Rethinking the Role of NCBs in the EMU

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Abstract: Five years after the introduction of unified monetary policy in the EMU, some member countries are wondering whether they have ceded too much of their policy-making powers. The fact that National Central Banks no longer carry out open market operations or foreign exchange market operations suggests that they face substantially reduced abilities to set economic policy.

This paper demonstrates that, in fact, very little power has been yielded on the fiscal front, since the force of such policy initiatives is enhanced by the fixity of the exchange rate. On the monetary front, we show that there is an observational equivalence between all central bank actions under fixed exchange rates. This implies that the same amount of policy flexibility as before is available to the authorities, so long as they reform their domestic financial institutions in order to carry out what amounts to sterilized foreign exchange market operations.
I. Introduction

This month marks the fifth anniversary of the introduction of unified monetary policy in the European Monetary Union.¹ Such a milestone invites a reassessment of how the system has evolved so that lessons can be drawn from the past in order to guide policymakers in the future. The present paper contributes to this discussion by putting in context what a currency union means, and how its operations differ from those of a fixed exchange rate system.

No member of a currency union has at its command an actively functioning central bank as it did previously. This suggests that its independence of policy action is severely curtailed. After all, the essence of an independent central bank is that the authorities can carry out activities that are feasible due to the existence of an identifiably different national currency: open market operations and foreign exchange market operations. Without such an institution, these operations are not possible, and the leeway which the authorities have to set national interest rates seems to have disappeared as well.

The present paper looks into this question anew, by asking what freedom of action a National Central Bank gives up when its traditional functions are absorbed by a supranational central bank, like the European Central Bank. The answer is surprising: very little freedom is given up by an NCB beyond what was already relinquished in the decision to fix exchange rates at permanent values. In such a setting we find that different policy initiatives are observationally equivalent: an open market operation, up to a factor of proportionality, has the same effects as a foreign exchange market operation. While such initiatives have very different effects under a flexible exchange rate system, they have identical effects when rates are fixed.

In order to establish this claim, this paper presents a model of a small open economy which manages its exchange rate in the limiting case when that management goes to the limit of rigid pegging. This approach is taken so as to make clear that fixing exchange rates when no currency union exists, is a task which requires explicit intervention by the authorities. The consequences of a particular policy initiative depend very much on the form which interventions take if management is less than complete. And, of course, for a given form of management, different policy initiatives have quite distinctive effects. For example, expansionary open market operations tend to lower interest rates, whereas expansionary foreign exchange market operations tend to raise rates of interest.²

All this changes when exchange rates are rigidly fixed. In this case all policy initiatives have identical consequences up to a factor of proportionality. But this implies that if NCBs have at least one policy initiative at their disposal, they continue to have the same freedom to act as they did before. In order to set interest rates, they no longer have open market operations or unsterilized foreign exchange market operations available. But they

¹ See Issing et al. [2001], which points to the reduction in interest rates in December 1998 as the launch of the unified monetary policy for the EMU countries.
² Boyer [2003] demonstrates these results.
continue to have an initiative that can accomplish the same task: namely the trade of domestic bonds for international bonds, which is essentially equivalent to a sterilized foreign exchange market initiative.

Being in a currency union implies as well that fiscal policy actions by the national governments will have impacts that are enhanced over what they are in a flexible exchange rate setting. This, too, adds to the power which national governments continue to enjoy in undertaking stabilization policy. Their freedom is diminished somewhat by the deficit guidelines which the EMU authorities enforce against member countries, but within this tighter constraint actions that are taken have a bigger impact than otherwise.

A sterilized foreign exchange market is an unusual concept in the context of a currency union. What is meant by the term is that by changing the quantity of the distinctive local bond, the authorities have some influence on interest rates. Without the ability to issue its own currency, an NCB must raise the funds to do this by issuing bonds which have a ready market throughout the union. In the process the central bank is carrying out what amounts to a sterilized foreign exchange market operation. It is reducing (say) the quantity of domestic bonds held by the public, hoping thereby to reduce domestic rates of interest (by reducing the risk that is specific to that country). In its place, the NCB is raising funds by issuing bonds which are good substitutes for those issued and traded throughout the union. Since the quantity of money is not changed directly by the NCB, this amounts to a sterilized operation, in which bonds with a world-wide market are traded for bonds which tend to be traded locally. The analogy with language familiar from central banking theory is, domestic credit has been increased and international reserves have been decreased by an equal amount so that the quantity of money is unchanged.

This argument points out that so long as the strains from the seignorage division can be withstood, a currency union should benefit its members through the efficiencies which are gained from the use of a common unit of denomination, and easily tradability of coins and pieces of currency. This does not come at the expense of loss of freedom, if the country was already on a fixed exchange rate. To maintain that flexibility of action the NCBs need to recast their thinking, and see that through non-monetary financial asset market transactions, they can accomplish everything that they were capable of doing previously.

