Central Bank Intervention, the Current Account, and Exchange Rates

MAURICE LARRAIN*

Abstract

This paper seeks to explain exchange rate and current account or net foreign assets behavior under central bank foreign exchange rate intervention. To analyze central bank intervention we use the current account-net foreign assets identity, as well as the long-run monetary exchange rate model. The intervention function is one where exchange rate deviations from equilibrium are governed by nonlinear adjustments. That is, exchange rate deviations from their long-run equilibrium are such that the degree of reversion towards equilibrium increases with the size of the deviation from equilibrium. In this type of nonlinear function exchange rates determine the current account, and the current account in turn determines exchange rates. This iterative duality contrasts with several portfolio balance models where exchange rates are a function of trade, but trade is not a function of exchange rates. This two way causality is slightly more complex, but is also analytically richer than assuming that exchange rates change solely in a one step process as targeted by central banks. Managing exchange rates is posited to be an active iterative feedback process where intervention changes the current account, which may in turn make further intervention necessary. (JEL F31)

Introduction

This paper seeks to explain exchange rate and current account behavior under central bank foreign exchange rate intervention. Some basic forms of intervention include targeting an appropriate level for the domestic currency; attempting to preserve orderly market conditions; and concerted intervention by several central banks, as witnessed by the support of the Euro over 2000 and 2001. The object of intervention is to influence movements in exchange rates, and the capital and current accounts of the balance of payments[1] for policy purposes. To analyze central bank intervention we use the current account-net foreign assets identity, as well as the long-run monetary exchange rate model (MM). The intervention function is one where exchange rate deviations from equilibrium are governed by nonlinear adjustments. That is, exchange rate deviations from their long-run equilibrium are such that the degree of reversion towards equilibrium increases with the size of the deviation from equilibrium. In this nonlinear function exchange rates determine the current account, and the current account in turn determines exchange rates. The first (reminiscent of the traditional elasticity approach), shows a causality link from the exchange rate to trade, while the second (used in Portfolio Balance Models) shows an opposite and concurrent relationship: that changes in the current account will lead to changes in the exchange rate.

Section one shows a brief and very limited exposition of PBM's and the monetary model. This is followed by a discussion in section two of the coexistence of movements in exchange

*Pace University—U.S.A.

rates, and current account imbalances. This is explained by short-run exchange rates deviating from, or being equal to their long-run equilibrium. Section three develops a model of the joint functionality of the current account and exchange rates, and sections four and five respectively discuss real exchange rates and the effectiveness of central bank intervention.

Open Economy Models

First and Second Generation Portfolio Balance Models

Portfolio Balance Models are approaches to open-economy analysis that have gained broad acceptance in the last three decades. Of consequence to our discussion are limitations of PBM's in explaining current account-exchange rate interactions, and their ensuing lesser adequacy in intervention analysis[2] than the less complex and more limited monetary model.

First generation PBM's assume perfect (or near perfect) capital mobility which clears financial asset markets and determines the value of the exchange rate. Examples of these models are Mundell [1962], and Dornbusch [1976]. Among these elegant yet simpler portfolio balance approaches, we note in particular the earlier work by Niehans [1977], Dornbusch and Fisher [1980], and Rodriguez [1980]. In these first generation models the current account plays an important role in determining exchange rates,[3] but this role is at times ambiguous. The models are characterized by one way causality since trade flows are viewed as a determinant of exchange rates, while the exchange rate has no influence on trade flows.

Second generation PBM's follow the more rigorous framework set by Obstfeld and Rogoff [1995]. These models are described by Sarno [2001] as showing an increasingly higher standard of analytical sophistication than first generation PBM's, while simultaneously including a less solid interpretation of the current account. More recent second generation PBM's limit the analysis to a current account immune to shocks, which effectively renders it inactive. Both first and second generation PBM's treat the effect of the current account on the exchange rate as ambiguous in varying degrees. This renders these models relatively ineffective in a concurrent analysis of exchange rate management and current account or net foreign assets interaction.

