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Money supply endogeneity and bank stock returns: empirical evidence from the G-7 countries

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Money Supply Endogeneity and Bank Stock Returns: Empirical Evidence from the G-7 Countries

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Other Publications Relevant to Thesis but not Forming Part of it

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Declaration of Authorship

This thesis is submitted to Bond University in fulfilment of the requirement for the Degree of Doctor of Philosophy.

This thesis represents my own work and contains no material which has been previously submitted for a degree or diploma at this University or any other institution, except where due acknowledgement is made.

Signature: ……. Date: ……

Zatul Effawaty Badarudin

Abstract

This thesis is about (a) money supply being determined by banking behaviour, or by the behaviour of central banks and (b) the influence of money supply on bank stock returns. That money is endogenously determined is a proposition of post-Keynesian (PK) economists suggesting that money supply is determined by the behaviour of commercial banks as banks adjust money creation in response to credit demands by the public. This theory challenges the monetarist view of exogenous money supply, where the central bank is said to control money supply. This thesis examines how, under the credit-creation behaviour of banks, the money supply affects bank stock returns in a multi-equation model.

The theory of endogenous money is founded on the idea that loans made by banks cause deposits, and that deposits in banks, as a component of money supply, thus create more money supply. In the process, due to the changes in loans and deposits experienced by banks, the stock returns of banks may also be affected, since banks' profit margins are affected by the changes in credits. Whether endogeneity is in fact the way the money supply behaves has not yet been widely tested and there is also not yet any published study on the behaviour of aggregate *bank stock prices in relation to money supply changes.* Hence, the aim of this thesis is to provide new findings on this unexplored relationship between endogenous money supply and bank stock returns by testing this proposition across several key economies over a long period, taking into account the actual monetary policy regimes in place in these economies.

The empirical evidence in this thesis is obtained by using quarterly data from 1973 to 2007 for the G-7 countries: Canada, France, Germany, Italy, Japan, the United Kingdom (UK) and the United States (US). As the data series covering the sample is over a long period, important monetary-policy regime changes – especially in Canada, the UK and the US – are considered and used in the empirical tests of the underlying hypotheses. The empirical tests conducted begin with unit root and Johansen cointegration tests to test for stationarity of the variables and whether the variables are cointegrated, followed by vector error-correction models (VECM) and

Granger causality tests to test whether there is one-way or bidirectional causality in the long run and in the short run. These tests are used to determine (1) whether money is endogenous or exogenous, (2) if money is endogenous, which of the three views of PK theory is supported in this study, and (3) whether there exists a relationship between money supply and bank stock returns. Trivariate VAR tests developed by Toda and Yamamoto (1995) are used to test whether deposits are an important variable in the causality between bank loans and money supply.

Later, a simultaneous equation model is developed to explore the possible simultaneous relationship between aggregate bank stock returns and money supply, and money supply and bank loans. This model is tested using Generalised Method of Moments (GMM) panel data estimation as proposed by Arellano and Bond (1991). Prior to the model estimation, panel unit root tests are applied following procedures provided in Maddala and Wu (1999) and Choi (2001) to test for stationarity in the variables; Pedroni (1997) panel cointegration is performed to establish whether the variables are cointegrated. VECM and Granger causality tests are also employed to determine whether there is causality between the variables in the equations.

The results of this thesis provide several important new and useful leads. Firstly, bank loans are found to cause money supply; bidirectional causality exists between bank loans and money supply, suggesting that money is endogenous (except for two cases). Secondly, for the countries where money is found to be endogenous, there is mixed evidence as to which of the three views are supported by the test results – accommodationist, structuralist or liquidity preference. Mainly the structuralist and liquidity preference views were supported for Canada (1976:3 to 1990:4), France, Germany, Japan, the UK (1992:4 to 2006:2), and the US. Thirdly, the results indicate that there is a difference between long-term and short-term causality – for example, where there is support for structuralist or liquidity preference in the long run, evidence is in support of the accommodationist view in the short run, as in the cases of Japan, Canada (1976:3 to 1990:4) and the US (1987:1 to 2007:1).

Fourthly, as indicated by the robust results of the trivariate VAR tests, bank deposits are found to be a significant variable in all samples except those of Canada

(1991:1 to 2007:1) and Italy. Fifthly, it is found that with the exception of US (over 1975:3 to 1986:4), there is a relationship between money supply and bank stock returns. The US has the most competitive banking system. Finally, the findings using the panel data estimation show that there is a positive relationship from money supply growth to growth of bank stock returns, but negative from the growth of bank stock returns to money supply growth. This may be explained through the central bank changing interest rates with the aim of negating inflation. This action leads to a rise in interest rates and subsequently to reduced money supply. It was also found, in this context, that there is a bidirectional positive relationship between bank loan growth and money supply growth, which supports the PK theory of endogenous money. Thus, the money-to-bank-stock-returns relation is founded on money being endogenous, meaning that bank credit creation is the source of the effect of the money supply on bank stock returns. The money supply to bank stock returns were tested for robustness using three different tests. All tests provided confirmation of the relationship (except for the US).

Apart from the very important empirical evidence that the thesis brings to bear on this new PK theory for a group of seven key developed economies, the findings of the thesis have important implications as to the key functioning of a banking system. Banks are not only *transmitters* of monetary policy but are also important in the development of the growth of money through *loan creation* to the money supply and bank stock price formation.

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Chapter 1: Money Supply and Bank Stock Returns

1.1 Background and motivation

The relationship between money supply and bank stock returns is a little-researched topic. Post-Keynesian (PK) theorists assert that money is endogenous and that causality runs from bank lending to bank deposits, which suggests a potential money supply influence on bank stock returns. The alternative, traditional (classical) view is that deposits create loans, and that this forms the basis for money being exogenous. The debate on whether money is endogenous or exogenous is still not settled (Davidson, 2006). Further, whether money is endogenous or exogenous is ultimately an empirical issue. Proponents of the PK theory insist that money supply will respond endogenously to any changes in the demand for funds/capital by producing-units (mostly firms) through the intermediation of banks, given the interest rate, which is under the control of the central bank. This debate on the notion of endogenous money is still unresolved among mainstream economists, since the few studies to date have provided evidence in support of both schools of thought. The first issue relevant to this thesis is an investigation of money endogeneity and exogeneity, using a lengthy time-series of the latest data available across developed economies.

Banks are important in a financial system, indeed in an economy, as, under both schools of thought, they are the *transmitters* of monetary policy changes. For example, using bank reserves as the principal channel, banks intermediate with the economy the effects of the central bank's monetary policy changes. Banks possess an optimising behaviour in determining money supply, as they respond to changes in the portfolio decisions and loan demand of the public – households and firms – given the money market conditions set by the central bank (Holtemöller, 2003). This behaviour of the public and the resultant commercial bank behaviour make money endogenous, according to the originator of this idea (Moore, 1998). Given the central role played by the banks as a conduit for the effect of monetary policy on the economy, the

second issue of concern to this thesis is the relationship between money supply and bank stock returns. This issue has not yet been investigated.

With official short-term interest rates playing the leading role as the instrument of monetary policy, the attention paid to money has declined (King, 2002). However, some central banks[1] use money supply growth rates as an information variable by monitoring money supply movements as a robustness check to avoid serious monetary policy mistakes. Money growth rates in excess of those needed to sustain economic growth at a non-inflationary pace may provide early information on any developing financial instability. Thus, there is a motivation for this study to investigate the nexus of this behaviour by studying whether the money supply effect is endogenous or exogenous and leads to a flow-through effect to bank stock returns, if indeed the profitability of a given banking system is dependent on the money supply flow-through effect.

Evidence that supports money endogeneity is found in the following studies: Arestis (1987), Moore (1989), Foster (1992, 1994), Palley (1994), Howells and Hussein (1998), Holtemöller (2003), Vymyatnina (2006) and Cifter and Ozun (2007). Studies that have investigated the relationship between macroeconomic variables including money supply and stock *index* returns include Mukherjee and Naka (1995) for Japan, and for the US market, Dhakal, Kandil and Sharma (1993), Lee (1994), Flannery and Protopapadakis (2002), and Ratanapakorn and Sharma (2007). These studies conclude that there is a long-term relationship between stock returns and macroeconomic variables including money supply. The index used in these studies is that of the whole stock market and **not** the banking index. Most banking studies, however, appear to be interested in investigating (i) the relationship between risk and returns of individual bank stocks (Stiroh, 2006; Iannotta, Nocera and Sironi, 2007; and Uzun and Webb, 2007), (ii) the efficiency of banks and its relationship to their returns (Beccalli, Casu and Girardone, 2006; Kirkwood and Nahm, 2006; and Fiordelisi, 2007) or (iii) the determinants of individual bank stock returns (Goddard, Molyneux and Wilson, 2004; Carbó and Rodríguez, 2007; and Barros, Ferreira and Williams, 2007). Thus, an investigation of money endogeneity/exogeneity and the

[1] For example, the Bank of Canada, the Bank of England and the European Central Bank.

money supply effect on bank stock index returns is imperative. This thesis sets out to investigate this relationship.

The evolution of the PK theory of endogenous money allows for the relationship between money supply and bank stock returns to be investigated from an intertemporal perspective. As proposed by the PK theory of money endogeneity, an exogenous change in interest rates by the central bank's action will have an effect on the amount of loans made by the banking system or by individual banks and, in turn, on deposits. This will ultimately affect the money supply. At the same time, the changes to interest rates by the central bank will have an impact on the banks' loan and deposit rates, thus creating a flow-through effect on their stock returns.

This thesis is therefore motivated by two potential financial economics topics to add new findings to the literature. Seven of the G-8 countries were chosen for this study. It would be interesting to use data from all G-8 countries for the purpose of this analysis; however, data on economic time-series prior to 1992 in Russia and financial statistics on banks in Russia are not available. Hence, this study will focus on the remaining seven countries, namely Canada, France, Germany, Italy, Japan, the United Kingdom and the United States of America. The G-7 data set spans a long period, 1973-2007. Part of the tests is done with quarterly data, consistent with the prior practices of PK theorists.

1.2 Objectives and contribution of the thesis

The main aim of this thesis is to present evidence on the relationship between money supply and bank stock returns using aggregate and panel data[2] respectively, while taking into account the post-Keynesian theory of endogenous money in the model. Two main issues – endogenous money and the link between endogenous money and bank stock returns, arising from the discussion in the previous section – are the themes of this thesis.

[2] Aggregate data include data that involves the banking industry in each country, whereas panel data include combined time-series data from 1973 to 2007 and stacked cross-section data from the seven countries.

There is a continuing debate on the monetary phenomenon, between the monetarists and PK theorists respectively, as to whether money supply is exogenous or endogenous. The controversies are mainly related to whether money supply causes loans, as monetarist theory assumes, or whether loans cause money supply (through deposits and reserves), as per the PK theory of endogenous money. Howells and Hussein (1998) and Caporale and Howells (2001),[3] using quarterly data from 1957 to 1993,[4] found support for endogenous money in the G-7 countries. As this is a debatable issue, this thesis will examine whether money supply is exogenous (that is, money supply causes loans) or endogenous (loans cause money supply) in each of the seven countries by using vector error-correction modelling methodology. Any findings on this issue are likely to add to the body of literature by expanding the sample period used in the previous studies. Additionally, Howells and Hussein (1998) do not account for the fact that there was a change in monetary policy regime in Canada, the UK and the US in their sample period. In contrast to the approach taken by Howells and Hussein (1998), this thesis will include sample splits for Canada, the UK and the US to determine whether there was a major change in the nature of money supply between different monetary policy regimes.

Presenting empirical evidence on emerging economies, Shanmugam, Nair and Li (2003), Vymyatnina (2006) and Cifter and Ozun (2007) not only investigate the nature of money supply in Malaysia, Russia and Turkey respectively, but also take a step further in investigating which of the three views of the money supply – accommodationist, structuralist or liquidity preference – is supported. In the developed economies, only Palley (1994) has determined this, for the US. Besides adding to the current body of literature on endogenous money, determining which of the three views is supported if money is endogenous could provide an understanding in the conduct of monetary policy in terms of the central banks being fully or partly accommodating to banks' demand for reserves and the reaction in the banking system of the developed nation.

[3] Caporale and Howells (2001) used the same sample as Howells and Hussein (1998) but a different methodology was employed.

[4] The actual dates vary between countries.

Empirical tests on money endogeneity are commonly used to determine the causality between bank loans and money supply. The reason is that deposits are not only held in the transactional form, but also in other forms of the broad money supply. Post-Keynesian theorists discuss money endogeneity as loans creating deposits, with this in turn, creating money supply. Thus, it is possible that deposits may be an important variable in the transmission from bank loans to money supply, as bank loans acquired are immediately transferred into demand deposits and not only into other types of deposits. Determining this trivariate causality beside the bivariate one allows a more robust procedure and a better understanding of the transmission from one variable to another.

Before a further investigation of the simultaneous effect of money supply and bank stock returns can be pursued, an empirical investigation on the long-run equilibrium and causality relationship between money supply and bank stock returns in each country has to be established. This is imperative as there would be no merit in further investigation if the long-run relationship of the two variables is not in equilibrium. Previous studies, for example, Mukherjee and Naka (1995) for Japan, and Dhakal, Kandil and Sharma (1993), Lee (1994), Flannery and Protopapadakis (2002) and Ratanapakorn and Sharma (2007) for the US market, have investigated the relationship between money supply (among other macroeconomic variables) and stock index returns. These studies have found that there is a relationship between stock index returns and the money supply. However, these studies were not extended to bank index stock returns. In this thesis, unit root tests will also be performed to determine the stationarity of the variables with controls for trend and constant. Later, Johansen's cointegration test will be employed to determine whether there is a long-run relationship between money supply (whether exogenous or endogenous) and bank stock returns. Furthermore, long-run causality tests using vector error-correction modelling will determine whether the two variables cause one another. This will add to the body of literature on macroeconomic variables and stock returns.

As the PK theory of endogenous money has not been addressed in relation to bank stock returns, a simultaneous equation model is developed to test the effects of money supply on bank stock returns. The money supply effect revolves around three items in the balance sheet of a bank: deposits, loans and the flow-through effect on

the market value of the equity in the balance sheet. Other changes that may be taking place in other balance-sheet items are of no relevance to this relationship. Further, we assume that changes in all other aspects of a bank are controlled by focusing only on the money supply effects and the flow-through effect to the market value of bank stocks. Bank earnings spread associated with the flow-through effect will be included in the model: this is predicated by the dividend valuation theory. The model will also include other macroeconomic variables that are seen as factors that affect the endogenous variables. The development of the model, incorporating possible new findings from applying the model using the Generalised Method of Moments (GMM) panel data methodology proposed by Arellano and Bond (1991), will add to the banking literature. The assessment of the effects of endogenous money supply on banking industry stock returns, taking into account the post-Keynesian theory of endogenous money, in this thesis, is a first attempt at exploring this relationship.

Prior to testing the GMM panel data model, a number of econometric tests are required to assess whether the variables used are stationary and cointegrated. Panel data unit root tests proposed by Maddala and Wu (1999) and Choi (2001) will be employed to test the stationarity of the variables, while the Pedroni (1999, 2004) panel cointegration test will be utilised to determine if cointegration exists between the variables. Vector error-correction modelling will also be used to test for the existence of causality between the variables. These procedures will contribute a new methodology for investigating this issue and thus add to the existing literature.

In summary, this thesis aims to investigate the following research questions:

1. Is the money supply endogenous or exogenous in each of the G-7 countries?
2. If the money supply is endogenous, which of the three views (accommodationist, structuralist or liquidity preference) does it support?

2a. Is the support for the views in (2) above different in the short-term than in the long-term?

3. Following the PK theory where loans cause deposits and this in turn causes the money supply, is the PK theory valid for the sample of G-7 countries under study in this thesis?
4. Is there causality between the money supply and aggregate bank stock returns?

5. Does a simultaneous relationship exist between bank loans, the money supply and aggregate bank stock returns such that loans create deposits (in the form of money supply) whilst at the same time loans and deposits affect the value of bank stocks?

1.3 Organisation of the thesis

The remainder of this thesis is organised as follows. Chapter 2 provides an introduction to the research issues in the context of the theories, while also presenting a very brief review of the literature on (a) the money supply debate and (b) bank stock returns and money supply. The evidence on the relationship between money supply and stock returns is also elaborated within Chapter 2. Following this, an overview of the history of the financial system and monetary policy regimes in each country is provided in Chapter 3. Based on the findings in the literature review, the aim of Chapter 4 is to describe an appropriate research design and test methodology, keeping in view the need for robust test processes required to link bank stock returns to the money supply. A description of the data used in this thesis is also provided in this chapter.

Chapter 5 is devoted to the discussion of the results of the empirical tests. It presents summary results obtained from cointegration and vector error-correction models to determine whether money supply is exogenous or endogenous. Prior to doing those two tests, the stationarity property of the variables is examined and the results presented. Further results by controlling for regime changes are also discussed in this chapter. This chapter also includes results of the three views of money endogeneity; results from the trivariate causality test between bank loans, deposits and money supply; and results attained from the cointegration and vector error-correction models, to ascertain whether there is a relationship between money supply and bank stock returns. Chapter 5 also contains the detailed results on the model developed in Chapter 4, which tests the effects of the money supply on the banking stock *index* returns. Panel unit root tests are performed and the results analysed to examine whether the variables are stationary. A description of the panel cointegration tests and the results is also included in this chapter. Vector error-correction models determine if the variables in the simultaneous equation model

developed in Chapter 4 cause the endogenous variables. Results of the robustness tests are also included in this chapter.

Chapter 6 concludes the thesis by summarising the main findings and by linking the findings. The chapter also identifies the limitations of this research and the scope and avenues for future research.

Chapter 2: Theory and Evidence on Money Supply and Bank Stock Returns

2.1 Introduction

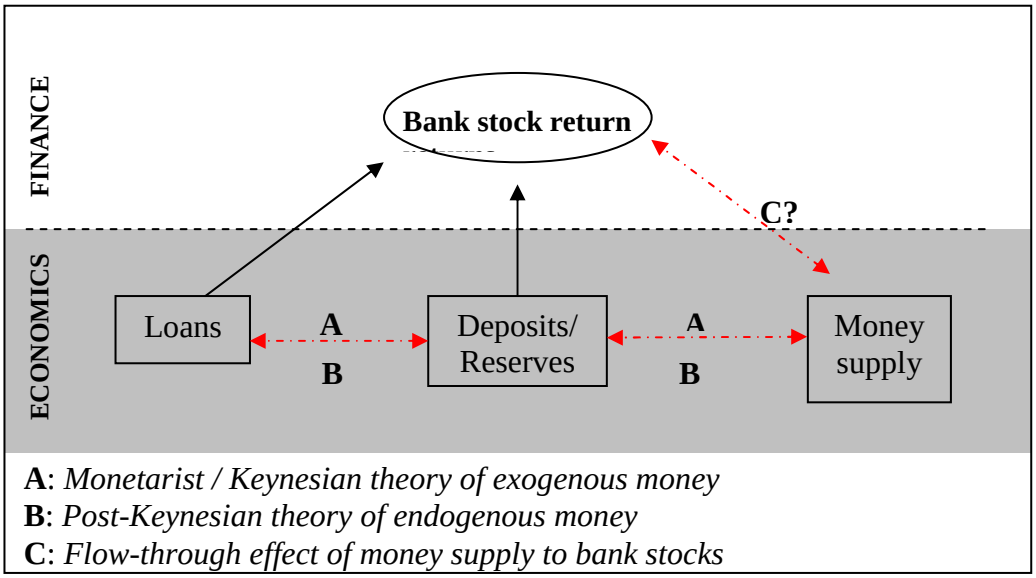
This chapter provides an overview of the theory and empirical evidence on the Post-Keynesian (PK) debate concerning endogenous money and its predecessor, exogenous money. The chapter also includes a discussion of the theory relating to stock return behaviour of the banking sector by way of equity valuation theory. Section 2.2 explains the theory of exogenous and endogenous money supply. In Section 2.3 the reader will find a description of bank behaviour that includes the theory on equity valuation. Empirical evidence on the theories is presented in Section 2.4. Finally, a discussion as to any gaps in the literature is provided in Section 2.5.

2.2 Possible link between money supply and bank stock returns

There is a debate among mainstream economists on the PK theory of endogenous money. Arising from that, almost all textbooks have failed to discuss the PK theory, therefore leaving an important impression that money is entirely determined exogenously. But post-Keynesians have maintained for a while now that the money supply is endogenous, in that loans made by a bank lead to further deposits (which create reserves), which in turn create the supply of money, which therefore must have an impact on bank stock returns. This section will discuss both approaches in detail, and also provide a review of the theory of exogenous money.

Figure 2.1 is a representation of the central theme of this thesis as discussed in Chapter 1. It shows the link between the money supply theories and theories on bank stock returns.

Figure 2.1 The unexplored link between money supply and bank stock returns



A: *Monetarist / Keynesian theory of exogenous money*
B: *Post-Keynesian theory of endogenous money*
C: *Flow-through effect of money supply to bank stocks*

It is possible to visualise that the economic theories on money supply (see the shaded gray area in Figure 2.1) must have an effect on aggregate bank stock returns (see the unshaded portion of Figure 2.1). The debate among economists is that the effect of money, if exogenous as traditionally maintained, on the stock return behaviour ought to be different from that of money being endogenous. Besides this known behaviour, finance theories such as the equity valuation theory would suggest a flow-through effect of money supply acting through the interest rate changes flowing to the bank as income changes and then affecting the bank stock returns. These ideas will be further elaborated in the sections that follow.

2.3 Money supply: Exogenous and Endogenous

The question as to whether money supply is exogenous or endogenous has long been debated amongst monetary economists, as emphasised in Chapter 1. Two schools of thought, originating from Keynesian and monetarist sources, have merged over time, resulting in a consensus that money is exogenous. On the other hand, post-Keynesians have come to support the idea that money is endogenous. However, the existence of evidence of money exogeneity means that the old school is still not out of consideration.

The idea of money supply being exogenous stems from Keynes' liquidity preference theory. There are two views – the money view and the credit view (possibly relevant for bank stock returns) – which according to the advocates of this old idea explain the monetary transmission mechanism. This will be discussed in the following section. Although monetarists agree that money is exogenous, they still argue against Keynesian theory on the demand for money and the flow-through effect of the monetary transmission mechanism. This will be briefly discussed next. The PK theorists, though agreed on money endogeneity, also have differences of opinion on how money is considered endogenous. Three views are central to the PK theory of endogenous money: the accommodationist, structuralist and liquidity preference approaches, which will be elaborated on later.

2.3.1 Exogenous money: Mainstream Keynesian and monetarists' view

Within the exogenous strand, there are two different views on the mechanisms through which monetary policy translates as money supply, which is expected to affect economic activity, and thus bank stock returns. These views are found in the literature as the *money* view and *credit* view.[5] The money view and credit view correspond to the old Keynesian stream.

The *money* view can be found in the standard *ISLM* framework – Investment-Saving-Liquidity preference-Money equilibrium theory – using Keynes' liquidity preference theory. Keynes (1936) assumed that individuals hold two assets: money and bonds, where money has a zero rate of return but bonds have a positive nominal return. Keynes' liquidity preference theory suggests that individuals have three motives to money demand: transactions, precautionary and speculative. He believed that the demand for money is determined primarily by the level of the individual's transactions (the transactions motive), and that individuals will hold money for the level of future transactions that they expect to make (the precautionary motive). Keynes also assumed that individuals hold money and bonds as a store of wealth and that speculation on interest-rate expectations on bonds will determine whether an

[5] This term, money view, is not to be confused to mean the "monetarist" view of the transmission mechanism. Another term used for the credit view is "lending view"; see Kashyap and Stein (1993) and Cecchetti (1995).

individual would want to hold more money or more bonds (the speculative motive). This led Keynes to conclude that money demand is positively related to national income and negatively related to interest rates. These basic ideas were extended in later years, as will be made clear below.

Keynes' theory formed the basis of the ISLM analysis developed by Hicks (1937) and Hansen (1949, 1953), and extended by others. The theory is fully developed in the papers cited. Like Keynes, the ISLM model assumes that there are two assets held by individuals: money and bonds. It also assumes that price levels are fixed and that real interest rates play an important role in individual portfolio decisions to hold money or to invest in bonds.

The LM curve is derived from the equilibrium condition where money demand (liquidity preference, *L*) equals money supply *M*, which is dependent on income *y*, and interest rates *i*:

$$M = \underset{+}{L}(y, \underset{-}{i}) \qquad (2.1)$$

The IS curve satisfies the equilibrium condition where savings, *S*, dependent on the level of output, *y*, equal investment:

$$I = S(y) \qquad (2.2)$$

and I is determined by capital, *k*, invested at a given interest rate, *i*:

$$I = k(i) \qquad (2.3)$$

Hence, the money view shows that, assuming the central bank directly influences the quantity of money by adjusting money supply, a decrease in money supply will increase real interest rates (without regard to what actually happens inside the banking sector), which raises a firm's cost of capital. With a higher cost of capital, there are fewer profitable projects. Thus the end result is a decrease in investment, causing aggregate output to decline. If the contrary happens, economic activity increases.

This line of reasoning assumes banks are passive, and that loans and bonds are perfect substitutes for borrowers. The early theorists ignored the fact that once a loan is made, then the loan leads to deposits, often in the same bank, which in turn could affect reserves and create new deposits when the borrowers issue cheques to draw down the loan. Hence the money supply is endogenously determined in the process within the banking sector through the actions of individual banks.

As the money view assumed that banks were passive, a different view of the monetary transmission mechanism was proposed. Based on the fact that there is asymmetric information in the financial markets, the proponents of the credit view of the monetary transmission mechanism insist that both money supply and bank loans are important in affecting aggregate output. Two different channels exist here: the bank lending channel and the balance sheet channel. For the purposes of this thesis, only the bank lending channel is described here in detail. The balance sheet channel is discussed in Mishkin (1995) and Bernanke and Gertler (1995).

The bank lending channel takes into account that close substitutes for bank credit are unavailable for households and small firms; hence they rely mainly on bank credit for external financing. By assuming that both bonds and loans are imperfect substitutes, Bernanke and Blinder (1988) modified the ISLM model of the money view by including bank loans that bear an interest rate, so that the financial side becomes:

$$D\underset{- \;\; +}{\left(i_B, y\right)} = m_D\underset{+}{\left(i_B\right)}R \tag{2.4}$$

$$L\underset{- \;\; + \;\; +}{\left(i_L, i_B, y\right)} = m_L\underset{+ \;\; +}{\left(i_B, i_L\right)}D\underset{- \;\; +}{\left(i_B, y\right)}\left(1-rr\right) \tag{2.5}$$

where $D(.)$ and $L(.)$ are the demand for deposits and loans respectively, $m_D(.)$ and $m_L(.)$ denote the money multiplier and loan multiplier, i_B is the interest on bonds and i_L is the loan interest rate. R is the monetary base and rr is the required reserve ratio. Accordingly, the IS curve is replaced with the CC (commodities and credit) market:

$$y = Y\underset{- \;\; -}{(i_B, i_L)} \tag{2.6}$$

where y is output and is a function of the interest on bonds (i_B) and interest rates on loans, such that:

$$i_L = \phi(i_B, y, R). \quad (2.7)$$

Here, a contractionary monetary policy decreases bank reserves or excess reserves (money supply) and hence, bank deposits. The converse is true under expansionary policy. This will decrease the banks' ability to extend credit. The lower credit availability will reduce gross investment in the economy, which will lead to a decline in output. The effect of this is greater on small firms than on large firms, as the latter can access the credit markets directly through the stock and bond markets. In contrast to the money view, the credit view indicates that loans and equities are imperfect substitutes both for banks and borrowers. Palley (2002) asserts that this model is similar to the structuralist approach of the PK theory of endogenous money, which will be discussed in Section 2.3.2.2.

The above views (money and credit views) show the transmission mechanism of changes in money supply to the economy through banks, which in turn has an influence on bank stock returns. However, these views take into account that money-supply changes are controlled by the central bank (exogenous) through the adjustment of high-powered money (monetary base).

2.3.1.1 Monetarists

Monetarists are mainly aligned with Milton Friedman's ideas. They oppose the Keynesian view of money with regard to money demand.[6] However, like the original Keynesians, they consider money supply as an exogenous variable, which means that the money supply is perfectly inelastic (vertical), with the interest rate driven by money demand. Friedman (1956) argued that there is more than one interest rate that is important to the operation of the economy. He developed a different theory of money demand by stating that individuals hold wealth in three forms: bonds, equity and goods. Thus, expectations as to whether there will be an increase in returns on either bonds, equity or goods relative to money, will have an

[6] Meltzer (1998) gives a full account of the debate between mainstream Keynesians and Monetarists.

effect on an individual's demand for money. The mathematical derivation of the theory is not reproduced here as it is in the cited paper, and is well entrenched in theory literature.

The monetarists' view "… has not been accepted broadly within the profession or at central banks" (Meltzer, 1998, p. 13). Three reasons are given by Meltzer (1998) for why this is the case: (1) economists either did not accept the idea of neutrality or believed that the proposition held only in the long-term, (2) monetarists argue that the velocity of money is stable, which is disputed, and (3) they believe that inflation is essentially a monetary phenomenon and therefore is the result of excessive money growth.

Kaldor (1980) was probably the first to develop a response to the monetarists' theory in that the causal relation between money and income goes in the opposite direction to that of the monetarists. With respect to the central bank controlling money supply by adjusting the monetary base, Kaldor and Trevithick (1981) argue that central banks tend to accommodate monetary base demand from banks, as frequent changes of the monetary base by the central banks can give rise to highly variable interest rates and unstable capital markets. Their accommodating behaviour is also attributable to their role as a lender of last resort.[7] This accommodation of reserve behaviour by the central bank is one of the central ideas of post-Keynesians.

2.3.2 Post-Keynesian theory of endogenous money

Influenced greatly by Kaldor, Basil Moore in 1988 developed the post-Keynesian view on money, which is today the cornerstone of the PK theory of endogenous money (Rochon, 2006). Pollin (1991, p. 367) claims that [PK theorists] accept the assessment by the former New York Federal Reserve Bank senior vice president Holmes (1969) that, in the real world, banks extend credit, creating deposits in the process, resulting in money supply. The PK theory of endogenous money asserts that money supply[8] is endogenously determined by the asset and liability management decisions of the commercial banks, the portfolio decisions of

[7] More discussion on Kaldor's work can be found in Bertocco (2001).

[8] In some literature, this is known as credit-money or money derived from credit supply.

the non-bank public and the demand for bank loans (Palley, 1994). The core of this theory is that causality runs from bank lending to bank deposits, instead of the traditional notion that deposits create loans. Thus, all other things being equal, the central idea revolves around three items on a bank's balance sheet – namely loans, deposits and the share price (or market value) of the bank. These are financial variables in entering the economics of money.

Lavoie and Godley (2006) describe the balance-sheet structure of a banking sector in the PK world.[9] As the banking sector has become more complicated with the introduction of capital adequacy standards,[10] there is a need for two balance sheets: one explaining the overall macroeconomic balance sheet – seen on the right-hand side of Table 2.1 (see page 17) – and the other corresponding to private accounting. This research is based on the well-known Lavoie and Godley (2006) model in the following discussion.

In the standard accounting balance sheet, it is assumed that the financial value of shares is equal to the net worth of the banks or their capital – or, in this case, the own funds (shares) of the banks, OF_b.[11] The own funds, when added to the liabilities, ensure that assets equal liabilities. A healthy bank must have more assets than liabilities so that its own fund is positive. If the bank is dissolved, then its own funds would accrue to the shareholders. Thus, if it is negative, the owners would get nothing, and the bank would be unable to pay back all of its liabilities. For banks, this situation could arise if borrowers were to default on their loans to the amount equal to the bank's own funds. For example, if the borrowers of $100 million were in default, then $100 million would need to be subtracted from both sides of the balance sheet, that is, L and OF_b. The bank would then need to find means to increase its own funds back to the required level relative to its loans in order to achieve an adequate

[9] They start with a balance sheet of a closed economy with a simple asset-based banking system and expand this to a more realistic banking sector. Only the realistic banking sector is summarised here.

[10] Capital adequacy is acknowledged as an important aspect of banking but is not the main focus of this thesis.

[11] These terms follow Lavoie and Godley (2006). While net worth is the term commonly used by accountants, the Bank of International Settlement refers to it as "capital", while the authors call it "own funds of banks", *OF*.

capital ratio. The own funds of the bank are therefore not the ultimate residual, as this is determined by the sum of the own funds of the banks in the last period OF_{b-1}, their retained earnings FU_b and the proceeds of the new issues of shares, $eb.p_{eb}$, minus the amount of non-performing loans, *NPL*:

$$OF_b = OF_{b-1} + FU_b + \Delta eb.p_{eb} - NPL \qquad (2.8)^{12}$$

The balance-sheet constraint of the banking system is thus:

$$B_b = M1 + M2 + OF_b - L - H_b \qquad (2.9)$$

where banks are assumed to provide loans, *L*, and deposits (current and time deposits denoted as *M1* and *M2* respectively) on demand. They also need to acquire reserves, H_b, from the central bank. The amount of Treasury bills, B_b, held by the banks will normally fluctuate depending on whether the system needs them.

Table 2.1: Two possible balance sheets of banks

Standard accounting		Macroeconomic accounting	
Assets	Liabilities	Assets	Liabilities
B_b	*M1*	B_b	*M1*
L	*M2*	*L*	*M2*
H_b	A_b	H_b	A_b
	OF_b		$eb.p_{eb}$
Total Assets = Total Liabilities		Assets – Liabilities = V_b	

Source: adapted from Lavoie and Godley, 2006, p. 263 exactly as in that source.

Note: *L* are loans, *M1* and *M2* are current and time deposits respectively, B_b is Treasury bills, H_b is reserves, $eb.p_{eb}$ is the outstanding number of shares issued by banks multiplied by the price of each share, A_b are advances, OF_b is the bank's own funds, and V_b is the net worth of the banking system from a system-wide view.

There is also a possibility of an overdraft in the financial system, as in Europe. It is also possible that banks borrow from each other, as in the case of large city banks in the US. In this type of financial system, banks hold no Treasury bills but get

[12] Table 2.1 is taken from page 15 of Lavoie and Godley (2004), which was incorporated in Setterfield's (2006) book. The equations are also found in the book. Lavoie and Godley's works on post-Keynesian economics is widely acknowledged.

advances, A_b at cost r_a (the borrowing rate) from the central bank; that is, the banks borrow from the central bank, so that the balance-sheet[13] constraint now becomes:

$$A_b = L + H_b - M1 - M2 - OF_b \qquad (2.10)$$

Thus, if the system is to function well at all, the advances must be provided whenever they are needed. This may arise if households are holding a large proportion of their money holdings as cash or if the reserve ratios on money deposits are high. There is also the possibility that banks hold bills and receive advances from the central bank as part of their liabilities. Whatever is the case, the supply of reserves, *H*, must equal the demand for reserves. This means that the central bank is always responding fully to the banking system's demand for reserves. This is in line with the accommodationist view (discussed in Section 2.3.2.1).

Similarly, in the macroeconomic balance sheet, the net worth of the banking system (from a system-wide view), V_b may be positive : it becomes negative when the whole banking system undergoes a severe crisis with loss of regulatory capital and the value of the affected banks may be negative. Here *eb* is the outstanding number of shares issued by banks and p_{eb} is the price of each share, which equates to the banks' market value. When the banks' market value, $eb.p_{eb}$, is high, the net worth of the whole banking system could be negative. In essence, the banks' market value may increase due to any share price increase occurring as a result of an increase in profits (earnings) and potential increase in dividends. This flow-through effect is consistent with the dividend valuation theory discussed in Section 2.4.2.

2.3.2.1 The Accommodationist approach

Although proponents of the PK theory accept the fundamentals of the endogeneity idea in that loans cause deposits and this in turn creates money supply, there is still a debate among advocates of the PK theory. That debate is between the accommodationists (horizontalists) and the structuralists. The disagreement mainly

[13] Table 2.1 is taken exactly from a well-used source that only discusses what happens when credit is created. Thus the terms in the table defined on page 17 only refer to consequential items in part of the balance sheet. It includes the shareholder value as OF_b which can be equal to the market value of shares, $eb.p_{eb}$ as shown in the table.

revolves around the central bank's role in accommodating the demand for reserves, which ultimately determines the slope of the money supply curve. According to the accommodationists, the central bank determines the level of interest rates and the banking sector fully accommodate any demand for credit at any level of interest rate, while the structuralists insist that full accommodation is not necessary and that interest rates may increase endogenously (Palley, 1997). Both views will be elaborated further in the following sections.

Exponents of the accommodationist view such as Moore (1988, 1989), Lavoie (1992) and Rochon (1999) reject the classical loanable funds theory and insist that money is generated by bank credit, and is used for the production and exchange of commodities. Thus, money supply will respond endogenously through bank intermediation to any changes in the demand for working capital by firms. The exogenous variable for this process of money creation is the price of credit (the interest rate), which is under the control of the central bank.

The process of money creation involves a sequence of events starting from the firms and running to the banks, and to the central bank, as established by Moore (1988). It starts with firms that require credit to finance the expansion of their business, be it a production process or to start a new business. There are of course other ways besides bank financing for a business to obtain credit; however, for reasons of simplicity it is assumed here that banks are the only means by which firms or households can increase funds.

As banks are in the business of selling credit, they will fully accommodate the firm's demand for additional funds with the loan interest rate determined by the bank (i_L) as a mark-up (m) on the short-term interest rate set by the central bank (i_{CB}), bearing in mind the possibility of alternative sources of finance provided by liability management practices. Commercial banks consider the discount rate pegged by the central bank as exogenous, so that:

$$i_L = (1+m)\, i_{CB}. \qquad (2.11)$$

By the mark-up approach, banks apply a margin to any refinancing cost and automatically grant all the funding demanded by the productive economy (Piegay, 1999) in a competitive market. The banks' lending rates are based on the funding costs and the interest rate spread – the mark-up (margin) between the cost to banks and the loan rate that the bank charges, which is needed to achieve the bank's profit goal (Rousseas, 1998). Hence, banks are price-makers and quantity takers.

As banks are unable to increase or decrease the volume of loans in their loan portfolios directly on their own, but only indirectly through varying loan prices or controlling selling expenses, loan volume is not controllable from an individual bank's perspective. Thus, at any point in time, banks usually give firms a line of credit, which largely exceeds their needs. Any decision on the part of the firm to draw on its credit line would automatically be accepted, at the agreed interest rate. Such loans are automatically created with a mandatory decision from the bank. The cost of borrowing is set in advance according to the risk grade assigned to the firms, based mainly on the absolute size of each firm's earning assets (Lavoie, 1992). The supply of credit is thus horizontal within the limits set by the norms of the financial system, whether firms have access to credit at the decided rate or not. These norms include ensuring that loan requests meet the bank's income and asset collateral requirements, and the loan officers having to satisfy themselves as to the credit-worthiness of the project and the character of the borrower (Moore, 1988).

As banks are concerned with the liquidity of their assets, they rely on the central bank as the last supplier of liquidity in order to meet any unexpected demand for cash withdrawals or international transfers. Hence, the liquidity of banks as a whole relies exclusively on the supply of reserves by the central bank. Moore (1998) argues that the central bank must always accommodate bank demand for reserves and currency in order to fulfil its responsibility of preserving the liquidity of the financial system, that is, the central bank acts as a lender of last resort. However, if reserves are fully supplied at the initiative of banks, the central bank is able to set the price of those reserves. Thus, although the central bank is unable to control the money supply in general, it can still choose the short-term interest rate at which reserves are made available. Hence, under the accommodationist view, money supply is perfectly interest-elastic (horizontal), as the supply of loans is determined by the

level of loan demand (see quadrant X of Figure 2.2) and the short-term cost of funds is pegged by the central bank (see quadrant W of Figure 2.2). Due to this, the accommodationist approach is also known as the horizontalists' approach.

Figure 2.2: Accommodationist model (adapted from Palley, 1994, p. 74)

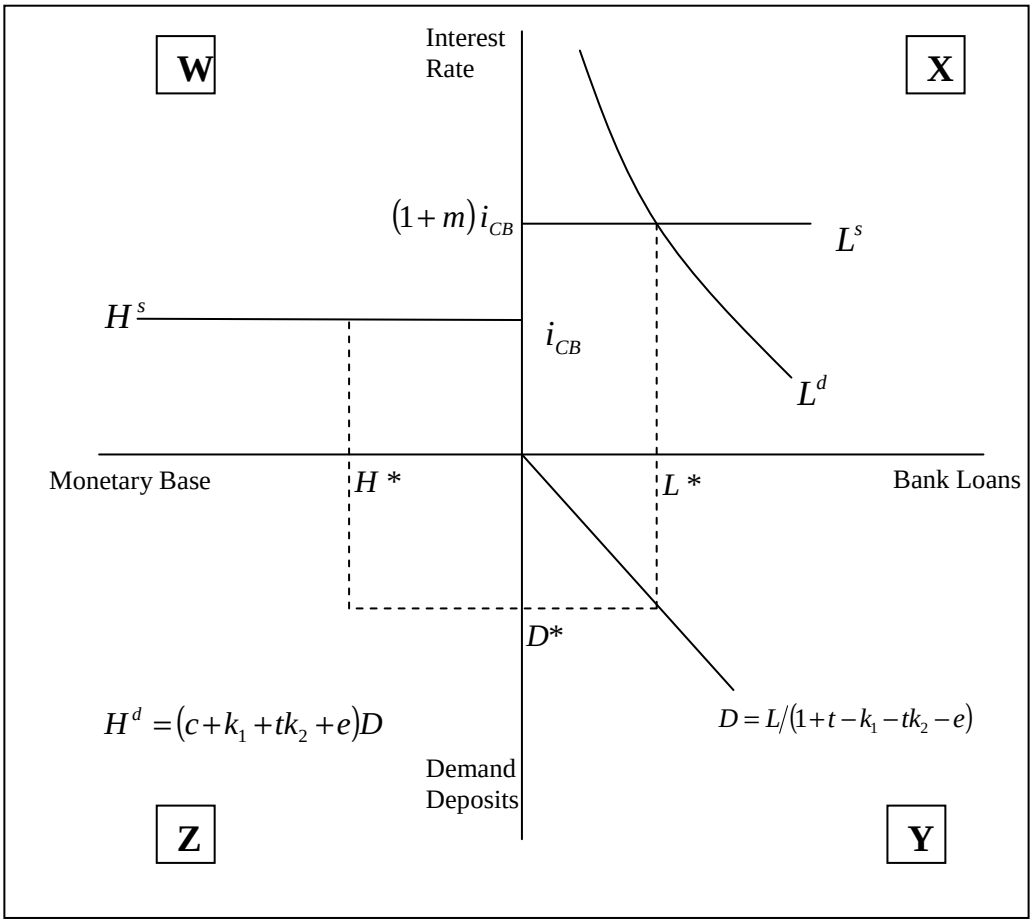


Figure 2.2 shows the equilibrium of a model from the accommodationist viewpoint[14] built by Palley (1994) where quadrant W shows the supply of reserves (H^s) being perfectly elastic at the exogenously set central bank rate (i_{CB}). Quadrant X shows the market for bank loans where the loans supply schedule (L^s) is perfectly elastic at a rate determined by the mark-up over the central bank rate, as in equation (2.10). Quadrant Y shows the banking sector balance-sheet constraint where demand deposits (D) are determined from any given level of bank lending (L^*). Quadrant Z determines the demand for reserves (H^d) associated with the level of demand

[14] Palley (1994) used i_F to denote the central bank's interest rate, which in his case was the Federal funds rate. In order to be consistent, the central bank rate in this thesis is denoted by i_{CB}.

deposits (D^*), which is linked to quadrant W to determine the actual supply of reserves (H^*). The equations in quadrants Y and Z for the demand for reserves and demand deposits are derived as follows:

$$i_L = (1+m)\, i_{CB} \tag{2.12}$$

$$L^d = L(i_L, \Lambda) \tag{2.13}$$

$$L^s + R^d + E^d = D + T^d \tag{2.14}$$

$$T^d = tD \tag{2.15}$$

$$R^d = k_1 D + k_2 T^d \tag{2.16}$$

$$E^d = eD \tag{2.17}$$

$$C^d = cD \tag{2.18}$$

$$H^d = C^d + R^d + E^d \tag{2.19}$$

$$L^s = L^d \tag{2.20}$$

$$M = C^d + D, \tag{2.21}$$

where:

L^d = bank loan demand,

i_L = bank loan interest rate,

m = bank mark-up,

i_{CB} = central bank interest rate,

L^s = bank loan supply,

R^d = required reserves,

E^d = demand for excess reserves,

D = demand for checkable deposits,

T^d = demand for time deposits,

k_1 = required reserve ratio for demand deposits,

k_2 = required reserve ratio for time deposits,

t, c, e = ratios of time deposits, currency and excess reserves to checkable deposits,

H^d = demand for monetary base (reserves),

C^d = demand for currency, and

M = money supply (narrow);

with equation (2.12) being the loan pricing equation where the loan rate is a fixed mark-up over the short-term interest rate set by the central bank. Equations (2.13) and (2.14) are the loan demand and loan supply schedules respectively. Equations (2.15) to (2.18) describe the demands for time deposits, reserves, excess reserves and currency respectively as fixed proportions of the demand for checkable deposits, while equation (2.19) explains the total demand for reserves. Equation (2.20) is the loan market clearing condition (equilibrium), and equation (2.21) is the definition of the money supply.

