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November 2008

Online at <http://mpra.ub.uni-muenchen.de/14845/>  
MPRA Paper No. 14845, posted 25. April 2009 / 00:16

**Discussion Paper (2009)**

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# Locked-in and Sticky Textbooks: Mainstream Teaching of the Money Supply Process

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April 2009

## Abstract

Current macro-economic textbooks provide a fatally misleading description of the money supply process in modern economies. Over the past 20 years Post Keynesian authors have established conclusively that despite strictly-enforced cash reserve requirements, changes in the supply of bank deposits are not determined exogenously by central bank open market operations, but are endogenously determined by changes in bank borrowers' demand for credit. Nevertheless the vast majority of undergraduate macroeconomic textbooks continue to teach the high-powered-base "money-multiplier" paradigm that the supply of money is exogenously determined by the central bank. Few texts recognize that interest rate targeting renders the high-powered base endogenous. This paper summarizes the extent mainstream macroeconomic textbooks are "locked in" and "sticky," and fail both in the teaching of monetary policy and in proper scientific discourse.

**Keywords:** macroeconomic textbooks, endogenous money paradigm, EMP, Post-Keynesian economics, paradigm shift

**JEL classification:** A2, B59, E1, E43

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<sup>1</sup> Paper submitted to *Journal of Post-Keynesian Economics*, November 2008.

*“One of the purposes of economic theory is to look through the veil of money to the realities behind it”*

- Joan Robinson, 1956, 25-6.

## **1. Introduction**

Current macro-economic textbooks purvey a ‘fatal misunderstanding’ of the money supply process in modern economies.<sup>2</sup> In overdraft systems commercial bankers assign individual borrowers a line of credit based on prudent conservative estimates of borrower’s “credit-worthiness”.<sup>3</sup> Central Banks (CBs) set the supply price of bank credit: ‘Bank Rate’ - the overnight interest rate they charge the banking system for additional reserves - their key monetary policy instrument. Banks set their lending and deposit rates at a relatively stable “mark-up” or “mark-down” on Bank Rate. Banks are price-setters and quantity-takers in their retail lending and deposit markets. In consequence bank borrowers and not the banking system nor the CB determine the quantity of bank credit granted and bank deposits supplied to the economy. The supply of credit money is now “credit-driven”.<sup>4</sup>

Post Keynesian authors have modelled the bank lending process and empirically estimated how the demand for bank credit is transmuted into the supply of bank deposits in modern credit-money economies. This may be termed the Endogenous Money Paradigm (EMP).<sup>5</sup> The Post Keynesian EMP is both highly realistic and well-supported empirically. Once accepted it will enrich the profession’s understanding of the process of monetary change and its inflationary consequences. Nevertheless mainstream economists have near-completely ignored the Post Keynesian endogenous money literature, and have tended to regard the Post Keynesian canon as *“the product of incompetent outsiders with a structurally-imposed incapacity to comprehend”*.<sup>6</sup> As Fontana recently concluded:

*“Over the last two decades work on the Post Keynesian theory of endogenous money has been flourishing, and has prompted a rethinking of the complex nature of money in modern economies. ... But the Post Keynesian theory of endogenous money has largely been*

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<sup>2</sup> See Alston, et al. 1992; Vercelli, 2000; Moore, 2006.

<sup>3</sup> The current sub-prime residential mortgage crisis illustrates how the securitization of illiquid mortgages and the accompanying introduction of derivative instruments has undermined this prudent credit-review process and resulted in an insolvency crisis for major underwriters. This crisis has proven highly contagious, and has raised the possibility of future widespread market failure. See Davidson, 2008.

<sup>4</sup> For a brief outline of bank intermediation see Moore, 1968, 1988a, 2006, Arestis & Sawyer, 2006.

<sup>5</sup> For a selective survey see Moore, 1988, 2006; Lavoie, 2005a/b; Lavoie & Seccareccia, 2004; Rochon, 1999, 2006, Fontana, 1996; Wray, 1990, 1998, 2004.

<sup>6</sup> Merton, 1972.

*dismissed by most economists and practitioners as too scholastic or philosophical, and of little relevance for theoretical and empirical developments in monetary economics.”* (Fontana, 2003:291-292)

Most macroeconomic texts continue to purvey the Monetarist vision that the money supply is exogenously controlled by the CB. After manipulating the simple balance-sheet identity, the inverse of the ratio of the monetary base to the money supply, they construct a “high-powered base money-multiplier” and conclude that the money supply is directly controlled by the CB. In mainstream texts the money supply is treated as an exogenous policy instrument, with fatal consequences for understanding the significance of interest rates and credit money for economic growth and the inflation process.

The purpose of this paper is to show the extent mainstream macro-economic textbooks texts have become “*locked in*” and “*sticky*.” The paper first briefly outlines the EMP, examines a sample of undergraduate and graduate texts, and summarizes the mainstream treatment of exogenous money. The paper shows how the belief that money is exogenous impedes a more thorough understanding of the structural relationship between bank intermediation, monetary policy and inflation. The paper argues the scandalous near-total exclusion of EMP from macro-textbooks is totally unjustified on epistemological grounds. Students should be taught the EMP and expected to judge its insights and validity.<sup>7</sup> An attempt is made to determine *why* mainstream textbooks have been so resistant to the Post Keynesian EMP.

## **2. Theoretical and Empirical Discussion of the EMP**

Credit money consists of bank deposits, liabilities issued to borrowers by commercial banks. As a financial asset credit money is a liability to its issuers (banks and ultimately bank borrowers) and an asset to its owners (bank depositors and ultimately bank shareholders). Whenever banks grant loans, bank deposits and the money supply rise. “Loans create deposits”<sup>8</sup>. In an uncertain world, bank deposits and lines of credit provide critically important buffers of liquidity and finance to credit-worthy prospective buyers.

The extension of bank credit increases the supply of bank deposits, with no accompanying *volitional* change in the demand by depositors to save. As credit money, bank deposits are “*generally accepted*” in exchange in all monetary transactions. So long as deposits are

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<sup>7</sup> See Alston *et.al.*, 1992; Danziel, 2002.

<sup>8</sup> Moore, 1988a, 1988b. 2006.

generally accepted deposits can never be in '*excess supply*'. Changes in the demand for bank credit by bank borrowers depend on borrowers' *current expectations* of unknown *future* changes in prices and output. The supply of bank deposits is determined by the demand for bank credit by those borrowers whom banks regard as credit-worthy and have granted a prudent line of credit. Under overdraft systems, credit-worthy borrowers endogenously determine the change in the quantity of loans granted and deposits supplied.