The Monetary Model

One drawback of not using portfolio balance models is that they can treat large economies. But their drawback is their current account indeterminacy. The monetary model is a small country model but has two features needed for the development of our arguments. First, it is clear regarding its treatment of the current account. Second, it is a long-run model, and we need a long-run exchange rate against which we can measure short-run exchange rate deviations. The monetary model assumes a small open economy. By small is meant that the country cannot affect international prices or the interest rate it faces. The small country assumption of the monetary model may nevertheless be more apparent than real. Thus, in discussing Lane's [1997] use of the assumption, Sarno [2001] points out that research based on a small open economy is plausible for most countries except the U.S. By open is meant that the country participates in world trade. The degree to which a country depends on international transactions defines its degree of openness. Viewing international trade as a percent of GDP, Melvin [1995], defines Belgium as relatively open and the U.S. as relatively closed.

There is only trade in this economy's current account, and domestic and foreign assets are perfect substitutes. If the assumption of perfect substitutability is relaxed, a premium is required on foreign assets, and interest rate parity will not hold. A portfolio model is then more relevant. The exchange rate would then be determined by relative supplies of domestic and foreign bonds as well as domestic and foreign money. Thus the effectiveness of the pure monetary model will be inversely related to the degree of asset substitutability. The monetary model nevertheless has well defined properties regarding its treatment of trade imbalances on the one hand, and of exchange rate movements on the other. Under the premises of the MM [see Frenkel, 1976], only fixed exchange rates result in trade balance movements. Monetary and fiscal policies are assumed to change prices and interest rates, but the rigidity of exchange rates generates current account surpluses and deficits. The trade imbalances increase foreign assets in the first case, and decrease them in the second. Under floating rates instead, the deficits and surpluses of the current account are nonexistent, and changes in relative moneys, real incomes and nominal interest rates determine movements in the exchange rate. That is, there is the supposition that fiscal and monetary policies generate price level and interest rate changes, which cause incipient current account deficits or surpluses. These incipient pressures then manifest themselves in exchange rate movements.

Because of its purchasing power parity roots the MM is viewed primarily as a model which would explain long-run exchange rate equilibrium. Empirical tests of the MM since its inception have, for the most part, not been successful. Recent work, however, has somewhat redeemed the MM's empirical value. Though section four details the many studies supporting the MM since the 1990s to date, it is noteworthy to highlight a distinctive contribution. This is the work of Taylor and Peel [2000], who re-cast the MM in nonlinear terms. Here exchange rate deviations from equilibrium are governed by nonlinear adjustments such that the degree of adjustment towards equilibrium increases with the size of the deviation from equilibrium. This results in improved empirical results. The intervention function we develop next is also of this type.

Central Bank Intervention

The movement in exchange rates in a free float, or the surpluses and deficits in the balance of payments under fixed rates are usually considered a function of policy parameters. When rates are neither fixed nor freely floating, but are instead managed by central banks, a hybrid situation develops. Under managed floating, movements in a country's exchange rates and current account imbalances coexist. The co-movements in both rates and trade can be explained by short-run exchange rates deviating from, or being equal to their long-run equilibrium. A managed exchange rate implies a short-run rate induced by central bank intervention which differs from a long-run equilibrium rate as shown in (1) below. Equation (1) and all ensuing equations are expressed as logarithmic functions.

$$a^T = f(e - e^*) \quad , \tag{1}$$

where (a) are net foreign assets, $(^T)$ denotes a target level, (e^*) is the long-run equilibrium exchange rate, and (e) is the desired or managed exchange rate. This equation tells us the central bank will intervene to achieve a particular exchange rate target; that is, it will hold a level of reserves consistent with its exchange rate and current account goals. This type of intervention is characterized by a manipulation of foreign assets to obtain a specific exchange rate.

Let us now assume that in a given period the exchange rate in existence is an equilibrium rate, that is, short and long-run rates are equal. The balance on trade and capital flows would be zero, and there would be no net addition or subtraction to the country's stock of foreign assets. If we next assume deviations of the short-run rate from equilibrium, these deviations may be the result of two separate forces: market rigidities on one extreme, or central bank management on the other. When the cause are sluggish market forces, deviations are accompanied by nonzero changes in the trade balance. As a consequence there will be a change in the stock of foreign assets. This is similar to Rodriguez [1980], where exchange rate deviations from their steady-state level are determined by corresponding movements in the current account.