Substituting equations (2.12) to (2.17) into (2.20) gives:

$$D = \frac{L\left((1+m)i_{CB},\Lambda\right)}{\left(1+t-k_1-tk_2-e\right)} \ . \tag{2.22}$$

Putting equations (2.17) and (2.21) into (2.18) yields:

$$H^d = \left(c+k_1+tk_2+e\right)\frac{L\left((1+m)i_{CB},\Lambda\right)}{\left(1+t-k_1-tk_2-e\right)}, \tag{2.23}$$

and substituting (2.17) and (2.21) into (2.20) gives:

$$M = (1+c)\frac{L\left((1+m)i_{CB},\Lambda\right)}{\left(1+t-k_1-tk_2-e\right)}. \tag{2.24}$$

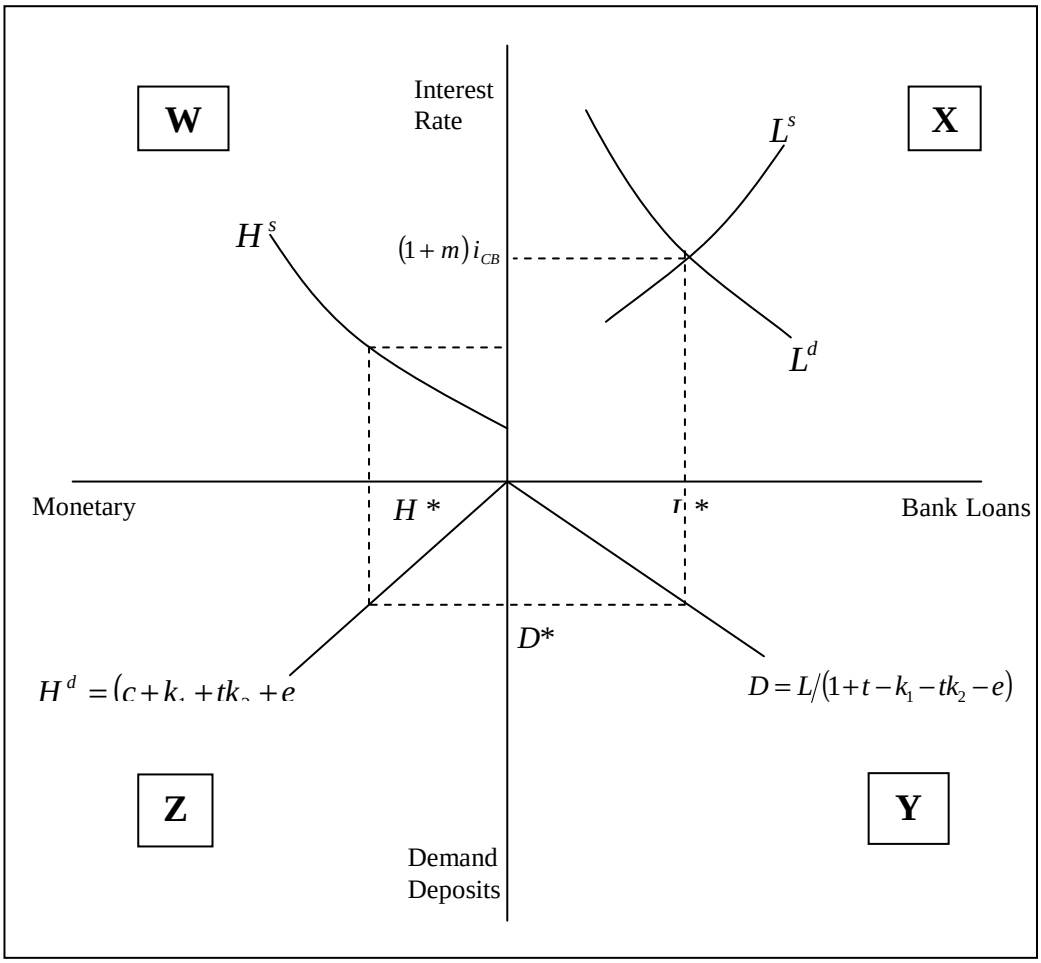
Hence, any changes in the short-term interest rate by the central bank will change the level of bank lending and the money supply. Accordingly, the supply of reserves will automatically adjust to fully accommodate the increase in deposits. Expansionary shifts of loan demand increase the level of bank lending and raise the level of checkable deposits, and hence both the narrow and the broad money supply, which in turn is expected to influence bank stock returns: the converse is true under contractionary demand situation. This assumes that the central bank fully accommodates the demand for loans and hence reserves. However, if the central bank were unwilling to accommodate fully any increases in loan demand and so imposed a feedback rule whereby the central bank interest rate would rise in response to market pressures, then the supply of reserves schedule would be positively sloped as in Figure 2.3, in line with the structuralists' view.

2.3.2.2 The Structuralist approach

Proponents of the structuralist view, such as Wray (1990), Howells (1995) and Rousseas (1998), maintain that banks do not fully accommodate the demand for credit as the accommodationists propose, because the banks always use a combination of price and quantity rationing in their loan-making. For this reason, the structuralists argue that money supply is upward-sloping (quadrant X, Figure 2.3), as they believe that central banks only partially accommodate the demand for reserves, which will increase interest rates due to market pressures. This makes the supply of reserves a positive function of the central bank rate. The central bank has no control over total reserves (H^s), as this is determined by the quantity demanded by banks to support their lending and deposit-taking activities; however, the central bank is still able to alter the mix of borrowed (BR) and non-borrowed reserves (NBR) to achieve its target, thus:

$$H^s = NBR + BR. \qquad (2.25)$$

Figure 2.3 The structuralist model (adapted from Palley, 1994, p. 76)



Additionally, Pollin (1991) argues that it is the changing structure of the liability side of the balance sheet of banks, rather than the asset side, that is responsible for the upward-sloping curve. Nevertheless, this behaviour would lead to the same endogeneity of money supply.

Bank behaviour can be seen as that of a profit-maximising firm. As money creators, banks require guarantees against default risks, which make interest rates fixed in a partly endogenous manner. With the structuralist view, the commercial banks no longer apply a uniform mark-up (m) of the short-term interest rate pegged by the central bank; they instead take their liquidity preference into account, which is their risk assessment (Piegay, 1999). (The liquidity preference of different economic agents such as households and firms will be discussed further in Section 2.3.2.3.) Banks' liquidity preference, which is expressed in terms of risk premium (ε), influences their responsiveness to the demand for credit. Thus, the interest rate on loans is (as per Deriet and Seccareccia, 1996):

$$i_L = \left[1 + m\left(\varepsilon\right)\right] i_{CB}.^{15} \qquad (2.26)$$

Hewitson (1995) asserts that as the banks increase their amount of credit extension, they will face greater risks and demand larger guarantees. This leads to higher interest rates as the volume of credit increases (Piegay, 1999). By changing the mix of their assets and liabilities, banks are able to obtain cheaper funding rather than relying solely on reserves, especially when the central bank raises interest rates in response to a strong demand for reserves. Palley (1987, 1994) explains that in asset management, banks hold secondary reserves, which exist in the form of holding bonds, to buffer any changes in loan demand and also demands for checkable and time deposits. Thus, if there are any unexpected withdrawals of deposits into currency, banks will sell their secondary reserves to fund the outflow; and alternatively if there is an increase in loan demand, individual banks will sell secondary reserves to fund the additional lending. In essence, Palley (1994) asserts

[15] This equation is originally derived by Rousseas (1985) (similar to equation (2.10) used by Palley (1994)) and modified by Deriet and Seccareccia (1996) to account for perceived risk in the financial system.

that the banks perform their own internal open market operations between their portfolios and those of the non-bank public. Although the total stock of reserves remains unchanged from these transactions, they allow the banking system to fund more loans.

Liability management on the other hand is, as Lavoie (1992, p. 212), states, "the ability of banks to increase their lending activity by borrowing funds which appear on the liability side of the balance sheet, without having to dispose of their marketable assets, mainly Treasury bills". Through liability management, banks are able to fulfil the demands of their borrowers by supplying credit at the banks' lending rates, as long as the banks' norms are satisfied. Structuralists, however, have long criticised this argument, questioning the reason for banks to engage in liability management if the central bank can accommodate required reserves, as claimed by the accommodationists (Pollin, 1991). Rochon (1999) agrees that perhaps banks would engage in liability management to meet their reserve needs, but he adds that banks may also practise liability management because reserves represent an implicit tax on banks and a loss of potential earnings. Regardless of whether central banks accommodate reserves or not, banks still actively engage in asset and liability management, as in the case of Canada, where reserve requirements have been abandoned (Rochon, 1999).

Palley (2002) proposes that the structuralist model is similar to the Bernanke-Blinder model discussed in Section 2.3.1, where the money multiplier, $m_D(.)$ and loan multiplier $m_L(.)$ perform the role of bank liability and asset management respectively. In the asset management case, an increase in the demand for loans pushes loan market interest rates up, making banks move out of bonds and into loans. Alternatively, in managing liability, banks raise rates paid on deposits to attract more funds. The profit-maximising behaviour of banks drives them to equalise marginal costs and returns across different financial markets. This behaviour allows the financial sector to accommodate increases in credit demand. It also explains the movements of the loans and deposit multipliers and answers the question of why endogenous money supply responds positively to loan demand shocks.

2.3.2.3 The Liquidity Preference approach

In setting the mark-up over the short-term interest rate, banks may display different degrees of liquidity preference in distinct situations (Minsky, 1975). Dow and Dow (1989) suggest that liquidity preference is a preference for a liquid asset over any illiquid assets. Banks distinguish among potential borrowers by risk category and are likely to have higher liquidity preference. Thus, for riskier borrowers, banks tend to adopt a very cautious lending behaviour. Liquidity preference[16] affects the behavioural functions of households, firms, banks and the central bank and in turn the money supply process (Wray, 1995).

The liquidity preference for households affects the money supply process in two ways: either through the composition of the households' portfolios, or through or their size. In the case of the former, when households are more willing to exchange cash and current deposits for short- and long-term assets, firms' profitability will increase, and this in turn will reduce their demand for financing any future working capital expenses. On the other hand, when households are willing to incur mortgages and consumer loans to finance the purchase of commodities, therefore changing the size of their loan portfolios, they influence the money supply process directly.

As for firms, they may change the composition of their portfolios by exchanging liquid for less liquid assets. For example, they may exchange cash and deposits either for direct purchase of capital goods or for an indirect purchase by acquiring securities in the financial markets (Fontana, 2003). Firms may also change the size of their portfolios by incurring business loans to finance the production of new goods and services. On the other hand, firms may adopt a more conservative borrowing behaviour or more liquid portfolios.

Structuralists insist that banks have their own liquidity preference. They argue that an expansion in the economy alone makes the interest rate rise. This is

[16] Some authors, for example, Shanmugam, Nair and Li (2003) and Nell (2000) describe liquidity preference as another approach in addition to the accommodationist and structuralist approach. Others – for example, Dow and Dow (1989) – explain liquidity preference as part of the structuralist approach. In this thesis, we maintain three different approaches.

because as firms rely increasingly on external borrowing (and as banks meet the credit demand of firms), both firms and banks will become illiquid. Hewitson (1995) explains that banks will vary their propensity to make advances of a given expected riskiness depending on expectations as to the value of alternative assets and the degree of confidence in those expectations. Defaults encourage a move to more liquid portfolios and an increase in the mark-up to the loan rate. Wray (1995) states that the liquidity preference of both banks and borrowers plays an important role in determining the price and quantity of credit; so that given a state of liquidity preference, any balance sheet expansion, capital and reserve leveraging, and exceeding of prudent margins of safety, can occur only at rising interest rates. As a result, banks have to charge higher rates to compensate for the risk of increased illiquidity, as inferred by Rochon (1999).

The liquidity preference of the central bank influences the money supply through the short-term interest rate (the interest rate on which market rates are based). Therefore, it represents an important monetary policy instrument of the central bank. The liquidity preference of the central bank may rise as a result of changes in the economy, such as changes in the general level of prices or the exchange rate, or dramatic swings in the financial markets. In such cases, the central bank is less willing to accommodate the bank's demand for reserves. If such is the case, then being less willing to exchange liquid for less liquid assets (that is, to make a change in the composition of its portfolio) means that the central bank would increase the short-term interest rate (Fontana, 2003). This is the feedback rule. This implies that the structuralist and accommodationist views are observationally equivalent.

As noted above, different groups of economic agents have different preferences concerning how much money they wish to hold. Howells (1995) explains that any increase in credits may not result in a corresponding increase of deposited money. This is because liquidity preferences or some other motives may induce owners of newly created deposits to transform them at least partly into cash or into assets of some other kind. In this regard, the existence of an independent money demand function would place constraints on the ability of loans to create deposits. This means that not only do loans create broad money supply, as the

accommodationists suggest, but also that causality runs from broad money supply to bank loans.

The discussions in the sections above have focused on the banking system as a whole. The nexus is that the banking system is an important factor in the economy, especially with respect to the monetary transmission mechanism, regardless of whether money supply is exogenous or endogenous. However, each bank is a profit-maximising firm and has its own asset and liability management strategies. The following section discusses the behaviour of individual banks and the consequences of their actions towards the banking system. Following this, a discussion on how bank stock returns are determined is given and the efficient markets hypothesis is explained.

2.4 Bank stock returns

The discussion has so far focused on aggregate banks (the shaded part of Figure 2.1 on page 10), bearing in mind the question of exogenous and endogenous money supply and the part that banks play in the monetary transmission mechanism. Banks can be seen as special in this case. However, banks can also be observed as profit-maximising firms. In such cases, each individual bank's behaviour may affect the banking system as a whole. The following section will discuss this theory further. Following this, a discussion on equity valuation will be provided.

2.4.1 Bank behaviour

Minsky (1982, 1986) developed the financial fragility hypothesis, which maintains that the relation between the banking system and the trend to financial fragility during the upturn of the business cycle illustrates how a crisis can occur as an endogenous result of these units' own economic dynamics. Dymski (1988), Wray (1990) and Kregel (1997) build on Minsky's (1982) theory in that banks in uncertain environments seek to base their behaviour on their customers' histories and also the average behaviour of other banks. This means that if the banking system as a whole is expanding or contracting credit, most individual banks will follow suit. Under uncertainty, this is the safe way to compete with other banks, as it guarantees both

market share and institutional reputation. This behaviour tends, however, to amplify the scale of business cycles.

As Alves Jr., Dymski and de Paula (2004) argue, the balance sheet of an individual bank is partially determined by the management decision on how aggressively to expand credit, and partly by the balance-sheet position of other banks. Using Minsky's (1982, 1986) financial fragility hypothesis, they show that there are factors that may alter an individual bank balance sheet, such as the banks' adoption of different strategies for profitability[17] and the speed of the loan expansion of the bank. That is, the more aggressive bank will be more financially fragile (as it loses reserves to other banks) and at the same time it will take on higher liquidity and insolvency risks.

Applying the PK theory, Alves Jr., Dymski and de Paula (2004) suggest that the bank's pro-cyclical behaviour towards bank loans may amplify economic growth during the upturn of a business cycle. On the other hand, during a downturn, as the amount of bad loans in the banking system increases and banks' expectation about the future worsens, all banks tend to contract their credit supply due to a rising liquidity preference. Their borrowers' expectations also become pessimistic, thus causing deterioration in the quality of overall bank credit portfolios, which may amplify the cyclical downturn. This has consequences for the pricing of the banking stock.[18]

How well a bank manages its assets and liabilities during the peak or trough of a business cycle is evident through its share price. In order to be able to relate the loan creation of the bank to its stock price, the standard dividend discount valuation model can be used. (In this thesis, the use of more recent models will be refrained – free cash flow, for example – that are sophisticated expansions of this model). The

[17] The authors only presented loan-making as a strategy, but acknowledge that there are other choices such as branch networks, whether to offer new kinds of financial services, whether to reduce credit risk through securitisation, whether to merge with other banks or non-bank firms, and the like.

[18] Alves Jr., Dymski and de Paula (2004) discuss four cases regarding banking strategy and the effect it has on different stages of the business cycle. This thesis will not elaborate on these stages, and interested readers are directed to the paper.

next section will briefly discuss the valuation of equity, using the dividend discount valuation model.

2.4.2 Equity valuation

The Gordon's (1962) dividend discount valuation model specifies that stock price P_0 is the present value of the expected stream of dividends D_t growing at a *g*-rate of growth (which can be constant or variable) discounted at the required rate of return or discount rate k_e (the third term of equation 2.27a). The k_e itself can be divided into risk-free rate r_f and the market risk premium *rp*, scaled by the risk, β_i. Also, if the dividends grow at a constant rate indefinitely, then the numerator of the general model (the first term of equation 2.27a) becomes $D_o(1+g)^t$ as in the second term of equation (2.27a).

This theory was used by Keran (1971), Homa and Jaffee (1971) and Hamburger and Kochin (1972) to test the theory of money supply influencing stock prices. Over the years, the theory has been extended from the general valuation model to include earnings components as in equation (2.27b). Therefore, the activities of a bank can be calculated in terms of its stock price:

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+k_e)^t} = \sum_{t=1}^{\infty} \frac{D_0(1+g)^t}{(1+r_f+\beta_i rp)^t} = \frac{D_0(1+g)}{(k_e-g)} \qquad (2.27a)$$

$$P_0 = \frac{a \times EPS_0(1+g)}{(k_e-g)} = \frac{a \times EPS_0(1+g)}{(k_e-((1-a)\times ROE))} \qquad (2.27b)$$

where P_0 is the current price of the common stock, D_0 and D_t are the current and expected dividends respectively, β_i is the beta of the bank, *g* is the constant rate of growth of bank stock dividends, *a* is the payout rate, EPS_1 is earnings per share in the next period, and k_e is the discount rate, which includes the risk-free rate, r_f, and the market risk premium, *rp*. Also 1-*a* is the retention rate and *ROE* is return on equity, which is equal to net income divided by equity. Following changes in credit creations in banks, changes must take place from the resulting earnings and then the dividends and *g* as well. The net effect would lead to a price effect, which can be measured as the industry stock returns for the whole banking sector or for each bank stock return. The change in the prices of the shares over any two periods (example over a month

or quarter) may be used as representing the reaction of shares to events such as money supply changes.

Here, any changes, up or down, in the market interest rate by the central bank may change the bank's interest-sensitive expenses and receipts. However, the change in interest-sensitive expenses may be offset by interest-sensitive income or interest sensitive income may exceed the expenses. If the interest-sensitive income and expenses do not equal each other, then a gap arises, and decision-making by the bank's management team – for example, a decision resulting in fee income activities – becomes especially important. Depending on the outcome of the interest rate gap considerations of the bank's management, changes in interest rates may thus lower the bank's net interest income. Thus, the value of the bank's stock will tend to fall because the value of future dividends is expected to decrease: the converse is true if otherwise. If there are decreases in expected dividends combined with an expectation of increasing risk by investors in the bank's stock, then the value of the bank's stock will also decrease (Rose, 2002).

The dividend valuation model can be related to the bank firm and subsequently connected to the macroeconomic balance sheet discussed in Section 2.3.2. An increase in loans and deposits, provided that there is still a high profitable margin, will affect dividends. From the dividend valuation model, this effect will then increase share prices: otherwise a contrary effect will result. From Table 2.1, one can deduce that this increase, assuming the number of shares remains constant, will make the net worth of the banking system positive provided non-performing loans are low.

As the risk-free rate (r_f) is a direct function of market interest rates, an increase (decrease) in the market interest rate will have a negative (positive) impact on the bank stock price, everything else held equal. The risk premium depends on the uncertainty of the future values of the growth rates of dividends and the level of price of the risk-free asset. As the variability of interest rates increases, then the uncertainty or variability in the economy will rise, making the risk premium increase and hence causing the stock price to fall. Rose (2002) explains that the value of the bank stock will decrease through higher risk premiums, either because the bank's

perceived level of risk has increased, because there is an increase in its loan losses, or because of heightened investor perception of the riskiness of the bank.

2.5 Empirical evidence on money supply and bank stock returns

Empirical evidence relating to the PK theory of endogenous money, exogenous money and bank stock returns is presented in this section.

2.5.1 Exogenous money supply

The traditional Keynesian approach to test money supply effects on *economic activity* (financial activity is still not studied) uses a structural model in which a system of equations describes the behaviour of firms and consumers in the economy and how they operate. In an old study, Scott (1966) found that, consistent with the ISLM framework, money supply and income affected interest rates. Using dummy variables from reading the minutes of the Federal Open Market Committee to indicate periods of tight money, Romer and Romer (1990) found that M1 tends to drop faster than bank credit in the wake of contractionary monetary policy, and that bank credit growth lags behind money growth. They concluded that their findings were consistent with the money view.

Although Bernanke and Blinder (1988) extended the ISLM model to show that bank loans are important, they found that in the 1980s, money shocks were more important in the US relative to credit shocks. However, they concluded that there was no strong evidence to reject the credit view. Using monthly aggregate data from 1959 to 1989, Bernanke and Blinder (1992) obtained similar findings to those of Romer and Romer (1990). Yet Bernanke and Blinder interpreted their evidence as being consistent with the credit view, because they found that contractionary monetary policy is followed by a decrease in the volume of aggregate bank lending.

Most of the previous literature has used aggregate data in its studies. However, a problem of identification arises when using aggregate data in that it may not be possible to disentangle credit supply and demand effects, a necessary condition for deciding whether a distinct lending channel exists. Kashyap, Stein and

Wilcox (1993) suggest that a decrease in loans coinciding with a decrease in output may not imply causation. They suggest that the decrease in loans may rather be due to a decrease in loan demand, and not to a decrease in supply following a contractionary monetary policy. Thus, the traditional money channel may cause the decrease in output, and bank lending follows passively.

In order to solve the identification problem, Kashyap, Stein and Wilcox (1993) used US disaggregated data (bank loans and commercial paper). They found that tighter monetary policy leads to a rise in commercial paper issuance while bank loans fall, suggesting that contractionary policy can reduce loan supply. They also found (after controlling for interest rates and output) that these shifts seem to affect investment. Similarly, Gertler and Gilchrist (1993) and Oliner and Rudebusch (1996) found that there is a reduction in loan supply, mainly to households and small firms, following a contractionary monetary policy.

Other studies of the US investigate whether monetary policy has a different impact for banks of different asset sizes. Kashyap and Stein (1995), Kashyap and Stein (2000) and Kishan and Opiela (2000) found that a bank lending channel exists and is mainly transmitted through small banks. Small banks have more problems of asymmetric information than large banks and thus have more difficulties substituting non-deposit sources of external finance (Lensink and Sterken, 2002). Large banks are able to shield their loans portfolio against monetary shocks as they hold a larger buffer of liquid assets.

On an international level, evidence for the bank lending channel is mixed. In Europe, de Bondt (1999) found evidence of the bank lending channel in Germany, Belgium, Italy, France and The Netherlands; but no significant effect of a bank lending channel in United Kingdom. This was supported by Kakes and Sturm (2002) and de Haan (2003), who found the bank lending channel in Germany and The Netherlands respectively. Altunbas, Fazylov and Molyneux (2002) found, out of 11 EMU countries tested, a bank lending channel only in Italy and Spain.

Favero, Giavazzi and Flabbi (1999) found no evidence of a bank lending channel in France, Germany, Italy and Spain during 1992, and Kakes (2000) and

Garretsen and Swank (2003) found none for The Netherlands. Hernando and Pagés (2003) supported the findings of Favero, Giavazzi and Flabbi (1999) for Spain. However, Chrystal and Mizen (2002) and Huang (2003) did find evidence of a bank lending channel in the UK.

Guender (1998) did not find a bank lending channel in New Zealand, while Ford, Agung, Ahmed and Santoso (2003) found support for a bank lending channel in Japan prior to 1984 but none after 1985. Alfaro, Garcia, Jara and Franken (2005) and Golodniuk (2006), using a panel of bank balance sheet data, found support for a bank lending channel in Chile and Ukraine. Also, a bank lending channel exists in Portugal (Ferreira, 2007) and in Colombia and Argentina (Gomez-Gonzalez and Grosz, 2007).

These mixed results are attributable to the difference in time periods tested, to differences in methodologies, and also to the different proxies used for monetary policy stance. Most of the empirical evidence that finds a bank lending channel concludes that it is transmitted mainly through small banks. The results also show that undercapitalised banks are more affected than average banks by a change in monetary policy. Table 2.2 summarises the empirical evidence on the credit view, in particular the bank lending channel.

Table 2.2 Empirical studies relating to exogenous money

Author (Year)	Country	Data	Methodology	Findings Is there a bank lending channel?
Bernanke and Blinder (1988)	US	Q: 1953:1-1985:4	Regression	No but concluded that there was no strong evidence to reject the credit view
Bernanke and Blinder (1992)	US	M: 1959-1989	VAR	Yes
Kashyap, Stein and Wilcox (1993)	US	Q: 1964- 1989	Causality tests	Yes
Gertler and Gilchrist (1993)	US	Q: 1975:1-1991:4	VAR	Yes
Kashyap and Stein (1995)	US	Q: 1976:1-1992:2	Regression	Yes
Oliner and Rudebusch (1996)	US	Q: 1973:4-1991:2	GMM estimator for DPDM	Yes
Guender (1998)	New Zealand	Q: 1965:1-1995:4	Regression	No
de Bondt (1999)	Germany, Belgium, Netherlands, Italy, UK, France	Q:1980-1996	Regression	Yes for Germany, Belgium, France, Italy and Netherlands but No for UK
Favero, Giavazzi and Flabbi (1999)	France, Germany, Italy, and Spain	A: 1992	Regression	No
Kashyap and Stein (2000)	US	Q:1976:1-1993:2	Regression	Yes
Kishan and Opiela (2000)	US	Q: 1980:1-1995:4	PDR	Yes
Kakes and Sturm (2002)	Germany	Q: 1975:1-1997:4	VECM	Yes
Kakes (2000)	Netherlands	Q: 1979:1-1993:4	VECM	No
Altunbas, Fazylov and Molyneux (2002)	11 EMU countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy Luxembourg, Netherlands, Portugal, Spain	A: 1991-1999	PDR	Yes in Italy and Spain only
Chrystal and Mizen (2002)	UK	Q: 1977:4-1998:1	VAR and dynamic structural modelling	Yes
Huang (2003)	UK	A: 1975-1999	GMM estimator for DPDM	Yes
Garretsen and Swank (2003)	Netherlands	M: 1982.12-1996.12	VAR	No
de Haan (2003)	Netherlands	A: 1990-1997	GMM estimator for DPDM	Yes
Hernando and Pagés (2003)	Spain	Q: 1991-1998	GMM estimator for DPDM	No
Ford, Agung, Ahmed and Santoso (2003)	Japan	M: 1965:1-1999:6	VAR	Yes prior to 1984 and none after 1985
Alfaro, Garcia, Jara and Franken (2005)	Chile	Q: 1990:1-2002:2	PDR and VAR	Yes
Golodniuk (2006)	Ukraine	A: 1998-2003	PDR	Yes
Gomez-Gonzalez and Grosz (2007)	Colombia and Argentina	M: 2003:8-2005:11	PDR	Yes
Ferreira (2007)	Portugal	A: 1990-2002	PDR	Yes

Note: PDR=Panel data regression, GMM estimator for DPDM= Generalised Method of Moments estimator for dynamic panel data model. A, Q, M is annual, quarterly and monthly data respectively.

2.5.2 PK theory of endogenous money

Using different methodologies, the empirical evidence on money endogeneity supports the PK theory in that loans cause deposits, and in turn deposits cause money supply, which in turn influences bank stock returns. Table 2.3 (page 38) summarises the empirical evidence on the PK theory of endogenous money.

Arestis (1987) used a structural equation model using data over the period 1964:Q1 to 1985:Q1 to test endogeneity of money in the UK economy. His results showed that bank lending to the private sector was demand-determined, with the monetary authorities having little means of influencing it. He also found evidence that the money was primarily credit money, created by the banking system in response to loan demands.

Applying a series of Granger-Sims causality tests between bank lending, the monetary base and four different monetary aggregates for the US market, Moore (1989) found that unidirectional causality ran from bank lending to the four monetary aggregates, and from the monetary aggregates to the monetary base, except for bidirectional causality between the monetary base and M2. In addition, he found that the monetary aggregates were endogenous in both the US and the UK, where changes in the money wage bill (demand for working capital) explained the changes in bank credit, which in turn explained the changes in credit money stock.

Foster (1992) developed a model of M3 from the money supply perspective, taking into account the existence of non-bank financial institutions and the use of collateral by banks to assess the borrowers' risk. He found that property price inflation appeared to have had a crucial role to play in inflating M3 in the UK. The same model was then used by Foster (1994) to test the Australian M3 by using ordinary and two-stage least squares. It was determined that there was a very stable endogenous money supply model in Australia and that real property value played a key role in the determination of M3.

Table 2.3 Empirical studies relating to endogenous money

Author (Year)	Country	Data	Model / Method of estimation	Money variable used	Findings
Arestis (1987)	UK	Q: 1964:1 – 1985:1	Structural equation model	M3	Money is endogenous; bank lending to industrial and commercial companies is the most important component of bank lending to the private sector
Moore (1989)	US and UK	Q: 1965:1 – 1979:4 and 1965:1 to 1978:2	Granger-Sims causality tests	Monetary base to M2	Unidirectional causality from bank lending to monetary aggregates
Foster (1992)	UK	Q: 1963:3 – 1988:2	OLS and recursive least squares	M3	Property price inflation has a crucial role in inflating M3
Foster (1994)	Australia	Q: 1967:4 – 1993:1	OLS and 2SLS	M3	Money supply is endogenous and stable in Australia
Palley (1994)	US	M: 1973:1 – 1990:6	Granger causality	M1 and M2	Money is endogenous in favour of the structuralist approach
Howells and Hussein (1998)	G7	Q: 1957:1-1993:4	Granger causality and VECM	Canada, Italy, US : M2; Germany, France, Japan: M3; UK: M4	Broad money is endogenous
Caporale and Howells (2001)	UK		Toda and Yamamoto (1995) causality tests	UK: M4	Loans do cause deposits, even in the presence of total transactions
Nell (2000)	South Africa	Q: 1966:1-1997:4	Granger causality and ECM	M3	Money supply is determined endogenously
Vera (2001)	Spain	M: 1987:1 – 1998:10	Granger causality test	Various money multipliers	Money supply is credit driven and demand determined
Shanmugam, Nair and Li (2003)	Malaysia	Q: 1985:1 – 2000:4	Granger causality tests and ECM	M3	Support for accommodationist view: total bank loans cause M3 but no support for structuralist view: no causality from total bank loans to M3 money multiplier
Holtemöller (2003)	Germany	Q: 1975-1998	VECM	M3	Money stock and monetary base are determined endogenously after the Bundesbank has set the interest rate
Vymyatnina (2006)	Russia	M:1995:7-2004:9	Granger causality test	M0 and M2	Money endogenous: support for accommodationist and structuralist approach
Ahmad and Ahmed (2006)	Pakistan	M: 1980-2003	Granger causality test	Narrow and broad money	Money endogenous in the short run but exogenous in the long run
Cifter and Ozun (2007)	Turkey	Q: 1997-2006	VECM	Money base, M2	Money is endogenous and there is support for the accommodationist view

Q, and M are quarterly and monthly data respectively. VECM is Vector Error-Correction Model, ECM is Error-Correction Model, OLS is Ordinary Least Squares and 2SLS is Two-stage least squares.

Palley (1994) provided Granger-causality evidence for three competing approaches to the determination of money supply. The first approach identified the conventional money multiplier approach to money supply (the pure portfolio approach); the second identified the PK accommodationists' approach (pure loan demand); and the third identified the PK structuralist approach (the mixed portfolio-loan demand approach). He concluded that the results are in favour of the mixed portfolio-loan demand approach (the structuralists).

Howells and Hussein (1998), using a causality test based on cointegration and the error correction representation, tested whether broad money supply is endogenously determined in the G-7 countries. Their results suggested that, in the UK, the ability of the demand for loans to cause deposits was constrained by the demand for those deposits; that is, the willingness of agents to hold newly created deposits puts constraints on the ability of the demand for loans to create those deposits, contrary to the Moore (1988) argument that there is no reconciliation problem and that the demand for money is completely elastic. Caporale and Howells (2001) revised some of their earlier inferences, especially the reverse causality running from deposits to loans found in Howells and Hussein (1998). They used tests developed by Toda and Yamamoto (1995) to investigate the possibility that earlier causal inferences made from bivariate tests were incorrect due to the presence of a third variable – total transactions. They found that while total transactions cause deposits, there is no causal connection in any direction between loans and transactions; thus they concluded that even with the third variable present, the core of the endogeneity issue holds, in that loans do cause deposits.

Nell (2000) produced evidence that bank loans created money in South Africa over the period 1966 to 1997. There exists a long-run cointegrating relation between money income and the M3 money supply over the entire sample period. Vera (2001), using Granger causality tests for the period 1987 to 1998, found support for both the structuralists' and the accommodationists' approach in Spain. It was established that Granger causality ran predominantly from bank lending to the various money multipliers used, and it was confirmed that liability management was significantly utilised for the accommodation of loan demand, in support of the structuralist view. It was also found that the mark-up of the prime lending rate over the interbank rate

appeared to fluctuate pro-cyclically, as claimed by the structuralists. However, closer inspection of the liquidity position of banks suggests that other factors, such as changing market power and changing demand elasticities over the cycle, and therefore not the structuralist approach, may explain the pro-cyclical pattern of mark-ups.

An interesting study by Pinga and Nelson (2001) tested the monetarists' and structuralists' theory using Granger causality tests on 26 countries. It should be stressed that their study focused on testing the causality between money supply and prices (consumer, wholesale or producer price indices, where available, as a proxy for inflation) and not money supply and bank loans. They found mixed evidence on the causality between money and inflation for each country over different lag structures. Their results indicated that there is strong evidence of money endogeneity in Chile and Sri Lanka and of money exogeneity in Kuwait, Paraguay and the US. Other countries – Argentina, Brazil, the Central African Republic, Egypt, El Salvador, Ghana, India, Indonesia, Iran, Italy, Japan, Korea, Malaysia, The Netherlands, Pakistan, The Philippines, Singapore, Syria, Thailand, Tunisia and Uruguay – exhibited either no causality or mixed evidence, that is, bidirectional causality. Pinga and Nelson concluded that countries with high inflation were shown to have an endogenous money supply responding to inflationary pressure, while low inflation environments supported the monetarist view.

Similarly, utilising error-correction models and Granger causality tests to test the money endogeneity hypothesis, Shanmugam, Nair and Li (2003) found that money supply was endogenous in Malaysia between 1985 and 2000. The results supported the liquidity preference approach as there was a long-run cointegrating relationship between money income and M3 money supply; and they provided support for the accommodationists' view as there was causality between total bank loans and the M3 money supply. However, there was no support for the structuralist approach in Malaysia as there was an absence of causality from total bank loans to the M3 money multiplier.

Using a vector error-correction model (VECM) on German quarterly data over the period 1975 to 1998, Holtemöller (2003) found that money stock and

monetary base were determined endogenously after the Bundesbank had set the money market interest rate, a finding that opposed the money multiplier approach; and there was a stable relationship between money stock and monetary base. There was, however, one shortcoming stated in his paper in that the money stock formulated was simply the quantity of loans, which was representative of M1, but Holtemöller (2003) used M3 as a money supply variable in his tests.

Vymyatnina (2006), using Granger causality over the period 1995 to 2004 (a relatively short period), found support for money endogeneity in Russia. There exist two sources of endogeneity in the results, in support of the accommodationists and structuralists. Similarly, using Granger causality tests over monthly data from 1980 to 2003, Ahmad and Ahmed (2006) concluded that money is endogenous in the short run, spanning a time period of not more than 18 months, but is exogenous in the long run. Cifter and Ozun (2007) tested the monetary transmission mechanism and money endogeneity in Turkey. Using a VECM methodology over a sample period running from 1997 to 2006, they found support for the accommodationist approach of the PK theory of endogenous money.

The empirical evidence relating to money endogeneity above is mainly concerned with investigating whether money is endogenous. The next section discusses the empirical evidence relating to bank stock returns.

2.5.3 Empirical evidence on bank stock returns

This section will explore the empirical evidence with respect to bank stock returns. Studies on macroeconomic variables, including money supply and stock index returns, will also be discussed in this section.[19] This section restricts the review to bank and money supply relevant studies.

Most of the studies that use bank stocks investigate (i) the relationship between the risk and returns of bank stocks (Chance and Lane, 1980; Flannery and James, 1984; Booth and Officer, 1985; Aharony, Saunders and Swary, 1986; Tarhan,

[19] Empirical evidence to support the theory proposed by Alves Jr., Dymski and de Paula (2004) to the author's knowledge does not exist.

1987; Bae, 1990; Dinenis and Staikouras, 1998; Lajeri and Dermine, 1999; Stiroh, 2006; Iannotta, Nocera and Sironi, 2007; Uzun and Webb, 2007), (ii) the efficiency of banks and its relationship to their returns (Beccalli, Casu and Girardone, 2006; Kirkwood and Nahm, 2006; Fiordelisi, 2007) or (iii) the determinants of bank stock returns (Cooper, Jackson and Patterson, 2003; Goddard, Molyneux and Wilson, 2004; Barros, Ferreira and Williams, 2007; Carbó Valverde and Rodríguez Fernández, 2007). Recently, Berger and Bouwman (2008) found that banks that create liquidity are valued highly by investors through their market-to-book ratio and price-earnings ratio.

A number of studies, for example, Keran (1971), Homa and Jaffee (1971) and Hamburger and Kochin (1972) have found a significant and positive relationship between money supply and stock prices, with money supply leading stock prices. However, consistent with Fama's (1970) efficient markets hypothesis, Rozeff (1974), Pesando (1974) and Rogalski and Vinso (1977) found that past money changes do not contain predictive information on stock prices.

Since then, studies such as Pearce and Roley (1983), Cornell (1983) and Pearce and Roley (1985) have focused on the unanticipated changes of money supply and stock prices, where evidence shows that there is a negative relationship between the two in the US studies. Hardouvelis (1987) analysed the response of stock prices to the announcements of 15 macroeconomic variables and concluded that the NYSE Financial Index has the strongest response to monetary news as the cash flows of financial companies are directly affected by monetary developments. Hashemzadeh and Taylor (1988) found that there exists bidirectional causality between money supply and stock returns in the US. Mukherjee and Naka (1995) found that the Japanese stock market is cointegrated with six macroeconomic variables, of which money supply is one (perhaps this study is directly relevant to this thesis). Dhakal, Kandil and Sharma (1993), Abdullah and Hayworth (1993), Lee (1994), Flannery and Protopapadakis (2002) and Ratanapakorn and Sharma (2007) tested the long-run relationship between macroeconomic variables (including money supply) and stock returns in the US and also found that there is a long-run relationship between stock returns and money supply (amongst other macroeconomic variables, here too money supply is identified).

Most of these studies, however, use general stock index prices and *not* bank stock prices in particular.[20]

2.6 Discussion

This review of the literature suggests that research has mainly focused on exogenous or endogenous money or stock index returns and that the effect of earnings (dividend model) has not yet been studied in the money supply context. But no study has investigated these issues together, that is, the simultaneous relationship between banking sector stock returns *and* the creation of money supply by banks. This has been highlighted in Figure 2.1. The first question for this integrated investigation is to verify the money endogeneity. That is, whether or not the G-7 countries[21] have evidence in support of money being endogenous, as our hypothesis maintains. Rejection of this hypothesis for all or some countries would show that money is exogenous for those cases. An associated issue is that endogeneity and exogeneity need to be verified in terms of causality. This can be achieved by using existing econometric models to test for causality.

The nature of the post-Keynesian theory of endogenous money is debated amongst its proponents. Three views, accommodationist, structuralist and liquidity preference, evolve from the debates, mainly concerning the amount of credit demanded that banks accommodate, giving rise to differences in the slope of the money supply curve. Empirical evidence relating to these three views has focused on emerging economies and the US. Another avenue of research is to investigate which of these three views is supported by the seven countries examined in this thesis, if money is found to be endogenous. These questions can also be determined using the latest econometric causality models.

[20] Other studies, for example, Strongin and Tarhan (1990), Li and Hu (1998), Rapach (2001) and Funke and Matsuda (2006) investigate the effects of macroeconomic announcements and stock returns, however, as this thesis investigates the relationship between the bank stock returns and money supply as defined through the post-Keynesian theory of endogenous money, these studies are not relevant to this thesis in that respect.

[21] Russia, though a member of the G-8, is not included in the thesis due to lack of data availability.

Most empirical research regarding endogenous money tests the causality between bank loans and money supply, as deposits may be held not only in the transactional form but also in any form that constitutes broad money supply. However, post-Keynesians assert that loans create deposits and in turn deposits create money supply. This makes it possible that deposits may be an important variable in the transmission from bank loans to money supply, as bank loans acquired are immediately transferred into demand deposits and not only into other types of deposits. Thus, it will be useful to use Toda and Yamamoto's (1995) causality technique to determine whether this trivariate causality exists.

Empirical studies relating to bank stock returns have concentrated on investigating the relationship between the risk and return of bank stocks, the efficiency of the banks and its relationship with bank stock prices, or the determinants of bank stock returns. The unstudied issue here is the relationship between money supply – be it endogenous or exogenous – and bank stock returns. The relationship between exogenous money supply affecting bank stock returns is exhaustively explained via the liquidity effect or portfolio balance effect. The direction of the endogenous money supply effect on bank stock returns is interesting, as the transmission from changes in interest rates by the central bank (following the PK theory), as it moves through loans and is then filtered into bank stock prices, has not been investigated.

Previous literature argues that money supply and other macroeconomic variables do have an important impact on stock prices in general: money supply in general is positively related to stock prices, given the impact of money supply increases on reducing the discount rate via the market interest rate. For example, an expansionary monetary policy may increase stock prices, as the increase in money supply means that the public will have more money to spend, especially in the stock market. In this regard, the dividend valuation theory in the finance literature appears to suggest that increases in money supply which reduce interest rates mean that investment can be financed cheaply, resulting in increased earnings and hence increased stock prices.

The central issue is the link between money supply – a monetary economics issue – and bank stock returns. An examination of this issue is likely to add new findings about the dynamics of bank stock price behaviour arising from money supply. In this thesis, a model will be developed for the purposes of investigating this central issue. By combining the findings as to whether money is endogenous and whether there is a relationship between money supply and bank stock returns, a simultaneous model may be able to answer the question of whether there is a simultaneous relationship in the financial economics issue. These discussions will be further elaborated in the ensuing chapters. Chapter 3 will provide an overview of the financial system and monetary policy adopted by the G-7 countries included in this thesis. Chapter 4 will develop testable hypotheses based on the discussion in this chapter and a testable model, while Chapter 5 will provide the results of the tests.

Chapter 3: Overview of the Financial System and Monetary Policy in the G-7 Countries

3.1 Introduction

The countries examined in this thesis have developed financial systems as well as a history of changes in their monetary policy regimes. This chapter discusses the history of the financial systems and monetary policies of the G-7 countries. These will be discussed in the sequence of first the non-euro countries – Canada, Japan, United Kingdom (UK) and the United States (US) – followed by the euro countries of France, Germany and Italy. The Exchange Rate Mechanism Crisis and the foundation of the euro will also be discussed in this chapter, since the data span the pre-euro period. Further, identification of time periods to control for the regime changes and regulatory changes within the econometric models to be developed in the next chapter will depend on verifying the monetary policy changes in the countries. These are fully explored in this chapter.

