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The Monetary Transmission Mechanism

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THE MONETARY TRANSMISSION MECHANISM

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1. INTRODUCTION

Understanding the mechanisms by which monetary policy is transmitted to the real economy has long been a key interest area for academic economists and policy-makers alike. Conventional wisdom holds that a tightening of monetary policy raises open market interest rates and causes interest-sensitive spending to fall. Of course, in the long run, the effects of the policy wash out as prices adjust but nevertheless, significant output responses may occur in the short term.

In recent years, considerable attention has been given to possible channels of monetary policy operating in addition to the traditional interest rate or money view channel. The ideas are not new; rather, developments in the economics of imperfect information have rekindled interest in the area by offering economists the ability to provide formal underpinnings for older theories which argued that financial aspects could be important for business cycles. This paper reviews the theory and implications of this research, with particular emphasis on models exploring the importance of financial constraints on a specific class of borrowers, namely small and medium sized firms. My aim is to present in a simple manner the theory which underlies what I call the balance sheet channel of monetary policy, and to draw out the testable implications of that theory. Some of the existing empirical work is examined and some new evidence with an Australian focus is also provided.

The structure of the paper is as follows. Section 2 reviews the traditional interest-rate channel of monetary policy as well as the "bank lending channel" which is related and indeed may be complimentary to the transmission mechanism emphasised in this paper. In Section 3 the theory of the balance sheet mechanism is presented. Section 4 provides an overview of some of the existing empirical work on the monetary transmission process and presents the results of my own work with Australian data. Section 5

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addresses some issues which are pertinent to the analysis of financial factors, while a final section concludes the paper.

2. BACKGROUND

2.1 The Interest-Rate Channel

Before examining the role that credit market frictions play in the transmission of monetary policy to the real sector, it is useful to review the mechanisms and assumptions of the conventional interest-rate view. To make the story tractable, consider an economy with two types of assets - "money" and "bonds". Suppose, further, that the central bank wishes to conduct a monetary contraction and it does so by open market sales of bonds. This serves to drain reserves from the banking system thereby restricting the system's ability to issue demand deposits. As a consequence, depositors are required to hold more bonds and less money in their portfolios and therefore, assuming non-instantaneous price adjustment to the change in the money supply, real money balances decline. Equilibrium is restored as the real interest rate on bonds increases. In the final step of the process, the higher real interest rate raises the user cost of capital causing interest-sensitive spending to fall. This traditional view of the monetary transmission mechanism has been referred to as the "money view".

The stylised two-asset model just described is familiar from the standard textbook representation of the Keynes-Hicks IS-LM system[1] . This textbook model has come to be the accepted tool for analysing the effects of monetary policy on economic activity. However, the interest-rate channel embodies some important assumptions which are often overlooked in textbook presentations.

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[1] The money view is also consistent with a number of alternative models.

The first key assumption is that the central bank can control the supply of outside money for which there are imperfect substitutes. To a large extent, however, the monetary base is endogenously determined by the actions of households, firms and the banking system. Moreover, there exist liquid assets in the economy, such as bank bills held outside the banking system, which are not controllable by the Reserve Bank. As pointed out by Brainard and Tobin (1963), the availability of money substitutes limits the ability of the central bank to change the interest rate in response to a given change in the money supply. Especially with financial innovation, money supply and demand can be reequilibrated with offsetting movements of money substitutes - or, alternatively, with an increase in velocity compensating for any shortage of money - therefore reducing the required response of the interest rate. Nonetheless, in practice, the ability of the central bank to alter short-term nominal interest rates is not contentious. Any person with a mortgage in 1989-90 could testify to that. More formally, however, Romer and Romer (1993) have found that the Federal Reserve in the US has always had significant influence over short-term interest rates despite institutional and regulatory changes. They point out that the required change in reserves to bring about a given change in interest rates may have varied, but the fact remains the Federal Reserve has consistently been able to influence short-term rates.

A second important assumption is that prices do not adjust instantaneously to changes in the money supply thereby nullifying the real effects of the policy. This assumption is not particular to the interest-rate channel, rather, it underlies any theory of monetary transmission and any explanation of why monetary policy has real effects in the first place. No attempt will be made to resolve this issue here as it entails a thesis in itself and indeed has been a perennial problem in macroeconomics which has yet to be convincingly explained. Part of the answer, of course, lies in the (unexplained) fact that there are many multiperiod nominal wage, loan, and purchase contracts in the economy which are not fully indexed. This paper proceeds on the premise that such nominal rigidities exist and attempts to explain how monetary policy works in their presence. This is not an arbitrary

assumption since there is some evidence that short-term real interest rates respond to shifts in policy[2].

While one may be able to rationalise real interest rate changes in response to changes in the money supply over a short horizon, it becomes increasingly difficult to argue that monetary actions affect long-term real interest rates. Given the irreversible nature of many capital and housing investments, purchases of such goods depends primarily on the long-term real interest rate. Consequently, the interest-rate channel requires that policy-induced changes in real short-term interest rates translate to changes in longer-term rates. The consensus among economists, however, is that the long-term real interest rate is relatively immune to central bank policy actions.

A final assumption or requirement of the money view is that components of aggregate demand such as consumer durables, housing, and business investment, are interest-sensitive and therefore respond to monetary policy innovations. Although such an argument is theoretically plausible, observed output responses are too large compared to the generally small estimated effects of user costs of capital on major categories of spending[3].

2.2 The Bank Lending Channel

The foregoing discussion suggests that, although the interest-rate channel may play a role in the transmission of monetary policy, it does not provide a complete characterisation of the mechanisms involved. This has led to a search for a broader channel which explores the links of the financial system - as opposed to just the money market - and firms' capital structures with aggregate economic activity.