II. The Model

Consider a small open economy which takes as given the foreign currency price of the goods which it imports. It is assumed that the country is specialized in the production of a single good that can be purchased at home or exported to the rest of the world. This economy is assumed to have ready access to financial assets issued by the rest of the world. But market instruments issued domestically do not have a good market outside the country’s borders, so that to a first approximation they are not traded at all. This is the standard set-up for small open economy macro models which analyze the effects of
market interactions for both goods and financial market instruments. As a consequence there are many elements in our system of equations that are quite conventional. In particular our model specifies the goods and money markets in the usual manner.

Our approach falls into the group of portfolio balance models in that the foreign exchange market is portrayed in a way that is consistent with those of other financial assets. Namely its equilibrium is portrayed as occurring when the stock of foreign exchange demanded is just equal to the quantity that is available. If domestic money and domestic bonds are both assumed to be market instruments which are not traded with the rest of the world, then the only changes in the quantity of foreign exchange which can occur within that timeframe are those which are undertaken by the central bank.

The model of the small open economy is given by the matrix equation denoted by (1). The system includes two equations which, as noted, are absolutely conventional. In all cases the parameters present within the elements in the matrix are defined so as to have positive values. The algebraic signs preceding the parameters indicate the signs of the elements themselves.

The four unknowns in the system are: domestic price level, P; domestic interest rates, r; the money supply, M, and the size of the stock of foreign exchange held domestically, F. All variables, both endogenous and exogenous, are defined as deviations from previous equilibrium values. For example, if P takes on a positive value as a result of a shock, then the price level has a higher value than it did previously. The initial values of the money supply, the price index, and wealth, W, are all assumed to be one, by choice of units. In order to avoid the taxonomy of portfolios which this rich array of market instruments can generate, we assume that the simplest conditions hold: namely, that the quantities of both domestic bonds and foreign exchange held by domestic residents are equal to zero at the initial equilibrium.

With the supply side of the goods market being undeveloped in this model, we will assume that output depends positively on the price level. This view is consistent with many models of supply, in particular those that see output as influenced by unexpected or unperceived changes in the price level.

The model of the small open economy is as follows:

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3 See for example the models of exchange rate determination in Sarno and Taylor [2002], pages 97-123..

4 Branson and Henderson [1985] represents the high-water mark of the first wave of portfolio balance models. More recent work tends to assume perfect capital mobility, in which the distinctive aspects of these earlier model are lost.

5 We assume that Ricardian equivalence does not hold, on the grounds that individuals do not take account of the future tax liabilities that these market instruments represent. The ineffectiveness conclusions that follow from assuming such equivalence can be found in Backus and Kehoe [1989].

6 The assumption of non-tradability of domestic market instruments is made in order to simplify our discussion. The tools that we use will remain valid even if domestic assets are held by foreigners.

7 Devereux and Engel [2001] discuss the factors which go into the choice of currency-denomination of price setting. This in turn influences the extent to which expansionary shocks from the demand side influence the movement of output.
The first three rows of this matrix deal with the markets for domestic goods, for money, and for foreign exchange. These equations state that equilibrium holds for these markets when the excess demand generated endogenously in each is equal to the excess supply that is generated there by changes in the values of the exogenous variables.

The last line of the matrix is the residual of a reaction function which in its general formulation shows how changes in holdings of assets adjust in order to manage the movement of the exchange rate. But here we have assumed that these transactions rigidly peg the value of the exchange rate. The remaining question is in what proportions are various assets used in the process of pegging the rate. The reaction function shown answers that question.

The function indicates that the Central Bank has a target level of the money supply outstanding, $M_0$, and a target value for the quantity of foreign-currency denominated market instruments held within the private sector, $F_0$. The reaction function specifies that the amount by which the actual quantity of money, $M$, deviates from its target level, $M_0$, is proportional to the deviation of the actual quantity of foreign exchange from its target level. We assume that the economy is initially in equilibrium, as is the Central Bank, so that the quantities of both kinds of market instruments are at the target levels which it has set for them. With our assumptions, the initial values of the levels (both actual and target) of these magnitudes are: one for the money supply, and zero for both foreign exchange and domestic bond holdings. Since our variables are defined as deviations from initial levels, they all have values of zero in the original equilibrium.

This reaction function has three parameters associated with it. The target levels of the money supply and of foreign exchange have been explained already. These target levels can be changed exogenously, and correspond to the policy initiatives that the Central Bank carries out. In addition, $\alpha$ is a parameter which characterizes the way in which the Central Bank carries out the stabilization of the exchange rate. Further discussion of all these parameters is presented below.

The first line of the matrix represents the goods market equilibrium condition, with the parameters related to this market denoted by $X_j$. In particular, $X_j$ denotes the effect which the variable $j$ has on excess demand in the goods market. The first element in that line shows that the excess demand for domestic goods is negatively related to the price level. A rise in the price level creates a negative excess demand (that is an excess supply) in the goods market through two distinct mechanisms. First, with the nominal value of the exchange rate held at unity, a rise in the price level makes domestic goods more
expensive than previously relative to foreign goods. This improvement in the terms of trade generates an excess supply of domestic goods, which is denoted by \(-X_e\). In addition, the rise in the price level reduces the real value of nominal wealth, whose value is held fixed at one. This too creates an excess supply in the domestic goods market, and in the amount \(-X_w\). These two effects reinforce each other, and thereby create an excess supply in the domestic goods market.