3.2 Canada: Financial system

In 1967, the Bank Act was amended in Canada as a first step in a financial deregulation that included the elimination of the 6 percent ceiling on the interest rate on bank loans (Freedman 1998). Banks were also prohibited from making agreements with any other banks on the rate of interest paid on deposits or the rate of interest charge on loans. Thus, as indicated by Kaminsky and Schmukler (2003), the determination of interest rates on loans was left to market forces. The amendments also eliminated restrictions on the banks' involvement in residential mortgage financing, so that they could invest in non-insured or conventional mortgages. Furthermore, when the 10 percent ownership limit on the shares of banks was introduced, banks were prohibited from owning trust companies in order to ensure that Canadian banks remained under domestic ownership and control and to prevent any concentration of ownership. Deposit insurance for banks and for trust and mortgage loan companies was also introduced in Canada following the financial difficulties of some trust and loan companies.

In 1973, chartered banks were allowed to borrow abroad, and corporations were allowed to issue bonds abroad, although they were subject to some guidelines and controls (Kaminsky and Schmukler, 2003). No controls were in place on foreign exchange transactions at this time. There were also no controls over inward or outward portfolio investment for stocks. However, there were some specific restrictions on inward direct investment in broadcasting, telecommunications, transportation, fisheries, and energy and financial services. In 1974, chartered banks were given greater freedom to conduct foreign currency operations. Following this, in February 1975, the 1970 guideline that requested Canadians to explore fully all available sources in the domestic market before issuing bonds abroad was lifted.

The Bank Act was again amended in 1980. This time the amendments allowed foreign banks to establish subsidiaries in Canada, although they had restrictions on the total size of the bank business. These were removed in 1989 for US banks as part of the Canada-US free trade agreement, in 1994 for Mexican banks as part of NAFTA, and in 1995 for the rest of the foreign banks' subsidiaries as part of the world trade negotiations. The Canadian Payments Association (CPA) Act was passed in 1980 to allow banks and non-bank deposit-taking institutions to take over from the Canadian Bankers Association the responsibility for running the cheque-clearing system. The CPA was given responsibility for planning the future evolution of the Canadian payments system.

From 30 June 1987, there was no longer any limit on investments in securities firms by Canadian financial institutions. Non-residents were permitted to own up to 50 percent of an existing securities firm from this date, and up to 100 percent from 30 June 1988. Direct entry into the Ontario market by foreign securities firms was also permitted without limit from 30 June 1987. Reserve requirements were phased out in the early 1990s (Williamson and Mahar, 1998). The "Four Pillars" system was largely eliminated in 1992, giving Federal financial institutions the power to diversify into new financial businesses through financial institution subsidiaries. As a result of the 1987 and 1992 amendments, Canadian financial institutions were able to develop into financial conglomerates, with involvement in a wide variety of financial areas.

3.2.1 Canada: Monetary policy

In 1975, in response to the persistence of high inflation during the 1970s, the Bank of Canada adopted a narrowly defined monetary aggregate (M1) under a program of "monetary gradualism" whereby M1 growth would be controlled with a gradually falling target range. When this aggregate became increasingly unreliable and turned out not to have been all that helpful in achieving the desired lessening of inflation pressures, it was abandoned as a target in November 1982, with Gerald Bouey, the governor of the Bank of Canada describing the situation by saying, "we didn't abandon monetary aggregates, they abandoned us" (Mishkin, 2000, p. 102). As the Bank of Canada was not able to find an alternative monetary aggregate target, monetary policy in Canada between 1982 and 1991 was carried out with price stability as a long-term goal and inflation containment as the short-term goal, but without an intermediate target or specified path to the longer-term objective.

Thiessen (1998) explained that in February 1991, the Bank of Canada and the Government of Canada jointly announced targets for the control of inflation, which confirmed price stability as the appropriate long-term objective for monetary policy in Canada and specified a target path to low inflation. At the end of 1992, a target rate of 3 percent for the 12-month increase in the Consumer Price Index was announced. It was to be followed by reductions to 2.5 percent from mid-1994 and 2 percent by the end of 1995. These targets had a band of plus or minus one percentage point around them. The announcements specified that after 1995 there would be further reductions of inflation until price stability was achieved. In December 1993, it was agreed that the 1 to 3 percent target range for inflation would be extended through to 1998. In February 1998, the government and the bank announced that the 1 to 3 percent target range would be extended again, this time to the end of 2001.

3.3 Japan: Financial system

In 1947, the Temporary Interest Rate Adjustment Law (TIRAL), which provided the principal framework for interest rate control in Japan, was introduced. It allowed the Bank of Japan to develop detailed guidelines for ceilings on deposit rates and on short-term lending rates, as well as on rates of discounted bills with an

amount greater than ¥1 million and a maturity of less than one year (Kanaya and Woo, 2001). Due to this interest-rate control, there was very little interest-rate variation among different financial institutions in Japan.

In 1959, controls on lending rates were loosened and the Federation of Bankers Association of Japan introduced a system that set short-term lending rates between the official discount rate and the ceiling imposed by TIRAL. This system, however, was abolished in 1974. In 1979, the deregulation of interest rates started, and controls on inflows were eased. In January of the same year, the prohibition regarding non-residents' purchase of bonds with a remaining maturity of less than five years was entirely lifted.

The Japanese authorities implemented major reforms during the 1980s that included the deregulation of cross-border transactions and improvements in access to foreign financial institutions. Starting in July 1980, Japanese corporations were allowed to issue bonds abroad, provided that advance notice was given. Deregulation continued during the 1990s, with lending rates being market-determined. Kozuka (2005) notes that, as a result of the massive structural reforms undertaken in the 1990s, Japan is now characterised by a principle of competition rather than a "convoy system", or a set of regulations, as it once was.

By the end of 1991, interest rates in almost all time deposits held by corporate clients were fully liberalised. Also, the share of deposits with market-determined interest rates amounted to 75 percent of total deposits (Kaminsky and Schmukler, 2003). In July 1991, direct quantitative controls on credit were abolished. In June 1992, the liberalisation of interest rates on time deposits was completed. Controls on interest rates on most fixed-term deposits were eliminated by 1993, and non-time deposit rates were freed in 1994 (Williamson and Mahar, 1998).

Williamson and Mahar (1998) note that, as a result of the extensive financial deregulation, a crisis loomed from 1992 onwards that affected all types of financial institutions. The banks suffered from a sharp decline in stock market and real estate prices. Concerns about the quality of *jusen* lending grew during 1992 and in the spring of 1993 (Kanaya and Woo, 2001). *Jusen*, or housing loan corporations, were

established in the mid-1970s by banks, securities companies and insurance companies to complement the housing loans offered by banks. In the 1980s, the *jusen* companies shifted their lending towards real estate developers, which was a mistake as they had little commercial lending expertise. In 1995, the aggregate losses of the seven *jusen* companies were found to be ¥6,410 billion.

On 9 December 1994, two urban credit co-operatives, Tokyo Kyowa and Anzen, failed. The resolution package included a newly established bank, the Tokyo Kyoudou Bank that was to take over the business of the two failed institutions. The Bank of Japan and private financial institutions injected ¥20 billion each into the new bank, with the Deposit Insurance Corporation also providing the new bank with financial assistance. In 1995, the official estimate of non-performing loans was ¥40 trillion, with the Cosmo Credit Co-operative announcing a failure in July, followed by Kizu Credit Cooperative in August, and the Hyogo Bank in western Japan (Nakaso, 2001). Following this, in September 1995, the internationally active Daiwa Bank announced that it had incurred a loss of approximately $1.1 billion; by 3 November, US regulators ordered the bank to close all operations in US markets. In 1996, rescue costs were estimated at more than $100 billion. In 1998 the government announced the *Obuchi* plan which provided ¥60 trillion in public funds for loan losses, bank recapitalisation and depositor protection.

On November 11, 1996, Prime Minister Ryutaro Hashimoto unveiled a plan called the “Big Bang”, consisting of dozens of proposals to reform Japanese financial institutions and markets by the year 2001 (Craig, 1998). The aim of this plan was to create a “free, fair and global” financial system, that is, it was to operate according to market principles rather than regulatory prescriptions; it was to be fair, in that it would be transparent and reliable; and global, as it would be sophisticated and internationally respected.

Despite the plans, by early 1997 the Nippon Credit Bank was experiencing severe funding problems and opted for a bailout with a capital injection in July of ¥290.6 billion from both the Bank of Japan and private sources. However, in December 1998 the bank failed and was nationalised. In October 1997, there were successive failures in the western part of Japan, starting with Sanyo Securities,

Hakkaido Takushodu bank, Yamachi Securities and Tokuyo City Bank.[22] On 23 October 1998, the Long-Term Credit Bank was nationalised. In 1999, Yatsuda Trust was merged with Fuji Bank, and Mitsui Trust was merged with Chuo Trust. By 2002, non-performing loans were 35 percent of total loans, and a total of seven banks had been nationalised, 61 financial institutions closed and 28 institutions merged (Caprio and Klingebiel, 2003).

3.3.1 Japan: Monetary policy

In order to achieve price stability, the Bank of Japan (BoJ) tried, prior to 1962, to maintain an appropriate level of money stock and interest rates by raising or lowering its lending rates and so directly influencing financial institutions' lending and securities investment. This made the financial institutions overly dependent on the BoJ. In order to address the situation, the BoJ introduced a new scheme for monetary control in 1962 whereby (i) the increase in money demand coming from economic expansion would be met by funds supplied through operations using bonds, and (ii) an upper limit on loans was set for major financial institutions. As the market grew more mature and deposit rates were deregulated in the early 1990s, the BoJ made more explicit its new way of controlling the money supply and interest rate levels by guiding the overnight call rate through the adjustment of the BoJ's account balances.

As of 1991, the BoJ started adopting an expansionary monetary policy. It cut its official discount rate, which had peaked at 6 percent in August 1990, nine times until it reached a record low level of 0.5 percent in September 1995 (Kato, Ui and Watanabe, 1999). Expansionary monetary policy was pursued further by lowering the BoJ's target level of uncollateralised overnight call rate from 0.5 to 0.25 percent in September 1998 and finally to zero percent in February 1999.

In 2001, the BoJ adopted strong monetary easing measures to prevent a continuous price decline and to lay the foundation for a sustainable recovery. Following the attacks on New York and Washington in September 2001, the BoJ took all necessary measures to secure smooth fund settlement and to maintain financial stability (Yamaguchi, 2004). One of the points of the framework of the

[22] For further explanation of the failures, see Nakaso (2001).

BoJ's monetary easing measures is that they will continue to pursue the current monetary policy framework until the rate of increase in the consumer price index rises and stays at or slightly exceeds zero percent.

3.4 United Kingdom: Financial system

The 1950s and 1960s were a period of direct controls in the United Kingdom (UK). However, after the collapse of the fixed exchange rate regime in 1971, things moved more towards deregulation. On 10 September 1971, the Bank of England announced a new regime of more flexible control over banks and finance houses. Six days later, ceilings on lending rates were removed.

The Minimum Lending Rate was introduced to replace the Bank rate on 9 October 1972, and on 17 December the Supplementary Special Deposits Scheme ("the corset") was introduced. This scheme required banks and finance houses to place special deposits with the Bank of England if their growth in interest-bearing liabilities exceeded specified limits. It was discontinued in 1980. In 1979, the special exchange rate regime for capital account transactions was abolished and authorities eliminated all barriers to outward and inward flows of capital (Kaminsky and Schmukler, 2003). On 21 August 1981, the publication of the MLR was discontinued, and the minimum reserve assets ratio was abolished and replaced by a universal 0.5 percent liquidity requirement. In July 1982, hire purchase controls on cars and other consumer goods were abolished, and in December 1986 mortgage lending guidance was withdrawn. The London Stock Exchange was fully deregulated in 1986, and building societies were allowed to expand their lending business after this year (Williamson and Mahar, 1998).

3.4.1 United Kingdom: Monetary policy

On 14 May 1971, the Bank of England published a paper on Competition and Credit Control that set out a new framework of a much more market-related approach to monetary policy. The collapse of the fixed-rate regime that year saw the floating of sterling on 23 August 1971. Oil price rises and wage disputes combined to push inflation to high levels during this period.

In the mid-1970s, in response to mounting inflation concerns, the UK introduced monetary targeting. Informal targeting of a broad aggregate sterling M3 began in late 1973 and formal publication of targets began in 1976. The Bank of England had great difficulty in meeting its M3 targets in the 1976 to 1979 period. Mishkin (2000) explains that not only were announced targets consistently overshot, but the Bank of England frequently revised its targets midstream or abandoned them altogether. In 1978, inflation in UK began to accelerate, reaching nearly 20 percent by 1980. In early 1980, Prime Minister Thatcher introduced a medium-term financial strategy that proposed a gradual deceleration of M3 growth. As the relationship between targeted aggregate and nominal income became very unstable after 1983, the Bank of England began to deemphasise M3 in favour of a narrower aggregate, the monetary base (M0). The target for M3 was temporarily suspended in October 1985 and was dropped altogether in 1987. Following the Louvre Accord in 1987, the exchange rate became an important target. On 8 October 1990, the UK joined the European Exchange Rate Mechanism.

Downward pressure on the exchange rate and upward pressure on interest rates, especially in anticipation of the Maastricht Treaty referendum in France and also the weak US dollar in August 1992, forced the UK to leave the European Exchange Rate Mechanism on 16 September of that year. Three weeks later, on 8 October 1992, the Chancellor, Norman Lamont, set out a new framework for monetary policy which consisted of two features: (i) an explicit inflation target and (ii) a much greater degree of openness and transparency in the conduct of monetary policy (King, 1999). The inflation target was originally set at 1-4 percent with the aim of getting it near the 1 percent end by 1997; however, in July 1997 the Bank of England set an inflation target of 2.5 percent. In December 2003, this was reduced to 2 percent.

3.5 United States: Financial system

The passing of the Federal Home Loan Bank Act in 1932 in the United States (US) established the Federal Home Loan Bank Board, and accordingly in 1934 the Federal Savings and Loan Insurance Corporation (FSLIC) was set up to insure deposits at the Savings and Loan (S&L) institutions. In the 1960s, Regulation Q was

applied to the S&L industry in order to put a ceiling on the interest rate paid by the S&L institutions to depositors.

Interest rate deregulation started in 1980 with the Depository Institutions Deregulation and Monetary Control Act (1980) phasing out restrictions on banks' ability to pay interest on deposits. This act aimed to prevent member banks from leaving the Federal Reserve System and to make banks more competitive with non-bank competitors for savings (Wells, 2004). One of the provisions of the act was that Regulation Q was to be phased out by 1986.

Between 1979 and 1982 interest rates increased sharply, leading to an asset-liability crisis at many S&Ls. In 1982, in response to this crisis, the Garn-St. Germain Act was passed, allowing banks and thrifts to compete with money market mutual funds by offering money market deposit accounts of their own. Regulation Q was phased out. Enactment of the Garn-St. Germain Act and the deregulation of asset powers by several key states – for example, California and Florida – led many S&Ls to change their operating strategies, substantially intensifying the competitive environment of commercial banks and placing downward pressure on bank profitability (Curry and Shibut, 2000).

On 19 October 1987, in the midst of the S&L crisis, the US stock market crashed, resulting in the most dramatic single-day decline in share prices history. The crash created difficulties for certain financial institutions (Illing, 2003). There was an immediate threat to financial stability being the potential for widespread failure of securitised firms and the consequent impairment of loans from the banking system. The US stock market collapse also spilled over to equity markets around the world, for example, to Canada and the United Kingdom. Due to the crash, the New York Federal Reserve engaged in substantial, highly visible and earlier-than-normal open market operations almost immediately and for each date until 30 October (Illing, 2003). As a result, the overnight Federal funds rate fell 114 basis points between 19 and 21 October.

3.5.1 United States: Monetary policy

In the United States, it is well understood that the two episodes most commonly seen as major monetary policy failures since the founding of the Federal Reserve, namely the Great Depression of the 1930s and the Great Inflation of the 1970s, were episodes where policymakers failed to properly monitor and heed the warnings present in the behaviour of money (Orphanides and Porter, 2001). The Federal Reserve has regularly monitored the growth of money since the late 1970s in large part because of these experiences,.

Beginning in 1970, as a result of increasing concerns about inflation, the Federal Open Market Committee (FOMC) selected a weekly tracking path for the M1 money supply and indicated its preferred behaviour for M2. In 1972, it introduced six-month growth targets aimed at gradually reducing inflation. In 1975, in response to a congressional resolution, the Fed began to announce publicly its targets for money growth. Mishkin (2000) explains that in practice, however, the Fed did not consider achieving the money growth targets to be of high priority, placing higher weight on reducing unemployment and smoothing interest rates. This is reflected in the fact that, despite the declining target ranges, M1 growth had an upward trend after 1975. Furthermore, while unemployment declined steadily after 1975, inflation rose sharply.

Until 1979, the framework used by the FOMC to guide open market operations involved setting a monetary objective and encouraging the Federal funds rate to move gradually up or down if money had deviated from the objective. Thus, the Federal funds rate became an indicator of money market conditions. In October 1979, the Fed changed its operating procedures to deemphasise the Federal funds rate as its operating target. While supposedly increasing its commitment to the control of monetary aggregates, it also adopted a non-borrowed reserves operating target. Mishkin (2000) asserts that the change in operating procedures made fluctuations in M1 growth increase, rather than decrease as expected; hence it did not result in improved monetary control.

The Fed missed its M1 growth targets in all three years of the 1979 to 1982 period. It appears that controlling monetary aggregates was never the intent of the 1979 policy shift, but rather was a smokescreen to obscure the need of the Fed to raise interest rates to very high levels to reduce inflation, as inferred by Mishkin (2000). In addition, the relationship between monetary aggregates and nominal GDP, and between monetary aggregates and inflation, had broken down, hence raising concerns that monetary aggregates were no longer useful as a guide to the conduct of monetary policy. Thus, in October 1982, with inflation in check, the Fed began to deemphasise monetary aggregates, and in February 1987, the Fed announced that it would no longer set M1 targets, while also finding that M2 and M3 were unreliable. It also moved away from borrowed reserve targets, which subsequently contributed to the stock market crash in October 1987.

As alternative operating targets ceased to work, the FOMC in effect began gradually to return to targeting the Federal funds rate, which continued well into the 1990s (Meulendyke, 1998). Finally, in July 1993, Alan Greenspan announced that the Fed would no longer use any monetary targets, including M2, as a guide for the conduct of monetary policy, because the historical relationship between money and income and money and price levels had broken down, thus depriving these aggregates of their usefulness as monetary policy guides. In 1995, announcements on the preferred funds rate in press releases were formalised.

3.6 France: Financial system

The first deregulatory episode in France came between 1966 and 1969, when the intervention rate of the Bank of France was made flexible (Melitz, 1990). Financial institutions were highly specialised until the mid-1980s; then, after 1984, universal banks were permitted to operate. Some banks in France have been nationalised since 1945; however, all larger banks were only nationalised in 1982, while several French banks were privatised in 1987 and 1993, including Banque Nationale de Paris (Williamson and Mahar, 1998).

In 1985 (deposit and lending) interest rate ceilings were mostly eliminated. In 1986, interest rates became the chief instrument by which the monetary authorities

sought to achieve their monetary policy aims. For this reason, Icard (1994) explains that the financial markets were reorganised and deregulated. During this year, the ceiling and selectivity of credit policies were abolished. In January 1987, credit controls were completely removed and the compulsory ratio for assets was abolished (Kaminsky and Schmukler, 2003).

Subsidised loans for exports, investments and housing, as well as to local authorities, were slowly phased out – but not eliminated – in the 1980s and 1990s. According to Williamson and Mahar (1998), capital flows in and out of the country were largely liberalised from 1986 to 1988 and liberalisation was completed in 1990.

3.6.1 France: Monetary policy

France has set a monetary aggregate target since 1977, and it has participated in all the mechanisms instituted by the European Monetary System (EMS) since its inception in 1979. Icard (1994) explains that for many years, France combined these monetary targets with regulatory measures to stem the growth of bank lending (quantitative credit controls), and with foreign exchange controls. French monetary policy is based on two targets: the exchange rate and the monetary aggregate. The main policy instrument is short-term interest rates, with reserve requirements a supplementary instrument. Coinciding with the inception of deregulation in 1985, the relationship between monetary aggregates and nominal GDP deteriorated. In 1986, interest rates became the chief instrument through which the monetary authorities sought to achieve their objectives. As a result, the Banque de France redefined its money market intervention techniques and quantitative credit controls were removed.

3.7 Germany: Financial system

Ceilings on interest rates were abolished in Germany in 1967 and there were no credit controls after 1973 (Kaminsky and Schmukler, 2003). In 1973, banks were subject to a high minimum reserve requirement on the level of their foreign liabilities with maturities of less than four years. Banks' foreign currency borrowing that was immediately reinvested abroad was exempted from the minimum reserve requirements. Cash deposit requirements were applied to certain borrowing made by residents from non-residents. The prior approval of the central bank was required for sales to non-residents of all domestic money market paper and other fixed-interest

securities of German issuers with less than four years remaining to maturity. No special exchange rate regime for capital account transactions existed. In February 1974, Bundesbank approval requirements were lifted for all borrowings abroad made by residents. Most capital controls were dismantled in 1974. Stock market regulation was eased in the 1980s and money market funds were permitted in 1994 (Williamson and Mahar, 1998).

In March 1980, Germany lowered the minimum maturity for domestic fixed interest securities eligible for sale to non-residents from four to two years; it was further reduced to one year in November. In March 1981, restrictions on the sale of German money market paper and fixed-interest securities to non-residents were lifted. This implied a *de facto* abolition of the remaining restrictions on capital transactions.

3.7.1 Germany: Monetary policy

The monetary aggregate chosen by Germany was central bank money, a narrower aggregate that was the sum of currency in circulation and bank deposits weighted by the 1974 required reserve ratios. When the Bundesbank first set its monetary targets at the end of 1974, it announced the medium-term inflation goal of 4 percent, which has been labelled as an “unavoidable rate of price increase" (Mishkin, 2000). Its gradualist approach to reducing inflation led to a period of nine years before the medium-term inflation goal was considered to be consistent with price stability. When this occurred at the end of 1984, the medium-term inflation goal was renamed the “normative rate of price increases”. It was set at 2 percent and continued at this level until 1997, when it was changed to 1.5 to 2 percent. In 1988, the Bundesbank switched targets from central bank money to M3.

3.8 Italy: Financial system

In Italy, the maximum interest rates on deposits and minimum interest rates on loans were set by Italian Bankers Association until 1974. In 1975 deposit interest rate ceilings were re-established, only to be eliminated again in 1981 (Kaminsky and Schmukler, 2003). Credit ceilings were eliminated in 1984 and reimposed temporarily between 1986 and 1987. Reserve requirements were progressively lowered between 1989 and 1994, while foreign exchange and capital controls were eliminated by May 1990. Floor prices on government bonds were eliminated in 1992.

Bank branching was liberalised in 1990 and foreign banks were permitted in 1993. Due to this, a number of banks merged between 1990 and 1998 and the number of banks in Italy decreased by 19 percent (Calcagnini, De Bonis and Hester, 1999). Also, due to the "Amato Law" or law 218/90 which allowed the transformation of public banks into joint stock companies, some banks were also privatised, for example, Banca Commerciale Italiana, Credito Italiano, Istituto Bancario San Paolo di Torino, Banca Nazionale del Lavoro and Banca di Roma.

3.8.1 Italy: Monetary policy

Between 1984 and 1998, growth paths for the aggregate M2 were at first announced as point values (between 1984 and 1985). They then moved to ranges up until 1995, when there was a return to announcing the aggregates in point values. Until 1992, the announcement of growth ranges was complemented by the exchange rate commitment represented by the lira's participation in the European Monetary System. In 1992, when the lira abandoned the Exchange Rate Mechanism due to its devaluation, greater emphasis was put on monetary growth, but in 1994 the focus of monetary policy switched to the behaviour of actual and forecast inflation. The following year, the Governor of the Bank of Italy announced upper limits for inflation; thus monetary policy actions were based on deviations of internal inflation forecasts from the desired path (Altissimo, Gaiotti and Locarno, 2001).

3.9 The European Monetary System (EMS) and the euro

The breakdown of the Bretton Woods system of fixed exchange rates in the late 1970s resulted in widespread currency floats and devaluations. The Werner Report, which detailed how Europe could reach monetary union in three stages by 1980, was published in 1970. However, it was not taken seriously due to (1) the creation of new institutions outside the existing framework not being accepted by the members, and (2) the emergence of inflation and unemployment as new challenges for economic policy due to the different policy preferences of the member countries (Gros and Thygesen, 1998). The Werner Report was, then, neglected.[23]

[23] Thanks to an examiner for pointing this out.

Even with the Werner Report not implemented, its fundamental thrust regarding preserving stability in European exchange movements was followed. In March 1971, the European Economic Community (EEC) member states[24] agreed to establish a Community system known as the "snake" for the progressive narrowing of the fluctuation margins of the members' currencies. It was put into operation in April 1972. Under this system, the spot exchange rates of the participating currencies were allowed to fluctuate within ±2.25 percent against the US dollar. On 19 March 1973, the fluctuation margins in relation to the US dollar were suspended and the snake henceforth fluctuated freely.

In March 1979, the European Monetary System (EMS) took effect, based on a currency unit called the European Currency Unit (ECU). The ECU, designed to stabilise the exchange rates of the national currencies and to counter inflation, was a "basket" of fixed quantities of the currencies of the member states. It was meant to serve as the measure or *numéraire* of the Exchange Rate Mechanism (ERM); as a unit of account to denominate operations in the intervention and credit mechanisms; and as a reserve asset and means of settlement among the participating central banks (Scheller, 2004). The EMS was not, however, just an exchange rate mechanism; it also covered the adjustment of monetary and economic policies as tools for achieving exchange rate stability.

In February 1986, the Single European Act was signed. It modified the Treaty of Rome, formalising political cooperation between the member states and including six new areas of competence, including monetary cooperation. The main objective of the act, which came into force on 1 July 1987, was to introduce the Single Market as a further objective of the Community, to make the necessary decision-making changes to complete the Single Market, and to reaffirm the need for the Community's monetary capacity in order to achieve economic and monetary union.

[24] These include the countries that signed the Treaty of Rome. The Treaty of Rome was signed in March 1957 between Belgium, France, West Germany, Italy, Luxembourg and The Netherlands to establish the European Economic Community (EEC) and the European Atomic Energy Community (Euratom).

On 17 April 1989, the Delors Report recommended that economic and monetary union be achieved in three steps. Stage One was to focus on completing the internal market, reducing disparities between member states' economic policies, removing all obstacles to financial integration, and intensifying monetary cooperation. This stage began on 1 July 1990 with the abolition of all restrictions on the movement of capital between the member states. This stage also included preparatory work for Stage Three as soon as the Maastricht Treaty was signed in 1992. On 7 February 1992, the Maastricht Treaty was signed. It elevated the project of European integration to a new and far more ambitious level by setting January 1999 as the date for the replacement of national currencies by a single, shared currency, the euro. On June 3 1992, Denmark refused to ratify the treaty and soon after the pound sterling declined below its floor against the Deutsche Mark, which made the UK withdraw from the ERM on September 17, 1992. Four days later, on September 21, a French poll approved the Maastricht Treaty by the narrowest of margins.

Under the Delors Report, Stage Two would serve as a period of transition to Stage Three, setting up the basic functions and organisational structure of the EMU and strengthening economic convergence. This included the establishment of the European Monetary Institute (EMI) on 12 January 1994 as a precursor for a future European Central Bank. The EMI's functions were to strengthen central bank cooperation and monetary policy coordination, and to make the necessary preparations for establishing the European System of Central Banks (ESCB),[25] for the conduct of the single monetary policy and for the creation of a single currency in Stage Three of the EMU. In 1998, the members of the EMU joined the ESCB, and the individual central banks' main charge has since been limited to implementing the interest rate policy set by the ESCB. While the European Central Bank was indeed established on 1 June 1998, its exchange rate policy remains uncertain.

Stage Three of the transition to economic and monetary union aimed to lock the exchange rate irrevocably, and assign the various Community institutions and bodies their full monetary and economic responsibilities, which began on 1 January

[25] ESCB includes the European Central Bank and the national central banks of the European Union member states.

1999. On January 5, 1999, the euro was launched and appreciated to $1.19 against the dollar on its first trading day. At the end of the year, the euro fell below dollar parity. On January 1, 2002, euro notes and coins were launched.

3.10 The Exchange Rate Mechanism (ERM) Crisis

The establishment of the EMS[26] was not without its problems. In late 1991, Finland – an ECU "pegger" – devalued its currency the markka by 12 per cent as a result of the credit boom following financial liberalisation in the mid-1980s and rising German and European interest rates. On 26 August 1992, the pound sterling fell to its ERM floor despite intervention by the Bank of England. Two days later, the Italian lira joined the fate of the pound. Germany refused to reduce interest rates, while France, Britain and Spain avoided all discussion of a general realignment of the ERM currencies.

On 8 September, Finland abandoned its peg and the markka depreciated by 15 percent. Following this, Italy devalued the lira by 7 percent on 13 September and the Bundesbank lowered its Lombard rate by 25 basis points. On 16 September 1992, following massive speculation against sterling and its suspension from the Exchange Rate Mechanism, the Chancellor of the Exchequer, Norman Lamont, opened his statement with the words, "Today has been an extremely difficult and turbulent day" King (1999, p. 1). The pound and the lira both withdrew from the ERM.

The consequences of these actions were devastating. The Banque de France was forced to raise interest rates, despite the French having ratified the Maastricht Treaty; and it spent $32 billion on the franc's defence. Sweden abandoned its ECU peg on November 19 and Denmark, Spain and Portugal were forced to raise interest rates. Following this, Norway abandoned its ECU peg on December 10 and Ireland devalued by 10 percent within the ERM on January 30. The Danish krone and the Belgian franc came under attack in early 1993. The Spanish Iberia was forced to devalue another 8 percent on 13 May 1993; this had a spillover effect on Portugal, which devalued another 6 percent. By July 1993, the Banque de France lacked the reserves to continue to intervene in its currency, and for the Bundesbank to intervene any further would have threatened its anti-inflationary objectives. Europe's central

bank governors and finance ministers responded and finally widened the ERM's bands to 15 percent. With most of the EU members reiterating their commitment to move ahead with monetary unification (but with the UK remaining outside), the markets settled down and the crisis receded.

3.11 Chapter Summary

This chapter has provided an overview of the history of the financial system and monetary policy in the G-7 countries, with a discussion of the ERM crisis of 1992 and a detailed overview of the foundations of the euro. This discussion will be very useful in specifying controls for regime and regulatory changes in our test models. Table 3.1 provides a summary of the different financial systems and monetary policies of the G-7 countries discussed in the sections above.

Table 3.1 Summary of financial system and monetary policy of the G-7 countries

Country	Financial System		Monetary Policy			
	Financial deregulation start	Financial Crisis	Monetary targeting	Inflation targeting	Interest rate targeting	Other
Canada	1967		1975-1982	1991-present		1982-1991: transition
France	1985	1991-1993: ERM crisis	1977-1986		1986-1998	1998: euro
Germany	1967	1991-1993: ERM crisis	1974-1984	1984-1998		1998: euro
Italy	1981	1991-1993: ERM crisis	1984-1994	1997-1998		1998: euro
Japan	1979	1992-2002: *Jusen*, credit cooperatives and bank crisis	1962	1991-present: target CPI change at or above zero percent		
UK	1971	1991-1993: ERM crisis	1973-1987	1992-present		1987-1992: transition 1992: UK left EMS
US	1980	1979-1989: S&L crisis 1987: stock market crash	1970-1982		1987-present	

Note: ERM is Exchange Rate Mechanism, S&L is Savings and Loan, and EMS is European Monetary System.

[26] Details of the EMS crisis were sourced from Eichengreen (2000).

Chapter 4: Data Variables, Model and Methodology

4.1 Introduction

In view of the discussions in Chapter 2, this chapter aims to establish testable hypotheses, to develop a model for this purpose, and to discuss the data sources. The chapter presents the research questions and hypotheses in sections 4.2 and 4.3 respectively. This is followed by the empirical model designed for use in this thesis as discussed in Section 4.4, while the details of the econometric methodology to test the hypotheses are provided in Section 4.5. Data to be used in this thesis are detailed in Section 4.6. Section 4.7 discusses the Chow breakpoint analyses and Section 4.8 summarises the chapter.

4.2 Research questions

As stated in Section 1.2, this thesis aims to answer the following questions:

1. Is the money supply endogenous or exogenous in each of the G-7 countries?
2. If the money supply is endogenous, which of the three views (accommodationist, structuralist or liquidity preference) does it support?

2a. Is the support for the views in (2) above different in the short term than in the long term?

3. Following the PK theory, whereby loans cause deposits and this in turn causes the money supply, is the PK theory valid for the sample of G-7 countries under study in this thesis?
4. Is there causality between the money supply and aggregate bank stock returns?
5. Does a simultaneous relationship exist between bank loans, the money supply and aggregate bank stock returns such that loans create deposits (in the form of money supply) whilst at the same time loans and deposits affect the value of bank stocks?

The hypotheses in the following section are based on the above research questions and previous literature. The last two concern bank stock returns.

4.3 Hypotheses

4.3.1 Money endogeneity or exogeneity

The literature review in Chapter 2 relates to the post-Keynesian (PK) theory on endogenous money, which is extensive. Despite the controversy on the slope of the money supply (horizontal or positively sloped) under the PK theory, the empirical research findings show that loans create money supply, thus making it endogenous. Past empirical research used broad money supply instead of deposits, as deposits may be held in different forms similar to those that constitute the broad money supply.

The post-Keynesians assert that money supply (*MS*) is endogenous through the behaviour of commercial banks and the public dealing with the banks. The central bank only influences the level of interest rates. Based on this set interest-rate level, commercial banks adjust their loan portfolios, in which process money is created. These adjustments will affect deposits and in turn the money supply.

Alternatively, mainstream Keynesians have maintained that the money supply is controlled by the central bank and that changes in the money supply will change interest rates. This makes money supply exogenous, as it is controlled by the central bank. Any changes in money supply through the monetary base (*MB*) will affect deposits. Any changes in deposits will have an impact on the bank's ability to extend bank loans (*BL*). Thus, it is hypothesised:

H1.1*: MS* causes *BL* only (suggesting money is exogenous)

H1.2: *BL* cause *MS* or there is bidirectional causality between *MS* and *BL* (implying money is endogenous)

4.3.2 Monetarist[27] and three money endogeneity views

4.3.2.1 Monetarist

Proponents of Keynes (the money view) assume the central bank directly influences the quantity of money by adjusting the money supply. The central bank may, for example, decrease money supply and so increase real interest rates (without regard to what actually happens inside the bank), therefore raising a firm's cost of capital. With a higher cost of capital, there are fewer profitable projects. The result is a decrease in investment, leading to a decline in aggregate output or income (*Y*). If the bank takes the opposite course and increases the money supply, economic activity increases.

Similarly, the credit view maintains that banks themselves are important. Hence, a contractionary monetary policy decreases money supply through reserves. This will reduce bank deposits and the banks' ability to extend credit. The lower credit availability will reduce gross investment in the economy and in turn cause a decline in output. In both cases, it is hypothesised that:

H2.1: *MB* causes *BL*
H2.2: *MS* causes *BL*
H2.3: *MS* causes *Y*.

4.3.2.2 Accommodationist

Under the accommodationist view, the central bank determines the level of interest rates and banks fully accommodate any demand for credit at any level of interest rates. If demand for reserves is fully accommodated by the central bank, and the loan supply schedule of commercial banks is horizontal, the accommodationist view predicts unidirectional causality from total bank loans to the monetary base and the money supply. Accommodationists assert that changes in the expected income lead to changes in bank loan demand. This results in changes in deposits and hence money supply. However, changes in the volume of loans, and in turn of the money

[27] In this thesis, monetarists are synonymous with Keynesians as both view the money supply as exogenous and perfectly inelastic with respect to the central bank influencing the quantity of money.

supply, imply changes in economic growth, thus influencing income in the next period.

H3.1: *BL* cause *MB*
H3.2: *BL* cause *MS*
H3.3: There is bidirectional causality between *MS* and *Y*.

4.3.2.3 Structuralist

Structuralists, on the other hand, insist that full accommodation as suggested by accommodationists is not necessary, as they believe that central banks only partially accommodate the demand for reserves, which will increase interest rates due to market pressures. This is also due to the banks always using a combination of price and quantity rationales in their loan-making decisions.

The structuralist hypothesis can be described as a mixed model that incorporates some of the ideas of the monetarist approach and some of the accommodationist view. The accommodationist part of the model depicts causality from total bank loans to the monetary base, and the monetarist part of the model depicts causality from the base and the broad money multiplier (*MM*) to total bank loans. If the monetary base does not proportionately support an increase in the demand for bank loans, that is, if it is less than one and total bank loans is exogenous, then structuralists identify liability management practices as an alternative to supplement the shortage in reserves. Increased lending causes liability transformations so that bank loans cause an increase in the money multiplier. Given that the main components of the money multiplier consist of the currency/deposit ratio (*cd*) and reserve/deposit ratio (*rd*), the Palley (1994) test implies that liability management frees up reserves, which subsequently alters *cd* and *rd*. The structuralists share accommodationist views on the relation between income and broad money supply.

H4.1: There is bidirectional causality between *BL* and *MB*
H4.2: There is bidirectional causality between *BL* and *MM*
H4.3: There is bidirectional causality between *MS* and *Y*.

4.3.2.4 Liquidity preference

The empirical hypothesis of the liquidity preference view predicts causality from total bank loans to the broad money supply when the money supply is endogenously determined. If the demand for money and the demand for loans were independent, the supply of deposits created by the net flow of new bank lending would not need to be willingly held by new deposit owners, who have independent liquidity preferences about the amount of money they wish to hold. If this were the case, the independent demand for money would place a constraint on the ability of loans to create deposits. Causality can also be expected from the money supply to bank credit.

H5: There is bidirectional causality between bank loans and money supply.

Table 4.1 provides a summary of hypotheses 2 to 5. Hypothesis 1 is not summarised in this table because the hypothesis is focused on examining whether money supply is exogenous or endogenous only and not which approach of monetary theory it falls under.

Table 4.1 Summary of causality implications of different approaches towards monetary theory

Monetarist	**Accommodationist**	**Structuralist**	**Liquidity Preference**
$MB \Rightarrow BL$	$BL \Rightarrow MB$	$BL \Leftrightarrow MB$	$BL \Leftrightarrow MS$
$MS \Rightarrow BL$	$BL \Rightarrow MS$	$BL \Leftrightarrow MM$	
$MS \Rightarrow Y$	$Y \Leftrightarrow MS$	$Y \Leftrightarrow MS$	

Note: *BL* denotes bank loans, *MB* is monetary base, *MM* is money multiplier, *MS* is money supply and *Y* is income. $\Rightarrow$ and $\Leftrightarrow$ denote unidirectional and bidirectional causality respectively.

4.3.3 Bank loans, deposits and money supply

Post-Keynesians assert that bank loans cause deposits (*DEP*) and in turn deposits cause money supply: these are financial variables in the model. However, previous literature on money endogeneity focuses on investigating the causality between bank loans and money supply, even though loans may cause deposits, and deposits may be held not only in the transactional form, but also in any form that

constitutes broad money supply.[28] It is possible that deposits may be an important variable in the transmission from bank loans to money supply, as bank loans acquired are immediately transferred into demand deposits and into other types of deposits, as Howells and Hussein (1998) have inferred.

Thus it is hypothesised under the post-Keynesian theory of endogenous money that causality exists such that:

H6.1: *BL* cause *DEP* and *DEP* cause *MS*.

However, it could also be that the monetarist view of exogenous money holds where:

H6.2: *MS* causes *DEP* and *DEP* cause *BL*.

4.3.4 Money supply and bank stock prices

Money supply can be linked to bank stock prices through two ways: portfolio substitution or liquidity effects. A rise in money supply could enhance stock prices via the liquidity effect. Expansionary monetary policy means consumers will have more money to invest in bond and stock markets. With the increase in demand for stocks, stock prices will increase: the converse occurs otherwise. The increase in money supply also reduces interest rates, meaning that borrowings from the banks are cheaper. This will also raise stock prices as consumers can use these borrowings to buy more stocks or bonds.

However, under the PK theory the relationship is more complex in the case of bank stocks and endogenous money supply, with the central bank only exercising control over short-term interest rates. The central bank may decide to exercise an expansionary monetary policy by reducing interest rates to stimulate the economy. This action increases loan demand, which will increase money supply via the banks. If the bank is seen as a business entity and the loan is the product being sold, then increases in loans would lead to a rise in profits and ultimately in stock prices

[28] Moore (1989) ran causality tests for a variety of monetary aggregates and found strong causality between bank loans and broad monetary aggregates.

according to a cash-flow effect on earnings then on dividends, as in the dividend valuation theory. An opposite effect occurs otherwise.

In the case of the portfolio-balance model (and as suggested by the quantity theory of money), an increased money supply may re-balance other assets, including securities in the portfolio. An increase in the money supply may raise the discount rate through inflationary expectations. Under the post-Keynesian theory, changes in interest rates mean that deposit rates are also affected. Thus, an increase in interest rates will see a move in portfolios more towards deposit accounts, thus reducing stock prices, as investors can earn more with deposit accounts relative to stocks or bonds. The empirical test will determine which of the processes dominate.

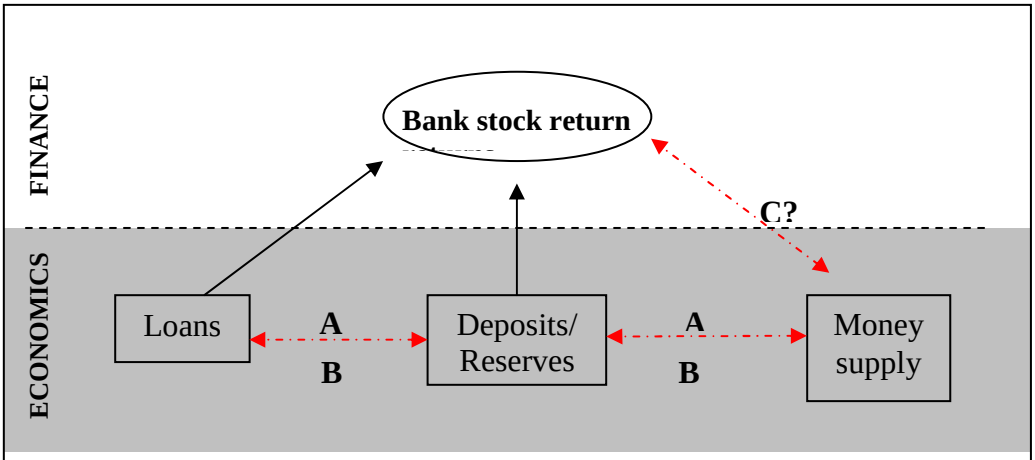
Although Hashemzadeh and Taylor's (1988) study focused on general stock prices and not on bank stock prices, they found that increases in stock prices may also have a feedback effect and cause money supply. Thus, our hypothesis using bank stock returns (*RET*) is:

H7: *MS* causes *RET* or/and *RET* cause *MS*.

4.3.5 Simultaneous effects

Once all the causality links are established, the empirical model discussed in the next section will be tested. Figure 2.1 from Chapter 2 is reproduced here as the central issues of this thesis are brought together.

Extracted from Chapter 2, Figure 2.1, p. 10



A: *Monetarist / Keynesian theory of exogenous money*
B: *Post-Keynesian theory of endogenous money*
C: *Flow-through effect of money supply to bank stocks*

The debate among economists is that money may be exogenous, as maintained by mainstream Keynesians or monetarists, or it could be endogenous, as argued by post-Keynesians. Loans and deposits as earning products of a bank will have an effect on bank stock returns through the bank's profit margins (via interest and non-interest incomes or even fee incomes), in accordance with the equity valuation theory. Besides this behaviour, the literature suggests a flow-through effect of money supply affecting stock returns (general and not bank stock returns), thus:

H8 : There is a simultaneous relationship (or effect) between *RET* and *MS* and *MS* and *BL*.

4.4 Empirical model

The discussion in Chapter 2 provides the basis for an empirical model. In order to analyse the relationship between bank stock returns, money supply and bank loans, a robust and stable simultaneous equation model is required, which is what we developed.[29] Firstly, bank loans may be related to money supply through the post-Keynesian theory of endogenous money. Banks adjust their loan portfolios depending on the demand for bank loans. The changes in loans by the banks will affect deposits and in turn money supply.

