2
Neoclassical Approaches to Exchange Rate Determination[1]

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The goal of this chapter is to offer a critical survey of those exchange rate theories put forward by the Neoclassical school of thought in economics. It will start with a review of the general characteristics of that school of thought, followed by a roughly chronological review of models from purchasing power parity to modern micro-based ones.

FOUNDATIONS OF NEOCLASSICAL ECONOMICS

Neoclassicism is diverse, so much so that one cannot easily create a list of universal traits. I will, therefore, limit my attention to those characteristics that are both most commonplace and play an important role in their analyses of currency prices. To begin, understanding the Neoclassical approach to exchange rates requires an understanding of the fact that they view market systems as *natural*, at least in the sense that they are what humans would adopt if "external" influences did not force them to do otherwise. In addition, behavior therein is law governed. Markets, they argue, have existed throughout human history and have always been the preferred means of human economic interaction.[2] As they are natural, their basic character does not vary over time or space. Hence, little by way of specific institutional or historical detail is necessary in order to construct reliable explanations of economic phenomena.

Also, economic agents are assumed to be the best judge of their own welfare and to be rational in the sense that they can consistently order these preferences and select the options that would serve to maximize their welfare. Because markets allow these rational individuals the greatest freedom of choice, they are the most likely form of economic organization to generate outcomes that are beneficial to all parties. There are certainly exceptions to this, but even the term applied to those situations–"market failure"–implies the primacy or default nature of market-based solutions. This tendency for an ex-ante preference for markets (a residue of the fact that economics developed alongside political individualism) and their concomitant belief that markets systematically punish "irrational" behavior plays a very important role in the Neoclassical's analysis of foreign exchange rates.

In terms of specific modeling techniques, Neoclassical economists tend to rely heavily on deductivism (typically expressed mathematically) and equilibrium analysis. The former results from their implicit belief that less can be understood about economic activity from observing it than from the process of devising axiomatic first principles. In other words, while it may on some level be interesting to hear what managers claim to do in terms of pricing, there are reasons to suspect that their assertions are less than reliable and that we should instead suppose for them some simple and reasonable behavioral tendencies (e.g., short-term profit maximization). Our senses may deceive us (both as actors in the economy and as researchers), and we should thus depend instead on *reasoning* for inputs into our analyses. This process of developing first principles of economic behavior meshes well with the use of deductive logic in drawing conclusions from these behavioral and structural assumptions.[3]

Because mathematics is such a useful device in constructing and testing deductive arguments, it has become an important tool in the Neoclassical. Every one of their major theories of international economics can be expressed mathematically; in fact, it is the preferred method. A series of relations or assumptions (derived, as suggested above, primarily from reasoning rather than observation) is quantified, and then conclusions are drawn by either solving for or manipulating variables in the system. It is probably safe to say that no new development would be taken seriously by the economic Neoclassical were it not expressed in this manner.

In addition, such deductive arguments are typically placed within an equilibrium framework. Economic phenomena are assumed to seek resting points, points from which they will not stray unless parameters within the model change or exogenous forces come to bear. The economy is thus characterized as timeless and static, with dynamics usually limited to simple comparisons of equilibrium positions.

Last, it is commonly assumed that there is a strong tendency toward continuous full employment.[4] The simplest version of this premise argues that demand can never fall short of total supply because the raison d’etre for supplying goods and services is to spend the income so earned. If that is so, then involuntary unemployment (beyond frictional and structural) falls to zero and the economy grows, without interruption, according to available resources and technology and past accumulation.[5] Though Neoclassical models allow for deviations from this ideal state, they are treated either as temporary (as in monetarism, where they represent short-run movements away from the natural rate) or due to “interference” with the natural tendencies of the economy (as in Neoclassical Keynesianism, where market rigidities like minimum wage laws and unions create downward wage rigidity). At the very least, they argue, full employment holds in the long run, a time horizon which in their view is determined by forces distinct from those relevant in the short run. Furthermore, it is, according to Neoclassicism, to long-run analysis that we should look in informing policy.[6]

Key for exchange rate determination is that in such a world, capital flows must logically play a passive role. In the long run, output and employment are wholly determined by technology, productivity, resources, and the stock of capital; there is, therefore, nothing left for the financial side of the economy to do but to adjust to the real sector (recall the simple Neoclassical macro model in chapter one wherein the financial sector, via interest rates, acted to automatically reinvigorate spending). Financial capital flows are in the Neoclassical are an epiphenomenon. They arise and exist only because real economic activity took place. Money is neutral.

In summary, Neoclassical models, including those concerned with explaining exchange rate movements, are marked by a bias toward free-market solutions, a conspicuous lack of attention to historical and institutional detail, the assumption that economic forces tend toward equilibrium, axiomatic theorizing in a mathematical framework, and an almost complete lack of attention to the role of portfolio capital (due to the implicit acceptance of the long-run validity of the full employment assumption). Though I would argue that one can find elements of each of these in the theories reviewed below, it is the last that will be the most noticeable. Financial markets are either entirely ignored or of interest only because short-term "stickiness" or irrationality somewhere in the real economy is preventing rapid return to equilibrium. In the long run, they have no impact on the path economic activity follows.

PURCHASING POWER PARITY[7]

The core Neoclassical exchange rate theory is purchasing power parity. It says in short that, once exchange rates are taken into account, the average price of goods and services world wide should be equal. That is,

$$\$/FX = P_{\$}/P_{FX} \qquad 2.1$$

where \$/FX is the dollar price of foreign currency, $P_{\$}$ is the average price of goods and services in the United States, and P_{FX} is the average price of goods and services in the rest of the world. If this relationship does not hold, then (assuming no taxes, transportation, or transactions costs) it must be that merchandise is cheaper in one area than the other. This sets into motion arbitrage that will restore the equality (goods and services prices are bid up in the "cheap" nations and driven down in the "dear" nations, and the currency of the "cheap" nations appreciate as agents buy those money to buy their products). In this way, it is implied that the trade balance drives the exchange rate and that there is a systemic tendency for balanced trade to emerge as the equilibrium (a recurring theme in Neoclassical models). Portfolio capital flows play no role in the theory of purchasing power parity.

Purchasing power parity is an extremely well researched phenomenon. Econometric methods employed range from ordinary least squares to cointegration and data sets have included many, many countries all around the world over very long and varied time periods. Through all that, the best that economists can say is that there is *some* evidence that purchasing power parity *may* have validity for the major exchange rates over the long run (Sarno and Taylor 2002: 96). In the short run (wherein "short" implies three to five years), purchasing power parity is useless as a guide to currency price movements. Currency dealers go so far as to characterize the theory as "only academic jargon" (Cheung and Chinn 2000).

Why has such an intuitively appealing theory performed so poorly? Many suggestions have been made within the Neoclassical, ranging from measurement issues to nonlinearities. However, if financial flows are important, then the answer is quite simple (and overlooked)–purchasing power parity assumes that trade flows dominate the foreign exchange market when, in fact, they do not; portfolio capital does. Take the data from chapter one on currency markets, wherein the daily volume is sufficient to finance world trade over forty times.[8] Only if portfolio capital flows are white noise are they unimportant; otherwise, they clearly play a considerable role in driving currency prices. Purchasing power parity ignores them entirely, and one is not likely to successfully explain a phenomenon by focusing on a small, unrepresentative sample of its determinants.[9]

MONETARY MODEL

Though there is no single, universally accepted model of currency price determination among Neoclassical economists, the monetary model would probably at least claim the title of the most tested. It is, in essence, the monetarist approach to domestic macroeconomic modeling with purchasing power parity attached. In other words, the monetary model can be understood as equation 2.1 with a specific explanation of prices added.

Monetarism argues that prices are determined as follows:

$$P = MV/y \qquad 2.2$$

where P is the domestic price level, M is the supply of money, V is the velocity of money, and y is the level of real output. It is assumed that both V and y are constant (at least in the long run), the former because they argue that it is a function of slow-to-change habits and institutions, the latter since the full employment assumption implies that it can only change either as supply shocks occur or due to the gradual growth of technology and population.[10] This leaves M as the sole long-run determinant of P.