The second entry in the first line of the matrix relates excess demand in the domestic goods market to the level of domestic interest rates. The negative sign here indicates that an increase in domestic yields will curtail interest-sensitive expenditures, thereby leading to an excess supply of domestic goods.

The zero values for the final two entries in this first line point out that there is no direct relation between the state of the domestic goods market and the composition of portfolios. Our treatment of money is that it has an effect which is symmetric with other market instruments. No direct wealth effects are attributed to it.

The only exogenous variable that affects the goods market is the level of expenditures undertaken by the government, denoted by \(G_0\). Government expenditures create an excess demand situation in the domestic goods market. Since the right-hand-side of equation (1) measures exogenously generated excess supply, \(G_0\) appears in this equation multiplied by minus one.

The second line of the matrix presents a standard specification of the money market with the price level having a positive impact on demand equal to \((1-L_w)\). The reason for this compound effect is that the rise in price has two influences. It raises demand for money in proportion to the increase in price for a given level of real wealth. But with nominal wealth fixed in the short run, real wealth declines with a higher price level. With the money supply, nominal wealth, and the price level all having values of unity initially, evaluation of the derivative of the money demand function yields \(1 - L_w > 0\).

As with the standard specification, interest yields have a negative impact on the excess demand for money \((-L_r)\). The money supply is an endogenous variable, since except in polar policy regimes it is used in the process of stabilizing the exchange rate. An endogenous increase of one dollar in the money supply (with unchanged nominal wealth) reduces excess demand there by an equal amount.

The third row in the matrix describes conditions in the foreign exchange market. The quantity of private sector holdings of this asset are assumed to be zero in the initial equilibrium. This assumption permits us to avoid the taxonomy which would be needed if the economy were either a creditor or a debtor in this particular market instrument. The negative response to interest rates is shown by the entry \(-F_r\), the argument being that all market instruments are substitutes for each other. A rise in domestic rates of interest causes an excess supply of both money and foreign exchange. The negative effect which the price level has on real wealth and therefore on demand for foreign exchange is shown as \(-F_w\). Since the supply of this asset is zero at the initial equilibrium, there is no separate
price index effect working in this market, as there was in the money market. This guarantees that a rise in the price index creates an excess supply of foreign exchange.

All market instruments are assumed to be normal with respect to wealth. A key difference among them is that both domestic bonds and foreign instruments are assumed to be in zero supply domestically in the initial equilibrium. In contrast the quantity of money outstanding is assumed to be positive, equal to one.

Portfolios in the economy contain three categories of financial instruments: domestic money, domestic bonds, and foreign exchange. If, as we assume, domestic money and domestic bonds are not tradable with the rest of the world, then foreign exchange as well can not be traded in the short run. The reason is that by elimination there is nothing that the small economy can trade in aggregate with foreigners. All changes in holding of foreign exchange in the short run come through transactions which the Central Bank initiates, or carries out in order to stabilize the exchange rate.

Given the wealth constraint, it must be true that:

\[ +F_w + B_w + L_w = 1 \]  

(2)

This equation states that a one dollar increase in nominal wealth must be allocated to the three market instruments in such a way that the proportions of allocation sum up to one hundred cents. In this equation \( B_w \) is the responsiveness of the demand for the domestic bond to wealth, which, as indicated, is assumed to be positive, since all assets are assumed to be normal with respect to wealth. In light of this equality it must be true that:

\[ F_w < 1 - L_w \]  

(3)

Further, the wealth constraint implies that for interest rates the demand responses must sum to zero:

\[ -F_r + B_r - L_r = 0 \]  

(4)

Notice that this equation does not provide us with any tighter relationship between \( F_r \) and \( L_r \). Modern capital markets are often characterized as having high capital mobility. This case is represented by \( F_r \) and \( B_r \rightarrow \infty \). Also of interest will be in the case of a liquidity trap when \( L_r \) and \( B_r \) \( \rightarrow \infty \).

There is a further constraint on these parameters, given that the sum of the excess demands for these market instruments must always sum to zero, in accordance with nominal wealth’s value being given at unity. Start from a position in which all of these excess demands are zero. Now raise the rate of return on the domestic bond. This generates an excess demand for the domestic bond, and an excess supply of the other two instruments. The excess demand for domestic bonds and the excess supply of money can be eliminated by raising the price level. But it is clear that the rise in the price level needed in order to clear the money market (for a given rise in interest rates) is less than
the rise needed in order to clear the domestic bond market. The reason is that this price movement augments the excess supply of foreign exchange. The excess demand for the domestic bond can not be eliminated until after the excess supply for money has been reduced to zero, for otherwise there would be excess supply in all three markets simultaneously. Such a situation is inconsistent with the wealth constraint stating that the sum is always equal to zero. Instead the price rise eliminates the excess supply of money first, at which point the augmented excess supply in the foreign exchange market just matches the diminished excess demand for domestic bonds.