It is expected that a rise in money supply may enhance stock prices. The idea behind this is that if inflation is within the central bank's target, then the central bank may exercise a reduction in interest rates to stimulate the economy via an expansionary policy. This reduction in interest rate in turn increases demand for loans, which subsequently raises the money supply. If the bank is seen as a business entity and its loans are the product being sold, then increases in loans would lead to a

[29] The basis of the model in this section stems from Foster (1992). However, as the model developed in this section is different from Foster's (1992) model, his model is not summarised here. The model in this thesis differs from Foster's (1992) model in two ways. Firstly, Foster uses his variables in a linear regression in an attempt to determine money supply in the UK, whereas we allow a simultaneous relationship between the variables. Secondly, not all the variables used by Foster (1992) were used in this thesis.

rise in profits for the bank and ultimately in its stock prices, according to cash-flow effect as in the dividend valuation theory.

With the bidirectional causality hypothesised, then an increase in bank stock returns would indicate that the economy is in strong growth. This means that any increases in inflation or expected inflation may increase interest rates. The reduced interest rates may lead to more affordable investments funded through loans, which in turn increases money supply. Hence, a positive relationship is expected between stock returns and money supply. A contractionary policy will lead to the opposite result with the money supply being curtailed, interest rates going up, and bank returns being adversely affected by decline in loan growth.

An increase in bank loans is expected to raise money supply through deposits, as hypothesised by the post-Keynesians. Additionally, an increase in money supply may also increase bank loans. This is hypothesised according to the structuralist view that there is bidirectional causality between money supply and bank loans.

There may also be other factors that may have an influence on the endogenous variables: bank stock price, money supply and bank loans. According to the dividend valuation theory discussed in Chapter 2, there is a positive relationship between the bank's earnings and stock prices. As earnings are an item on the individual bank's income statement and this thesis is focused on aggregate banks, the bank earnings spread (*ES*) will be used as a proxy for earnings. Bank earnings spread is calculated as:

$$ES = \left[Rl \times L - Rd \times DEP\right] \tag{4.1}$$

where *Rl* and *Rd* are loan rates and deposit rates respectively and *L* and *DEP* are bank loans and bank deposits respectively.

Inflation and money supply are expected to have a positive relationship because an increase in inflation means that real interest rates are reduced through the Fisher Effect:

$$i_r = i - \pi^e \tag{4.2}$$

where i_r, i and π^e are real interest rates, nominal interest rates and expected inflation respectively. A variable on inflation (*INF*) is included in the model for this reason. A reduction in interest rates will likely lead to a rise in loans needed to fund investments. The increase in loans, according to the post-Keynesians, would in turn increase money supply.

Another variable included in the model is the domestic-to-foreign interest rate differential (*RbRf*), which is needed to take account of Fisher's International Effect Hypothesis. Foster (1992) found a positive relationship between money supply and the domestic-to-foreign interest rate differential. He argued that a rise in the domestic interest rate would increase domestic deposits. This will increase money supply not only because deposits are more attractive, but also because banks may make matching switches from foreign currency denominated to domestic currency denominated marketable financial assets. This variable is included as a proxy for an open economy, since the member economies of the G-7 group are all open economies.

It is expected that there is a positive relationship between income and bank loans because when income increases, individuals will have more money to pay for their loans or other liabilities. There is evidence that this is the case in most countries in markets with a low level of competitive banking (Ariff and Lamba, 2007).[30] Income is used as an assessment by the banks for loan approvals. Thus, income is also added into the model.

Loan and deposit rates are important for bank earnings. Thus, the net interest margin is calculated as:

$$RlRd = Rl - Rd \qquad (4.3)$$

where *Rl* is bank loan rates and *Rd* is bank deposit rates, and it is included in the model. It is expected that *RlRd* will have a negative relationship with bank loans as increases in loan rates higher than deposit rates increase the net interest margin. With

[30] Also, this impact of interest rate behaviour is different in the US with a competitive banking market as shown by Stiglitz and Weiss (1981).

higher loan rates, loans would be less affordable; thus the amount of loans would decrease.

By including all the variables discussed above, the simultaneous equation model becomes:[31]

$$P_{it} = f\left[\underset{+}{ES}, \underset{+}{MS}\right] \tag{4.4}$$

$$MS_{it} = f\left[\underset{+}{BL}, \underset{+}{INF}, \underset{+}{RbRf}, \underset{+}{P}\right] \tag{4.5}$$

$$BL_{it} = f\left[\underset{+}{MS}, \underset{+}{Y}, \underset{-}{RlRd}\right] \tag{4.6}$$

where P_{it} is the bank stock price in country *i* at time *t*, *BL* is bank loans, *MS* is money supply, *INF* is inflation, *Y* is income, *ES* is bank earnings spread $= \left[Rl \times L - Rd \times DEP\right]$, *RbRf* is domestic-to-foreign interest rate differential $= Rb - Rf$, and *RlRd* is net interest margin $= Rl - Rd$.[32] All variables are in logarithmic form except *RbRf* and *RlRd*.

Using the simultaneous equation model above, the following testable equations will be used to test hypotheses 1 to 8:

$$P_{it} = f\left[\underset{+}{MS}\right] \tag{4.4a}$$

$$MS_{it} = f\left[\underset{+}{BL}, \underset{+}{P}\right] \tag{4.5a}$$

$$BL_{it} = f\left[\underset{+}{MS}\right] \tag{4.6a}$$

where P_{it} is the aggregate bank stock price in country *i* at time *t*, *BL* is bank loans and *MS* is money supply. All variables are in logarithmic form. The use of the testable equations will be further elaborated below.

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[31] It would be interesting to include *EPS* and *ROE* in the model to reflect the dividend valuation theory and control for bank-specific factors, but data are available only on an annual individual bank basis. This would not have been consistent with the macroeconomic quarterly data used in this thesis. Thus, we did not use these variables.

[32] As this thesis investigates the contemporaneous relationship between the macroeconomic variables, the model will not differentiate between expected and unexpected changes in the macroeconomic variables.

From the above section, it is hypothesised under Hypothesis 1.2 that there may be unidirectional or bidirectional causality from bank loans to money supply. Using vector error-correction models (VECM) and Granger causality tests discussed in the next section, equations (4.5a)[33] and (4.6a) will be employed to determine this hypothesis. These equations will also be used to test Hypothesis 5 on whether there is bidirectional causality between bank loans and money supply, suggesting the existence of the liquidity preference view. Under hypotheses 1.1 and 2.2, money supply is expected to cause bank loans only, thus implying that money is exogenous under the monetarist view. By employing a VECM and Granger causality tests, equation (4.6a) will be useful to determine whether these hypotheses are true. On the other hand, equation (4.5a) will determine whether Hypothesis 3.2 is true in that bank loans cause money supply, thus supporting the structuralists' view of the PK theory of endogenous money.

The robustness of findings on hypotheses 1.1 and 1.2 is then tested under hypotheses 6.1 and 6.2. In order to test their validity, the Toda and Yamamoto (1995) trivariate VAR methodology as discussed in Section 4.5.4 below will be used. Equations (4.5a) and (4.6a), with the inclusion of deposits as a variable, will also be used. Hypothesis 7, which suggests that there is either unidirectional or bidirectional causality between bank stock returns and money supply, will be tested using a VECM and Granger causality test using equations (4.4a) and (4.5a).

Hypothesis 8, which suggests that there is a simultaneous relationship (or effect) between bank stock returns and money supply, and between money supply and bank loans, will be tested by using equations (4.4) to (4.6). The empirical model (equations 4.4 to 4.6) will be tested using panel data, as this approach allows for the individual heterogeneity of the countries to be controlled and gives more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency (Hsiao, 1985). Other benefits of using panel data include allowing the construction and testing of more complicated behavioural models than purely time-series; a greater ability to identify and measure effects that are simply not detectable in pure time-series data; and a greater ability to study the dynamics of

[33] It should be noted that only bank loans and money supply (excluding price) are used under these hypotheses and that the variable price (without money supply) is used to test Hypothesis 7 only.

adjustment (Klevmarken, 1989). The next section discusses the empirical methodology used to test the hypotheses that have been posed in this chapter.

4.5 Methodology

This section explains a number of econometric methodologies that will be used to test the eight hypotheses discussed in Section 4.3. The discussions start with the unit root tests followed by the Johansen cointegration and the vector error-correction models. Trivariate causality tests are detailed next. This is followed by the panel unit root, panel cointegration tests and the panel Generalised Method of Moments (GMM) used to test Hypothesis 8.

4.5.1 Unit root tests

Unit root tests are performed on the variables so as to prepare the data set for cointegration and causality tests. For cointegration analysis to be valid, the unit root test investigates whether the order of integration of the variables of interest is similar – specifically, whether the order of integration is shown to be greater than zero. Thus, we first validate the stationarity properties of the variables, prior to conducting the cointegration tests.

An economic time-series that follows a random walk process is called "non-stationary" over time. It may be made stationary by differencing *d* times. The variable, once established as stationary, is then referred to as integrated of order *d* or *I(d).* In order to test for unit roots, the Augmented Dickey-Fuller (ADF) (Dickey and Fuller 1979, 1981) test is performed. The ADF test can control for higher-order serial correlation when higher-order lags are used, such that:

$$\Delta X_t = a_0 + a_1 X_{t-1} + a_2 t + \sum_{i=2}^{p} b_i \Delta X_{t-i+1} + u_t \qquad (4.7)$$

where p is the number of lagged changes in X_t necessary to make u_t serially uncorrelated. Testing the null against the alternative hypothesis $H_a : a_1 < 0$, the null hypothesis of the unit root is rejected if the observed *t*-statistic is sufficiently negative compared to the MacKinnon (1996) lower tail critical values at the accepted level of significance. Equation (4.7) is a test on whether the series can be characterised as an *I(1)* process with a constant (drift) and time trend. Two other tests

can be conducted. One of those tests, equation (4.8), allows for the series to be characterised as an *I(1)* process with a drift, while equation (4.9) tests for the series to be an *I(1)* process without a drift or time trend:

$$\Delta X_t = a_0 + a_1 X_{t-1} + \sum_{i=2}^{p} b_i \Delta X_{t-i+1} + u_t \qquad (4.8)$$

$$\Delta X_t = a_1 X_{t-1} + \sum_{i=2}^{p} b_i \Delta X_{t-i+1} + u_t \qquad (4.9)$$

Thus, in all three cases, the hypotheses tested are: H_0: the series contain a unit root, against H_1: the series is stationary. The test statistic (equation 4.4) is then tested against the critical values at the accepted level of significance:

$$Test\ statistic = \frac{\hat{a}_1}{S\hat{E}(\hat{a}_1)} \qquad (4.10)$$

The Phillips and Perron (1988) test is a generalisation of the ADF test procedure that allows for weak assumptions regarding the distribution of errors. This thesis employs the Phillips-Perron test to test for the existence of unit roots in the variables. The advantage of the Phillips-Perron test is that it allows for the effect of serial correlation and heteroskedasticity. There is evidence that the Phillips-Perron test has more power than the augmented Dickey-Fuller test (Davidson and MacKinnon, 1993). If the variables are found to be *I(1)* stationary, the next step is to test whether they are cointegrated using the Johansen cointegration test, as discussed in the next section.

4.5.2 Johansen cointegration tests

It is known that the cointegration results based on Johansen's (1988) procedure are sensitive to the choice of lag length in VAR (Cheung and Lai, 1993). Thus, the optimum lag lengths of the VAR are determined by minimising the Schwarz (1978) Bayesian Information Criteria (SBC). This criterion is designed to select the model with the maximum information available. This is to be determined first before the Johansen (1988) cointegration tests are performed and the results presented later.

The general concept of cointegration between variables suggests that there exists an equilibrium or a long-run relationship between a set of time-series variables,

provided that the series is integrated of the same order. This will be confirmed using the Phillips-Perron test.

The Johansen (1988) multivariate cointegration test is essentially a likelihood ratio test based on a vector autoregressive (VAR) model that allows for possible dynamic interactions among variables. The Johansen (1988) cointegration test is a more robust test than the Engle and Granger (1987) cointegration test. According to Dickey, Jansen and Thornton (1991), the Engle and Granger (1987) test is sensitive to the choice of dependent variables, and thus may not be robust.

The general VAR model is specified as follows:

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \mathrm{K} + \Gamma_{k-1} \Delta X_{t-k-1} + \Gamma_k \Delta X_{t-k} + \mu + \varepsilon_t \qquad (4.11)$$

where:

X_t = An *n* x 1 vector of the variables;

Γ = An *n* x *n* coefficient matrix;

μ = An *n* x 1 constant vector; and

ε_t = An *n* x 1 vector of white noise with a mean of zero and a finite variance.

The rank of the coefficient matrix Γ represents the number of cointegrating vectors. The likelihood ratio test for the null hypothesis that there are at most *r* cointegration vectors is called the Trace Test statistic:

$$Trace\ Test = -T \sum_{i=r+1}^{p} \ln\left(1 - \hat{\lambda}_i\right), \qquad (4.12)$$

where *T* is the sample size and $\hat{\lambda}_{r+1}, \mathrm{K}, \hat{\lambda}_p$ are the *p*-*r* smallest squared canonical correlations. The MacKinnon, Haug and Michelis (1999) critical values are used to determine whether the null hypothesis that there are at most *r* cointegration vectors is rejected or not. The critical values differ depending on whether a linear trend is included or not and are summarised in Table 4.2.

Another restricted maximum likelihood ratio test is referred to as the Maximal Eigenvalue Test statistic:

$$Maximal\ Eigenvalue\ Test = T\sum_{i=1}^{r} \ln\left\{\left(1-\hat{\lambda}_i^*\right)/\left(1-\hat{\lambda}_i\right)\right\}, \qquad (4.13)$$

where $\lambda_1^*, \mathrm{K}\ , \lambda_r^*$ are the *r* largest squared canonical correlations. Similar to the Trace Test, the Maximal Eigenvalue Test statistics will be compared against the MacKinnon, Haug and Michelis (1999) critical values given in Table 4.2.

Table 4.2 MacKinnon, Haug and Michelis (1999) critical values

	1 percent	**5 percent**	**10 percent**
Trace Test			
Linear trend	31.15	25.78	23.34
Constant only and no trends	25.07	20.26	17.98
Maximal Eigenvalue Test			
Linear trend	23.97	19.38	17.23
Constant only and no trends	20.16	15.89	13.90

There are instances when there is a discrepancy between the results of the Trace Test and the Maximal Eigenvalue Test, where one test will indicate the presence of cointegration and the other will not. In such cases, Johansen and Juselius (1990) suggest that the Trace Test may lack power relative to the Maximal Eigenvalue Test, and thus any discrepancies will be resolved through acceptance of the Maximal Eigenvalue Test. This procedure will be followed in our analysis. The results of the tests are detailed in the next chapter.

4.5.3 Causality tests: VECM and Granger causality

If cointegration can be identified between dependent and independent variables as presented in the results discussed in the last section, then it can be understood that there is at least a single aspect of causality (Granger, 1969). Causality refers to the ability of one variable to predict (and thus cause) the other. The Granger (1969) causality test for two variables x_t and y_t involves the following Vector AutoRegressive (VAR) model to be estimated:

$$y_t = a_1 + \sum_{i=1}^{n} \beta_i x_{t-i} + \sum_{j=1}^{m} \gamma_j y_{t-j} + e_{1t} \qquad (4.14)$$

$$x_t = a_2 + \sum_{i=1}^{n} \theta_i x_{t-i} + \sum_{j=1}^{m} \delta_j y_{t-j} + e_{2t} \qquad (4.15)$$

where it is assumed that both ε_{yt} and ε_{xt} are uncorrelated white-noise error terms. Thus, x_t does not Granger cause y_t if $\beta_1 = \beta_2 = ... = \beta_i = 0$, where the latter hypothesis is tested using the *F* test.

If no cointegration is found between variables, then the standard causality test (Granger, 1969) can be applied. If there is cointegration, then causality can be examined using the vector error-correction model (VECM) (Granger, 1988) as below:

$$\Delta y_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta y_{t-1} + \sum_{i=1}^{n} \alpha_{2i} \Delta x_{t-1} + \sum_{i=1}^{n} \alpha_3 \Delta EC_{t-n} + \varepsilon_i \qquad (4.16)$$

The short-term causality of the VECM can be tested using the *Wald* test (χ^2 test), and the long-term causality is tested by examining whether the error-correction coefficient α_3 in the model is significantly different from zero.

The same test will be used to test for causality in the panel data equations. If the Pedroni (1997) panel cointegration tests (discussed in Section 4.5.6 below) confirm that the variables in equations (4.4) to (4.6) are cointegrated, a modified version of equation (4.16) to account for the panel data will be used:

$$\Delta y_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta y_{t-1} + \sum_{i=1}^{n} \alpha_{2i} \Delta x_{t-1} + \sum_{i=1}^{n} \alpha_{3i} \Delta z_{t-1} + \sum_{i=1}^{n} \alpha_4 \Delta EC_{t-n} + \varepsilon_i \qquad (4.16a)$$

where Δy_{t-1} and Δx_{t-1} are the endogenous variables from each equation while Δz_{t-1} are the exogenous (predetermined) variables in the equations.

The three tests – namely, the unit root test, Johansen cointegration and the causality test discussed in this section and the former two sections – will be used to determine the validity of hypotheses 1 to 5 and 7.

4.5.4 Trivariate VAR

Post-Keynesians assert that bank loans cause deposits and in turn deposits cause money supply. However, most empirical tests on money endogeneity focus on investigating the causality between bank loans and money supply as, even though

loans may cause deposits, deposits may be held in any form that constitutes broad money supply, not only in the transactional form.[34]

In order to test the robustness of the results of money endogeneity, a trivariate causality test that includes bank loans, deposits and money supply is conducted. These trivariate vector autoregressive models also allow for the investigation of the possibility that earlier inferences were incorrect because of the omission of a third relevant variable, in this case, deposits.

In the presence of *I*(*1*) variables, the *Wald* test statistic is likely to have non-standard asymptotic distribution. Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996) suggest an approach to causality testing which allows the researcher to use standard asymptotic theory and thus obtain valid statistical inferences. They point out that *Wald* tests that do not restrict the coefficients of all lagged terms under the null hypothesis still have their usual χ^2 distribution. For example, consider the augmented VAR model:

$$y_t = \sum_{i=1}^{k} \prod_i y_{t-i} + \sum_{i=1}^{d} \prod_{k+i} Y_{t-k-i} + \varepsilon_t \qquad (4.17)$$

where y_t is at most integrated of order *d*, that is, it is *I*(*d*). *Wald* test statistics based on testing restrictions involving the coefficients contained in $\prod_1, \mathrm{K}, \prod_k$ have asymptotic χ^2 null distributions. This is explained further in Theorem 1 in Toda and Yamamoto (1995).

The basic idea is to augment artificially the correct order, *k*, of the VAR by the maximal order of integration (d_{max}) that characterises the series being used. Thus, a level VAR model augmented by an extra redundant lag is estimated and a *Wald* test is performed on the first *k* non-redundant lags.

The advantages of the Toda and Yamamoto (1995) approach are that it does not require any pre-testing for the cointegration properties of the system and that it is easy to implement. However, the extra redundant lagged terms result in a loss of

[34] Moore (1989) ran causality tests for a variety of monetary aggregates and found strong causality between bank loans and broad monetary aggregates.

efficiency and power, although the power loss is relatively small in trivariate or higher-order systems, for moderate to large sample sizes and for systems in which the true lag order is large. Giles and Mirza (1999) and Clarke and Mirza (2006) suggest that this loss is frequently minimal and the approach often results in more accurate Granger non-causality outcomes than the VECM method, which conditions on the outcome of preliminary cointegration tests.

In order to test whether the existence of a third variable, deposits, causes an invalid inference in the previous result, the following system of VAR (k, d_{max}) will be used:

$$\begin{bmatrix} g_{BL,t} \\ g_{DEP.t} \\ g_{MS,t} \end{bmatrix} = \beta_0 + \sum_{i=1}^{k} \left(\beta_i \begin{bmatrix} g_{BL,t-i} \\ g_{DEP.t-i} \\ g_{MS,t-i} \end{bmatrix} \right) + \sum_{j=k+1}^{d_{\max}} \left(\beta_j \begin{bmatrix} g_{BL,t-i} \\ g_{DEP.t-i} \\ g_{MS,t-i} \end{bmatrix} \right) + \begin{bmatrix} \varepsilon_{BL,t} \\ \varepsilon_{DEP.t} \\ \varepsilon_{MS,t} \end{bmatrix} \qquad (4.18)$$

where β_0 is a 3 x 1 vector that takes the constants of the model, β_i and β_j are matrices 3 x 3 that represent the coefficients, and vector (ε) is white noise.

The Granger causality test proposes the following null hypothesis:

$$H_0 : R\gamma = r \qquad (4.19)$$

where R is the rank N matrix, r is a null vector, N is the number of restrictions of the estimated coefficients and γ is a vector of $(\beta_0, \mathrm{K}\ , \beta_k)$. Thus in order to test the null hypothesis of no causality between bank loans and deposits, the following test is applicable:

$$H_0 = b_1^{12} = b_2^{12} = \mathrm{K} = b_k^{12} = 0$$

where b_k^{12} are the coefficients corresponding to the k first lag lengths of $g_{BL,t-i}$ expressed in equation (4.18).

If it is found that deposits (*DEP*) affect both bank loans (*BL*) and money supply (*MS*), then it means that inference on the causality between *BL* and *MS* is invalid in both directions. Thus, in the next section, if it is found that *BL* causes *DEP* and in turn *DEP* causes *MS*, then it shows that *DEP* is an important variable such that bank loans acquired are immediately transferred into demand deposits and not only into other types of deposits, as Howells and Hussein (1998) have inferred. However,

if only part of the above causality is found – for example, *DEP* cause *MS* – and it is also found that *BL* cause *MS* but no causality link between *BL* and *DEP* is found, then earlier inference on the causality between *BL* and *MS* holds true.

On the other hand, it is expected that *MS* causes *DEP* as demand deposits are a component of *MS*. Also, if there is causality flowing from *MS* to *DEP* and from *DEP* to *BL*, then the monetarist view that deposits are used to create loans still holds true.

This methodology will be used to test Hypothesis 6.

4.5.5 Panel unit root tests

In order to test Hypothesis 8, it is imperative that preliminary tests such as the panel unit root test as discussed in this section and the panel cointegration test detailed in the next section are conducted before the simultaneous equation model is estimated using panel data Generalised Method of Moments. This is to ensure that the variables are stationary, as before.

Panel unit root tests are similar but not identical to unit root tests carried out on a single series, such as those discussed in Section 4.5.1. However, the panel unit root tests proposed by Levin and Lin (1993), Im, Pesaran and Shin (1997) and Maddala and Wu (1999) are known to have more power than the conventional univariate time series tests.

In keeping with the unit root test in Chapter 4, the panel unit root test used will be the Fisher Phillips-Perron test. Maddala and Wu (1999) propose the use of the Fisher (1932) test, which is based on combining the *p*-values of the unit-root test statistics in each cross-sectional unit. One of the advantages of this test is that it can use different lags in the individual ADF (or PP) regressions. Also, unlike the Im, Pesaran and Shin (1997) test, the Fisher test does not require a balanced panel.

Based on combining the *p*-values of the test statistics (of β_i) of N independent ADF regressions from equation (5.1), Maddala and Wu (1999) propose a non-parametric test statistic based on Fisher (1932). Like Im, Pesaran and Shin's

(1997), this test allows for different first-order autoregressive coefficients. Thus, for a sample of *N* groups observed over *T* time periods, the panel unit root regression of the conventional ADF test is written as:

$$y_{it} = \alpha_i + \beta_i y_{it-1} + \sum_{j=1}^{P_i} \gamma_{ij} \Delta y_{it-1} + e_{it}, \quad i = 1, \text{K}, N, \quad t = 1, \text{K}, T \tag{4.20}$$

where y_{it} is the variable in country *i* at time *t*; Δ is the first difference operator, α_i, β_i and γ_{ij} are the coefficients to be estimated and e_{it} is the error term.

The null hypothesis of a unit root in the panel data is thus defined as:

$\beta_i = 0$ for all *i*,

against the alternative that at least one of the individual series in the panel is stationary:

$\beta_i < 0$ for all *i*.

The equation of the alternative hypotheses allows for β_i to differ across groups.

The Fisher-type test statistic is given as:

$$P(\lambda) = -2\sum_{i=1}^{N} \ln(\pi_i) \tag{4.21}$$

where π_i is the *p*-value of the test statistic for unit *i*. The Fisher test statistic $P(\lambda)$ has a χ^2 distribution with 2*N* degrees of freedom. Maddala and Wu (1999) show that the Fisher test achieves more accurate size and high power relative to the Levin and Lin (1993). In practice, the Fisher test is straightforward to use and may decrease the bias caused by the lag selection (Banerjee, 1999, Maddala and Wu, 1999).

Besides Maddala and Wu (1999), Choi (2001) proposes another test statistic, the inverse normal test:

$$Z = \left(1/\sqrt{N}\right)\sum_{i=1}^{N} \Phi^{-1}(p_i) \tag{4.22}$$

where Φ is the standard normal cumulative distribution function. Since $0 \le p_i \le 1$, $\Phi^{-1}(p_i)$ is a $N(0,1)$ random variable and as $T_i \to \infty$ for all *i*, $Z \Rightarrow N(0,1)$. Choi (2001) asserts that there are similar advantages to the Maddala and Wu (1999) test in that: (1) the cross-sectional *N* can be either finite or infinite, (2) the time-series dimension *T* can be different for each *i*, (3) the alternative hypothesis allows some

groups to have unit roots and not others, and (4) each group can have different types of stochastic and non-stochastic components.

Both tests were carried out under the Phillips and Perron (1988) method as opposed to ADF in order to be consistent with the unit root tests discussed in Section 4.5.1. The results are discussed in the next chapter.

4.5.6 Panel cointegration tests

If the panel variables are integrated of order one, i.e. *I(1)*, then testing for the presence of cointegration can be undertaken. In conventional time-series, the Engle and Granger (1987) cointegration test based on an examination of the residuals of a regression is usually performed using *I(1)* variables. If the variables are cointegrated, then the residuals should be *I(0)*. In such cases, the same unit root tests can be applied for both raw data and residuals, with proper adjustments to the critical values when applied to the latter.

Pedroni (2004) showed that testing for cointegration in panel data is not as simple as the conventional Engle-Granger way unless the regressors are strictly exogenous and the pooled ordinary least square (OLS) slope is constrained to be homogeneous. He argued that proper adjustments should be made to the test statistics themselves if the alternative hypothesis is that the cointegrating relationship is not constrained to be homogeneous across members, and that the parameters' estimates are allowed to vary across individual members. If this is not done, then the null hypothesis of no cointegration will certainly be rejected, regardless of the true relationship, as the sample size grows large. Also, imposing homogeneity falsely across members when the true relationship is heterogeneous generates an integrated component in the residuals, making them non-stationary, thus leading to the conclusion that the variables are not cointegrated even if they really are.

Extending the Engle-Granger framework to tests that involve panel data, Pedroni (1999, 2004) proposes several tests for cointegration that allow for heterogeneous intercepts and trend coefficients across cross-sections. Consider the following regression:

$$y_{it} = \alpha_i + \delta_i t + \beta_{mi} x_{mit} + e_{it} \qquad (4.23)$$

for $t = 1,\text{K}\ ,T;\ i = 1,\text{K}\ ,N;\ m = 1,\text{K}\ ,M$; where *y* and *x* are assumed to be integrated of order one, *I(1)*. The parameters α_i and δ_i are individual and trend effects respectively that may be set to zero if desired. Under the null hypothesis of no cointegration, the residuals e_{it} will be *I(1)*.

Pedroni's tests can be classified into two categories: the *within* dimensions and the *between* dimensions. The former are based on estimators that effectively pool the autoregressive coefficient across different members for the unit root tests on the estimated residuals, while the latter are based on estimators that simply average the individually estimated coefficients for each member *i*. A consequence of this distinction arises in terms of the autoregressive coefficient, γ_i , of the estimated residuals under the alternative hypothesis of cointegration.

Both tests were designed to test for the null of no cointegration for the case of heterogeneous panels: $H_0 : \gamma_i = 1$. Two alternative hypotheses, the homogeneous and heterogeneous alternatives, were proposed depending on the two categories. The first set involves averaging test statistics for cointegration in the time-series and cross-sections, that is, pooling the residuals along the *within* dimension of the panel, so that the alternative hypothesis becomes:
$H_1 : \gamma_i = \gamma < 1$ for all *i*. This presumes a common value $\gamma_i = \gamma$

On the other hand, the second set is the heterogeneous alternative which involves pooling the residuals along the *between* dimension of the panel, so that:
$H_1 : \gamma_i < 1$ for all *i*. This allows for heterogeneous autocorrelations parameters across members.

The panel *within* statistics includes four statistics that are similar to the 'panel variance ratio' Z_v^w ,'panel rho' Z_ρ^w , and 'panel t' Z_t^w statistics in Phillips and Ouliaris (1990), such that:

$$Z_{\rho}^{w} = \left(\sum_{i=1}^{N} \sum_{t=1}^{T} L_{11i}^{-2} \hat{e}_{it-1}^{2} \right)^{-1} \sum_{i=1}^{N} \sum_{t=1}^{T} L_{11i}^{-2} \left(\hat{e}_{it-1}^{2} \Delta \hat{e}_{it} - \hat{\lambda}_{i} \right) : Rho - stat \tag{4.24}$$

$$Z_{PP}^{w} = \left(\tilde{S}_{NT}^{*2} \sum_{i=1}^{N} \sum_{t=1}^{T} L_{11i}^{-2} \hat{e}_{it-1}^{2} \right)^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} L_{11i}^{-2} \left(\hat{e}_{it-1}^{*} \Delta \hat{e}_{it}^{*} \right) : PP - stat \tag{4.25}$$

$$Z_{t}^{w} = \left(\tilde{\sigma}^{2} \sum_{i=1}^{N} \sum_{t=1}^{T} L_{11i}^{-2} \hat{e}_{it-1}^{2} \right)^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} L_{11i}^{-2} \left(\hat{e}_{it-1}^{2} \Delta \hat{e}_{it} - \hat{\lambda}_{i} \right) : ADF - stat \tag{4.26}$$

$$Z_{\nu}^{w} = \left(\sum_{i=1}^{N} \sum_{t=1}^{T} L_{11i}^{-2} \hat{e}_{it-1}^{2} \right)^{-1} : \nu - stat \tag{4.27}$$

On the other hand, the panel *between* statistics include three statistics as set out below:

$$Z_{\rho}^{B} = \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{e}_{it-1}^{2} \right)^{-1} \sum_{i=1}^{N} \sum_{t=1}^{T} \left(\hat{e}_{it-1}^{2} \Delta \hat{e}_{it} - \hat{\lambda}_{i} \right) : Rho - stat \tag{4.28}$$

$$Z_{t}^{B} = \sum_{i=1}^{N} \left(\hat{\sigma}^{2} \sum_{t=1}^{T} \hat{e}_{it-1}^{2} \right)^{-1} \sum_{t}^{T} \left(\hat{e}_{it-1}^{2} \Delta \hat{e}_{it} - \hat{\lambda}_{i} \right) : ADF - stat \tag{4.29}$$

$$Z_{PP}^{B} = \sum_{i=1}^{N} \left(\sum_{t=1}^{T} \hat{S}^{*2} \hat{e}_{it-1}^{*2} \right)^{-1} \sum_{t}^{T} \left(\hat{e}_{it-1}^{*} \Delta \hat{e}_{it}^{*} \right) : PP - stat \tag{4.30}$$

with:

$$\hat{\lambda} = \frac{1}{T} \sum_{s=1}^{k_i} \left(1 - \frac{s}{k_i + 1} \right) \sum_{t=s+1}^{t} \hat{\mu}_{it} \hat{\mu}_{it-s} \tag{4.31}$$

$$\hat{s}_{i}^{2} = \frac{1}{T} \sum_{t=s+1}^{t} \hat{\mu}_{it} \tag{4.32}$$

$$\tilde{\sigma}_{i} = \hat{s}_{i}^{2} + 2\hat{\lambda}_{i} \tag{4.33}$$

$$\tilde{\sigma}_{NT}^{2} = \frac{1}{T} \sum_{i=1}^{N} \hat{L}_{11i}^{-2} \hat{\sigma}_{i}^{2} \tag{4.34}$$

$$\hat{s}_{i}^{*2} = \frac{1}{T} \sum_{t=s+1}^{t} \hat{\mu}_{it}^{*2}, \quad \hat{s}_{NT}^{*2} = \frac{1}{T} \sum_{t=s+1}^{t} \hat{s}_{it}^{*2} \tag{4.35}$$

$$\hat{L}_{11i}^{-2} = \sum_{t=1}^{T} \hat{\eta}_{it}^{2} + \frac{2}{T} \sum_{s=1}^{k_i} \left(1 - \frac{s}{k_i + 1} \right) \sum_{t=s+1}^{t} \hat{\eta}_{it} \hat{\eta}_{it-s} \tag{4.36}$$

and where the residuals are extracted from the above regressions:

$$\hat{e}_{it} = \hat{\rho} \hat{e}_{it-1} + \hat{\mu}_{it} \tag{4.37}$$

$$\hat{e}_{it} = \hat{\rho}\hat{e}_{it-1} + \sum_{k=1}^{K_i} \tilde{\gamma}_{ik} \Delta\hat{e}_{it-k} + \hat{\mu}_{it} \quad (4.38)$$

$$\Delta y_{it} = \sum_{m=1}^{M_i} \tilde{b}_{mi} \Delta X_{mit} + \hat{\eta}_{it} \quad (4.39)$$

and L_i represents the *i*th component of the Cholesky decomposition of the residual variance-covariance matrix, $\hat{\lambda}$ and *NT* are two parameters used to adjust the autocorrelation in the model, and $\hat{s}_i^2$ and σ_i are the contemporaneous and long-run individual variances.

The Pedroni (1997) statistics are one-sided tests with a critical value of − 1.64 where $Z < -1.64$ implies rejection of the null hypothesis of no cointegration; except the panel *v*-statistic that has a critical value of 1.64, so that $Z_v^w > 1.64$ suggests rejection of the null of no cointegration. Each of the statistics has an asymptotic distribution in the form:

$$\frac{X_{N,T} - \mu(N)^{\frac{1}{2}}}{(\nu)^{\frac{1}{2}}} \Rightarrow N(0,1) \quad (4.40)$$

where $X_{N,T}$ is the corresponding form of the test statistic, while μ and ν are the mean and variance of each test, respectively.

In a Monte Carlo experiment, Pedroni (1997) compared the performance of the seven statistics in terms of size, distortion and power. He concluded that concerning power and small samples, the group ADF generally performed best, followed by the panel ADF and the panel rho; hence these are more reliable. These will be used as to guide the interpretation of the results in Chapter 5.

4.5.7 Panel data estimation: Generalised Method of Moments (GMM)

If there is causality between the variables in each equation, the research question that this chapter sets out to answer can be explored using the panel data Generalised Method of Moments (GMM) method. The GMM method allows for a number of advantages: it exploits the time-series element of the data and controls for firm-specific effects, like the fixed-effect method; it allows for the inclusion of

lagged dependent variables as regressors; and it controls for the endogeneity of all explanatory variables. Like the fixed-effect model, the GMM is designed for panel data.

Arellano and Bond (1991) proposed a GMM procedure that allowed for additional instruments to be obtained in a dynamic panel data model, if the orthogonality condition that exists between lagged values of y_{it} and the disturbances v_{it} are used. Consider the autoregressive model with predetermined regressors:

$$y_{it} = \delta y_{i,t-1} + x'_{it}\beta + u_{it} \qquad i = 1,\text{K}\ ,N; \quad t = 1,\text{K}\ ,T \tag{4.41}$$

where δ is a scalar, x'_{it} is $1\times K$ and β is $K\times 1$. $u_{it} = \mu_i + v_{it}$ with $\mu_i \sim$ IID$(0, \sigma_\mu^2)$ and $v_{it} \sim$ IID$(0,\ \sigma_v^2)$ are independent of each other and among themselves.

In order to get a consistent estimate of δ, equation (4.41) is differenced to eliminate the individual effects:

$$y_{it} - y_{i,t-1} = \delta\left(y_{i,t-1} - y_{i,t-2}\right) + \left(x'_{it} - x'_{i,t-1}\right)\beta + \left(v_{it} - v_{i,t-1}\right) \tag{4.42}$$

where $\left(v_{it} - v_{i,t-1}\right)$ is MA(1) with unit root. As the regressors x_{it} are predetermined, with $E\left(x_{it}v_{is}\right) \neq 0$ for all $t, s = 1, 2,\text{K}\ ,T$ and for $s < t$ and zero otherwise, then only $\left[x'_{i1}, x'_{i2},\text{K}\ , x'_{i(s-1)}\right]$ are valid instruments for equation (4.42) at period *s*.

For $t = 3$, the first-differenced equation of (4.41) becomes:

$$y_{i3} - y_{i2} = \delta\left(y_{i2} - y_{i1}\right) + \left(x'_{i3} - x'_{i2}\right)\beta + \left(v_{i3} - v_{i2}\right) \tag{4.43}$$

so that x'_{i1} and x'_{i2} are valid instruments as neither is correlated with $\left(v_{i3} - v_{i2}\right)$. Similarly, for $t = 4$:

$$y_{i4} - y_{i3} = \delta\left(y_{i3} - y_{i2}\right) + \left(x'_{i4} - x'_{i3}\right)\beta + \left(v_{i4} - v_{i3}\right) \tag{4.44}$$

and there are additional instruments as now x'_{i1}, x'_{i2} and x'_{i3} are not correlated with $\left(v_{i4} - v_{i3}\right)$. If this is continued, then:

$$W_i = \begin{bmatrix} [y_{i1}, x'_{i1}, x'_{i2}] & & & 0 \\ & [y_{i1}, y_{i2}, x'_{i1}, x'_{i2}, x'_{i3}] & & \\ & & \mathrm{O} & \\ 0 & & & [y_{i1}, \mathrm{K}\ , y_{i,T-2}, x'_{i1}, \mathrm{K}\ , x'_{i,T-1}] \end{bmatrix} \quad (4.45)$$

Premultiplying equation (4.42) in vector form by W' makes it:

$$W'\Delta y = W'(\Delta y_{-1})\delta + W'(\Delta X)\beta + W'\Delta v \quad (4.46)$$

where ΔX is the stacked $N(T-2)\times K$ matrix of observations on Δx_{it}.

The one- and two-step estimators of (δ, β') can be obtained from:

$$\begin{pmatrix} \hat{\delta} \\ \hat{\beta} \end{pmatrix} = \left([\Delta y_{-1}, \Delta X]' W \hat{V}_N^{-1} W' [\Delta y_{-1}, \Delta X] \right)^{-1} \left([\Delta y_{-1}, \Delta X]' W \hat{V}_N^{-1} W' \Delta y \right) \quad (4.47)$$

where $V_N = \sum_{i=1}^{N} W_i'(\Delta v_i)(\Delta v_i)' W_i$.

Arellano and Bond (1991) proposed a test for the hypothesis that there is no second-order serial correlation based on the residuals from the first-differenced equation. This test is important as the consistency of the GMM estimator relies upon the condition $E[v_{it}, v_{i,t-2} = 0]$. The test statistic takes the form:

$$m_2 = \frac{\hat{v}'_{-2}\hat{v}_*}{\hat{v}^{1/2}} \sim N(0,1) \quad (4.48)$$

where $\hat{v}$ is given by:

$$\hat{v} = \sum_{t=1}^{N} \Delta v'_{t-2} \Delta \hat{v}_{t*} \Delta v'_{t*} \Delta \hat{v}_{t-2} - 2\Delta \hat{v}'_{-2} X_* \left(X' W \hat{V}_N W' X \right)^{-1} X' W \hat{V}_N \left(\sum_{t=1}^{N} W_t' \Delta \hat{v}_t \Delta \hat{v}'_{i*} \Delta \hat{v}_{t-2} \right) + \Delta \hat{v}'_{-2} X_* \hat{\mathrm{var}}(\hat{\delta}) X'_* \Delta \hat{v}_{-2} \quad (4.49)$$

and $\Delta \hat{v}_{-2}$ is a vector of residuals lagged twice, Δv_* is a $q \times 1$ vector of trimmed v to match v_{-2} and this is similar for X_*. m_2 is only defined if min $T_i \geq 5$.

In order to test for overidentifying restrictions, Arellano and Bond (1991) proposed the Sargan (1958) test given by:

$$J = \Delta \hat{v}' W \left[\sum_{i=1}^{N} W_i'(\Delta \hat{v}_i)(\Delta \hat{v}_i)' W_i \right]^{-1} W'(\Delta \hat{v}) \sim \chi^2_{p-K-1} \quad (4.50)$$

where p refers to the number of columns of W and $\Delta \hat{v}$ is the residuals from the two-step estimation given in equation (4.47). The test determines whether any correlation

between instruments and errors exists. For an instrument to be valid, there should be no correlation between instruments and errors.

Using Arellano and Bond's (1991) GMM panel data estimation, the simultaneous equations (4.4 to 4.6) can be specified as:

$$R_{it} = \alpha_1 + \Delta ES_{it} + \Delta MS_{it} + e_{it} \quad (4.4b)$$

$$\Delta MS_{it} = \alpha_2 + \Delta BL_{it} + \Delta INF_{it} + RbRf_{it} + R_{it} + u_{it} \quad (4.5b)$$

$$\Delta BL_{it} = \alpha_3 + \Delta MS_{it} + \Delta Y_{it} + RlRd_{it} + v_{it} \quad (4.6b)$$

where Δ denotes first difference and α is a constant for each equation. R_{it} is bank stock returns or first difference of logarithm of bank stock price in country *i* at time *t*, *BL* is bank loans, *MS* is money supply, *INF* is inflation, *Y* is income. *ES* is bank earnings spread $= [Rl \times L - Rd \times DEP]$, *RbRf* is domestic-to-foreign interest rate differential = $Rb - Rf$, *RlRd* is net interest margin = $Rl - Rd$.*e*, *u* and *v* are error terms. The results of the GMM panel data estimation are discussed in Chapter 5.

4.6 Sources of data

All variables are downloaded from the *Datastream* database and the macroeconomic variables are checked against the *International Financial Statistics* (IFS) database of the International Monetary Fund (IMF) to ensure that there are no errors.[35] The empirical analysis is conducted using quarterly data for different sample periods. It is important to note that income is included as an explanatory variable in some models specified here. Real gross domestic product is used as a proxy for income and only quarterly data is available for income. Hence quarterly data is employed in the empirical estimation in this thesis. The sample periods are dictated by the availability of the data for the seven countries so that each country has a balanced sample. Table 4.3 (page 92) lists the sample periods for each country.

The sample periods for the non-euro countries start from different periods due to data availability of some variables. The United Kingdom's sample period ends in 2006:2, as data for gross domestic product lags a number of quarters. As 1999 is the start of the euro, the sample size for these European countries ends in 1998:4. For

[35] This is carried out following the findings of Ince and Porter (2006).

Germany and Italy, currency in circulation, deposits and loans were only available in *Datastream* from 1999. Thus, these data are taken from the *IMF IFS* database following the same codes as the other non-euro countries. For Italy, the bank lending rate is only available from 1982:4, so the sample takes this into consideration. France has a small sample size because the banking industry price index is only available from 1987:1. The sample ends 1998:2, as some variables are incomplete.

Table 4.3 Sample periods used for each country

Country	Sample periods
Canada	1976:3 – 2007:1
France	1987:1 – 1998:2
Germany	1980:1 – 1998:4
Italy	1982:4 – 1998:4
Japan	1973:3 – 2007:1
United Kingdom	1975:3 – 2006:2
United States	1975:3 – 2007:1

Datastream's banking industry price index is used as a proxy to calculate banking industry stock returns. The price indices comprise a number of banks, as summarised in Table 4.4. For the US, the Nasdaq Financial Index is used as it has 519 banks included in it, which is a better representative of the US financial sector.

Table 4.4 Number of banks included in Datastream Bank Price Index

Country	Number of banks
Canada	7
France	9
Germany	9
Italy	30
Japan	79
United Kingdom	10
United States (Nasdaq Financial Index)	519

Data for money supply are each country's broad form of money supply: M3 for Canada, France, and Germany; M2 for Italy; M3+ for Japan; M4 for the United Kingdom (UK) and M2 for the United States (US).[36] Monetary base is reserve money while the money multiplier is the ratio of broad money supply to reserve money. Deposits are the demand deposits of the banking institutions, while loans are the domestic credit of the banking sector in each country. The local bill rate and the foreign bill rate are the domestic treasury-bill rate and the US 3-month Treasury bill rate respectively. For the US, however, the foreign bill rate is the UK Treasury bill

[36] Howells and Hussein (1998) used the same money definitions.

rate. The consumer price index is used as a proxy for inflation. The bank lending rate, deposit rates and real gross domestic product are also obtained for use in the empirical models.