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[2] See, for example, Bernanke and Blinder (1992) for evidence that the real federal funds rate moves in response to Federal Reserve actions.

[3] Some recent reviews of empirical studies of the sensitivity of investment to the user cost of capital can be found in Hirtle and Kelleher (1990) and Chirinko (1993).

Another assumption underlying the interest-rate channel, and most economic analysis for that matter, is the less explicit idea that real decisions are not influenced by firms' financial structure. This is, of course, the familiar Modigliani-Miller (1958) irrelevance result. The theorem states that in a frictionless world of competitive markets in which market participants are fully informed about firms' opportunities, investment and other real decisions are determined only by product market opportunities and the available production technology. Firms' capital structures - their mix of debt and equity finance - or financial policies - payment of dividends, etc. - are irrelevant to real economic decisions. After applying the Modigliani-Miller theorem to banks and the financial system generally, Fama (1980) further reasoned that the public's portfolio choices among, say, bank deposits, bonds, or common stocks, are irrelevant to real macroeconomic outcomes. In other words, the financial system is merely a "veil". One counterfactual implication of such a view is that massive bank runs should have no effect on real outcomes.

Empirical evidence strongly suggests that firms' investment is sensitive to financial variables. This, however, does not imply that the Modigliani-Miller theorem is "incorrect", rather it reflects that for most firms the Modigliani-Miller assumptions are not satisfied. It should be emphasised that the irrelevance result applies to a taxless, frictionless world of perfect markets. The practical message of the theorem, therefore, is that any apparent rejection of the irrelevance result must be explained by some specifically identified market imperfections or frictions. One such imperfection on which much attention has been focused is the presence of incomplete or asymmetric information.

The operation of markets in the presence of incomplete information was first analysed in some detail by Akerlof (1970). In this seminal article, Akerlof showed that asymmetric information between buyers and sellers about product quality could result in inefficient

outcomes due to the "lemons" or "adverse selection" problem. The argument runs as follows: assume a market where transactions are made under incomplete information; that is, one party to the transaction has specialised information that is relevant to the other party's decision. A typical example is where a seller knows details about the quality of the product being sold, whereas the buyer has difficulty in perfectly discerning quality on inspection and perhaps even after purchasing the product. Under such circumstances, sellers of high quality goods may be unable to communicate the true quality of their product to buyers and therefore may not receive a price that fully reflects the product's quality. If we reasonably assume that high-quality sellers face a higher marginal cost of production than low-quality sellers, then it is conceivable that the former will be driven out of the market since they will be unable to extract a higher price.

Another general problem which arises as a result of asymmetric information is that of "moral hazard"[4] . This problem refers to the fact that one party to the transaction may take some action that is undesirable for and unobservable to the other party. Performance depends, therefore, partly on these unobservable actions - as well as on random events - but the contract governing the transaction cannot stipulate the "morally hazardous" action. Instead, incentives in the contract need to be structured in such a way so as to indirectly induce desired actions.

The development of this "new" theory of imperfect information was naturally extended to the study of financial markets whose essence is the gathering and transmission of information. In his analysis, Akerlof provided as an example the used car market and argued that mechanisms would be developed that partially resolve the problems of adverse selection and moral hazard such as seller warranties, the use of third-party mechanics and the development of good reputations on the part of car dealerships. In the market for borrowing and lending, financial intermediaries emerge as the institutions that

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[4] Note that adverse selection refers to a case where the trading parties have asymmetric information prior to contracting, while moral hazard arises when one party (the "agent") has superior information after contacting.

allow the market to work, by specialising in the acquisition of information, the evaluation of projects and borrowers, and the monitoring of borrowers' performance. Diamond (1984), for example, endogenously motivates intermediaries as an optimal response to informational frictions and the associated monitoring costs. Financial intermediaries serve to economise on these monitoring costs by channelling funds between savers and investors and acting as "delegated monitors" of borrowers on behalf of the lenders. Further, to eliminate the need for depositors to monitor the monitor, the intermediaries are required to hold diversified portfolios[5].

The argument, then, is that for a large class of borrowers, particularly small firms, monitoring costs are significant so these firms become dependent on banking institutions for external finance. Substitutes to bank credit are unavailable for these borrowers or alternatively are prohibitively expensive. The implication of this analysis is that any disruption to bank credit will have real effects. This then opens up the possibility for a broader monetary transmission mechanism. Owing to reserve requirements on deposits, a monetary tightening which reduces deposits induces banks to contract lending and this directly influences the spending of bank-dependent borrowers. Contrary to Fama (1980), therefore, the financial system is not simply a "veil". This view has been called the "credit view" or the "bank lending channel"[6]. According to this view, banks are important because of the special services they provide to firms with limited access to capital markets in the form of bank loans. Hence, this view emphasises the asset side of banks' balance sheets. With the money view, on the other hand, banks perform a special role on the liability side of their balance sheets by issuing demand deposits which are an important component of the money supply.

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[5] Other papers which explain the existence of financial intermediaries include Boyd and Prescott (1986), Allen (1990), and Calomiris and Kahn (1991). For a review of some of this work and for a general survey of developments in the study of the interaction of the real and financial sectors, see Gertler (1988).

[6] Blinder and Stiglitz (1983) provide an overview of the credit view in the language of the economics of imperfect information. More recent descriptions of credit view arguments can be found in Bernanke and Blinder (1988), Romer and Romer (1990), Bernanke (1993), and Kashyap, Stein and Wilcox (1993).

It should be noted, as it has been by several authors, the bank lending channel does not require, although is consistent with, the presence of credit rationing in the Stiglitz and Weiss (1981) sense that some borrowers are denied credit altogether at the prevailing interest rate. All that is required for the bank lending channel to be operative is that alternative sources of finance for these borrowers be imperfect substitutes for bank credit. Therefore, all markets may clear although the clearing rates may differ. Further, the gap in the rates may persist because the markets are segmented.

