The Continuing Muddles of Monetary Theory: A Steadfast Refusal to Face Facts

By C.A.E. Goodhart
Financial Markets Group
London School of Economics

Abstract

Lionel Robbins was much concerned about the methodology of economic science. When he discussed the desirable relationship between theory and 'reality', two of the three examples that he presented where the theoretical analysis was not sufficiently based on a knowledge of historical fact were taken from monetary economics. Indeed, monetary theory has remained prone to such shortcomings ever since.

Amongst the worst are:-

(1) IS/LM: the monetary authorities set the monetary base, and the interest rate is determined in the market;

(2) The monetary base multiplier of bank deposits, and the role of reserve ratios;

(3) The current three equation neo-classical consensus, which not only assumes perfect creditworthiness for all agents, but also an essentially non-monetary system, e.g. no need for banks;

(4) The standard theory of the evolution of money.

Monetary economics can only get better, but it has a long way yet to go.

Keywords: Monetary theory; IS/LM; Monetary base multiplier; Default; Evolution of money

JEL categories: B22, E40, E42, E51, E59

The Continuing Muddles of Monetary Theory: A Steadfast Refusal to Face Facts

A. Economic Generalisations and Reality

Lionel Robbins was much concerned with the methodology of economic science, and wrote several books on this subject.[1] For the purposes of this paper, I shall focus on the relationship between theory and factual knowledge, or as Robbins put it, between 'Economic Generalisations and Reality', which was the subject of Chapter V of his book entitled, An Essay on the Nature and Significance of Economic Science (3rd Edition, 1984).

On this relationship, I have selected the following statements as representing the core of Robbins' position:-

> "It is a characteristic of scientific generalisations that they refer to reality. Whether they are cast in hypothetical or categorical form, they are distinguished from the propositions of pure logic and mathematics by the fact that in some sense their reference is to that which exists, or that which may exist, rather than to purely formal relations." …p. 104.
>
> "It follows, too, that it is a complete mistake to regard the economist, whatever his degree of "purity", as concerned merely with pure deduction. It is quite true that much of his work is in the nature of elaborate processes of inference. But it is quite untrue to suppose that it is only, or indeed mainly, thus. The concern of the economist is the interpretation of reality."…p. 105.
>
> "The fruitful conduct of realistic investigations can only be undertaken by those who have a firm grasp of analytical principle and some notion of what can and what cannot legitimately be expected from activities of this sort.
>
> But what, then, are legitimate expectations in this respect? We may group them under three headings.
>
> The first and the most obvious is the provision of a check on the applicability to given situations of different types of theoretical constructions. As we have seen already, the *validity* of a particular theory

[1] I am grateful to Amos Witztum for pointing me in this direction.

> is a matter of its logical derivation from the general assumptions which it makes. But its *applicability* to a given situation depends upon the extent to which its concepts actually reflect the forces operating in that situation. Now the concrete manifestations of scarcity are various and changing; and, unless there is continuous check on the words which are used to describe them, there is always a danger that the area of application of a particular principle may be misconceived. The terminology of theory and the terminology of practice, although apparently identical, may, in fact, cover different areas."…pp 116-177
>
> "Secondly, and closely connected with this first function of realistic studies, we may expect the suggestion of those auxiliary postulates whose part in the structure of analysis was discussed in the last chapter. By inspection of different fields of economic activity we may expect to discover types of the configuration of the data suitable for further analytical study…..
>
> And, thirdly, we may expect of realistic studies not merely a knowledge of the application of particular theories, and the assumptions which make them appropriate to particular situations, but also the exposure of areas where pure theory needs to be reformulated and extended. They bring to light new problems."…p. 118

When Robbins comes to give illustrations, it is notable that his examples of failures to take facts, 'reality', into consideration in both his first and second heading were taken from monetary theory. Thus his first example relates to the need to identify what is used as money in order to test the quantity theory of money.[2] His second example

[2] "A simple illustration will make this clear. According to pure monetary theory, if the quantity of money in circulation is increased and other things remain the same, the value of money must fall. This proposition is deducible from the most elementary facts of experience of the science, and its truth is independent of further inductive test. But its applicability to a given situation depends upon a correct understanding of what things are to be regarded as money; and this is a matter which can only be discovered by reference back to the facts. It may well be that over a period of time the concrete significance of the term "money" has altered. If then, while retaining the original term, we proceed to interpret a new situation in terms of the original content, we may be led into serious misapprehension. We may even conclude that the *theory* is fallacious. It is indeed well known that this has happened again and again in the course of the history of theory. The failure of the Currency School to secure permanent acceptance for their theory of Banking and the Exchanges, in other respects so greatly superior to that of their opponents, was notoriously due to their failure to perceive the importance of including Bank Credit in their conception of money. Only by continuously sifting and scrutiny of the changing body of facts can such misapprehensions be avoided."…pp 117/118

related to the relationship between the reserve base available to banks and the size of the money stock[3], on which I shall have more to say later.

