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Is Launching the Euro Unstable in the Endgame?

Robert P. Flood and Peter M. Garber

Recent analyses of the transition to European Economic and Monetary Union (EMU) have emphasized technical problems in the conversion ratios of currencies into the euro at the start of Stage III. Restrictions on bilateral conversion rates imply that they must be the same as market bilateral rates at the end of Stage II. From this fact has come a conclusion that exchange markets may generate volatility, speculative attacks, or even indeterminacy of exchange rates on the last day of Stage II. We show in this paper that concern over these technical issues per se, as an additional source of exchange market volatility, is a red herring: euro payment institutions that begin operating at the outset of Stage III make it easy for "in" central banks to establish any desired bilateral conversion ratios for their currencies. As long as Stage III itself is viable at the outset—a premise of the discussion—"in" central banks are formidably armed to impose desired conversion ratios within the restrictions. All discussion of the conversion problem presumes that Stage III will be viable. Otherwise, the notion that exchange rates are locked on 1 January 1999 is not valid. We also will presume that the irrevocable fixed rates will not be revoked on 1 January 1999 (or more accurately by the time the payments systems close on 4 January, the first business day of the year) and that the institutions will work as designed at the start of Stage III.

Moreover, the exchange rate models of monetary policy used to derive implications of increased volatility are quite narrow. Models that more accurately capture central bank operating policy in practice do not gener-

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ate problems with controlling exchange rate volatility in the transition to Stage III, as we show in section 5.3.

5.1 The Endgame Problem

The endgame of Stage II of the EMU is a period of great potential exchange rate instability. Uncertainty about final bilateral conversion factors of "in" country currencies and the market value of the euro and the ECU at the end of Stage II creates a pressure cooker for speculation after the "in" countries emerge. Various schemes for monetary cooperation and exchange rate policies have been proposed, ranging from tight bands, to progressively narrowing bands, to early operations of the European Central Bank (ECB) to enforce monetary cooperation.[1]

Atop this general speculative environment, Obstfeld (1997a, 1997b), De Grauwe (1997), and De Grauwe and Spaventa (1997), among others, have emphasized a technical feature of the transition to Stage III that adds to the endgame instabilities. The Maastricht treaty requires that the conversion rates of individual "in" currencies into the euro announced on 1 January 1997 do not, of themselves, cause a jump in the ECU from its market value on 31 December 1998. The Madrid Council decision requires that on 1 January 1999, the conversion rates of the "in" currencies into the euro be such that one euro equals one ECU. Obstfeld (1997a, 1997b) shows that either of these requirements implies that the irrevocable bilateral conversion rates between "in" country currencies announced on 1 January 1999 must equal the market bilateral exchange rates at the close of business on 31 December 1998.

From this fact of arithmetic, Obstfeld (1997a) and De Grauwe (1997) infer additional problems for the transition. First, transient disturbances that are still contained in market exchange rates on 31 December 1998 will be locked forever in the bilateral conversion rates when the market rates are ratified by Stage III policy on 1 January 1999. Even a one-day transitory shock on 31 December 1998 will be permanently impounded in bilateral conversion rates, as stabilizing speculation will not soften the disturbance's permanent impact. Indeed, any arbitrary exchange rates established by the markets will be made permanent, and this can generate tremendous volatility on the last day of Stage II.[2]

A facile answer to this endgame volatility is to manage the exchange

1. See Obstfeld (1997a) for a list of these proposals.

2. There is a difference of opinion between Obstfeld and De Grauwe over whether this volatility constitutes an indeterminacy problem among multiple equilibria. Obstfeld claims that there is an "especially severe risk on Dec 31 of an attack" since "speculators know that bilateral exchange rates must be maintained in Stage 3." The "in" central banks may have to intervene in large amounts, but if their willpower fails there is a chance for a large speculative gain.

rate leading into 31 December 1997 with a hard peg at some mutually agreed set of bilateral rates by close of business. Indeed, to head off speculation about the bilateral conversion rates, the potential members of the European System of Central Banks (ESCB) have agreed that the intended bilateral rates will be announced simultaneously with the announcement of the "in" countries in May 1998. Such pegs, however, are subject to attack if speculators doubt that "in" central banks will conduct a near-in defense without limit. The attack may occur on or before 31 December 1997. Moreover, there is a moral hazard problem: a central bank may gain competitive advantage from a last-minute depreciation of its currency and reduce the real value of its debt. This may undermine the monetary cooperation needed to sustain preprogrammed bilateral exchange rates.