The necessary conditions for the bank lending channel are two: (i) certain borrowers must be bank-dependent, that is, they must be unable to access funds on the open capital market or borrow from non-bank financial intermediaries; (ii) the central bank must be able to directly constrain bank lending through open market operations.

There is some empirical evidence that supports the idea that bank credit is special for some borrowers. For example, Fama (1985) finds that bank borrowers rather than depositors bear the incidence of the "tax" associated with reserve requirements. If the borrowers had easy access to other sources of funds, they would not willingly bear this tax. The literature mentioned earlier, however, argues that financial intermediaries, not just banks, emerge so as to manage the adverse selection and moral hazard problems that arise in the market for borrowing and lending. It is not obvious why banks as compared to finance companies, for example, are more efficient in managing such problems. Arguments which have been advanced include that banks have a comparative advantage due to their large scale (economies of scale), because they provide many different products (economies of scope), and relatedly, because they can exploit information produced as a by-product of their providing liquidity services. Edwards (1993) argues that none of these arguments are persuasive in today's markets. First, many non-bank financial intermediaries can exploit economies of scale because they are as large or larger than banks. Second, many of these institutions are as well or better diversified than

banks. Third, other financial intermediaries, such as finance companies, have increasingly become providers of information-intensive business loans despite their not providing liquidity services. In addition, in exploring the relationship between credit and the determination of income, Benjamin Friedman (1982,1983) has found a role for total credit rather than for bank credit alone. Nevertheless, most people would not object to the fact that at least some borrowers are bank-dependent and to the extent that bank credit flows are disrupted their spending will be influenced.

Most recent criticism has been directed at the second prerequisite that in the aftermath of an open market sale which reduces bank reserves, banks' ability to extend loans is constrained. These studies have examined bank portfolio behaviour, or more succinctly, they have looked at whether banks can raise funds from non-deposit sources when the central bank decreases reserves. Romer and Romer (1990) argue, for example, that banks can fund loans at the margin by issuing certificates of deposit (CDs) thereby offsetting the fall in deposits and mitigating the effect of the monetary contraction on bank lending. Banks are unlikely, however, to face a perfectly elastic supply schedule for CDs at the prevailing CD rate. For one thing, large CDs increase the risk of the bank's portfolio and second, an adverse selection problem arises between the bank and large depositors thereby making the supply schedule for large-denomination CDs upward sloping. In any case, the argument is largely irrelevant for Australia because CDs and transactions deposits are subject to uniform reserve requirements. Under such a regulatory arrangement, a reduction in reserves requires a decline in bank liabilities, including CDs, and this in turn limits the quantity of loans that can be made.

However, banks are able to issue managed liabilities other than CDs such as bank bills and Eurodollar borrowings. The evidence suggests that Australian banks have been very active in both these areas (see, for example, RBA, 1989). Moreover, Battellino and McMillan (1989) show that at least since financial deregulation, banks have moved from being "asset managers" to becoming active "liability managers".

Finally, banks also hold assets that are highly liquid including government securities and private loans such as mortgages which can be readily standardised, packaged and sold in secondary markets. If banks hold sufficient buffers of these types of liquid assets they may be able to shield their business loans from the impact of a monetary contraction. In other words, a decline in deposits following a dynamic open market operation may be met by banks by selling off liquid assets while continuing to provide loans to borrowers for whom bank credit is important. There is some evidence that this does in fact occur. Bernanke and Blinder (1992), and Romer and Romer (1990) find that following a monetary contraction banks sell off securities and only after a significant lag of two to three quarters bank loans begin to decline.

Although from the perspective of a single bank there are various options available in adjusting its portfolio, it is unlikely that all banks will be able to contemporaneously offset the loss of their deposits following tight money without incurring extra costs. I believe more evidence is required to resolve this issue as well as the more general question of whether a bank lending channel is operative[7] . In any case, what the foregoing discussion makes obvious is that the credit view is tied to the institutional and regulatory environment. There is another theory of the monetary transmission mechanism which is not so constrained and forms the subject of the rest of this paper.

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[7] To the extent that some borrowers are bank-dependent, exogenous changes in banks' ability to lend other than open market operations will have real effects. For example, Romer and Romer (1993) find that direct credit controls have largely been responsible for reduced bank lending during episodes of tight money in the US.

3. The Balance Sheet Channel

3.1 Overview

The balance sheet channel is similar to the credit view in that it has as its foundation the idea that informational asymmetries introduce frictions in financial markets (that is, the markets for borrowing and lending). However, while the credit channel stresses the importance of bank credit, the balance sheet channel focuses on the supply of funds from all financial intermediaries. According to this latter view, the key distinction is not between bank loans and other forms of credit but between internal finance - firms' retained profits and cash flow - and external (debt) finance. In particular, owing to problems of asymmetric information between borrowers and lenders, all forms of external finance are imperfect substitutes for internal finance and this introduces a wedge between the cost of the two types of funds. The theory underlying the balance sheet channel is based on recent research which emphasises the role of financial factors in business fluctuations. Unfortunately, the conclusions that can be drawn from this work are very sensitive to the postulated informational and incentive problems. Nonetheless, some basic propositions arise from this work which are consistent with a wide class of models[8].

First, as I just noted, informational asymmetries lead to a gap between the price of external finance and the price of internal finance. This gap or wedge is referred to as the (cost) premium for external funds. Second, the premium for external funds varies inversely with the borrower's collateralisable net worth relative to the amount of the loan required. Third, aggregate economic disturbances, including monetary policy, lead to a deterioration of borrowers' net worth inducing a rise in the cost premium thereby making it more difficult to borrow to undertake investment and production. The result is a

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[8] See, for example, Townsend (1979), Gale and Hellwig (1985), Williamson (1987), Bernanke and Gertler (1989, 1990), Greenwald, Stiglitz and Weiss (1984).

