

A Monetary Model of Exchange Rate and Balance of Payments Adjustment

Anthony J Makin¹

ABSTRACT

This article proposes an alternative monetary model for examining the effects of domestic monetary shocks on the exchange rate and the balance of payments. Using an output-expenditure framework, it shows that domestic monetary shocks can drive a wedge between national expenditure and production and generate incipient current account imbalances with exchange rate and balance of payments implications. Contrary to previous monetary approaches, the model suggests a new chain of causality that runs from domestic money to the exchange rate to the price level, rather than from money to the price level to the exchange rate. It also shows that under fixed rates external adjustment is consistent with money market equilibrium and price level stability.

1. INTRODUCTION

THE TRADITIONAL MONETARY APPROACH to the balance of payments (MABP) and the monetary approach to the exchange rate (MAER) developed by numerous authors decades ago (Polak 1957, Frenkel 1976, Johnson 1977, Branson and Henderson 1985, Frenkel and Mussa 1985) proposed that the domestic money market should be at the centre of balance of payments and exchange rate analysis, an idea originally espoused by the classical economist David Hume (1752).

The MABP assumed national output was autonomous and suggested that balance of payments adjustment under a fixed exchange rate reflected temporary *disequilibria* between domestic money demand and supply. The MAER also presumed an invariant level of national income, focusing on money's role in determining nominal exchange rates rather than changes in the central bank's reserves. However, by taking national income as given, the MAER neglected the significance of the current account as an output-expen-

diture imbalance and the possibility of monetary shocks contributing to temporary variations in national income.

The still popular Mundell-Fleming (MF) model explicitly addresses exchange rate and national income variation in the open economy, but as an aggregate demand-side model, it ignores national price level dynamics and has aggregate supply adjusting endogenously to total spending. (See Mundell 1963, Fleming 1962 and Frenkel and Razin 1992). Though other authors have tried to remedy this by positing an upward sloping aggregate supply function (Argy and Salop 1979, Bruce and Purvis 1985), all variants of the MF model rely on an *ad hoc* specification of the external accounts that is unrelated to total spending and production.

This model also neglects that current account imbalances signify international borrowing and lending and the intertemporal use of foreign saving in the economy (Makin 2002, Frenkel and Razin 1992 and Sachs 1982). More recently, the 'new open economy macroeconomics' (Obstfeld and Rogoff 1995, 1996) has provided an alternative intertemporal paradigm, characterized by explicit microfoundations, nominal rigidities and imperfect competition. Unfortunately models developed within this paradigm (also see Chari, Kehoe and McGrattan 2000 and Corsetti and Pesenti 2001) are highly sensitive to the specification of the microfoundations themselves, such as the nature of utility functions and the source of price stickiness (Sarno and Taylor 2003).

Methodologically, this paper is at odds with recent theorizing in the field founded on microeconomic principles and optimising representative agents. Nonetheless, it is consistent with Krugman's (1995) call for workable guides to answer unresolved questions in the field and Romer's (2000) defense of traditional approaches in macroeconomics on the grounds that they are no less realistic than more complicated optimising approaches developed from microeconomic foundations.

This paper presents an alternative monetary model of the exchange rate and balance of payments consistent with the precepts of international finance. The framework to be outlined in what follows yields several new results. For instance, *inter alia*, it shows that contrary to the MABP, international adjustment under fixed rates is consistent with money market equilibrium, not disequilibrium. Under floating rates, it permits temporary variation in output, expenditure and employment, contrary to the MAER. It also suggests a new chain of causality that runs from domestic money market to exchange rate to price level, rather than from money market to price level to exchange rate.

At the same time, unlike the MF model, it puts the output-expenditure relationship at the forefront and explicitly traces out the impact of monetary shocks on national expenditure, output, the exchange rate and price level. Moreover, unlike the new open economy macroeconomics, the current account imbalance is treated throughout as an output-expenditure rather than saving-investment phenomenon. The next section of the paper develops the basic linkages and framework to be used to model domestic monetary

shocks in section 3. The final section concludes by highlighting the contribution of the model.