Substituting 2.1 into 2.2:

$$\$/FX = (M_{\$}V_{\$}/y_{\$})/(M_{FX}V_{FX}/y_{FX}) \qquad 2.3$$

where all variables are as defined above and the subscripts indicate nationality (with FX used to represent the “foreign” country and $ the US or home country). Hence, the monetary approach argues that changes in the money supply lead to movements in the price level, which in turn causes exchange rate adjustments. Again, this is simply purchasing power parity with a specific explanation of prices tacked on.

Most versions of the monetary approach include interest rates as determinants of the exchange rate. One might be tempted to conclude that this means that capital flows are being taken into account. This is not the case, however, as rising domestic interest rates (for example) do not lead to what we observe in the real world: a domestic currency appreciation as international investors attempt to place more of the home country's bonds into their portfolio assets. Rather, their role is to affect the domestic demand for cash. What occurs when interest rates rise is a decline in the demand for cash (as agents move into bonds), leading to (assuming no change in the supply of money) an excess supply of cash and hence a rise in prices. Because this causes a deterioration in the trade balance, the home currency depreciates–precisely the opposite of what is observed in the real world. The developers of this model certainly did not have modern financial markets in mind when adding this feature.

The monetary model can be shown graphically as in Figure 2.1. On the left is the purchasing power parity relationship. Measured on the vertical axis is the domestic (in this case, US) price level, and on the horizontal the price of foreign exchange in terms of dollars. As the slope of the PPP curve is the domestic price level divided by the exchange rate, it must be, if purchasing power parity holds, exactly equal to the foreign price level. If the foreign price level rises, you make the line steeper, and vice versa. Note also that, first, an economy lying on the PPP curve must have balanced trade and, second, lying off the curve would set into motion the arbitrage discussed above (and hence move us back onto the curve). In particular, points to the right of PPP would imply a trade surplus for the domestic economy (leading to higher domestic prices and a domestic currency appreciation–both movements taking us back to PPP) and points to the left would imply a deficit (leading to falling domestic prices and a domestic currency depreciation–again movements returning the economy to PPP).

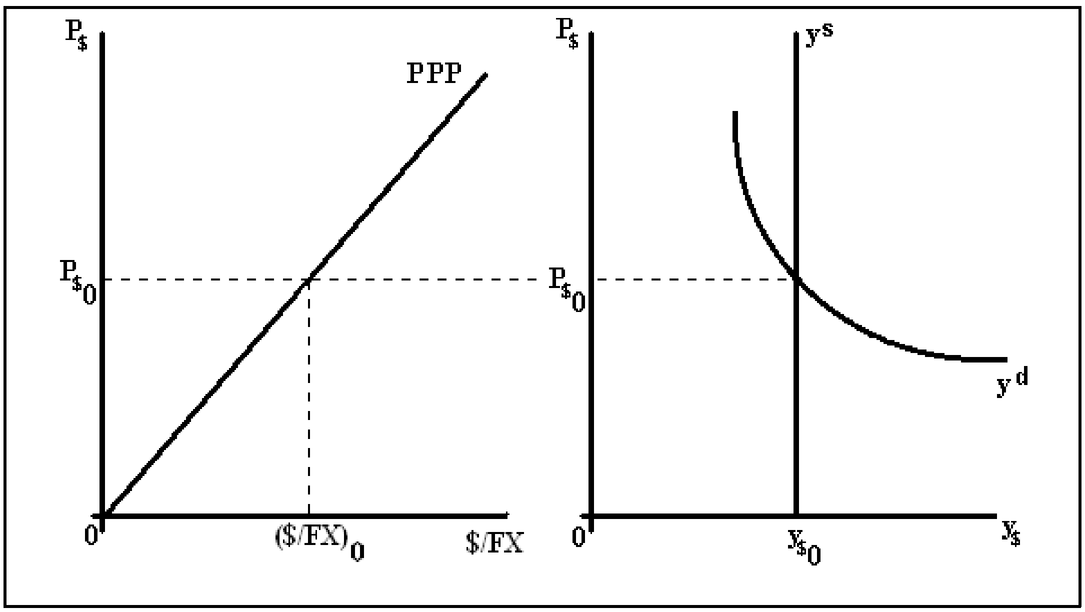

Figure 2.1: Monetary Model setup.

The graph on the right in Figure 2.1 is the domestic macroeconomy. The vertical axis remains the domestic price level, while the horizontal is real output or income. In this simple version the aggregate supply curve is vertical at the full employment (or natural) level of real output. This can be termed the long run supply curve, and to it can be added a more traditionally shaped positive short run curve as well (where the position of the latter is a function of workers' perceptions of the current price level). However, as this would only create further complication and not change the basic result of the model, the long-run, vertical-supply-curve version will be studied here.

Note that once the long-run supply curve is identified, the level of output is completely determined. Regardless of what else we show on either diagram in Figure 2.1, we know that $y = y_{\$0}$. No other outcome is possible and money and financial issues do not matter. The function y^s can shift, but this will tend to occur only over the long run as resources, technology, productivity, and the stock of capital change (for the good or the bad).

The demand curve (which exists in this model only to resolve the question of what the price level must be) is derived from equation 2.2 above:

$$P = MV/y \qquad 2.2$$

Given V as a constant and M as an exogenous variable under control of the central monetary authority, the demand curve is simply all the combinations of P and y (or in the case of Figure 2.1, $P_\$$ and $y_\$$) that solve equation 2.2. The demand curve asymptotically approaches either axis because neither P nor y can fall to zero and still satisfy an equation where V and M are non-zero. Changing either V or M will shift y^d (in particular, a rise in either necessitates a rightward shift).

Once we see where y^d intersects y^s, we know $P_\$$. Armed with $P_\$$ and assuming a particular price level in the foreign country (which defines the slope of PPP), the exchange rate is known. If shifts occur in PPP, y^d, or y^s, this will temporarily move us away from the PPP curve and lead to a trade deficit or surplus. The resulting arbitrage returns the system to equilibrium. For example, say the central monetary authority chooses to increase the money supply. This is illustrated in Figure 2.2, where the initial equilibria are at point ($P_{\$0}$, $(\$/FX)_0$) on the PPP diagram and ($P_{\$0}$, $y_{\$0}$) on the domestic macroeconomy. If M then rises, all the combinations of P and y that solve equation 2.2 are at higher points, and therefore y^d shifts to the right. This raises $P_\$$ to $P_{\$1}$ (in terms of the behavior of the agents involved, they attempt to rid themselves of the excess money balances by spending but, since no more output can be forthcoming as we are already at the full employment level, this only bids prices higher).