All variables are seasonally adjusted where available and transformed to logarithmic form, with the exception of the bank lending rate, bank deposit rate, local bill rate and foreign bill rate. Descriptive statistics of the variables used for empirical analyses are given in Table 4.5. Unit root test results for the variables listed in Table 4.5 and cointegration test results are provided in Chapter 5.

Table 4.5 Descriptive statistics

	Mean	**Med**	**Max**	**Min**	**S.D.**	**Mean**	**Med**	**Max**	**Min**	**S.D.**
			Canada					*France*		
P	5.99	5.79	7.83	4.58	0.92	5.13	5.13	5.97	4.56	0.26
DEP	6.19	6.23	7.77	4.60	0.83	7.19	7.18	7.42	7.07	0.09
BL	6.33	6.40	7.80	4.67	0.81	8.84	8.90	9.06	8.48	0.16
MB	3.18	3.20	3.87	2.34	0.41	10.37	10.33	10.62	10.14	0.14
MM	9.69	9.79	10.03	9.20	0.22	-3.77	-3.69	-3.44	-4.32	0.27
MS	12.88	13.00	13.90	11.54	0.61	6.59	6.65	6.73	6.27	0.13
Y	13.57	13.55	14.00	13.15	0.25	14.01	14.02	14.11	13.87	0.06
			Germany					*Italy*		
P	5.26	5.39	6.33	4.48	0.47	6.59	6.56	7.69	6.03	0.32
DEP	5.67	5.55	6.54	4.99	0.50	5.82	5.88	6.36	5.13	0.33
BL	7.89	7.77	8.61	7.21	0.42	7.00	7.05	7.55	6.16	0.44
MB	4.67	4.67	5.07	4.19	0.29	4.82	4.95	5.10	4.16	0.27
MM	8.70	8.66	8.96	8.49	0.11	8.10	8.03	8.49	7.93	0.15
MS	13.37	13.31	13.99	12.76	0.38	12.92	12.97	13.38	12.19	0.38
Y	14.20	14.15	14.45	13.97	0.18	13.80	13.84	13.94	13.60	0.10
			Japan					*UK*		
P	5.52	5.76	6.92	4.08	0.89	7.35	7.11	9.12	5.51	1.19
DEP	4.71	4.58	5.91	3.52	0.68	5.66	5.99	7.44	3.50	1.21
BL	6.59	6.93	7.19	5.07	0.61	6.00	6.52	7.69	3.93	1.20
MB	3.62	3.73	4.75	2.33	0.67	2.95	3.05	3.76	2.03	0.46
MM	9.16	9.22	9.40	8.72	0.19	9.82	10.01	10.41	8.86	0.49
MS	12.79	13.08	13.48	11.42	0.61	12.77	13.08	14.16	10.95	0.93
Y	19.79	19.91	20.14	19.27	0.27	13.61	13.60	14.00	13.26	0.22
			US							
P	6.25	6.13	8.14	4.27	1.21					
DEP	6.29	6.43	6.80	5.45	0.37					
BL	8.40	8.46	9.49	7.12	0.64					
MB	5.71	5.70	6.68	4.62	0.62					
MM	2.30	2.31	2.52	2.03	0.13					
MS	8.01	8.12	8.88	6.90	0.53					
Y	15.79	15.78	16.26	15.28	0.28					

Note: Med, Min, Max and S.D. are Median, Minimum, Maximum and Standard Deviation respectively. *P*, *DEP*, *BL*, *MB*, *MM*, *MS* and *Y* are bank stock price, deposits, bank loans, monetary base, money multiplier, money supply and income respectively. All variables are in logarithmic form except for money multiplier. Sample sizes are Canada = 123 observations, France = 46 observations, Germany = 76 observations, Italy = 65 observations, Japan = 135 observations, UK = 124 observations and US = 127 observations.

Data used for the panel data estimation are cross-sectional data (data of each country) pooled over several time periods. Table 4.6 provides the descriptive statistics of the variables used for panel data estimation. Unit root tests for the variables and cointegration tests for equations (4.4b) to (4.6b) are discussed in Chapter 5.

Table 4.6 Descriptive statistics: Panel data variables

	Mean	Median	Maximum	Minimum	S.D.	Observations
P	5.95	5.80	9.15	3.98	1.21	805
MS	10.75	12.23	14.24	4.52	2.89	799
BL	6.91	7.03	9.49	3.56	1.31	804
Y	15.10	13.97	20.14	13.02	2.27	806
INF	4.21	4.41	4.78	2.16	0.50	806
RlRd	2.52	2.68	11.07	-6.00	2.21	733
RbRf	0.74	0.43	15.10	-9.41	3.54	806
ES	8.34	8.24	10.98	2.20	1.41	718

Note: S.D. is Standard Deviation. *P, MS, BL, Y, INF, RlRd, RbRf* and *ES* are bank stock price, money supply, bank loans, income, inflation, net interest margin, domestic-to-foreign interest rate differential and bank earnings spread respectively. All variables are in logarithmic form except for *RlRd* and *RbRf*.

4.7 Chow breakpoint test

Given the long sample period used in the empirical estimation and the overview of the history of the sample countries in Chapter 3, it is clear that each country experienced some internal or external shocks during the period under study. Thus, the Chow test is performed to see whether a model changed after a certain event. In this thesis, however, the choice of events is limited only to changes in monetary policy regimes, as this relates directly to the exogenous or endogenous nature of money supply with consideration to the conduct of monetary policy in each country. The Chow test is commonly used to test the structural stability of a model.

Consider the simple linear regression (restricted model):

$$Y_T = \beta_0 + \beta_1 X_T + u_T, \tag{4.51}$$

where T denotes the full sample period, $T = 1,\ldots,T$.

If an event z happened within that period, the sample is divided into two such that:

$$Y_t = \alpha_0 + \alpha_1 X_t + u_t \tag{4.52}$$

$$Y_{zt} = \gamma_0 + \gamma_1 X_{zt} + u_{zt} \tag{4.53}$$

where $t = 1,\ldots, t$ are the periods before event z happened and $zt = z,\ldots, T$ are the periods since event z happened. This is the unrestricted model. The null hypothesis $H_0 : \alpha_0 = \gamma_0 \quad and \quad \alpha_1 = \gamma_1$ is tested against the alternative that either the intercepts, the slopes or both are not equal.

Tested against the F-statistic, the test statistic is:

$$test\ statistic = \frac{RSS - (RSS_t + RSS_{zt})}{RSS_t + RSS_{zt}} \times \frac{T - 2k}{k} \tag{4.54}$$

where: RSS = residual sum of square for the whole sample,

RSS_t = residual sum of squares for sample with t periods,

RSS_{zt} = residual sum of squares for the sample with zt periods,

T = number of observations, and

k = number of regressors in the unrestricted model.

The monetary policy events summarised in Table 4.7 are tested using the simple linear regression model taken from equation (4.4A) on page 74. The results of the test are discussed in the next section.

Table 4.7 Changes in monetary policy regime

Country	Event	Start date	End date
Canada	Inflation targeting announced (Thiessen (1998))	1991:1	2007:1
United Kingdom	Chancellor wrote to the Chairman setting out new framework for monetary policy (Boe diary of events)	1992:4	2006:2
United States	Fed announced that it would no longer set M1 targets and moved away from borrowed reserve targets	1987:1	2007:1

4.7.1 Results of the Chow breakpoint test

Table 4.8 provides a summary of the Chow breakpoint test results. The null hypothesis of the Chow breakpoint test is that the model does not change after the date the event occurred.

Table 4.8 Chow breakpoint test results

	F-statistic	**Log likelihood ratio**
Canada: 1991q1	140.97 ***	149.41 ***
UK: 1992q4	152.28 ***	156.68 ***
US: 1987q1	17.14 ***	31.23 ***

Note: ***, ** and * indicate significance at 1 percent, 5 percent and 10 percent levels respectively.

The results indicate that the null hypothesis of the model being stable after the occurring dates is rejected in Canada, UK and US at the one percent level of significance. This is evident through the probabilities of the *F*-statistic and the log-likelihood ratio in all three countries. As it is found that there is a change in the model after the monetary policy event, split samples will be used (together with the full sample) to test the hypotheses presented in Section 4.3. The split samples used in the rest of this thesis are labelled as follows: Canada 1 and 2 are for 1976:3 to 1990:4 and 1991:1 to 2007:1 respectively; UK 1 and 2 are 1975:3 to 1992:3 and 1992:4 to 2006:2 respectively; and US 1 and 2 are 1975:3 to 1986:4 and 1987:1 to 2007:1.

4.8 Chapter Summary

This chapter provides a detailed explanation of the hypotheses to be tested in this study, along with the data sources and the empirical model to be used to test the hypotheses. Chow breakpoint tests and the results are discussed to determine the stability of the model.

Hypotheses 1 to 7 will be tested using vector error-correction models and Granger causality tests. The results of these tests will be discussed further in the next chapter. It was found that the model is not stable after a change in monetary policy regimes in Canada, the UK and the US. Thus, the causality tests will be performed on a full sample as well as on split samples to account for the change in monetary

policy regimes. A simultaneous equation model was developed to test Hypothesis 8. The model will be tested using panel data and the results discussed in Chapter 5.

Chapter 5: Results of the Causality Tests and Panel Data Estimation

5.1 Introduction

This chapter reports findings relating to the research questions in this thesis. The questions are repeated here for ease of reference:

1. Is the money supply endogenous or exogenous in each of the G-7 countries?
2. If the money supply is endogenous, which of the three views (accommodationists, structuralists or liquidity preference) does it support?

2a. Is the support for the views in (2) above different in the short term than in the long term?

3. Following the PK theory where loans cause deposits and this in turn causes the money supply; is the PK theory valid for the sample of G-7 countries under study in this thesis?
4. Is there causality between the money supply and aggregate bank stock returns?
5. Does a simultaneous relationship exist between bank loans, the money supply and aggregate bank stock returns such that loans create deposits (in the form of money supply) whilst at the same time loans and deposits affect the value of bank stocks in the market?

The first question will be answered by investigating whether one-way or two-way causality exists between bank loans and broad money supply. The answers to questions 2 and 2a will be provided using vector error-correction modelling (VECM) and Granger causality on the hypotheses set out in Chapter 4. VECM and Granger causality will allow for causality to be determined both in the long term and in the short term. In order to test for the robustness of the results for Question 1, a VAR causality test is performed with the inclusion of deposits in a trivariate test, while Question 4 will be answered by conducting a bivariate VECM and Granger causality test between money supply and bank stock returns. Once causality is determined, the findings will be extended by investigating whether a simultaneous relationship exists

between bank loans, money supply and bank stock returns such that loans create deposits (in the form of money supply) at the same time that loans and deposits affect shareholder value. This will provide the answer to the final research question.

Investigating this relationship allows one to understand the importance of banks in creating money supply and also to determine whether this role has an effect on the bank's share price. Past literature has found that a relationship exists between money supply (amongst other macroeconomic variables) and *general* stock prices. However, no study has investigated the relationship between money supply and *bank* stock prices.

The answers will be organised as follows. Section 5.2 contains a discussion of the results of the unit root tests, which is followed by the Johansen (1988) cointegration tests results. The long-run and short-run causality tests employing respectively the vector error-correction models and Granger causality tests are also discussed in this section. Following this, Section 5.3 answers questions 2 and 2a. Trivariate VAR causality tests and the results are described in the ensuing section. Section 5.5 discusses the results of causality tests between money supply and bank stock returns, which answers research question 4. A simultaneous equation model was developed for identifying the existence of these simultaneous relationships in Chapter 4 to assist in answering Question 5. Section 5.6 provides a discussion of the preliminary test results: panel unit root, panel cointegration and vector error-correction model. This section also discusses the results of the panel data Generalised Method of Moments (GMM) and the sensitivity analyses results. Section 5.7 summarises the chapter.

5.2 Money supply: Is it exogenous or endogenous?

Mainstream Keynesians have maintained that changes in money supply by the central bank will affect interest rates. Any changes in money supply through the monetary base will affect deposits and in turn loans. This makes money supply exogenous, as it is controlled by the central bank. The post-Keynesians (PK), however, assert that money supply is endogenous through the behaviour of commercial banks and the public. The central bank only determines the level of interest rates, and the banks then adjust their loan portfolios based on this given rate.

Changes in loans by the banks will affect deposits and in turn money supply (which will in turn influence bank stock returns). This section investigates whether money supply is exogenous or endogenous in the G-7 countries, using vector error-correction models and/or Granger causality tests.

5.2.1 Results of the unit root tests

The results of the unit root tests are summarised in Table 5.1. Two variables were tested – bank loans (*BL*) and broad money supply (*MS*) – as these variables are used in our analysis to determine whether money is endogenous or exogenous. Prior to the unit root test, we tested for the sign of a trend and/or intercept in the series by plotting a line graph of the variables. Significant trends are included in subsequent tests.

Table 5.1 Unit root test results (Phillips-Perron)

	Bank Loans (*BL*)		**Broad Money Supply (*MS*)**		**Critical values**		
	Level	Difference	Level	Difference	1%	5%	10%
Canada	-2.564	-10.715***	7.295	-3.045***	-4.034	-3.447	-3.148
Canada 1	-1.567	-5.146***	-2.224	-4.166**	-4.356	-3.595	-3.233
Canada 2	-1.952	-8.264***	0.817	-9.539***	-4.055	-3.457	-3.154
France	-1.760	-6.782***	-1.637	-4.41***	-4.166	-3.509	-3.184
Germany	-1.093	-8.782***	-2.184	-9.022***	-4.085	-3.471	-3.162
Italy	0.112	-12.426***	-1.300	-15.578***	-4.106	-3.480	-3.168
Japan	-1.134	-11.73***	-1.384	-7.528***	-4.027	-3.443	-3.146
UK	-0.836	-11.103***	-1.038	-7.67***	-4.034	-3.446	-3.148
UK 1	-2.296	-8.459***	0.151	-4.97***	-4.095	-3.475	-3.165
UK 2	-0.663	-6.335***	-0.605	-6.208***	-4.137	-3.495	-3.177
US	-2.171	-9.627***	-2.633	-6.601***	-4.032	-3.446	-3.148
US 1	-1.671	-6.73***	-2.747	-5.702***	-4.171	-3.511	-3.186
US 2	-0.612	-7.59***	-0.907	-6.02***	-4.075	-3.466	-3.160

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2= (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). ***, **, * denote significance at the 1, 5 and 10 percent levels respectively.

The Chow breakpoint tests in Chapter 4 indicated the existence of a break in the sample for Canada, the UK and the US. Thus a full sample and the split samples were tested for money endogeneity or exogeneity. For simplicity, the split samples are labelled as follows: Canada 1 and 2 refer to 1976:3 to 1990:4 and 1991:1 to 2007:1 respectively; UK 1 and 2 are 1975:3 to 1992:3 and 1992:4 to 2006:2 respectively; and US 1 and 2 are 1975:3 to 1986:4 and 1987:1 to 2007:1.

The results indicate that the null hypothesis of a unit root could not be rejected in levels for both variables. This is because the Phillips-Perron (PP) test statistic is higher than the respective critical value. However, the null hypothesis can be rejected at the one percent significance level in first difference for both variables, thereby showing that they are stationary in first difference or *I*(*1*). In Canada 1, the null hypothesis is rejected at the five percent level for money supply because the PP test statistic is lower than the critical value of -3.595. This confirms that the Johansen (1988) cointegration test can be performed, as both variables are integrated of order one. This is discussed in the next section.

5.2.2 Results of Johansen cointegration tests

Table 5.2 presents the results of the optimal lag length of the VAR using Schwarz Bayesian Criteria (SBC). VAR (1) is suggested as the most appropriate model to test for cointegration between bank loans and money supply in most of the samples: Canada 1 and 2, France, UK 1 and 2 and US 1 and 2. However, lag lengths two and five are also preferred in some cases.

Table 5.2 VAR optimal lag length

BL* and *MS							
	Lag 0	**Lag 1**	**Lag 2**	**Lag 3**	**Lag 4**	**Lag 5**	**Lag 6**
Canada	0.475	-9.227	-9.286*	-9.225	-9.164	-9.042	-9.016
Canada 1	-1.944	-11.027*	-10.928	-10.733	-10.628	-10.398	-10.210
Canada 2	-1.261	-9.322*	-9.115	-8.906	-8.723	-8.527	-8.571
France	-5.728	-12.827*	-12.824	-12.643	-12.464	-12.258	-12.011
Germany	-2.362	-11.041	-11.142*	-10.939	-10.733	-10.838	-10.861
Italy	-4.036	-9.978	-9.763	-9.639	-10.071	-10.785*	-10.587
Japan	0.033	-12.252	-12.537*	-12.445	-12.329	-12.318	-12.273
UK	1.283	-9.241	-9.268*	-9.164	-9.052	-8.951	-8.837
UK 1	1.034	-8.522*	-8.452	-8.264	-8.054	-7.913	-7.713
UK 2	-4.179	-12.694*	-12.464	-12.222	-11.997	-11.903	-11.671
US	-2.216	-13.293	-13.377	-13.264	-13.186	-13.555*	-13.529
US 1	-3.913	-13.371*	-13.192	-13.040	-12.829	-12.975	-12.783
US 2	-3.688	-13.931*	-13.843	-13.787	-13.592	-13.834	-13.668

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2= (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). *BL* denotes bank loans and *MS* is money supply. * indicates optimal lag length.

In the case of Canada, Germany, Japan and UK, VAR (2) is preferred to test for cointegration between bank loans and money supply, as reported in Table 5.2

where -9.286, -11.142, -12.537 and -9.286 are the lowest values among the SBC. Lag length five is chosen for cointegration tests between the two variables in Italy and the US as the lowest SBC are -10.785 and -13.555 respectively. These lags are used for the subsequent cointegration tests.

The Johansen cointegration test results summarised in Table 5.3, show that most of the variables are cointegrated. The null hypothesis of the cointegration tests is that there is no cointegrating vector against the alternative that there is at most one cointegrating vector. The tests include a linear trend following from the unit root tests. Thus, the MacKinnon, Haug and Michelis (1999) critical values at 1, 5 and 10 percent levels of significance for the Trace Test are 31.15, 25.78 and 23.34 respectively and for the Maximal Eigenvalue Test, the critical values are 23.97, 19.38 and 17.23 at the significance level of 1, 5 and 10 percent respectively.

Table 5.3 Johansen cointegration test results

BL* and *MS

Country	**Trace**	**M.E.**	**Lag**
Canada	16.37	10.87	2
Canada 1	31.30***	23.23**	1
Canada 2	56.05***	50.78***	1
France	33.3***	26.97***	1
Germany	26.05**	21.15**	2
Italy	26.78**	22.88**	5
Japan	39.16***	34.27***	2
UK	31.63***	22.00***	2
UK 1	12.01	8.15	1
UK 2	28.58***	24.88***	1
US	33.19***	21.57**	5
US 1	33.89***	22.5**	1
US 2	55.62***	51.89***	1

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2= (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US2 = (1987:1 - 2007:1). *BL* denotes bank loans and *MS* is money supply. Trace is Trace Test statistic and M.E. is Maximal Eigenvalue Test statistic. ***, **, * denote significance at the 1, 5 and 10 percent levels respectively.

The Trace Test and Maximal Eigenvalue Test statistics are above the MacKinnon, Haug and Michelis (1999) critical values at the one and five percent levels of significance for all cases except Canada and UK 1. This indicates a long-run equilibrium between bank loans and money supply in all the sample countries except Canada and UK 1.

The variables that are found to be cointegrated will be tested for long-run and short-run causality using vector error-correction modelling (VECM), and those that are found not to be cointegrated will be tested using the standard Granger (VAR) causality test, as explained in the next section.

5.2.3 Results of the causality tests

In order to assess whether money supply is exogenous or endogenous in the seven countries, the causality results between bank loans and money supply are examined. Tables 5.4 and 5.5 (p. 104) summarise the results.

Table 5.4 Error-correction terms

DV	*INDV*	*ECT*	*t-stat*	*ECT*	*t-stat*
Canada 1				**UK**	
BL	*MS*	-0.191	[-3.268]***	-0.002	[-0.684]
MS	*BL*	-0.134	[-4.783]***	-0.004	[-6.607]***
Canada 2				**UK 2**	
BL	*MS*	0.003	[1.010]	-0.095	[-4.619]***
MS	*BL*	-0.003	[- 8.50]***	-0.095	[-3.967]***
France				**US**	
BL	*MS*	-0.11	[-5.45]***	-0.071	[-2.336]**
MS	*BL*	-0.068	[-3.255]***	0.086	[3.147]***
Germany				**US 1**	
BL	*MS*	-0.016	[-1.499]	-0.099	[-5.017]***
MS	*BL*	-0.25	[-4.142]***	-0.07	[-1.131]
Italy				**US 2**	
BL	*MS*	-0.051	[-0.190]	-0.17	[-5.825]***
MS	*BL*	-0.774	[-2.612]***	-0.123	[-6.919]***
Japan					
BL	*MS*	-0.066	[-5.447]***		
MS	*BL*	-0.014	[-3.293]***		

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2= (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). *BL* denotes bank loans and *MS* is money supply. ***, **, * denote significance at the 1, 5 and 10 percent levels respectively.

The results in Table 5.4 show that the error-correction terms are negative and significant. Money supply reacts to a deviation from the equilibrium relationship between 0.3 percent (Canada 2) and 77.4 percent (Italy), while bank loans react to the same deviation adjusting from 6.6 percent (Japan) to 19.1 percent (Canada 1).

Table 5.5 Results of causality test: *BL* and *MS*

	LR	*SR*	*Granger*	*Conclusion*	*Monetary Policy*
Canada			$BL \Rightarrow MS$	ENDO	MT
Canada 1	$BL \Leftrightarrow MS$			ENDO	INF
Canada 2	$BL \Rightarrow MS$			ENDO	MT/INF
France	$BL \Leftrightarrow MS$	$MS \Rightarrow BL$		ENDO	MT/INF
Germany	$BL \Rightarrow MS$	$BL \Rightarrow MS$		ENDO	MT/INF
Italy	$BL \Rightarrow MS$			ENDO	MT
Japan	$BL \Leftrightarrow MS$	$BL \Rightarrow MS$		ENDO	MT/INF
UK	$BL \Rightarrow MS$	$MS \Rightarrow BL$		ENDO	MT
UK 1			$MS \Rightarrow BL$	EXO	INF
UK 2	$BL \Leftrightarrow MS$			ENDO	MT/INF
US	$BL \Leftrightarrow MS$	$MS \Rightarrow BL$		ENDO	MT
US 1	$MS \Rightarrow BL$			EXO	INT
US 2	$BL \Leftrightarrow MS$			ENDO	MT/INT

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2= (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). $\Rightarrow$ indicates unidirectional causality and $\Leftrightarrow$ indicates bidirectional causality. *BL* denotes bank loans and *MS* is money supply. EXO and ENDO indicate money supply as exogenous and endogenous respectively.

Bidirectional causality between bank loans and money supply or unidirectional causality from bank loans to money supply in Table 5.5 indicates money supply as being endogenous, for example, in the case of Japan. Overall, it was found that money is endogenous in all the countries except for UK 1 and US 1, where money supply was found to be exogenous. During this period, monetary policy in UK 1 and US 1 was focused on targeting monetary aggregates. In line with the monetarist view, a change in money supply caused by the central bank has an effect on bank loans through the bank lending channel. Thus, it is not surprising that money supply is found to be exogenous in these two countries during those periods only. The results for UK 1 and US 1 are supportive of the existence of exogenous money found by Huang (2003) and Romer and Romer (1990) respectively for those years.[37]

The other monetary targeting sample is Canada 1. However, money supply was found to be endogenous during this period. A natural explanation for this could be that the Canadian central bank abandoned monetary targeting in 1982 and changed its monetary policy to price stability by targeting inflation, which it only

[37] Huang (2003) found existence of the bank lending channel in the UK, while Romer and Romer (1990) concluded that the money view (exogenous money) exists in the US.

announced in February 1991, as reported by Thiessen (1998). The reason for this could be that as the demand for loans in the financial system changes, the flow from loans to monetary aggregates as predicted by the post-Keynesian theory also changes the monetary aggregates, resulting in the central bank not being able to hit the predetermined rates.

A causality test between bank loans and money supply was conducted up to 1982; however, the result was inconclusive as it was found that there was no causality between the two variables. This could be due to the small sample size. Thus, in this thesis, the sample period for Canada 1 was determined to be 1976:3 to 1990:4.

These results are in line with Howells and Hussein's (1998) findings, even with an extended sample period of nine years. Similarly, the results appear to suggest bidirectional causality in the long run in France and the US, and to suggest that loans cause money supply in Italy and the UK. However, in their paper Howells and Hussein (1998) concluded that money was endogenous in Canada and Germany in the short run, but did not mention that in the long run it was found to be exogenous. One factor that Howells and Hussein (1998) did not consider was to split the sample for the UK and the US; the results in this thesis indicate that there was a difference between monetary policy regimes.

As money supply was found to be endogenous in most samples, the next question is: which of the three views of the post-Keynesian theory (accommodationist, structuralist or liquidity preference) is supported? This will be answered in the next section.

5.3 Three views of endogenous money

Debate exists under the PK theory of endogenous money regarding whether money supply has unidirectional or bidirectional causality on bank loans. The controversy over this issue impinges on the causality between monetary base and bank loans and the money multiplier and bank loans. These arguments of PK theory fall into three views: accommodationist, structuralist and liquidity preference. With the above findings of the nature of money supply, it is interesting to investigate which view the endogenous money supports or whether the components of the money supply follow

the monetarist view. Empirical tests of unit roots and cointegration are employed before the VECM causality tests are performed.

5.3.1 Results of the unit root tests

As in Section 5.2 above, unit root tests are first conducted on the variables to test whether they are stationary or not. The results of the unit root tests are summarised in Table 5.6 (p. 107).

Three variables were tested: monetary base (*MB*), broad money multiplier (*MM*), and nominal income (*Y*). Prior to the unit root tests, we tested for the sign of a trend and/or intercept in the series by plotting a line graph of the variables.

The results indicate that the null hypothesis of a unit root could not be rejected at level for all the variables.

The null hypothesis, however, can be rejected for all variables when these variables were differenced once, thereby showing that they are stationary in first differenced or *I(1).* This confirms that the Johansen (1988) cointegration test can be performed on the variables.

Table 5.6 Unit root test results (Phillips-Perron)

	Monetary Base (*MB*)		**Broad Money Multiplier (*MM*)**		**Nominal Income (*Y*)**		**Critical values**		
	Level	Difference	Level	Difference	Level	Difference	1%	5%	10%
Canada	-1.860	-15.399***	-2.342	-15.119***	-2.144	-6.569***	-4.034	-3.447	-3.148
Canada 1	-2.425	-9.537***	-1.762	-9.318***	-1.931	-4.776***	-4.356	-3.595	-3.233
Canada 2	-0.281	-14.466***	-2.370	-12.365***	-3.104	-4.275***	-4.055	-3.457	-3.154
France	-2.540	-6.657***	-1.745	-6.24***	-1.821	-4.238***	-4.166	-3.509	-3.184
Germany	-1.898	-11.689***	-2.348	-13.207***	-2.119	-9.046***	-4.085	-3.471	-3.162
Italy	0.186	-6.407***	-1.845	-13.02***	-1.023	-6.316***	-4.106	-3.480	-3.168
Japan	-2.853	-11.301***	-1.437	-11.461***	-0.596	-11.196***	-4.027	-3.443	-3.146
UK	-3.020	-14.429***	-1.344	-13.968***	-2.134	-11.627***	-4.034	-3.446	-3.148
UK 1	-2.348	-10.481***	-2.169	-10.244***	-1.570	-8.801***	-4.095	-3.475	-3.165
UK 2	-2.626	-9.648***	-3.028	-9.165***	-1.326	-5.17***	-4.137	-3.495	-3.177
US	-2.755	-16.374***	-1.988	-14.192***	-2.985	-8.443***	-4.032	-3.446	-3.148
US 1	-2.721	-10.64***	-2.360	-9.988***	-1.900	-4.849***	-4.171	-3.511	-3.186
US 2	-2.284	-11.628***	-0.485	-10.712***	-1.881	-7.142***	-4.075	-3.466	-3.160

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2 = (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1).

***, **, * denote significance at the 1, 5 and 10 percent levels respectively.

5.3.2 Results of the cointegration tests

Table 5.7 (p. 109) presents the results of the optimal lag length of the VAR using Schwarz Bayesian Criteria (SBC). VAR (1) is suggested as the most appropriate model to test for cointegration between two variables in most of the samples.

Lag lengths of order two, three and five are preferred in all other cases. VAR (2) is chosen to test for the cointegration between money supply and income in Canada, Canada 1 and 2, Japan, UK, US and US 2. VAR of order three is preferred for cointegration tests between bank loans and monetary base and bank loans and money multiplier in France as the SBC is -9.553 and -9.483 respectively, showing the lowest among the seven lags included. The results for Germany also preferred lag length three to use for testing for cointegration between money supply and income as the SBC of -10.403 is the lowest at this lag. SBC gives preference to a lag length of five in the US as the lag employed for testing cointegration between bank loans and monetary base and bank loans and money multiplier. Similarly for Italy, SBC of -8.746, -8.536 and -11.873 are the lowest among all the lags, making VAR (5) the preferred lag to be used for the subsequent cointegration tests.

Table 5.7 VAR optimal lag length

BL* and *MB							
	Lag 0	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5	Lag 6
Canada	-0.346	-7.698*	-7.660	-7.522	-7.374	-7.239	-7.094
Canada 1	-2.381	-10.064*	-10.058	-9.796	-9.654	-9.452	-9.248
Canada 2	-1.254	-6.690*	-6.566	-6.345	-6.114	-5.885	-5.663
France	-3.557	-9.538	-9.287	-9.553*	-9.287	-9.060	-8.841
Germany	-1.332	-10.027*	-9.991	-9.883	-9.716	-9.636	-9.482
Italy	-0.817	-8.583	-8.419	-8.221	-8.138	-8.746*	-8.586
Japan	2.070	-8.618*	-8.476	-8.355	-8.213	-8.085	-7.945
UK	1.250	-6.382*	-6.272	-6.269	-6.156	-6.031	-5.884
UK 1	0.244	-5.914*	-5.706	-5.686	-5.517	-5.342	-5.111
UK 2	-2.124	-9.351*	-9.085	-9.070	-8.862	-8.696	-8.463
US	0.072	-10.965	-11.054	-10.925	-10.843	-11.263*	-11.141
US 1	-3.741	-10.829*	-10.602	-10.430	-10.414	-10.366	-10.316
US 2	-1.261	-11.388*	-11.317	-11.154	-11.067	-11.332	-11.160
BL* and *MM							
Canada	-0.109	-7.489*	-7.426	-7.274	-7.121	-6.977	-6.856
Canada 1	-2.855	-9.551*	-9.517	-9.294	-9.111	-8.885	-8.696
Canada 2	-1.916	-6.522*	-6.369	-6.135	-5.896	-5.670	-5.453
France	-3.086	-9.367	-9.148	-9.483*	-9.176	-8.974	-8.704
Germany	-2.660	-10.280*	-10.170	-10.207	-10.005	-9.887	-9.694
Italy	-0.762	-8.286	-8.133	-7.980	-8.006	-8.536*	-8.436
Japan	1.236	-8.644*	-8.502	-8.387	-8.246	-8.115	-7.975
UK	1.494	-6.342*	-6.222	-6.238	-6.131	-6.010	-5.863
UK 1	1.274	-5.715*	-5.512	-5.551	-5.407	-5.211	-4.980
UK 2	-1.772	-9.274*	-9.004	-8.972	-8.720	-8.547	-8.293
US	0.330	-10.774	-10.832	-10.705	-10.679	-11.031*	-10.910
US 1	-2.816	-10.553*	-10.374	-10.258	-10.193	-10.197	-10.134
US 2	-1.212	-11.254*	-11.164	-11.045	-10.965	-11.199	-11.041
MS* and *Y							
Canada	-1.186	-13.267	-13.444*	-13.331	-13.315	-13.218	-13.132
Canada 1	-2.910	-12.588	-12.634*	-12.413	-12.300	-12.141	-12.028
Canada 2	-3.964	-14.097	-14.430*	-14.190	-14.151	-13.954	-13.747
France	-6.520	-14.407*	-14.265	-14.000	-13.811	-13.831	-13.668
Germany	-3.177	-10.103	-9.897	-10.403*	-10.207	-10.241	-10.016
Italy	-3.837	-10.744	-10.704	-10.690	-11.285	-11.873*	-11.694
Japan	-3.040	-13.956	-14.193*	-14.063	-13.990	-13.952	-13.931
UK	-0.154	-12.692	-12.723*	-12.659	-12.604	-12.521	-12.432
UK 1	-1.879	-11.987*	-11.926	-11.803	-11.670	-11.578	-11.403
UK 2	-5.384	-15.120*	-14.980	-14.704	-14.424	-14.164	-13.938
US	-1.493	-13.614	-13.837*	-13.722	-13.663	-13.529	-13.438
US 1	-3.903	-13.051*	-12.863	-12.611	-12.350	-12.040	-11.728
US 2	-3.462	-14.771	-14.841*	-14.759	-14.657	-14.459	-14.449

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2= (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). *BL* denotes bank loans, *MB* is monetary base, *MM* is money multiplier, *MS* is money supply and *Y* is income. * indicates optimal lag length.

The Johansen cointegration test results summarised in Table 5.8 show that most of the variables are cointegrated. If there is a discrepancy between the tests, for example in UK 2 between the variables *BL* and *MM*, the Maximal Eigenvalue Test will be upheld for the reasons noted in Section 4.5.2 above.

Table 5.8 Johansen cointegration test results

	BL* and *MB			***BL* and *MM***		
Country	Trace	M.E.	Lag	Trace	M.E.	Lag
Canada	29.00**	17.1*	1	16.95	10.04	1
Canada 1	42.65***	32.58***	1	9.59	6.32	1
Canada 2	25.25***	19.42**	1	10.67	6.16	1
France	24.72*	17.73*	3	21.27**	16.34**	3
Germany	23.67*	17.59*	1	26.8**	23.12**	1
Italy	34.31***	22.17**	5	30.48**	20.57**	5
Japan	60.23***	52.11***	1	60.2***	49.19***	1
UK	13.65	11.70	1	40.62***	34.57***	1
UK 1	12.91	10.51	1	9.93	7.15	1
UK 2	25.62*	22.4**	1	23.24	20.47**	1
US	20.78	17.29*	5	26.07**	19.30*	5
US 1	11.35	8.95	1	20.4	14.11	1
US 2	19.1	14.3	1	47.51***	41.44***	1
	MS* and *Y					
Country	Trace	M.E.	Lag			
Canada	33.09***	26.99***	2			
Canada 1	24.75*	19.54**	2			
Canada 2	30.54**	20.28**	2			
France	26.36***	22.01***	1			
Germany	23.83*	16.67	3			
Italy	28.75**	23.59**	5			
Japan	31.86***	25.56***	2			
UK	25.81***	20.94***	2			
UK 1	4.89	3.39	1			
UK 2	20.26***	15.89***	1			
US	20.49	10.35	2			
US 1	18.82	11.41	1			
US 2	27.76***	23.66***	2			

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2 = (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). *BL* denotes bank loans, *MB* is monetary base, *MM* is money multiplier, *MS* is money supply and *Y* is income. Trace is Trace Test statistic and M.E. is Maximal Eigenvalue Test statistic. ***, **, * denote significance at the 1, 5 and 10 percent levels respectively.

The null hypothesis of the cointegration tests is that there is no cointegrating vector against the alternative that there is at most one cointegrating vector. The cointegration tests include a linear trend for all samples with the

exception of testing for cointegration between bank loans and money multiplier in France and between money supply and income in France, UK, UK 1 and 2 as the unit root tests showed that the trend was insignificant. Thus, for a cointegration test that includes a linear trend, the MacKinnon, Haug and Michelis (1999) critical values for the Trace Test are 31.15, 25.78 and 23.34 and for the Maximal Eigenvalue Test the critical values are 23.97, 19.38 and 17.23 for 1, 5 and 10 percent level of significance respectively. For cointegration tests that include a constant only, the critical values for the trace tests are 25.07, 20.26 and 17.98 and the Maximal Eigenvalue Test statistics will be tested against the critical values of 20.16, 15.89 and 13.90 at the 1, 5 and 10 percent level of significance respectively.

The results suggest that the non-cointegration hypothesis between the bank loans and monetary base is rejected at one and five percent for Canada 1 and 2, Italy, Japan and UK 2. The null hypothesis of no cointegration between bank loans and monetary base is also rejected at the ten percent level in Canada, Germany, and France. As non-cointegration is rejected for the Maximal Eigenvalue Test in the US but not for the Trace Test, the results for the Maximal Eigenvalue Test were used.

The cointegration results are supportive of the hypothesis that the relationship between bank loans and broad money multiplier is stable in the long run in France, Germany, Italy, Japan, UK and US 2, since the null hypothesis is rejected at the one and five percent level of significance but significant at the five percent level for the Trace Test. UK 2 was found to have a discrepancy between the Trace Test and Maximal Eigenvalue Test. Since the Maximal Eigenvalue Test of 20.47 was found to be significant at the five percent level of significance, it was deduced that there is at least one cointegrating vector between bank loans and money multiplier.

Most of the samples have a cointegrating vector between money supply and income at the one and five percent levels of significance. However, UK 1, US and US 1 were found to have no cointegrating vector present between the two variables. For Germany, the Trace Test indicates that the non-cointegration

hypothesis between money supply and income is rejected at the ten percent level. But the opposite is true according to the Maximal Eigenvalue Test. Thus, it was concluded that there is no cointegrating vector between money supply and income in Germany.

From the results of the cointegration tests, the causality tests using VECM and Granger causality are performed. The results of these tests are provided in the next section.

5.3.3 Results of the causality tests

Results for the long-run and short-run causality tests are summarised in Table 5.10 (page 116). The detailed results are provided in Appendix A5.1. Table 4.1 outlines the hypotheses of all three post-Keynesian views of money endogeneity as well as the monetarist view, reproduced here from Chapter 4 for the convenience of the reader.

Extracted from Chapter 4, Table 4.1, p. 68

Monetarist	**Accommodationist**	**Structuralist**	**Liquidity Preference**
$MB \Rightarrow BL$	$BL \Rightarrow MB$	$BL \Leftrightarrow MB$	$BL \Leftrightarrow MS$
$MS \Rightarrow BL$	$BL \Rightarrow MS$	$BL \Leftrightarrow MM$	
$MS \Rightarrow Y$	$Y \Leftrightarrow MS$	$Y \Leftrightarrow MS$	

Note: *BL* denotes bank loans, *MB* is monetary base, *MM* is money multiplier, *MS* is money supply and *Y* is income.

The variables that were found to be cointegrated will be tested for long-run and short-run causality using vector error-correction modelling (VECM) and those that are found not to be cointegrated will be tested using the standard Granger (VAR) causality test, as explained in Section 4.5.3.

The error-correction terms in Table 5.9 (page 114) indicate all the signs are correct, that is, they are negative. This is consistent with the earlier results that all series are cointegrated. The US results indicate some positive and significant error-correction terms; however, these error-correction terms are calculated from the same cointegrating vector – that is, one cointegrating vector is used to calculate the error-correction term, as opposed to calculating a

different cointegrating vector for each causality pair. Thus, these terms are acceptable as they are the opposite sign of the other error-correction term.

The results suggest that the speed of adjustment for bank loans varies from 0.6 percent (Japan) to 26.2 percent (Italy) and the speed of adjustment for monetary base varies from 0.3 percent (Canada) to 44.6 percent (France). For bank loans and money multiplier, the magnitude of the error-correction term varies from 0.1 percent (Japan) to 42.2 percent (Germany). Furthermore, the speed of adjustment for income varies from 0.2 percent (UK) to 6.5 percent (UK 2).

In this section, the results in sub-section 5.3.3 are revisited and analysed in terms of the four views (including monetarist) of money supply. Table 5.10 (p. 116) consolidates the results. On which view of money endogeneity is supported, the evidence from our tests is mixed.

As mentioned above, UK 1 and US 1 show money is exogenous, a result in line with the monetarist view since causality runs from money supply to loans. This is due to the monetary policy regime adopted by the two countries during these two sample periods. From 1975 to 1992, the UK's monetary policy regime focused on monetary aggregates and the US followed a similar policy from 1975 to 1986, targeting monetary aggregates as discussed in Chapter 3.

Consistent with its monetary policy of targeting monetary aggregates, the evidence for Italy also supports the monetarist view, as causality runs from loans to monetary base and money multiplier in the long and short run. However, causality runs from loans to money supply in the long run, supporting the accommodationist view. It was also found there is bidirectional causality between money supply and income, as the error correction terms of 2.5 and 0.6 percent in Table 5.9 are significant at the one and five percent level of significance respectively.

Table 5.9 Error-correction terms

DV	*INDV*	*ECT*	*t-stat*	*ECT*	*t-stat*
Canada				**Japan**	
BL	*MB*	-0.003	[-0.448]	-0.006	[-7.641]***
MB	*BL*	-0.012	[-4.198]***	-0.003	[-1.743]*
BL	*MM*			-0.012	[-7.567]***
MM	*BL*			-0.001	[-0.163]
MS	*Y*	-0.027	[-4.473]***	-0.001	[-5.118]***
Y	*MS*	-0.009	[-2.254]**	0.002	[0.404]
Canada 1				**UK**	
BL	*MB*	-0.15	[-4.214]***		
MB	*BL*	-0.136	[-4.783]***		
BL	*MM*			-0.017	[-5.818]***
MM	*BL*			-0.008	[-2.779]***
MS	*Y*	-0.033	[-4.038]***	-0.005	[-4.130]***
Y	*MS*	0.013	[1.977]**	-0.002	[-1.955]*
Canada 2				**UK 2**	
BL	*MB*	-0.029	[-3.146]***	-0.215	[-3.652]***
MB	*BL*	-0.015	[-3.326]***	-0.358	[-2.467]**
BL	*MM*			-0.138	[-3.692]***
MM	*BL*			-0.306	[-2.452]**
MS	*Y*	0.079	[2.636]***	-0.024	[-4.587]***
Y	*MS*	-0.056	[-4.044]***	-0.065	[-3.333]***
France				**US**	
BL	*MB*	0.081	[2.846]***		
MB	*BL*	-0.446	[-3.021]***		
BL	*MM*	-0.069	[-3.16]***	-0.069	[-3.747]***
MM	*BL*	-0.318	[-2.441]**	0.121	[2.145]**
MS	*Y*	-0.087	[-3.356]***		
Y	*MS*	-0.035	[-3.315]***		
Germany				**US 2**	
BL	*MB*	0.029	[2.576]***		
MB	*BL*	-0.202	[-3.146]***		
BL	*MM*	-0.147	[-2.951]***	-0.001	[-6.921]***
MM	*BL*	-0.422	[-3.809]***	0.001	[2.431]**
MS	*Y*	-0.087	[-3.356]***	-0.033	[-4.824]***
Y	*MS*	-0.035	[-3.315]***	-0.005	[-0.951]
Italy					
BL	*MB*	-0.262	[-4.600]***		
MB	*BL*	-0.062	[-0.556]		
BL	*MM*	-0.113	[-4.398]***		
MM	*BL*	-0.067	[-0.857]		
MS	*Y*	-0.025	[-3.561]***		
Y	*MS*	-0.006	[-2.330]**		

Note: Numbers in square brackets are t-statistics. Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2 = (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). *ECT* is error-correction term. *BL* denotes bank loans, *MB* is monetary base, *MM* is money multiplier, *MS* is money supply and *Y* is income. ***, **, * denotes significance at the 1, 5 and 10 percent levels respectively.

Table 4.1 indicates support for both the accommodationist and the structuralist views. This means that money supply occurs from banking credit creation as changes in money income affect demand in bank loans. The new loans created also create deposits, which are then used to finance the change in demand. This would also explain the support for the monetarist view in the short run between loans and monetary base and multiplier.