2. MONETARY FOUNDATIONS

When modelling aggregate demand, extant open economy macroeconomic approaches, including the MF model, typically define aggregate demand as the sum of domestic spending on an economy's goods and services, net of imports, plus foreign demand for its goods and services, measured as exports. That is,

$$(C + I - M) + X = Y \quad (1)$$

where C is consumption including government spending, I is domestic investment, M is imports, X exports and Y output. The left side shows domestic demand for home production, the bracketed term, plus foreign demand for domestic product. Defined this way, aggregate demand always equals aggregate supply.

Alternatively, following Alexander (1952) and Makin (2004), this paper defines aggregate demand as total spending by resident entities on goods and services, inclusive of imports, that is

$$C + I = E = AD \quad (2)$$

and E is total expenditure or aggregate demand, AD , measured in real flow terms. At the same time, it interprets aggregate supply as the total quantity of goods and services provided for sale at home and abroad, recognising that part of aggregate supply is produced to satisfy export demand.

Since $Y - E = X - M$, it follows that, $AD = AS$ only when exports equal imports. Or in other words, only when the current account is balanced and there is no net international flow of funds, so the economy is neither incrementally borrowing nor lending abroad. *Ex post*, under a fixed exchange rate with limited capital mobility, the current account balance, CA , must also equal the central bank's change in reserves, dR .

Yet, under a floating rate with capital mobility, as $AD > AS$ foreign investors either acquire home currency denominated bonds, to the extent of the private capital inflow FI , or as $AD < AS$, residents acquire foreign bonds and there is capital outflow. In summary,

$$AD - AS = CA = dR \text{ or } FI \quad (3)$$

For (3) to hold, increased net demand for foreign currency arising from a spending-output difference must be matched by a net supply of foreign currency made available from the central bank's reserves, or through private capital inflow. Otherwise, the exchange rate adjusts.

All goods and services are potentially tradable and in final equilibrium the domestic price level is simply the product of the exogenous world price (P^*)

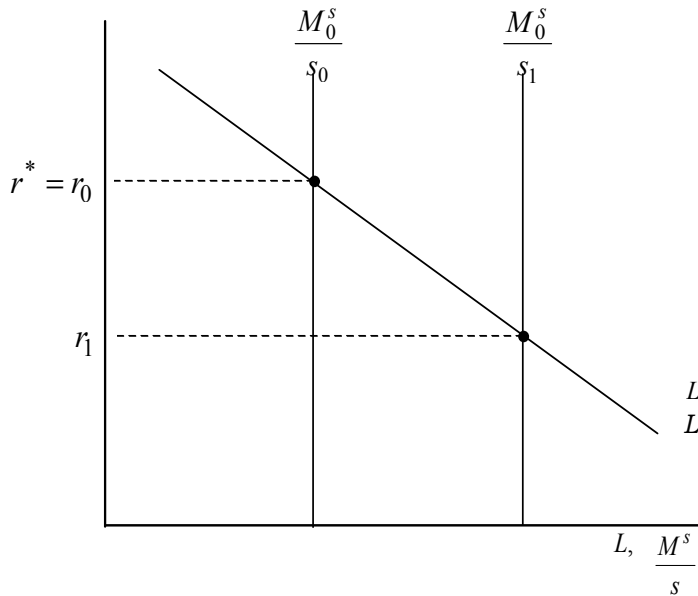
and nominal effective exchange rate (s), defined as the trade weighted price of foreign exchange, $P=sP^*$. By setting the foreign price level at unity throughout, the domestic price level becomes

$$P = s \tag{4}$$

The domestic money stock M^S is determined by the home economy's central bank. Money market equilibrium prevails when residents' real demand for cash balances, (L), which is negatively related to the domestic interest rate (r) and positively related to output (Y), the level of real wealth (K), equals the real supply of money. That is,

$$\frac{M^S}{s} = L(r, Y, K); \quad \frac{\partial L}{\partial r} < 0 \quad \frac{\partial L}{\partial K} > 0 \tag{5}$$

Figure 1: Domestic money market equilibrium



Equations (4) and (5) suggest that the stronger the exchange rate, the lower is the price level, the larger is the real money stock and, for given money demand and nominal money supply, the lower is the real interest rate. Consumption and investment spending by residents is negatively related to the exchange rate, the price level and the real interest rate.