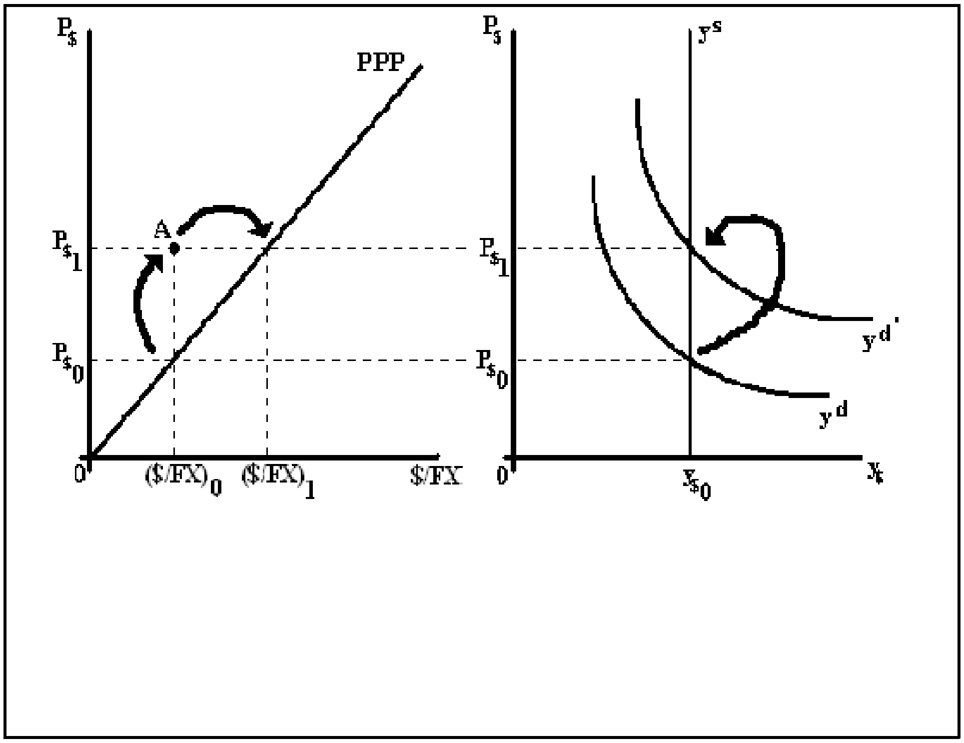

Figure 2.2: Monetary Model, effects of an increase in the money supply.

Moving to the PPP diagram, the rise in the price level has placed the economy at point A, where the domestic economy (the US in this example) is experiencing a trade deficit. This means that domestic goods and services are not selling, while those of the trading partner are. Ceteris paribus, this will place downward pressure on the domestic price level, upward pressure on the foreign price level, and cause the domestic money to lose value. However, if we assume that neither national price level can change without a policy decision by their central bank (an assumption that can be relaxed if we allow for flows of money between the two nations–a necessity, incidentally, in the fixed exchange rate version of this model), then the only variable able to bear the burden of adjustment is the exchange rate. Hence, in Figure 2.2, the dollar will depreciate, falling from $(\$/FX)_0$ to $(\$/FX)_1$.[11]

As the graphical analysis drives home, the monetary approach is purchasing power parity (the graph on the left) with a few new features added (the graph on the right). As such, it suffers from all the former's weaknesses. In particular, it is based on the assumption that trade flows drive currency prices, and that trade flows are a function of price variables only. Though changes in income may have an impact in the short run (more sophisticated models use money illusion to allow agents to freely choose levels other than the full employment one–until they realize that their choices were based on flawed perceptions), they do so only by changing the demand for cash and not because, as we so often observe in the real world, they raise import levels.

Not surprisingly, the empirical record of the monetary model is very similar to that of purchasing power parity. In general, it is possible to obtain some success for a few countries over the very long run (Rapach and Wohar 2002). But, again, while it may be *suggestive* in terms of long-term movements, it is a poor guide to policy over the time horizons in which we live our lives.[12]

INTEREST RATE PARITY

Interest rate parity is associated with the work of Irving Fisher and the Fisher effect.[13] Most simply, it argues that the rate of return from holding interest-denominated assets must tend toward equality across countries. Interest rate parity comes in two forms, covered and uncovered. The latter appears below as equation 2.4:

$$(\$/FX)^e/(\$/FX) = (1+r_\$)/(1+r_{FX}) \qquad 2.4$$

where $(\$/FX)^e$ is the expected future spot exchange rate, ($/FX) is the current spot exchange rate, $r_\$$ is the rate of interest available on dollars, and r_{FX} is the rate of interest available on foreign currency.[14] If it is rearranged as show in 2.4', its meaning becomes especially clear as it shows that the rate of return (plus principle) one could earn on an interest-bearing asset in the United States, $(1+r_\$)$, must be equal to the same amount translated into foreign currency (i.e., multiplied by (FX/$)), earned, (multiplied by $(1+r_{FX})$), and then repatriated (multiplied by $(\$/FX)^e$):

$$(1+r_\$) = (FX/\$)(1+r_{FX})(\$/FX)^e \qquad 2.4'$$

If for some reason the equality does not hold, then forces are set into motion that restore equilibrium. For example, were the left-hand side of 2.4' larger than the right, this would mean that agents expected the rate of return to be higher in the United States than elsewhere. This would attract capital into the US, driving $r_\$$ down, moving r_{FX} up, and causing a dollar appreciation (a rise in FX/$). This process continues until 2.4' (and, by implication, 2.4) holds again.

Covered interest rate parity is superficially similar but has a very different meaning and consists entirely of observable variables. It is shown as equation 2.5:

$(\$/FX)^f/(\$/FX) = (1+r_\$)/(1+r_{FX})$ 2.5

where $(\$/FX)^f$ is the forward exchange rate (i.e., the price at which an agent, typically a bank, agrees in the present to deliver foreign currency at some date in the future), ($/FX) is the current spot exchange rate, $r_\$$ is the rate of interest available on dollars, and r_{FX} is the rate of interest available on foreign currency.[15] Not coincidentally, the equation bankers use to calculate the forward rate they will charge customers is simply 2.5 rearranged (Taylor 1987):

$(\$/FX)^f = (\$/FX)((1+r_\$)/(1+r_{FX}))$ 2.5'

Essentially, their goal is to immediately cover any commitments created by a forward transaction by buying the necessary currency today. If the interest rate that the bank then earns in the foreign economy (while holding the currency until the delivery date) is lower than that at home, the bank makes up the loss by setting the forward rate at the premium indicated by 2.5'; if the foreign interest rate is higher, competitive pressures will force the bank to pass on this excess to the customer in the form of a discount, again determined by 2.5'. The bank earns its income either through transactions fees or the spread between the buy and sell rates.

Because, except for the substitution $(\$/FX)^f$ for $(\$/FX)^e$, this equation is identical to that for uncovered interest rate parity, some economists have argued that $(\$/FX)^f$ could server as a proxy for $(\$/FX)^e$. This is especially tempting to believe since the latter would be a very useful variable to obtain and yet is unobservable. And it is certainly true that if both covered and uncovered interest rate parity held then $(\$/FX)^f$ would be equal to $(\$/FX)^e$. Unfortunately, not only are $(\$/FX)^f$ and $(\$/FX)^e$ not created by similar processes, but while there is a great deal of evidence that covered interest rate parity holds, the record for uncovered is mixed at best (see Taylor 1987 for an example of the former and Wu 2007 for the latter). In fact, there are compelling reasons to believe that equation 2.4 does not represent an equilibrium relationship in the real world. The lengthy explanation of this contention is left for chapter five. Suffice it to say for now that agents' collective uncertainty regarding their forecasts opens the door to other factors determining the actual relationship between currency prices and interest rates. Covered interest rate parity holds because it is a definition rather than an equilibrium relationship; uncovered does not hold because it does not take into account the manner in which agents form expectations.

DORNBUSCH MODEL

In response to the obvious weaknesses of the monetary model, Rudiger Dornbusch proposed a new and innovative approach (Dornbusch 1976). The major differences were the rejection of the continuous maintenance of purchasing power parity and the explicit inclusion of uncovered interest rate parity as a determinant of currency prices.

The Dornbusch model makes a sharp distinction between short-run and long-run phenomena. Long-run outcomes are comparable to those found in the monetary model in that purchasing power parity holds and output returns to its natural level (or rate of growth, if the model is specified in logs). In fact, equations 2.2 and 2.3 above are included in the Dornbusch model, as are both of the graphs employed in Figures 2.1 and 2.2 (albeit with a few modifications). In the end, however, money and finance remain irrelevant.

In the short run, it is assumed that certain rigidities exist that prevent prices from fully responding to exogenous events. At the domestic level this means that the income variable is required to absorb the excess. Hence, the initial effect of a rise in the money supply, for example, would be a rise in *both* output and prices. This is modeled by allowing short-term fluctuations in y in equation 2.2, and by introducing an IS-LM apparatus into the system. The latter is necessary to link the change in y now permitted under the sticky price assumption to changes in the interest rate.[16] Once these are known, they can be plugged into the uncovered interest rate parity equation to determine the new exchange rate. The former is expressed as:

$$(\$/FX)^e/(\$/FX) = (1+r_\$)/(1+r_{FX}) \qquad 2.4$$

where all variables are defined as above. According to the Dornbusch model, this must hold at all times.

