UK INDUSTRIAL FIRMS' DEBT DECISION UNDER MONETARY POLICY TRANSMISSION

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Summary

Aston University, UK Industrial Firms' Debt Decisions under Monetary Policy Transmission: the Case in the UK, **Xiaoyan Cheng, Master of Research, October, 2008.** This thesis investigates the impact of monetary policy on firms' debt decisions using firms' accounting data. More appropriate measures of changes in monetary conditions are used. Foreign exchange rates are taken into account in the empirical model. The research findings are: Divisia money is not a good index for changes in monetary policy. The accounting ratios need further treatment to reflect the impact of monetary policy on firms' debt.

Keywords: Monetary policy, Firms' debt and Divisia money

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CHAPER 1 INTRODUCTION

This research aims to investigate the sensitivity of UK firms debt related to the availability of bank loans when the supply and demand of bank loans are impacted by monetary policies. Monetary policy is the decisions of official authorities (government or central bank) made on the official interest rates, usually short-term interest rates, of lending money and buying securities to the private financial sector to control the money supply and credit conditions in order to achieve certain macroeconomic goals, such as stable prices, fast economic growth and low unemployment (Mankiw, 2006). Monetary transmission, also called monetary policy transmission mechanism, is the mechanisms by which changes in monetary policy affect real economic activity (Miles and Scott, 2005). The impact of monetary policy transmission, or the effect of monetary policy changes includes: Domestically, the impact of monetary policy transmission follows the sequence of changes in interest rates of all maturities, fluctuation of asset prices, variability in demand, consumption and investment. Externally, monetary policy transmission shifts in the exchange rate, alters import prices and influences domestic inflation. Because individual faces a lifetime inter-temporal budget constraint, changes in interest rate affects consumption. The impact of bank lending on large, medium and small firms will be examined since it is likely that banks will alter lending policies to reflect changes in economic conditions or the price of debts based on the firms' balance sheet. Banks will be most wanted to change their lending polices as the riskness of firm with different size will do vary. This study intends to provide evidence about: i) the role that firms' debt play in UK monetary transmission; ii) the low presence of UK banks among small firms

(Bikker and Haaf, 2002); and iii) the conditions under which financial innovation and monetary transmission affect the debt levels of firms.

Related empirical studies have emphasised three different aspects in relation to bank lending and behaviour of recipients of bank loans under monetary impact. i) Money channel. This conventional view considers that monetary policy takes effect via interest rate changes in banks' reserves. ii) Bank lending channel. This stance regards the changes on money supply and aggregate spending is the core factor of monetary transmission. iii) The broad credit channel. Based on capital market imperfection in transmitting and amplifying monetary impact, the credit view of monetary transmission (Bernake and Gertel, 1995), in turn can be divided into two parts. One concerns the financial health of firms in relation to firms' level of bank borrowing (Bernake and and Gertel, 1989). The other considers changes in bank assets reflected by bank lending policies (Kakes and Sturm, 2002) under different economic conditions. This research falls into the former category which stresses the level of bank borrowing in relation to a firm's total debt. The variability of bank debts under different economic conditions will also be examined as this will affect the firm's investment policies.

CHAPTER 2 THEORETICAL LITERATURE

2.1 INTRODUCTION

This literature review chapter shows the weakness of existing empirical studies and provides theoretical and empirical evidence of the proposed research. It explores the factors which UK industrial firms consider to make their debt decisions under monetary policy transmission in order to establish the research models (in Chapter 3).

2.2 THE LIMITATION OF PAST STUDIES

There is no study examining the impact of monetary policy on firms' short and long-term debt. A large number of studies investigate firms' bank loans under monetary policy transmission to prove the existence of a lending channel in monetary policy transmission mechanism. They use banks' (Haan 2003; Hulsewig et al. 2006; Elbourne and Haan 2006), countries' (Ramlogan 2004; Bredin and O' Reilly 2004; Atta-Mensah and Dib 2006) and firms' (Haan and Sterken 2006; Nagahata and Sekine 2005; Guariglia and Mateut 2006) data respectively. However, firms' bank loans and short/long term debt are two independent accounting concepts. The former includes only loans while the latter comprises both bond and loans (Owen and Law, 2005). Furthermore, some studies conflate two concepts (Bougheas, et

al. 2006; Guariglia and Mateut, 2006) that they use the concept of bank loans and the sum of, short and long-term, debt interchange in calculating bank loans.

The accounting measures, which are used to determine the amount of bank loans, are biased. Past studies limit their accounting measures to gearing (Hallsten, 1999; Brigden and Mizen, 2004; Bougheas, et al 2006; Mateut et al. 2006), sales (Gertler and Gilchrist, 1994; Hu, 1999; Atanasova and Wilson, 2004), profit (Bougheas et al 2006), trade credit (Kohler, 2000; Atanasova and Wilson, 2004; Nilsen, 2002; Guariglia and Mateut 2006), coverage ratio (Guariglia 1999), collateral (Bougheas, et al. 2006), inventory (Guariglia, 1999; Nilsen, 2002) and cash flows (Chatelain, et al. 2003; Haan and Sterken, 2006). It is important to note: firstly, the above accounting measures are highly correlated with each other (Blinder and Maccini, 1991). For example, since the interest rates are highly correlated with the inventory level of a firm, the use of both inventory and interest rate in one model lack creditability. Secondly, measures of investment and taxation are not taken into account. However, in the short run, firms' demand of debt is determined by the relationship between the current rate of investment and funds generated internally. In the long term, firms' demand of debt is a result of the interaction between profitability, internal cash flow and investment (Light and White, 1979). Since tax payment is based on historical costs, the corporate income tax seriously affects after-tax internal cash flow after a monetary shock (Pinches, 1994). Moreover, in some studies macroeconomic measurements, such as capital stock and cost of capital (Nagahata and Sekine, 2005; Atta-Mensah and Dib, 2008), are inappropriately applied as the above accounting measures which are at the microeconomic level.

There is no consensus on the measurement of changes in monetary conditions. Previous measures of changes in monetary conditions rely on either positive/negative changes in a

short-term interest rates (Bougheas, et al.2006; Mateut, et al. 2006), the spread between a short-term and long-term interest rate (Kohler, et al. 2000; Suzuki, 2004), or a zero/one dummy variable (Huang, 2003; Atanasova and Wilson, 2004) to represent tight/loose money supply. Nonetheless, it is questionable whether, a positive interest rate innovation is directly related to tight monetary conditions. Because divisia money is a weighted result of money aggregation which takes the liquidity of different components of money into account, the index of divisia money appears to be a more comprehensive measure of money tightness. Using a dummy variable for tight money neglects various factors (e.g. foreign exchange rate) which also influence monetary conditions (Taylor, 2001; Scholl and Uhig 2005).

The impact of foreign exchange rate fluctuation has not been considered as an independent factor in determining firms' debt decisions when firms' level data is employed. Huang's (2003) paper is the only example which examines the impact of the exchange rate when examining firms' balance sheet data. However the impact is studied through a weighted monetary condition index. The studies which use the exchange rate as an independent determinate employ banks' or countries' level data (Hallsten, 1999; Suzuki, 2004; Elbourne and Haan, 2006).

2.3 THEORETICAL LITERATURE

The literature review consists of three subsections. Section 2.3.1 discusses the empirical evidence on firms' response in the monetary policy transmission mechanism. Section 2.3.2 reveals the monetary policy transmission mechanism and the media of monetary policy

transmission, such as banks, of monetary policy transmission. It also indicates the measure of monetary condition used in this research. To understand the criteria of firms, when they make debt decisions under monetary policy transmission, Section 2.3.3 provides the relevance of finance theories in explaining firms' investment decisions.

2.3.1 Firms' Debt under Monetary Policy Transmission

Modern firms depend on debt, equity, and derivatives to finance their daily activities (Levy and Sarnat, 1994). Since equity and financial derivatives are more expensive and riskier than firms' debt, including bank loans and bonds, firms prefer debt to equity and derivatives (Gallinger and Healey, 1991). When a monetary contraction increases firms' cost of capital[1], firms' demand of debt increases. However, the soaring cost of capital also promotes financial speculation and fraud in all financial markets (Warburton, 1999). In order to ensure the repayment of debt, firms' commercial paper issuance is constrained and collateral is requested from banks when issuing new loans. Due to increased market friction, a decline occurs in firms' access to credit market and thereby in economic efficiency (Altman and Suggitt 2000; Peersman and Smets, 2005).

Under a monetary contraction, the balance sheet of most firms will be weaker because of the constraint of the firm's access to credit (Bernanke, et al. 1996). The cost of funds rises and the value of the firm's assets shrinks. Alongside credit rating, balance sheet items are primarily used as an index of the value of collateral (Bernanke and Gertler, 1995). This research will employ the most important accounting measures: leverage, profitability and cash flow to measure firms' debt structure (Leland and Pyle, 1977). Other measures used in this research,

[1] It refers to the premium which borrowers pay to lenders.

for example, is the long-run level of firms' debt as it is the most heavily affected accounting measures (Alec and Mizen, 2002).

The impact of monetary policy conditions is also likely to vary between different sizes of firms.[2] Following a shift to tight money, large companies may just begin to borrow for inventories, whereas the inventories of small businesses shrink significantly (Gertler and Gilchrist, 1994). The change in the stock returns of large firms is also not considered to be significant, while the stock returns of small firms tend to decrease (Fama and French, 1993, and Perez-Quiros and Timmermann, 2000). Fazzari et. al (1988) conclude that this is because small firms finance most of their borrowing from banks through customer relationships, while large corporations finance more than 85% of new borrowing through non-bank sources.

The extent of changes in firms' debt is different in positive and negative monetary policy shock, i.e. monastery expansion and monetary contraction. Since the real effect of monetary policy are asymmetric (Florio 2005), negative monetary policy shocks affect firms' debt more than a positive monetary policy shock of similar size (Cover, 1992). This is because i) the nominal interest rate can be raised without end but it cannot be lower that zero; ii) firms' investment depends on equivalence of the marginal product of capital and the interest rate. If expectations get worse, there may be no reduction in interest rates that can compensate for a very low marginal efficiency of capital; iii) when money is tight, there is less funds available to firms.

[2] The assumption here is that transmission channels function perfectly and that their ability to transmit strongly depends on monetary conditions. In practice, it will not always be the case. For example, banks are always known to favor large and more credit worthy firms above small firms (Peterson and Rajan, 1994).

2.3.2 The Monetary Policy Transmission Mechanism

Market Conditions

The existence of monetary policy[3] is because of uncertainty in the economy, where the expectations are not based on a statistical analysis of past data (Keynes, 1936). Uncertainty distorts resource allocation via false prices (Carlin and Soskice, 2006), and thereby reduces economic welfare (Snowdon and Vane, 2005). Uncertainty results in a cost to obtain information. The phenomenon that information is not equally available to every market participant is called asymmetric information (Akerlof, 1970).

Asymmetric information in credit markets are due to firms having inside information about the quality of the projects, while banks do not have (Milgrom and Roberts, 1987). Asymmetric information entails moral hazard and adverse selection problems in monetary policy transmission. In credit market, the phenomenon that firms announce low return even if the true return is high is called moral hazard (Repullo and Suarez, 2000). Adverse selection refers to the behavior when firms act in favor of shareholders over creditors by taking projects with excessive risks (Vercammen, 2002). When a monetary authority increases the interest rates, firms with higher profits are likely to claim a low return in order to get a discount rate on borrowing. Due to adverse selection, only the projects with higher failure rates tend to stay in the credit market after monetary contraction while the projects with less risk and better return withdraw from the market (Hillier, 1997).

Monetary Transmission Mechanism and UK Evidence

Many articles discuss the channel of monetary policy transmission. That is, the media of

[3] Monetary policy is the instrument used by the official authorities (government or central bank) to control the money supply and credit conditions in order to achieve certain macroeconomic goals, such as stable prices, fast economic growth and low unemployment (Mankiw, 2006).

transmission after a monetary shock (Kuppers, 2001; Kakes and Sturm, 2002). There are three major views on monetary policy transmission mechanism. The Keynesian IS/LM[4] view (Keynes 1936; Hicks 1937; Abeland and Bernanke 2001; Mankiw 2006) reveals that monetary policy can be implemented through altering interest rates in the short-term money market. Some researchers name this mechanism as monetary channel or the interest rate channel (Hu, 1999). However, monetarists argue that monetary policy changes planned expenditures on assets in order to change the economy. This is the second view called money view (Taylor, 1995). The impact of changes in monetary policy widely spreads in all assets rather than working through the changes in interest because of direct substitution between money and other assets (Friedman 1959, 1970; Gordon, 1974; Laidler 1991). Money view has another branch which implies that monetary policy takes place by a wealth effect (Blinder and Solow, 1973, 1976; Tobin 1980; Tobin and Buiter 1976; Scarth 1988). A wealth effect is a process where expenditure is changed because of a nominal increase in the price of real estate (Tobin 1980). Under an expansionary monetary policy, a nominal increase in the value of real assets lead to an excess of collateral in banks' capital. Hence banks encourage expenditure and relax liquidity constraints. Neo-classicists indicate that monetary policy is transmitted by shifting money stock shown as the broadly defined monetary balance (M3) (Lucas 1980; Bordo 1986; Mankiw and Romer 1991). This is the third view. Bernanke and Gertler (1995) name this view as credit view or credit channel. By adopting the credit view, this research also includes the capital market imperfection as its important theoretical implication.

The above three major views on monetary policy transmission mechanism are used in different periods within UK's monetary history. Fixler and Zieschang (2006) note that the UK monetary policy affects the real economy primarily through the banking sector via interest

[4] IS/LM stands for Investment/saving and liquidity preference/monetary policy.

channel between 1961 and 1984. Both interest channel and credit channel are used from 1984 to 1992. After 1992, the credit channel is more prominent.

Foreign Exchange Rates

In an open economy, foreign exchange rates have a significant influence on domestic interest rates as determined by the monetary authority (Taylor, 2001). In conventional theory on the interrelation between monetary policy and exchange rates, when a monetary authority alters domestic interest rates, the exchange rate has an absorber function which offsets the effect of monetary policy transmission by home currency appreciation followed by depreciation (Fleming 1962; Dornbusch 1976; Mundell, 1981). Nonetheless, Eichenbaum and Evans (1995) demonstrate a rise in interest rate that monetary policy causes only currency appreciation. Furthermore, in the G-7 countries, Sims (1992) and Grilli and Roubini (1995, 1996) there is a currency depreciation after a monetary contraction relative to the US. Because the effect of foreign exchange rates on monetary policy is debatable[5], this research will test whether the exchange rate is a critical factor in firms' debt decision. The effect of exchange rate under the Labour and Conservative governments might be different.

Measurement of Monetary Transmission: Divisia Money

A divisia index for money is a money aggregation indicator[6] which weights various components of money, according to the extent to which they provide monetary services. In measuring monetary aggregation as well as identifying money tightness, past studies have relied on the bank base rate. The most significant flaw of using the base rate is that it neglects the characteristics of different components of the aggregate. The monetary assets which compose money have different liquidity and the components of monetary aggregate is

[5] This is known as 'the exchange rate puzzle'.
[6] The simple sum aggregate indexes refer to the interest rate based indexes from M_0 to M_4. These indexes measure the absolute amount of money in circulation within a certain period of time.

changing over time. For example, assets with high liquidity, such as notes and coin, are assumed to be fully substitutable by interest-bearing deposits without any effect on the aggregate. However, Divisia money is flexible to the opportunity costs of holding monetary asset (Mullineux, 1996). It captures the changes of interest yields on the various component of money, including both inflation and innovation monetary influential indicators. It also "predict both nominal output and inflation ..." (Fisher et al, 1993, p.33). Binner et al (1999, pp1022) indicate that divisia money is "a superior indicator of UK monetary conditions". Hence, this research will employ divisia money to measure changes in monetary conditions.

Role of Banks in the Monetary Transmission

When tight monetary policy is expected, banks tighten their credit policies even before the change in money policy (Bernanke, 1983). The reason is that banks, as a financial accelerator, are sensitive to variations in the changes of monetary policy (Brunner and Meltzer, 1988). Therefore, the credit view contends that the network of monetary mechanisms under deposits competition gives the banks a monopoly position on fund availability, information collection and network distribution (Benston and Smith 1976; Santomero, 1984; Brigden and Mizen, 2004). The functions of banks in the credit market can be described as:

i) Asset transformer and broker.

Apart from breaking down large-denominations of assets into small subsets (Kane and Buser, 1979), Altman and Suggitt (2000) show that the bank plays a transformation role of modifying the attributes of financial claims by matching assets and liabilities of different duration and numeraire. Furthermore, based on the IS/LM model above, if bank deposits on reserve can be fully substituted for time deposits, banks will only act as fund conduits in the monetary policy transmission mechanism (Campbell, 1978).

When asset return is uncertain at times of tight monetary policies, banks tend to act as brokers to obtain a bargain price for clients' financial products. By acting as a broker, banks can borrow with relatively lower cost when the cost of lending in the whole credit market increases. Banks' financial distress risk is reduced (Deshmukh, et al. 1983). Moreover, under tight monetary conditions, banks' brokers function helps to carry out the credit activities, i.e. lending and borrowing (Ruby and Opiela, 2000). That is, when money is tight, many suppliers of funds rely on banks to decide the quality and the safety of certain lending.

ii) Portfolio allocation.

Pyle's (1971) financial intermediation model reveals that banks tend to adjust the weight at which to hold different assets after monetary policy transmission. Based on analyzing the expected return on deposits and loans, banks allocate suitable portfolio both for the credit market and themselves. Following the cost of capital rule, when banks have to pay extra for unexpected non-marketable asset decreases (e.g. the drop of the net worth of collateral) to maintain their portfolio with fixed liabilities, banks would be forced to cut their credit availability towards borrowers (Roosa, 1951, Lucas, 1995). The credit cut on lending is more significant for banks with less liquidity (Kashyap and Strein, 2000). Such banks tend to be smaller and in turn may have a relatively larger base of small client firms. This means the size of the banks also influences banks choices of portfolios in monetary policy transmission.

Although some researchers (e.g. Oliner and Rudebusch, 1996) argue that information asymmetries, rather than the unique features of banks, lead to the constraints on UK industrial

firms borrowing from banks. In general, banks play an important role in monetary policy transmission as they alter the availability of funds to fund users through changing interest rates (Van Ees et al., 1999). This would have important implications for the level of bank debts in the firm's balance sheet as well as the firm's investment decisions.

2.3.3 Theories of Firms' Debt Decisions and the Size of Firms

Cost of Capital

Firms' cost of capital, or the opportunity cost of capital is the weighted average of the marginal cost of capital expected to be raised by the firm. It is shown in the weighted average cost of capital (WACC). The risk of debt is measured by Sharp's (1964) Capital Asset Pricing Model (CAPM). In his model, the cost of capital of any investment project can be calculated as the risk-free rate of return plus a risk premium. The risk premium is the beta of a security multiply the difference between the expected rate of return on the market portfolio and the risk-free rate of return. So far, CAPM is still the dominating principle in calculating the cost of capital (e.g. Bancel and Mittoo, 2004) and determining firms' investment strategies.