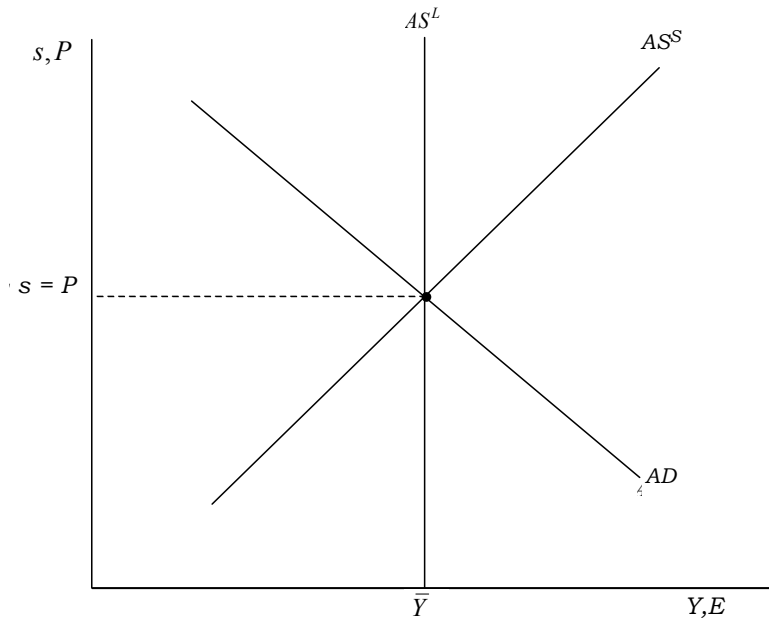
Hence

$$AD = AD(r(s, P); M^S, L) \tag{6}$$

$$\frac{\partial AD}{\partial r} < 0, \frac{\partial AD}{\partial s} < 0, \frac{\partial AD}{\partial P} < 0 \quad \frac{\partial AD}{\partial M^s} > 0, \frac{\partial AD}{\partial L} < 0$$

Equation (6) provides the basis for an AD schedule in exchange rate - expenditure and income space, as shown in Figure 2.

Figure 2: An international monetary framework



It is downward sloping because, other things being equal, a stronger exchange rate (lower price level) raises the real money supply, which lowers the real domestic interest rate, thereby inducing higher domestic expenditure. The negative slope of this schedule can also be justified on the basis that a lower price level increases the economy's real wealth level, which induces higher expenditure for given real income.

Money supply or money demand shocks shift the AD schedule because it is drawn for a given nominal money supply and real money demand. Figure 2 also depicts short and long run aggregate supply functions. Long run AS^L depends on the size of the labour force, W , the economy's capital stock, K , which determines real wealth, and multifactor productivity, φ . Hence,

$$AS^L = f(W, K, \varphi) = \bar{Y} \quad \frac{\partial f}{\partial W} > 0 \quad \frac{\partial f}{\partial K} > 0 \quad \frac{\partial f}{\partial \varphi} > 0 \quad (7)$$

It is assumed that W , K and ϕ are constant over the time frame of the following analysis.

All domestic prices including wages are presumed fully flexible over the time frame in question, enabling the goods and services markets to clear and for the unemployment rate to stabilize at its natural rate. Hence, the longer term aggregate supply schedule rises vertically at \bar{Y} .

Nominal exchange rate depreciation makes home produced goods and services cheaper from foreigners' perspective since domestic output is priced in the home currency. This creates additional demand for the home country's output, as determined in elasticities approach parlance by the elasticity of the rest of the world's demand for its exports, M^* .