In the case of Japan, the evidence indicates mixed results between the four hypotheses tested. Causality between bank loans and monetary base supports the structuralist view, evident from the significant error-correction terms of 0.6 and 0.3 percent in Table 5.9, while causality between bank loans and money supply supports the liquidity preference view in the long run as the error-correction terms are found to be 6.6 and 1.4 percent in Table 5.9. Both views are consistent with the PK theory. However, it was also found that the money multiplier causes bank loans in Japan, which is a support for the monetarist view. This may mean that liability management practices are lacking in Japan. The Japanese literature recognises the non-independence of corporations to manage liability given the nature of the main banking system (one long-standing relationship-based bank provides capital in times of need as this bank holds about 30 percent of the share capital of the firm) and the practice of *keiretsu* firms providing financing to each other. Structuralists identify liability management practices as an alternative to supplement reserve shortages; thus an increase for loan demand causes liability transformation, so that credit causes an increase in the money multiplier. In the short run, loans cause money supply and there is bidirectional causality between money supply and income.

For the rest of the countries – Canada, Canada 1, Canada 2, France, Germany, UK, UK 2, US and US 2 – the evidence leans towards the three views of money endogeneity theory in the long run. For instance, in France, the results indicate that causality between bank loans and monetary base, bank loans and money multiplier, and money supply and income, support the structuralist[38] view in that there is bidirectional causality between the variables. In addition, it was

[38] The accommodationist view is also supported in the case of money supply and income.

found that the liquidity preference view is supported as there is bidirectional causality between bank loans and money supply.

Table 5.10 Summary of endogenous money views found in G-7 countries

	VECM		**GR**	**VECM**		**GR**	**VECM**		**GR**
	LR	*SR*		*LR*	*SR*		*LR*	*SR*	
	Canada (MT/INF)			**Canada 1 (MT)**			**Canada 2 (INF)**		
BL & *MB*	AC			ST			ST		
BL & *MM*			MO			AC			
BL & *MS*			AC	LP			AC		
MS & *Y*	AC / ST			AC / ST	MO		AC / ST	MO	
	France (MT/INF)			**Germany (MT/INF)**					
BL & *MB*	ST	MO		ST	AC				
BL & *MM*	ST	ST		ST	MO				
BL & *MS*	LP	MO		AC	AC				
MS & *Y*	AC / ST					MO			
	Italy (MT)			**Japan (MT/INF)**					
BL & *MB*	MO	MO		ST					
BL & *MM*	MO	MO		MO					
BL & *MS*	AC			LP	AC				
MS & *Y*	AC / ST			INC	AC / ST				
	UK (MT/INF)			**UK 1 (MT)**			**UK 2 (INF)**		
BL & *MB*			AC				ST		
BL & *MM*	ST						ST		
BL & *MS*	AC	MO				MO	LP		
MS & *Y*	AC / ST						AC / ST		
	US (MT/INT)			**US 1 (MT)**			**US 2 (INT)**		
BL & *MB*									
BL & *MM*	ST						ST	AC	
BL & *MS*	LP	MO		MO			LP		
MS & *Y*			INC				INC	INC	

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2 = (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). *LR* and *SR* are long-run and short-run conclusion based on the Vector Error-Correction Model (*VECM*), while *GR* stands for Granger causality. *BL* denotes bank loans, *MB* is monetary base, *MM* is money multiplier, *MS* is money supply and *Y* is income. AC is Accommodationist, ST is Structuralist, LP is Liquidity Preference, MO is Monetarist view and INC indicates the results are inconclusive. Monetary policies are given in parentheses where MT, INF and INT are monetary, inflation and interest rate targeting respectively.

The long-run evidence supports the structuralist view for causality between bank loans and monetary base and also between bank loans and money

multiplier. Liquidity preference view was found in Canada 1, France, UK 2, US and US 2 as there is bidirectional causality between money supply and bank loans. This implies that both the demand for money and the demand for loans are independent, as new deposit owners have independent liquidity preferences about the amount of money they wish to hold. Palley (1994), however, classifies the same finding under the structuralist approach. Bank loans cause money supply in Canada 2, Germany and UK, supporting the accommodationist view. The causality between money supply and income was found to be bidirectional in most cases except in US 2.

In summary, countries with a pure monetary targeting regime, that is, UK 1, Italy and US 1 still had the monetarist view supported in our tests in the long run. Canada 1 was the exception to this pattern. With the mixed monetary policy regimes (Canada, France, Germany, Japan, UK and US), the money endogeneity views were more evident in our tests.

In the short run, the evidence on the conduct of monetary policies of the central banks is mixed. In interpreting the results, the Granger causality tests are also included as short-run causality. Most of the short-run results indicate support for either the monetarist view or the accommodationist view, with the exception of bank loans and money multiplier in France, where there is bidirectional causality giving support for the structuralist view. It is interesting to note that countries with monetary aggregate targeting as their monetary policy (Canada 1, Italy, UK 1 and US 1) had results consistent with monetarist view in the short term, while those with a mixed monetary policy regime over the years (for example, France, Germany and Japan) yielded results indicative of a mixed endogenous (mostly accommodationist) and exogenous view in the short term. This means that even though money is endogenous in the long run in some of these countries, central banks still maintain an intervening operation in the short run – for example, the UK and the US are found to have unidirectional causality from money supply to bank loans, supporting the monetarist view. In the UK, loans also cause monetary base in the short run, which means any demand for reserves is fully accommodated by the Bank of England.

Canada, Germany and Japan are found to support the accommodationist view, with Canada and Germany also supporting the monetarist view as the money multiplier causes bank loans only. An explanation for this could be that as the demand for reserves is fully accommodated, true to the accommodationist beliefs, this change in reserves also changes the reserves ratio in the money multiplier. This in turn affects loans.

As the sample period for France and Italy ends before the start of the European Monetary System, the short-run results are indicative of the type of monetary policy adopted by these countries before the full advent of the euro. Both countries set monetary aggregate targets during this time. It is interesting to note that Germany was also a monetary targeting country but has an accommodationist view between bank loans and monetary base. This could be a reason why Germany was found to have an endogenous money supply in both the short run and the long run. The evidence towards money endogeneity in Germany is similar to Holtemöller's (2003) results.

There has been little evidence of which money endogeneity view (whether accomodationist, structuralist or liquidity preference) is in favour in the G-7 countries. Most studies of this kind concentrate mainly on emerging economies, for example, Shanmugam, Nair and Li (2003), Vymyatnina (2006) and Cifter and Ozun (2007) for Malaysia, Russia and Turkey respectively. Results of the bivariate tests, especially between bank loans and money supply, have been used in a number of studies, for example Howells and Hussein (1998) and Vera (2001). However, these tests may have suffered from the possibility that the results were invalid because of an omitted variable. In this thesis, we have used a variety of hypotheses specifically to test not only the money endogeneity, but also the question of whether it supports the accommodationist, structuralist or liquidity preference view. The results clearly answer these questions for each country, both in the short run and the long run. Having obtained evidence from G-7 countries on this important issue could be considered a significant contribution of this thesis.

The next section will use the Toda and Yamamoto (1995) trivariate VAR to test for the validity of earlier inferences between bank loans and money supply, with the existence of a third variable: deposits.

5.4 Results of the trivariate VAR

As the Toda and Yamamoto (1995) analysis requires the maximum order of integration (d_{max}) of the variables and the lag length (k), unit root tests (Phillips-Perron) and the VAR optimal lag length tests are conducted in the first instance. Unit root tests for the logarithm of deposits were conducted similar to Section 4.5.1, to test for stationarity. Unit root tests for bank loans and money supply have been conducted in Section 5.2.1. Thus, Table 5.11 summarises the results of unit root tests for deposits only.

Table 5.11 Unit root test results (Phillips-Perron)

	Deposits (DEP)		**Critical values**		
	Level	*Difference*	*1%*	*5%*	*10%*
Canada	-2.177	-11.004***	-4.035	-3.447	-3.149
Canada 1	-1.742	-6.512***	-4.127	-3.491	-3.174
Canada 2	-1.956	-8.343***	-4.106	-3.480	-3.168
France	-0.504	-6.508***	-4.176	-3.513	-3.187
Germany	-2.818	-8.622***	-4.085	-3.471	-3.162
Italy	-2.214	-7.299***	-4.108	-3.482	-3.169
Japan	-2.051	-16.249***	-4.027	-3.443	-3.146
UK	-1.591	-11.425***	-4.034	-3.446	-3.148
UK 1	-1.277	-8.442***	-4.095	-3.475	-3.165
UK 2	-1.447	-7.563***	-4.137	-3.495	-3.177
US	0.028	-10.251***	-4.032	-3.446	-3.148
US 1	-0.144	-7.832***	-4.176	-3.513	-3.187
US 2	-1.044	-8.023***	-4.075	-3.466	-3.160

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2 = (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). *** denotes significance at the 1 percent level.

The results show that the null hypothesis of non-stationarity could not be rejected for all countries. The series was then tested for stationarity in first difference form and the results indicate that the series was *I(1)* for all countries. Both bank loans and money supply are also found to be *I(1)* from Section 5.3.1. Thus, the maximum order of integration (d_{max}) is 1 in all countries.

As in Section 5.2.2, the VAR optimal lag length was determined using Schwarz Bayesian Criteria (*SBC*). VAR (1) is preferred in most cases as the optimal lag length between bank loans, deposits and money supply in Canada, Canada 2, France, UK, UK 1 and 2, US, and US 1 and 2, as provided in Table 5.12. The lag length of two is preferred for Canada 1, Germany and Japan as the SBC of -17.247, -15.711 and -15.707 respectively are the lowest among all the SBC, while in Italy SBC of -15.345 indicates VAR of lag length 5 should be employed. Following this, the Toda and Yamamoto (1995) VAR causality test is performed.

Table 5.12 VAR optimal lag length

BL*, *DEP* and *MS							
	Lag 0	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5	Lag 6
Canada	-3.176	-14.290*	-14.050	-13.758	-13.467	-13.269	-13.032
Canada 1	-8.398	-17.205	-17.247*	-16.739	-16.371	-16.233	-16.066
Canada 2	-5.007	-14.128*	-13.723	-13.331	-12.831	-12.635	-12.420
France	-10.198	-17.875*	-17.778	-17.489	-17.253	-17.260	-16.641
Germany	-6.385	-15.562	-15.711*	-15.359	-14.922	-15.052	-14.550
Italy	-7.596	-14.765	-14.225	-13.868	-14.172	-15.345*	-14.896
Japan	-1.361	-15.523	-15.707*	-15.620	-15.576	-15.628	-15.440
UK	0.070	-12.520*	-12.295	-11.986	-11.698	-11.438	-11.131
UK 1	-0.864	-11.524*	-11.071	-10.605	-10.145	-9.892	-9.427
UK 2	-6.784	-16.661*	-16.216	-15.621	-15.217	-14.948	-14.618
US	-2.910	-17.998*	-17.846	-17.533	-17.295	-17.510	-17.293
US 1	-8.194	-17.678*	-17.113	-16.557	-15.984	-16.083	-15.563
US 2	-5.191	-18.632*	-18.346	-18.056	-17.686	-17.887	-17.578

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2 = (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). *BL* denotes bank loans, *DEP* is deposits, and *MS* is money supply. * indicates optimal lag length

Table 5.13 summarises the results of the trivariate VAR tests. In order to compare the results from previous findings, Table 5.5 is reproduced for the reader. The results are detailed in Appendix A5.2.

Table 5.13 Trivariate VAR results

DV	*INDV*	Canada	Canada 1	Canada 2	
BL	*DEP*	$DEP \Rightarrow BL$			
BL	*MS*	$MS \Rightarrow BL$	$MS \Rightarrow BL$	$MS \Rightarrow BL$	
BL	*DEP & MS*	$DEP\&MS \Rightarrow BL$	$DEP\&MS \Rightarrow BL$	$DEP\&MS \Rightarrow BL$	
DEP	*BL*				
DEP	*MS*		$MS \Rightarrow DEP$		
DEP	*BL & MS*	$BL\&MS \Rightarrow DEP$	$BL\&MS \Rightarrow DEP$	$BL\&MS \Rightarrow DEP$	
MS	*BL*	$BL \Rightarrow MS$			
MS	*DEP*	$DEP \Rightarrow MS$			
MS	*BL & DEP*	$BL\&DEP \Rightarrow MS$	$BL\&DEP \Rightarrow MS$		
		France	**Germany**	**Italy**	**Japan**
BL	*DEP*	$DEP \Rightarrow BL$			$DEP \Rightarrow BL$
BL	*MS*				$MS \Rightarrow BL$
BL	*DEP & MS*	$DEP\&MS \Rightarrow BL$			$DEP\&MS \Rightarrow BL$
DEP	*BL*	$BL \Rightarrow DEP$			$BL \Rightarrow DEP$
DEP	*MS*		$MS \Rightarrow DEP$		
DEP	*BL & MS*				$BL\&MS \Rightarrow DEP$
MS	*BL*	$BL \Rightarrow MS$	$BL \Rightarrow MS$		$BL \Rightarrow MS$
MS	*DEP*		$DEP \Rightarrow MS$	$DEP \Rightarrow MS$	
MS	*BL & DEP*		$BL\&DEP \Rightarrow MS$	$BL\&DEP \Rightarrow MS$	$BL\&DEP \Rightarrow MS$
		UK	**UK 1**	**UK 2**	
BL	*DEP*				
BL	*MS*	$MS \Rightarrow BL$	$MS \Rightarrow BL$		
BL	*DEP & MS*	$DEP\&MS \Rightarrow BL$	$DEP\&MS \Rightarrow BL$		
DEP	*BL*			$BL \Rightarrow DEP$	
DEP	*MS*	$MS \Rightarrow DEP$		$MS \Rightarrow DEP$	
DEP	*BL & MS*	$BL\&MS \Rightarrow DEP$		$BL\&MS \Rightarrow DEP$	
MS	*BL*	$BL \Rightarrow MS$	$BL \Rightarrow MS$	$BL \Rightarrow MS$	
MS	*DEP*	$DEP \Rightarrow MS$	$DEP \Rightarrow MS$		
MS	*BL & DEP*		$BL\&DEP \Rightarrow MS$	$BL\&DEP \Rightarrow MS$	
		US	**US 1**	**US 2**	
BL	*DEP*	$DEP \Rightarrow BL$			
BL	*MS*		$MS \Rightarrow BL$	$MS \Rightarrow BL$	
BL	*DEP & MS*	$DEP\&MS \Rightarrow BL$	$DEP\&MS \Rightarrow BL$	$DEP\&MS \Rightarrow BL$	
DEP	*BL*	$BL \Rightarrow DEP$		$BL \Rightarrow DEP$	
DEP	*MS*	$MS \Rightarrow DEP$		$MS \Rightarrow DEP$	
DEP	*BL & MS*	$BL\&MS \Rightarrow DEP$		$BL\&MS \Rightarrow DEP$	
MS	*BL*	$BL \Rightarrow MS$		$BL \Rightarrow MS$	
MS	*DEP*	$DEP \Rightarrow MS$		$DEP \Rightarrow MS$	
MS	*BL & DEP*	$BL\&DEP \Rightarrow MS$		$BL\&DEP \Rightarrow MS$	

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2= (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). $\Rightarrow$ indicates unidirectional causality. *BL* denotes bank loans, *DEP* is deposits and *MS* is money supply.

Overall, the results show that causality exists either between loans and deposits or between deposits and money supply. In France, Japan and UK 2, it was found that bank loans cause deposits but deposits do not cause money supply.

In Canada, Germany, Italy, UK and UK 1, it was found that deposits cause money supply but loans do not cause deposits.

Extracted from Table 5.5, p. 104

	LR	*SR*	*Granger*	*Conclusion*
Canada			$BL \Rightarrow MS$	ENDO
Canada 1	$BL \Leftrightarrow MS$			ENDO
Canada 2	$BL \Rightarrow MS$			ENDO
France	$BL \Leftrightarrow MS$	$MS \Rightarrow BL$		ENDO
Germany	$BL \Rightarrow MS$	$BL \Rightarrow MS$		ENDO
Italy	$BL \Rightarrow MS$			ENDO
Japan	$BL \Leftrightarrow MS$	$BL \Rightarrow MS$		ENDO
UK	$BL \Rightarrow MS$	$MS \Rightarrow BL$		ENDO
UK 1			$MS \Rightarrow BL$	EXO
UK 2	$BL \Leftrightarrow MS$			ENDO
US	$BL \Leftrightarrow MS$	$MS \Rightarrow BL$		ENDO
US 1	$MS \Rightarrow BL$			EXO
US 2	$BL \Leftrightarrow MS$			ENDO

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2 = (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). $\Rightarrow$ indicates unidirectional causality and $\Leftrightarrow$ indicates bidirectional causality. *BL* denotes bank loans and *MS* is money supply. EXO and ENDO indicate money supply as exogenous and endogenous respectively.

The results also show that in all these countries, bank loans cause money supply. Also, it can be deduced that money supply causes bank loans in Canada, Japan, UK and UK 1, as it was found that there was either causality from money supply to deposits, or from deposits to loans (but not both); and that there is also an existing causality link between money supply and bank loans. These links were not found for France, Germany and UK 2. For UK 2, the finding is similar to that of Caporale and Howells (2001), who found causality from loans to money supply but not from money supply to loans. This makes the earlier findings in Section 5.3.3 for Canada, France, Germany, Japan, UK, UK 1, and UK 2 robust.

For the UK, this also confirms the earlier findings of Howells and Hussein (1998) and Caporale and Howells (2001). However, where Caporale and Howells (2001) used total transactions as the third omitted variable, in this thesis demand deposits have been used. Caporale and Howells found that transactions

do not cause deposits and/or loans; thus their finding, and also the Howells and Hussein (1998) finding for the UK that loans cause money supply, appears to be valid.

There is a strong causal link between money supply and bank loans in Canada 1 and US 1. For US 1, the results are similar to those from Table 5.5, but for UK 1 and Canada 1, there are differences in the results. In Canada 1, causality was bidirectional in the previous result, whereas money supply causes bank loans only when deposits are included. However, for UK 1 it was found that there is bidirectional causality between money supply and loans, but money supply was found to be exogenous in Section 5.2.

Conflicting results are also found for Canada 2 and Italy. Canada's monetary policy regime during this period (1991:1 to 2007:1) was inflation targeting, while Italy conducted monetary aggregate targeting as its monetary policy regime before the euro, as discussed in Chapter 3. Previous results for Canada and Italy in Section 5.2.3 showed causality running from bank loans to money supply, in support for endogenous money. For both samples, the result that bank loans cause money supply was not found with the inclusion of deposits. For Canada 2, money supply causes bank loans, and for Italy, the relationship does not exist at all.

In the case of US and US 1, the results show that demand deposits play an important role in the financial system, as it was found that bank loans cause deposits and in turn deposits cause money supply. However, on top of this, other types of deposits are also important, as the causal link between bank loans and money supply exists. This is interesting as, unlike the other countries under investigation, the US and US 2 have a monetary policy of targeting interest rates. Besides Caporale and Howells (2001), there has been no research that focused on running trivariate VAR causality between bank loans, deposits and money supply in the G-7 countries. This may be taken as another important contribution of this thesis.

As loans and deposits are an important factor in money endogeneity and also in equity valuation, it would be interesting to investigate whether there is a causal link between money supply and bank stock returns. This will be provided in the next section.

5.5 Money supply and bank stock prices

In the post-Keynesian theory, the central bank only exercises control over short-term interest rates. If inflation is below the central bank's target, then the central bank may reduce interest rates to stimulate the economy, which increases demand for loans, subsequently raising money supply. As loans have an effect on banks' profit margins, then any changes in loans would affect profits and ultimately stock prices under the dividend valuation theory. The decrease in interest rates might also mean that one can earn less through deposit accounts relative to stocks or bonds. Thus, stock prices will be affected. This section will investigate whether there is a relationship between money supply and bank stock prices (returns), using VECM. As in previous sections, unit root and cointegration tests are conducted beforehand.

5.5.1 Results of the unit root tests

Before the VECM test can be conducted, a few preliminary tests need to be performed, as in previous sections. Again, the unit root test in the context of Phillips and Perron (1988) is used to test the stationarity of the bank price index.

The results provided in Table 5.14 show that the variables are non-stationary in levels but stationary in first differences. As money supply was also found as *I(1)* in Section 5.2.1, the two series are integrated of the same order and cointegration can be tested using the Johansen (1988) method.

Table 5.14 Unit root test results (Phillips-Perron)

	Bank stock prices (P)		Critical values		
	Level	Difference	1%	5%	10%
Canada	0.640	-11.064***	-4.035	-3.447	-3.149
Canada 1	-1.348	-5.810***	-4.127	-3.491	-3.174
Canada 2	-0.447	-9.486***	-4.106	-3.480	-3.168
France	-0.774	-5.436***	-4.176	-3.513	-3.187
Germany	-1.130	-7.317***	-4.085	-3.471	-3.162
Italy	-1.514	-7.308***	-4.108	-3.482	-3.169
Japan	-1.296	-11.309***	-4.027	-3.443	-3.146
UK	-0.704	-14.309***	-4.034	-3.446	-3.148
UK 1	-0.944	-15.716***	-4.095	-3.475	-3.165
UK 2	2.147	-7.091***	-4.137	-3.495	-3.177
US	-0.495	-10.399***	-4.032	-3.446	-3.148
US 1	1.858	-6.418***	-4.176	-3.513	-3.187
US 2	-0.333	-8.173***	-4.075	-3.466	-3.160

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2 = (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). *** denotes significance at the 1 percent level.

5.5.2 Results of the cointegration tests

Prior to the Johansen cointegration test, the optimal lag length to be used in the cointegration test is determined using vector autoregression (VAR). This is similar to the procedure described in Section 5.2.2. Table 5.15 shows that the lag length of one is chosen by the Schwarz Bayesian Criterion (SBC) as the optimal lag length in Canada 2, France, Germany, UK 1, UK 2, US 1 and US 2. VAR(2) is the optimal lag length preferred in Canada, Canada 1, Japan, UK and US as the SBC is the lowest among the seven lags tested – for example, in Canada the SBC of -7.908 is the lowest. The lag length of five is chosen for Italy as the SBC of -5.47 is the lowest among all the lags. These lag lengths will be used to determine whether a long-run equilibrium exists between bank stock returns and money supply.

Table 5.15 VAR optimal lag length

MS* and *RET							
Country	**Lag 0**	**Lag 1**	**Lag 2**	**Lag 3**	**Lag 4**	**Lag 5**	**Lag 6**
Canada	2.248	-7.907	-7.908*	-7.827	-7.750	-7.668	-7.604
Canada 1	-0.271	-7.529	-7.717*	-7.504	-7.317	-7.225	-7.208
Canada 2	-0.352	-8.479*	-8.294	-8.067	-8.003	-7.761	-7.605
France	-2.479	-7.133*	-7.070	-6.806	-6.464	-6.257	-6.205
Germany	0.837	-6.444*	-6.270	-6.064	-5.909	-5.690	-5.483
Italy	1.261	-4.373	-4.492	-4.480	-4.871	-5.470*	-5.365
Japan	3.527	-7.984	-8.150*	-8.015	-7.920	-7.897	-7.855
UK	3.512	-7.391	-7.412*	-7.377	-7.268	-7.160	-7.085
UK 1	0.784	-7.490*	-7.440	-7.356	-7.171	-7.120	-6.956
UK 2	0.398	-7.668*	-7.438	-7.193	-6.922	-6.746	-6.696
US	2.093	-8.810	-8.894*	-8.754	-8.642	-8.499	-8.454
US 1	0.140	-9.929*	-9.623	-9.390	-9.215	-8.973	-8.771
US 2	1.190	-8.562*	-8.483	-8.283	-8.121	-7.995	-8.008

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2 = (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1).

Both Trace and Maximal Eigenvalue test statistics are reported in Table 5.16. As the tests included only a constant, the MacKinnon, Haug and Michelis (1999) critical values for the Trace tests are 25.07, 20.26 and 17.98 and for the Maximal Eigenvalue tests are 20.16, 15.89 and 13.90 at the 1, 5 and 10 percent level of significance respectively.

Table 5.16 Johansen cointegration test

MS* and *RET			
Country	**Trace**	**M.E.**	**Lag**
Canada	27.48***	20.48***	2
Canada 1	24.28*	18.79*	2
Canada 2	56.83***	52.67***	1
France	19.80*	16.24**	1
Germany	40.84***	33.72***	1
Italy	21.62***	14.14*	5
Japan	29.72***	25.82***	2
UK	30.96***	27.59***	2
UK 1	27.48***	25.02***	1
UK 2	38.12***	31.58***	1
US	20.18*	15.26*	2
US 1	15.32	11.24	1
US 2	32.16***	30.15***	1

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2 = (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). Trace is Trace Test statistic and M.E. is Maximal Eigenvalue Test statistic. ***, **, * denotes significance at the 1, 5 and 10 percent levels respectively.

The results show that bank stock returns and money supply were not cointegrated in US 1. In the rest of the sample, bank stock returns and money supply have a long-run equilibrium relationship, and this is significant at the one percent level in Canada, Canada 2, Japan, Germany, UK, UK 1 and 2 and US 2.

Bank stock returns and money supply are also cointegrated at the five percent level of significance in France, and ten percent significance in Canada 1, Italy, and US. Where there are discrepancies between the results, for example in Italy, where the Trace Test statistic is significant at the one percent level and the Maximal Eigenvalue is significant at the ten percent level, the result of the Maximal Eigenvalue dominates, following Johansen and Juselius (1990).[39] As US 1 was found not be cointegrated, then only the Granger causality test will be performed on the two variables in this sample.

5.5.3 Results of the causality tests

The long-run and short-run conclusions of the VECM results are summarised in Table 5.18. Details of the results are provided in Appendix A5.3. The results in Table 5.17 show that the error-correction terms are of the expected sign, that is, negative. The magnitude of the error-correction term for money supply causing returns ranges from 0.6 percent (UK) to 49.7 percent (UK 1), while causality running from returns to money supply ranges from 0.1 percent (UK 2) to 3.7 percent (Italy).

[39] This is also mentioned in Section 4.5.2

Table 5.17 Error-correction terms

DV	*INDV*	*Country*	*ECT*	*t-stat*	*Country*	*ECT*	*t-stat*
RET	*MS*	**Canada**	-0.05	[-1.943]*	**Japan**	-0.036	[-1.642]*
MS	*RET*		0.008	[2.888]***		-0.002	[-1.762]*
RET	*MS*	**Canada 1**	-0.485	[-4.435]***	**UK**	-0.006	[-1.951]*
MS	*RET*		0.014	[0.949]		-0.001	[-4.755]***
RET	*MS*	**Canada 2**	-0.022	[-1.262]	**UK 1**	-0.497	[-5.007]***
MS	*RET*		-0.012	[-8.365]***		0.021	[1.616]
RET	*MS*	**France**	-0.029	[-0.717]	**UK 2**	-0.062	[-2.510]**
MS	*RET*		0.012	[4.260]***		-0.01	[-5.296]***
RET	*MS*	**Germany**	-0.009	[-6.173]***	**US**	-0.052	[-1.642]*
MS	*RET*		-0.015	[-1.643]*		0.007	[3.150]***
RET	*MS*	**Italy**	-0.156	[-1.640]*	**US 2**	-0.011	[-0.351]
MS	*RET*		0.037	[3.057]***		0.007	[3.670]***

Note: Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2 = (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). ***, **, * denote significance at the 1, 5 and 10 percent levels respectively. *MS* is money supply and *RET* is bank returns.

Table 5.18 Results of causality test: *MS* and *RET*

Country	**LR Conclusion**	**SR Conclusion**
Canada	$MS \Leftrightarrow RET$	$MS \Rightarrow RET$
Canada 1	$MS \Rightarrow RET$	
Canada 2	$RET \Rightarrow MS$	
Japan	$MS \Leftrightarrow RET$	
Germany	$MS \Leftrightarrow RET$	
France	$RET \Rightarrow MS$	
Italy	$MS \Leftrightarrow RET$	$MS \Rightarrow RET$
UK	$MS \Leftrightarrow RET$	
UK 1	$MS \Rightarrow RET$	$RET \Rightarrow MS$
UK 2	$MS \Leftrightarrow RET$	
US	$MS \Leftrightarrow RET$	
US 2	$RET \Rightarrow MS$	

Note: LR = long run and SR = short run, $\Rightarrow$ indicates unidirectional causality and $\Leftrightarrow$ indicates bidirectional. Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:3), UK 2= (1992:4 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). *MS* is money supply and *RET* is bank returns.

Overall, there exists at least one-way causality from money supply to bank stock returns in the long run and in the short run. It was found that money supply caused bank stock returns in UK 1 in the long run; however, in the short run, returns caused money supply. In Canada 1 in the long run and Canada and Italy in the short run, the evidence shows that money supply causes bank stock returns only. In the case of Canada 2, France and US 2, it was found that bank stock returns caused money supply instead. There was no causality found

between money supply and bank stock returns when the Granger causality test was performed for US 1. The results are provided in Appendix A5.3, Panel C.

5.6 Simultaneous equations estimation

The causality tests between bank stock returns and money supply in Section 5.5.3 confirm the hypothesis that there is a relationship between the two variables. Furthermore, there is evidence that there is bidirectional causality between the two variables. Thus, since it is hypothesised that profit-making by banks and movements from loans to money supply vis-à-vis money endogeneity occur simultaneously, panel data estimation is performed. The model proposed in Chapter 4 is repeated below:

$$P_{it} = f\left[\underset{+}{ES}, \underset{+}{MS}\right] \tag{4.4}$$

$$MS_{it} = f\left[\underset{+}{BL}, \underset{+}{INF}, \underset{+}{RbRf}, \underset{+}{P}\right] \tag{4.5}$$

$$BL_{it} = f\left[\underset{+}{MS}, \underset{+}{Y}, \underset{-}{RlRd}\right] \tag{4.6}$$

where P_{it} is bank stock price in country i at time t, BL is bank loans, MS is money supply, INF is inflation, Y is income, ES is bank earnings spread $= \left[Rl \times L - Rd \times DEP\right]$, $RbRf$ is domestic-to-foreign interest rate differential $= Rb - Rf$, and $RlRd$ is net interest margin $= Rl - Rd$. All variables are in logarithmic form except $RbRf$ and $RlRd$.

Split samples for Canada, the US and the UK, as in previous sections (5.2 to 5.5), are not applied here, as the purpose of the panel data estimation is to investigate whether there is a simultaneous relationship between loans, money supply and bank stock returns.

Before the panel data are estimated, a number of preliminary tests are conducted. These are to ensure that the variables are stationary and subsequently that there is causality, not merely correlation, between the predetermined and endogenous variables. The tests include panel unit root tests proposed by Maddala and Wu (1999) and Choi (2001), panel cointegration following Pedroni (1999, 2004) and vector error-correction model estimation. Discussion of the

tests and their results is provided in the next sections, beginning with panel unit root tests.

5.6.1 Results of the panel unit root tests

Table 5.19 summarises the results of the Maddala and Wu (1999) and Choi (2001) Fisher tests. All variables are in logarithmic form except for domestic-to-foreign interest rate differential (*RbRf*) and interest rate margin (*RlRd*). For *RbRf* and *RlRd*, these variables are the difference between two percentages; thus there is no need to transform these variables. The hypotheses tested are: H_0: each series in the panel contains a unit root, against H_1: at least one of the individual series in the panel is stationary.

Table 5.19 Unit root test – Fisher Phillips-Perron tests

	Fisher chi-square statistic		***Choi Z-statistic***	
Variables	*Level*	*Difference*	*Level*	*Difference*
P	5.496	405.587***	2.858	-18.323***
	(0.9776)	(0)	(0.9979)	(0)
MS	17.835	186.885***	0.025	-11.515***
	(0.2144)	(0)	(0.51)	(0)
ES	8.628	292.975***	3.074	-14.863***
	(0.8541)	(0)	(0.9989)	(0)
BL	5.819	440.749***	1.688	-19.724***
	(0.9708)	(0)	(0.9543)	(0)
RbRf	39.455***		-4.057***	
	(0.0003)		(0)	
INF	5.501	176.706***	1.332	-10.981***
	(0.8712)	(0)	(0.9086)	(0)
Y	6.119	345.168***	3.330	-16.714***
	(0.9634)	(0)	(0.9996)	(0)
RlRd	28.319**		-1.830**	
	(0.0129)		(0.0336)	

Note: Numbers in parentheses are *p*-values. ***, **denote significance at the 1 and 5 percent levels respectively. *P* is bank stock price, *ES* is bank earnings spread, *BL* is bank loans, *MS* is money supply, *INF* is inflation, *RbRf* is domestic-to-foreign interest rate differential, *RlRd* is net interest margin and *Y* is income.

The results indicate that, besides *RbRf* and *RlRd*, the null hypothesis that the series contains a unit root cannot be rejected for all variables at the one percent level of significance. For example, the Fisher chi-square statistic and Choi *Z*-statistic were 17.84 and 0.025 respectively for money supply, with *p*-values of 0.21 and 0.51. The *p*-values are above the 10 percent level of

significance, indicating the null hypothesis cannot be rejected. The variables (except for *RbRf* and *RlRd*) are then tested for stationarity in first differences. The results show that the null hypothesis that the series is non-stationary when first differenced is rejected for the same variables. This means that all variables (besides *RbRf* and *RlRd*) are integrated of order one or *I(1).*

For *RbRf*, both the Phillips-Perron Fisher tests based on Maddala and Wu (1999) and Choi (2001) reject the null hypothesis that the series contains a unit root, thus making the variable stationary. The Fisher chi-square statistic of 28.32 and Choi *Z*-statistic of -1.83 together with the *p*-value of less than 5 percent indicate that *RlRd* is stationary at level under both tests at the 5 percent level of significance. The results indicate that *RbRf* and *RlRd* are *I(0).* Thus these variables are left in level form.

As most of the variables are found to be integrated of order one (*I(1)),* the next step is to test these series to determine whether they are cointegrated. The panel cointegration test is based on Pedroni (1999, 2004) and the results are reviewed in the next section.

5.6.2 Results of the panel cointegration tests

Four lags are chosen as the optimal number of lag lengths as the series are quarterly data. The Pedroni (1997) panel cointegration test results are provided in Table 5.20. The results for equation (4.4) show that the null of no cointegration is rejected for panel *v,* panel ADF, group rho and group ADF. The panel v-statistic was found to be 2.44, which is higher than the critical value of 1.64. Similarly, the panel ADF, group rho and group ADF were found to be -5.58, -1.79 and -7.19 respectively. As the Pedroni (1997) statistics are one-sided tests and these statistics are smaller than the critical value of -1.64, the panel ADF and group ADF statistics are found to be significant at the one percent level of significance, while the group rho was found to be significant at the ten percent level.

Table 5.20 Panel cointegration results - Pedroni (1997) test

Panel A: Within-dimension			
	Eq 4.4	*Eq 4.5*	*Eq 4.6*
Panel v-Statistic	2.44**	4.4***	0.72
Panel rho-Statistic	-1.34	-3.64***	-3.03***
Panel PP-Statistic	-1.11	-0.12	-0.59
Panel ADF-Statistic	-5.58***	-4.18***	-4.94***

Panel B: Between-dimension			
	Eq 4.4	*Eq. 4.5*	*Eq4.6*
Group rho-Statistic	-1.79*	-4.09***	-3.31***
Group PP-Statistic	-1.04	-0.29	-0.25
Group ADF-Statistic	-7.19***	-7.21***	-5.77***

Note: ***, **, * denote significance at the 1, 5 and 10 percent levels respectively. Pedroni (1997) tests are one-sided tests with critical values of 1.64 for the panel v-statistic and -1.64 for all others. The equations are:

$$P_{it} = f\left[\underset{+}{ES}, \underset{+}{MS}\right] \quad \text{(Eq. 4.4)}$$

$$MS_{it} = f\left[\underset{+}{BL}, \underset{+}{INF}, \underset{+}{RbRf}, \underset{+}{P}\right] \quad \text{(Eq. 4.5)}$$

$$BL_{it} = f\left[\underset{+}{MS}, \underset{+}{Y}, \underset{-}{RlRd}\right] \quad \text{(Eq. 4.6)}$$

For equation (4.5), the panel *v* statistics of 4.4 are above the critical value of 1.64. Furthermore, the panel rho, panel ADF, group rho and group ADF all show a lower value than the critical value of -1.64, and these statistics are significant at one percent level of significance. This shows that there is cointegration.

In addition, for equation (4.6), the panel rho, panel ADF, group rho and group ADF statistics are all lower than -1.64 and significant at the one percent level of significance. This suggests that the null hypothesis of no cointegration is rejected based on these four statistics. As mentioned above, due to power and small sample size, the top three statistics in terms of performance are the group ADF, panel ADF and panel rho. Thus, the results from these tests are more reliable. For all three equations, the results are consistently significant for group ADF and panel ADF.

As cointegration is present in the equations, the vector error-correction model can be used to test for long-run and short-run causality in the equations. This is discussed in the next section.

5.6.3 Results of the VECM tests

The Pedroni (1997) panel cointegration tests confirm that the variables in equations (4.4) to (4.6) are cointegrated. VECM tests are then performed to test for long-run and short-run causality, using equation (4.16).

The resulting long-run coefficients as summarised in Table 5.21 are obtained through the normalisation of the cointegrating vectors. It should be stressed that the VECM are individually run for each equation and that it is not run together as a system. This is because the purpose of this section is to determine whether the predetermined variables and the endogenous variables that are on the right hand side have a causal effect on the dependent variable.

The evidence of cointegrating relations in Table 5.21 shows that there is a positive relationship in equation (4.4) between money supply and bank stock price, a major concern of this thesis. There is a negative relationship between bank stock price and money supply for equation (4.5). Bank loans and money supply are found to have a positive relationship for equations (4.5) and (4.6), suggesting the presence of a bidirectional relationship similar to earlier results.

Table 5.21 Cointegrating relations

Equations		Cointegrating relation
$P_{it} = f\left[\underset{+}{ES}, \underset{+}{MS}\right]$	(4.4)	0.38*MS*-20.28
$MS_{it} = f\left[\underset{+}{BL}, \underset{+}{INF}, \underset{+}{RbRf}, \underset{+}{P}\right]$	(4.5)	8.38*BL*-0.84*P*-95.62
$BL_{it} = f\left[\underset{+}{MS}, \underset{+}{Y}, \underset{-}{RlRd}\right]$	(4.6)	0.18*MS*-9.06

Note: *P* is bank stock price, *ES* is bank earnings spread, *BL* is bank loans, *MS* is money supply, *INF* is inflation, *RbRf* is domestic-to-foreign interest rate differential, *RlRd* is net interest margin and *Y* is income.

The VECM results provided in Table 5.22 (p. 135) suggest whether the endogenous and exogenous (predetermined) variables have a causal relationship. All the error-correction terms have the correct expected sign, which is negative. For example, under equation (4.4) the error correction terms are -0.0012 and -0.0002, which indicate that money supply reacts to a deviation from the

equilibrium relationship by 0.12 percent, while bank stock prices react to a deviation from the equilibrium relationship by 0.02 percent respectively.

For equation (4.4), the results show there is bidirectional causality between money supply and returns in the long run but not in the short run. This is consistent with the findings for most of the countries in Section 5.4.3. About 0.12 percent of disequilibrium is corrected by changes in returns each quarter and 0.02 percent of disequilibrium is adjusted by changes in money supply. Earnings spread is found to have an effect on returns as the coefficient is found to be significant at the five percent level from the *t*-statistics in Table 5.22 (p. 135).

Thus, bank loans and bank stock returns jointly were found to cause money supply, and money supply and bank stock returns together were found to cause bank loans, according to the VECM results of equation (4.5). However, bank loans and money supply were found not to have an effect on bank stock returns in the long run. In the short run, only money supply and bank stock returns jointly cause bank loans, and this is found to be significant at the one percent level of significance. This result is acceptable as it is more important to determine the causality from returns and bank loans to money supply, as this is the predetermined equation. In addition, it was found that in the short run there is bidirectional causality between bank loans and money supply. This is consistent with the results in Section 5.2.3 where money was found to be endogenous in most countries. The exogenous variables, inflation and domestic-to-foreign interest rate differential, were also found to be significant at the one percent and ten percent levels of significance respectively.

Table 5.22 VECM causality test

								SRC			Conclusion	
Endo	*ECT*	*t-stat*	*Exo*	*t-stat*	*Exo*	*t-stat*	*RET*	*MS*	*BL*	χ^2 *test*	*LR*	*SR*
Equation 3.7			Δ ***ES***									
RET-MS	-0.0012	[-2.553]**	0	[-2.443]**						1.656	$MS \Leftrightarrow RET$	
MS-RET	-0.0002	[-5.161]***	0	[1.638]						1.876		
Equation 3.8			Δ ***INF***		***RbRf***							
MS-BL&RET	-0.0002	[-8.411]***	0.0809	[2.588]***	-0.0001	[-1.657]*		0.505	0.028	4.707	$BL\&RET \Rightarrow MS$	
BL–MS&RET	-0.0004	[-4.467]***	0.0172	[0.202]	0.0005	[1.572]		0.365		23.836***	$MS\&RET \Rightarrow BL$	$MS\&RET \Rightarrow BL$
RET – MS & BL	-0.0005	[-1.569]	-0.1984	[-0.563]	-0.0024	[-1.707]*	0.089		0.266	5.557		
MS – BL										4.647*		$BL \Rightarrow MS$
MS- RET										0.059		
BL-MS										23.012***		$MS \Rightarrow BL$
BL – RET										0.87		
RET-MS										1.99		
RET-BL										3.733		
Equation 3.9			Δ ***Y***		***RlRd***							
BL-MS	-0.0029	[-2.316]**	0.2527	[1.913]*	0.0002	[1.704]*		0.585		22.791***	$MS \Leftrightarrow BL$	$MS \Leftrightarrow BL$
MS-BL	-0.0024	[-5.261]***	0.0272	[0.572]	-0.0006	[-2.930]***		0.52	0.032	7.42*		

Note: Numbers in square brackets are t-statistics. ***, **, * denote significance at the 1, 5 and 10 percent levels respectively, Endo and Exo are endogenous and exogenous variables respectively, ECT denotes error-correction term; SRC is short-run coefficient; only significant lags are summed under SRC. LR = long run and SR = short run, $\Rightarrow$ indicates unidirectional causality and $\Leftrightarrow$ indicates bidirectional causality. Δ denotes first difference. *RET* is bank returns, *ES* is bank earnings spread, *BL* is bank loans, *MS* is money supply, *INF* is inflation, *RbRf* is domestic-to-foreign interest rate differential, *RlRd* is net interest margin and *Y* is income. The equations are:

$$P_{it} = f\left[\underset{+}{ES}, \underset{+}{MS}\right] \qquad (4.4)$$

$$MS_{it} = f\left[\underset{+}{BL}, \underset{+}{INF}, \underset{+}{RbRf}, \underset{+}{P}\right] \qquad (4.5)$$

$$BL_{it} = f\left[\underset{+}{MS}, \underset{+}{Y}, \underset{-}{RlRd}\right] \qquad (4.6)$$

There is bidirectional causality between bank loans and money supply in the VECM results of equation (4.6). The error-correction terms are both significant at the one and five percent levels, and about 0.29 and 0.24 percent of disequilibrium is corrected by bank loans and money supply respectively each quarter. The bidirectional causality is supportive of earlier results in Section 5.2.3. Bidirectional causality was also found in the short run under equation (4.6), as the χ^2 test statistic of 22.79 for money supply causing loans and 7.42 for loans causing money supply are significant at the one and ten percent levels respectively. Furthermore, income and net interest margin are also found to be weakly significant as the *t*-statistic 1.93 and 1.74 in the table are both higher than the critical value of 1.64 for a ten percent level of significance.

The results of these causality tests will be used in the subsequent Generalised Method of Moments (GMM) panel data estimation. Statistics relating to how the model fits will be discussed in the next section as the causality tests are a preliminary test to show that the predetermined independent variables do cause, and are not just correlating with, the independent variables.

5.6.4 Results of the GMM panel data estimation

Table 5.23 (p. 137) provides the summary of results of the GMM panel data estimation as proposed by Arellano and Bond (1991). Two important statistics are discussed first.

From the results, the Arellano and Bond (1991) test of the hypothesis that there is no second-order serial correlation based on the residuals of the first differenced equation is not rejected. This suggests that the GMM estimators are consistent. Secondly, the Sargan (1958) test statistic in Table 5.23 is 0.0187 with a *p*-value of 1. The Sargan test is used to test for overidentifying restrictions, that is, it determines whether any correlation between instruments and errors exists. For an instrument to be valid, there should be no correlation between instruments and errors. From the results, the null hypothesis cannot be rejected, thus providing evidence of

the validity of lagged levels dated *t-2* and earlier lags as instruments in the first-difference equations.