However, later studies soon realized the pitfalls of CAPM, especially in measuring market risk factor using *beta*. McNulty et al. (2002) summarize two problems of the measurement - *beta*. Firstly, *beta* cannot reflect both the volatility and the correlation of the investment project because these two items can be offset in the calculation process of *beta*. For example, an investment project with a low market correlation but a high volatility can be concluded as a low-risk project. Secondly, *betas*' calculation is based on historical data. Nevertheless, historical data cannot keep up with the changing risk of the investment project over time.

Firms' Size

Aside from market frictions, the distribution of firms within industries also contributes to why small firms in particular suffer from a monetary constraint. Small firms are concentrated in cyclical industries and rely on the businesses large firms contract out. In recessions, large firms tend to make products by withdrawing the businesses which was contracted out to small businesses during boom conditions (Gertler and Gilchrist, 1994). Additionally, because of the limitation of funds and less diversified asset portfolio, small firms cannot completely substitute bank loan by other non-reserve liabilities (Gambacorta and Mistrulli, 2004). Small firms tend to have much short-term credit (Kakes and Sturm, 2002). In periods of tight money, the short-term credit drops with a dramatic increase in cost. High-grade large firms can obtain funds through commercial paper issuance, whereas small firms cannot because of their lower creditworthiness (Kashyap, et al. 1993). Banks tend to lend to large creditworthy firms to avoid increased default risk of loans (Gorton and Rosen, 1995). Many small firms are in risky industries with great opportunities but little tangible assets. However, only tangible assets are widely used as collateral and a signal of firms' operation situation whilst the value of intangible assets, e.g. growth opportunities, is likely to fall in financial distress. Peterson and Rajan (1994) conclude that the lending relationship between small companies and banks is more important for small businesses during monetary contraction.

Fama and French (1992) indicate the book-to-market ratio, is another important determinant of the cost of capital. Additionally, Titman and Wessels (1988) suggest that the firm's characteristic, e.g., asset structure, non-debt tax shields etc., are also good determinants of the firm's capital structure. The firm's financial characteristics will therefore play an important role in the empirical model used in this study.

The Cost of Internal versus External Finance

The discussions about the cost of funds originate from Modigliani and Miller (1958)'s classic work on the perfect market. Under perfect capital markets, the value of the firm will not change no matter how the firm arranges its capital structure[7]. The perfect capital market does not exist in practice. Differential taxation, agency costs and asymmetric information are some of the main factors in an imperfect capital market. These factors are explored below in the context of the monetary policy transmission mechanism and the firm's investment decisions.

i) Tax advantage

Since firms do not pay taxes after they paid interest of their loans, the amount of interest is tax-free. By debt financing, firms enjoy a 'tax shield'. Thus debt financing can be used as a tool to increase a firm's value. This function of debt can be seen as a negative correlation between firms' tax payments and debt ratios (Mackie-Mason, 1990). Based on the tax advantage of debt, firms seek to maintain an optimal debt ratio where the marginal value of tax shield offsets the possible costs of financial distress. Bancel and Mittoo (2004) find that about 75% of large firms have a target debt-to-equity ratio. Moreover, because the tax on capital gain is much lower than the tax rate on dividends, internal finance enjoys a cost advantage against external finance. By maintaining the optimal debt ratio and using internal finance before external finance, firms can minimize the effect of monetary policy transmission.

ii) Agency costs

During a monetary contraction, small firms face difficulty to obtain loans, partly because of the agency costs problems of loans. That is, corporate managers, agents of the firm,

[7] The perfect capital market means the capital market is competitive and frictionless, and the risk of every security issued can be matched by purchase of another existing security.

tend to act in the interest of equity owners. By maintaining a high debt ratio and holding risky investment, creditors are forced to share high financial distress risks with equity owners despite the same amount of return. Because of agency costs, the cost of loans is increased. Therefore, under a monetary contraction, creditors in credit markets always require a higher return in new debt issue.

iii) Asymmetric information

Small firms face more constraints under tight monetary condition because of the asymmetric information[8] problem within the credit market. Without information, the creditors underprice lenders' assets and require more collateral from the borrowers of the funds. Comparing with listed companies which trade their shares in the stock market, the information from small firms is much more limited. With longer maturity, long-term loans are most affected by agency cost and asymmetric information. Therefore when money is tight, it is more difficult to make lending decisions towards small firms, especially long-term loans decisions.

Pecking Order

The trade-off theory concludes that because of the tax advantage, a firm seeks to alter its debt levels to an optimal level. However, with increased collateral requirement, the higher leverage also entails a higher shadow price of funds (see e.g. Fazzari, et. al., 1988). Therefore, only large and more mature companies could benefit from high debt ratios. Graham and Harvey (2001) prove that only large firms with high corporate tax rates or foreign debts use debt to exploit certain tax advantages. Additionally, Rajan and Zingales (1995) find that the most profitable US, Japanese and Canadian firms have lower debt ratios. For profitable firms, the relationship between profits and leverage is found to be negative (Fama and French, 2002).

[8] See Akerlof's (1970) "lemons" problem for detail.

These phenomena are interpreted by the pecking order theory (Myers and Majluf, 1984 and Myers, 1984). That is, because of information asymmetry and signalling[9], firms prefer internal to external finance and debt over equity. Indeed, because equity is more expensive, firms firstly turn to debt finance during monetary contraction. Profitable firms usually have more internal financing available and therefore make less use of external funds. One implication of the pecking order theory is that the impact of monetary policy transmission on a firm's investment decisions will depend on the firm's profitability.

2.4 CONCLUSION

This chapter has reviewed the theoretical and empirical literature of firms' financing decisions under monetary policy transmission. There is strong evidence in the literature to suggest that monetary policies affect the degree of lending and in turn affect the financing and investment decisions of firms. Because banks' aggregate debt cannot measure monetary policy impacts on firms' level (Kashyap and Strin, 2000), this research adopts firms' accounting data to measure changes of firm's debt structure under monetary policy transmission. In measuring firm's debt structure, against Huang's (2003) inventory and gearing variables, the selected variables of this research are leverage, profitability, cash flow and investment of the firm. Firms' investment reflects current profitability and signal from the financial markets about future profitability. Cash flow is selected because management can be misled by focusing on high levels of reported profits under the condition of inflation, while the cash flow declines. Divisia money measurement and foreign exchange rates are added into consideration. These

[9] This refers to investors making their investment decision toward a firm according to the information they collect from the firm's operation. The firm's share price and dividend policy are considered as the most common method by which a firm passes information to investors.

choices of variables are based on the financial characteristics of the firms where the existing literature appears to have little concern about those issues. This research will empirically assess the impact of monetary policy transmission on the financing and investment decisions of a sample of small and larger UK firms.

CHAPTER 3 RESEARCH HYPOTHESES AND DESIGN

3.1 INTRODUCTION

This chapter presents the hypotheses associated with firms' short-term and long-term debt and monetary policy transmission. The hypotheses are followed by a brief description of the research methodology and data set. Appendix 3.1 shows the definitions of all the accounting measures in used in this study. The industrial sectors for the sample of firms are outlined in Appendix 3.2. The accounting variables which are used to test the research hypotheses are described in Appendix 3.3. The full sample period is 1988 Q1 to 2005 Q4.

3.2 RESEARCH HYPOTHESES

The general null hypothesis to be tested is that firm's debt decisions cannot be influenced by monetary policy transmission. To establish firms' debt decision under monetary transmission, this research separates short-term debt and long-term debt,

and tests whether their magnitudes can be explained in each of the models. In order to state the hypothesis more specifically, the firms' accounting measures are discussed as following:

3.2.1 Ability of Finance Long-term Debt Hypothesis

When money is tight, the default risk of loans increases and the amount of long-term debt available to firms substantially reduces. Firms leverage and collateral levels are the two accounting measures which are regarded as observable default risk (Carey et al, 1998).

The demands for financing derive from the continual investment in new assets (Grinblatt and Titman 2002). Because small firms are the fastest growing firms, the internal finance is always not available (The Committee to Review the Functioning of Financial Institutions, 1979). They engage all their funds in future growth and thereby may reduce the level of collateral, whereas a firm's collateral represents the firm's expected productivity and expected return in the future (Bordo and Jeanne, 2002). To reduce failure costs of small firms, banks enforce the collateral requirement when money is tight. Hence, when money is tight, for small firms, both the short-term debt and the long-term debt are likely to shrink substantially. As firms' leverage and collateral levels are essential to firms' debt structure, the hypothesis can be stated as:

$H_{0,1}$: There is no connection between firms' financing method (D_t) and collateral (S_t), and firms' short-term debt (SDRATIO) and long-term debt (LDRATIO). The alternative hypothesis is that firms with low leverage or high collateral are more likely to borrow less debt.

The definitions for the short-term debt[10]:

The short-term debt and current portion of long-term debt, which is the portion of debt payable within one year including current portion of long term debt and sinking fund requirements of preferred stock or debentures. It includes but is not restricted to: current portion of long-term debt, notes payable, arising from short-term borrowings, current maturities of participation and entertainment obligations, contracts payable for broadcast rights, current portion of advances and production payments, current portion of long term debt that must be paid back during the next twelve months and included in long term debt, bank Overdrafts, advances from subsidiaries/associated companies, if the term of the loan is not known it is assumed to be long term debt, current portion of preferred stock of a subsidiary, Treasury tax and loan demand notes, short sales of U.S. government securities, Eurodollar borrowings, if not reported separately and the amount cannot be separated.

The long-term debt is defined as:

All interest bearing financial obligations, excluding amounts due within one year. It is shown net of premium or discount. It includes but is not restricted to: mortgages, bonds, debentures, convertible debt, sinking, fund debentures, long term bank overdrafts, long term notes, long term bills, medium term loans, long term royalties, long term contracts, industrial revenue bonds, notes payable, which due within one year and to be refunded by long term debt when carried as non-current liability, long term prepaid contracts, advances and production payments, talent and broadcasting rights, capitalized lease obligations, revolving credit, long term advances from subsidiaries/associated companies, compulsory convertible debt (South Africa), Eurodollar borrowing, long term liability in connection with ESOP, Federal Home Loan advances, which excludes: current portion of long term debt, pensions, deferred taxes. Please see Appendix 3.1 for the definitions of all the accounting measures in used in this study.

The three variables to test this hypothesis for leverage are: long-term borrowing/total assets (LTBORRATIO), long-term borrowing/market value (LTBORR/MV), and total interest charges/the sum of operating and non-operating income (IGEAR). The three variables for collateral are: trade creditor/market value (CREDITOR/MV), trade creditor/total assets (CREDITOR/TA), and fixed assets/total assets (FIXA/TA). The above six measurement all aims to exam the capital structure, investment and financial risk of the firm. The reason to choose these measurements above is: firms'

[10] All definitions are from *Datastream.*

short-term and long-term debt decisions depend on when firms are short of cash, they can finance their long-term finance need through long-term creditors under the condition of repaying the interest and filling their obligations to suppliers of good and services (Stickney, et al., 2007). The purpose of using total asset as a denominator is to show the proportion of total assets which is financed with the molecule items (Fraser and Ormiston, 1998). Market value as a denominator is to measure the extent to which molecule items is used to finance an expected market discounted value after taking firms' common equity risk into account (Walton, 2000). Generally, both leverage and collateral measures show a proportion of ongoing operations are generating cash for fix asset investment and growth (Reid and Myddelton, 2005). Depending on the extent which variables can explain the research model, there may be more than one variable within the same set. Multi-collinearity among variables must be avoided. The methods for avoiding multi-collinearity in this study are factor analysis, SURE and GMM.

3.2.2 Firms' Size Effect Hypothesis

The sample of firms will be categorized into small and large firms according to their year-end total assets. The criterion for each group is determined by the median of the natural log of total assets of all the firms in the sample. The firms with natural log of total assets are higher (lower) than the median are labeled big (small) firms. Since changes of monetary conditions are more likely to have a greater impact on small firms, this research runs regression twice: once on the original research model and secondly on the same model but with adding a dummy variable SMALL to show the monetary transmission effect on small firms specifically.

$H_{0,2}$: There is no connection between firm size and their short-term (SDRATIO) and long-term debt (LDRATIO) under different monetary conditions. The alternative hypothesis is that large firms are more likely to borrow less debt.

3.2.3 Internal Financing Ability Hypothesis

Because the volume of external finance declines during a tight monetary period, firms' abilities to finance internally become critical (Oliner and Rudebusch, 1996). Firms' cash flow and investment determine firms' internal financing abilities (Guariglia, 1999).

Higher cash flows directly reduce the costs of funds by decreasing the demand for expensive[11] external funding. Investment has a role of buffer towards capital constraint (Gilchrist and Himmelberg, 1995). When firms cannot access capital markets during monetary contraction, firms with insufficient cash flows to support long-term debt have to borrow short-term. They are also forced to reduce their investment as the demand of internal finance increases. Aguiar (2002) shows that firms with a higher cash flow and investment are less sensitive to monetary policy changes.

$H_{0,3}$: There is no connection between firms' internal finance abilities, which are denoted as firms' cash flow (CF_t), the level of investment (I_t), and firms' short-term (SDRATIO) and long-term debt (LDRATIO). The alternative hypothesis is that firms with high internal finance abilities are more likely to borrow less debt.

[11] External funding is more expensive due to its direct costs such as underwriting, administration fees and potential financial distress costs. Potential financial distress cost includes legal expenses, trustee fees, disruption of operation and loss of suppliers or customers.

To test this hypothesis, the firms' initial finance ability can be measured by cash flow (CF_t) and asset related measures (I_t) which have significant impact on firms' investment decisions. Cash flow can be measured by one or more of the following variables: gross cash flow/total liabilities (CASHFLOW/TLIABILITIES), gross cash flow/market value (CASHFLOW/MV), gross cash flow/total assets (CASHFLOW/TA). CASHFLOW/TLIABILITIES shows the proportion of total liabilities that could be paid off out of gross cash flow. CASHFLOW/MV and CASHFLOW/TA show the proportion of firm's market value and total assets funded by cash flow (Pendlebury and Groves, 2004). These three measurements indicate the liquidity and stability of the firm.

The reasons to select gross cash flow over free cash flow are that the definition of free cash flow is not identical and the creditability of free cash flow is dubious. The free cash flow can be calculated as the result of operating cash flow minus changes in working capital and minus capital expenditures or the result of operating cash flow subtracting changes in capital expenditures and dividends. Even if operating cash flow is set as net income plus amortization and depreciation, there are too much flexibility on the definition of working capital and the definition of capital expenditures. Furthermore, negative free cash flow only signifies the company has little cash while gross cash flow indicates the worth of the firm.

In order to investigate the relationship between sale and assets, net sales/market value (SALES/MV), and net sales/total assets (SALES/TA) are also employed. Asset related measures (I_t) are: book-to-market value[12] (BOOK/MV), dividend yield[13] (DY),

[12] Defined as book value of the firm to market value.

total assts/market value (TA/MV), short-term debt/fixed assets (STDEBT/FA), long-term debt/fixed assets (LTDEBT/FA), tax charge on profit and loss/pre-tax profit (TAXRATIO), or R&D/MV.[14] Dividend yield is selected because firms' dividend affects cash flow within the firms, where cash flow has impact on the finance decisions of firms (Pendlebury and Groves, 2004). The reason for selecting TAXRATIO is to test the effect of taxation on firms' debt decisions given a worldwide trend for financial liberty. R&D is regarded as an essential firm characteristic index which influences the firm's debt decisions because more and more firms put emphasis on research and development in the last 10 years (Hall, 2002).

3.2.4 Growth Options – Profitability Hypothesis

Altman and Suggitt (2000) show that firms' profitability is used as a reference for financial institutions when they issue loans to firms. Firms' profitability directly affects the choice between long-term versus short-term debt as well as equity versus debt choices. Bougheas et al (2006) indicate that the lower the level of profitability, the more new investment has to be financed by short-term debt. Therefore, good performance, i.e. increase in profitability, will reduce financial distress risk. The hypothesis that is examined is:

$H_{0,4}$: There is no connection between firms' profitability (P_t) ratios and firms' short-term (SDRATIO) and long-term debt (LDRATIO). The alternative hypothesis is that firms which have high profitability ratios are more likely to borrow less debt.

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[13] Defined as dividend per share divided by the price per share.
[14] Defined as total R&D costs (including write-offs to profit and loss) divided by the firm's market value.

The variables to test $H_{0,4}$ are: operating profit margin[15] (OPM); operating income/market value (OPINCOME/MV), operating income/total assets (OPINCOM/TA), pretax margin/market value (PM/MV), pretax margin/total assets (PM/TA), quick ratio (QRATIO) and current assets/current liabilities (CA/CL). The last two variables are liquidity measures, which have a close relationship with firms' profitability level. The profit margin shows amount of profit firms generate from each unit of sales. Operating income signals capital structure of the firms (Holme, et. al, 2005).

3.2.5 Foreign Exchange Rate

Firms' debt decisions are highly dependent on the current exchange rate regime (Martinez and Werner, 2002). Krugman (1999) suggests that domestic currency devaluation produces a negative shock on the net worth of firms which borrow in foreign currency. Bleakley and Cowan (2002) argue that currency devaluation has a positive effect on firms' investment. When interest rates are comparatively high domestically, firms might borrow from abroad. Although sometimes the extent of foreign borrowings by firms may not be directly observed in firms' balance sheets, changes in exchange rates affect firms' debt decisions during monetary policy transmission. When the domestic interest rates increase, the exchange rates decline.

$H_{0,5}$: There is no connection between foreign exchange rates (FX_t) and firms' short-term (SDRATIO) and long-term debt (LDRATIO). The alternative hypothesis is firms' exchange rates are more likely to affect firms' short-tem as well as long-term debt decisions.

[15] Defined as operating income to net sales

The Bank of England's effective exchange rate index is used to test $H_{0,5}$ and measure the effects of exchange rates (FX_t) through foreign borrowing. The average quarterly change in the exchange rate index is used since the level of the FX rate is likely to be non-stationary.

3.3 THE TESTABILITY OF CORPORATE ACCOUNTING MEASURES

This research is based on the assumption that imperfect capital market makes firms' debt is the ultimate channel for monetary policy transmission. However, given the innovation and trend for liberalized financial markets, firm's external finance, such as debt, may not be the only channel through which monetary policy effects are observed. If firms do not rely on external finance as their main source of finance, some of the above hypotheses many be difficult to evaluate.

There are certain experimental problems in testing the hypothesized relations using accounting measures. This research aims to investigate how firms make short-term and long-term debt decisions under monetary policy transmission. The selected accounting measures may not be able to capture and thereby explain all factors which influence firms' debt decisions. Also, various variables in different hypotheses may have counter effects in determining firms' short-term and long-term debt. Therefore, there are situations in which the theoretical predictions are not sufficiently capable of testing all the relations between firms' attributes in regard to their debt decisions.

Furthermore, the impact of monetary policy on firms' debt decisions is not easily identified. The accounting measures are designed to examine firms' attributes in relation to debt decisions. Even if theoretical predictions are confirmed, there is a limitation on the extent to which selected accounting measures can test monetary policy's impact on firms' debt decisions.

In response to the above potential flaws of this research, this research uses a factor analysis approach and two advanced estimation approaches (SURE and GMM) to reduce the correlation problems in the model. It is also important to highlight that the accounting measures only proxies for firms' attributes which the research aims to measure. Throughout this research, null hypothesis is rejected if the *p*-value associated with the test statistic is 10% or less.