B. The IS/LM Basic Model

Most economic undergraduates still get their initial exposure to macro-economics in the guise of the IS/LM model, and it sits at the centre of most introductory textbooks[4], even today; it certainly did so in 1957, when Robin Matthews taught me at Cambridge.

You will recall that,

$$y = I + C \qquad \text{(expenditure)} \qquad (1)$$

$$y = S + C \qquad \text{(use of income)} \qquad (2)$$

So in equilibrium I must equal S;

$$I = f(i),\ f' < 0 \qquad (3)$$

$$S = f(y),\ f' > 0 \qquad (4)$$

where y is output, I investment, C Consumption, S Saving, i the interest rate. When this model was first put together, in the late 1930s, 'the rate of interest' was more commonly taken to be the long-term rate of interest. Now it is usually taken to be the

[3] "Again, we may take an example from the theory of money. It will be clear from an inspection of the actual procedure of banks of issue that the effect upon the supply of money in the widest sense of given additions to the reserve of precious metals will depend upon the exact nature of the law and practice concerning reserve requirements. It follows, therefore, that in the full elaboration of the theory of money we must introduce alternative assumptions, taking account of the various possibilities in this respect. It is clear that these are not possibilities which are necessarily easily exhausted by general reflections on the nature of banks of issue. Only close study of the facts is likely to reveal which assumptions are most likely to have a counterpart in reality, which assumptions, therefore, it is most convenient to make."…p. 118

[4] See Begg et al. (2005); Lipsey and Chrystal (2007).

short-term rate[5], to which the long-term rate is related by an expectations-based, no-arbitrage, yield curve.

Also the demand of money must equal the supply of money, which is assumed to be set by the Central Bank, so M_S is given, and in equilibrium

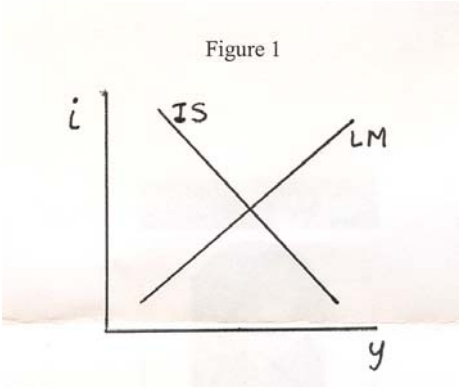
$$M_S = M_D \qquad (5)$$

Since,

$$M_D = f(Y, i),\ f'_y > 0,\ f'_i < 0 \qquad (6)$$

Which gives us:-

Figure 1



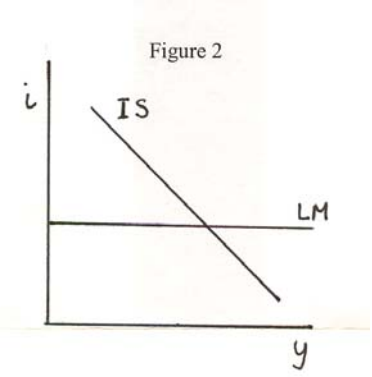
This is probably the second most famous diagram in economics.

The basic problem with this formulation was that no Central Bank has ever operated in this way.[6] Instead they set the short-term official policy rate, or maintain a fixed exchange rate peg against the currency of another country, which in turn has a Central Bank which sets a policy rate. This means that at any point of time the LM curve is horizontal.

[5] Tim Congdon has frequently noted how the meaning of economic concepts, such as the output gap, tends to migrate over time.

[6] There can be a few historical qualifications to this dictum, but they are sufficiently rare, and doubtful under careful analysis, to ignore.