This analysis has a significant conclusion for the parameters in the matrix. It indicates that

\[(1-L_w)B_t > B_w L_t \]  

(5)

This condition will enable us to sign some of the results which we obtain from the model.

III.  Discussion of the Model

Two elements are unique to this model: the specification of equilibrium in the foreign exchange market, and the reaction function of the Central Bank. Both these elements deserve further discussion before we proceed to the results.

The foreign exchange market is viewed as being that for the aggregate of foreign-currency-denominated market instruments available to the small country upon which we are focusing. This view embraces a much broader definition of what constitutes foreign exchange than one usually finds in discussions of this sort. In particular, foreign bonds and equity shares issued by foreign entities would be included in this aggregate along with the far-more liquid assets that are usually referred to as foreign exchange.

It may seem inappropriate to view the quantity of foreign exchange as given to the small economy in the short run, since there is such a vast market to which it has access. But we are assuming that both domestic money and domestic bonds have a poor market in the rest of the world. As a result, there is nothing that the small economy has available to trade with foreigners in order to increase or decrease its holdings of foreign exchange. This means that the quantity of foreign exchange is a fixed magnitude in the short run, and can be changed only by trades that the Central Bank undertakes with the private sector.

The reaction function, too, deserves further discussion, since it is a key element in the portrayal of the consequences of open market operations and foreign exchange market operations. It is useful at this point to introduce a important distinction when dealing with Central Bank policies: the distinction between policy regimes and policy initiatives.

A policy regime is the endogenous response pattern which the central bank uses in order to deal with day-to-day changes in the conditions in the economy. We are portraying a central bank which is rigidly stabilizing the exchange rate, so that part of the response pattern is already determined. What remains of interest is the question, What transactions does the bank use in order to accomplish that task? Is it foreign exchange market
operations (trading foreign-currency market instruments for domestic currency ones) or open market operations (trading more liquid market instruments for less liquid ones, where both are denominated in domestic currency)?

In contrast a policy initiative is an exogenous transaction carried out by the Central Bank, in order to have an impact on the values of the endogenous variables. Since the transactions are not responding to developments in the economy (at least not ones that we have modeled), policy initiatives will be represented by changes in exogenous variables.

These observations have particular application to the reaction function which we repeat here for convenience:

\[
\alpha (M - M_0) = -(1 - \alpha) (F - F_0) \tag{6}
\]

For the moment we assume that \( M_0 \) and \( B_0 \) are fixed in value.

The parameter that describes the policy regime that the Central Bank is pursuing is represented by \( \alpha \).

When \( \alpha = 0 \), the money supply, \( M \), is the magnitude which is used to stabilize the exchange rate. This is clear from equation (6) which indicates that the money supply can deviate from its target value (\( M \neq M_0 \)) without causing any deviation in foreign exchange holdings from their target values. The reason is that the coefficient multiplying this monetary deviation has a value of zero, which causes \( F = F_0 \) in order for the equation to be satisfied. There are three market instruments in this model, and the Central Bank is trading one kind of market instrument for another. If money is being traded but foreign exchange is not, that leaves only domestic bonds as being the other half of the transaction. One concludes that for this case the exchange rate is being stabilized through the use of open market operations. Such operations, as indicated, trade money for domestic bonds, but do not impinge on foreign exchange holdings.

Conversely, when \( \alpha = 1 \), equation (6) indicates that \( F \) can deviate from \( F_0 \) without the money supply deviating from its target level. Now a coefficient with a value of zero is multiplying the deviation in the holdings of foreign exchange, indicating that the money supply will continue to be held at its target level no matter what is happening to the quantity of foreign exchange.

Such a situation describes a Central Bank which is using sterilized foreign exchange market operations to stabilize its exchange rate. That is, foreign exchange is being traded for domestic bonds, creating deviations from target values for holdings of both those market instruments, but since the quantity of money is not involved, the deviation for monetary holdings remains at zero.

Finally, when \( \alpha = \frac{1}{2} \) the Central Bank is stabilizing the exchange rate using unsterilized foreign exchange market operations. In this case the money supply deviation from its target level is just equal to minus the deviation of the quantity of foreign exchange from
its target level. This means that money is being traded in precisely the same amounts as foreign exchange. This is exactly what a non-sterilized intervention amounts to. The Central Bank buys foreign exchange from the private sector, thereby reducing $F$ below its target value, but it pays money in exchange for it, thereby boosting $M$ above its target value by the same amount. Clearly, $\alpha = \frac{1}{2}$ describes such a situation.