At the same time, production of additional output by home firms, or the elasticity of the supply of the home economy's exports, is constrained by domestic costs, including wages. For given wages, the rising AS^S schedule will therefore reflect diminishing marginal capital productivity and rising marginal costs under competitive conditions. Hence,

$$dM^* = Y - \bar{Y} = dX \quad (8)$$

Production in the short run therefore behaves as depicted by the AS^S schedule in Figure 2 where real appreciations (depreciations) temporarily lower (raise) output above its normal level. Eventually nominal wages will adjust as

workers bargain to restore real wages, $\left[\frac{w_0}{s_0} = \frac{w_2}{s_2} \right]$. Alternatively, nominal wage

adjustment is consistent with the equation

$$\dot{w} = \sigma (Y - \bar{Y}) \quad (9)$$

where σ is an adjustment parameter. As becomes apparent, the degree of wage stickiness is irrelevant to the international adjustment process under fixed exchange rates.

The economy is in initial general equilibrium in this framework where the AD and AS schedules intersect. At this point, money demand equals money supply, national expenditure equals production, exports equal imports, the domestic interest rate equals the foreign interest rate and there is no net external financing requirement.

3. MONETARY SHOCKS: FLOATING VERSUS FIXED EXCHANGE RATES

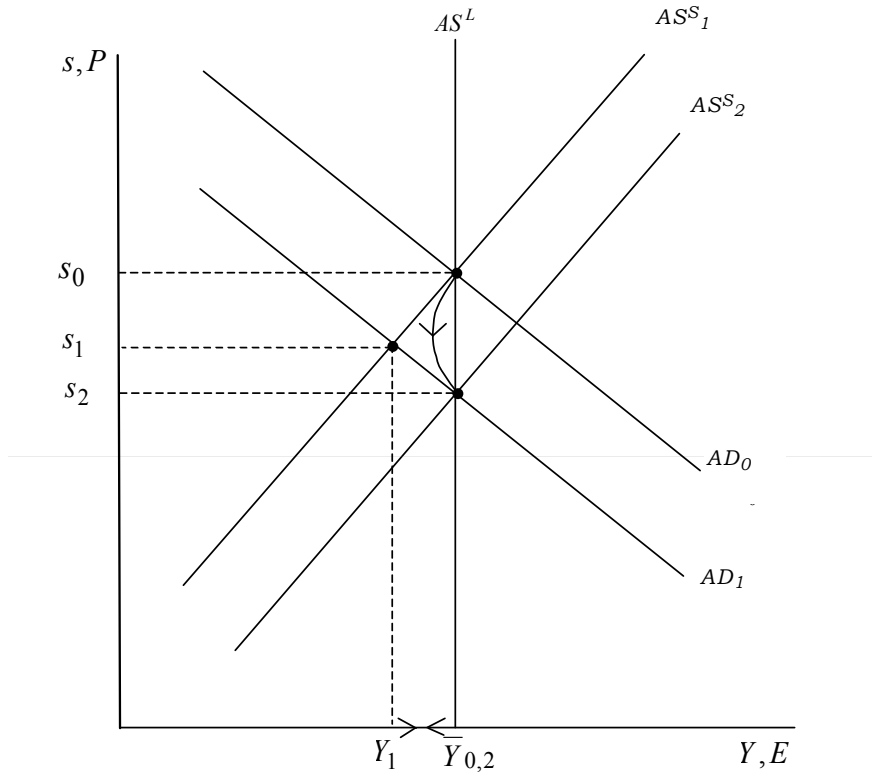
We now consider domestic and international adjustment in response to monetary shocks under fixed and floating exchange rates. The results for monetary contractions and expansions are symmetrical in this model. However, for variety, a monetary contraction is illustrated under floating rates and a monetary expansion under fixed rates.

Monetary contraction under a floating rate

Consider first a monetary contraction under a floating exchange rate brought about by domestic bond sales by the central bank. Under these circumstances, the home economy's interest rate rises and reduces domestic spending. The AD schedule therefore shifts to the left, appreciating the nominal exchange rate since the incipient current account surplus creates an excess supply of foreign exchange.