Figure 2



This means that there was a discrepancy between discussions and proposals about current policy, which were naturally couched in terms of how the Central Bank should vary its policy rate, and theoretical analysis of how it should allow the monetary base to vary. Admittedly in a given context[7], there is a dual relationship so that a given interest rate implies a certain stock of monetary base, and vice versa, but, under conditions of uncertainty, the Central Bank would not know what level of interest rates would be associated with what level of monetary base, and vice versa. That, of course, led on to the famous Poole article (1970), which suggested that the case for choosing to set M or i depended on the relative stability (predictability) of the demand for money and investment functions. It is the case that the instability (unpredictability) of the demand for money functions did help to bring about the demise of pragmatic monetary targetry in the mid 1980s. But none of the monetary target mechanisms, including Volcker's famous non-borrowed reserve target, ever denied commercial banks access to cash, at a predictable interest rate, though in the

[7] Making a strong assumption about the existence of a single unique equilibrium.

above case via borrowing at the discount window which involved some small non-pecuniary cost.

The real reason why Central Banks set interest rates, rather than a monetary aggregate, relates to its financial stability objective, not to its macro-monetary price control aim (though the two are, of course, intertwined). Commercial banks cannot operate a fractional reserve system, with relatively low levels of cash and liquid assets, without assured recourse, at a predictable interest rate, to cash on demand, see Goodhart, Sunirand and Tsomocos (2007). Of course, one could run a free-banking system, but this would simultaneously raise the cost of intermediation (as more capital and liquid assets would have to be held by the banks), and, most likely[8], the probability and severity of financial crises.

In another famous article, Sargent and Wallace (1973) demonstrated that, if the policy interest rate was exogenously set, then the macro-economic system, especially the price level, would become totally unstable and would explode. Whereas if the Central Bank set the money stock, the macro-monetary system would be stable, (though, as I have asserted, the financial system would become unstable, with panics and collapses). This seemed to overlook the historical fact that Central Banks had been setting interest rates on a regular basis, and only on some rare occasions did macro-economic price instability ensue.

The resolution of this conflict between reality and theory was, as is now well known, resolved by the realisation that Central Banks did not set interest rates exogenously,

[8] In view of the Fed's failure to mitigate the 1929-33 great depression in the USA, this latter claim is debatable.

but endogenously in response to current, and expected, macro-economic developments, especially to forecasts of inflation. This was encapsulated in the Taylor reaction function,

$$i = a + b_1(\pi - \pi^*) + b_2(y) \qquad (7)$$

where π = inflation, π^* = the inflation target, y is the output gap. To this is added the Taylor principle that stability will be achieved so long as $b_1 > 1$. [9]

So, at least, this division between reality (Central Banks set interest rates, not monetary quantities) and theory has at long last[10] been resolved, as it must eventually be, in favour of reality.

While the question of what the Central Bank is trying to do has now been settled, the subsidiary issue of exactly how it goes about doing this remains open. The Taylor reaction function relates the present choice of interest rates to the current deviations of inflation from target and output from potential. Because of the long and variable lags in the transmission mechanism from monetary policy to controlling inflation, Central Banks in practice decide on present changes in interest rates on the basis of their forecasts of future deviations of inflation from target, (and of output from potential). Such forecasts are not always easily available, and those that are published by Central Banks are usually ex post, i.e. after the interest rate decision has been taken, not ex ante, i.e. the forecasts that triggered the decision. This can make quite a difference to the econometric results (Goodhart, 2005). While it can be argued that current deviations are an important input into forecasts of future deviations, nevertheless the discrepancy between the way that the Taylor reaction function assumes that Central

[9] Actually the stability condition is somewhat more complicated than this, but the simple form will do, and is widely used.

[10] Taylor's first article on this did not appear until 1993.

Banks behave and the way that they actually do so has distorted much research and analysis in this area.

C. The Base Multiplier

Analysis of the determination of the money stock is frequently undertaken via the base money multiplier, e.g. Friedman and Schwartz (1963).

$$M = H \frac{(1 + C/D)}{(R/D + C/D)} \qquad (8)$$

Whereas this is frequently misinterpreted as a behavioural equation, it is in fact a definitional identity, derived from the two identities,

$$M = D + C \qquad (9)$$

(the money stock is defined as deposits plus currency in the hands of the public), and

$$H = R + C \qquad (10)$$

(the high powered money stock is defined as the reserves of the banking system and currency outstanding; to get from (9) and (10) to (8) divide throughout by D and then divide (9) by (10)).