The uncovered interest rate parity relationship can be shown graphically as in Figure 2.3. The exchange rate (domestic currency units per foreign currency unit) is shown on the horizontal axis and the interest rate in the home country is graphed on the vertical. Each UIRP function is drawn for a particular foreign interest rate (which can be recorded on the vertical) and expected exchange rate. Changing either will entail a shift (to be detailed momentarily). It is easiest to begin with the point at which the domestic and foreign interest rates are the same. First, the UIRP shown is drawn assuming that agents expect the future spot rate to be equal to $(\$/FX)_0$ (hence the notation under the UIRP label). Second, recalling either equation 2.4 or 2.4', it is easily shown that if $r_\$ = r_{FX}$, then it must also be true that $(\$/FX)^e = (\$/FX)$. Hence, at the point where $r_\$ = r_{FX}$ on Figure 2.3, the prevailing exchange rate must also be the one that is expected by agents to prevail in the future: $(\$/FX)_0$. This must be the case since any excess expected return in either country would lead to compensating capital flows that eliminated the excess. If the rates of interest are identical, then agents cannot be expecting to earn extra return as a result of currency appreciation or depreciation.

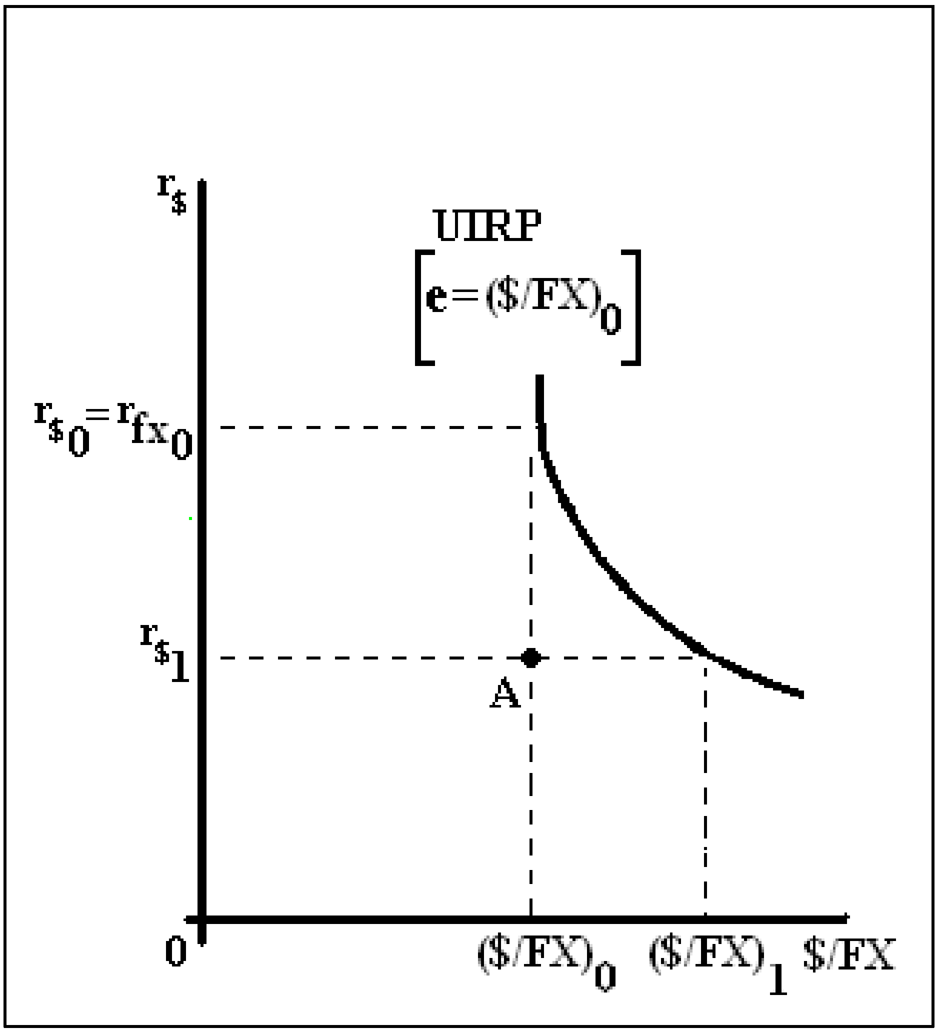

Figure 2.3: Uncovered Interest Rate Parity.

Now assume a fall in the domestic rate of interest to $r_{\$1}$. This leaves us at point A, where US assets are expected to earn a lower return than those in the rest of the world (this is easily seen by the fact that the exchange rate is already at the level the market expects to see prevail in the future, but US interest rates are lower than Japanese). This leads to capital flows away from the US which will cause, ceteris paribus, a rise in $r_{\$}$, a fall in r_{FX}, and a depreciation of the dollar (a rise in (\$/FX)). Making the interest rates exogenous and placing the entire burden of adjustment on the exchange rate yields the movement illustrated on Figure 2.3 to point ($r_{\$1}$, $(\$/FX)_1$). This is an equilibrium position because even though US interest rates are lower than those in the rest of the world, agents expect the dollar to compensate by appreciating.

Were expectations to change then we would see a self-fulfilling prophecy on Figure 2.3. For example, were agents to come to believe that the dollar would be cheaper in the future than they had earlier anticipated, UIRP would shift to the right. Having done so would leave the economy momentarily at a point to the left of the new UIRP, which is comparable to what occurred after the domestic interest rate movement in Figure 2.3. Just as there, the capital would flow out of the US and the dollar would depreciate–as anticipated. Changing the foreign interest rate also requires a shift in UIRP, rightward for a rise and leftward for a fall. In any event, all points to the left of a particular UIRP imply a net capital outflow for the domestic country (leading to a domestic currency deprecation) and all points to the right of a particular UIRP imply a net capital inflow for the domestic country (leading to a domestic currency appreciation).

The IS-LM portion of the construct can be expressed as in equations 2.6 through 2.10:

$$S = (\underset{+}{r}, \underset{+}{y}) \qquad 2.6$$

$$I = (\underset{-}{r}) \qquad 2.7$$

$$S = I \qquad 2.8$$

$$M^d/P = (\underset{-}{r}, \underset{+}{y}) \qquad 2.9$$

$$M^d/P = M^s/P \qquad 2.10$$

where S is savings, r is the interest rate, y is real output, I is investment, M^d/P is (real) money demand, and M^s/P is (real) money supply. Equations 2.6 through 2.8 specify IS (the first two giving behavioral relationships and the last showing the equilibrium condition) and equations 2.9 and 2.10 specify LM (with 2.9 showing the money demand equation and 2.10 the equilibrium condition; nominal money supply is assumed exogenous). To this simple version, a government and trade sector are added so that 2.8 becomes:

$$S = I + (G-T) + B \qquad 2.8'$$

where G is government spending, T is taxes, and B is the current account balance. The last is assumed to be a positive function of the real exchange rate, Q:

$$Q = (\$/FX)(P_{FX}/P_{\$}) \qquad 2.11$$

where all variables are defined as above. Note that when purchasing power parity holds, it must be true that $\$/FX = P_{\$}/P_{FX}$ and, therefore, Q = 1.