3.4 THE SAMPLES AND THE DATA SETS

To test the above hypotheses, the data for industrial firms are obtained from two main sources: *Datastream* and *Worldscope*. Tax-ratios and companies' primary UK Standard Industrial Classification (SIC) (2003) code are from *FAME*. Although the data are collected from two databases, the consistency of data is ensured. Because in 2004, the company *Thomson Financial*, who produces the *Datastream* data, brought data from *Worldscope* and uses *Worldscope* as their only source of company accounts. In addition, there are only 409 industrial firms left after excluding non-

financial firms in *Datastream*. In order to extend the sample size of this study, data from Worldscope are also collected. Since tax-ratios and companies' primary UK SIC (2003) code are not available in neither of above databases, data in *FAME* are also collected. One-to-one correspondence between the firms in these three data sources is strictly employed. The data used in this research excludes financial[16] companies, real estates companies, recruitment agencies, football clubs and the records of state-owned monopoly companies[17] before their privatization because all the companies above have different debt need comparing with ordinary industrial firms. The overall sample size is reduced to 887 listed UK industrial firms with more than 5 years (including 5 years) continuous record. Table 3.1 presents the distribution of firms in these two databases.

Table 3.1

Distribution of firms in Datastream and Worldscope

Data source	All firms	Of which: Financial	Of which: recruitment	Of which: real estate	Of which: repeated	Of which: missing	Of which: industrial	Final Sample
Datastream	711	174	8	27	5	17	480	409
Worldscope	538	2	2	8	24	1	501	478
Total	1249	176	10	35	29	18	981	887

The selected sample consists of 887 which is 71.0% of the total number of industrial firms of 1249 from the whole database during 1988-2005. This form of data selection is also employed in Huang's (2003) work. Therefore, it is reasonable to say that the selected sample is a good representative of listed industrial firms in the UK.

[16] Financial companies refer to banks, securities, brokerage, insurance, trusts, management consultancy companies and asset management companies.

[17] For example, because British Telecom (BT) was privatised in 1984, this research does not include the data for BT until 1986 in order for the full effect of privatisation in BT to be observable. See the tables in Haskel and Szymanski (1993) pp169 and Harris, et al (1998) pps15, for lists of companies undertaking privatization in the UK.

Table 3.2

Distribution of firms over years in selected sample

Year	Number of firms	Percentage[18]	Year	Number of firms	Percentage
1988	318	35.9%	1998	671	75.6%
1989	360	40.6%	1999	691	78.0%
1990	399	45.0%	2000	783	88.3%
1991	417	47.0%	2001	844	95.2%
1992	428	48.3%	2002	836	94.3%
1993	444	50.1%	2003	831	93.7%
1994	461	52.0%	2004	837	94.4%
1995	476	53.7%	2005	822	92.7%
1996	523	59.0%			
1997	553	62.3%			

Table 3.2 presents the distribution of the number of firms over the sample period. As expected, the numbers of firms increases each year in the sample period. The sample includes more than half of the companies (50.3%) of the total number of the firms within the sample since 1993. This is because the FA00 scheme[19] in 1993 made more companies' data available on both *Datastream* and *Worldscope*. As can be seen from the table, the numbers of firms increase dramatically during 1997-1998. It reaches a peak of 95.2% of the total samples in the year of 2001 because of the UK's economy boom beginning in 1999. Appendix 3.2 exhibits the distribution of the industrial firms by industry. The highest number of firms in this sample exists in software consultancy and supply industry (39 firms); followed by construction and civil engineering

[18] It is the proportion of the number of firms in that year relative to the number of all the industrial firms in the sample.

[19] FA93/S92 (as amended by FA00) restates the basic rule that for CT purposes, profits and losses must be computed and expressed in sterling. In the original scheme, this section applied only to trades, but following FA00 it applies to the profits and losses of a business or part of a business.

companies (33), computer related companies (25), software publishing companies (24) and business companies (23).

3.5 DESCRIPTIVE STATISTICS FOR ACCOUNTING DATA

This section (in table 3.3) shows the summary statistics of the financial measures. The table shows that Skewness[20] and Kurtosis[21] are both statistically significant suggesting that the measures are non-normally distributed. The normality test is significant. Therefore estimation methods that assume normality will not generate efficient parameter estimates even if the estimates will still be unbiased.

20 It gauges asymmetry around its mean and the peakness of the distribution of the series.

21 It measures the flatness of the distribution of the series.

Table 3.3

Descriptive statistics for accounting measures

Variables	N	Mean	Std. Dev	Skewness	Kurtosis	Normality[22]
SDRATIO	10599	0.436[a]	0.354	13.375[a]	-26.813[a]	949.115[a]
LDRATIO	9573	0.518[a]	0.340	-9.880[a]	-26.580[a]	801.093[a]
LTBORRATIO	10435	0.188[a]	3.067	223.329[a]	6776.688[a]	4.60e+09[a]
LTBORR/MV	10462	0.935	64.902	4225.667[a]	215413.667[a]	4.66e+10[a]
IGEAR	10634	0.002	9.875	-2245.333[a]	83985.383[a]	6.90e+09[a]
CASHFLOW/TLIABILITIES	10631	0.053	5.157	-3602.333[a]	173709.756[a]	3.08e+10[a]
CASHFLOW/MV	10486	-0.346	45.613	-425.533[a]	217696.313[a]	4.77e+10[a]
CASHFLOW/TA	10463	0.113[a]	2.875	3315.208[a]	151008.458[a]	2.29e+10[a]
SALES/MV	10333	28.935[a]	420.672	1028.250[a]	15295.438[a]	2.33e+08[a]
SALES/TA	10466	1.297[a]	1.134	600.875[a]	10620.271[a]	1.14e+08[a]
OPM	10440	-1.273	48.724	-3643.917[a]	173213.938[a]	3.01e+10[a]
OPINCOME/MV	10495	-0.712	76.875	-4268.208[a]	218623.188[a]	4.81e+10[a]
OPINCOME/TA	10473	0.062[b]	2.325	3509.417[a]	165923.063[a]	2.77e+10[a]
PG/MV	10307	-1.873	120.917	-1957.750[a]	54317.396[a]	2.92e+09[a]
PM/TA	10439	-0.047	0.980	-1629.750[a]	43223.750[a]	1.87e+09[a]
QRATIO	5224	1.136[a]	1.761	372.706[a]	3608.706[a]	13221808[a]
CA/CL	10378	2.027[a]	3.280	408.000[a]	2606.938[a]	6932012[a]
BOOK/MV	10340	13.655[a]	184.554	943.083[a]	18971.375[a]	3.58e+08[a]
DY	10334	0.310[a]	5.491	2042.792[a]	69827.262[a]	4.84e+09[a]
R&D/MV	1306	0.002	3.875	-245.333[a]	985.383[a]	3.90e+09[a]
TA/MV	10340	15.468[a]	185.265	1014.292[a]	18848.014[a]	3.53e+08[a]
STDEBT/FA	10395	4.035	287.947	4228.417[a]	251201.000[a]	4.62e+10[a]
LTDEBT/FA	10395	9.191	707.987	4227.117[a]	215110.063[a]	4.61e+10[a]
TAXRATIO	9429	0.247[a]	1.239	42.640[a]	6169.500[a]	37358758[a]
CREDITOR/MV	10082	2.734[a]	43.945	1797.417[a]	52951.286[a]	2.83e+09[a]
CREDITOR/TA	10191	0.136[a]	0.131	273.042[a]	2734.776[a]	7690424[a]
FA/TA	10471	0.314[a]	0.239	37.250[a]	12.771[a]	1557.267[a]

[a], [b] and [c] indicate that the statistics are significant at the levels of 1- , 5- and 10- percent level, respectively. The critical value for means are: 2.648 (1-percent), 1.994 (5-percent) and 1.648 (10-percent). For skewness and kurtosis, all the critical values were obtained from Snedecor and Cochran (1989). The critical values for skewness are: 0.673 (1-percent) and 0.459 (5-percent). The critical values for kurtosis are 4.59 (1-percent) and 3.87 (5-percent).

[22] It is tested through the Jarque-Bera test.

In order to be consistent with the whole sample selection in this research excludes quick ratio (QRATIO) and research and development over market value (R&D/MV) in the analysis. For the mean of the ratios, only 16 out of 27 financial accounts variables (e.g. CREDITOR/MV and CREDITOR/TA) are significant. All the variables are significant on skewness, kurtosis and normality. Only 27% of the companies have records throughout the whole sample period. Furthermore, based on the value of N, almost half of the observations are missing for the variable 'QRATIO'. Only one tenth of data for 'R&D/MV' is available. This is because q-ratio is merely available in *Datastream*. There is no 'QRATIO' for the rest of 478 industrial firms in *Worldscope*. *Datastream* is the only database where research and development 'R&D' is available and most companies' 'R&D' items are missing.

The reason for choosing these 27 ratios is that these ratios include thorough accounting measures to test how firms make debt decisions under monetary policy. In testing firms' access to long-term finance, their ability to internally finance and their general performance, these ratios fill a gap in all past studies, since past studies only picked limited measures[23]. That is, most of them ignore the effect of investment and taxation measures on the firms' debt decisions. Also, the measurements past studies used are not widely accepted accounting measurements. For example, there are the capital stock and cost of capital measures in Nagahata and Sekine (2005) and Atta-Mensah and Dib's (2008) studies respectively. However, standard accounting records are the primary source of data for all firms when they make debt decisions. TAXRATIO are decided to be excluded in the final model estimation because the data for this measure prior 1996 are not available in *FAME*. After QRATIO, TAXRATIO

[23] i.e. leverage, liquidity and collateral measures.

and R&DMV are excluded, there are 25 accounting ratios.

Table 3.4

Nonparametric Spearman's rank order correlations

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1 SDRATIO																									
2 LDRATIO	-1.000[a]																								
3 LTBORRATIO	-0.370[a]	0.777[a]																							
4 LTBOR/MV	-0.308[a]	0.694[a]	0.924[a]																						
5 IEAR	0.028[a]	0.143[a]	0.360[a]	0.392[a]																					
6 CASHFLOW/TLIABILITIES	-0.015	-0.023[b]	-0.139[a]	-0.216[a]	0.119[a]																				
7 CASHFLOW/MV	-0.009	0.117[a]	0.234[a]	0.338[a]	0.442[a]	0.451[a]																			
8 CASHFLOW/TA	-0.007	0.044[a]	0.067[a]	-0.048[a]	0.212[a]	0.844[a]	0.533[a]																		
9 SALES/MV	0.177[a]	-0.099[a]	0.078[a]	0.305[a]	0.274[a]	-0.177[a]	0.453[a]	-0.078[a]																	
10 SALES/TA	0.201[a]	-0.190[a]	-0.096[a]	-0.060[a]	0.118[a]	0.126[a]	0.205[a]	0.288[a]	0.624[a]																
11 OPM	-0.118[a]	0.195[a]	0.194[a]	0.081[a]	0.286[a]	0.670[a]	0.353[a]	0.695[a]	-0.294[a]	-0.118[a]															
12 OPINCOM/MV	-0.013[a]	0.122[a]	0.227[a]	0.294[a]	0.487[a]	0.408[a]	0.791[a]	0.504[a]	0.402[a]	0.276[a]	0.540[a]														
13 OPINCOM/TA	-0.002	0.050[a]	0.072[a]	-0.045[a]	0.258[a]	0.731[a]	0.405[a]	0.878[a]	-0.059[a]	0.329[a]	0.800[a]	0.626[a]													
14 PM/MV	0.034[a]	-0.073[a]	-0.139[a]	-0.123[a]	0.311[a]	0.664[a]	0.552[a]	0.564[a]	0.094[a]	0.155[a]	0.477[a]	0.495[a]	0.503[a]												
15 PM/TA	0.030[a]	-0.085[a]	-0.166[a]	-0.196[a]	0.253[a]	0.738[a]	0.437[a]	0.652[a]	-0.022[a]	0.174[a]	0.547[a]	0.414[a]	0.596[a]	0.967[a]											
16 CA/CL	-0.064[a]	-0.054[a]	-0.261[a]	-0.268[a]	-0.146[a]	0.128[a]	-0.075[a]	-0.033[a]	-0.112[a]	-0.111[a]	-0.45[a]	-0.061[a]	-0.28[a]	0.121[a]	0.119[a]										
17 BOOK/MV	0.009	0.002	-0.038[a]	0.207[a]	0.168[a]	-0.075[a]	0.331[a]	-0.296[a]	0.469[a]	-0.156[a]	-0.183[a]	0.206[a]	-0.317[a]	0.106[a]	-0.031[a]	0.133[a]									
18 DY	0.021[b]	0.047[a]	0.112[a]	0.200[a]	0.263[a]	0.268[a]	0.514[a]	0.281[a]	0.399[a]	0.211[a]	0.262[a]	0.546[a]	0.313[a]	0.268[a]	0.211[a]	-0.021[a]	0.283[a]								
19 TA/MV	0.047[a]	0.052[a]	0.197[a]	0.474[a]	0.263[a]	-0.301[a]	0.412[a]	-0.348[a]	0.733[a]	0.025[b]	-0.252[a]	0.292[a]	-0.349[a]	0.000	-0.160[a]	-0.097[a]	0.790[a]	0.327[a]							
20 STDEBT/FA	0.603[a]	-0.462[a]	0.191[a]	0.210[a]	0.211[a]	-0.242[a]	0.034[a]	-0.074[a]	0.226[a]	0.147[a]	-0.097[a]	0.044[a]	-0.041[a]	-0.110[a]	-0.129[a]	-0.182[a]	-0.085[a]	-0.004[a]	0.153[a]						
21 LTDEBT/FA	-0.318[a]	0.703[a]	0.903[a]	0.837[a]	0.314[a]	-0.210[a]	0.150[a]	-0.003	0.093[a]	-0.052[a]	0.110[a]	0.168[a]	0.030[a]	-0.157[a]	-0.180[a]	-0.191[a]	-0.084[a]	0.054[a]	0.168[a]	0.349[a]					
22 TAXRATIO	-0.043[a]	0.071[a]	0.069[a]	0.051[a]	0.099[a]	0.212[a]	0.198[a]	0.224[a]	0.054[a]	0.084[a]	0.238[a]	0.221[a]	0.239[a]	0.187[a]	0.187[a]	-0.025[a]	0.003	0.182[a]	0.012	-0.040[a]	0.035[a]				
23 CREDITOR/MV	0.186[a]	-0.099[a]	0.079[a]	0.297[a]	0.230[a]	-0.244[a]	0.356[a]	-0.165[a]	0.851[a]	0.467[a]	-0.295[a]	0.309[a]	-0.136[a]	0.048[a]	-0.066[a]	-0.116[a]	0.413[a]	0.316[a]	0.704[a]	0.254[a]	0.115[a]	0.053[a]			
24 CREDITOR/TA	0.212[a]	-0.171[a]	-0.048[a]	0.015	0.102[a]	-0.116[a]	0.140[a]	0.045[a]	0.520[a]	0.653[a]	-0.193[a]	0.180[a]	0.093[a]	0.060[a]	0.038[a]	-0.099[a]	-0.106[a]	0.139[a]	0.139[a]	0.224[a]	0.026[a]	0.064[a]	0.754[a]		
25 FIXA/TA	-0.072[a]	0.202[a]	0.308[a]	0.316[a]	0.199[a]	0.238[a]	0.297[a]	0.214[a]	0.054[a]	-0.077[a]	0.261[a]	0.241[a]	0.161[a]	0.099[a]	0.079[a]	-0.225[a]	0.199[a]	0.221a	0.159[a]	-0.262[a]	-0.024[a]	0.116[a]	0.028[a]	-0.104[a]	

N=10645. [a], [b] indicate that correlation is significant at 1- or 5-percent level (2-tailed), respectively.

3.6 BIVARIATE CORRELATION TESTS FOR ACCOUNTING DATA

Table 3.4[24] shows strong correlation amongst the 25 accounting measures. The measures are highly correlated in most cases. For example, PT/TA, STDEBT/FA and CREDITOR/MV are significant highly correlated with SDRATIO and LDRATIO.

3.7 EMPIRICAL MODEL AND ESTIMATION METHODLOGY

Two main empirical models are tested in this research: one in respect of short-term debt and the other in respect of long-term debt. These two models address thress questions. Firstly, which firm-specific characteristics determine firms' debt decisions. Secondly, how firms adjust their debt after a monetary shock. Thirdly, how monetary policy transmission effect varies with firm characteristics. This research predicts that firms' leverage, collateral, cash flow, profitability, monetary conditions, and the foreign exchange rates are the factors determining firms' debt decision. The full version of each empirical model is:

$$SD_t = \alpha + \beta_1 SD_{t-1} + \beta_2 D_t + \beta_3 S_t + \beta_4 CF_t + \beta_5 P_t + \beta_6 I_t + \beta_7 MP_t + \beta_8 MP_{t-1} + \beta_9 FX_t + \beta_{10} DUM_t + \varepsilon$$

$$LD_t = \alpha + \beta_1 LD_{t-1} + \beta_2 D_t + \beta_3 S_t + \beta_4 CF_t + \beta_5 P_t + \beta_6 I_t + \beta_7 MP_t + \beta_8 MP_{t-1} + \beta_9 FX_t + \beta_{10} DUM_t + \varepsilon$$

[24] In order to avoid heteroskedasticity among variables, this research uses non- parameter method, i.e. Spearman's rank order method, to test the correlation among variables.

where

SD_tRATIO	= the ratio of short-term debt to total debt at time t
LD_tRATIO	= the ratio of long-term debt to total debt at time t
D_t[25]	= the leverage at time t
S_t	= the collateral (security) related measures at time t
CF_t	= the cash flow (liquidity) at time t
P_t	= the profitability at time t
I_t	= the firm's investment at time t
MP_t	= the monetary policy at time t, measure by 4 time series data (See chapter 4 for the choice of time series in detail)
FX_t	= the foreign exchange rate at time t
ε	= a uncorrelated error at time t
t	= 1988…2005

The monetary condition is determined by the base rate, the 3-month Treasury bill rate, M4 and Divisia index. The natural log of the median of total assets is used as the criterion to distinguish small firms from big firms. The lag effect of variables in monetary policy transmission will be discussed at the end of the research.

Because this research consists of a cross-section regression model, some of the variables in this model may be highly correlated. As simultaneous inclusion of all variables in the model can lead to poor statistical results and unreliable inferences, this research adopts factor analysis to identify the independent dimensions of the data to avoid potential multi-collinearity which can violate the classical assumptions. In order to further avoid this problem, even within the factor analytical framework,

[25] Please see 3.3 for the definitions of model selected accounting measures in detail.

Seemingly Unrelated Regressions Equations (SURE) and Generalized Method of Moments (GMM) methods are employed for estimating the model. In the GMM procedure, one lag of each of the regressors including the interaction terms is used as instruments. Seemingly Unrelated Regressions Equations (SURE) approach aims to achieve the same objective.

Furthermore, to assess the validity of the model, the model's q-statistics, Lagrange multiplier (LM) test and Wald (W) test and the goodness of fit measure are used as diagnostic checks for the model. The q-statistics are adopted to ensure the data in the model are white noise and provide a fair assessment on the choice of lag for the research model. LM test for residual correlation aims to reveal whether the error term is serially correlated. Since if the error term is serially correlated, the estimated model's standard errors are invalid and the estimated coefficients will be biased and inconsistent. Wald (W) test measures how close the explanatory variables are statistically relevant, excluding the constant.