Since equation (8) above is a definitional identity it gives no clues at all to the direction of causation. If, however, one should assume that the Central Bank operates by fixing the monetary base (H), then that, (plus variations in the two ratios, which may be influenced by policy (R/D), and by confidence in the banking system (C/D), and other economic factors, e.g. relative interest rates), determines M, the money stock. But, if, as we have now seen, it is agreed that the Central Bank sets a policy interest rate, then given the demand for money and credit, and the factors affecting the

two ratios, the so-called multiplier simply determines the quantity of high-powered money (H) and bank reserves (R) that the Central Bank has to create in order to maintain its desired rate of interest. The base multiplier in reality works in reverse, determining H, not M. Economists, and others, often fail to appreciate this. It is not uncommon to find textbooks incorporating both a Taylor reaction function and a standard base multiplier, wherein the CB is supposed to control H in order to determine M! See, for example, Blanchard (2006), Dornbusch, Fischer and Startz (2001).

This misunderstanding has caused numerous policy errors. It leads people to believe that raising the reserve ratio, e.g. by calls for Special Deposits, will have a significant direct effect in reducing the money stock. In practice, in order to maintain the chosen interest rate, the Central Bank has to provide the extra reserves required, after the minimum reserve ratio has been raised, in order to maintain the given interest rate. It usually does so in effect by buying short-dated liquid assets from the banks. Since such reserves are required to be held, and generally offer a zero or lower interest rate, the net effect is to make banks both less liquid and less profitable. The latter may induce the banks to widen the spread between deposit and loan rates, which will tend to reduce money (and credit) expansion slightly, but also to shift bank portfolios towards riskier, but higher yielding, loans. Reserve requirements are, therefore, best seen as a tax on banks, slightly reducing their growth rate and making them both less liquid and less risk averse. In so far as taxes can be avoided by shifting location, they will be.[11]

[11] There were many policy discussions about whether, and how, to impose reserve requirements on the euro-$ international markets in the 1970s and 1980s. These were made more difficult since many of the participants misunderstood the base multiplier analysis.

Next, it is often stated that Central Banks have a choice whether to sterilise, or not, intervention in the foreign exchange market. In fact, so long as they seek to maintain some given policy-determined domestic interest rate (greater than zero), they have no such choice. Such intervention will automatically be sterilised.

The failure to appreciate this mechanism has also complicated discussion of monetary policy during the 2007 financial crisis. When banks wanted more cash, they were automatically given it by all Central Banks. Because of counterparty risk, and projections of future calls for extra bank funding, (to replace asset-backed commercial paper not being rolled-over), banks would not lend to each other in the three-month interbank market, so three month Libor rates rose relative to overnight rates. To reduce this latter rate, Central Banks either had to lower the short-term policy rate, or try to undertake an 'operation twist', in which they buy (lend on) 3 month paper and offset this by net sales (borrowing) overnight in order to keep overnight rates close to the policy rate. In the past such an operation twist has rarely been successful, but it may well have been worth attempting in the recent crisis, (what can one lose from it?).

D. The Current Consensus Model

Besides the shift from assuming that the Central Bank sets the monetary base, to the realisation that it sets a policy interest rate, recent decades have seen two revolutions, the adoption of rational expectations and quest for optimising micro-foundations, both connected with the work of Lucas, (e.g. 1972, 1976). This has led the initial two

equation model to morph into the current consensus three equation model, whose domination of analysis is stronger than ever. As is well-known, this takes the form:-

$$y_t = E(y) + b_1(i_t - E(\pi)),\ b_1 < 0 \qquad (11)$$

$$\pi_t = E(\pi) + b_2(y),\ b_2 > 0 \qquad (12)$$

$$i_t = b_3(\pi - \pi^*) + b_4(y),\ b_3 > 1,\ b_4 > 0 \qquad (13)$$

where E, the expectations operator, is some combination of backwards and forwards looking elements, y is the estimated output gap, and equation (13) is the Taylor reaction function.

Equations 11 (the old I/S curve) and 12 (the old Phillips curve) are, in turn, derived from an underlying optimising DSGE model, plus a (rather dodgy) assumption/estimate of temporary wage/price frictions/rigidities (e.g. Calvo pricing) (Calvo, 1983). Amongst the several problems/disadvantages of this current consensus is that, in order to make a rational expectations, micro-founded model mathematically and analytically tractable it has been necessary in general to impose some (absurdly) simplifying assumptions, notably the existence of representative agents, who <u>never</u> default. This latter (nonsensical) assumption goes under the jargon term as the transversality condition.