"financial propagation" or "financial accelerator" mechanism which serves to amplify the initial shock in borrowers' balance sheets or net worth. I will now expand a little on each one of these points to highlight the sort of intuition which underlies them.

3.2   External vs Internal Finance

In a full information world, firms needing to obtain external funds to finance investment and other plans can do so at risk-corrected interest rates. With information asymmetry this is no longer the case. Typically, borrowers have superior knowledge or information about the ex ante quality of investment projects and/or their ex post returns than lenders do. This provides an incentive for borrowers to dishonestly appropriate value from lenders. Rational lenders are aware of this incentive problem and therefore take actions to mitigate it. As a consequence, the price of external finance increases as lenders need to be compensated for the costs they incur. The premium for external funds therefore may reflect the expected costs of evaluating projects, monitoring borrowers and enforcing outcomes. On the other hand, to the extent that quality is unobservable, external funds may incorporate a lemons premium thereby introducing a wedge between external and internal finance.

A simple example may be helpful in clarifying the latter possibility. The situation is very similar to Akerlof's adverse selection problem in the used car market where owners of high quality cars cannot adequately convey the quality of their cars to potential buyers. In financial markets, the problem is that high quality borrowers - those with a low probability of default - cannot credibly convey their "project" quality to potential lenders. The result is that "good" borrowers (and "bad" borrowers) are required to pay an interest rate that compensates lenders for the probability that any particular borrower might be a low quality borrower - that is, one with a high probability of default. To make this more explicit, consider an entrepreneur that has evaluated a potential investment project and who needs to raise all funds externally if she decides to proceed with the project. The

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evaluation reveals that if she is successful, the entrepreneur will produce output according to a production function f(K); if unsuccessful, the entrepreneur produces nothing and defaults on her loan. The marginal product curve corresponding to the production function is shown in Figure 1. Moreover, there are two possible types of firm - high quality firms succeed with probability p^h and low quality firms succeed with probability $p^l < p^h$.

Figure 1:   The Investment Decision of a High Quality Firm in the Presence of a Lemons Problem in Credit Markets
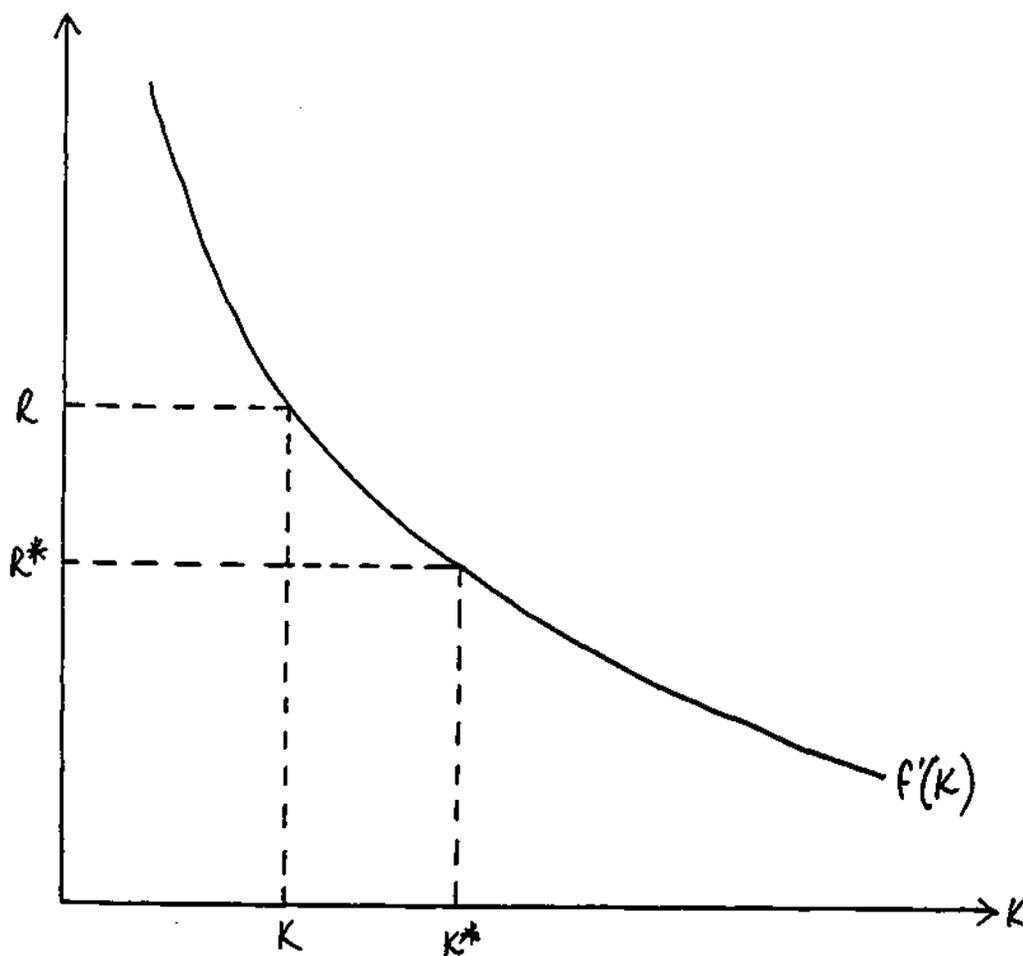
$R^* = r/p^h$

$R = r/\pi^g p^h + \pi^b p^l$

$\Omega = R - R^*$

Assume that our entrepreneur is a high quality borrower. If there was no private information and quality was readily observable and known to everybody participating in the credit market, she would borrow at an interest rate R such that

$$p^h R^* = r \qquad (1)$$

where r is the rate of return that can be earned on an alternative risk-free investment by lenders. Equation 1 simply says that the expected return of proceeding with the investment project should be just equal to the opportunity cost of the funds required to finance the project. The first-best optimum corresponds to K^* in Figure 1 where the entrepreneur equates the expected marginal benefit from adding a unit of capital with the expected marginal cost.