If the exchange rate deviation comes about instead because of central bank intervention, the difference will then be some function of the surplus or deficit that the bank targets (a^T):

$$e * -e = f(a^T) \quad . \tag{2}$$

The actual surplus or deficit the country experiences however, will be a function of how far the managed rate is from the long-run equilibrium rate (e^*):

$$a = f(e^* - e) \quad . \tag{3}$$

If (a) is not equal to (a^T), the authorities will revise the managed rate in light of the actual surplus or deficit, (a), they have observed. Thus, if the surplus or deficit is accumulating at a rate different from that desired by the central bank, it revises the next periods' managed rate according to the near term evidence it has on the actual surplus or deficit. This assumes that central banks can only target, that they can therefore miss a particular balance of payments goal, and that they intervene frequently.

The central bank can thus force exchange rate deviations, but it can also react in the opposite direction: to restore short-run rates to equilibrium and maintain orderly market conditions. If the disequilibrium in exchange rates comes about because of market rigidities or imperfections, and the central bank only seeks to smooth erratic fluctuations in the exchange rate, it will seek to restore the short-run rate to its equilibrium value, as discussed by Neely [2001]. Again, the parameter the authorities can observe as indicative of disequilibrium will be surpluses or deficits on the current and capital accounts. The functional form of the intervention parameter would be the same as in (2) above, where the bank desires a particular surplus or deficit. In the case of market imperfections however, the motivation of the central bank would be different, it would now seek an exchange rate that sets (a) equal to zero.

In addition, market forces would help the central bank narrow the difference between (e^*) and (e). Market participants would also view an unexpected surplus or deficit as indicating the observed rate is not an equilibrium rate. Because agents can only profit if they anticipate an equilibrium trend, their actions would help move the observed disequilibrium rate towards its clearing value. Thus, if unanticipated surpluses or deficits occur, both the central bank and the market would seek a new rate for the following period. This new rate would tend to eliminate or reduce the imbalance in the country's international transactions.

A Model of Central Bank Intervention

The joint interaction between exchange rates and the current account can be shown explicitly by means of a specific function relating net foreign assets to exchange rates and vice-verse. Let us consider an intervention function where exchange rate deviations from equilibrium are governed by nonlinear adjustments. The theory behind the nonlinearity follows the reasoning of Dumas [1992, 1994], Sercu and Van Hulle [1995], as well as Flood and Taylor [1996]. That is, exchange rate deviations from their long-run equilibrium could be such that the degree of reversion towards equilibrium increases with the size of the deviation from equilibrium, as shown in (4) below:

$$a = c(e - e^*)^z \quad . \tag{4}$$

This differs from Sarno and Taylor's [2001] intervention function both in its linearity, and in its more limited and simpler variable set. As shown in the Mathematical Appendix, from equation (4) we can derive equations (5) and (6) :

$$e - e^{*} = c^{-\frac{1}{z}}(a)^{\frac{1}{z}} \quad , \tag{5}$$

$$e = e^{*} + c^{-\frac{1}{z}}(a)^{\frac{1}{z}} \quad . \tag{6}$$

The expression in (5) shows that the difference between a managed rate (e), and a long-run equilibrium rate (e^{*}), is a function of net foreign assets (a), as much as net foreign assets in equation (4) are a function of $(e - e^{*})$. The direction of causality in equation (4) when the current account is a function of the spot exchange rate relative to its long-run value, is because surpluses (deficits) will accumulate if the spot exchange rate is undervalued (overvalued) Exports will exceed imports at undervalued spot exchange rate levels and imports will exceed exports at overvalued spot exchange rate levels. The direction of causality in equation (5), when the exchange rate is a function of foreign assets, is that as holdings of foreign assets increase (decrease), the relative value of foreign currency and therefore the exchange rate will decrease (increase). The set of equations also has surpluses or deficits net to zero when short-run rates become equal to the long-run n equilibrium rate. Thus from (4) above, if $(e^{*} = e)$, the right hand side of the equation becomes zero. When this is the case, then (a) itself becomes zero, showing that if a managed rate equals a free floating rate there would be no surpluses or deficits and therefore no net foreign assets. Conversely, if (e) is bigger than (e^{*}), foreign assets will decrease, while, if (e) is smaller than (e^{*}), foreign assets will increase, that is, surpluses will accumulate.