Table 5.23 Results of GMM panel data estimation

	Variables	***Coefficients***	***t-statistic***
Equation 4.4b	α	0.0211	[3.853]***
	ΔES	0	[-2.415]**
	ΔMS	4.2923	[1.925]*
Equation 4.5b	α	0.003	[1.416]
	ΔBL	0.9995	[3.923]***
	ΔINF	0.1468	[1.786]*
	RbRf	-0.001	[-1.777]*
	R	-0.119	[-1.813]*
Equation 4.6b	α	-0.0021	[-1.878]*
	ΔMS	1.154	[12.433]***
	ΔY	0.1791	[2.117]**
	RlRd	0.0007	[1.755]*
	AR(2)	0.0332	[1.596]
	Sargan statistic (*p-value*)	0.0187	(1)

Note: Numbers in square brackets are t-statistics and in parentheses are p-values. ***, **, * denote significance at the 1, 5 and 10 percent levels respectively. Δ denotes first difference and α is a constant for each equation. *R* is bank stock returns, *BL* is bank loans, *MS* is money supply, *INF* is inflation, *Y* is income. *ES* is bank earnings spread $=[Rl \times L - Rd \times DEP]$, *RbRf* is domestic-to-foreign interest rate differential =*Rb-Rf*, and *RlRd* is net interest margin = $Rl - Rd$. AR(2) is the second-order serial correlation term.

Most of the variables show the expected signs. Table 5.24 compares the signs that were expected for each coefficient and the actual sign obtained from the GMM panel data estimation. Four signs were different from the expected sign: The bank earnings spread (*ES*) in equation (4.4), the domestic-to-foreign interest rate differential (*RbRf*) and returns (*R*) in equation (4.5) and the net interest margin (*RlRd*) in equation (4.6). These will be further discussed below.

Table 5.24 Expected and actual signs for variables in GMM estimation

Variables	*Expected sign*	*Actual sign*
Equation 4.4b		
ES	+	-
MS	+	+
Equation 4.5b		
BL	+	+
INF	+	+
RbRf	+	-
R	+	-
Equation 4.6b		
MS	+	+
Y	+	+
RlRd	-	+

Note: *R* is bank stock returns, *BL* is bank loans, *MS* is money supply, *INF* is inflation, *Y* is income. *ES* is bank earnings spread = $[Rl \times L - Rd \times D]$, *RbRf* is domestic-to-foreign interest rate differential = $Rb - Rf$, *RlRd* is net interest margin = $Rl - Rd$.

An increase in money supply growth by one percent increases growth of bank stock returns by 4.29 percent. This positive relationship is similar to the one found in the cointegrating equation in Section 5.5.4. The results support Ratanapakorn and Sharma (2007) and Abdullah and Hayworth (1993), who found a relationship between money supply (among other macroeconomic variables) and stock prices in the US. In Japan, Mukherjee and Naka (1995) obtained similar findings. One explanation for the positive result could be that a rise in money supply could enhance stock prices via the liquidity effect, that is, the higher liquidity in the economy reduces the interest rate and, consequently, raises stock prices. Another explanation is that the central bank may reduce interest rates to stimulate the economy. This in turn increases demand for loans, which subsequently raises money supply. If the bank is seen as a business entity and loans are the product being sold, then increases in loans would lead to a rise in profits and ultimately stock prices according to cash-flow effects as in the dividend valuation theory.

Another reason could be that as demand for loans increases and is satisfied through any means necessary, be it the central bank or other sources, money supply increases. Berger and Bouwman (2008) found a positive correlation between

liquidity creation by banks and their market value, concluding that banks that create more liquidity are valued more by investors. Liquidity creation in this sense is the ability to transform illiquid assets such as business loans into liquid liabilities – for example, transaction deposits. However, Berger and Bouwman (2008) calculate a bank's value using market-to-book ratio and price-earnings ratio rather than the stock prices. Following from this, the creation of loans to deposits (and in turn money supply), which creates liquidity in the banks, is valued more by investors.

In addition, even though it is significant at a five percent level of significance, bank earnings spread was found to have a negligible effect.

A one-percentage increase in bank loan growth increases money supply growth 0.99 percent. This confirms the earlier findings in Section 5.2.3 that loans cause money supply, thus supporting the post-Keynesian theory of endogenous money. Inflation and money supply are found to have a positive relationship. From Table 5.23, a one-percentage change in inflation growth leads to a rise in money supply growth by 0.1468 percent; this is significant at the ten percent level of significance as the *t*-statistic is higher than the critical value of 1.64. An increase in inflation means that real interest rates are reduced through the Fisher Effect $i_r = i - \pi^e$ where i_r, i and π^e are real interest rates, nominal interest rates and expected inflation respectively. With the real interest rates reduced, it is likely that this leads to a rise in loans needed to fund investments. According to the post-Keynesians, the increase in loans would in turn increase money supply.

The domestic-to-foreign interest rate differential was found from Table 5.24 to have a negative relationship rather than a positive one. An increase in the domestic-to-foreign interest rate differential decreases money supply growth by 0.001, which is negligible. A natural explanation for this is that as the domestic rate increases more than the foreign rate, thus increasing the differential, there is capital flow out of the country as it is now cheaper to obtain funding internationally. This is the opposite of the currency effect, which suggests that short-term money foreign cash will flow into the country to earn its higher deposit rates. This means that the grwoth of domestic loans will decrease, which in turn will decrease money supply growth. This is contrary to Foster (1992), who found a positive relationship between

money supply and the domestic-to-foreign interest rate differential. Foster (1992) argued that a rise in the domestic interest rate would increase domestic deposits. This will increase money supply not only because deposits are more attractive but also because banks may make matching switches from foreign-currency-denominated to domestic-currency-denominated marketable financial assets.

An increase in the growth of bank stock returns, through bank stock prices, reduces money supply growth by 0.12 percent. From Table 5.24, this was not expected, as increases in bank stock prices would indicate that the economy is in strong growth, which may relate back to increased inflation. This means that any increases in inflation or expected inflation may decrease the real interest rate. The reduced real interest rate leads to more affordable investments funded through loans, which in turn increases money supply. Hence, a positive relationship is expected.

An explanation for the negative relationship could be related to the changes in interest rates prompted by the central banks. Increases in bank stock returns growth reflecting strong economic growth in the country may lead to rises in inflation. In order to slow the economy, central banks may increase interest rates to negate the rising inflation. The rise in interest rates leads to increases in loan rates, leading to reduced money supply growth.

The results also confirm the bidirectional relationship between bank stock returns and money supply found previously in Section 5.5.3. They also support the results by Rogalski and Vinso (1977) and Hashemzadeh and Taylor (1988) that there exists bidirectional causality between money supply and stock returns, even though these two studies concentrated on general stock indices and not on the bank stock index.

In Table 5.24, for equation (4.6b), money supply and bank loans have a positive relationship. This is consistent with the long-run cointegrating relationship discussed in Section 5.6.3. An increase in money supply raises bank loans by 115 percent, from the results in Table 5.23. Following on from the positive relationship between bank loans and money supply results in equation (4.6b), this result confirms the existence of a feedback effect as found in Section 5.2.3.

A one percent increase in income growth leads to a rise in bank loan growth by 0.179 percent. The positive relationship is expected because, given income increases, individuals will have more money to pay their loans or other liabilities. From Table 5.24, net interest margin was expected to have a negative relationship with bank loans as increases in loan rates higher than deposit rates increase net interest margin. With higher loan rates, loans would not be affordable, so that the amount of loans would decrease. However, this was not the case. The results show that an increase in net interest margin increases bank loan growth by 0.0007 percent. Although the amount is small, the positive relationship suggests that even with loan rate increases, banks were still lending money. Maybe competition from sub-prime mortgage lenders was pushing banks to lend without any concern to ration credit to high-risk borrowers.

5.6.5 Results of the GMM panel data estimation: Sensitivity analysis

In order to check the robustness of the results, two more GMM panel data tests were carried out. The first included three countries – Japan, the UK and the US (called Group A) – and the second consisted of Canada, France, Germany and Italy (termed Group B). The first three countries were grouped together as they all had a developed banking sector, such that it had good money-market depth and few barriers to entry.

Due to smaller sample sizes, the results in Table 5.25 show that some of the variables have become insignificant – for example, money supply no longer has an effect on bank stock returns in Group A. Furthermore, none of the variables has an effect on money supply in Group A. However, it should be stressed that despite the insignificance of variables, none of the signs of the coefficients was contrary to theory. The signs were found to be the same as the previous results in Table 5.24.

Two important tests, the second-order serial correlation test and the Sargan test, are reported in Table 5.25. For both groups, it was found that there is no second-order serial correlation based on the residuals of the first differenced equation. This indicates that there is no correlation between instruments and errors, hence making the instruments used in the equations valid as before.

Table 5.25 Results of GMM estimation: Sensitivity analysis

		Group A: US, UK, Japan		Group B: EUR & CAN	
	Variables	*Coefficients*	*t-statistics*	*Coefficients*	*t-statistics*
Equation 4.4b	α	0.0226	[2.452]**	0.0123	[1.485]
	ΔES	0	[-0.746]	0	[-1.901]*
	ΔMS	6.8843	[1.25]	3.1821	[1.761]*
Equation 4.5b	α	0.0052	[0.45]	0.005	[2.548]**
	ΔBL	1.1172	[1.15]	0.8946	[2.936]***
	ΔINF	0.0734	[0.246]	0.1697	[1.634]
	RbRf	-0.0013	[-0.612]	-0.0005	[-0.919]
	R	-0.2617	[-0.571]	-0.0469	[-1.495]
Equation 4.6b	α	-0.0012	[-0.874]	-0.0059	[-3.603]***
	ΔMS	1.3549	[13.607]***	0.7667	[9.025]***
	ΔY	0.2387	[2.137]**	0.1401	[1.591]
	RlRd	0.0005	[1.009]	0.0006	[1.307]
	AR(2)	0.0492	[1.276]	0.0043	[0.207]
	Sargan statistic (*p-value*)	0.0554	(0.999)	0.0433	(0.999)

Note: Numbers in square brackets are *t*-statistics and in parentheses are p-values. ***, **, * denote significance at the 1, 5 and 10 percent levels respectively. Δ denotes first difference and α is a constant for each equation. *R* is bank stock returns, *BL* is bank loans, *MS* is money supply, *INF* is inflation, *Y* is income, *ES* is bank earnings spread $=[Rl \times L - Rd \times DEP]$, *RbRf* is domestic-to-foreign interest rate differential $= Rb - Rf$, and *RlRd* is net interest margin $= Rl - Rd$. AR(2) is the second-order serial correlation term.

5.7 Chapter Summary

In this chapter, we sought to answer the five research questions. First, whether money supply was exogenous or endogenous in the G-7 countries. Second, evidence for three views of the post-Keynesian theory of endogenous money was sought, followed by an investigation of whether these results differ in the long run and the short run. Next, using trivariate VAR causality tests, earlier inferences as to whether money was exogenous or endogenous were validated in the presence of a third variable, deposits. Fourth, whether there was causality between money supply and bank stock returns. Finally, using panel data, we investigated whether a simultaneous relationship exists such that loans create deposits in the form of money supply as suggested by post-Keynesian theorists, at the same time that loans and deposits affect shareholder value.

A number of econometric tests were performed: Phillips-Perron unit root tests, Johansen cointegration tests, vector error-correction modelling and Granger (VAR) causality tests were employed to answer questions 1, 2 and 4.

It was found that money supply is endogenous in most countries except UK 1 and US 1. In terms of which PK theory view was supported, the structuralist view was mainly supported for Canada 1 and 2, France, Germany, Japan, UK 2, US and US 2, as there was bidirectional causality between bank loans and monetary base and/or bank loans and money multiplier and/or money supply and income. The liquidity preference view was supported by these countries (except Canada 2 and Germany) as there was bidirectional causality between bank loans and money supply. Canada and UK were found to support the accommodationist view, with Italy supporting both the monetarist and the accommodationist views, while UK 1 and US 1 support the monetarist view.

The results also indicate that there is a difference between long-term and short-term causality. Where there is support for structuralist or liquidity preference in the long run, in the short run the evidence for Japan, Canada 1 and US 2 supports the accommodationist view, while France and Germany appear to conduct monetary policy in accordance with the monetarist view. Most of the short-run results indicate support for either the monetarist or the accommodationist view, with the exception of France, which supported the structuralist view (for bank loans and money multiplier). These results suggest that even though money is endogenous in the long run in some of these countries, central banks still intervene in the short run. For Question 4, it was found that with the exception of US 1, there is a relationship between bank stock returns and money supply.

Trivariate VAR causality tests proposed by Toda and Yamamoto (1995) were then used to answer Question 3. The results are robust to the inclusion of deposits for all samples except Canada 2 and Italy, while deposits were found to be important in US and US 2.

The final question was answered using the panel data Generalised Method of Moments proposed by Arellano and Bond (1991). Panel unit root tests, panel

cointegration tests and VECM causality were performed firstly to determine whether the characteristics of the variables entering the tests were satisfactory and also whether the predetermined variables should be omitted from the equations. The panel data GMM results show that there is a *positive relationship between money supply growth and growth in bank stock returns but a negative relationship from the growth in bank stock returns to money supply growth*. It was also found that there is a bidirectional positive relationship between bank loan growth and money supply growth, which supports earlier results in this chapter, as well as the post-Keynesian theory of endogenous money.

Chapter 6 : Conclusion, Limitations and Further Research

6.1 Summary of the main findings of the thesis

Monetary economists have long debated the nature of the money supply. Mainstream Keynesians and monetarists insist that the money supply is exogenous in that the central bank controls money supply, which in turn affects interest rates and subsequently output. Post-Keynesians, on the other hand, argue that the money supply is in fact endogenous and is created through the behaviour of commercial banks and the public's demand for loans. In such cases, the central bank's role is only to determine the level of interest rates and banks will adjust their loan portfolios based on this rate, or help change the liquidity of firms. Under this scenario, provision of liquidity and portfolio rebalancing of banks will lead to a money supply effect on bank stock returns, which is a little-researched topic in finance and banking. Here, changes in loans will affect deposits and this in turn will affect money supply.

The aim of this thesis centres around two main issues: (a) whether the money supply is determined by banking behaviour or by the behaviour of the central banks and (b) the impact of the money supply on bank stock returns. The first issue was investigated through a series of econometric tests to establish (1) whether the money supply was exogenous or endogenous, (2) which of the three views (accommodationist, structuralist or liquidity preference) is supported, and whether this support differs between the long run and the short run, and (3) whether earlier inferences were valid in the presence of a third variable, deposits, used in this thesis. The second issue was tested by investigating whether there was causality between the money supply and bank stock returns, and whether there was a simultaneous relationship such that loans create deposits, in the form of money supply as suggested by post-Keynesian theorists, at the same time that loans and deposits affect shareholder value. A simultaneous model was developed to test the simultaneous relationship.

Before determining whether the money supply was exogenous or endogenous, Phillips-Perron unit root tests were conducted to check for the stationarity of variables. If the variables were found to be *I(1)*, the Johansen cointegration tests were performed to determine whether there is a stable long-run relationship between bank lending and monetary base, bank loans and broad money multiplier, bank loans and broad money supply, and broad money supply and income. Vector error-correction modelling and Granger (VAR) causality tests were employed to test for long-run and short-run causality respectively once cointegration was determined. Table 6.1 summarises the findings in this thesis.

Table 6.1 Summary of findings

Country	**H1**: Money supply endogenous?	**H2, 3 & 4**: Monetarist, Accommodationist, Structuralist or Liquidity Preference?		**H6**: Deposits appropriate?	**H7**: Money supply and bank stock returns?	**Monetary Policy**
		LR	*SR*			
Canada 1	Yes	ST, LP	AC, MO	No	Yes	MT
Canada 2	Yes	ST, AC	INC	No*	Yes	INF
Canada	Yes	AC	AC, MO	No	Yes	MT/INF
France	Yes	ST, LP	MO, ST	No	Yes	MT/INF
Germany	Yes	ST, AC	MO, AC	No	Yes	MT/INF
Italy	Yes	AC, MO	MO	No*	Yes	MT
Japan	Yes	ST, LP	AC	No	Yes	MT/INF
UK 1	No	MO	MO	No	Yes	MT
UK 2	Yes	ST, LP	INC	No	Yes	INF
UK	Yes	AC	AC, MO	No	Yes	MT/INF
US 1	No	MO	MO	No	No	MT
US 2	Yes	ST, LP	AC	Yes	Yes	INT
US	Yes	ST, LP	MO	Yes	Yes	MT/INT

Note: AC is Accommodationist, ST is Structuralist, LP is Liquidity Preference, MO is Monetarist view and INC indicates the results are inconclusive. No* indicates that the results were not robust to the inclusion of deposits. MT is Monetary targeting, INF is Inflation targeting and INT is Interest rate targeting.

The findings show that money supply is endogenous in most countries except for the two periods coinciding with monetary targeting control regimes in UK 1 and US 1. The samples were split because of the change in monetary regimes – for

example, monetary policy was monetary aggregates targeting for UK 1, while under UK 2 monetary policy was inflation targeting. UK 1, US 1 and Canada 1 had monetary targeting. The results for UK 1 and US 1 support Hypothesis 1.1 where money is found to be exogenous, while the evidence on the other countries supportes Hypothesis 1.2. The results for UK 1 and US 1 were consistent with the monetary policy in place, that is, targeting monetary aggregates; however, Canada 1 was found to be endogenous. This is similar to Italy, where targeting monetary aggregates was the monetary policy before the advent of the euro. For the countries where money was found to be endogenous, there was mixed evidence as to which of the three views (accommodationist, structuralist or liquidity preference) was supported.

Very important results followed. Mainly the structuralist view was supported for Canada 1 and 2, France, Germany, Japan, UK 2, US and US 2, as there was bidirectional causality between bank loans and monetary base and/or bank loans and money multiplier and/or money supply and income. The liquidity preference view was supported for these countries (except Canada 2 and Germany, which supported the accommodationist view) as there was bidirectional causality between bank loans and money supply. Canada and UK were found to support the accommodationist view, with Italy supporting both the monetarist and accommodationist views; while UK 1 and US 1 supported the monetarist view.

The results also indicate that there is a difference between long-run and short-run causality. Where there is support for structuralist or liquidity preference in the long run, Japan, Canada 1, and US 2 show support for the accommodationist view in the short run, while France and Germany appear to conduct monetary policy in accordance with the monetarist view in the short run. Most of the short-run results indicate support for either the monetarist view or the accommodationist view, with the exception of bank loans and money multiplier in France, where there is bidirectional causality evidencing support for the structuralist view. These results suggest that even though money is endogenous in the long run in some of these countries, the central banks still intervene in the short run.

An interesting pattern that has emerged is that the countries with inflation targeting as their monetary policy, Canada 2 and UK 2, had an inconclusive result in

the short run. The countries with monetary aggregate targeting as their monetary policy (Canada 1, Italy, UK 1 and US 1) had results consistent with a monetarist view in the short run, while those with a mixed monetary policy regime over the years – for example, France, Germany and Japan – also had mixed endogenous (mostly accomodationist) views supported by the results in the short run. In the long run, countries with a pure monetary targeting regime, that is, UK 1, Italy and US 1, still had the monetarist view. Canada 1 was the exception to this pattern. With the mixed monetary policy regimes, the money endogeneity views were more evident.

Because post-Keynesians assert that bank loans cause deposit and in turn these cause money supply, a trivariate VAR causality test proposed by Toda and Yamamoto (1995) was used to determine whether causality was still valid between loans and money supply even with the presence of demand deposits. The results are robust to the inclusion of deposits for all samples except Canada 2 and Italy, while deposits were found to be important in US and US 2. One interesting fact is that the only country that had deposits found to be important also had interest rate targeting as its monetary policy. This supports Hypothesis 6, suggesting that the results are robust with the inclusion of deposits.

After all the tests for money endogeneity were performed, it was of interest to test whether there was a relationship between money supply and bank stock returns, which is the second important issue in this thesis. Econometric tests involving VECM and Granger causality tests, similar to those used in examining the nature of money supply, were performed between bank stock returns and money supply. The results indicate that, with the exception of US 1, there was a relationship between money supply and bank stock returns. This finding supports Hypothesis 7 in that money supply causes bank stock returns or/and bank stock returns cause money supply. These results were retested for robustness and the results are the same.

A simultaneous equation model was developed in Chapter 4 for the purposes of testing further the relationship between bank stock returns and money supply. This model was tested using the panel data Generalised Method of Moments (GMM) methodology proposed by Arellano and Bond (1991). Before the panel data GMM was estimated, a number of econometric tests were conducted to test whether the

characteristics of the variables entering the tests were satisfactory and also whether the predetermined variables should be omitted from the equations. As the data were panel data, which included a time-series component, panel unit root tests based on Fisher (1932) tests were used to examine whether the series were stationary. The Maddala and Wu (1999) Fisher chi-square test and Choi Z-statistics were adopted for this purpose. All the variables besides the interest rate variables, domestic-to-foreign interest rate (*RbRf*) and net interest margin (*RlRd*) were found to be integrated of order one (*I(1)*).

Since the variables were found to be *I(1)*, panel cointegration tests could be performed on the equations. Based on the Pedroni (1999, 2004) panel cointegration test, the equations were found to be cointegrated. We then tested for long-run and short-run causality using vector error-correction models and found that money supply causes bank stock returns in the long run. This finding corroborates related findings on money endogeneity – although, as the results were found in the long run, this result could be driven by some other relationship. There is bidirectional causality between bank loans and money supply even with the presence of exogenous (predetermined) variables.

The results of the panel data GMM test show that there is a positive relationship between money supply growth and growth in bank stock returns and a negative relationship from growth in bank stock returns to money supply growth. It was also found that there is a bidirectional positive relationship between bank loan growth and money supply growth, which supports earlier results in Section 5.2.3. This is consonant with the post-Keynesian theory of endogenous money. As there is a simultaneous relationship (or effect) found between bank stock returns and money supply, and money supply and bank loans, this finding supports Hypothesis 8.

Overall, this thesis has presented evidence on the relationship between money supply and bank stock returns by using aggregate and panel data[40] respectively, and

[40] Aggregate data includes data that involves the banking industry in each country, whereas panel data includes combined time series data from 1973 to 2007 and stacked cross-section data from the seven countries.

while taking the post-Keynesian theory of endogenous money into account in the model. This was the main aim of the thesis as set out in Chapter 1.

6.2 Limitations of the thesis

The thesis has some limitations. First, the data used are sourced from *DataStream*. Even though the macroeconomic variables were checked with the *IMF IFS* database, there may be some inconsistencies, especially for the bank price index taken from *DataStream*. Ince and Porter (2006) found inconsistencies between the *DataStream* data and that of the Center for Research in Security Prices (CRSP). They found issues of coverage, classification and data integrity for the *DataStream* data; for example, they noted several issues with calculating total returns using the return variables provided by *DataStream* in that there could be survivorship bias and coverage issues. However, as no bank price index for the seven countries is available elsewhere, this study had to rely upon the *DataStream* database.

Second, bivariate causality tests have been used in most cases. Besides the omitted variable bias, channels of causality may be hidden when only two variables are used. However, the causality between bank loans and money supply was tested using the trivariate test. Other tests, such as the unit root and cointegration tests, were also conducted prior to the causality tests. These two tests are known to have low power and size properties in small samples (Cheung and Lai, 1993). This limitation is more applicable in the case of France, where there are only 46 observations. Therefore, care must be taken when interpreting the results for France.

The GMM panel data model may contain variables that are omitted. This is the third limitation of this study. Omitted variables may be a source of threat to statistical validity. However, the predetermined variables have been used in previous studies, for example, Foster (1992), and are derived from monetary economic theory.

Finally, the thesis concentrates on the banking sector, as the post-Keynesian theory of endogenous money is focused on the idea that money supply is created by the operations of the commercial banks and the public. One limitation that is immediately recognisable is that the findings of this thesis may not be generalised to

other industries in the economy. However, even though the thesis concentrates on the banking sector of the G-7 countries, there is scope to generalise the findings to banking sectors in other countries with a well-developed financial system.

6.3 Implications and future research directions

6.3.1 Implications

The findings of this study provide several important implications. Firstly, our findings in general support Howells and Hussein's (1998) results – namely, that the money supply in our tests of G-7 countries is endogenous, as theorised by the PK economists. This is because we found bank loans to cause money supply, and found that bidirectional causality exists between bank loans and money supply. Contrary results, where money is exogenous, were found only in respect of two sub-sample tests in the UK and the US during which monetary aggregates were used as targets for the conduct of monetary policy. This implies that current monetary policy adopted by the G-7 countries allows for the creation of money supply, even though it is not directly controlled by the central banks.

Second, for the countries where money was found to be endogenous, mainly the structuralist and liquidity preference views were supported. This implies that monetary policy is not only important in determining the nature of money supply, but also that it may be seen as an informative tool in assessing the financial system. With the findings supporting the structuralist view, an inference may be made that banks are involved in liability management to meet credit demands, as suggested by Rochon (1999) amongst others.

Third, as indicated by the robust results of the trivariate VAR tests, bank deposits are found to be a significant variable in all samples except those of Canada (1991:1 to 2007:1) and Italy. Deposits were found to be important in the US. An interesting fact is that interest rate targeting is the main monetary policy regime in the US, and this is different from the other G-7 countries. This suggests that demand deposits are an important factor in the US compared to the other countries.

Fourth, our findings using the GMM panel data estimation method show that there is a positive relationship from money supply growth to growth in bank stock

returns. However, the relationship from growth in bank stock returns to money supply growth is negative. This may be explained by central bank interest-rate changes aimed at negating inflation, leading to a rise in interest rates and subsequently to reduced money supply. It was also found, in this context, that there is a bidirectional positive relationship between bank loan growth and money supply growth, which supports the PK theory of endogenous money. Thus, the results suggest that bank credit creation is the source of the effect of money supply on bank stock returns.

Finally, an important implication of the overall findings of this thesis points towards the key functioning of a banking system. Banks are not only transmitters of monetary policy but are also important in the development of the growth of money through loan creation to the money supply and bank stock price formation.

6.3.2 Future research directions

This thesis concentrated on three European countries (France, Germany and Italy) as part of the G-7 countries. However, due to the change to the euro system in these three countries, the data for these countries end in 1998. A natural extension to this thesis would be to investigate the nature of money supply in these three countries before and after the advent of the euro. This would show whether there were changes in money supply following monetary integration in 1998.

This thesis only tested endogenous money on the basis of vector error-correction models and Granger causality tests. Foster (1992) and Holtemöller (2003) have developed a model of broad money supply based on the UK and German systems respectively. Another avenue of research would be to test the nature of money supply (exogenous or endogenous) by applying one of these two models to different countries.

As the thesis focuses on the G-7 countries, one avenue of research is to utilise the methodology of this thesis, especially the GMM panel data, to study developing nations or even emerging economies.

Appendix A5.1: VECM Test Results

Panel A: Cointegrating equations

	DV	*INDV*	*Beta*	*t-stat*	*Intercept*	*Trend*	*t-stat*
Canada	*BL*	*MB*	12.066	[3.357]***	-33.139	-0.153	[-3.695]***
	MS	*Y*	-2.177	[-18.59]***	16.24		
Canada 1	*BL*	*MB*	-1.393	[-6.115]***	-1.419	-0.006	[-2.042]**
	BL	*MS*	-0.834	[-6.659]***	4.975	-0.008	[-2.704]***
	MS	*Y*	-11.595	[-4.626]***	139.433	0.071	[3.562]***
Canada 2	*BL*	*MB*	-2.282	[-2.757]***	0.142		
	BL	*MS*	3.45	[2.655]***	-47.422		
	MS	*Y*	2.114	[4.468]***	-39.315	-0.03	[-7.698]***
France	*BL*	*MB*	1.688	[5.236]***	-26.291	-0.002	[-0.675]
	BL	*MM*	-0.851	[-10.86]***	-11.952		
	BL	*MS*	-2.125	[-9.544]***	5.393		
	MS	*Y*	-1.35	[-6.887]***	12.239		
Germany	*BL*	*MB*	2.322	[4.136]***	-15.561	-0.048	[-6.405]***
	BL	*MM*	-1.592	[-7.654]***	6.733	-0.011	[-11.63]***
	BL	*MS*	-4.71	[-5.578]***	50.961	0.062	[4.235]***
Italy	*BL*	*MB*	-0.587	[-9.406]***	-3.259	-0.013	[-10.17]***
	BL	*MM*	1.285	[5.038]***	-15.404	-0.028	[-14.64]***
	BL	*MS*	-1.114	[-44.30]***	7.438	-0.001	[-0.992]
	MS	*Y*	-8.985	[-2.756]***	-11.882	0.061	[2.812]***
Japan	*BL*	*MB*	2.234	[5.571]***	-14.633		
	BL	*MM*	-1.195	[-2.135]**	0.059	-0.018	[-1.897]*
	BL	*MS*	-1.408	[-12.31]***	10.491	0.013	[6.834]***
	MS	*Y*	12.321	[1.869]*	-20.846	0.002	[0.048]
UK	*BL*	*MM*	-1.773	[-3.643]***	9.696		
	BL	*MS*	-8.954	[-4.029]***	-8.842		
	MS	*Y*	-2.27	[-2.356]**	15.706		
UK 2	*BL*	*MB*	-0.511	[-6.912]***	-3.657	-0.016	[-20.73]***
	BL	*MM*	0.679	[5.296]***	-11.169	-0.027	[-23.19]***
	BL	*MS*	-1.046	[-23.45]***	7.34		
	MS	*Y*	-2.353	[-9.234]***	19.444		
US	*BL*	*MM*	-0.763	[-8.788]***	-5.251	-0.019	[-57.66]***
	BL	*MS*	-0.997	[-18.16]***	-0.188	-0.003	[-3.978]***
US 1	*BL*	*MS*	-3.358	[-4.582]***	15.506	0.051	[3.081]***
US 2	*BL*	*MM*	28.319	[3.157]***	-86.664		
	BL	*MS*	-1.183	[-66.02]***	1.179		
	MS	*Y*	-1.835	[-16.55]***	20.63		

Note: Numbers in square brackets are t-statistics. ***, **, * denote significance at 1, 5 and 10 percent levels respectively; *DV* and *INDV* are dependent and independent variables respectively. Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:4), UK 2 = (1993:1 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). *BL* denotes bank loans, *MB* is monetary base, *MM* is money multiplier, *MS* is money supply and *Y* is income.

Panel B: VECM (Short-run and long-run causality)

				LR	SRC			SR	
DV	*INDV*	*ECT*	*t-stat*	*Conclusion*	*DV*	*INDV*	χ^2 *test*	*Conclusion*	*Lag*
Canada									
BL	*MB*	-0.003	[-0.448]				0.07		1
MB	*BL*	-0.012	[-4.198]***	$BL \Rightarrow MB$			1.416		1
MS	*Y*	-0.027	[-4.473]***	$MS \Leftrightarrow Y$			0.569		2
Y	*MS*	-0.009	[-2.254]**				1.614		2
Canada 1									
BL	*MB*	-0.15	[-4.214]***	$MB \Leftrightarrow BL$			1.276		1
MB	*BL*	-0.136	[-4.783]***				1.667		1
BL	*MS*	-0.191	[-3.268]***	$BL \Leftrightarrow MS$			0.842		1
MS	*BL*	-0.134	[-4.783]***				2.13		1
MS	*Y*	-0.033	[-4.038]***	$MS \Leftrightarrow Y$			0.881		2
Y	*MS*	0.013	[1.977]**		0.54	0.235	4.815*	$MS \Rightarrow Y$	2
Canada 2									
BL	*MB*	-0.029	[-3.146]***	$MB \Leftrightarrow BL$			0.203		1
MB	*BL*	-0.015	[-3.326]***				0.859		1
BL	*MS*	0.003	[1.010]				0.259		1
MS	*BL*	-0.003	[- 8.50]***	$BL \Rightarrow MS$			0.207		1
MS	*Y*	0.079	[2.636]***	$MS \Leftrightarrow Y$			2.638		2
Y	*MS*	-0.056	[-4.044]***		0.16	0.492	8.308**	$MS \Rightarrow Y$	2
France									
BL	*MB*	0.081	[2.846]***	$BL \Leftrightarrow MB$	-0.101		10.999**	$MB \Rightarrow BL$	3
MB	*BL*	-0.446	[-3.021]***		0.468	1.369	5.167		3
BL	*MM*	-0.069	[-3.16]***	$BL \Leftrightarrow MM$		0.1	13.796***	$BL \Leftrightarrow MM$	3
MM	*BL*	-0.318	[-2.441]**		0.505	-1.77	6.704*		3
BL	*MS*	-0.11	[-5.45]***	$BL \Leftrightarrow MS$		0.337	6.733***	$MS \Rightarrow BL$	1
MS	*BL*	-0.068	[-3.255]***		0.376		0.04		1
MS	*Y*	-0.087	[-3.356]***	$MS \Leftrightarrow Y$	0.324		0.053		1
Y	*MS*	-0.035	[-3.315]***		0.35		0.003		1
Germany									
BL	*MB*	0.029	[2.576]***	$MB \Leftrightarrow BL$			1.309		1
MB	*BL*	-0.202	[-3.146]***		-0.226	0.771	6.283**	$BL \Rightarrow MB$	1
BL	*MM*	-0.147	[-2.951]***	$BL \Leftrightarrow MM$	0.104		4.441**	$MM \Rightarrow BL$	1
MM	*BL*	-0.422	[-3.809]***		-0.191		0.137		1
BL	*MS*	-0.016	[-1.499]				0.474		2
MS	*BL*	-0.25	[-4.142]***	$BL \Rightarrow MS$	1.221		43.256***	$BL \Rightarrow MS$	2
Ital									
BL	*MB*	-0.262	[-4.600]***	$MB \Rightarrow BL$	0.782	-0.822	14.552**	$MB \Rightarrow BL$	5
MB	*BL*	-0.062	[-0.556]			0.68	7.392		5
BL	*MM*	-0.113	[-4.398]***	$MM \Rightarrow BL$	0.411	0.666	17.452***	$MM \Rightarrow BL$	5
MM	*BL*	-0.067	[-0.857]		0.341		8.662		5
BL	*MS*	-0.051	[-0.190]				5.442		5
MS	*BL*	-0.774	[-2.612]***	$BL \Rightarrow MS$	0.646	-0.879	7.115		5
MS	*Y*	-0.025	[-3.561]***	$Y \Leftrightarrow MS$	-0.475	-0.764	7.081		5
Y	*MS*	-0.006	[-2.330]**		-0.366	-0.089	8.605		5

Panel B: VECM (Short-run and long-run causality) continued

				LR	SRC			SR	
DV	*INDV*	*ECT*	*t-stat*	*Conclusion*	*DV*	*INDV*	χ^2 *test*	*Conclusion*	*Lags*
Japan									
BL	*MB*	-0.006	[-7.641]***	$BL \Leftrightarrow MB$			0.252		1
MB	*BL*	-0.003	[-1.743]*				0.835		1
BL	*MM*	-0.012	[-7.567]***	$MM \Rightarrow BL$			0.277		1
MM	*BL*	-0.001	[-0.163]				0.981		1
BL	*MS*	-0.066	[-5.447]***	$BL \Leftrightarrow MS$	-0.145		1.097		2
MS	*BL*	-0.014	[-3.293]***		0.018	0.605	10.163***	$BL \Rightarrow MS$	2
MS	*Y*	-0.001	[-5.118]***	$Y \Rightarrow MS$	0.48	0.123	5.555*	$MS \Leftrightarrow Y$	2
Y	*MS*	0.002	[0.404]		0.196		7.946**		2
UK									
BL	*MM*	-0.017	[-5.818]***	$BL \Leftrightarrow MM$			0.23		1
MM	*BL*	-0.008	[-2.779]***				0.198		1
BL	*MS*	-0.002	[-0.684]			0.961	5.843**	$MS \Rightarrow BL$	2
MS	*BL*	-0.004	[-6.607]***	$BL \Rightarrow MS$			0.095		2
MS	*Y*	-0.005	[-4.130]***	$MS \Leftrightarrow Y$			0.642		2
Y	*MS*	-0.002	[-1.955]*				1.133		2
UK 2									
BL	*MB*	-0.215	[-3.652]***	$BL \Leftrightarrow MB$			1.137		1
MB	*BL*	-0.358	[-2.467]**				0.358		1
BL	*MM*	-0.138	[-3.692]***	$BL \Leftrightarrow MM$			1.241		1
MM	*BL*	-0.306	[-2.452]**				0.118		1
BL	*MS*	-0.095	[-4.619]***	$MS \Leftrightarrow BL$		0.253	2.408		1
MS	*BL*	-0.095	[-3.967]***				0.346		1
MS	*Y*	-0.024	[-4.587]***	$Y \Leftrightarrow MS$			0.041		1
Y	*MS*	-0.065	[-3.333]***		0.347		1.643		1
US									
BL	*MM*	-0.069	[-3.747]***	$BL \Leftrightarrow MM$			1.835		5
MM	*BL*	0.121	[2.145]**				8.375		5
BL	*MS*	-0.071	[-2.336]**	$BL \Leftrightarrow MS$	0.17		9.901*	$MS \Rightarrow BL$	5
MS	*BL*	0.086	[3.147]***				2.011		5
US 1									
BL	*MS*	-0.099	[-5.017]***	$MS \Rightarrow BL$	-0.262	-0.415	0.765		1
MS	*BL*	-0.07	[-1.131]		0.338		1.689		1
US 2									
BL	*MM*	-0.001	[-6.921]***	$BL \Leftrightarrow MM$			1.176		1
MM	*BL*	0.001	[2.431]**			0.538	4.647**	$BL \Rightarrow MM$	1
BL	*MS*	-0.17	[-5.825]***	$BL \Leftrightarrow MS$			0.14		1
MS	*BL*	-0.123	[-6.919]***		0.252		2.532		1
MS	*Y*	-0.033	[-4.824]***	$Y \Rightarrow MS$	0.27	-0.379	8.208**	$Y \Rightarrow MS$	2
Y	*MS*	-0.005	[-0.951]		-0.307		1.09		2

Note: Numbers in square brackets are t-statistics. ***, **, * denote significance at the 1, 5 and 10 percent levels respectively, DV and INDV are dependent and independent variables respectively, ECT denotes error-correction term; SRC is short-run coefficient; only significant lags are summed under SRC. LR = long run and SR = short run, $\Rightarrow$ indicates unidirectional causality and $\Leftrightarrow$ indicates bidirectional. Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:4), UK 2= (1993:1 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). *BL* denotes bank loans, *MB* is monetary base, *MM* is money multiplier, *MS* is money supply and *Y* is income.

Panel C: Granger Causality results

DV	*INDV*	*F test*	*Probability*	*Lags*	*Granger*	*DV*	*INDV*	*F test*	*Probability*	*Lags*	*Granger*
UK						**Germany**					
BL	*MB*	1.824	(0.177)	1		*MS*	*Y*	2.809	(0.246)	2	
MB	*BL*	6.777	(0.009)	1	$BL \Rightarrow MB$	*Y*	*MS*	72.172	(0)	2	$MS \Rightarrow Y$
UK 1						**US**					
BL	*MB*	0.088	(0.766)	1		*BL*	*MB*	8.869	(0.114)	5	
MB	*BL*	0.132	(0.717)	1		*MB*	*BL*	4.753	(0.447)	5	
BL	*MM*	0.498	(0.481)	1		*MS*	*Y*	7.418	(0.025)	2	$Y \Rightarrow MS$
MM	*BL*	0.027	(0.87)	1		*Y*	*MS*	1.651	(0.438)	2	
BL	*MS*	2.72	(0.099)	1	$MS \Rightarrow BL$						
MS	*BL*	0.18	(0.672)	1							
MS	*Y*	1.051	(0.305)	1							
Y	*MS*	0.273	(0.602)	1							
Canada						**US 1**					
BL	*MM*	7.092	(0.008)	1	$MM \Rightarrow BL$	*BL*	*MB*	0.643	(0.423)	1	
MM	*BL*	0.442	(0.506)	1		*MB*	*BL*	0.009	(0.923)	1	
BL	*MS*	1.343	(0.511)	2		*BL*	*MM*	0.191	(0.662)	1	
MS	*BL*	6.7	(0.035)	2	$BL \Rightarrow MS$	*MM*	*BL*	0.049	(0.825)	1	
						MS	*Y*	1.34	(0.247)	1	
						Y	*MS*	1.518	(0.218)	1	
Canada 1						**US 2**					
BL	*MM*	0.007	(0.935)	1		*BL*	*MB*	0.952	(0.329)	1	
MM	*BL*	8.391	(0.004)	1	$BL \Rightarrow MM$	*MB*	*BL*	2.31	(0.129)	1	
Canada 2											
BL	*MM*	0.155	(0.694)	1							
MM	*BL*	0.411	(0.521)	1							

Note: *DV* and *INDV* are dependent and independent variable respectively. Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:4), UK2= (1993:1 - 2006:2), US 1 = (1975:3 - 1986:4), US 2 = (1987:1 - 2007:1). $\Rightarrow$ indicates unidirectional causality and $\Leftrightarrow$ indicates bidirectional. *BL* denotes bank loans, *MB* is monetary base, *MM* is money multiplier, *MS* is money supply and *Y* is income.