Changes in bank demand for reserves are driven by changes in bank deposits and the demand for bank credit (Moore, 2006:207). So long as the monetary authorities have an interest rate target, they supply reserves to banks as demanded at that interest rate, and lose their ability to control the rate of growth of the Base. CBs provide the banking system the money demand at a predetermined price; the Bank Rate. Changes in the base are determined by changes in deposits, which are in turn determined by changes in the demand for bank credit. Changes in the base do not as is commonly believed *determine* but instead are *determined by* changes in the money supply:

*"The central bank's commitment to system liquidity and financial stability overrides its ability to control of the rate of growth of the money supply"* (Moore, 2006:222).

The EMP reverses the left-to-right causality chain from money-to-goods conventionally asserted in the quantity theory identity to right-to-left causality, from goods-to-money. Borrower *"animal spirits"* (Keynes' term to denote continuously-changing *current* expectations of the unknowable *future*) cause the *current* demand for credit and supply of money to change. Growth of the money supply varies directly with growth in the demand for bank credit, so bank loans and the money supply co-vary pro-cyclically. CBs adjust the level of interest rates pro-cyclically in their attempt to smooth cyclical fluctuations in aggregate demand (AD), and realize their stabilization goals. Changes in the demand for bank credit, in the high-powered base, and in the money supply are each endogenously determined within the system.

Banks are price-setters and quantity-takers in their deposit and loan markets. When plotted in interest-money space, the money supply function is horizontal at the banking systems' lending rate, set as a stable mark-up on the Bank Rate set by the CB. The quantity of bank credit and bank deposits supplied change endogenously with changes in borrowers' demand

for credit. Changes in bank credit and bank deposits *precede* changes in expenditures, as borrowers respond *currently* to expected changes in *future* events.

Since changes in bank loans, bank deposits, and bank reserves occur simultaneously, it is not possible to determine empirically the direction of causality between them. But there is a sound logical inductive explanation for reverse (right-to-left) causality between newly-created money and accompanying changes in expenditures.<sup>9</sup> Increases in the *current* demand for bank loans are generated by expectations of higher *future* employment and output, and result in increases in the *current* supply of bank deposits. The desire to increase spending in the *future* results in an increase in the *current* demand for credit and the *current* supply of deposits. When newly-created deposits are spent on goods and services by borrowers they do not disappear from the system, but are transferred from the accounts of buyers (debtors) to the accounts of sellers (creditors). In credit-money economies current changes in demand for bank credit (loans) result in identical current changes in the supply of bank deposits.

This central *endogeneity* of credit money has been strongly emphasized by Post Keynesians.<sup>10</sup> Several more heterodox mainstream economists have also recognized the supply of credit money is credit-driven.<sup>11</sup> CBs vary Bank Rate discretionarily and procyclically in pursuit of their stabilization goals. According to the EMP the Bank Rate not the money supply is the CB's key policy instrument.

### **3. The Monetarist Legacy of Exogenous Money**

Economists have long been cursed by the legacy of exogenous money. The belief that monetary change is exogenous is a historical legacy that dates back to profligate royal borrowers even before the gold standard. But gold has long been abandoned as the money commodity and commodity money is now an artifact of history. From the user's point of view credit money (bank deposits) and fiat money (currency) are near-perfect substitutes. Banks maintain the general acceptability of deposits as payment media, by promising to exchange them for currency on demand. Since credit money is as generally accepted as fiat money bank depositors regard an increase in their deposits as an increase in their money

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<sup>9</sup> Moore, 1988a, 2006.

<sup>10</sup> See Moore, 1988, 1988a, 1988b, 1994, 2006; Lavoie, 1996, 2002, 2004; Pollin, 1991, 1996; Goodhart, 1994; Palley, 2002; Davidson, 2002, 2006; Romer, 2000; Rochon, 1996, 1998, 2002, 2006.

<sup>11</sup> See e.g. Akerloff, 2007.



balances, not as what they technically are, the record of an increase in their loan of fiat money to the banking system.<sup>12</sup>

Unfortunately the EMP is fundamentally incommensurate with the rational general equilibrium core of mainstream macroeconomics. This makes it difficult for economists to reject the vision of exogenous money that underlies mainstream macro models.<sup>13</sup> A more important reason for the inherent resistance of the mainstream to the EMP is because the methodology of complex adaptive systems (CAS) shifts economists' analytical attention away from building "rigorous" if timeless general equilibrium models, and employing the latest econometric techniques to test these models' validity, to the simulation of dynamical CAS that never approach equilibrium, are time-dependent, and operate in historical time.<sup>14</sup>

Why do some ideas "make it" while others do not? Our heads continually entertain various new ideas. When empirically confirmed these ideas get replicated through social interactions and unconfirmed ideas get obscured and gradually die out. The sociology of knowledge studies the social context of agents as they create, develop and maintain new ideas, and the effects of these ideas on scientific development over particular historical periods. As Merton (1972) has stressed many hidden agendas reign in the political spectrum and serve to protect the views of "insiders". Human relationships are frequently organized so that "outsiders" perspectives are obscured, with the consequence that many new insights never reach the public. The ruling ideological superstructure in any discipline naturally tends to resist other points of view.<sup>15</sup>

The history of scientific knowledge is frequently characterized by struggles over new ideas, the best known example being Galileo. In his famous work *The Structure of Scientific Revolutions*, Kuhn argued that this is the manner by which science progresses. The gradual accumulation of knowledge leads to intellectual "revolutions". Anomalous evidence continues to accrue, until the old paradigms eventually reach a 'crisis' stage. A revolutionary new science then emerges, and a "paradigm shift" is born.<sup>16</sup>

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<sup>12</sup> See Moore, 1988a, 2006; Chick, 1992; Dalziel, 2002.

<sup>13</sup> See Fitzgibbons, 2000; Beinhocker, 2006; Akerloff, 2007.

<sup>14</sup> See Arthur, Durlauf & Lane, 1997; Miller & Page, 2007.

<sup>15</sup> Merton, 1937, 1972.

<sup>16</sup> Kuhn, 1970.