The IS-LM apparatus is represented graphically in Figure 2.4. Real output or income is measured along the horizontal axis and the interest rate along the vertical. The IS curve is the locus of points that shows the combinations of interest and output that set injections into the income stream equal to leakages. At the most basic level that means I = S. Equation 2.8', however, captures better what will need to be modeled here:

$$S = I + (G-T) + B \qquad 2.8'$$

Of these variables, G and T are exogenous and B will be a function of the real exchange rate, Q. Only S and I are driven by determinants measured on the axes. Taking any particular point in the space as satisfying equation 2.8, assume a rise in interest rates. Will this necessitate a rise or fall in real output and income? Rising interest rates have no effect on G, T, or B, but cause S to increase and I to fall (see equations 2.6 and 2.7). This would lead to leakages exceeding injections, causing a recession. Consequently, y will fall and, along with it, S (see equation 2.6). This fall will continue until S declines sufficiently to reestablish the equality of leakages and injections. The lesson here is

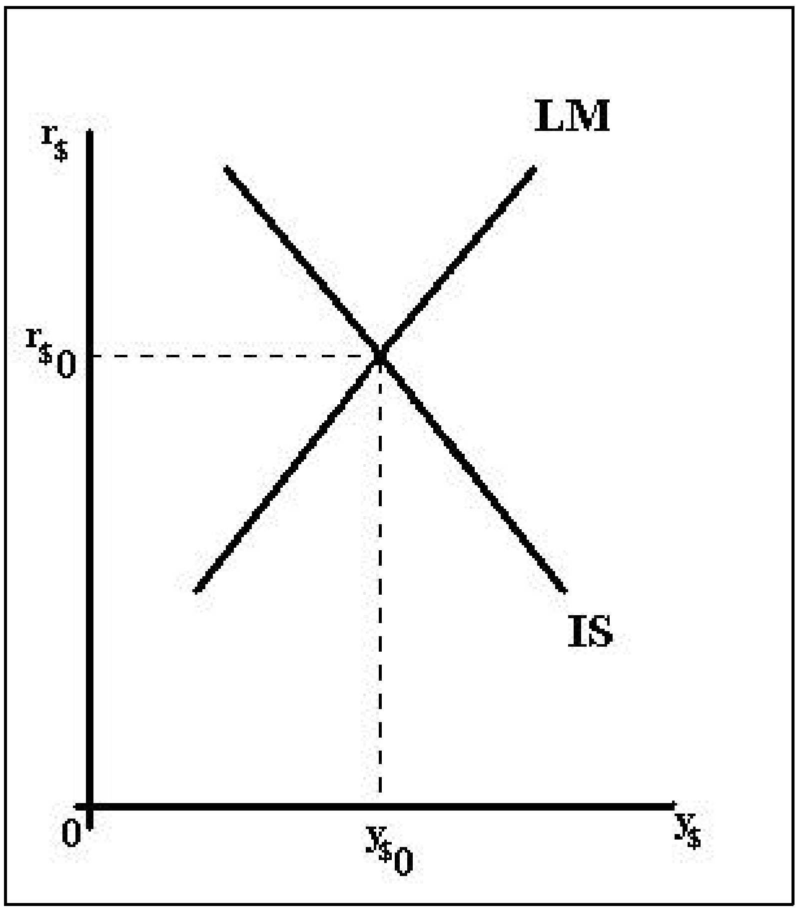

Figure 2.4: ISLM curves.

that rising interest rates require a fall in y, so IS is negatively sloped. Changes in G, T, and B will cause a shift, with rising G and B moving the function to the right and rising T to the left.

The LM curve is the locus of points that shows the combinations of interest and output that set the real supply of money equal to the real demand for money. Again, take any random point as satisfying equation 2.10. Now arbitrarily raise real output to see what impact this will have on the money market. According to equation 2.9, the demand for money will rise. However, with no change in the supply, this means there is a shortage. Bankers will response by raising interest rates in an effort to both attract more deposits and ration the funds that are available. In the money market, each time y rises, so must r. The LM curve therefore has positive slope.

To show how the equation-based model works, assume a rise in the money supply (both nominal and real). In the long run, the only result will be as has been shown in the monetary model: a rise in the domestic price level and a depreciation of the home currency (with trade remaining balanced). In the interim, however, a number of events occur. To begin, when M rises in equation 2.2, both P and y rise (recall that V is constant). The rise in y is reflected in the IS-LM system. There, it occurs not because the excess supply of money is spent, driving prices higher and temporarily raising output over its natural level or rate (the explanation consistent with equation 2.2), but due to the fact that the monetary policy stimulus lowers interest rates and thereby raises investment and consumption. This occurs via equations 2.9, 2.7, and 2.6. Note that the rise in investment and consumption does not create an additional rise in y, but is simply the IS-LM equivalent of that which takes place in equation 2.2.

The fall in the domestic interest rate now impacts on the price of foreign currency. Though it is clear from equation 2.4 that the fall in the US interest rate will lead to a depreciation of the spot dollar, there is a complicating factor (which is the key to the novelty of this approach). The increase in the money supply will have signaled to investors, equipped with rational expectations, a long-run change in the exchange rate. Furthermore, they will assume that change is equivalent to the one the monetary model would predict.[17] Hence, the estimates embodied in $(\$/FX)^e$ will have been revised upward by *exactly* the amount implied by equation 2.2 (given a constant V and y); and because of the relationship specified in equation 2.4, ($/FX) will have to rise by the same amount as $(\$/FX)^e$ (at this stage it is assumed that neither r has reacted). *This adjustment in expectations and the spot price of currency occurs immediately after the increase in the money supply*. It is the very first thing that happens and, in the end, this movement will represent the only permanent change in the exchange rate. But in the meantime there will be an additional decline in the dollar caused by the interest rate fall. It represents *overshooting* and will correct once the economy returns to long-run equilibrium (and r falls back to its original level). It occurs precisely because of the price rigidity that led to the increase in y reflected in IS-LM. Had the price rise been proportional to the money supply increase, LM would not have shifted (since the real money supply would not have changed) and the interest rate would not have moved. There would have been no overshooting.

But the US interest rate does fall so that the value of the dollar has moved below its long run equilibrium–an equilibrium that is still, as in the monetary model, equivalent to the purchasing power parity value of the dollar–meaning that the US will run a trade surplus (this also causes a rightward shift in IS, further raising y; the consequent rise is r is assumed to be smaller than the initial fall). All the while, prices are continuously, if slowly, moving to their long-run equilibrium levels.[18] As this process plays itself out, the real money supply declines (shifting LM to the left) and the real exchange rate falls (shifting IS to the left). This combination lowers y and (by assumption, since it could move in either direction) raises r. Given that uncovered interest rate parity holds constantly, the rise in r must lead to a dollar appreciation.[19] This continues, with y falling, r rising, and ($/FX) falling, until purchasing power parity is again satisfied and excess demand in the domestic economy is relieved. Long run equilibrium is achieved and only P and ($/FX) have moved.

The graphic version of this sequence of events is illustrated in Figure 2.5. Note first the addition of both several notations on the graphs and a short-run aggregate supply curve on the monetary model's macro diagram in the bottom right quadrant. Beginning with the latter, the vertical aggregate supply curve from Figure 2.2 is now the long-run supply curve y^s (l.r.). Real output will eventually return to $y_{\$0}$, but it may deviate in the short run. This is shown by the horizontal y^s (s.r.), or short-run aggregate supply curve. Such a curve exists, it is assumed, because prices are sticky in the short run which temporarily forces the entire burden of adjustment onto y. With respect to notation, the y^s-y^d diagram and IS-LM have parenthetical references to the variables that will shift those functions in this example (others may be added, as implied by the mathematical functions used to derive them). LM, for example, shows $M/P_\$$, or the real money supply. As it rises, this will shift LM to the right and hence drive interest rates down. IS shows Q which is defined above as the real exchange rate.[20] It is the true cost of foreign goods and services (with both the nominal exchange rate and relative price levels taken into account). As Q rises, so foreign goods and services become more expensive and a trade surplus is experience by the domestic economy. This causes injections to exceed leakages at any of the combinations of r and y available on the current IS, so IS must shift to the right. This leaves all the injections unaffected, but the rise in y causes a leakage (S) to increase. Equilibrium is restored. Finally, y^d is shifted by two variables: the money supply (as was already true in the monetary model) and the nominal