On the aggregate supply side of the economy, the appreciation decreases foreign demand causing domestic production to fall as exports fall and production moves down along the short run aggregate supply schedule. Meanwhile, the currency appreciation lowers the price level through its impact on the expenditure side, temporarily raising the real wage. Yet, as wage contracts are renegotiated, the equilibrium real wage is restored in the subsequent period $\left[\frac{w_0}{s_0} = \frac{w_2}{s_2} \right]$. This shifts the short run supply schedule down throughout the second period until eventual equilibrium is reached at \bar{Y}_2 .

Figure 3: Monetary contraction under a floating exchange rate



Note however, that while the nominal exchange rate appreciates throughout the first and second periods, the real money supply is also falling.

Eventually, the real money supply schedule returns to its initial level $\left[\frac{M_0^s}{s_0} = \frac{M_2^s}{s_2} \right]$

such that the real interest rate again equals its initial equilibrium value and real interest parity prevails. At the same time, the economy's nominal interest rate would have fallen to the extent of the nominal appreciation.

In the opposite case of monetary expansion, the model predicts that the exchange rate would immediately depreciate as expenditure rises above output, eventually curbing excess expenditure but pushing up nominal wages and eventually raising the domestic price level with no lasting effect on output. In sum, contractionary or expansionary monetary policy only temporarily influences expenditure and output in this model through its effect on the real interest rate and competitiveness but affects nominal variables in the long run, consistent with the neutrality of money proposition.

Monetary expansion under fixed rates

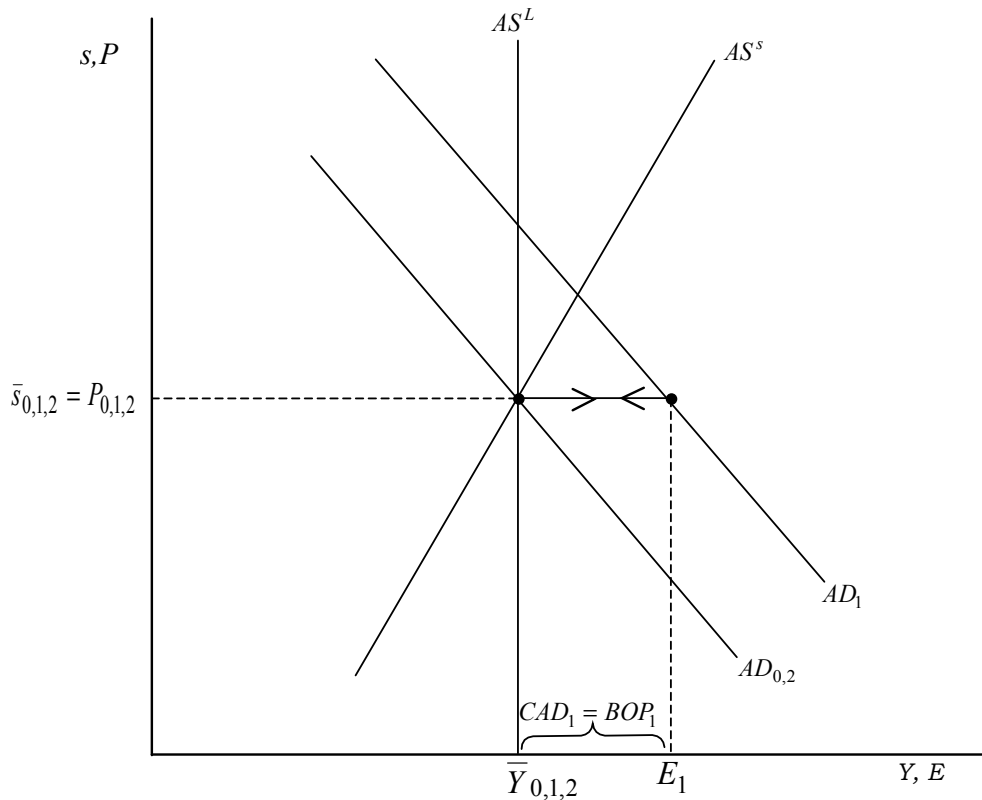
Consider next the economy-wide impact of a monetary expansion under a fixed exchange rate that results from a central bank purchase of bonds from residents. An exogenous rise in the nominal money supply initially lowers the domestic interest rate, thereby inducing greater consumption and investment expenditure by resident households and firms, shifting the *AD* curve rightward as shown in Figure 4.