Consider now the solution when there is asymmetric information and a firms' true quality is unknown to "outsiders". All that lenders know is that some fraction, π^g, of all firms are good quality and some fraction, π^b, are bad quality, where $\pi^g + \pi^b = 1$. Since lenders cannot price discriminate between good borrowers and bad borrowers in loan contracts, they must lend to all on equal terms. The interest rate on loans, R, will be such that

$$(\pi^g p^h + \pi^b p^l) R = r \qquad (2)$$

In other words, lenders demand a premium from good firms to offset any losses that might arise from inadvertently lending to bad borrowers (lemons). The lemons premium (Ω) is equal to the difference between R and R^*. Importantly, our high quality entrepreneur who is now facing an interest rate of R will choose an amount of capital K which is less than K^* (see Figure 1).

The example just presented is obviously incomplete. However, the intention was not to provide a complete model of the functioning of credit markets. Rather, the aim was to highlight in a simple manner the types of arguments used to show why outcomes might deviate from the benchmark full information case. The important implication of the above

analysis, and other more complete analyses which can be found in the relevant literature[9], is that the premium for external finance influences the costs of borrowing at the margin and consequently affects real economic decisions. Conversely, in the full information Modigliani-Miller world, firms are indifferent between internal and external funds and therefore investment is independent of financial factors.

3.3   The Role of Collateral or Net Worth

The second important result which survives across a number of frameworks is that the premium for external funds depends inversely on borrowers' collateralisable net worth. To the extent that movements in firms' net worth are procyclical, the wedge between the cost of external and internal funds moves countercyclically making it more difficult to borrow. As a consequence, investment and business activity become more volatile than they would be in a setting of perfect markets. These results are again derived from research that models the financial sector in the presence of imperfect information. In particular, these models make allowance for asymmetric information about borrower types, borrower actions, project qualities and project outcomes. The reasoning behind the models is easiest illustrated under the assumption of asymmetric information about borrower actions which introduces moral hazard and agency problems[10].

Debt finance creates "agency" problems in that firms may have an incentive to act counter to the interests of lenders. For example, managers may forego some investment projects with positive net present values and accept others with negative present values because the latter provide the manager with greater personal satisfaction. Alternatively, entrepreneurs may overspend on perquisites or, worse still, abscond with the funds and

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[9] One is again referred to Gertler (1988) for a review of this research.

[10] As in the previous section, the aim here is to present the intuition behind the general results that the premium for external funds varies inversely with borrowers' net worth. No attempt is made to provide a complete characterisation of the models which derive this result. Further, it is not important that I have assumed one particular informational friction. The same qualitative results are obtained under a wide variety of plausible assumptions - see, for example, references in footnote 8.

escape to some obscure place like Majorca, Spain. Moreover, assuming the debt contract entails a limited-liability clause, entrepreneurs have an incentive to invest in excessively risky projects. This incentive arises because in the event that the project is successful the entrepreneur retains most of the profits, while the lender (or debt holder) absorbs most of the losses if the project fails. The main point here is that lenders cannot perfectly monitor all the resource allocation decisions inside the firm and insiders may therefore have an incentive to misallocate resources for personal benefit.

Obviously, this is an unsatisfactory state of play for lenders so they will attempt to overcome the problem by structuring financial contracts in a way that aligns borrowers' incentives with their own. One important way in which this can be done is by having managers put some of their own resources at risk. Typically, this takes the form of requiring borrowers to pledge financial and physical assets including expected future earnings as collateral. The larger the value of this collateral relative to the amount which is to be borrowed, the greater the percentage stake of the borrower in the investment project and therefore the smaller the potential net gain from cheating creditors. Hence, the inverse relationship between collateralisable net worth and the premium for external funds.

3.4 Monetary Policy and Firms' Balance Sheets

It remains to tie the foregoing discussion of financial market frictions with the operation of monetary policy. Reiterating the main conclusions of that discussion - at least some borrowers face high costs of external finance in the sense that there is a wedge between the cost of external and internal funds; and, the cost premium for external finance varies inversely with borrowers' collateralisable net worth. Now, monetary policy enters the picture by affecting the size of the premium and it does so by inducing changes in borrowers' net worth. There are two distinct ways in which this may happen. First, a policy-induced increase in interest rates increases borrowers' debt-service burdens and

reduces the discounted value of collateralisable net worth. The decline in cash flow and asset values after interest payments implies that borrowers have less resources available to either use directly for investment finance or as collateral in obtaining external funds. Consequently, the informational risk faced by outside lenders increases thereby raising the premium for external funds which in turn reduces firms' ability to borrow in order to undertake investment and other programs.

Second, suppose the monetary tightening produces a decline in consumer spending. The subsequent decline in cash flows further worsens firms' balance sheets and this acts to raise the marginal cost of external finance even further thereby accentuating the downturn. The operation of the balance sheet channel can be illustrated with the use of the following diagram[11].