Meese and Rogoff [1988] show, and the literature generally assumes, that short-run currency appreciation and depreciation are positively related to the current account in theory. The causality is from trade to the exchange rate, as shown in equation (6) above. However, there is also an opposite and concurrent relationship: this is that changes in the short-run exchange rate will generate changes in the current account. The causality is then from the exchange rate to trade, as shown in equation (5) above. This last functional direction is reminiscent of the primary concern of earlier, and of modern elasticity theorists as exemplified by Devereux [2000]. The two way causality shown above is more complex, but it is also analytically richer than assuming that exchange rates change solely in a one-step process as targeted by the monetary authorities. Equations (4) and (6) may imply that managing an exchange rate is an active iterative feedback process, where intervention changes the current account which may in turn make further intervention necessary. That is, a future value of $(e - e^{*})$ is determined by a past value of (a); and a future value of (a) is determined by a past value of $(e - e^{*})$.

One should not be left with the impression that the joint functionality of the current account depending on $(e - e^{*})$, and $(e - e^{*})$ depending on the current account shown in equations (4) to (6) above, is exclusively due to central bank management. It is instead basically due to (e) being different from (e^{*}), regardless of why such a differential exists (though intervention is probably the most frequent causal factor). It is therefore possible to exclude central bank intervention from the previous argument, and instead restructure the discussion solely in terms of the current account. This would allow for a comparison of our results with the treatment of the current account by first generation PBM's. We can then argue that discrepancies between short-run rates and long-run equilibrium rates will cause current account imbalances. Following this reasoning, we would obtain the same results shown by equations (4) to (6). These results would be at odds with the analytical structure used by first generation PBM's. This refers, for example, to the previously discussed models developed by Niehans [1980], Rodriguez [1980], and Dornbusch and Fisher [1980], which assume that exchange rates are dependent on changes in trade, while concurrently trade is treated as independent of changes in exchange rates. Indeed, Rodriguez [1980], makes a point of contrasting the traditional elasticity approach which sees trade as determined by exchange rate changes, with the reverse directional emphasis of PBM's, where the concern is instead with how exchange rates determine trade flows.[4] The causality in these PBM's is from the current account to the exchange rate, with many portfolio models initially requiring that trade be independent of exchange rate movements.

Monetary Models, the Real Exchange Rate, and Net Foreign Assets

Since its inception in the 1970's the monetary model has been a topic of empirical controversy, with test results into the early 1990's by and large not supporting its predictions (this is not to say that other models have been significantly more successful). In the past decade, however, the MM has received increasing support in that research suggests the long-term behavior of exchange rates can be explained by relative moneys, incomes and interest rates. This includes empirical results by Mark [1990], Mac Donald and Taylor [1994] Froot and Rogoff [1995], Lothian and Taylor [1996], and Taylor and Sarno [1998], among others. More recently there is the previously cited work by Taylor and Peel [2000] who find a nonlinear structure improves empirical tests of the MM; that of Mark and Sul [2001] who use cross-sectional data for 19 countries showing the MM to be significant, and by Schnabel [2001] who explains the Yen with purchasing power parity and productivity data.

The primary use to which we put the MM is twofold. One is to define the long-run equilibrium rate (e^*) used here. The second is to use the MM in defining short-run exchange rates. Monetarists consider the long-run exchange rate (expressed as foreign currency units per unit of domestic currency), to be function of the differential of relative prices $(-P_i + P_j)$. These prices are in turn dependent on the differential between relative moneys $(M_i - M_j)$, incomes $(y_i - y_j)$, and interest rates $(r_i - r_j)$,where the subscripts (i) and (j) refer to two countries. The four relative differentials are expressed as (P_{ij}), (M_{ij}), (Y_{ij}), and (r_{ij}), so that:

$$e^* = P_{ij} \quad , \tag{7}$$

and

$$e^* = -(M_{ij}) + k(y_{ij}) - h(r_{ij}) \quad . \tag{8}$$

Though the MM shown in (8) above is analytically simpler than first and second generation PBM's, it can lend itself to a richer treatment of net foreign assets. As shown below, the MM helps develop consistent functional relationships involving the current account, and short and long-run exchange rates.