This makes <u>all</u> agents perfectly creditworthy. Over any horizon there is only one interest rate facing <u>all</u> agents, i.e. no risk premia. All transactions can be undertaken in capital markets; there is no role for banks. Since all IOUs are perfectly credit-worthy, there is no need for money. There are no credit constraints, (everyone is angelic; there is no fraud; and this is supposed to be properly micro-founded!). Money is generally introduced into the model by auxiliary ad hoc frictions, e.g. cash

in advance requirements or limited participation, both of which are totally internally inconsistent with a world without any default. Essentially, therefore, the consensus three equation model assumes a non-monetary, non-banking, system, so it is no surprise that most theoretical adherents of it tend to down-play attention to, or concern with, purely monetary variables, e.g. the monetary aggregates, (see for example Woodford, Svensson, (Woodford, 2003, 2007; Svensson, 2003, 2007)

Under normal circumstances risk premia remain, more or less, steady and defaults are low. In these (fair weather) circumstances, the main driving force affecting financial conditions is the change in the official policy rate, and expectations of future developments to inflation, the output gap and policy rates. In such usual circumstances the consensus model and its background DSGE representations will work well.

But every now and again, and 2007 has become an example, risk premia shift sharply, as do credit constraints. Defaults, and fear of future defaults, can rise sharply. DSGE, and the consensus, models have no capacity (at present) to incorporate such effects. A variety of, ad hoc, auxiliary data (on credit conditions) and subjective add-ons have to be bolted on to forecasting models. The modellers' hope is that the monetary authorities can restore calm (normal conditions) quickly enough to make the standard model usable again. But the truth is that such models can neither forecast financial disturbances, nor the scale of their effect while a crisis persists. This is hardly surprising since the models abstract from the possibility of any such crisis by definition.

A further implication of this is that the basic analytical paradigms of the macro-monetary side of a Central Bank and of its financial stability wing are mutually inconsistent, and rarely interconnect. The former (macro-monetary side) uses a model that abstracts from default. The financial stability department cannot do so, but struggles to find a theoretical underpinning.[12]

Hy Minsky (e.g. 1982) gave a verbal description of financial processes, but this has been generally dismissed as insufficiently rigorous, non-mathematical and not based on rational expectations or micro-foundations. Martin Shubik (e.g. 1973, 1977, 1999) provided a much more rigorous and well-founded account of a monetary/banking system in which default plays a central role, but his work has also been largely bypassed, for reasons that elude me, by the mainstream. D. Tsomocos and I have been trying to build on Shubik's work to develop practical, yet rigorous, models of the interaction between risk aversion, default probabilities and the real economy, (e.g. 2004, 2005a and b, 2006a and b, 2007). There is a long way to go, but a good starting point would be a recognise the inherent lack of realism, and deficiency, of any model, such as the current consensus model which fails to have a central role for default.

E. The Evolution of Money

Kiyotaki and Moore (2002) wittily and correctly coined the phrase 'Evil is the root of all money'. I described in the last Section how human failings in the shape of refusals, and/or inability, to honour promises to repay debts (i.e. defaults) was central

[12] I have a soft-spot for the old 'real bills' doctrine. It was analytically flawed, but it did unify the macro-monetary and the financial stability objectives. The idea was that, if a Central Bank limited its discounts to commercial bills based on real trading activity, it would simultaneously stabilise both inflation and the banking/financial system.

to the need for, and shape of, our monetary system. Another key failing of our human society is the predilection of the strong to prey (often violently) on the weak. In order to prevent society falling into Hobbesian chaos, there is a need for government, (often in the guise of the strongest power, see Mancur Olson (2000); 'power grows out of the barrel of a gun').