3.8 CONCLUSIONS

This chapter sets out the hypotheses, described some characteristics and possible relationships between the data. Hypotheses are tested in a generally abstract manner. Further research may want to focus on some highly complex areas, such as the effect of action of managers on monetary policy impact to firms which is not receiving

much attention at present. It then outlines the research models and estimation methods which that will be used in the empirical analysis. In next chapter, the empirical results are reported in testing the hypotheses in this chapter.

Chapter 4

Preliminary Estimates and Hypotheses – Time Series Data

4.1 INTRODUCTION

This chapter describes the time series data used to identify periods of monetary tightness and looseness. It explains why certain time series are employed and describes the data source of the time series. The chapter also discusses the importance of using structure breaks to identify the periods of tight money. Finally, the tight monetary periods that are identified and compared with those used in prior empirical studies where alternative methods of identifying periods of money tightness are used. Some univariate and bivariate tests are also presented for the time series.

4.2. SELECTED MEASURES OF MONETARY TIGHTNESS

This research selected five time series data to gauge monetary conditions. They are: the base rate; the 3-month Treasury bill rate; the UK effective foreign exchange rate, broad money M4[26]; and Divisia index. The first two series emphasizes on the money rate (or market rate) of interest while the last two series show the capital rate of interest. The money rate of interest measures the expected incomes in financial

[26] It includes notes and coin in circulation and all of the deposits held with all financial institutions. The choice of M4 rather than M0, M1, M2 or M3 is because M0 only measure cash or cash equivalent in the circulation whilst M1, M2 and M3 have no more used in money supply in10463 the UK since 1986.

markets, whilst the capital rate of interest measures the expected return on real investment. For this research on the firms' debt decisions, Divisia money and M4 are better measurements in identifying monetary conditions because of their close link with the expectation return on real investment.

4.3 DATA SOURCE AND DESCRIPTION

The analysis for changes in monetary conditions is based on quarterly time series data from 1988 Q1 to 2005 Q4. The selected data are: Bank of England's M4[27], Divisia index[28], the base rate, 3-month UK Treasury bill discount rate and UK effective exchange rate index. The first two data sets are obtained from the *Bank of England* while the last three data sets are obtained from *Datastream*.

The base rate has a direct impact on the firms' debt decisions by shifting interest rates on all financial products in financial institutions. However, it is not the commercial rate and the interest rates that a firm faces are much higher. Huang (2003) uses the log of base rate as an indicator for changes in monetary policy. That is, when a monetary policy transmission occurs, there will be a change in the base rate. Nonetheless, this research argues that there are three flaws in using the base rate to identify monetary condition. Firstly, as already indicated, the base rate is not the commercial interest

[27] Quarterly amounts outstanding of monetary financial institutions' sterling M4 liabilities to private non-financial corporations (in sterling millions) seasonally adjusted

[28] Quarterly index of monetary financial institutions' sterling Divisia for private non-financial corporations (in sterling millions) seasonally adjusted.

rate but a lending rate floor of interest rates. Secondly, the commercial interest rates on bank loans vary among different sizes of firms and different banks. Compared with small firms, big and mature companies always enjoy lower interest rates on borrowings because of their greater creditworthiness. Thirdly, the interest rates of loans are lower for those companies which have good relationships with banks. Therefore the base rate is not sufficient to measure the impact of monetary policy transmission on the availability of loans.

Because the Treasury bill rate is widely used as the premium of return for financial assets, the 3-month Treasury bill rate is chosen for its direct effect on the price of financial assets in capital market. For example, Atanasova and Wilson (2004) use the Treasury bill rate to identify monetary conditions. Nevertheless, similar to the base rate, Treasury bill rate is only a base for commercial interest rates as it is a risk-free rate. It is also lower than the commercial interest rates.

Relative to the base rate and Treasury bill rate measures, M4 provides a more direct measurement on the liquidity in the market by measuring the aggregate money in circulation. Money in circulation represents money supply and reflects the borrowing/lending relationships in financial markets, whilst any money demand measurements such as base rate only show estimated market rates of return.

Among all the time series data above in measuring monetary conditions, Divisia index is the most accurate one (Binner et al., 1999). By giving the components of money different weights based on the degree of liquidity of the various components of money

aggregation, Divisia index is likely to provide a better measurement of money aggregation (Mullineux, 1996) and thereby a fairer indication of firms' debt decisions under monetary transmission. Therefore the second contribution of this research is to select Divisia index. Despite its reliability, Divisia index has not been widely applied for testing periods of tight or loose money.

4.4 DESCRIPTIVE STATISTICS FOR TIME SERIES DATA

Table 4.1 presents the descriptive statistics for the log changes of the time series data over the full sample period. The base rate and the 3-month Treasury bill rate have the same trend while M4 and Divisia seem to shadow each other. This is because the former two are money demand measures and the latter two are money supply measures. The mean of changes of the base rate, the 3-month Treasury bill rate and the foreign exchange rate index are negative and close to zero. The means of M4 and Divisia index are significantly different from zero (p-value=0.01). For all the series, both skewness and kurtosis are statistically significant. The skewness measures for M4 and Divisia, which are typically greater than those of the other series. The significant skewness and kurtosis suggests that the time series data are non-normally distributed so linear estimation methods will generate inefficient parameters. To avoid this problem, non-parametric tests are used where possible for some of the estimates.

Table 4.1

Summary descriptive statistics for changes in the level (or the rate) of the univariate series

Variables	N	Mean	Std. Dev	Skewness	Kurtosis	Normality
Base rate	71	-0.0005	0.006	0.860[a]	6.911[a]	37.714[a]
3-month Treasury bill rate	71	-0.0005	0.006	-0.477[b]	9.650[a]	73.416[a]
M4	71	0.0195[a]	0.026	5.091[a]	11.931[a]	136.461[a]
Divisia index	71	0.0155[a]	0.034	1.274[a]	2.053	4.412[c]
Foreign exchange rate index	71	-0.0002	0.027	-0.993[a]	3.488[a]	9.918[a]

[a], [b] and [c] indicate that the statistic are significant at the 1-, 5- or 10-percent level, respectively. The critical values for mean are: 2.648 (1-percent), 1.994 (5-percent) and 1.648 (10-percent). For skewness and kurtosis, all the critical values were obtained from (Snedecor and Cochran, 1989). The critical values for skewness are: 0.673 (1-percent) and 0.459 (5-percent). The critical values for kurtosis are 4.59 (1-percent) and 3.87 (5-percent). All the series begin on 1988Q2 and end on 2005Q4.

4.5 BIVARIATE CORRELATION TESTS FOR TIME SERIES DATA

Table 4.2 shows the relationships between five time series. The pair of money demand measures (the base rate and the Treasury bill rate) is expected to be correlated. Similarly, two money supply measures (M4 and Divisia index) are also expected to be correlated. As expected, table shows that changes in the base rate and changes in the 3-month Treasury bill rate are positively correlated (r=0.898, *p*-value = 0.01, two-tailed). Changes in M4 and the Divisia index are also positively correlated (r=0.243, *p*-value=0.05, two-tailed). M4 is positively correlated with base rate and the Treasury bill rate. The Divisia measure is not correlated with the money demand measures. The exchange rate measure is not correlated with any of the other measures. This might be because the exchange rate is likely to be more random than the other series (Mussa, 1986).

Table 4.2

The Spearman rank order correlation test

Variables	1	2	3	4
1 Base rate				
2 3-month Treasury bill rate	0.898[a]			
3 M4	0.234[b]	0.354[a]		
4 Divisia index	-0.157	-0.053	0.243[b]	
5 Foreign exchange rate index	0.056	0.011	0.063	0.176

N=71. [a], [b] indicate that correlation is significant at 1- or 5-percent level (2-tailed), respectively.

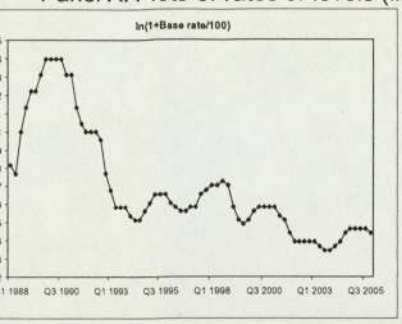
4.6 GRAPHICAL PLOTS FOR TIME SERIES DATA

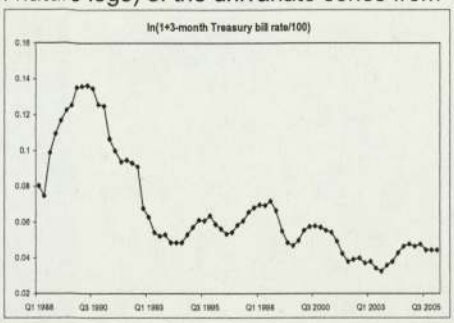
Figure 4.1 (panel A and panel B) shows the plots (in natural logs) of the series for the full period. Panel A suggests that the time series are nonstationary[29] with structure breaks at certain points. It is important to distinguish between trend stationary and difference stationary time series because this characteristic of the series determine whether the effect of shock are permanent. If there is no structure break in the series, the time series is difference stationary. If there is a structure break during the whole period of the time series, the level series is trend stationary. A trend stationary time series is characterized by a gradual fading away of the effect of shock. Alternatively, for a series which is difference stationary, the effect of any shock which changes the trend within the time series is permanent. Indeed, the plots in Panel B (of Figure 4.1) appear to be stationary on first difference using a statistical test. This consideration is further discussed below.

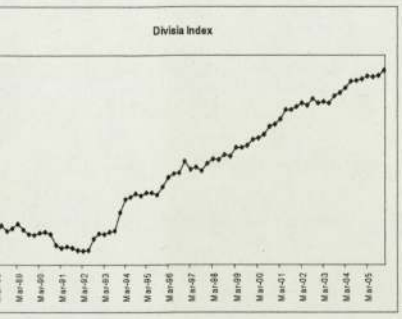
[29] If the time series is trending without reverting to its mean, it is likely to be nonstationary.

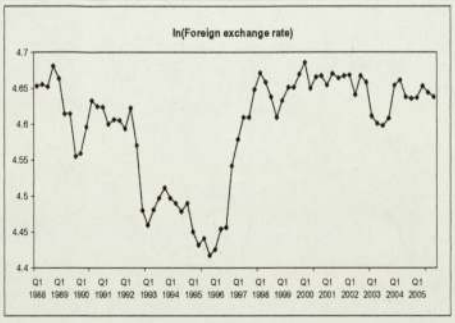
Figure 4.1

Panel A: Plots of rates or levels (in nature logs) of the univariate series from 1988 Q1 to 2005 Q4

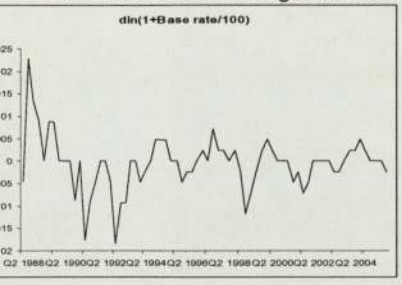


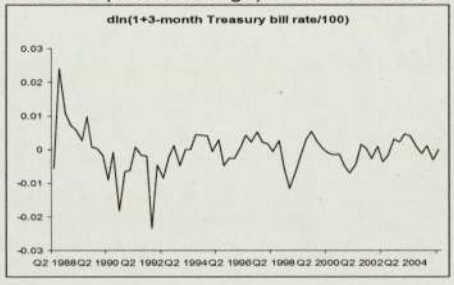


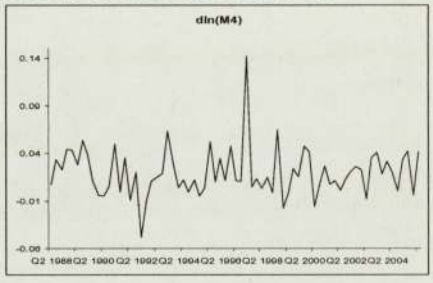


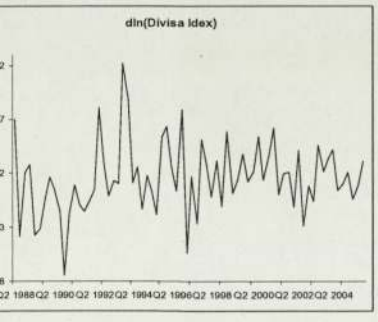


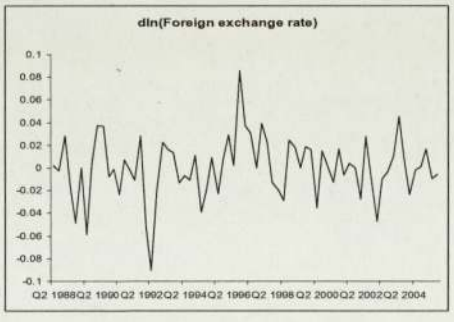
Panel B: Plots of changes in rates or levels (in nature logs) of the univariate series from 1988 Q2 to 2005 Q4











4.7 Identifying Periods of Tight Money

There are two approaches to identifying periods of tight money in the literature. One approach is to examine monetary conditions (Atanasova and Wilson, 2004; Mateut et al, 2006) using changes of the base rates or changes of the Treasury bill rate. The other is to identify which stage of business cycle the economy is in and use this as a basis for identifying monetary conditions (Beaudry et al, 2001; Eisfeldt and Rampini, 2006). However, the effects of business cycle depend on various factors in the economy and always come with a lag effect. In general it is difficult to be identified. Given these problems, this research employs a statistical approach, which is not used in prior related studies, the Philips-Perron (1994) test for structural breaks. Because Philips-Perron test identifies unit roots, it is appropriate to be used to detect the monetary stances.

4.8 PARAMETRIC ESTIMATION: STRUCTURE BREAKS

This hypothesis tested in this section is that the series does not contain a structural break. Stated formally,

$H_{0,1}$ There is no structure break occurring in the time series process y_t. The alternative hypothesis is that there is a structure break $T_b(1 < T_b < t)$. To test for the null hypothesis of no structural break, the Perron test can be written as:

$$y_t = \mu + \alpha^A y_{t-1} + \sum_{j=1}^{m} \beta \Delta y_{t-j} + \delta T + \phi DU_t + \gamma DT_t + \eta D(T_b) + e_t \qquad (1)$$

t stands for the time of the data; μ is a drift parameter. Δ denotes the log changes of time series T is a trend; T_b is the time of the structure break, i.e. the point where there is a change of the trend function; DU, DT and $D(T_b)$ are all dummy variables. DU is 1 if $t > T_b$, otherwise zero. DT is a trend function which starts immediately after the time of the break T_b. Thus DT is $t - T_b$, when $t > T_b$, otherwise zero. $D(T_b)$ depicts a structure break when time of break occurs after T_b. $D(T_b)$ is 1 when $t = T_b + 1$, otherwise zero. In order to ensure the optimal lag m is chosen, m must be based on Akaike Information Criterion (AIC), provided the residuals at the chosen lag does not exhibit autocorrelation based on Breusch-Pagan's LM Test[30] (p-value>0.10). At that optimal lag, null hypothesis of no ARCH[31] effects also needs to be satisfied ((p-value>0.10). Otherwise, the optimal lag chosen was the one at either side of the suggested lag based on the AIC until the conditions of no residual correlation and ARCH effects were satisfied.

Since Perron (1994) indicates that the second structure break ($D(T_b)$) has little effect in the trend function in determining when the break occurs. Hence, this research re-estimates equation (1), using.

$$y_t = \mu + \alpha^B y_{t-1} + \sum_{j=1}^{m} \beta \Delta y_{t-j} + \delta T + \phi DU_t + \gamma DT_t + e_t \qquad (2)$$

To identify the break points which are unknown prior, the graphical plots in Figure 4.1 were examined to identify possible break points. The following possible break points were initially identified prior to statistical testing. For the base rate, the

[30] Based on the Lagrange multiplier principle, Breusch-Pagan's LM Test is designed to test for serial correlation of the residuals.
[31] Engle's autoregressive conditional heteroskedasticity (ARCH) model tests whether there is serial correlation in the errors.

breakpoints can be identified as: 1990 Q4; 1994 Q2; 1999 Q3; and 2003 Q3. For the three-month Treasury bill rate, the breakpoints were identified as: 1990 Q4; 1991 Q1; 1994 Q1; 1999 Q3; and 2003 Q3. For M4, the breakpoints were identified as: 1992 Q4; 1997 Q1; and 1997 Q2. For Divisia Index, the breakpoints were identified as: 1992 Q1; 1993 Q2; 1993 Q3; and 1995 Q3. Because there is very little change on the foreign exchange rate in the sample period, the possible breakpoints consist of two periods[32]: 92Q2-93Q1, 96Q3-97Q2.

4.9 STRUCTURE BREAKS AND PAST STUDIES ON IDENTIFYING MONETART CONDITIONS

Table 4.3 shows the results of the Philips-Perron test for structural breaks. According to Zivot and Andrews's (1992) work, a structure break is identified based on the largest (negative) t-ratio for T_b (p-value < 0.10). Except the foreign exchange rate index, all the other 4 time series exhibit one significant break point each. Equation (1) and (2) generally identify the same break points. Notice also that there are two statistically significant break points for M4. The identified structure break points are:

i) For the base rate, the structure breakpoint is 1994 Q2.

ii) For the 3-month Treasury bill rate, the structure breakpoint is 1994 Q1.

iii) For M4, the structure breakpoints are 1997 Q1 (using Equation 1) and 1997 Q2 (using Equation 2).

iv) For Divisia index, the structure breakpoint is 1993 Q2.

[32] Each of these periods composes 4 points. For the periods consist of 3 points, the possible break-periods are: 92Q3-93Q1 and 96Q3-97Q1.

Regardless of whether the period of money is measured by business cycles or monetary conditions, the empirical results seem to agree that there are four points of monetary shocks and three periods of tight money in the UK economy during 1988-2001. Although they identified different periods of tight monetary conditions, they agrees there are three tight monetary stance. They are: 1990-1995 (Brigden and Mizen, 2004), 1990-1992 (Atanasova and Wilson, 2004) and 1996-1998 (Atanasova and Wilson, 2004). Among different stance, there are four points of time in common. These four points are: 1990 (Beaudry et al, 2001; Huang 2003); 1992 (Atanasova and Wilson, 2004); 1993 (Atanasova and Wilson, 2004; and Hannan and Sterkien, 2006) and 1996 (Atanasova and Wilson, 2004). The periods of monetary tightness based on the Perron tests are compared with those of prior studies as following.

The time of the stance of monetary condition in Table 4.3 which is determined by two money supply measurements (M4 and Divisia) are in line with the empirical evidence. Divisia money index echoes that 1993 is a recession year. The monetary shocks (1997Q1 and 1997Q2) which are determined by M4 also fit in the category where a tightening of monetary policy was occurred during 1996-1998.

However, the other break points identified by money demand measures (the base rate and the Treasury bill rate) are not consistent with those of past studies. This may reflect the both the choice of variable and the statistical test employed. For this study, a period of loose money is identified as the period before the statistical structural break – tight money being the period after the break. For example, the 3-month

Treasury bill rate shows that the period of loose money begins in 1994 Q1 whilst for M4, the period of loose money begins in either 1997 Q1 or Q2.