Taken together, the conversion constraints imposed by Maastricht and Madrid add to the potential volatility already inherent in exchange markets between the selection time of EMU members and the start of Stage III. Various proposals have aimed at controlling the problems imposed by these constraints. Obstfeld (1997a) states that it is rash to assume that monetary coordination will begin among independent central banks before the ECB is given control; he proposes a start-up in the ECB's powers of central monetary control prior to the start of Stage III.[3]

5.2 The Stage III Payments System Obviates the Conversion Problem

In the context of the 31 December 1998 exchange market, Obstfeld's (1997a) proposal to move the operations of the ESCB forward into Stage II already has implicitly been implemented in one vital aspect.[4] The TARGET payments system will begin operation on 4 January 1999, the first business day of Stage III. Payments among "in" countries will be made through the operating procedures of TARGET. Such payments include those in settlement of foreign exchange transactions made two business days earlier and forward exchange transactions with a 4 January 1999 value date. Thus any exchange market intervention by an "in" country on 31 December 1998 or, indeed, on 30 December 1998 to establish agreed bilateral exchange rates will be settled through TARGET. We will show

3. This problem was at least partly addressed by the agreement to announce bilateral conversion rates in May 1998.

4. In an extensive update of his original paper, Obstfeld (1997b) incorporates the two basic points of an early draft of our current paper: (1) the details of TARGET system operations are a key element in making credible unlimited intervention in support of the selected bilateral exchange rates prior to 1 January 1999, and (2) forward intervention with maturity after 1 January 1999 by "in" central banks can be used in unlimited amounts to stabilize bilateral rates at desired levels by "in" central banks between May 1998 and 31 January 1999. By continuing to center his paper around the technical requirement of maintaining the bilateral exchange rate between 31 December 1998 and 1 January 1999, however, he ignores the implication of points 1 and 2: the endgame bilateral conversion restrictions are an irrelevant distraction.

that the unlimited inter-central-bank credit facilities of TARGET in fact realize the ability of a central bank to intervene without limit on 31 December and constitutes a de facto reach-back into Stage II of the operations of the ESCB. Thus the conversion restrictions add no operational problem to the start-up of Stage III because "in" central banks can unquestionably establish whatever exchange rates they agree upon on 31 December. Focusing on these technical start-up conditions throws an irrelevancy into the discussion.

EMU is intended to remove the costs that are perceived from currency transactions between members of the European Union and to create a currency area on a scale that can generate liquidity comparable to that in the U.S. dollar zone. Equally important, EMU, once completed, is expected to eliminate the possibility of a speculative attack of the sort that crippled the Exchange Rate Mechanism (ERM).

At the start of Stage III on 1 January 1999, the major currencies of those countries that join will have "irrevocably" locked exchange rates. National currencies will continue to exist until 2002, and commercial bank deposits can still be denominated in national currencies, although euro-denominated accounts will also be available. By 2002, the individual currencies—French francs, deutsche marks, and so forth—will disappear and be replaced by a circulating paper euro. In addition, two key institutions will become operational at the start of Stage III—the European System of Central Banks led by the European Central Bank and TARGET, the large-value cross-border euro electronic payments system.

5.2.1 The Structure of the European System of Central Banks

The ESCB will be a combination of the national central banks, such as the Banque de France and the Bundesbank, under the coordination of the ECB, but key central banking functions and operations will be performed by the still-existing national central banks.[5] Monetary policy will be controlled by the ECB—that is, the setting of reserve requirements, discount rates, and foreign exchange policy; open market intervention; and so on. The ECB will have its own balance sheet and capital.

Nevertheless, the national central banks will retain their identities. In particular, each national central bank will operate its own national large-value payments system and have its own balance sheet and capital. The profits (and losses) on monetary operations of the ECSB will be distributed to the national central banks in proportion to their shareholdings in the ECB. In turn, national central banks can pass these profits through to their respective national governments as in current practice.