We now discuss policy initiatives, the exogenous changes in levers at the Central Bank’s disposal. These initiatives are captured by the magnitudes $M_0$ and $F_0$, the target values for the quantities of these two assets. This is clear since they appear in the exogenous variable vector of the matrix equation. These two magnitudes can be changed independently and without unconstraint, since there is implicitly a target for domestic bond holdings as well, and it is assumed that it is adjusted in step in order to satisfy the wealth constraint. The two magnitudes can be changed independently of the value of $\alpha$, so that policy initiatives can be undertaken no matter what the policy regime that is in place.8

The discussion we went through in analyzing exchange rate regimes provides guidance as to the effects of policy initiatives. Starting with changes in $M_0$, we note that an increase in this magnitude without any change in $F_0$ is a expansionary open market operation initiative since the rise in the target value for the money supply comes at the expense of the target level of the holdings of bonds. Conversely, an increase in $F_0$ with no change in $M_0$ comes at the expense of holdings of domestic bonds, since there is no offsetting alteration in the target for money. This is a contractionary sterilized foreign exchange market operation. Finally, if $M_0$ is increased, and $F_0$ is reduced by an equal amount, the policy initiative undertaken is an unsterilized foreign exchange market operation.

It is apparent that the consequences of these policy initiatives, carried out by the Central Bank, as well as those undertaken by the fiscal authorities, will very much depend upon the exchange rate regime in place. These consequences are spelled out below, starting with the monetary actions.

IV. Monetary Actions Under Fixed Exchange Rates

The determinant of the model, $\Delta$, is equal to:

$$\Delta = \alpha \cdot \Delta_L + (1-\alpha) \cdot \Delta_F$$

where $\Delta_L = (x_c + x_w)L_r + x_r(1-L_w)$

and $\Delta_F = (x_c + x_w)F_r - x_r F_w$

For small values of the capital mobility parameter, $F_r$, the value of $\Delta_F$ is negative. In this case for small, positive values of $\alpha$, the determinant of the system, $\Delta$, is negative. For

8 McCallum.[1996] asserts that monetary policy is “unavailable” under fixed exchange rates. This is an unusual term to use in describing an economic model. Our definition guarantees that policy initiatives can be carried out in all circumstances, although for some of them, the initiatives are “ineffective” because they have not impact on observable magnitudes.
large values for both \( F_r \) and \( \alpha (<1) \) the determinant is positive.\(^9\) Much of the discussion here will be for the case where the parameter values make the determinant positive, but we will do a taxonomy on \( F_r \) and \( \alpha \) later.

When the Central Bank engages in a policy initiative, setting a non-zero value for \( M_0 \) or \( F_0 \) or both, this causes the following changes in the endogenous variables:

\[
P = \frac{I_0X_r}{\Delta} \quad (7)
\]
\[
r = -\frac{I_0(X_e + X_w)}{\Delta} \quad (8)
\]
\[
M = I_0\Delta L/\Delta \quad (9)
\]
\[
B = -\frac{I_0(\Delta L + \Delta F)}{\Delta} \quad (10)
\]
\[
F = I_0\Delta F/\Delta \quad (11)
\]

where \( I_0 = (\alpha M_0 + (1-\alpha) F_0) \)

These results have the following immediate implications:

Consider first the case in which the authorities are following a regime of stabilizing the exchange rate by trading money for domestic bonds. In terms of our equations, this is the situation in which \( \alpha = 0 \), so that exclusively open market operations are used in the stabilization process. No transactions using foreign exchange are carried out in pursuing this regime.

Let’s consider first a policy initiative in the form of a change in \( M_0 \). Clearly this initiative is an open market operation, since the target quantity of money is increased, the target quantity of domestic bonds is decreased, and the target quantity of foreign exchange is held at zero.

The equation shows us immediately what are the consequences of an open market operation in this setting. A change in \( M_0 \) has no impact the value of \( I_0 \) which remains equal to zero. This is apparent from the equation since a coefficient with value zero multiplies \( M_0 \). As a consequence the impact on all variables is zero.

Under this regime for stabilizing the exchange rate, since only changes in \( F_0 \) have an impact on the system, it is apparent that foreign exchange market operations have the same consequences for the economy whether they are sterilized or not. In other words, a sterilized foreign exchange market operation has effects which are observationally equivalent to those of an equal-sized unsterilized operation.

\(^9\) The role of capital mobility in influencing the direction of reserve flows in response to an open market operation has been noted by Branson [1974]. The indeterminacy of the sign of the system determinant is due to the same phenomenon.
Consider now the case in which the authorities are following a regime of stabilizing the exchange rate by trading money for foreign exchange. For this case \( \alpha = \frac{1}{2} \), as any shock to the system is met by foreign exchange holdings of the public and their money holdings moving in opposite directions and by equal amounts. This means that the quantity of bonds held by the public is unchanging in the stabilizing process. Clearly this is a regime in which the exchange rate is stabilized by using unsterilized foreign exchange market operations.

For this regime it is apparent from inspecting the equation for \( I_0 \) that a policy initiative in the form of a unsterilized foreign exchange market intervention has no impact on the economy. Since the coefficients multiplying \( M_0 \) and \( F_0 \) are equal in value, a rise in \( M_0 \) and an equal fall in \( F_0 \) cause no change in the value of \( I_0 \), leaving its value at zero, and therefore there is no change in any magnitude in the economy.