Besides the pure rents that government can levy, they do have expenditures, on the army, police, justice system, etc. In some early governments, e.g. in early Egypt, these were financed in kind by transfers of labour services or goods (a set proportion of the harvest) to government. But this was highly inefficient. Payment in kind did not provide the government with the proportions of goods and (labour) services that it needed. A solution to this was for the government to issue claims on itself, (supported by, but not entirely dependent on, the intrinsic value of metallic coins in many cases), which it promised to accept in payment of taxes (in lieu of goods and services). Such promises were generally credible, (they were backed by the power of the state), so long as,

(i) the purchasing power of money was not debauched by over-issue and devaluation; and

(ii) the power of the state was not threatened.[13]

Violence is endemic in human societies, and can lead to debilitating and persistent feuds that disrupt the social framework. 'An eye for an eye, and a tooth for a tooth' is a natural, but not a welfare enhancing, response. Another key factor leading to a monetary system is the need for a common tariff whereby the wrong done by X on Y

[13] If the state collapsed, the value of its outstanding money would fall back to its intrinsic value as a pure commodity, whether of gold or as art-work, as in defaulted government bonds.

can be settled and expurgated by the transfer of a predetermined number of units of some object from the transgressor (or his clan) to the victim. That object will evolve into a monetary unit. Indeed many societal relationships, such as the bride price, involve transfers of monetary type objects.

Money was invented as a social, and governmental, phenomenon[14], not as a means of reducing transactions costs in markets. The invention of money probably predated the development of formal markets; thus money facilitated the rise of markets, rather than vice versa. One piece of evidence of this is that many early money forms, notably cattle, (the word pecuniary derives from the later Latin word 'pecus'), are highly unsuitable for ordinary transactions, (being neither standardised, easily portable nor divisible). Even gold coins, the prototype of early metallic money, were so expensive relative to regular wages/goods prices that they would very rarely be usable in day-to-day transactions.

Our knowledge of the monetary systems in primitive and early societies is necessarily somewhat sketchy. Nevertheless I believe that the consensus among historians and anthropologists is that money developed as a social (and governmental) artefact, rather than as a mechanism for reducing transactions costs in private-sector markets. But such a viewpoint is somewhat woolly and socio-logical, and has not, in the past[15], lent itself to mathematical modelling. So, economists have tended to ignore historical reality, to establish formal mathematical models of how private agents (with no

[14] Though money did reduce the transactions costs of government.

[15] There is an excellent paper by Dror Goldberg of Texas A&M on 'The Tax-Foundation Theory of Fiat Money', which uses a dynamic mathematical model. Perhaps once economists see that the realistic approach can be rigorously expressed in abstract theory, they will become more willing to accept its historical validity.

government), transacting amongst themselves, might jointly adopt an equilibrium in which they all settle on a common monetary instrument.

Does such a misconception matter? I have argued that it does, particularly in the case of the euro-zone, in my paper on 'The Two Concepts of Money' (2003). The concept, originally developed by Menger (1892), that money emerged as a private-sector initiative (to cut transactions costs), implied that you could change the monetary regime within the EU without worrying much about the need for associated adjustments to the fiscal regime. On the other hand, if money is a social artefact, then a key feature of any monetary regime change must be to design the appropriate accompanying fiscal measures.

Let me take a current concern. The adoption of a single currency is being accompanied, as intended, by the emergence of pan-European banks. That has led to proposals for a common pan-European system of banking supervision and of crisis management and resolution for such banks, in order to handle cross-border co-ordination problems. Crisis resolution is, however, potentially very expensive. There is no current fiscal mechanism to provide funds for crisis management at the federal level; that can only be done at national level. So long as the fiscal funding remains the responsibility of the constituent nation states, it is difficult to see how banking (financial) supervision and crisis management could be moved to a federal pan-European level.

F. Conclusions

John Hicks (1969), at least in his later years, argued that monetary economics needed to be firmly grounded on a knowledge of historical and institutional fact. Yet in recent decades the suggestion that Prof. X took an institutional approach to monetary analysis was sufficient to cast his/her reputation into outer darkness. Only small groups of mainly heterodox (and of various hues of post-Keynesian views) economists have bothered much to relate theory to reality. Why this has been so, I do not know. That it has been so, as I have sought to document, is not a good advertisement for this sub-sector of our profession.

Bibliography

Aspachs, O., Goodhart, C.A.E., Tsomocos, D.P. and L. Zicchino (2007), 'Towards a Measure of Financial Fragility', Annals of Finance, 3, (1), 37-74, (January).

Begg, D. K. H., S. Fischer and R. Dornbusch (2005) Economics (Maidenhead: McGraw-Hill Education).

Blanchard, O. (2006) Macroeconomics (Great Britain: Pearson/Prentice Hall).