Appendix A5.2: Trivariate VAR

DV	*INDV*	*MWald*	*Causality*	*MWald*	*Causality*	*MWald*	*Causality*
		Canada		**Canada 1**		**Canada 2**	
BL	*DEP*	5.68	*DEP* $\Rightarrow$ *BL*	2.26		0.31	
		(0.059)		(0.689)		(0.579)	
BL	*MS*	6.76	*MS* $\Rightarrow$ *BL*	14.87	*MS* $\Rightarrow$ *BL*	3.42	*MS* $\Rightarrow$ *BL*
		(0.034)		(0.005)		(0.064)	
BL	*DEP & MS*	12.55	*DEP&MS* $\Rightarrow$ *BL*	17.81	*DEP&MS* $\Rightarrow$ *BL*	6.06	*DEP&MS* $\Rightarrow$ *BL*
		(0.014)		(0.023)		(0.048)	
DEP	*BL*	4.57		2.64		0.04	
		(0.102)		(0.619)		(0.84)	
DEP	*MS*	2.39		25.4	*MS* $\Rightarrow$ *DEP*	1.23	
		(0.303)		(0)		(0.268)	
DEP	*BL & MS*	8.67	*BL&MS* $\Rightarrow$ *DEP*	28.98	*BL&MS* $\Rightarrow$ *DEP*	4.9	*BL&MS* $\Rightarrow$ *DEP*
		(0.07)		(0)		(0.086)	
MS	*BL*	11.99	*BL* $\Rightarrow$ *MS*	4.03		1.13	
		(0.003)		(0.403)		(0.287)	
MS	*DEP*	13.74	*DEP* $\Rightarrow$ *MS*	3.48		1.44	
		(0.001)		(0.482)		(0.23)	
MS	*BL & DEP*	15.16	*BL&DEP* $\Rightarrow$ *MS*	17.23	*BL&DEP* $\Rightarrow$ *MS*	1.77	
		(0.004)		(0.028)		(0.412)	
		France		**Germany**			
BL	*DEP*	5.98	*DEP* $\Rightarrow$ *BL*	1.62			
		(0.05)		(0.655)			
BL	*MS*	2.15		1.65			
		(0.342)		(0.648)			
BL	*DEP & MS*	13.4	*DEP&MS* $\Rightarrow$ *BL*	7.23			
		(0.01)		(0.3)			
DEP	*BL*	6.88	*BL* $\Rightarrow$ *DEP*	0.9			
		(0.032)		(0.826)			
DEP	*MS*	4.55		6.44	*MS* $\Rightarrow$ *DEP*		
		(0.103)		(0.092)			
DEP	*BL & MS*	7.56		10.16			
		(0.109)		(0.118)			
MS	*BL*	5.98	*BL* $\Rightarrow$ *MS*	12.85	*BL* $\Rightarrow$ *MS*		
		(0.05)		(0.005)			
MS	*DEP*	3.31		49.48	*DEP* $\Rightarrow$ *MS*		
		(0.191)		(0)			
MS	*BL & DEP*	7.67		101.3	*BL&DEP* $\Rightarrow$ *MS*		
		(0.105)		(0)			
		Italy		**Japan**			
BL	*DEP*	9.74		24.08	*DEP* $\Rightarrow$ *BL*		
		(0.136)		(0)			
BL	*MS*	4.14		14.17	*MS* $\Rightarrow$ *BL*		
		(0.658)		(0.003)			
BL	*DEP & MS*	14.34		35.07	*DEP&MS* $\Rightarrow$ *BL*		
		(0.279)		(0)			
DEP	*BL*	8.84		7.81	*BL* $\Rightarrow$ *DEP*		
		(0.183)		(0.05)			
DEP	*MS*	7.86		5.18			
		(0.248)		(0.159)			
DEP	*BL & MS*	13.42		11.26	*BL&MS* $\Rightarrow$ *DEP*		

		(0.339)		(0.081)			
MS	*BL*	4.56		9.9	*BL⇒MS*		
		(0.601)		(0.02)			
MS	*DEP*	15.88	*DEP⇒MS*	1.75			
		(0.014)		(0.625)			
MS	*BL & DEP*	24.32	*BL&DEP⇒MS*	12.54	*BL&DEP⇒MS*		
		(0.018)		(0.051)			
		UK		**UK 1**		**UK 2**	
BL	*DEP*	0.53		0.6		1.44	
		(0.769)		(0.742)		(0.487)	
BL	*MS*	11.95	*MS⇒BL*	5.26	*MS⇒BL*	2.29	
		(0.003)		(0.072)		(0.318)	
BL	*DEP & MS*	15.34	*DEP&MS⇒BL*	10.08	*DEP&MS⇒BL*	3.15	
		(0.004)		(0.039)		(0.534)	
DEP	*BL*	0.69		0.2		5.96	*BL⇒DEP*
		(0.708)		(0.907)		(0.051)	
DEP	*MS*	9.88	*MS⇒DEP*	4.19		5.97	*MS⇒DEP*
		(0.007)		(0.123)		(0.051)	
DEP	*BL & MS*	10.13	*BL&MS⇒DEP*	5.74		11.36	*BL&MS⇒DEP*
		(0.038)		(0.22)		(0.023)	
MS	*BL*	5.06	*BL⇒MS*	9.98	*BL⇒MS*	5.71	*BL⇒MS*
		(0.08)		(0.007)		(0.058)	
MS	*DEP*	5.15	*DEP⇒MS*	10.01	*DEP⇒MS*	3.51	
		(0.076)		(0.007)		(0.173)	
MS	*BL & DEP*	6.44		11.11	*BL&DEP⇒MS*	11.61	*BL&DEP⇒MS*
		(0.169)		(0.025)		(0.021)	
		US		**US 1**		**US 2**	
BL	*DEP*	4.7	*DEP⇒BL*	2.16		3.23	
		(0.095)		(0.34)		(0.199)	
BL	*MS*	0.21		13.22	*MS⇒BL*	7.85	*MS⇒BL*
		(0.899)		(0.001)		(0.02)	
BL	*DEP & MS*	8.13	*DEP&MS⇒BL*	15.34	*DEP&MS⇒BL*	9.2	*DEP&MS⇒BL*
		(0.087)		(0.004)		(0.056)	
DEP	*BL*	18.51	*BL⇒DEP*	0.17		13.39	*BL⇒DEP*
		(0)		(0.92)		(0.001)	
DEP	*MS*	12.13	*MS⇒DEP*	1.38		6.64	*MS⇒DEP*
		(0.002)		(0.502)		(0.036)	
DEP	*BL & MS*	24.79	*BL&MS⇒DEP*	1.4		26.62	*BL&MS⇒DEP*
		(0)		(0.844)		(0)	
MS	*BL*	8.59	*BL⇒MS*	0.02		27.53	*BL⇒MS*
		(0.014)		(0.991)		(0)	
MS	*DEP*	6.29	***DEP⇒MS***	0.54		4.76	*DEP⇒MS*
		(0.043)		(0.763)		(0.093)	
MS	*BL & DEP*	26.07	*BL&DEP⇒MS*	0.57		32.86	*BL&DEP⇒MS*
		(0)		(0.966)		(0)	

Note: Numbers in parentheses are probability. *DV* and *INDV* are dependent and independent variables respectively. Number of lag lengths (*k*) and order of integration (*d*) is 1 and 1 respectively in all cases except Canada 1, Japan and Germany where *k*=2 and *d*=1 and Italy where *k*=5 and *d*=1. Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:4), UK 2= (1993:1 - 2006:2), US 1 = (1975:3 - 1986:4), US. ⇒ indicates unidirectional causality. *BL* denotes bank loans, *DEP* is deposits and *MS* is money supply.

Appendix A5.3: Money Supply and Bank Stock Returns

Panel A: Cointegrating equations

Country	*Beta*	*t-stat*	*Trend*	*t-stat*	*Intercept*
Canada	-1.803	[-9.196]***			17.708
Canada 1	-0.324	[-1.095]	-0.014	[-2.129]**	-0.616
Canada 2	-3.823	[-11.58]***			42.876
France	-4.944	[-4.873]***			28
Germany	-1.136	[-1.674]*			12.188
Italy	-0.71	[-3.862]***			2.585
Japan	-5.492	[-5.241]***	0.031	[1.833]*	62.579
UK	1.06	[1.410]			-30.196
UK 1	1.111	[1.567]	-0.066	[-2.646]***	-16.882
UK 2	-2.192	[-5.448]***			19.897
US	-2.105	[-15.50]***			11.508
US 2	-1.795	[-5.212]***			7.992

Note: Numbers in square brackets are t-statistics. ***, **, * denote significance at the 1, 5 and 10 percent levels respectively. Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:4), UK 2= (1993:1 - 2006:2), US2 = (1987:1 - 2007:1).

Panel B: VECM (Short-run and long-run causality)

DV	*INDV*	*ECT*	*t-stat*	*LR Conclusion*	*SRC DV*	*INDV*	χ^2 *test*	*SR Conclusion*
Canada								
RET	*MS*	-0.05	[-1.943]*	$MS \Leftrightarrow RET$	-0.173	-0.591	17.656***	$MS \Rightarrow RET$
MS	*RET*	0.008	[2.888]***				2.829	
Canada 1								
RET	*MS*	-0.485	[-4.435]***	$MS \Rightarrow RET$			2.297	
MS	*RET*	0.014	[0.949]				0.034	
Canada 2								
RET	*MS*	-0.022	[-1.262]				0.12	
MS	*RET*	-0.012	[-8.365]***	$RET \Rightarrow MS$			0.469	
France								
RET	*MS*	-0.029	[-0.717]				0.383	
MS	*RET*	0.012	[4.260]***	$RET \Rightarrow MS$			2.251	
Germany								
RET	*MS*	-0.009	[-6.173]***	$MS \Leftrightarrow RET$			1.951	
MS	*RET*	-0.015	[-1.643]*				0	
Italy								
RET	*MS*	-0.156	[-1.640]*	$MS \Leftrightarrow RET$		-0.611	13.491**	$MS \Rightarrow RET$
MS	*RET*	0.037	[3.057]***				3.847	
Japan								
RET	*MS*	-0.036	[-1.642]*	$MS \Leftrightarrow RET$			0.249	
MS	*RET*	-0.002	[-1.762]*				3.752	
UK								
RET	*MS*	-0.006	[-1.951]*	$MS \Leftrightarrow RET$			4.582	
MS	*RET*	-0.001	[-4.755]***				0.507	
UK 1								
RET	*MS*	-0.497	[-5.007]***	$MS \Rightarrow RET$			0.152	
MS	*RET*	0.021	[1.616]			2.535	6.85***	$RET \Rightarrow MS$
UK 2								
RET	*MS*	-0.062	[-2.510]**	$MS \Leftrightarrow RET$			1.761	
MS	*RET*	-0.01	[-5.296]***				2.585	
US								
RET	*MS*	-0.052	[-1.642]*	$MS \Leftrightarrow RET$			2.344	
MS	*RET*	0.007	[3.150]***				0.881	
US 2								
RET	*MS*	-0.011	[-0.351]				2.272	
MS	*RET*	0.007	[3.670]***	$RET \Rightarrow MS$			0.464	

Note: Numbers in square brackets are t-statistics. ***, **, * denote significance at the 1, 5 and 10 percent levels respectively, DV and INDV are dependent and independent variables respectively, ECT denotes error-correction term; SRC is short-run coefficient; only significant lags are summed under SRC. LR = long run and SR = short run, $\Rightarrow$ indicates unidirectional causality and $\Leftrightarrow$ indicates bidirectional causality. Canada 1 = (1976:3 - 1990:4), Canada 2 = (1991:1 - 2007:1), UK 1 = (1975:3 - 1992:4), UK 2= (1993:1 - 2006:2), US 2 = (1987:1 - 2007:1). *MS* is money supply and *RET* is bank returns.

Panel C: Granger causality

Country	*DV*	*INDV*	*F-test*	*Probability*
US 1	*RET*	*MS*	1.573	(0.21)
	MS	*RET*	0.92	(0.338)

Note: *DV* and *INDV* are dependent and independent variables respectively. US 1 = (1975:3 - 1986:4). *MS* is money supply and *RET* is bank returns.

Appendix B1: *DataStream* Data Sources

Variable	Name	Code	Source
Canada			
DEP	CN BANKING INSTS.: DEMAND DEPS, OTHER RESD. SECTS. IN CNTY. CURN	CNQ24...A	IFS (IMF)
BL	CN DOMESTIC CREDIT CURN	CNQ32...A	IFS (IMF)
MS	CN MONEY SUPPLY M3 CURA	CNM3....B	CANSIM - Statistics Canada
INF	CN CPI NADJ	CNQ64...F	IFS (IMF)
Rb	CN TREASURY BILL RATE	CNQ60C..	IFS (IMF)
P	CANADA-DS Banks - PRICE INDEX	BANKSCN	DataStream
Rf	US TREASURY BILL RATE	USQ60C..	IFS (IMF)
Rl	CN LENDING RATE (PRIME RATE)	CNQ60P..	IFS (IMF)
Rd	CN DEPOSIT RATE	CNQ60L..	IFS (IMF)
Y	CN GDP (REAL) (AR) CONA	CNOCFGDPD	OECD MEIs
France			
DEP	DEMAND DEPOSITS	13224...ZF...	IFS (IMF)
BL	DOMESTIC CREDIT	13232...ZF...	IFS (IMF)
MS	FR MONEY SUPPLY - M3 (DEF. 1991) CURA	FROMA013B	OECD MEIs
INF	FR CPI NADJ	FRQ64...F	IFS (IMF)
Rb	FR TREASURY BILL RATE	FRQ60C..	IFS (IMF)
P	FRANCE-DS Banks - PRICE INDEX	BANKSFR	DataStream
Rf	US TREASURY BILL RATE	USQ60C..	IFS (IMF)
Rl	FR LENDING RATE (PRIME RATE)	FRQ60P..	IFS (IMF)
Rd	FR DEPOSIT RATE	FRQ60L..	IFS (IMF)
Y	FR GDP (REAL) (AR) CONA	FROCFGDPD...	OECD MEIs
Germany			
DEP	DEMAND DEPOSITS OF OTH RESID	13424...ZF...	IFS (IMF)
BL	DOMESTIC CREDIT	13432...ZF...	IFS (IMF)
MS	BD MONEY SUPPLY - M3 (CONTINUOUS SERIES) CURA	BDM3C...B	Deutsche Bundesbank
INF	BD CPI NADJ	BDQ64...F	IFS (IMF)
Rb	BD TREASURY BILL RATE	BDQ60C..	IFS (IMF)
P	GERMANY-DS Banks - PRICE INDEX	BANKSBD	DataStream
Rf	US TREASURY BILL RATE	USQ60C..	IFS (IMF)
Rl	BD LENDING RATE (PRIME RATE)	BDQ60P..	IFS (IMF)
Rd	BD DEPOSIT RATE	BDQ60L..	IFS (IMF)
Y	BD GDP (REAL)(EO76)(DISC.) CONA	BDO9FGDPD	OECD MEIs
Italy			
DEP	DEMAND DEPOSITS	13624...ZF...	IFS (IMF)
BL	DOMESTIC CREDIT	13632...ZF...	IFS (IMF)
MS	M2(NATIONAL DEFINITION)	13659MB.ZF...	IFS (IMF)
INF	IT CPI NADJ	ITQ64...F	IFS (IMF)
Rb	IT TREASURY BILL RATE	ITQ60C..	IFS (IMF)
P	ITALY-DS Banks - PRICE INDEX	BANKSIT	DataStream
Rf	US TREASURY BILL RATE	USQ60C..	IFS (IMF)
Rl	IT LENDING RATE (PRIME RATE)	ITQ60P..	IFS (IMF)
Rd	IT DEPOSIT RATE	ITQ60L..	IFS (IMF)
Y	IT GDP (REAL) (AR) CONA	ITOCFGDPD	OECD MEIs

Variable	Name	Code	Source
Japan			
DEP	JP BANKING INSTS.: DEMAND DEPS, OTHER RESD. SECTS. IN CNTY. CURN	JPQ24...A	IFS (IMF)
BL	JP DOMESTIC CREDIT CURN	JPQ32...A	IFS (IMF)
MS	JP MONEY SUPPLY: M3 PLUS CD (EP) CURN	JPM3CDF.A	Bank of Japan
INF	JP CPI NADJ	JPQ64...F	IFS (IMF)
Rb	JP NIKKEI BOND INDEX YIELD - SHORT-TERM (EP) NADJ	JPNKBNDSF	NIHON KEIZAI SHIMBUN, INC, JAPAN
P	JAPAN-DS Banks - PRICE INDEX	BANKSJP	DataStream
Rf	US TREASURY BILL RATE	USQ60C..	IFS (IMF)
Rl	JP LENDING RATE (PRIME RATE)	JPQ60P..	IFS (IMF)
Rd	JP DEPOSIT RATE	JPQ60L..	IFS (IMF)
Y	JP GDP (REAL) (AR) CONA	JPOCFGDPD	OECD MEIs
United Kingdom			
DEP	UK DEMAND, TIME, SAVINGS & FOREIGN CURRENCY DEPOSITS CURN	UKQ25L..A	IFS (IMF)
BL	UK DOMESTIC CREDIT CURN	UKQ32...A	IFS (IMF)
MS	UK MONEY SUPPLY M4 (END QUARTER LEVEL) CURA	UKM4Q...B	Bank of England
INF	UK CPI NADJ	UKQ64...F	IFS (IMF)
Rb	UK TREASURY BILL RATE	UKQ60C..	IFS (IMF)
P	UK-DS Banks - PRICE INDEX	BANKSUK	DataStream
Rf	US TREASURY BILL RATE	USQ60C..	IFS (IMF)
Rl	UK LENDING RATE (PRIME RATE)	UKQ60P..	IFS (IMF)
Rd	UK DEPOSIT RATE	UKQ60L..	IFS (IMF)
Y	UK GDP (REAL) (AR) CONA	UKOCFGDPD	OECD MEIs
United States			
DEP	US BANKING INSTS.: DEMAND DEPS, OTHER RESD. SECTS. IN CNTY. CURN	USQ24...A	IFS (IMF)
BL	US DOMESTIC CREDIT CURN	USQ32...A	IFS (IMF)
MS	US MONEY M2 CURA	USQ59MBCB	IFS (IMF)
INF	US CPI NADJ	USQ64...F	IFS (IMF)
Rb	US TREASURY BILL RATE	USQ60C..	IFS (IMF)
P	NASDAQ BANKS - PRICE INDEX	NASBANK	NASDAQ Stock Market
Rf	UK TREASURY BILL RATE	UKQ60C..	IFS (IMF)
Rl	US LENDING RATE (PRIME RATE)	USQ60P..	IFS (IMF)
Rd	U.S DEPOSIT RATE	USQ60L..	IFS (IMF)
Y	US GDP (REAL) (AR) CONA	USOCFGDPD	OECD MEIs

Note: IFS (IMF) is International Financial Statistics (International Monetary Fund), OECD EO is OECD Economic Outlook, and OECD MEI is OECD Main Economic Indicators.

Bibliography

Abdullah, D. A., and S. C. Hayworth, 1993, Macroeconometrics of stock price fluctuations, *Quarterly Journal of Business and Economics*, 32, 50–67.

Aharony, J., A. Saunders, and I. Swary, 1986, The effects of a shift in monetary policy regime on the profitability and risk of commercial banks, *Journal of Monetary Economics*, 17, 363-377.

Ahmad, N., and F. Ahmed, 2006. The long-run and short-run endogeneity of money supply in Pakistan: An empirical investigation, *State Bank of Pakistan Research Bulletin*, 2.

Alfaro, R., C. Garcia, A. Jara, and H. Franken, 2005. The Bank Lending Channel in Chile, *Investigating the Relationship between the Financial and Real Economy*, 22.

Altissimo, F., E. Gaiotti, and A. Locarno, 2001, Monetary analysis in the Bank of Italy prior to EMU: The role of real and monetary variables in the models of the Italian economy, in H.-J. Klockers, and C. Willeke, eds.: *Monetary Analysis: Tools and Applications* (European Central Bank, Frankfurt, Germany).

Altunbas, Y., O. Fazylov, and P. Molyneux, 2002, Evidence of the bank lending channel in Europe, *Journal of Banking and Finance*, 26, 2093-2110.

Alves Jr., A. J., G. A. Dymski, and L.-F. de Paula, 2004, Interrelated bank strategies, financial fragility and credit expansion: A post Keynesian approach, Anais do XXXII Encontro Nacional de Economia [Proceedings of the 32th Brazilian Economics Meeting], ANPEC - Associacao Nacional do Centros de Pos-graduacao em Economia [Brazilian Association of Graduate Programs in Economics] (João Pessoa, PB).

Arellano, M., and S. Bond, 1991, Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations, *Review of Economic Studies*, 58.

Arestis, P., 1987, The credit segment of a UK post Keynesian model, *Journal of Post Keynesian Economics*, 10, 250-269.

Ariff, M., and A. Lamba, 2007, The valuation effects of prime rate revisions: Is there an advantage of being first?, *International Review of Finance* Forthcoming.

Bae, S. C., 1990, Interest rate changes and common stock returns of financial institutions: Revisited, *Journal of Financial Research*, 13, 71-79.

Banerjee, A., 1999, Panel data unit roots and cointegration: An overview, *Oxford Bulletin of Economics and Statistics*, 61, 607-629.

Barros, C. P., C. Ferreira, and J. Williams, 2007, Analysing the determinants of performance of best and worst European banks: A mixed logit approach, *Journal of Banking & Finance*, 31, 2189-2203.

Beccalli, E., B. Casu, and C. Girardone, 2006, Efficiency and Stock Performance in European Banking, *Journal of Business Finance & Accounting*, 33, 245-262.

Berger, A. N., and C. H. S. Bouwman, 2008, Bank liquidity creation, *Review of Financial Studies*, Forthcoming.

Bernanke, B. S., and A. S. Blinder, 1988, Credit, money and aggregate demand, *American Economic Review*, 78, 435-439.

Bernanke, B. S., and A. S. Blinder, 1992, The Federal Funds rate and the channels of monetary transmission, *American Economic Review*, 82, 902-921.

Bernanke, B. S., and M. Gertler, 1995, Inside the black box: The credit channel of monetary policy transmission, *Journal of Economic Perspectives*, 9, 27-48.

Bertocco, G., 2001, Is Kaldor's theory of money supply endogeneity still relevant?, *Metroeconomica*, 52, 95-120.
Booth, J. R., and D. T. Officer, 1985, Expectations, interest rates and commercial bank stocks, *Journal of Financial Research*, 8, 51-58.
Calcagnini, G., R. De Bonis, and D. D. Hester, 1999, Determinants of bank branch expansion in Italy, 40th Società Italiana Degli Economisti meeting, October 29-30 (Univerity of Ancona).
Caporale, G. M., and P. Howells, 2001, Money, credit and spending: Drawing causal inferences, *Scottish Journal of Political Economy*, 48, 547-557.
Caprio, J., Gerard, and D. Klingebiel, 2003. Episodes of Systemic and Borderline Financial Crises, World Bank.
Carbó Valverde, S., and F. Rodríguez Fernández, 2007, The determinants of bank margins in European banking, *Journal of Banking & Finance*, 31, 2043-2063.
Cecchetti, S. G., 1995, Distinguishing theories of the monetary transmission mechanism, *Federal Reserve Bank of St. Louis Review*, May/June, 83-97.
Chance, D. M., and W. R. Lane, 1980, A re-examination of interest rate sensitivity in the common stocks of financial institutions, *Journal of Financial Research*, 3, 49-56.
Cheung, Y.-W., and K. S. Lai, 1993, Finite-sample sizes of Johansen's likelihood ratio tests for cointegration, *Oxford Bulletin of Economics and Statistics*, 55, 313-328.
Choi, I., 2001, Unit root tests for panel data, *Journal of International Money and Finance*, 20, 249-272.
Chrystal, A., and P. Mizen, 2002, Modelling credit in the transmission mechanism of the United Kingdom, *Journal of Banking and Finance*, 26, 2131-2154.
Cifter, A., and A. Ozun, 2007, The monetary transmission mechanism in the new economy: Evidence from Turkey (1997-2006), *South East European Journal of Economics and Business*, 2, 15-24.
Clarke, J. A., and S. Mirza, 2006, A comparison of some common methods for detecting Granger noncausality, *Journal of Statistical Computation & Simulation*, 76, 207-231.
Cooper, M. J., W. E. Jackson, III, and G. A. Patterson, 2003, Evidence of predictability in the cross-section of bank stock returns, *Journal of Banking and Finance*, 27, 817-850.
Cornell, B., 1983, The money supply announcements puzzle: Review and interpretation, *American Economic Review*, 73, 644-657.
Craig, V. V., 1998, Financial deregulation in Japan, *FDIC Banking Review*, 11, 1-12.
Curry, T., and L. Shibut, 2000, The cost of the savings and loan crisis: Truth and consequences, *FDIC Banking Review*, 13, 26-35.
Davidson, P., 2006, Exogenous versus endogenous money: The conceptual foundations, in M. Setterfield, ed.: *Complexity, Endogenous Money and Macroeconomic Theory* (Edward Elgar, Cheltenham, UK.).
Davidson, R., and J. G. MacKinnon, 1993. *Estimation and Inference in Econometrics* (Oxford University Press, New York).
de Bondt, G. J., 1999, Credit channels in Europe: Cross-country investigation, *Banca Nazionale del Lavoro Quarterly Review*, 52, 295-326.
de Haan, L., 2003, Microdata evidence on the bank lending channel in The Netherlands, *Economist-Netherlands*, 151, 293-315.
Deriet, M., and M. Seccareccia, 1996, Bank markups, horizontalism and the significance of banks' liquidity preference: An empirical assessment, *Économies et Sociétés. Monnaie et Production*, 10, 139-163.

Dhakal, D., M. Kandil, and S. C. Sharma, 1993, Causality between the money supply and share prices: A VAR investigation, *Quarterly Journal of Business and Economics*, 32, 52-74.
Dickey, D. A., and W. A. Fuller, 1979, Distribution of the estimators for autoregressive time series with a unit root, *Journal of the American Statistical Association*, 74, 427-431.
Dickey, D. A., and W. A. Fuller, 1981, Likelihood ratio statistics for autoregressive time series with a unit root, *Econometrica*, 49, 1057-1072.
Dickey, D. A., D. W. Jansen, and D. L. Thornton, 1991, A primer on cointegration with an application to money and income, *Federal Reserve Bank of St. Louis Review*, 73, 58-78.
Dinenis, E., and S. K. Staikouras, 1998, Interest rate changes and common stock returns of financial institutions: Evidence from the UK, *European Journal of Finance*, 4, 113-127.
Dolado, J. J., and H. Lutkepohl, 1996, Making Wald tests work for cointegrated VAR Systems, *Econometric Reviews*, 15, 369-386.
Dow, A. C., and S. C. Dow, 1989, Endogenous money creation and idle balances, in J. Pheby, ed.: *New Directions in post-Keynesian Economics* (Edward Elgar, Aldershot, UK).
Dymski, G. A., 1988, A Keynesian theory of bank behavior, *Journal of Post Keynesian Economics*, 10, 499-526.
Eichengreen, B., 2000, The EMS crisis in retrospect, *NBER Working Paper Series*, No. 8035.
Engle, R. F., and C. W. J. Granger, 1987, Co-Integration and error correction: Representation, estimation, and testing, *Econometrica*, 55, 251-276.
Fama, E. F., 1970, Efficient capital markets: A review of theory and empirical work, *Journal of Finance*, 25, 383-417.
Favero, C. A., F. Giavazzi, and L. Flabbi, 1999, The transmission mechanism of monetary policy in Europe: Evidence from banks' balance sheets, *NBER Working Paper Series No. 7231*.
Ferreira, C., 2007, The bank lending channel transmission of monetary policy in the EMU: A case study of Portugal, *European Journal of Finance*, 13, 181-193.
Fiordelisi, F., 2007, Shareholder value efficiency in European banking, *Journal of Banking & Finance*, 31, 2151-2171.
Fisher, R. A., 1932. *Statistical Methods for Research Workers* (Oliver & Boyd, Edinburgh).
Flannery, M. J., and C. M. James, 1984, The effect of interest rate changes on the common stock returns of financial institutions, *Journal of Finance*, 39, 1141-1153.
Flannery, M. J., and A. A. Protopapadakis, 2002, Macroeconomic factors do influence aggregate stock returns, *The Review of Financial Studies*, 15, 751-782.
Fontana, G., 2003, Post Keynesian approaches to endogenous money: A time framework explanation, *Review of Political Economy*, 15, 291-314.
Ford, J. L., J. Agung, S. S. Ahmed, and B. Santoso, 2003, Bank behaviour and the channel of monetary policy in Japan, 1965-1999, *Japanese Economic Review*, 54, 275-299.
Foster, J., 1992, The determinants of sterling M3, 1963-88: An evolutionary macroeconomic approach, *The Economic Journal*, 102, 481-496.
Foster, J., 1994, An evolutionary macroeconomic model of Australian dollar M3 determination: 1967-93, *Applied Economics*, 26, 1109-1120.

Freedman, C., 1998, The Canadian banking system, *Bank of Canada Technical Report*, No. 81.
Friedman, M., ed., 1956. *The Quantity Theory of Money—A restatement* (The University of Chicago Press, Chicago).
Funke, N., and A. Matsuda, 2006, Macroeconomic news and stock returns in the United States and Germany, *German Economic Review*, 7, 189-210.
Garretsen, H., and J. Swank, 2003, The bank lending channel in The Netherlands: The impact of monetary policy on households and firms, *De Economist*, 151, 35.
Gertler, M., and S. Gilchrist, 1993, The role of credit market imperfections in the monetary transmission mechanism: Arguments and evidence, *Scandinavian Journal of Economics*, 95, 43-64.
Giles, J. A., and S. Mirza, 1999, Some pretesting issues on testing for Granger noncausality, *Econometrics Working Papers* (Department of Economics, University of Victoria).
Goddard, J., P. Molyneux, and J. O. S. Wilson, 2004, Dynamics of growth and profitability in banking, *Journal of Money, Credit and Banking*, 36, 1069-1090.
Golodniuk, I., 2006, Evidence on the bank-lending channel in Ukraine, *Research in International Business and Finance*, 20, 180-199.
Gomez-Gonzalez, J., and F. Grosz, 2007, Evidence of a bank lending channel for Argentina and Colombia, *Cuadernos de Economia (Pontifical Catholic University of Chile)*, 44, 109-126.
Gordon, M. J., 1962. *The Investment, Financing, and Valuation of the Corporation* (R.D. Irwin, Homewood, Illinois).
Granger, C. W. J., 1969, Investigating causal relationship by econometric models and cross section special methods, *Econometrica*, 37, 425-435.
Granger, C. W. J., 1988, Some recent developments in a concept of causality, *Journal of Econometrics*, 39, 199-211.
Gros, D., and N. Thygesen, 1998, *European Monetary Integration. From the European Monetary System to Economic and Monetary Union* (Longman, London, UK).
Guender, A. V., 1998, Is there a bank-lending channel of monetary policy in New Zealand?, *Economic Record*, 74, 243.
Hamburger, M. J., and L. A. Kochin, 1972, Money and stock prices: The channels of influence, *Journal of Finance*, 72, 231-249.
Hansen, A. H., 1949. *Monetary Theory and Fiscal Policy* (McGraw-Hill, New York).
Hansen, A. H., 1953. *A Guide to Keynes* (McGraw-Hill, New York).
Hardouvelis, G. A., 1987, Macroeconomic information and stock prices, *Journal of Economics and Business*, 39, 131-140.
Hashemzadeh, N., and P. Taylor, 1988, Stock prices, money supply, and interest rates: The question of causality, *Applied Economics*, 20, 1603-1611.
Hernando, I., and J. M. Pagés, 2003, Is there a bank lending channel of monetary policy in Spain?, in A. K. a. B. M. I Angeloni, ed.: *Monetary Policy Transmission in the Euro Area* (Cambridge University Press).
Hewitson, G., 1995, Post-Keynesian monetary theory: Some issues, *Journal of Economic Surveys*, 9, 285-310.
Hicks, J. R., 1937, Mr. Keynes and the "Classics"; A suggested interpretation, *Econometrica*, 5, 147-159.
Holmes, A., 1969, Operational constraints on the stabilization of money supply growth, *Controlling Monetary Aggregates* (Federal Reserve Bank of Boston).

Holtemöller, O., 2003, Money stock, monetary base and bank behavior in Germany, *Jahrbücher für Nationalökonomie and Statistik,* 223, 257-278.
Homa, K. E., and D. M. Jaffee, 1971, The supply of money and common stock prices, *Journal of Finance,* 26, 1045-1066.
Howells, P. G. A., 1995, The demand for endogenous money, *Journal of Post-Keynesian Economics,* 18, 89-106.
Howells, P. G. A., 1995, Endogenous money, *International Papers in Political Economy,* 2.
Howells, P. G. A., and K. Hussein, 1998, The endogeneity of money: Evidence from the G7, *Scottish Journal of Political Economy,* 45, 329-340.
Hsiao, C., 1985, Benefits and limitations of panel data, *Econometric Reviews,* 4, 121-174.
Huang, Z., 2003, Evidence of a bank lending channel in the UK, *Journal of Banking and Finance,* 27, 491-510.
Iannotta, G., G. Nocera, and A. Sironi, 2007, Ownership structure, risk and performance in the European banking industry, *Journal of Banking & Finance,* 31, 2127-2149.
Icard, A., 1994, The transmission of monetary policy in an environment of deregulation and exchange rate stability: The French experience, *Journal of Monetary Economics,* 33, 87-103.
Illing, M., 2003, A review of notable financial-stress events, in J. Chant, A. Lai, M. Illing, and F. Daniel, eds.: Bank of Canada Technical Report No. 95, *Essays on Financial Stability* (Bank of Canada).
Im, K. S., M. H. Pesaran, and Y. Shin, 1997, Testing for unit roots in heterogeneous panels, Discussion Paper (University of Cambridge).
Ince, O. S., and R. B. Porter, 2006, Individual equity return data from Thomson Datastream: Handle with care!, *The Journal of Financial Research,* 29, 463-479.
Johansen, S., 1988, Statistical analysis of cointegration vectors, *Journal of Economic Dynamics and Control,* 12, 231-254.
Johansen, S., and K. Juselius, 1990, Maximum likelihood estimation and inference on cointegration - with application to the demand for money, *Oxford Bulletin of Economics and Statistics,* 52, 169-210.
Kakes, J., 2000, Identifying the mechanism: Is there a bank lending channel of monetary transmission in The Netherlands?, *Applied Economics Letters,* 7, 63-67.
Kakes, J., and J.-E. Sturm, 2002, Monetary policy and banking: Evidence from German banking groups, *Journal of Banking and Finance,* 26, 2077-2092.
Kaldor, N., 1980, Monetarism and UK policy, *Cambridge Journal of Economics,* 4, 293-318.
Kaldor, N., and J. Trevithick, 1981, A Keynesian persepective on money, *Lloyds Bank Review,* 139, 1-19.
Kaminsky, G. L., and S. L. Schmukler, 2003, Short-run pain, long-run gain: The effects of financial liberalization, *IMF Working Paper,* WP/03/34.
Kanaya, A., and D. Woo, 2001. The Japanese banking crisis of the 1900s: Sources and lessons, *Essays in International Economics*, 222
Kashyap, A. K., and J. C. Stein, 1993, Monetary policy and bank lending, *NBER Working Paper Series No. 4317.*
Kashyap, A. K., and J. C. Stein, 1995, The impact of monetary policy on bank balance sheets, *Carnegie-Rochester Conference Series on Public Policy,* 42, 151-195.

Kashyap, A. K., and J. C. Stein, 2000, What do a million observations on banks say about the transmission of monetary policy?, *American Economic Review*, 90, 407-428.
Kashyap, A. K., J. C. Stein, and D. W. Wilcox, 1993, Monetary policy and credit conditions: Evidence from the composition of external finance, *American Economic Review*, 83, 78-98.
Kato, R., T. Ui, and T. Watanabe, 1999, Asymmetric effects of monetary policy: Japanese experience in the 1990's, *Bank of Japan Working Paper Series*, 99-102.
Keran, M. W., 1971, Expectations, money and the stock market, *Federal Reserve Bank of St. Louis Review*, January, 16-31.
Keynes, J. M., 1936. *The General Theory of Employment, Interest and Money* (Macmillan, London).
King, M., 1999, Reforming the international financial system: The middle way, Speech delivered to a session of the Money Marketers at the Federal Reserve Bank of New York on 9 September 1999.
King, M., 2002, No money, no inflation - The role of money in the economy, *Bank of England Quarterly Bulletin* 42, 162-176.
Kirkwood, J., and D. Nahm, 2006, Australian banking efficiency and its relation to stock returns, *Economic Record*, 82, 253-267.
Kishan, R. P., and T. P. Opiela, 2000, Bank size, bank capital and the bank lending channel, *Journal of Money, Credit and Banking*, 32, 121-141.
Klevmarken, N. A., 1989, Panel studies: What can we learn from them? Introduction, *European Economic Review*, 33, 523-529.
Kozuka, S., 2005, Reform of banking regulation in Japan in the 1990s, *The Japanese Economy*, 33, 50-68.
Kregel, J., 1997, Margins of safety and weight of the argument in generating financial instability, *Journal of Economic Issues*, 31, 543-548.
Lajeri, F., and J. Dermine, 1999, Unexpected inflation and bank stock returns: The case of France 1977-1991, *Journal of Banking and Finance*, 23, 939-953.
Lavoie, M., 1992. *Foundations of Post-Keynesian Economic Analysis* (Edward Elgar, Aldershot, UK).
Lavoie, M., and W. Godley, 2004, Features of a realistic banking system within a post-Keynesian stock-flow consistent model, *Cambridge Endowment for Research in Finance Working Paper no. 12.*
Lavoie, M., and W. Godley, 2006, Features of a realistic banking system within a post-Keynesian stock-flow consistent model, in M. Setterfield, ed.: *Complexity, Endogenous Money and Macroeconomic Theory* (Edward Elgar, Cheltenham, UK).
Lee, U., 1994, The impact of financial deregulation on the relationship between stock prices and monetary policy, *Quarterly Journal of Business and Economics*, 33, 37-50.
Lensink, R., and E. Sterken, 2002, Monetary transmission and bank competition in the EMU, *Journal of Banking and Finance*, 26, 2065-2075.
Levin, A., and C. Lin, 1993, Unit root tests in panel data: Asymptotic and finite-sample properties, Discussion Paper (University of California, San Diego).
Li, L., and Z. Hu, 1998, Responses of the stock market to amcroeconomic announcements across economic states, *IMF Working Paper No. 98/79*.
MacKinnon, J. G., 1996, Numerical distribution functions for unit root and cointegration tests, *Journal of Applied Econometrics*, 11, 601-618.

MacKinnon, J. G., A. A. Haug, and L. Michelis, 1999, Numerical distribution functions of likelihood ratio tests for cointegration, *Journal of Applied Econometrics,* 14, 563-577.
Maddala, G. S., and S. Wu, 1999, A comparative study of unit root tests with panel data and a new simple test, *Oxford Bulletin of Economics and Statistics* 61, 631–652.
Melitz, J., 1990, Financial deregulation in France, *European Economic Review,* 34, 394-402.
Meltzer, A. H., 1998, Monetarism: The issues and the outcome, *Atlantic Economic Journal,* 26, 8-31.
Meulendyke, A.-M., 1998, The Federal Reserve and U.S. monetary policy: A short history, in *U.S. Monetary Policy and Financial Markets* (Federal Reserve Bank of New York, New York).
Minsky, H. P., 1975. *John Maynard Keynes* (Columbia University Press, New York).
Minsky, H. P., 1982. *Can "It" Happen Again?: Essays on Instability and Finance* (M.E. Sharpe, Armonk, New York).
Minsky, H. P., 1986. *Stabilizing an Unstable Economy* (Yale University Press, New Haven, CT).
Mishkin, F. S., 1995, Symposium on the monetary transmission mechanism, *Journal of Economic Perspectives,* 9, 3-10.
Mishkin, F. S., 2000, From monetary targeting to inflation targeting: Lessons from the industrialized countries, Banco de Mexico Conference, Stabilization and Monetary Policy: The International Experience (Mexico City).
Moore, B. J., 1988. *Horizontalists and Verticalists: The Macroeconomics of Credit-Money* (Cambridge University Press, Cambridge).
Moore, B. J., 1989, The endogeneity of credit money, *Review of Political Economy,* 1, 64-93.
Moore, B. J., 1998, Acommodation to accommodationism: A note, *Journal of Post Keynesian Economics,* 21, 175-178.
Mukherjee, T. K., and A. Naka, 1995, Dynamic relations between macroeconomic variables and the Japanese stock market: An application of a vector error correction model, *Journal of Financial Research,* 18, 223.
Nakaso, H., 2001, The financial crisis in Japan during the 1990s: how the Bank of Japan responded and the lessons learnt, *BIS Papers,* No. 6.
Nell, K. S., 2000, The endogenous/exogenous nature of South Africa's money supply under direct and indirect monetary control measures, *Journal of Post Keynesian Economics,* 23, 313-329.
Oliner, S. D., and G. D. Rudebusch, 1996, Is there a broad credit channel for monetary policy?, *Federal Reserve Bank of San Francisco Economic Review,* 1, 3-13.
Orphanides, A., and R. D. Porter, 2001, Money and inflation: The role of information regarding the determinants of M2 behavior, in H.-J. Klockers, and C. Willeke, eds.: *Monetary Analysis: Tools and Applications* (European Central Bank, Frankfurt, Germany).
Palley, T. I., 1987, Bank lending, discount window borrowing, and the endogenous money supply: A theoretical framework, *Journal of Post Keynesian Economics,* 10, 282-303.
Palley, T. I., 1994, Competing views of the money supply: Theory and evidence, *Metroeconomica,* 45, 67-88.
Palley, T. I., 1997, Endogenous money and the business cycles, *Journal of Economics,* 65, 133-149.

Palley, T. I., 2002, Endogenous money: What it is and why it matters, *Metroeconomica,* 53, 152-180.
Pearce, D. K., and V. V. Roley, 1983, The reaction of stock prices to unanticipated changes in money: A note, *Journal of Finance,* 38, 1323-1333.
Pearce, D. K., and V. V. Roley, 1985, Stock prices and economic news, *Journal of Business,* 58, 49-67.
Pedroni, P., 1997, Panel cointegration: Asymptotic and finite sample properties of pooled time series tests, with an application to the PPP hypothesis: New results, Working Paper (Indiana University).
Pedroni, P., 1999, Critical values for cointegration tests in heterogeneous panels with multiple regressors, *Oxford Bulletin of Economics and Statistics,* 61, 653–670.
Pedroni, P., 2004, Panel cointegration: Asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis, *Economic Theory,* 20, 597-625.
Pesando, J. E., 1974, The supply of money and common stock prices: Further observations on the econometric evidence, *Journal of Finance,* 29, 909-921.
Phillips, P., and S. Ouliaris, 1990, Asymptotic properties of residual based tests for cointegration, *Econometrica,* 58, 165-193.
Phillips, P. C. B., and P. Perron, 1988, Testing for a unit root in time series regression, *Biometrika,* 75, 335-346.
Piegay, P., 1999, The new and post Keynesian analyses of bank behavior: Consensus and disagreement, *Journal of Post Keynesian Economics,* 22, 265-283.
Pinga, V. E. B., and G. C. Nelson, 2001, Money, prices and causality: Monetarist versus structuralist explanations using pooled country evidence, *Applied Economics,* 33, 1271-1281.
Pollin, R., 1991, Two theories of money supply endogeneity: Some empirical evidence, *Journal of Post Keynesian Economics,* 13, 366-396.
Rapach, D., 2001, Macro shock and real stock prices, *Journal of Economics and Business,* 53, 5-26.
Ratanapakorn, O., and S. C. Sharma, 2007, Dynamic analysis between the US stock returns and the macroeconomic variables, *Applied Financial Economics,* 17, 369-377.
Rochon, L.-P., 1999. *Credit, Money, and Production: An Alternative post-Keynesian Approach* (Edward Elgar, Cheltenham, UK).
Rochon, L.-P., 2006, Endogenous moeny, central banks and the banking system: Basil Moore and the supply of credit, in M. Setterfield, ed.: *Complexity, Endogenous Money and Macroeconomic Theory* (Edward Elgar, Cheltenham, UK).
Rogalski, R. J., and J. D. Vinso, 1977, Stock returns, money supply and the direction of causality, *Journal of Finance,* 32, 1027-1030.
Romer, C. D., and D. H. Romer, 1990, New evidence on monetary transmission mechanism, *Brookings Papers on Economic Activity,* 149-213.
Rose, P. S., 2002. *Commercial Bank Management* (McGraw-Hill, Boston).
Rousseas, S., 1985, A mark-up theory of bank loan rates, *Journal of Post Keynesian Economics,* 8, 153-144.
Rousseas, S., 1998. *Post Keynesian monetary economics* (Macmillan, Basingstoke, UK).
Rozeff, M. S., 1974, Money and stock prices, *Journal of Financial Economics,* 1, 245-302.
Sargan, J. D., 1958, The estimation of economic relationships using instrumental variables, *Econometrica,* 26, 393-415.

Scheller, H. K., 2004. *The European Central Bank: History, Role and Functions* (European Central Bank, Frankfurt, Germany).
Schwarz, G., 1978, Estimating the dimension of a model, *Annals of Statistics*, 6, 461-464.
Scott, R. H., 1966, Estimates of the Hicksian IS and LM curves for the United States, *Journal of Finance*, 21, 479-487.
Shanmugam, B., M. Nair, and O. W. Li, 2003, The endogenous money hypothesis: Empirical evidence from Malaysia, *Journal of Post Keynesian Economics*, 25, 599-611.
Stiglitz, J., and A. Weiss, 1981, Credit rationing in markets with imperfect information, *The American Economic Review* ,71, 393-410.
Stiroh, K. J., 2006, A portfolio view of banking with interest and noninterest activities, *Journal of Money, Credit & Banking*, 38, 1351-1361.
Strongin, S., and V. Tarhan, 1990, Money supply announcements and the market's perception of Federal Reserve Policy, *Journal of Money, Credit & Banking*, 22, 135-153.
Tarhan, V., 1987, Unanticipated interest rates, bank stock returns and the nominal contracting hypothesis, *Journal of Banking and Finance*, 11, 99-115.
Thiessen, G., 1998, The Canadian experience with targets for inflation control, The Gibson Lecture (Bank of Canada, Queen's University, Kingston, Ontario).
Toda, H. Y., and T. Yamamoto, 1995, Statistical inference in vector autoregressions with possible integrated processes, *Journal of Econometrics*, 66, 225-250.
Uzun, H., and E. Webb, 2007, Securitization and risk: Empirical evidence on US banks, *Journal of Risk Finance*, 8, 11-23.
Vera, A. P., 2001, The endogenous money hypothesis: some evidence from Spain (1987-1998), *Journal of Post Keynesian Economics*, 23, 509-526.
Vymyatnina, Y., 2006, How much control does Bank of Russia have over money supply?, *Research in International Business and Finance*, 20, 131-144.
Wells, D. R., 2004. *The Federal Reserve system: A History* (McFarland & Company, Inc., Jefferson, North Carolina).
Williamson, J., and M. Mahar, 1998. A survey of financial liberalization, *Essays in International Finance*, 211.
Wray, L. R., 1990. *Money and Credit in Capitalist Economies: The Endogenous Money Approach* (Edward Elgar, Aldershot).
Wray, L. R., 1995, Keynesian monetary theory: Liquidity preference or black box horizontalism, *Journal of Economic Issues*, 29, 273-282.
Yamaguchi, H., 2004, Japan's economy and monetary policy: A pragmatic evaluation, *Japan and the World Economy*, 16, 113-119.