A further conclusion is that the equal values for these coefficients causes a rise in \( M_0 \) to have the same consequences as a rise in \( F_0 \). In words, this means that an open market operation has the same effect as a sterilized foreign exchange market operation (when unsterilized foreign exchange market operations are used to stabilize the exchange rate). \(^{10} \)

Consider finally the case in which the authorities are stabilizing the exchange rate by trading domestic bonds for foreign exchange (and the quantity of money outstanding is not altered in the process). In this case we say that they are following a fixed exchange rate regime using sterilized foreign exchange market interventions to stabilize the rate (so that \( \alpha = 1 \)). Inspection shows that policy initiatives in the form of sterilized foreign exchange market operations (for which \( M_0 \) is zero but \( F_0 \) is not) have no effects at all.

Furthermore, open market operations (which trade domestic money for domestic bonds) and unsterilized foreign exchange market operations have equal impacts so long as the change in \( M_0 \) is the same in both cases. Whether bonds or foreign exchange is the other half of the initiating transaction is irrelevant for a given change in the target level of money.

So far we have considered pure pegging regimes, in which only two of the three market instruments are used simultaneously. Now we analyze a hybrid situation in which \( \alpha \) has a value between zero and one half. This pegging operation is not a pure one, in that now all assets are utilized in the process, but there is a distinct pattern to the stabilization. When the money supply is increased (decreased) so as to the stabilize the exchange rate, the quantities of both foreign exchange and domestic bonds held by the public are decreased (increased).

In a regime of this type the effects of a sterilized foreign exchange market operation are greater than those of an open market operation or an unsterilized foreign exchange market operation.

\(^{10} \) This is the standard portrayal of monetary policy, which can be found, for example, in Marston [1985].
Finally, when \( \alpha \) has a value between \( \frac{1}{2} \) and 1, we have another distinct pattern of market intervention. In this case, the increase (decrease) in the money supply is generated by a decrease (increase) in the quantity of foreign exchange held by the public that is greater than the increase (decrease) in the quantity of domestic bonds.

For this stabilization regime open market operations have a bigger impact than do foreign exchange transactions, with the comparative size of these latter two operations dependent on the precise value of \( \alpha \). For values close to but slightly greater than \( \frac{1}{2} \), as noted above unsterilized foreign exchange market operations have muted effects, whereas for values of \( \alpha \) close to, but less than one, sterilized foreign exchange market operations have limited impacts.\(^{11}\)

Further observations can be made about these policy initiatives and pegging regimes, but at this point it is worthwhile generalizing our conclusions. These amount to stating that all policy initiatives by the Central Bank are observationally equivalent, up to a factor of proportionality under a fixed exchange rate regime.

Consider an open market operation of size \( M_0 \) under a pegging regime with parameter value \( \alpha \). Compare its effects with those of a sterilized foreign exchange market operation undertaken in a pegging regime in which the parameter value is equal to \( \alpha' \). These different operations under dissimilar regimes will nonetheless have identical effects so long as:

\[
F_0 = \frac{\alpha}{1-\alpha'} \cdot \frac{\Delta_\alpha}{\Delta_{\alpha'}} \cdot M_0 \tag{12}
\]

where \( \Delta_\alpha, \Delta_{\alpha'} \) are the values of the system determinant evaluated for the parameter \( \alpha \) having the values \( \alpha \) and \( \alpha' \) respectively.

Conversely, an unsterilized foreign exchange market operation of size

\[
M_0' = \frac{\alpha}{2\cdot \alpha'-1} \cdot \frac{\Delta_\alpha}{\Delta_{\alpha'}} \cdot M_0 \tag{13}
\]

when the stabilization parameter has the value \( \alpha' \) has the same effects as an open market operation of size \( M_0 \) when that parameter has the value \( \alpha \).

The observational equivalence result will be important as we seek the role which National Central Banks can play in the European Monetary Union.

V. The Impact of Fiscal Policies under Fixed Exchange Rates

\(^{11}\) Our discussion has focused on the market of exchange rate stabilization rather than on the degree of capital mobility which held the profession’s attention for two decades, starting in 1960. The conclusion of Mundell [1963] that a foreign exchange market operation has the same consequences as an open market is correct, and even patently obvious. The conclusion of Sohmen [1969] and Swoboda [1972] that an open market operation is ineffective is either a correct long-run one, shown first by Hume [1752], or an implausible short-run one based on a misspecification of asset markets.
Government expenditures have an important role to play in national governments’ use of macroeconomic policy tools. This is especially true in a fixed exchange rate setting, such as a currency union provides. The reason is that pegging the exchange rate tends to make such policy actions more effective than they would be under a flexible exchange rate regime. Nonetheless the impact of fiscal policy depends in part on how the exchange rate is pegged, as the analysis in this section shows.