Since the domestic real interest rate temporarily falls relative to the foreign interest rate, foreigners would be unwilling to finance any current account deficit arising from domestic spending over output at exchange rate s_0 . To maintain the exchange rate at \bar{s} , the monetary authorities must purchase domestic currency in the foreign exchange market by depleting foreign currency reserves.

This manifests as a temporary balance of payments deficit equivalent to the current account deficit. If left unsterilized, this foreign exchange market intervention necessarily offsets the original money supply decrease. Accordingly, the domestic interest rate reverts to its original level and the curve returns to its starting point in Figure 4.

Hence monetary expansion is impossible given the exchange rate constraint, though it does alter the composition of the central bank's balance sheet *ex post*. If the monetary shock is a fall in residents' demand for money, then the domestic interest rate would actually fall, shifting the *AD* curve rightward, thereby creating excess demand for goods, services and foreign currency. Under these circumstances, the central bank then has to reduce the domestic money supply to the same extent as the fall in money demand to maintain the exchange rate at \bar{s} .

Figure 4 - Monetary expansion under fixed exchange rate



It also follows here that sterilized foreign exchange market intervention by the central bank after expansionary open market operations would not stem exchange rate depreciation as it would not reverse the initial money supply increase and consequent fall in domestic interest rates and extra domestic expenditure.

4. CONCLUSION

Existing international monetary models provide an incomplete picture of the monetary transmission mechanism in open economies as they fail to explicitly trace out exchange rate and balance of payments adjustment with reference to the macroeconomic fundamentals of spending and production. In particular, standard approaches neglect the central role of the current account as an output-expenditure rather than a saving-investment phenomenon. Moreover, other models do not allow the exchange rate to be a major source of inflationary pressure for increasingly open economies.

By bringing discrepant output-expenditure behaviour to the forefront, the monetary model outlined above provides an alternative means of under-

standing the transmission of monetary shocks to domestic and international macroeconomic variables. Unlike the MABP, it treats international adjustment as a dynamic process consistent with continuous equality between residents' demand for the home money supply.

Moreover, under floating exchange rates, yet contrary to the MAER, it affords a major role to output-expenditure imbalances in determining the exchange rate. In so doing, it shows how causation runs from money through expenditure to the exchange rate to price level pressures, rather than from money to the price level to the exchange rate, even with purchasing power parity imposed as a long run condition.

The importance of economy-wide factors as an influence on exchange rates has generated considerable empirical testing and debate (Flood and Rose 1999, MacDonald 1999, Rogoff 1999). However, most econometric specifications have been based on the original MAER, whereas this paper relates monetary foundations to the exchange rate and balance of payments directly through national expenditure and production aggregates.

It would be useful to test empirically the alternative causality chain proposed by this model. This could entail examining for a cross section of countries whether episodes of currency depreciation that are associated with excessive domestic money supply growth and high national expenditure actually precede inflationary surges, as the model proposes, or whether inflationary surges in fact precede bouts of depreciation, as the original MAER implies.

The approach is also pertinent to the perennial policy debate about the choice of exchange rate regime. In this approach, a fixed exchange rate regime effectively neutralises the impact of a monetary shock on real output and employment, with the current account and overall balance of payments becoming the shock absorber.

It also suggests, contrary to the MF model, that exchange rate choice is not central to the issue of the effectiveness of monetary policy as an income stabilisation instrument over the medium term. Lastly, the model implies that, other things being equal, economies susceptible to high inflation should adopt fixed, rather than a floating, exchange rates, given low and stable inflation in their main trading partners.