On the basis of identifying the structure breaks in the time series, there are three variables to be used to investigate the money tightness. They are the time series and two level shift dummies of the time series. One is the time series before a structure break (begins with *PREBREAK*). The other is the time series after the structure break (begins with *POSTBREAK*). The created time series will be discussed in Chapter 5 in detail.

Table 4.3: Phillips-Perron test for structure breaks

1990Q4	1991Q2	1992Q1	1992Q4	1993Q2	1993Q3	1994Q1	1994Q2	1995Q3	1997Q1	1997Q2	1999Q3	2003Q3
Base rate												
α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM AR La CH g
-4.241 1.351 2.069 4	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- 1.249 0.192 1 6.242[a]	- - - -	- - - -	- - - -	-3.607 0.102 0.428 5	-2.980 0.041 0.3 5 13
α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM AR La CH g
-3.275 0.020 0.097 2	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- 0.977 0.145 1 6.212[a]	- - - -	- - - -	- - - -	-3.640 0.258 0.534 5	-2.995 0.073 0.3 5 11
3-month Treasury bill rate												
α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM AR La CH g
-4.274 2.203 0.050 2	-2.796 0.336 0.061 5	- - - -	- - - -	- - - -	- - - -	-5.679[a] 1.453 0.027 1	- - - -	- - - -	- - - -	- - - -	-3.412 1.023 0.093 5	-2.987 0.574 0.0 5 78
α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM AR La CH g
-3.404 0.219 0.067 2	-3.972 0.361 0.044 5	- - - -	- - - -	- - - -	- - - -	-5.660[a] 1.120 0.028 1	- - - -	- - - -	- - - -	- - - -	-3.445 0.982 0.092 5	-3.025 0.496 0.0 5 80
M4												
α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARC Lag H	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM AR La CH g
- - - -	- - - -	- - - -	-2.559 0.175 0.153 3	- - - -	- - - -	- - - -	- - - -	- - - -	- 1.700 0.759 3 5.339[b]	-4.025 0.011 0.138 3	- - - -	- - - -
α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARC Lag H	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM AR La CH g
- - - -	- - - -	- - - -	-2.664 0.215 0.160 3	- - - -	- - - -	- - - -	- - - -	- - - -	-3.634 0.289 0.304 0	- 1.958 0.574 3 5.320[b]	- - - -	- - - -
Divisia index												
α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM ARCH Lag	α^A LM AR La CH g
- - - -	- - - -	-2.966 0.100 1.516 5	- - - -	-4.995[c] 0.507 0.478 2	-3.682 1.950 0.456 3	- - - -	- - - -	-2.005 0.451 2.296 4	- - - -	- - - -	- - - -	- - - -
α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM ARCH Lag	α^B LM AR La CH g
- - - -	- - - -	-3.825 0.017 1.545 0	- - - -	-4.283 2.302 0.909 2	-4.731 1.410 0.228 3	- - - -	- - - -	-2.062 1.005 1.686 3	- - - -	- - - -	- - - -	- - - -

Foreign exchange rate[33]

92Q2-93Q1				96Q3-97Q2			
α^B	LM	ARCH	Lag	α^B	LM	ARCH	Lag
1.594	0.010	0.076	0	2.2410	0.302	1.642	5

[b] and [c] indicate that the *Tax-ratio* are statistically significant at a 1-, 5-, or 10-percent level respectively. The critical values were obtained from Zivot and Andrews's (1992). The critical values for α^A and α^B are: -5.57(1 percent), -5.08 (5 percent) and -4.82 (10 percent).

For the foreign exchange rate, the Perron test for structure breaks cannot be run when $D(T_b)$ is included (base on Equation 1). Only the equation 2 (using α^B) is used.

4.10 CONCLUTION

This chapter shows that the time series used to measure monetary conditions are trend stationary. This follows from the tests for structural breaks in all the series. The breaks are at different time points. That is useful as this allows more robust testing for monetary tightness/looseness over several periods. The approach used in this chapter seems more reliable as opposed to the graphical methods of prior studies. The structural breaks identified will be used in the multivariate test along with the financial measures in Chapter 5.

Chapter 5 Monetary Policy Transmission and Firms' Debts

5.1 INTRODUCTION

This chapter analyzes the impact of monetary policy transmission on firms' short-term and long-term debt decisions and tests the research hypotheses in Chapter 4. The main statistical methods used are Seemingly Unrelated Regressions Equations (SURE) and General Method of Moments (GMM) methods. Factor analysis is employed before conducting the analysis to reduce the number of variables in the research model. Several diagnostic checks are used after the analysis to validate the empirical findings of the analysis.

5.2 DATA PREPARATION

5.2.1 Factor Analytical Method and Results

Following the method used in determining firms' choice between debt and equity (Schatzberg and David 2004; Roll 1984), factor analysis is used before estimating the research models in order to resolve the high correlation problems between variables and reduce the number of variables in the research model. As the accounting measures

in the research model are highly correlated (see Table 3.4 in Chapter 3), if all variables are included simultaneously, the research model will lead to poor statistical results with unreliable interferences. Factor analysis identified the independent dimensions of the variables, and highly inter-correlated variables are loaded on the same dimension and are treated as one factor for their common attributes in factor analysis. Maximum likelihood procedure was not used because the estimated variables fail to produce the smallest variance across the sample (Schloerb and Heyer, 1997; Fuller, 1996). Instead, principal component analysis procedure is used in the factor analysis for this research. Principal component analysis is good at measuring the contribution of each component to the variance and indicating the interrelationship between variables (see also Scherer and Avellaneda, 2006). To ensure that the factors are uncorrelated, factors are rotated using the variance matrix orthogonal criteria (see also Schloerb and Heyer, 1997).

Firstly, all variables (25) were included in the factor analysis process. In order to resolve the multi-collinearity between these 25 variables, factor analysis was run for the second time with 16 factors which represent 96.312% of total variables. Because the selected 16 factors were still highly correlated and there are almost half of the data missing for 'QRATIO', the default setting were used to further reduce the factors within the factor analysis process. The system defaulted number of factors were 9 and there 9 factors capture 75.931 percentage of the total 25 variables.

Table 5.1 indicates that there are 9 factors representing the independent dimensions of the 25 accounting measures for firms. There are significant clusterings within each factor. Half of investment measures load onto the first factor (e.g. SALES/MV, BOOK/MV, DY). Two out of the 3 leverage measures are in factors 2 and 3 (e.g.

LTBORR/MV and LTBORRATIO), following by 2 accounting measures which load on factor 6 that are both profitability measures, and 2 measures which load on factor 8 that are both investment measures. Firms' leverage, cash flow and collateral measures show great variation in the factors which they load onto in this factor analysis.

Table 5.1: Factor analysis
Control Variables and Factor Matrix using Principal Component Analysis[a]: Varimax Orthogonal Rotation

	Factor								
Variables[b]	1	2	3	4	5	6	7	8	9
SDRATIO				0.982					
LDRATIO				-0.982					
LTBORRATIO			0.892						
LTBORR/MV		-0.999							
IGEAR									0.681
CASHFLOW/TLIABILITY							0.598		
CASHFLOW/MV		0.999							
CASHFLOW/TA			0.942						
SALES/MV	0.898								
SALES/TA					0.839				
OPM						0.766			
OPINCOME/MV		0.999							
OPINCOME/TA			0.937						
PM/MV									
PM/TA						0.912			
CA/CL							-0.624		
BOOK/MV	0.940								
DY	0.869								
TA/MV	0.949								
STDEBT/FA								0.694	
LTDEBT/FA								0.717	
CREDITOR/MV	0.995								
CREDITOR/TA					0.860				
FIXA/TA									
TAXRATIO									0.669
VP[c]	17.272	12.356	11.299	9.122	6.902	5.972	4.923	4.075	4.011
CVP[d]	17.272	29.628	40.926	50.048	56.950	62.921	67.845	71.920	75.931

Only the variables with the largest loadings on each factor are shown.
[a] The function of a principal component analysis is to reduce loadings for variables with poor reliability when those loadings are on smaller factors.
[b] Codes are fully represented in Appendix3.2 in Chapter 3.
[c] Percentage variance explained.
[d] Cumulative percentage variance explained.

Surprisingly, despite the vast amount of literature focusing on firms' bank loan decisions during monetary policy transmission, i.e. the external finance, both short-term debt ratio (SDRATIO) and long-term debt ratio (LDRATIO) only load onto factor four. The explanation for this is that the industrial firms in the UK do not seem to excessively rely on external finance during monetary policy transmission (see also Eijffinger, 2001; Kuttner, 2001). There are 3 investment related measures which load on the first factor and 2 of them (BOOK/MV and DY) are directly linked to share

prices. Because both BOOK/MV and DY directly link to shareholders' activities, firms' finance decisions are determined by shareholder's activities to a great extent. Furthermore, among all the measures which load on the first factor, trade creditor related measure CREDITOR/MV accounts for the highest proportion 99.5% of all measures within factor 1. This supports the large amount of empirical research investigating the importance of trade creditors in firms' bank loan decisions under monetary transmission (Guariglia and Mateut, 2006).

Although only 9 factors are selected, trying to estimate each accounting variable within one factor alongside each variable within another factor still creates numerous combinations for testing the research model. In order to reduce the number of combinations, the accounting measures are restricted to accounting measures which have the highest absolute values in each factor similar to Scherer and Avellaneda (2006) study. In order to investigate the possible influence of negative sign on each variable, if there are both positive and negative values within one factor, these two variables are both included. For example, in factor 7, both CASHFLOW/TLIABILITY and CA/CL are used in the estimation.

The final estimation for models in this research consists of 13 accounting measures analyzed with respect to 9 factors. Yet there are 117 combinations for the choice of these 9 factors in testing each of the dependent variable. In order to produce significant results in the research model, this research selects the combinations with the highest numbers of significant coefficient among all the possible combinations. The coefficient is obtained by estimation the research models using GMM. 6 out of 117 combinations are selected.

Using the short-term debt ratio (SDRATIO) and the long-term debt (LDRATIO) as the dependent variable respectively, the selected combinations of the independent variables in the research models are: 1) CREDITOR/MV, LTBORR/MV, CASHFLOW/TA, CREDITOR/TA, PM/TA, CASHFLOW/TLIABILITY, LTDEBT/FA, IGEAR; 2) CREDITOR/MV, CASHFLOW/MV, CASHFLOW/TA, CREDITOR/TA, PM/TA, CASHFLOW/TLIABILITY, LTDEBT/FA, IGEAR; 3) CREDITOR/MV, OPINCOM/MV, CASHFLOW/TA, CREDITOR/TA, PM/TA, CASHFLOW/TLIABILITY, LTDEBT/FA, IGEAR.

5.2.2 The Dummy and Time Series Variables in the Final Research Models

A dummy variable *SMALL* is employed to capture the effect of firms' size, i.e. each accounting variables multiply *SMALL*. The reason for introducing this dummy variable is that small firms are more likely to be constrained financially when money is tight (see also Berger and Udell, 2002). If the natural log of a firms' total assets is less than the median of the natural log of total assets for all the firms in the sample, *SMALL* is equal to 1. If this is not the case, *SMALL* is equal to 0. The difference of each independent variable compared to the previous year is used to in the final estimation. For the all the time series used in this study, please see Appendix 5.1 for detail.

For the time series which include a structure break, two levels shift dummies to be introduced in the final estimation. The first one is the time series before a structure break DTb*. It is 0 before the structure breaks (also at the structure break points) and is 1 after the structure breaks. For example, DU90 for 3 month Treasury Bill rate. The

second one is the time series after the structure break. It is 0 after the structure breaks (also at the structure break points) and is 1 before the structure breaks. For example, DT90 for 3 month Treasury bill rate.

The structure break points for the five time series variables (the base rate, 3 month Treasury bill rate, M4, Divisia, Foreign exchange rate) are determined after running the Perron test for each possible break points and fining the difference of the logarithm of each time series variable with most significant coefficients. Then the structure the variables show the structure breaks with the time series are set to zero at the structure break points and before the structure break, while it keeps the actual value of the time series after the structure break point. For instance, the most significant structure break point for 3 month Treasury bill rate is 1994 Q1, the PREBREAKTB is set to zero at the 1994 Q1 and before1994 Q1, while it keeps the actual value of the time series after 1994 Q1. This way of identifying structure breaks is an improvement on Perron (1994)'s original work, whereas Perron only employs zero and one dummy variables. The structure break points are given zero and the rest of the variables are given the value of one. By keeping the actual value of the time series, the original attribute of the selected time series is maintained and thereby the tight money periods which are identified in this research are with more accuracy.

After creating above dummy variables, some time series variables or their pre or post break variables cannot be included simultaneously in the research models. This is because there are correlations between certain time series as well as their pre and post break variables. The time series measuring money demand (the base rate and the 3-month Treasury bill rate) and the time series measuring money supply (M4 and Divisia) are correlated. Furthermore, money supply measures are correlated with their

pre-structure break and the post-structure break measures of money supply respectively. As a result, money demand measures and money supply measures are conducted separately. Also, for money supply measures, only the pre-structure break and post-structure break measures are included. For instance, the M4 is correlated with PREBREAKM4 and POSTBREAKM4 respectively. Hence, the level of M4 is excluded in the estimations which use money supply measures to identify monetary tightness. Finally, not every time series have structure breaks therefore only the level of that time series is included. For example, the foreign exchange rate.

On the basis of the 6 combinations in Section 5.2.1, when adding in the time series variables, there are two sets of time series combination added in the final estimations. The time series combinations are: 1) PREM4BREAK2, POSTM4BREAK2, PREBREAKDIVISIA, POSTBREAKDIVISIA LNFX; and 2) LNBASE, PREBREAKBASE, POSTBREAKBASE, LN3MTB, PREBREAK3MTB, POSTBREAK3MTB, LNFX.

5.3 SURE AND GMM METHODS

5.3.1 SURE Method

Although factor analysis reduces the number of variables which are correlated, there are still correlated variables in the research models. In order to avoid possible

autocorrelation among the residuals, the Seemingly Unrelated Regressions Equation (SURE) method is adopted to test the research models. That is[34],

$$y_i = X_i\beta_i + \varepsilon_i \; i = 1,...,M$$

Where $$\varepsilon = [\varepsilon_1', \varepsilon_2', ..., \varepsilon_M']'$$

and $$E[\varepsilon | X_1, X_2, ..., X_M] = 0,$$

$$E[\varepsilon\varepsilon' | X_1, X_2, ..., X_M] = \Omega$$

There are T observations in estimating the parameters of the M equations. There are K_m regressors for each equation. The total $K = \sum_{i=1}^{n} K_i$. $T > K_i$. The disturbances are uncorrelated across observations.

$$E[\varepsilon_{it}\varepsilon_{js}' | X_1, X_2, ..., X_M] = \sigma_{ij}, \text{ if } t = s \text{ and 0 otherwise.}$$

Therefore, $\Omega = \sigma_{ij}\mathbf{I}_T$, $\mathbf{I}$ is a Matrix vector.

In short, SURE generates a common structure of multiple regression equation to tests each residuals respectively. As each residuals are estimated separately, the autocorrelation problem is solved and SURE successfully avoids the violation to the classical assumption[35].

As indicated in Chapter 3 section 3.7, this research employs various diagnostic checks to evaluate the quality of the specification of the research models. To further validate the SURE results, the Wald (W) test, the Durbin-Watson test, the Q-statistics and the Lagrange multiplier (LM) test are employed. The Wald test evaluates the validity of the estimated coefficients in the estimated model by investigating the difference between the estimated values and the real values in the models (Davidson and MacKinnon, 1993). The Durbin-Watson test provides the first-order autocorrelation

[34] The equations and inference of the equations for SURE are from Greene's (2003) p 340-341.
[35] Part of the spherical disturbances condition.

of the residuals. However, this test's results are not reliable on any equation with lagged dependent variables. Thus Q-statistics[36] and Lagrange multiplier (LM) test are also employed. These two tests examine the correlations between the residuals and lagged values of the residuals. That is, whether there is autocorrelation up to the specified number[37] of lags in the residuals (Buse, 1982). Other results shown in the tables in Table 5.2 below are: adjusted R-square[38] and the standard error[39] (S.E.) of the regression.

5.3.2 GMM Method

In order to avoid possible heteroscedasticity in the research models, General Method of Moments is employed. A heteroscedastic regression can be written as[40]:

$$y_{it} = \mathbf{x}_{it}'\beta + \gamma y_{i,t-1} + \alpha_i + \varepsilon_{it} = \mathbf{w}_{it}'\delta + \alpha_i + \varepsilon_{it}$$

$T \geq K+1, K$ is the number of variables in $\mathbf{x}_{it}$, T is the number of observation in the equation,

$$\hat{\delta} = \left[\sum_{i=1}^{n} \mathbf{W}_i'\mathbf{M}^0\mathbf{W}_i\right]^{-1}\left[\sum_{i=1}^{n} \mathbf{W}_i'\mathbf{M}^0\mathbf{y}_i\right] = \left[\sum_{i=1}^{n} \mathbf{W}_i'\mathbf{M}^0\mathbf{W}_i\right]^{-1}\left[\sum_{i=1}^{n} \mathbf{W}_i'\mathbf{M}^0\mathbf{W}_i\mathbf{d}_i\right]$$

$$= \sum_{i=1}^{n} \mathbf{F}_i\mathbf{d}_i$$

$\mathbf{M}^0$ is the $T \times T$ matrix. $\mathbf{w}_{it}'$ is the number of rows in the $T \times (K+1)$ matrix. $\mathbf{W}_i'$. $\mathbf{d}_i$ is a estimator whose variance are not close to zero when n increases. Therefore, GMM

---

[36] Since the LM test in this research only manages to provide serial correlation tests for lag 2 and lag 3, this research uses the Q-statistics to show the serial correlation for up to 6 lags.

[37] When the order of lag is too small, serial correlation at high-order lags cannot be detected, whilst if the order of lag is too big, insignificant correlations at some lags may violate the significant correlations at some lags and thereby lower the explanatory power for the estimated correlation.

[38] Adjusted R-square measures the goodness of fit of the model using restricted variables which contribute the explanatory power of the model.

[39] The S. E. of the regression reports the estimated statistical noise in the coefficient estimates of the model.

[40] The equations and inference of the equations for GMM are adapted from Greene's (2003) Chapter 18.

introduces an instrumental matrix $\mathbf{V}_i$ and a transformation matrix H_η. The disturbances of the GMM model is

$$\eta_i = [\eta_{i1}, \eta_{i2}, ..., \eta_{iT}] = [(\varepsilon_{i1} + u_i), (\varepsilon_{i1} + u_i), ..., (\varepsilon_{i1} + u_i)]'$$

Hence

$$E[\mathbf{V}_i' \mathbf{H}_{\eta_i}] = E[\mathbf{g}_i] = 0$$

The heteroscedasticity problem is solved by constructing the moment conditions:

$$\text{plim} \frac{1}{n} \sum_{i=1}^{n} \mathbf{V}_i' \mathbf{H}_{\eta_i} = \text{plim} \frac{1}{n} \sum_{i=1}^{n} \mathbf{m}_i = \text{plim} \overline{\mathbf{m}} = 0$$

The GMM estimator is obtained by minimizing $q = \overline{\mathbf{m}}' \mathbf{A} \overline{\mathbf{m}}$, where $\mathbf{A}$ is a positive definite weighting matrix. Therefore, GMM are robust to heteroskedasticity of residuals even if when the distribution of the disturbance of the models, is unknown. GMM method solves the problem, which the independent variables are correlated with their residuals in the research models, by estimating a set of instrument variables which are uncorrelated with the residuals in the research models. It particularly suits for these research models with unfixed independent variables and undetermined lags in the models.