The explanation mainstream texts present for the exogenously-controlled money supply is primarily the assertion that CBs can control the quantity of the “high-powered” Base by open market operations, combined with persuasive empirical evidence that the ratio of the Base to the money supply is empirically highly stable. So long as it is believed the CB controls the Base at its discretion by open-market operations it is always possible to construct stable “money-multiplier” relationships between different definitions of the Base and the money supply:

*“The money supply can be described as a multiple of the monetary base, called the money supply multiplier. The idea behind the money supply multiplier is that the ratio of currency to deposits and the ratio of reserves to deposits are relatively stable. If we view these ratios as constants, the money supply multiplier is a constant, and the money supply is exogenously controlled by the Federal Reserve System”* (Farmer, 1999:192).

The “money multiplier” suggests the monetary authorities have a ‘hard’ control mechanism to influence the level of prices and output. It appears to follow that with appropriate economic advice, apart from the existence of variable lags, able and alert monetary authorities should be able to attain their stabilization objectives. As in the IS-LM model, the

Quantity Equation  $M \equiv \left(\frac{1}{V}\right) \cdot P \cdot Y \equiv kPY$  is grounded on the presumption that the High-

Powered Base is exogenously under CB control, so the direction of causality between money, prices and income in the quantity identity runs from the base-to-money-to-prices-to income (left-to-right).

But it does not logically follow that because something can be controlled *in theory*, it is also controlled *in practice*. All CBs have indefinitely more pressing short run concerns than targeting the rate of growth of the money supply. Their primary underlying objectives which must be continually and actively pursued are to maintain a liquid and profitable banking system, to ensure the economy remains both liquid and healthy (price stability), and to manage and/or support the exchange rate.

The quantity theory is derived from the Fisher identity  $M \cdot V \equiv P \cdot Y$ , where the money supply (M) times the velocity of money (V) is equal to the price index (P) times real income (Y). The money supply is assumed exogenous, and V is assumed stable over the short run. Since movements in the money supply chronologically precede movements in prices (P) and

output (Y), fluctuations in the money supply are believed the principal cause of macroeconomic fluctuations.

The “money-multiplier” is an integral component of the exogenous money hypothesis. The money multiplier ( $m$ ) denotes the ratio of the money supply (M) to the high-powered money base (B), and the base consists of currency plus bank reserves. The money multiplier identity

is simply  $m \equiv \frac{M}{B}$ . In the monetarist vision, the direction of causality in the quantity identity

runs from right to left, from money-to-income. Changes in the rate of growth of the “high-powered” base determine changes in the rate of growth of the money supply and the price level.

Under the “money-multiplier” process the CB is believed able to increase or reduce the money supply at its discretion by open market operations, which directly change the “High-powered Base.” It is widely believed by both the public and the economics profession that the Base is controlled by the CB through open-market operations, so the high-powered-base can be enlarged or contracted at its discretion. A typical textbook statement of the monetarist paradigm is:

*The stock of money is determined by the Fed through its control of the monetary base (high-powered money); by the public through its preferred currency-deposit ratio; and by the banks through their preferred reserve-holding behaviour. ... The Fed creates high-powered money in open market purchases when it buys assets by creating liabilities on its balance sheet.”* Dornbusch & Fisher (2004)

When plotted in interest-money space, the money supply is vertical or at least steeply upward-sloping, depending on how the value of the “multiplier” varies with the level of interest rates (Moore, 1968, 1988a). The Central Bank is believed to control the money supply directly by increasing or reducing the Base by open-market purchases or sales. Diagrammatically this may be viewed as shifting a vertical money supply curve to the right or left. So long as the ratio of the Base to deposits remains stable, CB’s open-market operations which change the quantity of non-borrowed reserves are believed to change proportionally total deposits of the banking system, and so the level of real income.

Here is a typical textbook description, which recognizes small endogenous changes in the money supply due to changes in the value of the multiplier:

*"Depositors can affect the level of money stock through changing their preference to hold currency relative to demand deposits. A change in depositors' preference may occur when the economy experiences either bank runs or bank panics. Depositors might incur substantial losses on deposits, and would thus have an incentive to have a greater preference for currency and less preference for deposits. Furthermore, when depositors subjectively anticipate a surge in inflation, the relative attractiveness of currency to deposits will rise, because depositors will increase their consumption of goods. Consequently, the money supply will shrink when depositors exhibit a greater preference for holding currency relative to demand deposits".* Lai, 2004.

The CB is believed to set a particular level or growth rate of high-powered reserves and so to control the level and growth rate of the money supply. Both the money supply and the Base are regarded as exogenous policy instruments of the CB and so independent of changes in business and household demand for bank credit. Like other commodities the value of money varies inversely with the quantity supplied. Changes in the money supply are believed to initiate changes in the level and rate of change of prices, income and output:

*"You will recall that when the central bank buys assets for example, the accompanying increase in the money supply is generally larger than the initial asset purchase because of multiple deposit creation within the private banking system. This money multiplier effect .... magnifies the impact of central bank transactions on the money supply"<sup>17</sup>.*

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<sup>17</sup> Krugman & Obstfeld, 2003:487. One direct consequence of the dominance of this "Monetarist" view of inflation is that since the main cause of inflation is viewed as excessive expansion of the money supply, inflation is viewed as at root a monetary phenomenon and due to excess demand. As a result it is widely concluded that inflation should be controlled by central bank "inflation targeting", a euphemism for tighter monetary policy and higher interest rates. Inflation is primarily attributed to the existence of excess demand for goods and services due to too large a money supply. But current inflation in most countries is primarily "cost" inflation, due to rising costs consequent upon rises in oil and other flex-prices (raw materials and foods). "Core" inflation is due to average wage increases exceeding average labor productivity growth, causing unit labor costs to rise, which with stable markups are passed on as rising prices.

The public must recognize that in order to achieve long run price level stability, so long as markups are stable, average unit production costs must also remain stable. For unit wage costs to remain stable, money wages must not rise more rapidly than the rate of growth of average labor productivity. No matter how high the rate of growth of money wages, in the long run **real wages** can never grow more rapidly than the average rate of growth of labor productivity as a simple rule of accounting. Money wage growth in excess of average labor productivity growth necessarily results in a higher rate unit labor costs and inflation unless firms are forced to lower average markups.

For price stability to be achieved without higher unemployment requires a kind of "social contract," as has evolved in selected Asian economies e.g. Singapore, Japan, Korea, China and Malaysia. Under such "social contracts" money wage increases in the current year are set by collective bargaining among labor, business and government to equal the estimated average percentage rate of growth of labor productivity in the previous year. It is explicitly recognized by all sides that whenever workers receive a wage increase in excess of average labor productivity growth, the result will be an increase in unit costs and so eventually an equivalent increase in the market price of the product.