Accepted for publication: 10th December 2004

ENDNOTE

1. Griffith Business School, Griffith University, Gold Coast, Australia. Email: t.makin@griffith.edu.au

REFERENCES

- Alexander S (1952) 'Effects of a Devaluation on a Trade Balance', *IMF Staff Papers*, 2, 263-78.
- Argy V and Salop J (1979) 'Price and Output Effects of Monetary and Fiscal Policy Under Flexible Exchange Rates', *IMF Staff Papers*, 26(2), 224-56.
- Branson W and Henderson D (1985) 'The Specification and Influence of Asset Markets' in R Jones and P Kenen (eds) *Handbook of International Economics*, vol. 2, Amsterdam: North Holland.
- Bruce N and Purvis D (1985) 'The Specification of Goods and Factor Markets in Open Economy Macroeconomic Models' in R Jones and P Kenen (eds) *Handbook of International Economics*, vol. 2, Amsterdam: North Holland.
- Chari V, Kehoe P and McGrattan E. (2000) 'Sticky Price Models of the Business Cycle: Can the Contract Multiplier Solve the Persistence Problem?', *Econometrica*, 68, 1151-1179.
- Corsetti G and Pesenti P (2001) 'Welfare and Macroeconomic Interdependence', *Quarterly Journal of Economics* 116, 421-445.
- Fleming J (1962) 'Domestic Financial Policies Under Fixed and Under Floating Exchange Rates', *IMF Staff Papers*, 9(4), 369-79.
- Flood R and Rose A (1999) 'Understanding Exchange Rate Volatility without the Contrivance of Macroeconomics', *The Economic Journal*, 109(459), 660-672.
- Frenkel J and Mussa M (1985) 'Asset Markets, Exchange Rates and the Balance of Payments', in R Jones and P Kenen (eds) *Handbook of International Economics*, vol. 2, Amsterdam: North Holland.
- Frenkel J and Razin A (1992) *Fiscal Policies and the World Economy*, 2e, Massachusetts: MIT Press.
- Frenkel J (1976) 'A Monetary Approach to the Exchange Rate: Doctrinal Aspects and Empirical Evidence', *Scandinavian Journal of Economics*, 78 (May), 200-224.
- Hume D (1752) 'Of the Balance of Trade' in R Cooper (ed) *International Finance: Selected Readings*, Harmondsworth: Penguin, 22-37.
- Johnson H (1977) 'The Monetary Approach to the Balance of Payments: A Nontechnical Guide', *Journal of International Economics*, 7, 251-68.
- Krugman P (1995) 'What Do We Need to Know about the International Monetary System?' in P Kenen (ed) *Understanding Interdependence : The Macroeconomics of the Open Economy*, Princeton: Princeton U P.
- MacDonald R (1999) 'Exchange Rate Behaviour: Are Fundamentals Important?', *The Economic Journal*, 109(459), 673-691.
- Makin A (2002) *International Macroeconomics*, Harlow: Pearson Education.

Makin A (2004) 'The Current Account, Fiscal Policy and Medium Run Income Determination' *Contemporary Economic Policy* (22), 309-317.

Mundell, R. (1963) 'Capital Mobility and Stabilization Policy Under Fixed and Flexible Exchange Rates', *Canadian Journal of Economics and Political Science*, 29 (November), 475-85.

Obstfeld M and Rogoff K (1996) *Foundation of International Macroeconomics*, Massachusetts: MIT Press.

Polak J (1957) 'Monetary Analysis of Income Formation and Payments Problems', *IMF Staff Papers*, 6, 1-50.

Rogoff K (1999) 'Monetary Models of Dollar/Yen/Euro Nominal Exchange Rates: Dead or Undead?', *The Economic Journal*, 109(459), 655-659.

Romer D (2000) 'Keynesian Macroeconomics without the LM Curve' *Journal of Economic Perspectives*, 14(2), 149-169.

Sachs J (1982) 'The Current Account in the Macroeconomic Adjustment Process', *Scandinavian Journal of Economics*, 84, 147-59.

Sarno L and Taylor M (2003) *The Economics of Exchange Rates*, Cambridge: Cambridge U P.