5. The discussion in this subsection and the next on TARGET is taken from Garber (1998).

5.2.2 Some Operational Details of TARGET

When it goes on line at the start of Stage III, the TARGET payments system will provide the interface between national payments systems and will not replace them.[6] Euro payments originating in one country will be delivered one for one nearly instantly as euros in another country. The cross-border euro payment can then emerge as a commercial bank deposit denominated either in euros or, after fixed rate conversion, in the national currency. An understanding of some operational rules of TARGET is important: individual national central banks strictly adhering to them will freely provide unlimited credit to each other so that speculators will have no chance to profit by attacking and breaking the Stage III locked exchange rates.[7]

TARGET will effect large-value payments in the euro, the new common currency. TARGET is designed, according to the current risk control practice of most industrial country central banks, as a real-time gross settlement (RTGS) system. In such a system, final settlement of a payment is made almost simultaneously with the transmission of a payment message during the day. Therefore, the sender of the payment must have central bank money available at the time that the payment order is sent—otherwise, the payment is blocked.

Standard European RTGS systems allow a bank to overdraw its central bank account to make payments during the day provided that the overdrafts are collateralized by acceptable paper such as the securities of the national government.

The TARGET system will work as follows. As a first example, suppose that a payment is made in euros or French francs from one commercial bank to another in France. Both banks will have accounts at the Banque de France and will transmit payments across the national system. Payments will be settled by instantaneously transferring funds across bank deposit accounts at the Banque de France.

Second, suppose that a euro payment is made from a bank in France to a bank in Germany. The French bank will send a payment message over the French national system. The payment order will be channeled automatically through Banque de France software that will subtract the amount from the Banque de France account of the French bank and process the payment order onward through the TARGET system to the Bundesbank. In turn, on receiving confirmation that euro funds are available

6. TARGET stands for *T*rans-European *A*utomated *R*eal-Time *G*ross Settlement *Ex*press *T*ransfer.

7. For the purposes of this paper we will make the standard assumption used by mainly European researchers on the EMU that Stage III is unassailable. Garber (1998) explores the issue of how the TARGET system might transmit and exacerbate a Stage III crisis.

in the Banque de France account of the sending bank, the Bundesbank will increment the account of the German bank one to one with euros.

Thus a euro payment will be settled almost instantaneously across borders. If in Stage III the cross-border payment from the French bank is denominated in deutsche marks, it will still be transmitted across the books of the central banks as euros but it will be credited as a deutsche mark deposit by the German bank on receipt. Such payments from the internal currency of one country to that of another now generally require the standard two-day wait in the exchange market through the use of two unconnected, parallel national payment systems.

Accounts can balance after this cross-border transaction because credit has been given by the Bundesbank to the Banque de France in settling the payment. The funds made available to the receiving bank in Germany are instantaneous and irrevocable; the funds that are deducted from the French bank are funds in an account at the Banque de France; so the Banque de France has incurred a "due to" to the Bundesbank. This will be accounted by incrementing the Bundesbank's bilateral correspondent (or interlinking) account at the Banque de France and reducing the Banque de France's correspondent account at the Bundesbank by the same amount.

In the example in table 5.1, Paribas makes a payment of 100 euros (or the equivalent amount of deutsche marks) to Deutschebank. This alters the Banque de France and Bundesbank balance sheets as shown between panels A and B. Commercial bank deposits fall by 100 euros at the Banque de France and rise by 100 euros at the Bundesbank. The overall monetary base in euros is unchanged, but part of it has migrated to Germany. This is accomplished instantly through an automatic credit from the Bundesbank to the Banque de France of 100 euros.[8]

In this regard, TARGET operation is not remarkable and differs little from, for example, the U.S. Federal Reserve's Fedwire system (based on Summers 1994). In the Federal Reserve system, daily imbalances between district Federal Reserve banks—that is, imbalances that arise when interbank payments cross district lines—are cleared by incrementing the claims of district Feds with net payment inflows against the Interdistrict Settlement Account. Claims against this account by district Feds with net payment outflows are reduced. This process is repeated on each succeeding business day. The cumulated claims against or obligations to the Interdistrict Settlement Account are settled once per year in April with the redistribution of gold certificates from district Feds with negative

8. The negative balance in the Banque de France's interlinking account at the Bundesbank is in accord with the European Monetary Institute's (1997) description of TARGET accounting. Peter Kenen has pointed out that this document is erroneous and that the item should appear as a "due from" Banque de France in the Bundesbank's asset column (see Kenen's comment on this chapter).