In economies where firms have strong market power increases in unit costs are directly passed on by firms in the form of sufficient percentage increases in prices to maintain their profit shares constant. Money wage increases in excess of average labor productivity increases can be viewed as a kind of "tax" on all other consumers and workers

The money supply is regarded as the CB's primary policy instrument. The mainstream view does not recognize that in practice, CBs are unable to quantitatively control either the Base or the money supply. As one leading macroeconomic text argues:

*“Our analysis of monetary policy has been based on the assumption that the Fed influences the economy by controlling the money supply. By contrast, when the media report on changes in Fed policy, they often simply say that the Fed has raised or lowered interest rates. Which is right?... Why has the Fed chosen to use an interest rate, rather than the money stock, as its short-term policy instrument? One possible answer is that shocks to the LM curve are more prevalent than shocks to the IS curve. If so, a policy of targeting the interest rate leads to greater macro-economic stability than a policy of targeting the money supply.... Another possible answer is that interest rates are easier to measure than the money supply. The Fed has several different measures of money - M1, M2, and so on - which sometimes move in different directions. Rather than deciding which measure is best, the Fed avoids the question by using the federal funds rate as its short-term policy instrument.”<sup>18</sup>*

#### 4. The Legacy of Macroeconomic Textbooks

Most mainstream macroeconomic texts simply take for granted that the money supply is the central bank's exogenous policy instrument, and interest rates are endogenous market-determined variables, when in fact the precise opposite is true. How and why has this reversal occurred? To investigate the undergraduate textbook presentation of the money supply process, a sample of 22 most frequently used undergraduate macroeconomic textbooks were obtained from three university libraries: Stellenbosch University, the University of Amsterdam, and the Free University of Amsterdam:

1. Arnolds, 2005. 2. Auerbach & Kotlikoff, 1998. 3. Barro & Grilli, 1994. 4. Branson, 1989. 5. Burda & Wyplosz, 1993. 6. DeLong, 2002. 7. Dornbusch & Fisher, 1994. 8. Farmer, 1999. 9. Frank & Bernanke, 2004. 10. Gärtner, 2003. 11. Gordon, 2006. 12. Hubbard, 2005. 13. Jha, 2003. 14. Krugman & Obstfeld, 2003. 15. Mankiw, 2003. 16. Mishkin, 2006. 17. Pentecost, 2000. 18. Pogel & Lindert, 2000. 19. Samuelson & Nordhaus, 1998. 20. Sobel et al., 2006. 21. Stiglitz and Walsh, 2006. 22. Thomas, 1990.

Eight graduate textbooks were then sampled to examine the extent the mainstream exogenous base money-multiplier with endogenous interest rates, or the Post Keynesian

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in the economy, who are forced to pay higher prices and to suffer from higher inflation rates and lower real incomes. The bottom line is that in all economies long-run price stability requires a moderation of labor's money wage increases to the rate of labor's average rate of productivity growth. In order for the inflation rate to be reduced to zero, unit costs must remain stable, so the average rate of money wage increase must not exceed the average rate of labor productivity growth. Note that higher average **money** wage growth does not result in higher **real** wage growth. Workers as a group do not gain from higher money wage growth, although individual unions can gain if they are able to negotiate higher percentage money wage growth than other unions. This basic fact of accounting is not sufficiently widely appreciated nor understood by union members in most LDC's.

<sup>18</sup> Mankiw (2003:290).

endogenous credit-driven money supply with exogenous interest rates, were taught at the graduate level:

1. Blanchard and Fisher, 1992.
2. Carlin & Soskice, 2006.
3. Leslie, 1993.
4. Romer, 2006.
5. Minford & Peel, 2002.
6. Snowdon & Vane, 2005.
7. Walsh, 2003.
8. Woodford, 2003.

The chapters (if present) on money, the financial system, interest rates, the IS-LM model, monetary policy were carefully examined. A search was made in the index for key phrases: interest rates, financial intermediation, monetary policy, money, credit money, endogenous money, inside money, outside money, the quantity theory. When IS-LM analysis was used, attention was directed as to how the analysis was set up. The shape of the LM curve was specifically examined, since its shape reveals how the money supply process is visualized, how the money supply and income change in response to changes in interest rates and whether interest rates are treated as the exogenous policy instrument. The texts were then summarily classified according to whether they used IS-LM analysis, whether the money supply was treated as exogenous or endogenous, and whether they mentioned or adopted the EMP. The results are summarized in Tables 1-3.

[TABLE 1 HERE]

How do mainstream macro-economic textbooks teach the money supply process? Proper scientific debate requires all major opposing views have textbook representation. This does not imply every school must be included, since what a textbook chooses to include or exclude is to some extent subjective. The question concerns where should the line be drawn?

*“Traditional economics is the set of concepts and theories articulated in undergraduate and intermediate graduate-level textbooks. It includes the concepts and theories that peer-reviewed surveys claim or assume the field generally agrees on. Textbooks represent a consensus view of the profession, and include basic ideas that anyone being introduced to the field needs to know. But textbooks inevitably omit more-advanced material... the limitation of both textbooks and surveys, of course, is that they typically focus on the conventional rather than the cutting edge.”* (Beinhocker, 2006: 24.)

One should not put too much weight on the **truth value** of textbook presentations, since texts portray the “conventional wisdom” rather than the cutting edge of professional opinion.

But we are now primarily concerned with “Conventional Wisdom.”

Most introductory macro-economic texts first define the money supply and then directly assert, e.g. *“the nominal stock of money is controlled by the Fed”* (Dornbusch & Fischer, 1994) An overwhelming huge majority (20 out of 22) of undergraduate texts taught the monetarist view that the supply of money is exogenously under the direct control of the CB through the high-powered-Base “money-multiplier” paradigm. Although three texts mentioned that the MS was sometimes endogenous, 20 concluded the money supply was set exogenously by the CB. Only 2 out of 22 undergraduate macro texts adopted the EMP, Jha (2003) and Gärtner (2003).

[TABLE 2 HERE]

The same large majority (20 out of 22) adopted the IS-LM model and demonstrated by shifting the shape and position of the LM curve how changes in the money supply can impact on the level of interest rates and income. After asserting the money supply was the CB’s chief exogenous policy instrument, 5 out of 22 texts acknowledged (some even stressed) that in the case of fixed exchange rates the money supply was uncontrollable. The typical treatment was simply an assertion, e.g.:

*“An economy’s money supply is controlled by its central bank. The central bank regulates the amount of currency in existence and has indirect control over the amount of checking deposits issued by private banks. The procedures through which the central bank controls the money supply are complex and we assume for now that the central bank simply sets the size of the money supply at the level it desires”* (Krugman & Obstfeld, 2003:359).