Figure 2: **The Balance Sheet Channel - Magnification of an Interest Rate Increase.**

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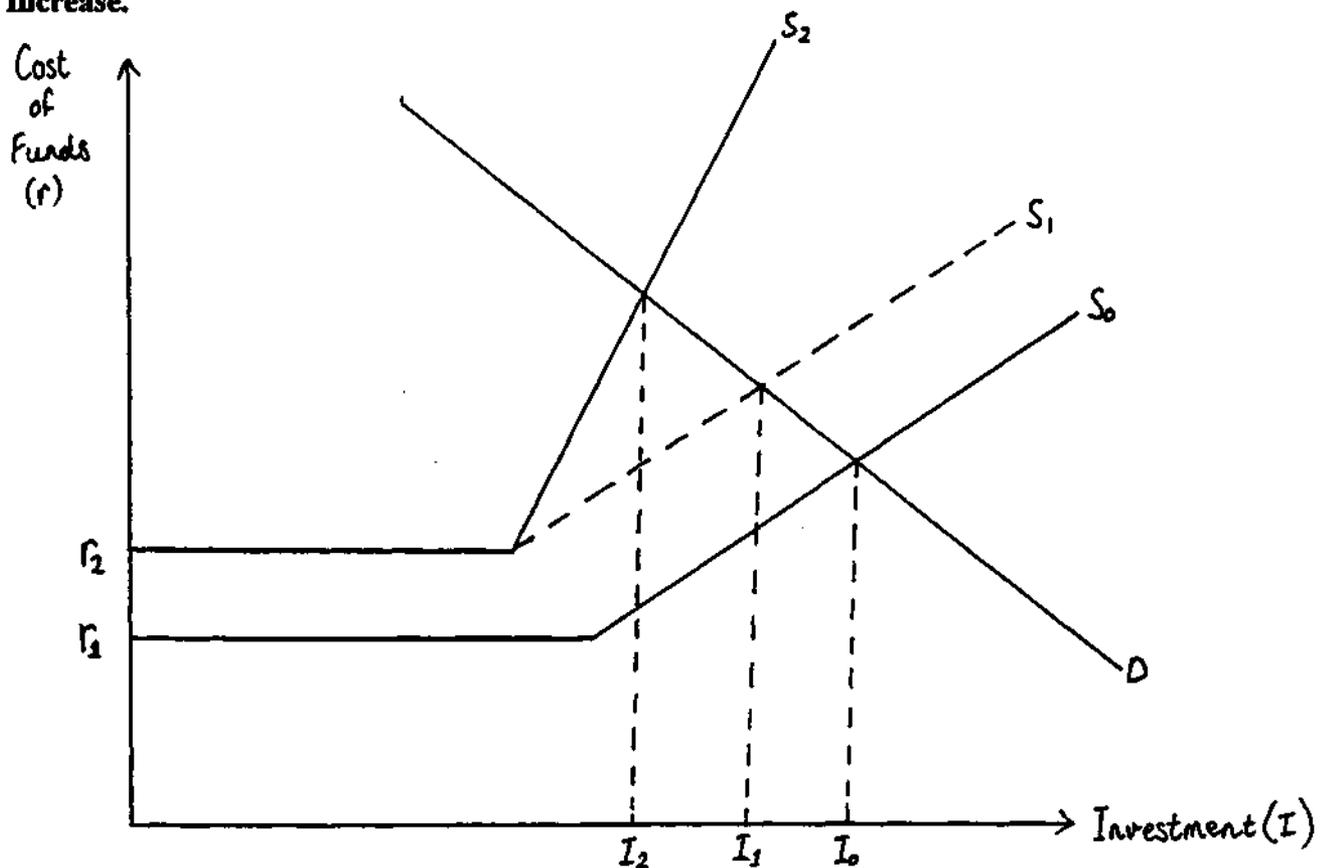
[11] The diagram and the analysis which follow are adapted from Oliner and Rudebusch (1994).

The initial cost of funds schedule facing a particular firm is shown by S_0 in Figure 2. The horizontal segment represents the internal funds available to the firm. The cost of these funds is $r_1 = r_1^f + \theta$, where r_1^f is the risk-free interest rate which is (assumed to be) exogenously set by the monetary authorities, and θ is a firm-specific risk adjustment. In a Modigliani-Miller world with full information and perfect markets, external funds would also be obtainable at r_1. However, owing to factors which have been discussed, external funds command a premium which as before we can denote by Ω.

The size of Ω varies positively with the size of the loan relative to net worth, and with the risk-free interest rate. For reasons already reviewed, the greater the amount of the loan, L, the higher are both the informational risk faced by lenders and the size of the premium. Indeed, it is this link between Ω and L which produces the upward slope of S_0 in Figure 2. An increase in the risk-free interest rate, on the other hand, induces a deterioration of balance sheets, as previously discussed, thereby raising Ω. These two factors are summarised in the equation $\Omega = (L, r^f)$, where $\delta\Omega/\delta L > 0$ and $\delta\Omega/\delta r^f > 0$.

It is the dependence of Ω on the risk-free interest rate which provides the mechanism for the balance sheet channel. An increase in the risk-free rate in response to a monetary contraction, increases the cost of external funds by $\delta r/\delta r^f + \delta\Omega/\delta r^f$. The second term is the "magnification effect" and is shown in Figure 2 by the shift of the upward slope from S_1 to S_2. In the absence of the magnification effect the supply schedule would be S_1 and investment would fall to I_1. This is in essence the conventional interest-rate mechanism. However, credit market frictions act to widen the spread between the rate on external funds over the risk-free rate, thereby magnifying the monetary shock as shown in Figure 2 by the fall in investment to I_2.

As with the bank lending channel, credit rationing is not necessary for the balance sheet channel to exist. Regardless of whether credit is rationed following tight money, credit market frictions distort the real investment decision by affecting the premium for external

finance and therefore the overall cost of funds faced by borrowers. In the presence of rationing, the non-price terms and conditions of lending are likely to be adjusted in a way that amplify the effects of the disturbance.