Table 5.1 **Cross-Border Payment on TARGET**

Banque de France				Bundesbank			
Assets			Liabilities	Assets			Liabilities
			A. Initial Central Bank Balance Sheets (euros)				
French government securities	400	0	Due to Bundesbank	Loans to German banks	400	0	Due to Banque de France
		400	French bank deposits			400	German bank deposits
			B. Central Bank Balance Sheets after Paribas Pays 100 Euros to Deutschebank				
French government securities	400	100	Due to Bundesbank	Loans to German banks	400	−100	Due to Banque de France
		300	French bank deposits			500	German bank deposits

cumulated net payment positions to those with positive positions. Settlement in the Federal Reserve system does not require the use of accounts in a third-party bank. Specifically, the Board of Governors in Washington is not a bank in itself but a regulatory body of each of the district Federal Reserve banks. Nevertheless, the Interdistrict Settlement Account is a multilateral—not a bilateral—account; claims against it are claims against the system.

If the individual national central banks freely provide credit to other national central banks, TARGET will function as planned and serve as the heartbeat of the unified currency. In this scenario, speculators will have no chance to profit by attacking the locked exchange rates of the system in the face of unlimited inter-central-bank credit. This differs from the current ERM, in which unlimited inter-central-bank credit is not available.[9]

5.2.3 A Decembrist Attack

Let us imagine that the "in" central banks attempt to establish an agreed vector of bilateral exchange rates on 31 December but that speculators launch an attack anyway. This may be a self-fulfilling crisis or the result of a large, though transitory shock on 31 December. Let us suppose that the weak currency is the French franc, and the strong currency is the deutsche mark. Speculators want to short deposits in France denominated in French francs and acquire deposits in Germany denominated in marks. The agreed bilateral rates may be defended in several ways.

1. *The Banque de France in the Breach.* The Banque de France may intervene in the spot market, selling marks for francs to whatever extent the speculators want. It does not raise interest rates or take other action. In two business days—on 5 January 1999—the Banque de France sends a payment order through the TARGET system to the Bundesbank to deliver deutsche marks to the speculators' mark-denominated bank accounts in Frankfurt. It incurs a euro-denominated liability to the Bundesbank, accounted for by adding to the Bundesbank's interlinking correspondent account at the Banque de France. The Bundesbank will subtract a like amount from the Banque de France's correspondent account at the Bundesbank. The Bundesbank will have given credit, if necessary, in unlimited amounts to the Banque de France. The speculators will have to deliver French francs to the Banque de France on the same day. Where will this huge amount of francs come from? The speculators have the marks just deposited by the Bundesbank in their Frankfurt commercial bank deutsche mark accounts, so they order franc payments to the Banque de

9. For a discussion of the accounting operations involved in a defense of ERM bands through the Very Short Term Financing Facility, see Garber (1998).

France in Paris. In turn, these payments will be processed over TARGET and exactly cancel the previous payments from the Banque de France. There is no net monetary impact from these transactions.

If we believe that the institutions of Stage III operate properly, as we must if we premise the problem on the viability of the conversion exchange rates at the start of Stage III, then the "in" central banks can effortlessly establish whatever bilateral exchange rates they want on 31 December or 30 December.

Extending the argument backward, intervention need not occur only in the spot markets. Prior to 30 December, "in" central banks can intervene in the franc-mark forward markets with a value date on 4 January 1999 to establish the bilateral exchange rates they may want. Again, the operation of TARGET implicitly feeds credit backward in time to whatever moment the central banks wish to begin their interventions to establish the desired conversion rates.

2. *Moral Hazard and a Stalwart Bundesbank.* Suppose that the Banque de France suffers from a bout of moral hazard and finds a reason not to intervene against the attack on 31 December. If it is still interested in the EMU, the Bundesbank can then pick up the burden through its own intervention. Again, the payment orders cancel on 5 January 1999, although they begin in the opposite direction.

3. *Does Any Central Bank Out There Want the EMU?* Suppose that, lukewarm about making the good faith effort to get to EMU, neither the Banque de France nor the Bundesbank intervenes when faced with the 31 December attack. The National Bank of Belgium, however, is enthusiastic about EMU, so it undertakes the massive intervention—selling deutsche marks for French francs in Stage II—required to maintain the desired bilateral rates. Where does it get the resources to do this? Again, through TARGET.