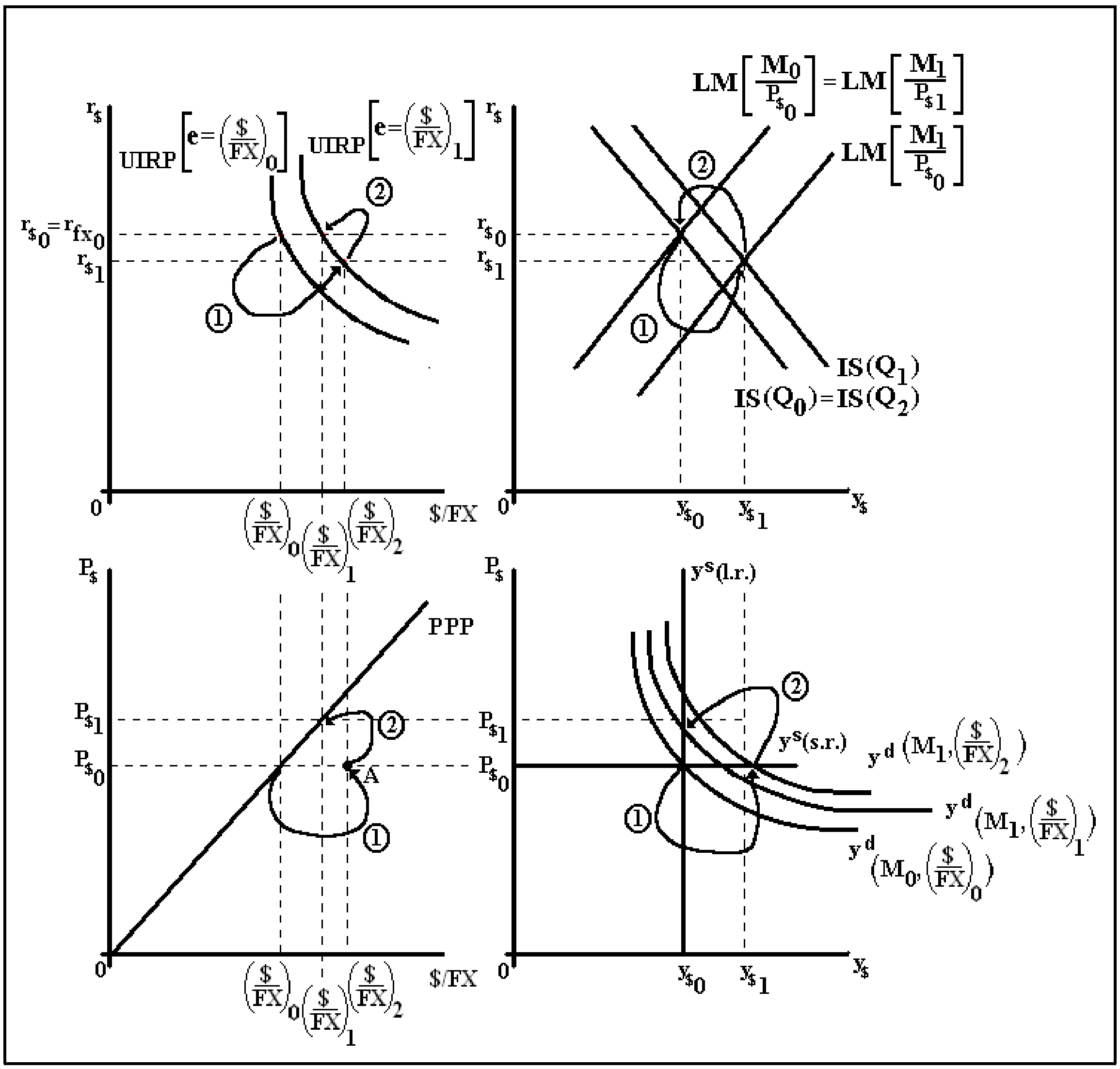

Figure 2.5: The Dornbusch Model, the effect of an increase in the money supply.

exchange rate. As explained earlier, a rise in the money supply shifts y^d to the right, and in the Dornbusch model it will be assumed that a rise in \$/FX (a domestic currency depreciation) also leads to a rightward shift.[21]

Showing the effect of a rise in the money supply (as was traced mathematically above) proceeds as follows. The initial equilibrium is given by all the variables subscripted with a zero. Now say the central monetary authority raises the money supply (and that they make no secret of this fact). Agents become aware of the policy move and the very first impact is on their expectations. As stated above, they have rational expectations and believe that the monetary model will prevail over the long run. Hence, they immediately decide that the future spot rate will come to rest at $(\$/FX)_1$ (they know that this is the right level because when purchasing power parity holds it is the equilibrium exchange rate for the final rise in the price level to $P_{\$1}$).

The change in agents' expectations requires a shift in UIRP to the curve where $e = (\$/FX)_1$. Given the fact that neither interest rate has changed (and nor may they without shifts in their corresponding IS-LM diagrams–the entire burden of adjustment in the UIRP market is on the spot exchange rate), the spot rate must immediately move to the level agents expect: $(\$/FX)_1$. All this has occurred in the rapidly adjusting financial market. Nothing has so far had time to happen anywhere else in the model.[22]

Now imagine the impact of the domestic currency depreciation and the rise in the money supply on the IS-LM diagram. Given that neither domestic nor foreign prices have moved, there is a rightward shift in both functions. While this will clearly lead to a rise in y, the effect on r is ambiguous; it is assumed to fall, however. Following the arrow labeled “1" on the IS-LM apparatus lead us to point ($r_{\$1}$, $y_{\$1}$) (actually, just short of that, since there is about to be an additional currency price depreciation that will move IS a little further to the right). Now move to the UIRP diagram, where there has been both a shift and a movement down the horizontal axis. This leaves the new exchange rate as $(\$/FX)_2$. Dropping down to PPP–which need not hold in the short run–the combination of $(\$/FX)_2$ and $P_{\$0}$ (which has yet to adjust) puts us off PPP to the right at point A. The US is experiencing a trade surplus because the dollar depreciation overshot its long-run equilibrium. Finally, the current situation on the y^d-y^s diagram is shown by the intersection between the short-run y^s and the y^d labeled with M_1 and $(\$/FX)_2$ (note that it is shifted higher than the long-run equilibrium y^d because of the overshooting exchange rate). The short run movements end here, at $r_{\$1}$, $y_{\$1}$, $P_{\$0}$, and $(\$/FX)_2$.

The next stage of the process (all the arrows labeled with a “2") begins as price finally adjusts. To see the impact of this movement begin again on IS-LM. First, it is clear that both IS and LM will shift left, the former because Q is falling and the latter because M/P is doing the same. How far will IS and LM move? Back to their original levels. This must be true because PPP holds in the long run (putting Q back to 1) and, with y back to the natural rate as defined by the long run supply curve, equation 2.2 shows that M and P must have changed proportionally (so that their ratio is unchanged). We return on IS-LM to $r_{\$0}$, $y_{\$0}$. With $r_\$$ back to $r_{\$0}$ on UIRP, the exchange rate must have moved to $(\$/FX)_1$ (just as agents predicted it would–note that this appreciation also helps to push IS back to its original position). The change in \$/FX shifts y^d down slightly, and the price level associated with the new demand curve (as it intersects with long run supply) will combine with $(\$/FX)_1$ in a manner that restores purchasing power parity. In the end, only three variables have changed in the model: the exchange rate, the expected exchange rate, and the price level.

On the surface of it, the Dornbusch model is a significant improvement over the monetary approach, especially in that it seems to offer a more dynamic view with an active portfolio capital market and the possibility of fluctuations in output above and below the natural rate.[23] But while the Dornbusch model does represent a step forward, some of this progress is more apparent that real. For example, capital flows occur only as a result of government policy or a supply shock. They react, but they do not cause; nor is their impact lasting or able to truly affect the economy. This is directly attributable to the full employment (or natural rate) assumption–output always returns to the same level or rate of growth, so there is no opening for finance to affect real variables.