When the optimal weighting matrix is used in a GMM model, the estimation method becomes the two-stage GMM where

$$\mathbf{A} = \text{Asy.Var}[\sqrt{n} \overline{\mathbf{m}}] = \left(\frac{1}{n} \sum_{i=1}^{n} \mathbf{V}_i' \mathbf{H}' \mathbf{H} \mathbf{V}_i \right)^{-1}$$

The two-stage GMM is adopted because it repeats the procedure of finding the suitable instruments until the theoretical results which are obtained by using instrument variables and the actual results of the research models are as close as possible. It is particularly suitable for the dynamic panel data used in this research. Thus, the two-stage GMM is a better estimation method for this research.

The GMM also employs the Wald (W) test, the Q-statistics and the Lagrange Multiplier (LM) as diagnostic checks for the GMM results. Additionally, the *J*-statistics result is reported. The *J*-statistics result is the minimized value of the research model and often used to test the number of overidentiying restrictions in any GMM models (Newey and West, 1987). When the *p*-values of *J*-statistics are greater than 0.01, the number of instruments are greater than the number of independent variables.

5.4 SURE AND GMM RESTULTS

5.4.1 SURE Results

The results of adjusted R-squared are within the range of 0 and 1 (Table 5.2). The Wald test and Q-statistics results are significant. This shows that the tested SURE models generally are well specified. The results of Durbin-Watson statistic are all close to 2. Hence there is no autocorrelations in the residuals. LTBORR/MV, CREDITORS/TA are significant with and without the size effect into account. LTDEBT/FA and their related size effect measure LTDEBT/FA*SMALL are significant when firms' size effect is taking into account. The significant of firms' leverage and trade creditor variables confirms that firms' leverage and trade creditor are the criteria banks use to decide whether they will issue loans to firms under monetary policy transmission. The number of significant variables in testing LDRATIO without considering firms' size effect are almost the same as the number of significant variables in testing both SDRATIO and LDRATIO when firms' size

effect are taken into account. This can be explained as that small firms tend to borrow the same amount of debt as large firms in the long run, although they have to borrow less right after monetary contraction. No matter firms' size effect is considered in the research models, both PREBREAKDIVISIA and POSTBREAKDIVISIA are significant. This indicates that Divisia money has significant contribution in explaining the research models. Therefore it is a better measurement in testing monetary conditions.

Table 5.2 SURE results

	Without size effect		With size effect	
Variables	**SDRATIO**	**LDRATIO**	**SDRATIO**	**LDRATIO**
ΔSDRATIO(-1)	-0.2950[a]	-	-0.2890[a]	-
	(0.0106)	-	(0.0105)	-
ΔLDRATIO(-1)	-	-0.2809[a]	-	-0.2712[a]
	-	(0.0114)	-	(0.0112)
ΔCREDITOR/MV	0.0002	-0.0002[c]	0.0001	-0.0001[c]
	(0.0001)	(9.16E-05)	(0.0001)	(9.02E-05)
ΔLTBORR/MV	-0.0353[a]	0.0363[a]	-0.0190[a]	0.0183[a]
	(0.0040)	(0.0035)	(0.0047)	(0.0040)
ΔCASHFLOW/TA	0.0012	-0.0013	0.0420[a]	-0.0409[a]
	(0.0022)	(0.0019)	(0.0107)	(0.0092)
ΔCREDITOR/TA	0.1960[a]	-0.1161[b]	0.2104[a]	-0.0619
	(0.1339)	(0.0473)	(0.0757)	(0.0697)
ΔPM/TA	0.0087	-0.0054	0.0120	-0.0194
	(0.0055)	(0.0058)	(0.0088)	(0.0146)
ΔCASHFLOW/TLIABILITIES	0.0007	-0.0010	-0.0275[b]	0.0020
	(0.0020)	(0.0053)	0.0116	(0.0121)
ΔCA/CL	-0.0350	0.0353[a]	-0.0320[a]	0.0329[a]
	0.0044	0.0047	(0.0047)	(0.0047)
ΔLTDEBT/FA	0.0012	0.0004[a]	-0.0230[a]	0.0232[a]
	(0.0022)	(0.0001)	(0.0020)	(0.0017)
ΔIGEAR	-9.53E-05	9.49E-05	7.85E-05	-8.05E-05
	(0.0002)	(0.0002)	(0.0004)	(0.0003)
ΔCASHFLOW/MV	0.0025	-0.0023	0.0017	0.0083
	(0.0014)	(0.0022)	(0.0053)	(0.0052)
ΔOPINCOME/MV	-0.0310	0.0318[a]	-0.0370[b]	0.0320
	0.0035	0.0033	(0.0229)	(0.0199)
ΔCREDITOR/MV*SMALL	-	-	0.0459[a]	-0.0411[a]
	-	-	(0.0163)	(0.0143)
ΔLTBORR/MV*SMALL	-	-	-0.0717[a]	0.0840[a]
	-	-	(0.0106)	(0.0096)
ΔCASHFLOW/TA*SMALL	-	-	-0.0409[a]	0.0397[a]
	-	-	(0.0109)	(0.0094)
ΔCREDITOR/TA*SMALL	-	-	-0.0851	-0.0022
	-	-	(0.0776)	(0.0717)
ΔPM/TA*SMALL	-	-	-0.0048	0.0168
	-	-	(0.0111)	(0.0157)
ΔCASHFLOW/TLIABILITIES*SMALL	-	-	0.0286[b]	-0.1024
	-	-	(0.0118)	(0.0828)
ΔCA/CL*SMALL	-	-	-0.0009	-0.0032
	-	-	(0.0045)	(0.0044)
ΔLTDEBT/FA*SMALL	-	-	0.0227[a]	-0.0229[a]
	-	-	(0.0020)	(0.0017)
ΔOPINCOME/MV*SMALL			-0.0425[c]	0.0581[a]
			(0.0244)	(0.0213)
ΔIGEAR*SMALL	-	-	-0.0003	0.0003
	-	-	(0.0004)	(0.0004)
ΔLNFX	0.0507	0.0119	0.0481	-0.6181[a]
	(0.0688)	(0.0636)	(0.0681)	(0.2284)
ΔLNBASE	0.6833	-2.2016	1.0018	-0.8767
	(0.9794)	(0.3296)	(0.9696)	(0.8880)
ΔPREBREAKBASE	-1.1387[c]	-2.1138	-1.1165	0.9335
	(0.6878)	(0.7658)	(0.6805)	(0.6215)
ΔPOSTBREAKBASE	-1.0659[a]	1.8324	-1.0301	0.9165
	(0.6941)	(0.3513)	(0.6805)	(0.6387)
ΔLN3MTB	-0.6019	6.1869	-0.8050	0.7267
	(0.9075)	(0.8116)	(0.8983)	(0.6387)
ΔPREBREAK3MTB	0.4655	1.6386	0.4207	-0.3183
	(0.4260)	(0.1156)	(0.4217)	(0.3791)
ΔPOSTBREAK3MTB	-0.2800	-2.0305	-0.2611	0.2794
	(0.2238)	(0.9119)	(0.2216)	(0.2007)
ΔPREM4BREAK2	-1.0312	0.9910	-1.0112	0.9093
	(0.3568)	(0.0899)	(0.3221)	(0.0766)
ΔPOSTM4BREAK2	-1.1145	0.9973	-1.1134	0.9933
	(0.0873)	(0.8991)	(0.0782)	(0.8811)
ΔPREBREAKDIVISIA	1.0012[b]	-1.4537[b]	1.0003[a]	-1.4327[a]
	(0.0237)	(0.0226)	(0.0222)	(0.0221)
ΔPOSTBREAKDIVISIA	0.9855[b]	-1.3442[b]	0.9958[a]	-1.2661[a]
	(0.0152)	(0.0172)	(0.0134)	(0.0144)
Durbin-Watson statistic	2.0797	2.0100	2.0872	2.0235
Q-statistics(1)	27.056[a]	9.5319[a]	30.816[a]	13.922[a]
Q-statistics(2)	258.21[a]	153.87[a]	256.09[a]	149.32[a]

Q-statistics(4)	283.04[a]	172.63[a]	280.86[a]	167.25[a]
Q-statistics(6)	284.28[a]	173.84[a]	282.01[a]	168.43[a]
Wald test	986.5779[a]	835.9105[a]	1186.679[a]	1123.766[a]
Adjusted R-squared	0.1070	0.1048	0.1251	0.1352
S. E. of regression	0.2862	0.2466	0.2833	0.2424

All the firms are divided into two groups, i.e. 'small' and 'large' firms using the log of median total assets of firms. [a], [b], and [c] denotes statistical significance at 1-, 5- and 10- percent level respectively. The standard errors are in parenthesis. LM Auto(2) and LM Auto(3) are the serial correlation LM test on lag2 and 3 respectively. Q- statistics test whether the suitable numbers of lags are used in the model. *J*-statistic is the minimized value of the research model and it is designed to test the validity of overidentifying restriction of the research model when the numbers of instruments are greater than the number of variables. The Wald test provides a test of the significance of all the explanatory variables besides the constant. Adjusted R-squared shows how good a model is in general. S.E. of regression is a summary measure of the estimated variance of the residuals.

5.4.2 GMM Results

Table 5.3 presents the results without taking the effect of firms' sizes into account. Table 5.4 shows the results, when the effect of firms' sizes is considered. Both tables have two panels. Panel A indicates the year effect of the GMM results and diagnostic check results. Panel B shows the coefficient on each independent variable in relation to SDRATIO and LDRATIO respectively. The year effect is introduced to see the possible monetary policy impact on UK economy in general. There is substantial amount of difference in panel A in both table 5.3 and table 5.4, whilst there is less significant difference between the coefficient results in panel B in the two tables. This is because panel A in both tables mainly report accumulated results for each year but panel B in both tables breaks down coefficient results by several different dependent variables for which only the changes of the variables are measured.

In panel A table 5.3, the results of adjusted R-squared are all negative. The results of the Wald test and J-statistics are significant. Q-statistics and LM test results are insignificant. This indicates that the tested research models generally are well specified. Except there are 11 significant year effects in testing SDRATIO using M4 and Divisia, rest of the results all show 8 years of year effects. When the base rate and the 3-month Treasury bill rate are used in testing the models, the year effects start and finish in different years in testing SDRATIO and LDRATIO respectively; while the

year effect starts and almost finishes in the same year, when M4 and Divisia are used in testing the models. In panel B of the same table, LTBORR/MV and CREDITORS/TA are significant in testing both SDRATIO and LDRATIO. This indicates that firms' short-term as well as long-term debt are sensitive to changes of firms' long-term borrowing as well as the changes of trade credit to firms because banks rely on collateral of all form to reduce the default risk of the loans. For time series, the base rate, foreign exchange rate and Divisia are significant. Since the base rate only significant in testing SDRATIO whilst foreign exchange rate and Divisia are significant in testing both ratios, it is reasonable to say that Divisia is better measure in identifying the monetary transmission impact on firms' short-term and long-term debt decisions.

The adjusted R-squared are also all negative. This means the research models face misspecification problem. In panel A of table 5.4, except the p-value of J-statistic are not available, the results of diagnostic checks show the models with firms' size effect are well specified based on their R-squared Wald test, Q-statistics and LM test results. The numbers of coefficients for the year effect in this panel A (in Table 5.4) are as same as the numbers of coefficients in table 5.3. Again, the year effect starts and finishes in the same year, when M4 and Divisia are used in testing the models. This shows that the year effect is not influence by firms' size effect. Furthermore, it indicates that money supply measures are better measures for testing monetary conditions. That is because compared with money demand measures, money supply measures have a relative fixed period which have significant coefficients.

When Panel A in both tables is compared, the adjusted R-squared results are relatively closer to 0 using money supply measures than the results using money demand measures. Therefore in general the research models using M4 and Divisia are better specified than the models using the base rate and the 3-month Treasury bill rate. Most of the coefficient results in the testing SDRATIO in both panel A are positive while most of the coefficients results in testing LDRATIO are negative. This is because firms' debt consists of short-term and long-term debt and there is negative relationship between these two types of debt. The only significant difference between the panel A in both tables are the residual tests results in testing LDRATIO using M4 and Divisia index. When size is taken into account (the last column in panel A table 5.4) the LM test and Q-statistic are significantly lower than the residual results in panel A table 5.3. This indicates that monetary impact on firms' long-term debt ratio is more sensitive to the effect of firm size, when money supply measures are used. This may be because the effect of firm size is more significant in the long run after monetary policy transmission.

Table 5.3 SDRATIO without firms' size effect (GMM results)

Panel A

Year Effect	Base rate & 3-month Treasury bill rate		M4break2 and Divisia	
Variables	**SDRATIO**	**LDRATIO**	**SDRATIO**	**LDRATIO**
1990	0.3583	-0.2541[c]	-0.0506	0.0180
	(0.3101)	(0.1454)	(0.0356)	(0.0310)
1991	0.4551	-0.3530[c]	0.0016	0.0173
	(0.4069)	(0.1971)	(0.0249)	(0.0230)
1992	0.4096	-0.3372[c]	0.0204	-0.0252
	(0.3498)	(0.1739)	(0.0245)	(0.0222)
1993	0.3121	-0.2827[c]	0.0469[b]	-0.0444[c]
	(0.2725)	(0.1476)	(0.0229)	(0.0235)
1994	0.1728[a]	-0.0691	0.0598[b]	-0.0541[a]
	(0.0659)	(0.0432)	(0.0239)	(0.0203)
1995	0.0863[b]	-0.0489[c]	0.0558[c]	-0.0237
	(0.0366)	(0.0256)	(0.0295)	(0.0219)
1996	0.1682[a]	-0.1336[a]	0.1182[b]	-0.0778[b]
	(0.0624)	(0.0437)	(0.0503)	(0.0342)
1997	0.1493[b]	-0.1436[a]	0.1161[b]	-0.0785[b]
	(0.0639)	(0.0460)	(0.0551)	(0.0367)
1998	0.0793	-0.0969[b]	0.0752[b]	-0.0656[a]
	(0.0500)	(0.0377)	(0.0311)	(0.0228)
1999	0.1196	-0.0818	0.0365[c]	-0.0328[b]
	(0.0909)	(0.0544)	(0.0187)	(0.0154)
2000	0.1222[a]	-0.0412	0.0437[a]	-0.0287[b]
	(0.0473)	(0.0274)	(0.0124)	(0.0122)
2001	0.1146[b]	-0.0195	0.0349[a]	-0.0052
	(0.0537)	(0.0277)	(0.0117)	(0.0103)
2002	0.0919[c]	-0.0384	0.0243[b]	-0.0173[c]
	(0.0531)	(0.0274)	(0.0112)	(0.0096)
2003	0.0123	0.0148	-0.0124	0.0092
	(0.0151)	(0.0121)	(0.0121)	(0.0106)
2004	0.0119	0.0007	0.0201[b]	-0.0117
	(0.0290)	(0.0190)	(0.0092)	(0.0088)
2005	-0.0436[b]	0.0117	-0.0065	0.0025
	(0.0207)	(0.0135)	(0.0094)	(0.0086)
Diagnostic Checks				
LM Auto(2)	-2.8711[a]	-1.6129	0.7671	1.8928[c]
LM Auto(3)	-0.4681	-0.0629	0.7093	2.4692
Q-statistics(1)	4.66741[b]	32.049[a]	0.2438	34.923[c]
Q-statistics(2)	11.680[a]	57.520[a]	1.8235	7.8620[b]
Q-statistics(4)	24.316[a]	84.349[a]	6.0742	15.174[a]
Q-statistics(6)	29.707[a]	93.758[a]	7.1910	20.541[a]
J-statistics	140.7337[a]	144.4346[a]	160.9786[a]	151.5520[a]
Wald test	86.2808[a]	82.9536[a]	105.1842[a]	88.1053[a]
Adjusted R-squared	-0.5749	-0.4638	-0.4554	-0.3619
S. E. of regression	0.2838	0.2493	0.2723	0.2404

All the firms are divided into two groups, i.e. 'small' and 'large' firms using the log of median total assets of firms. [a], [b], and [c] denotes statistical significance at 1-, 5- and 10- percent level respectively. The standard errors are in parenthesis. LM Auto(2) and LM Auto(3) are the serial correlation LM test on lag2 and 3 respectively. Q- statistics test whether the suitable numbers of lags are used in the model. *J*-statistic is the minimized value of the research model and it is designed to test the validity of overidentifying restriction of the research model when the numbers of instruments are greater than the number of variables. The Wald test provides a test of the significance of all the explanatory variables besides the constant. Adjusted R-squared shows how good a model is in general. S.E. of regression is a summary measure of the estimated variance of the residuals.

Panel B:

Time series	Base rate & 3-month Treasury bill rate		M4break2 and Divisia	
Variables	SDRATIO	LDRATIO	SDRATIO	LDRATIO
ΔSDRATIO(-1)	0.5150[a]	-	0.5030[a]	-
	(0.0170)	-	(0.0167)	-
ΔLDRATIO(-1)	-	0.5059[a]	-	0.5051[a]
	-	(0.0194)	-	(0.0187)
ΔCREDITOR/MV	-6.34E-05	0.0002	-2.56E-05	0.0002
	(0.0003)	(0.0003)	(0.0002)	(0.0002)
ΔLTBORR/MV	-0.0006[a]	0.0006[a]	-0.0006[a]	0.0006[a]
	(6.65E-05)	(4.35E-05)	(5.93E-05)	(4.40E-05)
ΔCASHFLOW/TA	0.0230	-0.0197	0.0153	-0.0212
	(0.0189)	(0.0134)	(0.0151)	(0.0142)
ΔCREDITORS/TA	0.3432[a]	-0.3451[a]	0.3385[a]	-0.3401[a]
	(0.1135)	(0.1106)	(0.1058)	(0.1041)
ΔPM/TA	-0.0218	-0.0294	-0.0218	-0.0144
	(0.0249)	(0.0204)	(0.0221)	(0.0166)
ΔCASHFLOW/TLIABILITIES	-0.0167	0.0189	-	0.0148
	(0.0133)	(0.0184)	-	(0.0185)
ΔCA/CL	-	-	-0.0011	-
	-	-	(0.0158)	-
ΔLTDEBT/FA	0.0002	2.37E-06	0.0002	-2.48E-05
	(0.0002)	(0.0001)	(0.0002)	(9.90E-05)
ΔIGEAR	0.0004	-0.0004	0.0005	-0.0007
	(0.0009)	(0.0008)	(0.0009)	(0.0010)
ΔLNFX	0.4206	-0.8028[a]	0.8235[b]	-0.6118[a]
	(0.4103)	(0.2604)	(0.3471)	(0.2278)
ΔLNBASE	-20.6213[b]	0.1305	-	-
	(8.9595)	(6.3707)	-	-
ΔPREBREAKBASE	12.4025[b]	-6.2160	-	-
	(5.4471)	(4.7523)	-	-
ΔPOSTBREAKBASE	14.1318[a]	-0.2010	-	-
	(4.8125)	(4.1553)	-	-
ΔLN3MTB	14.2048	4.6723	-	-
	(8.6605)	(6.8456)	-	-
ΔPREBREAK3MTB	-3.1014	1.5705	-	-
	(3.5508)	(3.0882)	-	-
ΔPOSTBREAK3MTB	-0.3972	-2.2240	-	-
	(2. 8335)	(1.9790)	-	-
ΔPREM4BREAK2	-	-	-1.4094	0.9044
	-	-	(0.8806)	(0.8375)
ΔPOSTM4BREAK2	-	-	-1.4302	0.9336
	-	-	(0.8728)	(0.8322)
ΔPREBREAKDIVISIA	-	-	1.5395[b]	-1.3064[c]
	-	-	(0.7708)	(0.7909)
ΔPOSTBREAKDIVISIA	-	-	1.5393[b]	-1.2975[c]
	-	-	(0.7597)	(0.7826)

All the firms are divided into two groups, i.e. 'small' and 'large' firms using the log of median total assets of firms. [a], [b], and [c] denotes statistical significance at 1-, 5- and 10- percent level respectively. The standard errors are in parenthesis. LM Auto(2) and LM Auto(3) are the serial correlation LM test on lag2 and 3 respectively. Q- statistics test whether the suitable numbers of lags are used in the model. J-statistic is the minimized value of the research model and it is designed to test the validity of overidentifying restriction of the research model when the numbers of instruments are greater than the number of variables. The Wald test provides a test of the significance of all the explanatory variables besides the constant. Adjusted R-squared shows how good a model is in general. S.E. of regression is a summary measure of the estimated variance of the residuals.