By substituting equation (8) into (6) and defining (a_{ij}) as being equal to $(a_i - a_j)$, we obtain:

$$e = -(M_{ij}) + k(y_{ij}) - h(r_{ij}) + g(a_{ij}) \quad , \tag{9}$$

where $g(a_{ij}) = C^{-\frac{1}{z}}(a_{ij})^{\frac{1}{z}}$ and:

$$g(a_{ij}) = (M_{ij}) - k(y_{ij}) + h(r_{ij}) + e \quad , \tag{10}$$

so that net foreign assets can be managed either by monetary and fiscal policies that change money (M), income (y), and the interest rate (r); or by using international reserves to manage the spot exchange rate (e). Alternately, when analyzing disorderly market conditions, the short-run exchange rate (e) can be made to approach (e^*). This may be achieved by using international reserves until the value of (e) leads to (a) being equal to zero.

Effectiveness of Intervention

Discussions on central bank intervention often allude to the difficulties inherent in defending non-equilibrium rates. These difficulties render long-run exchange rate changes as outside the banks' reach. Intervention is seen instead as effective only in the short-run. There is, however, a possible limitation that emerges from our analysis which we mention first. This is instability brought about by the feedback between trade and real exchange rates, which could be attributed to active and persistent exchange rate management We mentioned earlier in section three that equations (4) and (5) imply that managing an exchange rate is an active iterative feedback process. Intervention changes the current account to a moving target, and this in turn makes further intervention necessary. Since these equations are exponential in nature, nonlinear dynamics tells us there is no guarantee that the iterative process initiated by central bank intervention will either converge or diverge from a steady-state solution. We do not pursue the details of this topic here, but the potential instability of the feedback system is an interesting possibility. The magnitude of this instability, if it exists, would be dependent on the precise form of the nonlinearity.

A further limitation of intervention is related to a signaling process inherent in the current account regarding the disparity ($e - e^*$). If the long-run rate (e^*) is broadly seen to depend on money, income, and interest rates, agents would observe trends in these three macro-variables as influencing its movements. In this long-run view changes in foreign assets would be seen as being positively related to long-run changes in the money supply. In the longer term therefore, an increase in foreign assets may be viewed as increasing the domestic money supply, and through it affecting both prices and interest rates. This increase in the money supply will lead, over time, to a depreciation of the exchange rate. In the short-run, however, agents would also be attentive to changes in the balance of payments, but for a different reason. This is because in the near term increases (decreases) in foreign assets will have the opposite effect, and the exchange rate (e) will appreciate (depreciate) in line with the current account. This short-run process will follow a dynamic path similar to that shown by Dornbusch and Fisher [1980].

A managed exchange rate implies that the exchange rate the authorities choose to target is not equal to a free market rate.[5] Over time central banks may undergo a management of exchange rates which can be defined as sequential mini-fixing. The three cases of such mini-fixing can be represented as:

$$\begin{array}{llcll} (i) & e-e^* & > & 0; & a>0 \\ (ii) & e-e^* & < & 0; & a<0 \\ (iii) & e-e^* & = & 0; & a=0 \end{array}$$

where ($e*$) is the perceived long-run rate, (e) is the rate the authorities impose, and (a) are changes in net foreign assets. Under (i) there is an incentive for foreigners to purchase less goods and securities from the country, while residents have an opposite incentive, with the result being decreases in the balances on current account and an ensuing change in net foreign assets. Situation (ii) shows a managed rate which tends to increase the current account balances, while (*iii*) shows the long-run equilibrium rate as being equal to that desired by the central banks.

Since the stock of international reserves held by central banks is finite, intervention policies are likely to be limited in duration. The probability therefore, is that a managed rate will sooner rather than later have to bow to market forces. Changes in foreign assets are therefore likely to occur until the managed exchange rate reverts to the value of the long-run rate. If the short-run rate is undervalued, assets will keep accumulating. Market pressure will then persist until a higher rate is established such that it discourages further changes in the capital and current accounts. If the exchange rate is overvalued, then the finite stock of foreign assets will be depleted, and as discussed by Flood and Garber [1984], long term intervention will fail, Under a managed float therefore, the market will interpret movements in the current account as being related to either artificially high or low rates. Agents would then view these changes in two ways: (1) as contributing to the money supply and therefore affecting prices and interest rates in the longer run [Eichenbaum and Evans, 1995; Rogoff, 1996]; and (2) as reflecting an arbitrage disparity between short-run rates and what would otherwise be an equilibrium long-run exchange rate.