Second, while most certainly superior to the monetarist portrayal, the dynamism is somewhat contrived. Rather than a wholesale shift to modeling in historical time, where the past has a qualitative effect on the future, it is still mechanical. We know as soon as the increase in the money supply takes place where we will end up–it's only a matter of how long it will take. In other words, the future is not path dependent, it is pre-determined.

Last, the fluctuations above and below the natural rate represent in no way a break from the full employment assumption. Rigidities exist that prevent it from working properly, but it is still there. And eventually, it wins out. Regardless of the size of any change in the money supply, the economy will, sooner or later, return to the long run natural rate of growth.

Still, there is an explicit provision made for the role of expectations in the determination of currency prices, which was certainly a step in the right direction. In fact, once the change in money supply is made, the first movement of the exchange rate is due solely to a change in agents' forecasts. Unfortunately, the assumption of rational expectations completely eliminates the chance of $(\$/FX)^e$ playing any role other than the passive accommodation of the economy's movement toward long-run equilibrium.[24] To better understand its place in the model consider what would happen if expectations did not adjust after a money supply change.

There is no rightward shift in UIRP but, as before, when M rises in equation 2.2, both P and y rise. A matching increase in y occurs in the IS-LM system as interest rates fall and investment and consumption are encouraged. The fall in $r_\$$ means that, according to equation 2.4, there must be a depreciation of the dollar. Given that there has been no change in either national price level, this means that purchasing power parity no longer holds and the US is running a trade surplus. This causes a rightward shift of IS (due to the rise in Q), but not so large that there is not still a net decline in US interest rates. This completes the short-term movements.

In the long run, prices will begin to adjust. As this occurs, LM will move back to its original position. Since y must also return to its starting point, then IS must, as well. And if both IS and

LM have returned, then $r_\$$ cannot have changed.

But the fact that $(\$/FX)^e$ has not changed due to a shift in UIRP (as before) creates an irreconcilable problem in the model. Recall equation 2.4:

$$(\$/FX)^e/(\$/FX) = (1+r_\$)/(1+r_{FX}) \quad 2.4$$

Expectations have not changed, $r_\$$ has returned to its original level, and r_{FX} is exogenous and unchanged. Therefore, if uncovered interest rate parity must hold at all times, as required by the Dornbusch model, then ($/FX) must also be at its original level. But that means that, since $P_\$$ rose but neither $/FX nor P_{FX} have changed, purchasing power parity does not hold even in the long run (and the US has a trade deficit). The model breaks down. Without making the very powerful assumption that agents believe the Monetary model drives long run exchange rates (and that they have rational expectations), UIRP and PPP cannot both hold in the long run. Also, despite the fact that the model no longer operates as intended, agents' expectations were correct! They did not expect the exchange rate to move and, assuming UIRP holds continuously and given that $r_\$$ returns to its original level, that is precisely what happened. Interestingly, the latter would hold true regardless of the expectational assumptions made. This is so because, first, given an increase in the money supply, IS and LM must always return to their original positions in the Dornbusch model. The real money supply will be unchanged in the long run, and the fact that y can change only temporarily means that IS must move back. Hence, $r_\$$ cannot move. As r_{FX} is fixed and $(\$/FX)^e$ is exogenous, this means that ($/FX) always moves to match the expectations of economic agents. Only if the latter happen to coincide with the level that would yield purchasing power parity will trade return to balance. That is precisely the purpose of the Dornbusch model's assumptions regarding $(\$/FX)^e$. That is a shame, as the model would be considerably more interesting and relevant if expectations were allowed a free role rather than being tied to proving the monetary model's case.[25] The Post Keynesian model developed in chapter five will not share this weakness.

THE MEESE AND ROGOFF CRITIQUE AND SURVEY STUDIES

Though none of the above models tested terribly well, there was faith in the underlying truth of the relationships as modeled (at least over the long run). However, a truly remarkable paper was published in 1983 that broke (at least on the surface) with this thinking. Richard Meese and Kenneth Rogoff, young staffers at the *International Monetary Fund*, were charged with determining which of the extant exchange rate models generated the best forecast (Rogoff 2001). To their surprise, nothing could outperform a model based on the simple premise that today's spot price is a predictor of tomorrow's spot price (a random walk).[26] The initial response to their controversial results was decidedly negative. Robert Clower, the editor of the *American Economic Review*, for example, "sent our manuscript back in return mail with a scathing letter saying that the results are obviously garbage and if we wish to remain in the economics profession, we had better develop a more positive attitude" (Rogoff 2001: 4). Still, eventually they *were* published, and the implications of the study could not be ignored (see Meese and Rogoff 1983).

Whether Meese and Rogoff's results were a function of the fact that the large-scale models were simply wrong or because they had (in the Neoclassical view) unfairly tested the short-term forecasting abilities of what were essentially long-term processes, they encouraged a shift in the focus of empirical studies. Economists began testing currency market characteristics rather than complete models of foreign exchange rate determination. In particular, the assumptions of rationality and efficiency were questioned. This new research program was not solely a function of the Meese/Rogoff results. The early 1980's were also witness to a dramatic rise in the availability of surveys of exchange market participants' forecasts of future spot rates.[27] Hence, it was possible to undertake studies that were theretofore impossible. Still, given the suspicion with which Neoclassicals view survey data, Meese and Rogoff (1983) was probably necessary if not sufficient; and this ushered in a decade of tests involving exchange market expectations.

Most popular were tests for rationality and efficiency. These are rather straightforward as an economist need only be armed with spot currency data and a set of currency forecasts. For example, the following could be used to test for rational expectations:

$$(\$/FX)_{t+k} = a + dE_t(\$/FX)_{t+k} + e_{t+k} \qquad 2.12$$

where $(\$/FX)_{t+k}$ is the spot price of foreign currency (in dollars) in period t+k, $E_t(\$/FX)_{t+k}$ is the forecast in period t of the spot rate for period t+k, and e_{t+k} is a random error term. The forecast is unbiased (i.e., rational) if a = 0 and d = 1.

One can extend this test of market participants' expectations-formation process by taking e_{t+k} from equation 2.12 and placing it into the following:

$$e_{t+k} = \text{ß} + ?I_t + u_{t+k} \qquad 2.13$$

where I_t is information available in time t (researchers commonly use lagged values of e_{t+k} or the change in the exchange rate from t-1 to t as a proxy) and u_{t+k} is a random error term.[28] If the market if efficient then there should be no relationship between the forecast error term e_{t+k} and the information that had been available at time period t. Hence, it is expected that ß = ? = 0.

Many such tests have been conducted and there now exists widespread evidence that short-term forecasts are biased and markets are inefficient (Harvey 1998-9).[29] In other words, it appears that agents' predictions contain persistent errors that could have been corrected using existing information. The rising popularity of technical analysis had already put market efficiency under fire and this now added fuel to the fire.

BACK TO FUNDAMENTALS

Around the same time as the rise in popularity of survey-based studies, there was a conspicuous increase in the frequency with which currency price determinants were referenced as the "fundamentals" (see Harvey 2001 for an extensive discussion of this issue). This was a direct consequence of the troubles being had in constructing empirical explanations of exchange rate movements (both large scale models and tests of market efficiency and rational expectations). Identifying the determinants of currency prices in this general (and often quite vague) manner was a convenient mechanism for discussing the broader issues involved without getting bogged down in details.[30]

On the one hand, this is an intelligent strategy. Given the state of empirical exchange rate research, referencing the determinants in a more general manner makes sense. Why call them "money supply, output, and prices" or "the monetary model," for example, when there is little evidence that any specific list or model is the correct one? Strangely enough, however, that is, precisely what Neoclassical economists do when they offer a definition of the fundamentals. It is, in fact, common practice to explain the fundamentals by associating them with a list of specific variables or a particular currency price model. The advantage of the generalized approach is thus completely lost. To make matters worse, that is generally the extent of any attempt to define the fundamentals. There does not exist a single, coherent explanation of the concept; instead, readers are offered indirect references or definitions by example. This passage from Keith Pilbeam is typical: "economic fundamentals (are) derived from modern exchange rate models" (parenthetical reference added; Pilbeam 1994: 66). Were there a single, accepted approach to foreign exchange rate determination then this would be a clear statement. Of course, it would also then be unnecessary to call these determinants the fundamentals! Definitions by example, such as the one below by Mark Taylor, are similarly impractical, but common:

> The aim of this paper is to assess the importance of macroeconomic fundamentals–such as money supply, output, interest rates, and so on–for exchange rate movements and in particular for the modelling of exchange rate movements.
>
> (Taylor 1995b: 1)

Such an approach, lacking, as it does, a means for the reader to determine *why* Mark Taylor considers money supply, output, and interest rates as fundamentals, is of very limited usefulness.[31] A third approach, the least specific of all, is to say that the fundamentals are those variables "predicted by economic theory" as opposed to any specific model (MacDonald and Taylor 1992: 25).