As indicated in our model (equation (1)), government expenditures are pictured as an exogenous increase in the demand for domestic goods. With both $M_0$ and $F_0$ held at zero, the exogenous excess supply vector has only one non-zero element in it, $-G_0$, in the first position. With this vector, the change in the endogenous variables can be quickly solved for. The solutions are as follows:

\[
P_G = G_0[\alpha \cdot L_r + (1-\alpha) \cdot F_r]/\Delta \quad (14)
\]

\[
r_G = G_0[\alpha \cdot (1-L_w) - (1-\alpha) \cdot F_w]/\Delta \quad (15)
\]

\[
M_G = G_0[(1-\alpha) \cdot (1-L_w) F_r + F_w L_r] \quad (16)
\]

\[
F_G = -\alpha \cdot G_0[(1-L_w) F_r + F_w L_r] \quad (17)
\]

\[
B_G = G_0(2\cdot\alpha-1) \cdot [(1-L_w) F_r + F_w L_r] \quad (18)
\]

There are important observations to be made about these results. Notice that the money supply increases for the conventional values of $\alpha$ (namely, $\alpha \in [0,1]$). This causes inflationary pressures so that $P$ is higher for all of these values of $\alpha$. Whether the interest rate ends up lower depends on whether the money supply is permitted to expand sufficiently to do so (as it does with low values of $\alpha$), or instead is expanded by only a small amount, so that the pressures from the goods market overwhelm those from the money market. In this latter case, interest rates end up higher.

The supply of foreign exchange held by the public is lower as exchange rate stabilization requires such action to take the pressure off foreign currency, which would otherwise depreciate. Finally, whether the quantity of domestic bonds in the hands of the public increases or decreases depends on whether the value of $\alpha$ is greater or less than $1/2$. An alternative way of thinking about this is, that with stabilization taking the form mainly of sterilized foreign exchange market intervention ($1/2 < \alpha < 0$), the decrease in foreign exchange comes at the expense of domestic bonds. In contrast, if stabilization takes the form mainly of open market operations ($0 < \alpha < 1/2$), the increase in the money supply forces lower the supply of bonds held by the public. Clearly one half is a crucial value, determining whether holdings of domestic bonds will rise or fall with fiscal policy.

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12 The standard result, that fiscal policy is ineffective under flexible exchange rates, was demonstrated first by Fleming [1962], who argued that it was true only in the limit of perfect capital mobility. I have phrased the argument in a portfolio balance setting, with the conclusion that in the simplest case the result is generally true for any degree of capital mobility. See Boyer [2003].
Liquidity trap is not going to hinder the expansionary effects of fiscal policy.

High capital mobility will cause fiscal policy to be more potent, but it is not a very important augmenting factor. Augmenting for $\alpha$ somewhat less than $\frac{1}{2}$ up to 1. At 1, the quantity of foreign exchange necessary to be purchased to sustain the equilibrium is infinite. (Likewise with the quantity of domestic bonds necessary to be sold.) Diminishing for $\alpha$ less than one half, down to zero.

If output is keyed to movement in the price level, then fiscal policy by raising domestic prices, will lift output as well.

Member countries in the EMU must abide by deficit targets set by the governing council. In that sense a country’s fiscal policy stance faces a tighter constraint when it is a member of the currency union than it would otherwise. On the other hand the enhanced potency of fiscal policy under fixed exchange rates offsets this constraint at least to the certain extent. The maximum effectiveness would occur with fixed exchange rates without membership, in that sense membership curtails the independence of member countries’ governments.\(^\text{13}\)

VI. Recasting the Role of NCBs

Our point of reference up to now has been a country with an independent central bank under a fixed exchange rate regime. In this setting we have investigated the consequences of financial policy initiatives from both the central bank and from the fiscal authorities.

It is necessary now to see how that model has relevance to the situation of a member country in the EMU. Such a country continues to have a fiscal authority with some independence, but on the monetary side the country has been relinquished its usual tools. Its central bank no longer has the ability to carry out either open market operations or foreign exchange market operations. This seems to be quite a different situation from what we have portrayed above.

Let’s start with the similarities, and at the simplest level. First, such countries are on fixed exchange rates, in that they use euros, and the euros present in the country are identical in appearance with those outside the country. The difference, of course, is that the central bank does not have to engage in any stabilization transactions in order to maintain that exchange rate at parity. Instead, since a euro is a euro, the exchange rate is pegged at parity, with currency held within the country being identical to and trading one-for-one with currency outside the country.

\(^\text{13}\) Rules that limit member countries to running fiscal deficits of at most 3% of GDP have been in the news recently. Some member countries in the EMU have argued that the wars in Afghanistan and Iraq constitute “special circumstances” which permit the limits to be breached.
To make some progress here we need to talk in terms of analogies. The euros within the country are now the money which we dealt with in our model. The euros outside the country are the foreign exchange we consider there. And the pegging of the exchange is done by the private market, since these two sets of euros are identical, they trade at one-for-one in all transactions between nationals and foreigners. Such transactions amount to unsterilized foreign exchange market transactions since the quantities of money and foreign exchange move in opposite directions by equal amounts. We can think of individuals having to change their local money into foreign money before making purchases from foreigners.

In terms of our model, the value of $\alpha$ is equal to a half, even though the central bank is not the entity stabilizing the exchange rate: it is the private individuals who are doing it.