Calvo, G., (1983), 'Staggered Prices in a Utility-Maximizing Framework' Journal of Monetary Economics, 12(3), pp. 383-98.

Dornbusch, R., S. Fischer and R. Startz (2001) Macroeconomics (London: McGraw-Hill).

Friedman, M. and A. Schwartz (1963) A monetary history of the United States, 1867-1960 (Princeton: Princeton University Press).

Goodhart, C.A.E. (2003), 'The two concepts of money: Implications for the analysis of optimal currency areas', in S.A. Bell and E.J. Nell (eds), The State, the Market and the Euro, (Cheltenham, UK: Edward Elgar).

Goodhart, C.A.E., Sunirand, P. and D.P. Tsomocos (2004), 'A Model to Analyse Financial Fragility: Applications', Journal of Financial Stability, 1, 1-30.

Goodhart, C.A.E., Sunirand, P. and D.P. Tsomocos (2005), 'A Risk Assessment Model for Banks', Annals of Finance, 1, 197-224.

Goodhart, C.A.E., Sunirand, P. and D.P. Tsomocos (2006a), 'A Model to Analyse Financial Fragility', Economic Theory, 27, 107-142.

Goodhart, C.A.E., Sunirand, P. and D.P. Tsomocos (2006b), 'A Time Series Analysis of Financial Fragility in the UK Banking System', Annals of Finance, 2, 1-21.

Goodhart, C.A.E. and L. Zicchino (2005), 'A Model to Analyse Financial Fragility', Bank of England Financial Stability Review, June, pp 106-115.

Goldberg, D. (2007), 'The Tax-Foundation Theory of Fiat Money', Work in progress, Department of Economics, Texas A&M University.

Hicks, Sir J. R. (1969) A theory of economic history (Oxford: Clarendon Press).

Kiyotaki, N. and J. Moore (2002) 'Evil Is the Root of All Money' American Economic Review 92, pp. 62-66.

Lipsey, R. G. and K. A. Chrystal (2007) Economics (Oxford: Oxford University Press).

Lucas, R.E. Jr. (1972) 'Expectations and the Neutrality of Money' Journal of Economic Theory 4, pp. 103-124

Lucas, R. E., Jr. (1976) 'Econometric Policy Evaluation: A Critique' Journal of Monetary Economics Supplementary Series, 1(2), pp. 19–46.

Menger, C. (1892) 'On the Origin of Money' Translated by C. A. Foley Economic Journal 2 pp. 238–55

Minsky, H. (1982) 'The Financial-Instability Hypothesis: Capitalist processes and the behaviour of the economy', in Kindleberger and Laffargue editors, Financial crises: theory, history, and policy (Cambridge University Press).

Olson, M. (2000) Power and prosperity: Outgrowing communist and capitalist dictatorships New York: Basic Books.

Poole, W. (1970) 'Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macro Model' Quarterly Journal of Economics 84, pp. 197-216.

Robbins, Lord Lionel (1984), An Essay on the Nature and Significance of Economic Science, (New York University Press).

Sargent, T. J. and N. Wallace (1975) ' "Rational" Expectations, the Optimal Monetary Instrument, and the Optimal Money Supply Rule' Journal of Political Economy 83, pp. 241-254.

Shubik, M. (1973), 'Commodity money, oligopoly, credit and bankruptcy in a general equilibrium model', Western Economic Journal, 11: 24-38.

Shubik, M. (1999), The Theory of Money and Financial Institutions, (Cambridge, Mass: MIT Press).

Shubik, M. and C. Wilson (1977), 'The optimal bankruptcy rule in a trading economy using fiat money', Journal of Economics 37: 337-54.

Svensson, L.E.O. (2003), 'Comment: The Future of Monetary Aggregates in Monetary Policy Analysis', Journal of Monetary Economics, 50: 1061-70.

Svensson, L.E.O. (2008), Presentation at the Bundesbank 50th Anniversary Conference, Frankfurt, September 21, 2007, (forthcoming in Conference proceedings, 2008).

Taylor, J. B. (1993) 'Discretion versus Policy Rules in Practice' Carnegie-Rochester Conference Series on Public Policy 39, pp. 195-214.

Woodford, M. (2003) Interest and prices (Princeton and Oxford: Princeton University Press).

Woodford, M. (2007), ‘How important is money in the conduct of monetary policy?’, NBER Working Paper 13325, (August).