Conclusion

To analyze central bank intervention we use the current account-net foreign assets identity, as well as the long-run monetary exchange rate model (MM). The intervention function is one where exchange rate deviations from equilibrium are governed by nonlinear adjustments. That is, exchange rate deviations from their long-run equilibrium are such that the degree of reversion towards equilibrium increases with the size of the deviation from equilibrium. In this nonlinear function exchange rates determine the current account, and the current account in turn determines exchange rates. This iterative duality contrasts with several portfolio balance models where exchange rates are a function of trade, but trade is not a function of exchange rates. These results would be at odds with the analytical structure used by first generation PBM's. This refers, for example, to the previously discussed models developed by Niehans [1980], Rodriguez [1980], and Dornbusch and Fisher [1980], which assume that exchange rates are dependent on changes in trade, while concurrently trade is treated as independent of changes in exchange rates. The two way causality of our nonlinear model is slightly more complex, but is also analytically richer than assuming that exchange rates change solely in a one step process as targeted by central banks. Managing exchange rates is posited to be an active iterative feedback process where intervention changes the current account, which may in turn make further intervention necessary.

APPENDIX

The derivation of the equations in section three are shown below:

$$a = c(e - e^*)^z \tag{1}$$

If we raise both sides of equation (1) to the power of $(\frac{1}{z})$ we obtain:

$$a^{\frac{1}{z}} = c^{\frac{1}{z}}(e - e^*) \tag{2}$$

Multiplying both sides by $(c^{-\frac{1}{z}})$ we obtain:

$$e - e^* = c^{-\frac{1}{z}}(a)^{\frac{1}{z}} \tag{3}$$

From which:

$$e = e^* + c^{-\frac{1}{z}}(a)^{\frac{1}{z}} \tag{4}$$

Footnotes

[1]An inclusive survey of the literature on the effectiveness of central bank intervention policies is found in Edison [1993].

[2]Sarno and Taylor [2001] conjecture that future capital markets integration and increasing asset substitutability will diminish the PBM as a channel of influence to central bank intervention over time.

[3]Rodriguez [1980] states that at any instant in time, the difference between the spot exchange rate and its long-run equilibrium value is shown to be proportional to the current value of the normalized trade balance. The factor of proportionality increases with the interest elasticity of relative asset demand and decreases with the speed at which the trade balance will tend to approach zero over time.

[4]Niehans uses an adaptive approach to have the exchange rate as a function of the current account. To do this, Niehans and assumes that there is independence of expected exchange rates changes and the trade account. Rodriguez develops a rational expectations model where the exchange rate is dependent on only the current account, but to do so Rodriguez also has to assume that the trade balance is independent of the exchange rate. Dornbusch and Fisher introduce the current account by expanding an exchange rate function around its long term equilibrium and then linearizing.

[5]The exception being when central banks acts to maintain orderly market conditions by attempting to move the short-run rate towards its long-run value.

References

Devereux, M. B. "How Does a Devaluation Affect the Current Account?," Journal of International Money and Finance, 19, 2000, pp. 833-51.

Dornbusch, Rudiger. "Expectations and Exchange Rate Dynamics," Journal of Political Economy, December, 1976, pp. 1161-76.

—; Fischer, Stanley. "Exchange Rates and the Current Account," American Economic Review, December, 1980, pp. 960-71.

Dumas, B. "Dynamic Equilibrium and the Real Exchange Rate in a Spatially Separated World," Review of Financial Studies, 5, 2, 1992, pp. 153-80.

—. "Partial Equilibrium Versus General Equilibrium Models of the International Capital Market." in Van der Ploeg, F., (Ed) The Handbook of International Macroeconomics, Blackwell, Oxford, 1994, pp. 301-47.

Edison, H. J. "The Effectiveness of Central Bank Intervention: A Survey of the Literature Since 1982," University of Princeton Department of Economics Special Papers in International Economics, No 18, 1993.

Eichenbaum, Martin; Evans, Charles. "Some Empirical Evidence on the Effects of Monetary Policy Shocks on Exchange Rates," Quarterly Journal of Economics, November, 1995, pp. 975-1110.

Flood, Robert P.; Garber, Peter M. "Collapsing Exchange Rate Regimes: Some Linear Examples," Journal of International Economics, 1984, 17, 1-2, pp. 1-13.