One popular text commenced its discussion of money with the flat assertion:

*“The money supply is an exogenous policy variable chosen by the central bank”* (Mankiw, 2003:271).

Another asserted: *“We assume that there is an existing quantity (supply) of money circulating in the economy, and the government has complete freedom to increase or decrease that total money supply.”* Auerbach and Kotlikoff (1998:179)

After stating the money supply was exogenous most texts then developed the “base money-multiplier” analysis. There was near consensus that the money supply was controlled by the CB by three separate instruments: open-market operations, changes in the discount rate and changes in reserve requirements. Several texts described in detail using T-account analysis how each instrument affected the value of “money- multiplier” and the money supply.

Only two texts, Gärtner (2005) and Jha (2003), drew a horizontal MS or LM curve, and adopted the EMP (see also Branson 1989; Dornbusch & Fischer, 1994)<sup>19</sup>. No text recognized that if, as is now widely accepted, the monetary authorities target interest rates this implies the “high-powered base” is now endogenous, so the chief conclusion of “money-multiplier” analysis, that the money supply is exogenously set by the CB, no longer holds. Even though the money supply remains a stable “multiple” of the base, under interest rate targeting as under exchange rate targeting the base becomes endogenous.

It is impressed upon students why the money supply is exogenous, since the high-powered base can be controlled by CB open market operations, and the ratio of the base to deposits is empirically stable. The chief reason why exogenous money is so frequently taught in the textbooks is because “money- multiplier” analysis is an enormously popular, easily-teachable, and an extremely powerful and successful teaching tool. As Tobin described in a memorial paper, the idea of the “money-multiplier” makes a huge “eye-opening” impact on introductory students, as an example of the pervasive power of economic reasoning and the insightful brilliance of economists.<sup>20</sup>

Unfortunately for the “money multiplier,” the high-powered-Base-transmission-mechanism is a total fiction. The belief that the money supply is controlled by the CB is based on the fallacious assumption that because open market operations affect the base, the base must therefore be exogenous.

*“The theory that the only important determinant of the demand for money is the flow of spending is ... the quantity theory of money:  $M = \left(\frac{1}{V}\right) \cdot PY$ ” (De Long, 2002).*

But the quantity theory is simply an identity, and implies nothing about causality. To enhance the “transmission mechanism” it is frequently assumed that the velocity of money can be treated as a constant in the very short run. But this is however an extreme position and several textbooks express indignation at such an assumption (e.g. Mankiw, 2003). Many

<sup>19</sup> Both textbooks by Branson (1989) and Dornbosch and Fisher (1994) present a horizontal LM curve, yet do not conclude that money depicted in this way, is endogenous.

<sup>20</sup> *“Perhaps the greatest moment of triumph for the elementary economics teacher is his exposition of the multiple creation of bank credit and bank deposits. Before the admiring eyes of freshmen he puts to rout the practical banker who is so sure he”lends only the money depositors entrust to him”. The banker is shown to have a worm’s eye view, and his error stands as an introductory objectlesson in the fallacy of composition. From the Olympian vantage of the teacher and the textbook it appears that the banker’s dictum must be reversed: depositors entrust to bankers whatever amounts the bankers lend.” Tobin , 1963.*



textbooks not merely assert the right–left causality of the quantity theory, but claim the price level can be taken as given. This enormously increases the purported power of monetary policy, since monetary change then appears to directly change real output as well as prices.

One might expect mainstream textbooks to at least acknowledge that under fixed exchange rate regimes the base is uncontrollable, since exogenous changes in the Base by the domestic CB are then rather obviously ruled out. But only 5 out of 22 undergraduate texts explicitly acknowledge the money supply becomes endogenous under fixed exchange rates, even when most mainstream economists would surely agree when pushed that the money supply is then completely endogenous. Most textbooks assert the power of CBs to control the money supply through the “money multiplier,” with no qualifying reservation about the exchange rate regime in force. About one quarter of the texts did note that under fixed exchange rates the money supply becomes endogenous:

*“Monetary policy as usually conducted is ineffectual under fixed exchange rates”*. (Mankiw, 2003: 325).

*“The Fed cannot then completely control the money supply, and commercial banks and the public also play crucial roles in determining the level of money supply”* (Lai et al, 2004).

But such uncertainty about whether and when money-multiplier analysis is valid might lead more able students to question whether and when the Fed actually controls the money supply, and whether and when money is really endogenous. As a result even under conditions when most textbook writers would surely agree that the monetary authorities do not control the money supply, most texts neglect to mention that although  $M \equiv mB$  continues to hold, under interest rate and exchange rate targeting the Base and the money supply both become endogenous.

Gärtner (2003: 66, 77-78) was the only undergraduate text to completely embrace the EMP:

*“The money supply is endogenous, that is, outside government or central bank control”* (Gärtner, 2003: 121).

Gärtner was also the sole textbook to state explicitly that the money supply is endogenous, irrespective whether exchange rates are fixed or flexible (p.182), and the only text to point out the logical inconsistency of the mainstream view. When discussing why money is endogenous under interest rate and exchange rate targeting, he argued:

*“If the money supply increased via the purchase of domestic bonds by the central bank, the LM curve shifts to the right ... and the increased liquidity tends to drive interest rates down ... It [the central bank] is required to take any excess liquidity out of the market which the market does not want to hold. This reduces the money supply and continues until the money supply is back at its original level. The LM curve is back in its original position and nothing has changed”* (Gärtner, 2003:116).

Jha (2003) was the only other text to adopt the EMP and present the money supply as endogenous. He also noted:

*“Keynes ... made a spirited departure from the classical tradition by assuming monetary influences determine the rate of interest”* (2003:29),

thus indirectly endorsing the EMP.

Three undergraduate textbooks: Dornbusch & Fisher (1994), Blanchard & Fisher (1992) and Auerbach & Kotlikoff (1998) documented conditions when the monetary base and the money supply become endogenous. Dornbusch and Fischer acknowledged the LM curve becomes horizontal when the money supply is endogenous (1994; 421). But they fail to point out that when money is endogenous, the direction of causality in the “money-multiplier” and the “quantity theory” expression become reversed.