Unless an "in" central bank actively undercuts the agreed bilateral exchange rates, even the smallest "in" central bank is armed through TARGET with sufficient credit resources to hold the desired bilateral exchange rates together—in all the "in" currencies—in the face of a massive speculative attack.[10] It is difficult to imagine such subversion among members of the elite club, however, while still believing that Stage III will proceed as planned, which is the premise of the various analyses of the Stage II conversion and volatility problem.

10. The undercutting might take the form of an opposite intervention. Also, an "in" country that drops out of the EMU before Stage III certainly breaks the supposed provision of unlimited credit, but this violates our working assumption of a successful Stage III.

5.3 Modeling the Endgame Problem

Although TARGET operations make unassailable the fixing of bilateral exchange rates on 31 December 1998, it is useful to examine the generality of the modeling framework used to infer the added volatility problems in the Stage II–Stage III conversion restrictions. Obstfeld (1997a) concludes that the future fixing of exchange rates in Stage III can—because of the requirement to carry over bilateral exchange rates from the end of Stage II into Stage III—destabilize the exchange rate in the present. Obstfeld's conclusions arise from a special model. While we agree with the theoretical results in the context of his model, we find some aspects of the model at odds with standard central bank operating procedures. In particular, in Obstfeld's model, monetary authorities at first apparently set a monetary aggregate without regard to short-term interest rates. Then, when the date for exchange rate fixing arrives, they abandon their monetary aggregates and set the exchange rate; and by implication, they also set short-term interest rates.

Contrary to this perspective, central banks in practice implement monetary policy in a very different manner. Monetary authorities implement policy by setting short-term interest rates, though as the date for Stage III approaches, they must set them with increasing attention to exchange rates. In the model that we will lay out, there is no increase in exchange rate volatility in the transition. Indeed, with interest rate targeting, exchange rate volatility converges to zero on the verge of the switch time between Stage II and Stage III. We argue further that this alternative model better matches important institutional aspects of the money supply process and foreign exchange market.

We will first lay out Obstfeld's model and derive his conclusions about volatility. Then we will twist the model in a direction appropriate for short-term analysis. Finally, we will discuss some technical aspects of the money supply process in European countries during the transition that point in the direction of our modeling strategy rather than that adopted by Obstfeld.

5.3.1 Obstfeld's Model and His Warning

Obstfeld (1997a) adopts a flexible price model of exchange rates. The equations determining the equilibrium exchange rate are

$$N_t - S_t = -\alpha(i_t - i_t^*), \qquad \alpha > 0, \tag{1}$$

$$i_t - i_t^* = E_t S_{t+1} - S_t, \tag{2}$$

$$N_t = \bar{N} + \varepsilon_t, \tag{3}$$

where N is the log of market fundamentals, S is the log of the exchange rate quoted as the domestic currency price of foreign exchange, i is the short-term domestic currency interest rate, and i^* is the short-term foreign currency interest rate. Equation (1) is an asset market equilibrium condition that may be derived, for example, from the money market. In this view, N implicitly contains variables that are important in the short-term money market: the quantity of money and other price and money demand effects such as the real exchange rate, real income, or disturbances to money demand. Equation (2) is the statement of uncovered interest rate parity. It sets the interest differential equal to the rationally expected rate of exchange rate change. Equation (3) is a simple law of motion for exchange market fundamentals. $\bar{N}$ is a constant and ε_t is a mean-zero, serially uncorrelated disturbance term. The law of motion of the exchange rate is a special case of the one that Obstfeld uses, chosen both to put his warning in its sharpest relief and to simplify the algebra.