Importantly, if the balance sheet channel is operative there are likely to be "distributional" consequences with small firms' spending falling significantly following a monetary contraction compared to large firms. Small firms are likely to face a higher premium for external funds since the informational asymmetry is relatively more severe for this group of borrowers. The informational frictions that add to the costs of external finance are more applicable to younger firms, firms with a high degree of unobservable idiosyncratic risk and firms with low net worth. Young firms come to financial markets as unknowns while mature firms have a track record of past performance which allows lenders to generally know more about relevant characteristics. Idiosyncratic risk intensifies the moral hazard problem and is more severe for firms that are less well diversified. Finally, the greater the amount of collateralisable net worth the smaller the moral hazard problem and hence the lower the premium for external funds. The firms which on average are younger, less well diversified, and proportionately less well collateralised are the smaller firms.

In addition, while I have emphasised informational frictions as being more severe for small firms, there are other factors which may add to the costs of external finance for small firms compared to large firms. For example, lenders may benefit from economies of scale in gathering information on a single large firm rather than on many small ones. Alternatively, owing to fixed costs of evaluation and monitoring, bankruptcy costs may also be proportionately higher for small firms.

The balance sheet and bank lending channels make similar predictions about the impact of monetary policy. Both suggest an enhanced impact of monetary policy on borrowers with imperfect access to financial markets. Moreover, the sets of borrowers who are

balance-sheet constrained and who are bank-dependent are likely to overlap considerably. In predicting distributional or cross-sectional responses to monetary policy actions these two theories are also in contrast with the conventional interest-rate channel. Under the latter scenario, changes in the riskless rate affect the cost of capital similarly for all firms so that, while investment falls, the reduction falls on the least productive projects. The balance sheet and bank lending channels, however, do differ on at least one important detail. The credit view requires that bank credit flows are altered relative to other forms of credit and in this sense the theory is directly tied to the institutional details of banking. As I noted earlier, it requires banks to be unable to insulate their loan supply following a shock to reserves by rearranging their portfolio of assets and liabilities. The main distinction of the balance sheet channel is between internal funds and external funds supplied by all financial intermediaries and therefore it sees no special role for banks[12].

4.   Empirical Evidence

In this section I examine the empirical evidence which has been provided in support of the balance sheet channel and present the results of my own work with Australian data. Before doing this, I review some of the evidence that has been produced in the search for a bank lending channel.

4.1   Empirical Research on the Bank Lending Channel

Early empirical work investigating the credit channel predominantly focused on examining the correlation between output and money. This approach had one very important flaw - it did not address issues of endogeneity, that is, that both money and lending are affected by economic activity. Hence, a finding that output is more closely correlated with credit than with money does not imply that credit is more important in a

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[12] In fact, monetary policy is also not central to the theory. Factors other than monetary policy that affect firms' collateralisable net worth could generate the type of accelerator mechanism discussed in this paper.

causal sense. It could mean, for example, that credit is endogenous and responds more strongly than money to exogenous shocks.

A similar problem arises with work that investigates the timing relationship between a monetary contraction and bank lending. This can be illustrated by comparing two important studies that adapted this approach and found similar results but attached different interpretations to them - Romer and Romer (1990) and Bernanke and Blinder (1992). The Romers used their readings of the minutes of the Federal Open Market Committee to identify episodes of exogenous shifts in monetary policy. They found that following a period of tight money the money stock falls almost immediately, while bank loans fall with a significant lag of six to nine months after a Romer episode. Further, the drop in loans was found to be roughly contemporaneous with the decline in output. This latter result led the Romers to suggest that bank credit is driven by demand factors and concluded that the evidence favoured the traditional money view.

Bernanke and Blinder (1992), using innovations to the federal funds rate as a measure of changes in policy, obtained a similar temporal pattern. That is, after a monetary contraction, bank deposits and holdings of securities declined within a few months but bank loans initially rose slightly and only began to fall after six to nine months following the policy change. Again, the fall in lending was roughly coincident with a decline in overall economic activity which in this case was proxied by the unemployment rate. Bernanke and Blinder, however, interpreted the results as being consistent with the credit channel. Their conclusion was partly based on the argument that if bank credit and other bank assets were perfect substitutes, as they are under the traditional money view, there would be no reason for banks to systematically meet a decline in their deposits by selling off securities. The other part of their argument was that the relatively slow reaction of lending reflected the quasi-contractual nature of loans.

As Bernanke and Blinder noted themselves however, an identification problem arises because of observationally equivalent predictions about the movements of money and loans of the two competing theories. Consider the case of a monetary contraction that raises interest rates and thereby depresses investment spending. Under this scenario one would still expect to see the demand for credit to fall so that the reduction in the quantity of loans would reflect demand factors and not a reduced supply of loans. In an interesting paper, Kashyap, Stein and Wilcox (1993) - hereafter, KSW -- tackled the observational equivalence problem by looking at an alternative source of business finance, commercial paper. The intuition for their approach was that if bank loans fall after tight money because of a reduction in the supply of loans, as implied by the credit view, then non-bank sources of credit such as commercial paper should rise as firms who are able to substitute between alternative sources of finance will attempt to do so. Conversely, if the decline in bank loans is due to an output-induced effect on loan demand, as suggested by the money view, then both bank lending and commercial paper issuances should fall.

To explore this issue, KSW focused on changes over time in the mix between bank loans and commercial paper following both Romer dates and increases in the federal funds rate. The authors found that the mix declines sharply following monetary contractions reflecting a decline in bank loans and an increase in the volume of commercial paper issues. KSW interpreted the result as strong evidence for a bank lending channel. In subsequent studies, however, Gertler and Gilchrist (1993), Gertler (1993), and Oliner and Rudebusch (1993) have found that bank lending to large firms behaves similarly to commercial paper. That is, following tight money, credit in the form of both commercial paper and bank loans flows to large firms but contracts for small firms. Hence, the KSW results can be explained by the small firm/large firm distinction which is consistent with the balance sheet channel.