Table 5.4 SDRATIO and LDRATIO with firms' size effect (GMM results)

Panel A

Year Effect	Base rate & 3-month Treasury bill rate		M4break2 and Divisia	
Variables	SDRATIO	LDRATIO	SDRATIO	LDRATIO
1990	0.5045	-0.2170	-0.0565	0.0206
	(0.3318)	(0.1352)	(0.0359)	(0.0310)
1991	0.6406	-0.3219[c]	0.0018	0.0090
	(0.4367)	(0.1850)	(0.0256)	(0.0228)
1992	0.5772	-0.3066[c]	0.0203	-0.0361
	(0.3754)	(0.1627)	(0.0257)	(0.0225)
1993	0.4420	-0.2544[c]	0.0466[c]	-0.0519[b]
	(0.2924)	(0.1382)	(0.0246)	(0.0242)
1994	0.1957[a]	-0.0642	0.0578[b]	-0.0578[a]
	(0.0675)	(0.0416)	(0.0246)	(0.0202)
1995	0.0784[b]	-0.0400[c]	0.0545[c]	-0.0308
	(0.0382)	(0.0243)	(0.0299)	(0.0218)
1996	0.1577[b]	-0.1210[a]	0.1170[b]	-0.0866[b]
	(0.0640)	(0.0415)	(0.0515)	(0.0341)
1997	0.1350[b]	-0.1342[a]	0.1151[b]	-0.0886[b]
	(0.0658)	(0.0440)	(0.0565)	(0.0373)
1998	0.0705	-0.0942[a]	0.0714[b]	-0.0698[a]
	(0.0494)	(0.0356)	(0.0320)	(0.0233)
1999	0.1305	-0.0070	0.0334[c]	-0.0339[b]
	(0.0897)	(0.0515)	(0.0191)	(0.0159)
2000	0.1289[a]	-0.0253	0.0367[a]	-0.0215[c]
	(0.0472)	(0.0273)	(0.0135)	(0.0126)
2001	0.1270[b]	-0.0105	0.0295[b]	-0.0228[c]
	(0.0540)	(0.0272)	(0.0124)	(0.0124)
2002	0.1043[c]	-0.0340	0.0253[b]	-0.0044
	(0.0533)	(0.0270)	(0.0114)	(0.0104)
2003	0.0182	0.0120	-0.0144	-0.0161
	(0.0152)	(0.0124)	(0.0122)	(0.0100)
2004	0.0088	0.0016	0.0179[c]	0.0066
	(0.0286)	(0.0181)	(0.0094)	(0.0111)
2005	-0.0485[b]	0.0107	-0.0073	-0.0128
	(0.0206)	(0.0135)	(0.0096)	(0.0091)
Diagnostic Checks				
LM Auto(2)	-3.7532[a]	-2.1187[b]	0.0721	0.0023
LM Auto(3)	0.8824	-1.3061	0.6466	1.6700[c]
Q-statistics(1)	5.5140[b]	5.8912[b]	1.2777	4.510[b]
Q-statistics(2)	12.424[a]	15.503[a]	3.9903	10.192[a]
Q-statistics(4)	23.329[a]	31.333[a]	9.1049[c]	17.649[a]
Q-statistics(6)	28.348[a]	37.618[a]	10.536	21.695[a]
J-statistics[41]	141.3205	148.0530	164.6660	151.2296
Wald test	77.7201[a]	81.9800[a]	102.8667[a]	87.6027[a]
Adjusted R-squared	-0.6125	-0.4069	-0.4802	-0.3936
S. E. of regression	0.2872	0.2444	0.2746	0.2432

All the firms are divided into two groups, i.e. 'small' and 'large' firms using the log of median total assets of firms. [a], [b], and [c] denotes statistical significance at 1-, 5- and 10- percent level respectively. The standard errors are in parenthesis. Auto(2) and Auto(3) are the serial correlation LM test on lag2 and 3 respectively. Q- statistics test whether the suitable number of lags are used in the model. *J*-statistic is the minimized value of the research model and it is designed to test the validity of overidentifying restriction of the research model when the numbers of instruments are greater than the number of variables. The Wald test provides a test of the significance of all the explanatory variables besides the constant. Adjusted R-squared shows how good a model is in general. S.E. of regression is a summary measure of the estimated variance of the residuals.

[41] The *p*-values of *J*-statistics are not available.

Panel B

Time series	Base rate & 3-month Treasury bill rate		M4 break2 and Divisia	
Variables	SDRATIO	LDRATIO	SDRATIO	LDRATIO
ΔSDRATIO(-1)	0.5135[a]	-	0.4932[a]	-
	(0.0171)	-	(0.0172)	-
ΔLDRATIO(-1)	-	0.5156[a]		0.5140[a]
	-	(0.0193)		(0.0192)
ΔCREDITORS/MV	5.34E-05	6.65E-05	-2.55E-05	0.0001
	(0.0003)	(0.0002)	(0.0002)	(0.0001)
ΔLTBORR/MV	-0.0087	0.0104	-0.0013	0.0037
	(0.0098)	(0.0081)	(0.0102)	(0.0092)
ΔCASHFLOW/TA	-0.0020	-0.1598	-0.0223	-0.1368
	(0.0720)	(0.1055)	(0.0280)	(0.0962)
ΔCREDITOR/TA	0.2242[c]	-0.1529	0.2852[b]	-0.2050
	(0.1339)	(0.1265)	(0.1250)	(0.1309)
ΔPM/TA	0.0008	-0.0601[a]	-0.0067	-0.0455[a]
	(0.0189)	(0.0231)	(0.0170)	(0.0138)
ΔCASHFLOW/TLIABILITIES	0.0002	0.1005	-	0.0776
	(0.0580)	(0.0829)	-	(0.0753)
ΔCA/CL	-	-	-0.0107	-
	-	-	(0.0186)	-
ΔLTDEBT/FA	0.0004	-0.0005	0.0005	-0.0003
	(0.0029)	(0.0026)	(0.0031)	(0.0027)
ΔIGEAR	0.0012	-0.0006	0.0018	8.68E-05
	(0.0027)	(0.0021)	(0.0024)	(0.0027)
ΔCREDITOR/MV*SMALL	-0.0749[c]	0.0847[c]	-0.0551	0.0672[c]
	(0.0416)	(0.0447)	(0.0382)	(0.0397)
ΔLTBORR/MV*SMALL	0.0147	-0.0175[b]	-0.0055	-0.0090
	(0.0105)	(0.0089)	(0.0106)	(0.0098)
ΔCASHFLOW/TA*SMALL	0.0283	0.1546	0.0456	0.1268
	(0.0756)	(0.1087)	(0.0327)	(0.0999)
ΔCREDITOR/TA*SMALL	0.2305	-0.2382[a]	0.1344	-0.1673
	(0.1431)	(0.1344)	(0.0336)	(0.1348)
ΔPM/TA*SMALL	-0.0578	0.0744[b]	0.0887	0.0668[b]
	(0.0653)	(0.0336)	(0.0026)	(0.0267)
ΔCASHFLOW/TLIABILITIES*SMALL	-0.0143	-0.1223	0.0022	-0.1024
	(0.0618)	(0.0887)	(6.3296)	(0.0828)
ΔCA/CL*SMALL	-	-	4.7658	-
	-	-	(4.3513)	-
ΔLTDEBT/FA*SMALL	-0.0001	0.0005	6.8116	0.0002
	(0.0029)	(0.0026)	(3.1156)	(0.0027)
ΔIGEAR *SMALL	-0.0018	0.0006	1.9119	-0.0001
	(0.0027)	(0.0022)	(0.2502)	(0.0028)
ΔLNFX	0.2775	-0.7561[a]	0.8344[b]	-0.6181[a]
	(0.4292)	(0.2502)	(0.3575)	(0.2284)
ΔLNBASE	-23.0983[b]	-2.2016	-	-
	(9.0978)	(6.3296)	-	-
ΔPREBREAKBASE	13.3101[b]	-2.1138	-	-
	(5.5416)	(4.7658)	-	-
ΔPOSTBREAKBASE	15.9693[a]	1.8324	-	-
	(4.9699)	(4.3513)	-	-
ΔLN3MTB	14.6521	6.1869	-	-
	(8.9116)	(6.8116)	-	-
ΔPREBREAK3MTB	-3.4646	1.6386	-	-
	(3.6307)	(3.1156)	-	-
ΔPOSTBREAK3MTB	0.4372	-2.0305	-	-
	(2.9178)	(1.9119)	-	-
ΔPREM4BREAK2	-	-	-1.4031	0.9010
	-	-	(0.8770)	(0.8606)
ΔPOSTM4BREAK2	-	-	-1.4214	0.9241
	-	-	(0.8685)	(0.8547)
ΔPREBREAKDIVISIA	-	-	1.3937[c]	-1.2816
	-	-	(0.7619)	(0.8133)
ΔPOSTBREAKDIVISIA	-	-	1.1729[c]	-1.2902
	-	-	(0.7762)	(0.8057)

All the firms are divided into two groups, i.e. 'small' and 'large' firms using the log of median total assets of firms. [a], [b], and [c] denotes statistical significance at 1-, 5- and 10- percent level respectively. The standard errors are in parenthesis. LM Auto(2) and LM Auto(3) are the serial correlation LM test on lag2 and 3 respectively. Q- statistics test whether the suitable numbers of lags are used in the model. *J*-statistic is the minimized value of the research model and it is designed to test the validity of overidentifying restriction of the research model when the numbers of instruments are greater than the number of variables. The Wald test provides a test of the significance of all the explanatory variables besides the constant. Adjusted R-squared shows how good a model is in general. S.E. of regression is a summary measure of the estimated variance of the residuals.

5.5 COMPARISON IN USING GMM AND SURE

Although the models using SURE has a better results in the Adjusted R-square comparing ones using GMM, models using GMM provide more significant coefficients. Moreover, the tests for serial correlation (Durbin-Watson test) in SURE cannot deal with higher autocorrelation but first-difference autocorrelation. Durbin-Watson test are also limited in estimating any model which includes lag terms and the error term is not normally distributed. The various significant coefficient results using SURE and GMM method above both indicate that firms' debt decisions are determined by firms' leverage (D_t), collateral (S_t), size, cash flow (CF_t), the level of investment (I_t), foreign exchange rates (FX_t). All the null hypotheses of this research (see Chapter 3) are rejected.

5.6 THE ADVANTAGE OF USING DIVISIA MONEY

Base on the empirical results above, the research models which use Divisia money as the measurement of money tightness always obtain more significant results. Therefore, Divisia money is a more reliable measurement for the impact of monetary policy transmission on firms' debt decision. Unlike M4 which only focuses on money stock in the economy, Divisia index takes into account the liquidity of various monetary assets within money aggregation and adjusts the weight of each monetary assets according to changes in the weight of each assets which comprise money in

circulation. Since the liquidity of monetary assets discounts the price of monetary assets, Divisia money not only has the advantage of capturing the characteristic of monetary assets by measuring the liquidity of these assets, but also has the advantage of keeping up with changes within the economy. Indeed, the liquidity of monetary assets is important in determining firms' debt decisions which are affected by changes in monetary policy. For instance, since notes and coin have different liquidity to savings, they should be given different consideration when measuring the money supply in the economy. Because Divisia money adjusts the components within money aggregation in a dynamic manner, Divisia is the most appropriate measure of money conditions and thereby the best parameter for firms which make debt decisions based on the judgement of monetary conditions. The Bank of England abandoned all interest rate based measurements[42] in 1986 and switched to Divisia money as index of monetary aggregate.

5.7 CONCLUSION

This Chapter used both SURE and GMM methods to estimate the research model. The results indicate that the research models are well-specified and the alternative hypotheses are accepted. Compared with SURE, GMM is a better estimation for this research. Especially, the Divisia money is a better measurement of money tightness.

[42] The interest-based measurements are often referred to as the simple sum monetary aggregate of monetary condition.

CHAPTER 6 CONCLUSION

This research investigated how do firms make their short-term debt and long-term debt decisions under monetary policy transmission. It reviewed the limitation of past studies. Structure breaks are used to identify when there is tight monetary condition in the economy. It then established a set of research models. Although SURE and GMM are used to estimate the research models respectively, the results prove that there is misspecification problem in building the research models. Among these two estimation methods, GMM method was tested as a better estimation for this research. Further research may focus on the effect of action of managers on monetary policy impact to firms.

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tions of Accounting Measures

nting ures	Definition	Footnotes
term Debt	The portion of debt payable within one year including current portion of long term debt and sinking fund requirements of preferred stock or debentures. It includes but is not restricted to: Current portion of long-term debt Notes payable, arising from short-term borrowings Current maturities of participation and entertainment obligations Contracts payable for broadcast rights Current portion of advances and production payments Current portion of long term debt that must be paid back during the next twelve months and included in long term debt Bank Overdrafts Advances from subsidiaries/associated companies, if the term of the loan is not known it is assumed to be long term debt Current portion of preferred stock of a subsidiary Treasury tax and loan demand notes Short sales of U.S. government securities Eurodollar borrowings, if not reported separately and the amount cannot be separated	A. Notes payable included in accounts payable B. May include long term borrowings C. Includes debts due in four years or less for Germany D. Non-Operational borrowings are included F. No standard text
term Debt	All interest bearing financial obligations, excluding amounts due within one year. It is shown net of premium or discount.	It includes but is not restricted to: Mortgages Bonds Debentures Convertible debt Sinking fund debentures Long term bank overdrafts Long term notes Long term bills Medium term loans Long term royalties Long term contracts Industrial revenue bonds Notes payable, due within one year and to be refunded by long term debt when carried as non-current liability Long term prepaid contracts Advances and production payments Talent and broadcasting rights Capitalized lease obligations Revolving credit Long term advances from subsidiaries/associated companies Compulsory convertible debt (South Africa) Eurodollar borrowing Long term liability in connection with ESOP Federal Home Loan advances It excludes: Current portion of long term debt Pensions Deferred taxes
Debt	All interest bearing and capitalized lease obligations. It is the sum of long and short term debt	
Asset	The sum of total current assets, long term receivables, investment in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets	A. Excludes contra items (contingent liabilities) B. Includes trust business assets C. Adjusted to exclude foreign currency translation gains/losses
et Value	Market Price-Year End * Common Shares Outstanding	If Common Shares Outstanding is not available for the current year or prior year, then Common Shares Outstanding-Current is used. For companies with more than one type of common/ordinary share, market capitalization represents the total market value of the company. This item is also available at the security level for 1987 and subsequent years.

(continued)

(continued)

nting ires	Definition	Footnotes
R	Total interest charges/(the operating +non-operating income)	Since there is no data available for IGEAR, IGEAR is calculated by the definition.
nterest	The service charge for the use of capital before the reduction for interest capitalized. If interest expense is reported net of interest income, and interest income cannot be found the net figure is shown.	It includes but is not restricted to: Interest expense on short term debt Interest expense on long term debt and capitalized lease obligations Amortization expense associated with the issuance of debt Similar charges
Creditor	The claims of trade creditors for unpaid goods or services, which are due within the normal operating cycle of the company.	Data for this field is generally not available prior to 1989. It includes but is not restricted to: Due to factor Bills of Exchange
Asset	Gross Property, Plant and Equipment less accumulated reserves for depreciation, depletion and amortization.	It includes but is not restricted to: Land Buildings - Net Machinery- Net Equipment - Net Construction work in progress Minerals - Net Oil - Net Autos and trucks - Net Timberland and timber rights - Net Leasehold improvements - Net Rented equipment - Net Furniture and fixture - Net Property, Plant and Equipment leased under capitalized lease obligations - Net Book plates - Net Non-current film costs and inventory Broadcasting rights and licenses Franchise rights and licenses Long term power purchase contracts Publishing rights and licenses Funds held for construction Long term power purchase contracts Software products It excludes: Tools and dies amortized over less than two years Excess carrying value over cost of property Copyrights, trademarks, and goodwill Property not used in operations or used in operations to be discontinued Property held for sale for companies other than Real Estate companies (treated as investment and advances
on	The amount of income taxes paid as reported on the cash flow statement. It is all income taxes levied on the income of a company by federal, state and foreign governments. It includes but is not restricted to: Federal income taxes State income taxes Foreign income taxes Charges in lieu of income taxes Charges equivalent to investment tax credit Income taxes on dividends or earnings of unconsolidated subsidiaries or minority interest, if reported before taxes Deferred taxation charges It excludes: Domestic International Sales Corporation taxes Ad Valorem taxes Excise taxes Windfall profit taxes Taxes other than income General and services taxes	A. Includes other taxes B. Not comparable and includes other taxes C. Includes only domestic tax D. Includes employee profit sharing F. Exempt of income taxes G. Includes minority interests
Margin	Pre-tax Income / Net Sales or Revenues * 100	

(continued)