According to this model, if the exchange rate were freely flexible it would follow

$$S_t = \bar{N} + \frac{\varepsilon_t}{1 + \alpha}. \tag{4}$$

Setting the variance of ε at unity, exchange rate variance is

$$V(S) = \frac{1}{(1 + \alpha)^2} < 1.$$

Now turn to the days surrounding exchange rate fixing. Suppose that date t is the last day of floating and date $t + 1$ is the first day of the fixed rate era. This is a terminal condition on the foregoing model, and Obstfeld argues (correctly) that if the exchange rate is to be fixed precisely as proposed, at opening on Monday morning it will have to be pegged at the value inherited from closing the previous Friday. Hence, if day t is the day prior to fixing,

$$E_t S_{t+1} - S_t = 0. \tag{5}$$

Using this condition in equation (2) and then substituting into equation (1) we derive

$$S_t = N_t = \bar{N} + \varepsilon_t. \tag{6}$$

The effect of promising to fix the exchange rate has removed completely the expected exchange rate change from the asset market on the day before fixing. Movements in N_t are reflected in identical movements of the exchange rate S_t. The coefficient on ε_t jumps from $1/(1 + \alpha)$ in equation (4), a number between zero and unity, to exactly unity. The exchange rate

variance must also jump from $(1/(1 + \alpha))^2 < 1$ to unity. In other words, the promise to fix the exchange rate at time $t + 1$ raises the short-run exchange rate variance at time t. As Obstfeld demonstrates, the promise to fix has similar, but slightly muted, effects on exchange rate variance on all the days prior to the Stage III fixing.[11]

Obstfeld's logic, discussion, and derivation follow relentlessly once one has bought into the model embodied in equations (1), (2), and (3). From our perspective, however, it is plain that a different set of assumptions better describes one crucial aspect of the working of the foreign exchange market.

5.3.2 Modeling Monetary Policy

We agree that the empirical performance of all models of the foreign exchange market based on high-frequency data (observations of one year or less) has been an absolute disaster. These models usually include a market-clearing condition like equation (1), an uncovered interest parity condition, equation (2), and a data-appropriate forcing process for fundamentals like equation (3). While equations (1) and (2) do not hold up well in data, they allow Obstfeld to make his argument in a clean and simple way, and *that argument carries over to more complicated and possibly more realistic versions of equations (1) and (2).* We therefore adopt Obstfeld's equations for private behavior, but we part company with his equation (3), the time-series model of market fundamentals, which incorporates short-run monetary policy.

Our preferred model is

$$m_t - s_t = -\alpha(i_t - i_t^*) - \varepsilon_t, \qquad \alpha > 0, \tag{7}$$

$$i_t - i_t^* = \bar{\delta} + \lambda\varepsilon_t = E_t s_{t+1} - s_t, \tag{8}$$

$$m_t = \bar{m}_t + \psi\varepsilon_t. \tag{9}$$

In equation (7), we refine Obstfeld's N_t fundamentals into the sum of the money supply, m_t, and other fundamentals, ε_t. We continue to use Obstfeld's notation ε_t as the source of uncertainty, but we move it to the right-hand side of the money market equilibrium condition to distinguish it from m_t. Equation (8) continues to reflect uncovered interest rate parity, but in addition the government now sets the short-term interest rate differential at $i_t - i_t^* = \bar{\delta} + \lambda\varepsilon_t$. In this policy setting, $\bar{\delta}$ is the average interest rate differential and $\lambda\varepsilon_t$ depicts the sensitivity of interest rate policy to current market conditions. Equation (9) expresses the settings for monetary policy such that the government can realize its policy target for

11. See Obstfeld (1997a, app. A, eq. [3]) for details.

the interest rate differential. In this approach, *the time-series process for* $\overline{M}_t$, *the value of* ψ, *and the quantity of money* M_t *are all endogenous to the model.*

The policy authority may set $\bar{\delta}$ and λ as desired; but the money supply rule (9) must then be tailored to meet the interest rate target.[12] In the appendix we solve our model for a floating exchange rate along the lines suggested by Canzoneri, Henderson, and Rogoff (1983). That solution is

$$S_t = \alpha\bar{\delta} + \overline{M}_t - \lambda\varepsilon_t, \tag{10a}$$

$$\overline{M}_t = \bar{\delta} + \overline{M}_{t-1}, \tag{10b}$$

$$\psi = -[(1 + \alpha)\lambda + 1], \tag{10c}$$

where M_{t-1} *should be interpreted as a predetermined variable.*

With this interest rate policy, the exchange rate variance is λ^2. The deterministic portion of the money supply (differential) is explosive to the extent that $\bar{\delta}$ is different from zero.