*“The Fed cannot control both interest rate and the money stock exactly. It can choose combinations of the interest rate and money stock that are consistent with the demand-for-money function. ... The Fed cannot simultaneously set both the interest rate and the stock of money” and in recent years the Fed has pursued a ‘more eclectic approach towards monetary policy.’*” (Dornbusch & Fisher, 1994:417-421)

Blanchard and Fischer (B&F) were one of the few undergraduate texts to emphasize that under fixed exchange rates the money supply becomes endogenous. Although a base “money- multiplier” relationship may still be derived, the direction of causality is then reversed:

*“Money may be endogenous in the business cycle, either because central banks pursue accommodating policies, or because most of the money stock is inside money, who’s real volume adjusts to the level of economic activity”*. (Blanchard & Fisher, 1992, 534)

But B&F immediately reject these ideas because, *“they do not explain the behaviour of the price level.”* The rest of the textbook ignores this entire discussion, and continues to maintain the assumption that the money supply is exogenous (Blanchard & Fisher, 1992, 536). Although B&F do stick closely to the mainstream view their arguments and empirical research are all favourable to the EMP, and they admit empirical support appears to favour

monetary endogeneity. But like most textbooks they relegate these discussion to the “money-multiplier” formulation, and continue to conclude the money supply is exogenously be by the CB.

Most texts struggle in vain with any serious discussion of endogenous money. They simply assert the Base and so the money supply can be set by the CB. Even though some provide examples when money supply change appears endogenous, they continue to accept the two key underlying assumptions of the “money-multiplier”, the ability of CB’s to control the base by open-market operations, and the empirical stability of the base-deposit ratio. If pushed most textbook writers would surely agree that under fixed exchange rate regimes the money supply becomes endogenous. When exchange rates are fixed, it is patently obvious that the domestic CB loses its monopoly of money creation, and so ceases to control the Base. This is similarly the case under interest rate targeting, when CB’s buy or sell securities to keep interest rates on target. Monetary exogeneity is simply assumed irrespective of the exchange rate regime in force and whether CB’s target interest rates or the money supply. Most textbook writers would probably admit that given the existence of an underlying demand curve for credit, it is not possible for CB’s to control simultaneously both the level of interest rates, and the MS.

With the exceptions of Gärtner (2005) and Jha (2003), no undergraduate text adopted the EMP. Three other texts do mention endogenous money, and present evidence that the money supply frequently appears to act endogenously, but none analysed the general reasons for such endogeneity. In view of the much-publicized discussion of what Federal Funds Rate the Fed will establish at their next policy meeting, the few authors who address this issue continue to argue that the CB controls interest rates by controlling the money supply.

Graduate textbooks are much better acquainted with the EMP. Three new graduate texts, Walsh, 2003, Woodford, 2003, and Carlin and Soskice, 2006, adopt the Post Keynesian theory that money is endogenous. Each describes how commodity and credit money, inside and outside money, and exogenous and endogenous money are created. Each recognizes that CBs now control Bank Rate and not the money supply as its policy instrument. Each now develops the EMP, but with no citations of the Post Keynesian literature. Although Woodford adopts the EMP, his book is thoroughly new-classical, and assumes CBs can seek a “rational” and “efficient” “general equilibrium” outcome.

[TABLE 3 HERE]

Snowdon and Vane, when discussing the money–base-causality relationship, conclude that: “*Money is endogenous, and the money-to-output correlation that we observe are evidence of reverse causation*” (2005: 323).<sup>21</sup> But three of the eight graduate texts still treat the money supply as an exogenous policy instrument (Blanchard & Fisher, 1992, Leslie, 1993, and, surprisingly, Romer, 2006) Like the undergraduate texts they continue to assert that the base and so the money supply are directly controlled by open market operations, and make no attempt to discuss or model situations when the money supply is endogenous.

Tobin has long emphasized the possibility of CB monetary accommodation, and in 1970 showed how, in a model where money did not affect output, endogenous money could result in cyclical movements in the money supply preceding cyclical movements in output.

*“The endogenous-money approach provides a warning that the correlation between money and output is likely to reflect part of the causality from output to money (...) the approach may imply that real volume of inside money is more closely linked to the cycle than the volume of outside money. This indeed seems to be the case empirically”.* (Blanchard & Fisher, 1992:355-356)

Graduate textbooks reveal increasing dissatisfaction with the IS-LM model. In a recent paper, “*Keynesian Macroeconomics Without the LM Curve*” (2000), Romer made the following critical observations of IS-LM:

*“Changes in both the macro-economy and in macro-economics suggest the IS-LM-AS model is no longer the best baseline model of short-run fluctuations for teaching and policy analysis. This paper presents an alternative model, which replaces the assumption that the central bank targets the money supply with an assumption that it follows a simple interest rate rule... Most central banks pay little attention to monetary aggregates ... one of the IS-LM model's basic assumptions is that the central bank targets the money supply ... Recent developments work to the disadvantage of IS-LM ... Replace the LM curve with its assumption that the central bank targets the money supply, with an assumption that the central bank follows a real interest rate rule. This new approach turns out to have many advantages, besides the obvious one of addressing the weakness of IS-LM that it assumes money stock targeting ... It avoids the complications that arise with IS-LM involving the real*

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<sup>21</sup> Snowdon and Vane (2005) note loan market “disequilibrium” can act as a “propagation mechanism” and lead to endogenous money creation in response to entrepreneur demand for loans to finance investment, p. 298. When discussing the money causality relationship S&V note: “*money is endogenous and the money-to-output correlations we observe are evidence of reverse causation*”. p. 323. They mention research by King and Plosser on inside money consistent with Post-Keynesian view, and argue Kaldor, Davidson and Robinson were the first to recognize that  $MV = PY$  must be read from right to left, termed by Tobin the “*post hoc ergo propter hoc*” fallacy.

<sup>21</sup> Tobin, (1970).

*versus the nominal interest rate, and inflation versus the price level; it simplifies the analysis by making the treatment of monetary policy easier, by reducing the amount of simultaneity, and by giving rise to dynamics that are simple and reasonable; and it provides straightforward and realistic ways of modelling both floating and fixed exchange rates ... "* (Romer, 2000: 12)

Romer's recent text asserts: *"The central bank can control the real interest rate by adjusting the money supply"*. (Romer, 2006; 386) Yet statements such as, *"Suppose the Federal Reserve reduces the interest rate,"* (Romer, 2006; 388), *"The Federal Reserve typically has a target level of a specific interest rate"* (Romer, 2006, 506) imply monetary policy operates by directly setting short-term rates. He fails to explicitly conclude the money supply is then endogenous, even though the statement, *"Monetary policy focuses on controlling interest rates"* is as seen an implicit endorsement of the EMP.