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4.2 Empirical Research on the Balance Sheet Channel

In presenting evidence for a balance sheet channel, authors have looked at compositional effects. This follows directly from the theory presented in this paper. While the credit view concentrates on flows of bank versus non-bank credit, authors favouring the balance sheet view have searched for differential behaviour of small firms which are likely to face credit market frictions as compared to large firms which are likely to have costless, or at least cheaper, access to the open capital market. The three key predictions which are relevant for the empirical verification of the balance sheet channel are: (i) financing patterns should vary across firms with small firms having more limited access to financial markets; (ii) small firms' investment and other decisions should be more tightly linked to internal net worth; and (iii) following tight money, small firms' investment and output should decline relative to that of large firms. So far, empirical studies have been successful in that support has been found for all three predictions.

4.2.1 Financing Patterns

4.2.2 Link Between Investment and Net Worth

4.2.3 Response of Small Firms to Tight Money

4.2.4 Australian Evidence

TO BE COMPLETED

5. Importance and Implications of the Balance Sheet Channel

Are there alternative explanations for the phenomena that have been found in the aforementioned empirical work? Even if a balance sheet channel of monetary transmission is operative, how important is it for *aggregate* economic activity? If credit market frictions constrain small firms' ability to obtain debt finance, can governments intervene to improve the allocation of credit? Can the balance sheet channel have any broader applications in economic theory? I now turn to address each of these questions.

It is possible that nonfinancial factors are at work that may account for the differential response of small and large firms following tight money. This is particularly true for sales volatility. One possibility is that large firms smooth demand fluctuations by contracting out to small firms in high-demand periods but undertake all business themselves when demand is low. On the other hand, a technological choice model could explain qualitatively the same phenomenon. For example, small firms having more labour-intensive technologies face lower costs of adjustment relative to capital-intensive large firms, and therefore may be more volatile.

Nonetheless, these nonfinancial theories cannot explain the coincident variability of sales, inventories and investment across firm sizes, particularly following monetary contractions. Further, a host of recent studies show that responses to monetary policy are asymmetric - the differential response of firms while potent following a monetary contraction, seems to disappear during episodes of monetary easing. That is, the effect of shifts in monetary policy on small-firm variables is sharper in periods of depressed economic activity. This is consistent with the theoretical work which indicates that credit constraints are likely to bind more in recessions than in booms. Hence, balance sheet variables affect firms' ability to borrow mainly when net worth is low, while at other times, balance sheet considerations become less important. All this, together with the systematic differences in the way businesses finance their activities, seem to suggest that financial factors and therefore the balance sheet channel are at work.

The finding that monetary policy has a disproportionate effect on small firms may be of interest to policy-makers on distributional or equity grounds. However, although equity issues are not unimportant, it may be that from an aggregate economic perspective the balance sheet channel is of minimal significance. While small firms contract their operations in the aftermath of a monetary tightening, they may account for a small share of total output, employment and investment so that aggregate activity does not fall significantly. Evidence, however, seems to suggest the opposite. In 1991-92,

approximately 97 per cent of businesses in the non-agricultural sector in Australia were small, while in that same year small firms employed 51 per cent of the working population nationwide[13]. There are no official estimates of small firms' contribution to output and investment. The Beddall Committee did estimate, however, that small businesses account for about 30 percent of Australia's GDP. Despite this, the quantitative effects of a reduction in small business activity may still be minimal if large firms are able to take up the business of credit-constrained small firms. More evidence is required to explore this issue although my hunch is that it is unlikely that large firms are able or willing to pick up the extra business. First, it is doubtful that the products of small and large firms are perfect substitutes; in fact, in some industries they are complements. Second, factors of production are immobile in the short run. Third, as competition from small firms declines, large firms may choose to raise mark-ups rather than expand output.

If indeed a balance sheet channel is operative, the question arises of whether government intervention in financial markets can improve outcomes. There is no reason to suppose so. It must be remembered that the constraints faced by small firms are the result of informational frictions in credit markets. Since government intervention cannot remove those frictions, it is not obvious how government could improve on the responses developed by market participants. Indeed, the practices observed in financial markets could be efficient responses to the informational frictions present in the economic environment. To compare the situation to that which would arise in a world of full information and perfect markets, is to compare with an unobtainable ideal. Policies favouring small firms may be justified on other grounds; for example, it is argued that small firms engage in more innovative activities and develop new technologies and therefore generate external benefits that contribute to economic growth. This however is not an argument for intervention in credit markets. A more reasonable and simple approach would be to provide targeted tax breaks.

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[13] The figures are taken from ABS (1993). The ABS defines small businesses as those employing less than 20 persons except for manufacturing where small businesses are taken to be those employing less than 100 persons.

The analysis presented in this paper may also have implications for tax policy. The conventional view is that what matters for investment is the marginal tax rate through its effect on the cost of capital. However, for firms facing credit market constraints, average tax rates may be more important as it is these that affect the firm's cash flow and net worth. Nonetheless, a policy of lowering average tax rates may cause agency problems of its own. The availability of greater internal funds may encourage managers who are concerned with corporate size, for example, to overinvest.

The balance sheet channel and the theory of financial constraints more generally, can be applied to other pertinent issues in economics. One could, for example, make an appeal to credit market constraints to explain the sensitivity of consumer spending, particularly on durables, to current income. Balance sheet considerations may also be important for financial intermediaries and their ability to raise funds to maintain lending activity. Bernanke and Lown (1992) found for example, that a depletion of bank capital - which may be taken as a proxy for net worth - reduced the ability of some banks to lend during the 1990-91 recession in the US.

Finally, the theory in this paper has important implications for the recent trend in economics which has led to the development of representative agent, real-business cycle models in which financial factors are irrelevant. It would be a worthwhile practical task for economic modellers to incorporate financial factors in these models. It seems to me that this would be a more useful exercise than relying purely on productivity shocks to explain business fluctuations.

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