With this model of operational monetary policy in mind, let us move to 31 December 1998, before the Stage III, immutable, exchange rate fixing. As Obstfeld argues, on 31 December interest rates must converge. In order to keep $E_t S_{t+i} = S_t$ for all future dates $t + i$, the government must set $\bar{\delta} = 0$ and $\lambda = 0$. This, of course, *makes the 31 December exchange rate nonstochastic and equal to* M_t, the deterministic portion of the money supply.

5.4 Conclusion

There are many reasons to worry about the approaching EMU. It may collapse in Stage III. It may generate an attack on the ERM in Stage II. It may succeed and exacerbate asynchronous cyclical pressures. That these instabilities may occur, however, has little to do with the minor technical issue of the equality of bilateral exchange rates across the interface days between Stage II and Stage III. The operational nature of the TARGET payments system and the use of forward market interventions or the equivalent interventions to fix interest rates are sufficient to bridge the bilateral rates across Stage II and Stage III, given the standard assumption of a successful Stage III. The issue of the equality of bilateral conversion rates across Stages II and III is of some technical interest, but by begging the question it can only distract attention away from the far more important issues of the survivability of Stage III and, working backward, the speculation over such survivability and over the ultimate "in" membership that will be ongoing both before and after May 1998.

12. The values of $\bar{\delta}$ and λ may be set to minimize a Kydland-Prescott-style loss function (Kydland and Prescott 1977) as in Obstfeld (1994).

Appendix

To solve models in which the money supply is set to accommodate private demand in order to implement an interest rate target, Canzoneri et al. (1983) recommend the following solution technique.

Step 1. Substitute from the interest rate rule, equation (8), and the required money accommodation, equation (9), into the equilibrium condition, equation (7), and rearrange to derive

$$S_t = \alpha\bar{\delta} + \overline{M}_t + (\psi + \alpha\lambda + 1)\varepsilon_t. \tag{A1}$$

Step 2. Update equation (A1) by one period and take the expectation as of date t, yielding

$$E_t S_{t+1} = \alpha\bar{\delta} + \overline{M}_{t+1}. \tag{A2}$$

(Remember that $\overline{M}$ is the nonstochastic part of the money supply.)

Step 3. Subtract equation (A1) from equation (A2) and equate the result to the interest rate target, resulting in

$$\overline{M}_{t+1} - \overline{M}_t - (\psi + \alpha\lambda + 1)\varepsilon_t = \bar{\delta} + \lambda\varepsilon_t. \tag{A3}$$

Equation (A3) is to be regarded as an identity, which determines the money supply so that the money market is in equilibrium. This requires

$$\psi = -[(1 + \alpha)\lambda + 1], \tag{A4}$$

$$\overline{M}_{t+1} = \bar{\delta} + \overline{M}_t. \tag{A5}$$

By direct calculation, substituting the restriction described in equation (A4) into equation (A1) results in equation (10a), the exchange rate expression reported in the main text.

Canzoneri et al. complete their solution as we do by imposing the initial condition that $\overline{M}_0$ is predetermined from the prehistory of the model. The Canzoneri et al. insight is to preserve the dynamic structure in a Cagan-style model of the price level by recognizing that pegging the interest rate is equivalent, in that model, to pegging the expected inflation rate. Pegging expected inflation, in turn, requires setting the prospective money growth rate, taking as predetermined an inherited money stock. Canzoneri et al., therefore, propose solving a single dynamic equation in two unknowns by imposing an initial condition on money. Sargent and Wallace (1973) in other, previous research had proposed solving an equivalent indeterminacy problem by imposing the famous "no bubbles" terminal condition.

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Comment Peter B. Kenen

I have no quarrel with the main message of this paper. Central banks due to participate in EMU will have no trouble fixing the bilateral exchange rates between their currencies at the close of foreign exchange trading on the last day before EMU. They can therefore meet the restrictive conditions imposed by the Maastricht treaty. The real-time gross settlement system (TARGET) due to come into being when EMU begins will allow them to finance unlimited intervention on the day before EMU begins. Flood and Garber rightly draw an analogy with the short-term credit arrangements available under the ERM of the European Monetary System, and the analogy can be carried further. The exchange rate regime prevailing in the first years of EMU, before the national currencies are replaced completely by the euro, can be viewed as a new version of the ERM. There

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