Romer has argued that the traditional IS-LM framework should be supplanted and a new MP curve in interest rate-income space, to replace the old LM curve as, *"a monetary policy rule curve"* He states that when interest rates are exogenous, *"for a given inflation rate the real rate rule is ... a horizontal line in output-real rate space"* (Romer, 2000:14). But Post Keynesians have long recognized the LM curve becomes horizontal when the CB sets interest rates and the money supply is endogenous (Moore, 1988a). A horizontal LM curve is simply a diagrammatical way of portraying that the monetary authorities set Bank Rate and the banks' markup of their lending rate over Bank Rate is stable.

DeLong recently (2006) criticized IS-LM analysis as follows:

*"It is time to down weight the LM curve and return the teaching of intermediate macroeconomics to a closer relationship with reality, by focusing on (1) the IS curve, and (2) the fact that central banks target interest rates and not money stocks ... Its (exogenous money's) motivating assumption, that central banks fix money stocks is simply false... adds significant complexity to the algebra of determining the economy's short-run output-interest rate equilibrium, and produces no corresponding benefit. False to reality, unconnected with the flow of news, needlessly complex, and leading to problems in discussing the dynamic evolution of the economy--these four reasons to downplay the LM curve are not balanced by any offsetting advantages. You can see the contortions that people get themselves into by examining how modern textbooks attempt to convince students of the applicability of the IS-LM framework for understanding macroeconomic events ... one major textbook has a long discussion of the relevance of IS-LM--all of it discussing the effects of changes in central bank-controlled interest rates. There is no discussion at all of shifts in or movements along the LM curve. Smart students notice this incongruity and wonder what is going on. Other students don't wonder, but ... have a very hard time understanding the newspaper: 'why' they ask, 'does the newspaper talk about interest rate changes instead of shifts in the LM curve?' I believe*

*major reason for giving the LM curve a central place is historical: it allows you to present the Keynesian-monetarist debate of the 1970s as a debate about the relative slopes of IS and LM curves. Steep LM curve or shallow IS curves and the monetarists are right--the money stock is the principal determinant of output, unemployment, and inflation. Shallow LM or steep IS curves and the Keynesians are right. But it has been a long time since macroeconomics courses focused on the Keynesians vs. monetarist debates of the 1960s.”* (2006)

## **5. Conclusions**

The hypothesis that the supply of money varies with the demand for credit has a long history. While many different assets have been used as money, all countries now operate under bank overdraft systems. In overdraft systems the supply of credit money varies directly with the demand for bank credit. In this century the discovery that the supply of money varies endogenously over the business cycle dates back to the Great Depression of the 1930's. Schumpeter and Wicksell were among the first to recognize the supply of money was determined by the demand for bank credit.<sup>22</sup> Bank borrowers so long as they remain within their credit limits decide on the amount of credit they wish to borrow, based on a comparison of their expected future returns on investment and their marginal cost of credit.

CBs are the ultimate monopoly supplier and so the price-setter of system liquidity. The level of Bank Rate, not the money supply is the CB's key policy instrument. Unfortunately the EMP is currently embraced primarily by Post Keynesian “outsiders”. The recognition that the supply of credit-money is credit-driven scandalously still remains a dissenting opinion in the profession.

The conclusion of this paper is that with only two exceptions the EMP has yet to replace the exogenous money-multiplier in the undergraduate macro-economic textbook community. Empirical examination revealed a near complete exclusion of endogenous money from the textbooks. While a few texts raise the possibility that money at times appears to behave endogenously, and question whether the money supply is exogenous in all situations, such doubts are over-shadowed by the belief that the high-powered base is exogenously controlled by CB open market operations. While several authors now admit the CB sets interest rate targets, they conclude this is achieved by adjusting the money supply (e.g. Romer, 2000).

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<sup>22</sup> See Moore, 1968, 1988a, 2006; Fontana, 2004.

One has argued the belief money is exogenous is a “*minor misunderstanding*” (e.g. Mankiw, 2003).

There is near complete lack of textbook recognition that the fact that interest rates are now targeted exogenously by CBs logically implies the supply of money has become endogenous. The EMP hypothesis was completely ignored in all but 5 of 22 undergraduate macroeconomic textbooks, and in 3 of 8 graduate textbooks. The vast majority of undergraduate texts fail to confront the endogenous money hypothesis, by the simple assertion that the high-powered Base is exogenously controlled by open-market operations and the money supply is empirically a stable proportion of the Base.

Even though it is widely acknowledged that central banks now target the level of interest rates, the logical implication that money is now endogenous remains unrecognized. The numerous indications that the money supply frequently appears to be endogenous, which sticky textbooks intimate to smarter students, suggest obvious doubts in the mainstream facade. But the conclusion that the supply of credit-money is now endogenously credit-driven is never drawn.

Monetary exogeneity is a historical legacy from commodity money and the gold standard, which has now been resuscitated and artificially kept alive by the profession. The vast majority of undergraduate macroeconomic textbooks continue to treat money as an exogenous policy instrument of the CB. The statement the money supply is exogenous is asserted as if its truth value were self-evident. The money-multiplier sounds rigorous and “scientific”, is easy for the faculty to teach, and easy for the students to understand. It appears to imply monetary policy is a “hard” policy instrument, and intelligent central bankers ought to be capable of managing money and AD, and targeting the inflation and unemployment rate successfully.

Mainstream economists have to date been unable to acknowledge that the historical right-left causality from changes in money to changes in money income has now been reversed. It may well happen that the LM curve will gradually disappear from macroeconomic textbooks and be replaced with a new MP curve, with no recognition that the money supply is now endogenous.

The theory that credit money is exogenous is flatly incorrect. The nature of money has changed fundamentally over the past half-century. Over the entire period before 1990 undergraduate macroeconomic textbooks were unanimous that the supply of credit-money was exogenously determined by CB open market operations, changes in reserve requirements, and changes in the Discount rate. This mainstream view was unquestionably believed by everyone at that time. Post Keynesians have finally indubitably demonstrated the validity of the EMP and shown conclusively that credit-money is now credit-driven. But unfortunately the EMP has not yet been recognized by the profession and has not yet been incorporated in the textbooks. Even though financial practitioners are in full agreement with the EMP, the vast majority of undergraduate textbooks remain “locked in” and “sticky” and fail to advance academic debate and economic understanding.