(continued)

ting es	Definition	Footnotes
alue	The book value (proportioned common equity divided by outstanding shares) at the company's fiscal year end.	This item is also available at the security level for 1987 and subsequent years, and is shown per 1,000 shares for Brazilian companies. Because this data is not available, it is calculated as COMMENT EQUITY/ MAKERT CAPITALIZATION
d Yield	Dividends Per Share / Market Price-Year End * 100 This item is also available at the security level for 1987 and subsequent years.	Since the data is not available, dividend yield is calculated as: dividends/market value
ds	Total cash common dividends paid on the company's common stock during the fiscal year, including extra and special dividends.	If the company has ESOP preferred stock, the dividends paid will be the full amount shown on the cash flow. It excludes: Dividends paid to minority shareholders
Cash Flow	The difference between sales or revenues and cost of goods sold and depreciation.	Since there is no data under the item of gross cash flow, gross cash flow is calculated by EARNINGS BEFORE INTEREST AND TAXES (EBIT)+DEPRECIATION, DEPLETION AND AMORTIZATION
nt Equity	Common shareholders' investment in a company.	It includes but is not restricted to: Common stock value Retained earnings Capital surplus Capital stock premium Cumulative gain or loss of foreign currency translation, if included in equity
ation, n and ation	The process of allocating the cost of a depreciable asset to the accounting periods covered during its expected useful life to a business. It is a non-cash charge for use and obsolescence of an asset.	DEPLETION refers to cost allocation for natural resources such as oil and mineral deposits. AMORTIZATION relates to cost allocation for intangible assets such as patents and leasehold improvements, trademarks, bookplates, tools and film cost. Dry-hole Expense and Abandonments for extractive companies are included in Depreciation, Depletion & Amortization. If exploration expenses include dry-hole costs and impairment of unproved properties then it is included in Cost of Goods Sold. It excludes depreciation of discontinued operation It includes oil & gas property valuation provision If depreciation is not available from the income statement it is taken from the Statement in Changes in Financial Position.
abilities	All short and long term obligations expected to be satisfied by the company.	It includes but is not restricted to: Current Liabilities Long Term Debt Provision for Risk and Charges (non-U.S. corporations) Deferred taxes Deferred income Other liabilities Deferred tax liability in untaxed reserves (non-U.S. corporations) Unrealized gain/loss on marketable securities (insurance companies) Pension/Post retirement benefits Securities purchased under resale agreements (banks) It excludes: Minority Interest Preferred stock equity Common stock equity Non-Equity reserves

(continued)

(continued)

ting es	Definition	Footnotes
profit	All income/loss before any federal, state or local taxes. Extraordinary items reported net of taxes are excluded.	For U.S. corporations, equity in earnings of unconsolidated subsidiaries and minority interest are not included, unless the company specifically states that they are pre-tax. For non-U.S. corporations, this item is usually reported before taxes.
ost	All direct and indirect costs related to the creation and development of new processes, techniques, applications and products with commercial possibilities	These costs can be categorized as: 119/MV 1. Basic research 2. Applied research 3. Development costs of new products It includes but is not restricted to: Software Expense Amortization of Software Expense Design and Development Expense It excludes: Customer or government sponsored research For oil, gas, coal, drilling and mining companies, purchase of mineral rights Engineering Expense Contributions by government, customers, partnerships or other corporations to the company's research and development expense Data is not available.
es	Gross sales and other operating revenue less discounts, returns and allowances.	It includes but is not restricted to: Franchise sales when corresponding costs are available and included in expenses. Consulting fees Service income Royalty income when included in revenues by the company. Contracts-in-progress income Licensing and franchise fees Income derived from equipment lease or rental when considered part of operating revenue Commissions earned (not gross billings) for advertising companies Income from leased departments It excludes: Non-operating income Interest income Interest capitalized Equity in earnings of unconsolidated subsidiaries Rental income Dividend income Foreign exchange adjustment Gain on debt retired Sale of land or natural resources Sale of plant and equipment Sale of investment Sales from discontinued operations Security transactions Income on reserve fund securities when shown separately Operating differential subsidies for shipping companies Net mutual aid assistance for airlines companies General and Service Taxes Value-Added taxes Excise taxes Windfall Profit Taxes
erating	Income generated from interest bearing investments not related to the operating activities of the company.	Data for this field is generally not available prior to 1990. It includes but is not restricted to: Interest on savings Interest on Investments

(continued)

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ting es	Definition	Footnotes
Liability	Debt or other obligations that the company expects to satisfy within one year. It includes but is not restricted to: Accounts payable Short term debt Notes payable Current portion of long term debt All accrued expenses Other current liabilities Income taxes payable Dividends payable State franchise taxes Deferred credits Negative inventories (non-U.S. corporations) Obligations expected to be satisfied within four years (Germany)	A. Includes liabilities due in four years or less for Germany B. Company does not report current liabilities; calculated C. May include some long term debt F. Includes liabilities due in four years or less, may also include some long term debt G. No standard text O. Adjusted to include accrued expenses
Before and Taxes	The earnings of a company before interest expense and income taxes. It is calculated by taking the pre-tax income and adding back interest expense on debt and subtracting interest capitalized.	
Asset	Cash and other assets that are reasonably expected to be realized in cash, sold or consumed within one year or one operating cycle. Generally, it is the sum of cash and equivalents, receivables, inventories, prepaid expenses and other current assets. For non-U.S. corporations, long term receivables are excluded from current assets even though included in net receivables.	
atio	(current assets- inventory)/ current liability	
rm ng	The amount received by the company from the issuance of long term debt, (convertible and non-convertible), increase in capitalized lease obligations, and debt acquired from acquisitions.	A. Includes reduction in long term debt B. Includes increase in short term borrowings C. Includes proceeds from stock D. Includes other long term liabilities
ng Profit	Operating Income / Net Sales or Revenues * 100	
ng Income	The difference between sales and total operating expenses.	

y breakdown for selected sample

Appendix 3.2 (continued)

K SIC e	Primary UK SIC[43] (2003) Industry Description	Number of firms	Primary UK SIC (2003) Code	Primary UK SIC (2003) Industry Description	Number of firms
	Activities of other transport agencies	5	7210	Hardware consultancy	1
	Activities of travel agencies and tour operators; tourist assistance activities not elsewhere classified	2	7415	Holding companies including head Offices	11
	Advertising	10	5510	Hotels	2
	Agents involved in the sale of a variety of goods	2	6120	Inland water transport	2
	Agricultural service activities; landscape gardening	2	4531	Installation of electrical wiring and fittings	1
	Architectural and engineering activities and related technical consultancy	12	7460	Investigation and security activities	7
	Architectural and engineering activities and related technical consultancy	3	7450	Labour recruitment and provision of personnel[44]	18
	Bars	6	7020	Letting of own property[45]	3
	Building and repairing of ships	2	6601	Life insurance[46]	1
	Business and management consultancy activities[47]	20	3530	Manufacture of aircraft and spacecraft	4
	Camping sites, including caravan sites	1	2710	Manufacture of basic iron and steel and ferro-alloys (ECSC)	2
	Casting of iron	2	2441	Manufacture of basic pharmaceutical products	9
	Catering	1	1596	Manufacture of basic pharmaceutical products	8
	Collection and treatment of other waste	1	3420	Manufacture of basic pharmaceutical products	1
	Collection and treatment of other waste	1	1581	Manufacture of bread; manufacture of fresh pastry goods and cakes	3
	Collection, purification and distribution of water	5	2640	Manufacture of bricks, tiles and construction products, in baked clay	3
	Courier activities other than national post activities	1	2030	Manufacture of builder's carpentry and joinery	1
	Dental practice activities	1	2812	Manufacture of builders' carpentry and joinery of metal	1
	Development and selling of real estate[48]	10	2523	Manufacture of builders' ware of plastic	1

(continued)

(continued)

K Standard Industrial Classification (2003), i.e. SIC (2003) is based on Nomenclature des Activites Economiques (usually abbreviated to NACE) Rev.

his research includes these recruitment firms, because their main businesses are in various fields, such as health care, construction, communication. hese firms are with other services such as beverage.

his firm is a company which provides health care and internet service for elderly people. Strictly speaking, it is not a life insurance company.

hese firms run various businesses except management consultancy companies.

his research does not exclude these real estates companies because their major businesses are construction as well as sell properties. These firms have the e need on debt as other industrial firms.

K SIC e	Primary UK SIC (2003) Industry Description	Number of firms	Primary UK SIC (2003) Code	Primary UK SIC (2003) Industry Description	Number of firms
	Dispensing chemists	1	1751	Manufacture of carpets and rugs	2
	Extraction of crude petroleum and natural gas	17	2521	Manufacture of ceramic household and ornamental articles	1
	Floor and wall covering	1	1584	Manufacture of cocoa; chocolate and sugar confectionery	1
	Forestry and logging related service activities	2	3002	Manufacture of computers and other information processing equipment	16
	Forging, pressing, stamping and roll forming of metal; powder metallurgy	1	2661	Manufacture of concrete products for construction purposes	3
	Freight transport by road	6	2121	Manufacture of corrugated paperboard and of containers of paper and paperboard	2
	General construction of buildings and civil engineering works	33	3110	Manufacture of electric motors, generators and transformers	2
	General mechanical engineering	6	3210	Manufacture of electronic valves and tubes and other electronic components	8
	Growing of cereals and other crops not elsewhere classified	5	2911	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines	2
	Manufacture of fasteners, screw machine products, chains and springs	1	2943	Manufacture of other machine tools not elsewhere classified	1
	Manufacture of fertilizers and nitrogen compounds	1	3612	Manufacture of other office and shop furniture	3
	Manufacture of footwear	1	1822	Manufacture of other outerwear	6
	Manufacture of games and toys	3	2524	Manufacture of other plastic products	4
	Manufacture of gas	1	2513	Manufacture of other rubber products	3
	Manufacture of glues and gelatines	1	2956	Manufacture of other special purpose machinery not elsewhere classified	3
	Manufacture of industrial process control equipment	1	1754	Manufacture of other textiles not elsewhere classified	2
	Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment	16	1824	Manufacture of other wearing apparel and accessories not elsewhere classified	1
	Manufacture of jewellery and related articles not elsewhere classified	2	2430	Manufacture of other wearing apparel and accessories not elsewhere classified	1
	Manufacture of lifting and handling equipment	3	2112	Manufacture of paper and paperboard	3
	Manufacture of light metal packaging	1	3430	Manufacture of parts and accessories for motor vehicles and their engines	4
	Manufacture of lighting equipment and electric lamps	2	2452	Manufacture of perfumes and toilet preparations	4

(continued) (continued)

JK)	Primary UK SIC (2003) Industry Description	Number of firms	Primary UK SIC (2003) Code	Primary UK SIC (2003) Industry Description	Number of firms
	Manufacture of machinery for food, beverage and tobacco processing	3	2442	Manufacture of pharmaceutical preparations	5
	Manufacture of medical and surgical equipment and orthopedic appliances	11	2416	Manufacture of plastic in primary forms	4
	Manufacture of metal structures and parts of structures	4	2522	Manufacture of plastic packing goods	2
	Manufacture of motor vehicles	1	1571	Manufacture of prepared food for farm animals	2
	Manufacture of non-domestic cooling and ventilation equipment	1	2912	Manufacture of pumps and compressors	3
	Manufacture of non-electric domestic appliances	1	2320	Manufacture of refined petroleum products	2
	Manufacture of optical instruments and photographic equipment	1	2451	Manufacture of soap and detergents, cleaning and polishing preparations	2
	Manufacture of other ceramic products	3	1582	Manufacture of sugar	1
	Manufacture of other chemical products not elsewhere classified	6	3230	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods	5
	Manufacture of other electrical equipment not elsewhere classified	13	3220	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy	5
	Manufacture of other fabricated metal products not elsewhere classified	6	1600	Manufacture of tobacco products	2
	Manufacture of other food products not elsewhere classified	3	2862	Manufacture of tools	2
	Manufacture of other furniture	3	1823	Manufacture of underwear	1
	Manufacture of other general purpose machinery not elsewhere classified	3	2873	Manufacture of wire products	1
	Manufacture of other inorganic basic chemicals	4	6220	Non-scheduled air transport	1
	Manufacture of workwear	2	1551	Operation of dairies and cheese making	3
	Manufactures of rubber tyres and tubes	1	9261	Operation of sports arenas stadiums	6
	Market research and public opinion polling	3	4545	Other building completion	1
	Mining and agglomeration of hard coal	1	7487	Other business activities not elsewhere classified	23
	Mining of non-ferrous metal ores, except uranium and thorium ores	6	7470	Other cleaning services	1
	Motion picture and video production	7	7260	Other computer related activities	25
	Other construction work involving special trades	1	8514	Other human health activities	1

(continued) (continued)

K	Primary UK SIC (2003) Industry Description	Number of firms	Primary UK SIC (2003) Code	Primary UK SIC (2003) Industry Description	Number of firms
	Other credit granting	1	3663	Other manufacturing not elsewhere classified	7
	Other entertainment activities not elsewhere classified	5	1450	Other mining and quarrying not elsewhere classified	8
	Other financial intermediation not elsewhere classified	2	2745	Other non-ferrous metal production	1
	Other non-store retail sale	4	2741	Precious metals production	1
	Other publishing	7	1712	Preparation and spinning of woollen-type fibres	1
	Other recreational activities not elsewhere classified	3	1713	Preparation and spinning of worsted-type fibres	3
	Other retail sale in non-specialised stores	3	8010	Primary education	1
	Other retail sale in specialised stores	10	2222	Printing not elsewhere classified	7
	Other retail sale of food, beverages and tobacco in specialised stores	1	1586	Processing of tea and coffee	1
	Other scheduled passenger land transport	5	1511	Production and preserving of meat	1
	Other service activities not elsewhere classified	2	4011	Production of electricity	6
	Other software consultancy and supply	39	1513	Production of meat and poultry meat products	1
	Other sporting activities	6	1598	Production of mineral waters and soft drinks	2
	Other supporting air transport activities	2	2211	Publishing of books	6
	Other supporting land transport activities	1	2213	Publishing of journals and periodicals	8
	Other textile weaving	1	2212	Publishing of newspapers	3
	Other wholesale	9	1411	Quarrying of ornamental and building stone	2
	Radio and television activities	10	7110	Renting of automobiles	3
	Real estate activities with own property	1	7132	Renting of construction and civil engineering machinery and equipment	4
	Real estate agencies[49]	3	4550	Renting of construction or demolition equipment with operator	1
	Recycling of non-metal waste and scrap	1	7134	Renting of other machinery and equipment not elsewhere classified	2
	Renting of personal and household goods not elsewhere classified	1	6312	Storage and warehousing	2
	Reproduction of sound recording	1	8531	Social work activities with accommodation	1

(continued)

(continued)

his research does not exclude these real estates companies because their major businesses are construction as well as sell properties. These firms have the e need on debt as other industrial firms.

Research and experimental development on natural sciences and engineering	14	7521	Software publishing	24
Research and experimental development on social sciences and humanities	4	7430	Technical testing and analysis	2
Restaurants	9	6420	Telecommunications	13
Retail sale in non-specialised stores with food, beverages or tobacco predominating	3	5092	Toys and Hobby Goods and Supplies	1
Retail sale of alcoholic and other beverages	1	6010	Transport via railways	1
Retail sale of automotive fuel	1	1910	Tanning and dressing of leather	1
Retail sale of books, newspapers and stationery	2	8022	Technical and vocational secondary education	2
Retail sale of bread, cakes, flour confectionery and sugar confectionery	1	2851	Treatment and coating of metals	2
Retail sale of clothing	11	9301	Washing and dry cleaning of textile and fur products	1
Retail sale of electrical household appliances and radio and television goods	4	5134	Wholesale of alcoholic and other beverages	2
Retail sale of footwear and leather goods	1	5155	Wholesale of chemical products	2
Retail sale of furniture, lighting equipment and household articles not elsewhere classified	1	5142	Wholesale of clothing and footwear	3
Retail sale of hardware, paints, and glassware	2	5184	Wholesale of computers, computer peripheral equipment and software	7
Retail sale of second-hand goods in stores	1	5143	Wholesale of electrical household appliances and radio and television goods	3
Retail sale of textiles	2	5154	Wholesale of hardware, plumbing and heating equipment and supplies	4
Retail sale via mail order houses	3	5132	Wholesale of meat and meat products	1
Sale of motor vehicles	10	5186	Wholesale of other electronic parts and equipment	6
Sale, maintenance and repair of motorcycles and related parts and accessories	1	5147	Wholesale of other household goods	5
Scheduled air transport	3	5141	Wholesale of textiles	3
Sea and coastal water transport	2	5153	Wholesale of wood, construction materials and sanitary equipment	2
Service activities incidental to oil and gas extraction excluding surveying	3		Missing	2

(continued)

Appendix 3.3

Description of the Accounting Variables in the Empirical Analysis

Variable	Description
D_t (leverage)	
LTBORRATIO	Long-term Borrowing to Total Assets
LTBOR/MV	Long-term Borrowing to Market Value
IGEAR	Total Interest Charges to the Sum of Operating and Non-operating Income
S_t (collateral)	
CREDITOR/MV	Trade Credit to Market Value
CREDITOR/TA	Trade Credit to Total Assets
CF_t (cash flow)	
CASHFLOW/TLIABILITIES	Gross Cash Flow to Total Liabilities
CASHFLOW/MV	Gross Cash Flow to Market Value
CASHFLOW/TA	Gross Cash Flow to Total Assets
SALES/MV	Net Sales to Market Value
SALES/TA	Net Sales to Total Assets
I_t (asset based measures and a tax measure)	
BOOK/MV	Book to Market Value
DY	Dividend Yield[50]
TA/MV	Total Assets to Market Value
STDEBT/FA	Short-term Debt to Fixed Assets
LTDEBT/FA	Long-term Debt to Fixed Assets
FIXA/TA	Fixed Assets to Total Assets
TAXRATIO	Tax Charge on Profit and Loss to Pre-tax Profit

[50] Defined as dividend paid per share to the price by share.

P_t (Profitability and liquidity)

OPM	Operating Profit Margin[51]
OPINCOM/MV	Operating Income to Market Value
OPINCOM/TA	Operating Income to Total Assets
PM/MV	Pre-tax Margin to Market Value
PM/TA	Pre-tax Margin to Total Assts
QRATIO	Quick Ratio[52]
CA/CL	Current Assets to Current Liability

[51] It is calculated as operating income to net sales.
[52] i.e. (current assets – inventory)/ current liability

Appendix 5.1

Description of the in the Time Series Variables in the Research Models

Variable	Description
Quarterly Time Series[53]	
Base rate	the natural logarithm of 1+ the base rate over100
3-month Treasury bill rate	the natural logarithm of 1+ the 3-month Treasury bill rate over 100
M4	the natural logarithm of M4
Divisia	the natural logarithm of Divisia
Foreign exchange rate	the natural logarithm of exchange rate
Created Structure Breaks Time Series[54]	
Base Rate Related	
PREBREAKBASE	Pre-structure breakpoints variable for the base rate
POSTBREAKBASE	Post-structure breakpoints variable for the base rate
3-month Treasury Bill Related	
PREBREAKTB	Pre-structure breakpoint variable for the 3-month Treasury bill rate
POSTBREAKTB	Post-structure breakpoint variable for the 3-month Treasury bill rate
M4 Related	
PREBREAKM4	Pre-structure breakpoint variable for M4
POSTBREAKM4	Post-structure breakpoints variable for M4
Divisia Related	
PREBREAKDIVISIA	Pre-structure breakpoint variable for Divisia
POSTBREAKDIVISIA	Post-structure breakpoints variable for Divisia

[53] All the time series are calculated by the average of the sum of 4 quarterly data, because there is only quarterly data available for Divisia index from 1988. These 4 quarters are selected according to the date of the firm's financial year-end for every individual firm.

[54] This research develops two variables for each structure break. One begins with 'PREBREAK'. Another begins with 'POSTBREAK'. Both represent the time series in the opposite direction whilst the rest of the time series retain their actual values. Variables beginning with 'PREBREAK' represent the time before the structure break point. Variables beginning with 'POSTBREAK' represent the time since the structure break point. To take the time series which represent the change of the base rate before a structure break (*PREBREAKBASE*) for example, *PREBREAKBASE* is 0 before the structure breaks (also at the structure break points) and is 1 after the structure breaks. *POSTBREAKBASE* is 0 after the structure breaks (also at the structure break points) and is 1 before the structure breaks.