What is it that Neoclassical economists mean by the fundamentals? As it is not apparent that there is disagreement among them regarding their various definitions, one must assume that they perceive commonalities. Indeed, a careful reading of the literature reveals that what is generally meant by the fundamentals is "that set of variables guaranteeing the efficient operation of the foreign currency market" (Harvey 2001: 4). In other words, Neoclassical economists are assuming that, whatever the fundamentals are specifically, in general they are the determinants that would (if they prevailed) generate efficient or optimal outcomes in the currency market. The fundamentals thus appear to become the foreign exchange equivalent of perfect competition–a market ideal rather than a description.

Again, this starts off sounding like a good idea. It is not unreasonable for economists to describe an ideal state in the market and then use that description as a template for devising policy prescriptions. However, they take the gigantic leap of *assuming* that the fundamentals serve not only as a theoretical ideal, but a representation of the real world, as well. A priori, there is no justification for such a position. Furthermore, why should we, as social scientists, expect the phenomena we study to automatically generate first best, or even second best, outcomes (something that seems to afflict economists much more so than our colleagues in the other social sciences)? The particular manner in which the world really works is largely independent of our wishes.[32]

Today, exchange rate theory is marked by a return to the models being studied 30 years ago. The difference is that there is not now any expectation that these have relevance in the short run. Since the latter is thought to be characterized by irrationalities and inefficiencies, some Neoclassical economists have decided that "economics" is simply not equipped to explain it. Hence, rather than seeking new tools, the discipline has redefined the subject of its analysis. Keynes' criticism of long-run analysis seems to be as relevant as ever.

FUNDAMENTALISTS VS. CHARTISTS AND MICROSTRUCTURE

It would be unfair to say that all Neoclassical economists have completely abandoned the short run or any attempt to develop new tools. Some work has been interesting. For example, Jeffrey Frankel and Kenneth Froot (1986) have suggested an approach wherein it is assumed that there exist three agents:

i. chartists: those forecasting currency prices by relying solely on autoregressive technical trading rules;

ii. fundamentalists: those forecasting currency prices using exchange rate models (they suggest the Dornbusch) "that would be exactly correct if there were no chartists in the world" (Frankel and Froot 1986: 24);

iii. portfolio managers: those who buy and sell foreign assets based on the expectations of the above two sets of agents.

The key to the model is the fact that portfolio managers weight the sets of forecasts based on whose has been the most accurate over the recent past. Frankel and Froot also allow for the possibility that chartists and fundamentalists are really the same people, shifting their primary focus under varying sets of circumstances (something that would fit well with the survey findings of Mark Taylor and Helen Allen (1992)). We witness the largest movements away from fundamental equilibrium, they argue, when there has been a regime change and portfolio managers are slow to learn the new model.

This is a superior approach to that taken in the full-scale models reviewed above. It takes into account the important role of charting and technical analysis and it does not assume that all agents' forecasts are characterized by rational expectations. Market participants must learn how the world works, a problematic undertaking given that the world evolves. Still, in the end it does not represent a clear break with the Dornbusch, monetary, and portfolio balance models. Consider this question: if portfolio managers set the foreign exchange rate via their buying and selling of currency, why do they bother changing their forecasts? Will they not always, in aggregate, be correct? Not in Frankel and Froot's model, because the process that determines exchange rates is assumed to be the following:

$$s_t = c?\, s^m_{t+1} + z_t \qquad 2.14$$

where s_t is the spot exchange rate (logged), $?\, s^m_{t+1}$ is the rate of depreciation expected by portfolio managers, and z_t "represents other contemporaneous determinants" (Frankel and Froot 1986: 29). The variable z_t is shorthand for the fundamentals, which is represented by one of the traditional exchange rate models (or a derivative thereof). Hence, in the end it is still the fundamentals that drive currency prices. Indeed, the particular specification upon which Frankel and Froot depend in their 1986 paper is one wherein the fundamentals are proxied by the current account. Hence, though it is by far one of the most interesting Neoclassical approaches, it is still not a clean break with the premise that the financial side of the economy has no real impact. It is purchasing power parity in disguise.

Another innovative approach within the Neoclassical is typified by the work of Mark D. Flood (1994). Flood builds a simulation model of the foreign exchange market with the goal of "examining the market structure: the absolute and relative proportions of market-makers, brokers, and customers constituting the market" (Flood 1994: 132). He makes no assumption whatsoever regarding the relative importance of trade and capital flows, preferring instead to treat exogenous inputs as simply "news." Flood then specifies the structure of the market and the reaction functions of each agent. It is a very unique approach.

What his model suggests is that the unwanted inventories created by certain currency market events are not quickly or easily resolved. Rather, they are passed from agent to agent, creating further disruption and leading to market inefficiencies. Flood concludes that a means of centralizing price information would help resolve these problems.

ORDER FLOW

Last to be mentioned here is order flow. The basic idea is that asset prices react to buying pressure, or "the net of buyer-initiated and seller-initiated orders" (Evans and Lyons 2002: 171). This seems like a reasonable statement and, in fact, a rather elementary one. In the paper cited above, the exchange rate is modeled as a function of both the buying pressure variable (taken from Reuters data on Deutsche mark/dollar and yen dollar for four months of 1996) and the interest-rate differential. In short, this combination is shown to have an explanatory power far superior to that of other mainstream models.

But what does ad hoc empirical approach that really tell us? It shows that interest rates are important, which is entirely consistent with the Post Keynesian view that capital flows are key. The order flow variable itself, however, simply states that when more people want to buy than sell, price rises. The begging question, of course, is why that occurred. One attempt to answer this comes from Nikola and Neeley (2008), who examine the US-Canadian dollar market and test economic announcements as an explanation for variations in order flow. They are able to claim some significant successes.

This new approach breaks strongly with the Neoclassical bias toward real, fundamental variables as the driving force behind currency movements and it will be very interesting to see how the order-flow literature affects mainstream exchange rate research. Likely as not, it will be relegated to the Siberia of mainstream economics, the short run. In the meantime, there is nothing in the buying-pressure argument that is at odds with Post Keynesian economics.

CONCLUSIONS

To say that nothing has been learned from the above would be false. Those cited above are leading scholars in our discipline and their work has most certainly pushed back the frontiers of our knowledge. Still, it does not matter how clever you are if one of your major premises is false. Their implicit acceptance of continuous full employment and consequent relegation of the financial sector to irrelevance dooms their investigations. Unless capital flows are white noise, their approach is, at best, misleading.

One of the strange features of the Neoclassical literature is that on occasion someone will raise the possibility that their basic premise with respect to the centrality of trade flows in driving exchange rates is wrong. See, for example, Ronald MacDonald:

> ...it is our contention that for a sample period such as the current float, net capital flows will not go to zero and, therefore, they should be explicitly recognized in modeling the measure of the long-run exchange rate currently adopted in the literature.
>
> (MacDonald 1995: 482)

No one has pursued these leads. It appears that if an answer is to be found, it is not going to arise from the Neoclassical approach.