Now that central bankers have publicly declared Bank Rate to be their chief policy instrument, general public recognition that credit money is endogenous must eventually follow.<sup>23</sup> In the name of proper science, the EMP must no longer be regarded as the hazy and biased perspective of wobbly Post Keynesian “outsiders.” The recognition that credit money is endogenous is central to the understanding of monetary policy in modern economies. As Rochon recently observed, “*The outsiders are getting more inside*” (Rochon, 2001: 299). Endogenous money has recently gained renewed attention from New Keynesians. To quote again the Governor of the Bank of England:

*“I return to the paradox with which I began. Most people believe that economics is about money. Yet most economists hold conversations in which the word ‘money’ appears hardly at all. Surprisingly, that appears true even of central bankers.”* Mervyn King, 2002.

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<sup>23</sup> The Bank of England has recently acknowledged that the money supply is endogenous, and money no longer enters causally in the UK model of the economy. It has explicitly acknowledged that it does not control the money supply but sets Bank Rate, and leaves the system to adjust. “*Sustained increases in prices cannot occur without an accompanying increase in the money stock. But that does not mean that money causes inflation. When the short term nominal interest rate is viewed as the policy instrument, both money and inflation are jointly caused by other variables.*” King, 1999.



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## Appendix 1

### UNDERGRADUATE MACROECONOMIC TEXTBOOKS CONSULTED

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## Appendix 2

### GRADUATE MACROECONOMIC TEXTBOOKS CONSULTED

1. Blanchard, O.J. and Fisher, S. (1992). *Lectures on Macroeconomics*,\* MIT Press, Cambridge.
2. Carlin, W. & Soskice, D. (2006). *Macroeconomics: Imperfections, Institutions & Policies*.\* Oxford University Press.
3. Leslie, D. (1993). *Advanced Macroeconomics: Beyond IS-LM*.\* McGraw-Hill.
4. Minford, P. & Peel, D. (2002). *Advanced Macroeconomics: A Primer*.\* Edward Elgar.
5. Romer, D. (2006). *Advanced Macroeconomics*, 3rd Ed. McGraw-Hill.
6. Snowdon & Vane, *Modern Macroeconomics: It's Origins, Development and Current State*, Edward Elgar Publishing.
7. Walsh, C.E. (2003), *Interest-rate Rules and the Price Level*,\* MIT Press, Cambridge MA.
8. Woodford, M. (2003), *Interest and Prices: Foundations of a Theory of Monetary Policy*\*, Princeton University Press, Princeton, NJ.

**TABLE 1: UNDERGRADUATE AND GRADUATE TEXTBOOK COVERAGE**

<b>CATEGORY</b>	<b>UNDERGRATE</b>	<b>GRADUATE</b>
Exogenous money	91%	38%
IS LM Tradition	91%	38%
EMP Mentioned	23%	63%
EMP Adopted	9%	50%

**TABLE 2: SUMMARY OF UNDERGRADUATE TEXTBOOK COVERAGE**

<b>AUTHOR(S)</b>	<b>IS-LM ANALYSIS</b>	<b>EXOGENOUS MONEY, BASE SET BY CB</b>	<b>EXOGENOUS MONEY PARTIALLY CB CONTROL</b>	<b>ENDOGENOUS MONEY (EMP) INTEREST RATES SEY BY CB</b>
Arnolds (2005)	Yes	Control FED	Not fully controlled	N/A
Auerback & Kotlokoﬀ (1998)	Yes	Control government and authorities	N/A	Briefly considered (no diagrams)
Barro & Grilli (1994)	Yes	Control FED	Briefly explained	Briefly considered (no diagrams)
Branson (1989)	Yes, also includes horizontal LM curve	Control Authorities	N/A	N/A
Burda & Wyplosz (1993)	Yes	Control CB	N/A	N/A
De Long (2002)	Yes, also includes horizontal LM curve	Control FED	Alternative measures of money supply	N/A
Dornbusch & Fischer (1994)	Yes, also includes horizontal LM curve	Control FED	Influenced by both banks and public	Under fixed exchange rates money supply endogenous
Farmer\ (1999)	Yes	Control FED	N/A	N/A
Frank & Bernanke (2004)	Yes	Control FED	N/A	N/A
Gärtner (2003)	Yes, extensively	Endogenous money	Control via interest rates	EMP mostly adopted, distinguish fixed an floating exchange rates
Gordon (2006)	Yes	Control FED	Alternative measures of money supply, and influence of public	N/A
Hubbard (2005)	Yes	Control FED	N/A	N/A
Jha (2003)	Yes, extensively	Endogenous money	Indirect control	EMP adopted
Krugman & Obstfeld (2003)	Yes	Control CB	N/A	N/A
Mankiw (2003)	Yes	Control CB	N/A	N/A
Mishkin (2006)	Yes	Control CB	N/A	N/A
Pentecost (2000)	Yes	Control CB	N/A	N/A
Pogel & Lindert (2000)	Yes	Control CB	N/A	N/A
Samuelson & Nordhaus (1998)	Yes	Control FED	N/A	N/A
Sobel et al. (2006)	Yes	Control CB	N/A	N/A

**TABLE 3: SUMMARY GRADUATE TEXTBOOKS COVERAGE**

<b>AUTHOR(S)</b>	<b>IS-LM</b>	<b>EXOGENOUS MONEY, BASE SET BY CB</b>	<b>EXOGENOUS MONEY PARTIALLY CB CONTROL</b>	<b>ENDOGENOUS MONEY (EMP) INTEREST RATES SEY BY CB</b>
Blanchard & Fischer (1992)	Yes	Control CB	Partial control money supply	Yes, discussion "inside" and "outside" money, no EMP adopted
Carlin & Soskice (2006)	Yes, briefly	No	Endogenous money	Yes, no LM curve, replaced by horizontal MR curve Yes, only with fixed exchange rates
Leslie (1993)	No	Control authorities	Partial control money supply	Briefly discussed
Minford & Peel (2002)	Yes	Control authorities	Sometimes endogenous	N/A
Romer (2006)	No	Control CB	Money supply set indirectly	Briefly discussed, CB sets interest rates
Snowdon & Vane (2005)	Yes	Control CB	Money supply set indirectly	EMP adopted
Walsh (2006)		No	Endogenous money	EMP adopted
Woodford (2008)	No	No	Endogenous money	EMP adopted