Frenkel, J. "A Monetary Approach to the Exchange Rate: Doctrinal Aspects and Empirical Evidence," Scandinavian Journal of Economics, June, 1976, pp. 255-76.

Flood, R. P.; Taylor, M. P. "Exchange Rate Economics: What's Wrong With the Conventional Macro Approach?," in: Frankel, J. A., Galli. G., Giovannini, (Eds) The Microstructure of Foreign Exchange Markets, Chicago University Press, Chicago, 1996, pp. 261-94.

Froot, K. A.; Rogoff, K. "Perspectives on Purchasing Power Parity and Long-Run Real Exchange Rates," in: Rogoff, K. and Grossman, G. (Eds). Handbook of International Economics, Vol. 3, North Holland, 1995, pp. 1647-88.

Lane, Philip R. "Inflation in Open Economies," Journal of International Economics, May, 1997, 42 (3-4), pp. 327-47.

Lothian, J. R.; Taylor, M. P. "Real Exchange Rate Behavior: The Recent Float from the Perspectove of the Past Two Centuries," Journal of Political Economy, 104, 3, 1996, pp. 488-510.

MacDonald, R.; Taylor, M. P. "The Monetary Model of the Exchange Rate: Long-Run Relationships, Short-Run Dynamics, and How to Beat a Random Walk," Journal of International Money and Finance, 13, 3, 1994, pp. 276-90.

Mark, Nelson C. "Real and Nominal Exchange Rates in the Long-Run: An Empirical Investigation," Journal of International Economics, 28 (1-2), 1990, pp. 115-36.

—; Sul, Donggyu. "Nominal Exchange Rates and Monetary Fundamentals: Evidence from a Small Post-Bretton Woods Panel," Journal of International Economics, 53, 2001, pp. 29-52.

Meese, Richard; Rogoff, Kenneth. "Was it Real? The Exchange Rate-Interest Differential Over the Modern Floating-Rate Period," Journal of Finance, 43, 1988, pp. 933-48.

Melvin. Michael. International Money and Finance, Harper Collins, New York, 1995, pp.170.

Mundell, Robert A. "The Appropriate use of Monetary and Fiscal Policy for Internal and External Stability," International Monetary Fund Staff Papers, March 1962, pp. 70-9.

Neely, Christopher J. "The Practice of Central Bank Intervention: Looking Under the Hood," Federal Reserve Bank of St. Louis Review, May/June 2001, pp. 1-10.

Niehans, Jurg. "Exchange Rate Dynamics with Stock/Flow Interaction," Journal of Political Economy, 6, 83, 1977, pp. 1245-57.

Obstfeld, Maurice; Rogoff, Kenneth. "Exchange Rate Dynamics Redux," Journal of Political Economy, June, 1995, pp. 624-60.

Rodriguez, Carlos Alfredo. "The Role of Trade Flows in Exchange Rate Determination: A Rational Expectations Approach," Journal of Political Economy, 6, 88, 1980.

Rogoff, K. "The Purchasing Power Parity Puzzle," Journal of Economic Literature, 34, 1996, pp. 647-68.

Sercu, P.; Uppal, R.; Van Hulle, C. "The Exchange Rate in the Presence of Transactions Costs: Implications for Tests of Purchasing Power Parity," Journal of Finance, 1990, 50, 4, 1309-19.

Schnabl, Gunther. "Purchasing Power Parity and the Yen/Dollar Exchange Rate," The World Economy, January, 2001, pp. 31-50.

Sarno, Lucius. "Toward a New Paradigm in Open Economy Modeling: Where Do We Stand?," Federal Reserve Bank of St. Louis Review, May/June 2001, pp. 21-36.

—; Taylor, Mark P. "Official Intervention in the Foreign Exchange Markets: Is It Effective?," Journal of Economic Literature, September, 2001, pp. 839-68.

Taylor, M. P.; Sarno, L. "The Behavior of Real Exchange Rates During the Post Bretton Woods Period," Journal of International Economics, 46, 2, 1998, pp. 281-312.

Taylor, M. P.; Peel, David A. "Nonlinear Adjustment, Long-Run Equilibrium and Exchange Rate Fundamentals," Journal of International Money and Finance, 19, 2000, pp. 33-53.