Meanwhile, the staff of the NCBs continue to formulate economic research, and therefore they continue to have target levels for both the money supply and the supply of foreign exchange held by the private sector in the economy. The question is how can they effectuate these goals? How can they signal to the private sector that they wish to nudge the economy in a particular direction?

The answer clearly lies with the domestic bond market. The money supply and the quantity of foreign exchange can no longer be exogenously changed through policy initiatives. Nonetheless the quantity of domestic bonds remains a policy tool which they can manipulate. In order to raise domestic rates of interest the quantity needs to be raised; to lower rates of interest the quantity needs to be lowered.

Domestic bonds are typically viewed as being government debentures specifically tailored to the needs of the local economy. They therefore have a poor market in the rest of the world.

When the amount of change in the quantity of bonds is $B_0$, the changes in the variables in the system are:

\[
P = -B_0X_e/(\Delta_L + \Delta_F) \quad (19)
\]

\[
r = B_0(X_e + X_w)/(\Delta_L + \Delta_F) \quad (20)
\]

\[
M = -B_0\Delta_L/(\Delta_L + \Delta_F) \quad (21)
\]

\[
B = B_0 \quad (22)
\]

\[
F = -B_0\Delta_F/(\Delta_L + \Delta_F) \quad (23)
\]

How can this role be carried out in the current institutional setting for NCBs? Clearly it can’t, but a simple reform of the system would enable these central banks to take a role in interest rate setting. They would thereby recapture a key policy tool which was lost with the move to unified decision making in the EMU in October 1998. The question is how
can the ability to set interest rates be restored, even though the freedom to change the value of the exchange rate was lost with accession into the EMU system.

As a financial institution these central banks have assets and liabilities, both of which are typically claims on the financial resources of governmental bodies. Since monetary liabilities play a minimal role in these central banks in their current formulation, changing the quantity of liquid market instruments is an unrealistic approach to policy. In contrast, the asset side of their balance sheets includes both domestic bonds (claims on the national government, with a very limited market in the rest of the world) and international bonds (claims on governments around the world and within the EMU, with an international market that is highly organized). Transactions in these bonds of sufficient magnitude to have a perceptible impact on interest rates is a possibility. Money could of course be an important element in carrying out these transactions, so that there would be short-term changes in its quantity. But if the market instrument that is being sold is put on the market first, resulting in an increase in the quantity of money held, then the authority would never have to be concerned about running out of liquidity.

These transactions amount to unsterilized foreign exchange market transactions even if the international bonds are not denominated in foreign currency terms. (And of course with rigidly fixed exchange rate, revaluation of such assets would not occur in any case.) The reason is that we have assumed that there are only three assets in the system: money, domestic bonds, and foreign exchange. From a modeling point of view money constitutes only those liquid assets that are held by domestic residents. This quantity can not be altered to any substantial extent by transactions carried out by the NCB.

Even though the NCB can not alter these holdings endogenously, clearly they have an endogenous impact as shown by the equations. Indeed, those equations demonstrate that the money supply moves in the opposite direction from the supply of bonds, but by only a fraction of the amount. The alteration in the supply of international bonds (foreign exchange) is offset to some degree, but not fully. The end result is that these holdings too move in the opposite direction from domestic bonds, but again by only a fraction of the amount.

This discussion shows the importance of the observational equivalence results. Even though the policy tools of the central bank have been curtailed substantially, such that unconventional approaches must be taken, nonetheless an NCB can carry out as independent a policy as it did before (with respect to interest rates and money supply) when it was merely pursuing a fixed exchange rate regime, rather than part of a currency union.

VII. Conclusion

A country whose local bonds are imperfect substitutes for foreign bonds has at its disposal two independent policy tools: open market operations, and foreign exchange market operations. In fixing the exchange rate to a basket of currencies of other countries, it ties up one of these tools. That leaves the other which can still be employed
to hit a separate target. In recent economic experience this target is likely to be setting domestic rates of interest.

If this country joins a currency union and maintains the independence of its central bank, it is in the equivalent of a fixed exchange rate situation. But if it joins a union and does not maintain independence it appears to have given up one of its tools and therefore seems to have less flexibility than before. However, this is a false interpretation of its circumstances. It certainly has given up a tool, but in doing so it has contracted out the task of fixing exchange rates to the rest of the union. It is still left with the power to set interest rates, and by using the equivalent of what were previously sterilized foreign exchange market interventions, it enjoys just as much power as it did before.

There is a lesson from this analysis for NCBs in the EMU. It is that if they reform their financial operations, they can maintain as much influence over domestic interest rates as they did before they relinquished their powers to conduct open market operations and unsterilized foreign exchange market operations. They do so by conducting the equivalent of sterilized foreign exchange market operations, by operating in the markets for domestic bonds and international bonds.

The power to affect domestic rates of interest may not be great, given the high degree of capital mobility in modern international financial markets. But however strong or tenuous it may be, so long as NCBs reform themselves in the ways indicated, that power is not diminished by accession to a currency union.

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