Articles

Financial intermediation and the monetary transmission mechanism

Iris Claus and Christie Smith,[1] Economics Department

This article examines the role of financial intermediaries and the so-called credit channel in the transmission of monetary policy. It argues, primarily on theoretical grounds, that it is important to take account of a wide variety of information regarding financial market conditions; interest rates and exchange rates by themselves will not provide an adequate description of the influence of financial markets. Empirical events, too, indicate that financial markets play a much richer role in the business cycles experienced by the economy. Recent literature has formalised the role of credit markets in the transmission mechanism. These models, modified for an open economy and floating exchange rate setting, may prove informative about the transmission of monetary policy in the New Zealand economy.

"A general collapse of credit, however short the time it lasts, is more fearful than the most terrible earthquake." Michel Chevalier, Lettres sur l'Amérique du Nord, 3rd ed. (Brussels: Société Belge de librairie, 1837, Vol. 1: 368).

1 Introduction

The purpose of this article is to review the role of financial intermediaries and credit markets in the monetary transmission mechanism – the so-called credit channel. Macroeconometric forecasting models in widespread use tend to approximate financial market conditions with a limited set of financial market *prices*. Attention is usually limited to the exchange rate, a short-term, risk-less interest rate, and sometimes a long-term government bond rate. We argue that this approximation largely ignores the credit channel, and may at times be too limited in describing how monetary policy is transmitted to the economy. If so, it may be helpful explicitly to model financial market interactions, in order to develop a better understanding of macroeconomic outcomes.

In the next section we briefly review the monetary transmission mechanism as it is typically described. Specifically, we identify the role of interest rates, exchange rates, expectations and wealth.

In section 3, as a forerunner to the discussion of the credit channel, we examine the key theoretical insights that explain why financial intermediaries exist. Financial intermediaries are central players in financial markets, and one cannot really appreciate the role of credit markets unless one apprehends the role played by financial intermediaries. The primary reason underpinning financial intermediation is the *information asymmetry* that exists between lenders and borrowers: borrowers tend to have much more information about their investment projects, and hence the likelihood of repaying their financial obligations, than do lenders. This asymmetry leads to *adverse selection* and *moral hazard* problems (which we discuss in section 3). Financial intermediaries help resolve these problems and hence improve the allocation of resources. Financial intermediaries can improve the allocation of resources because they have a cost advantage in acquiring and processing the information required to facilitate lending.

The theories of financial intermediation discussed in section 3 are at odds with "traditional" theory.[2] This issue is at the crux of whether "traditional" theory can summarise financial markets adequately using interest rates and exchange rates

[1] The authors would like to thank Stephen Burnell, Sean Collins, Aaron Drew, Arthur Grimes, Ben Hunt, Magnus Jonsson, John McDermott, Adrian Orr, Weshah Razzak, Michael Reddell and Bruce White for helpful comments and suggestions. In particular, they wish to acknowledge the editorial input of Sean Collins and John McDermott.

[2] Almost certainly, some will think "traditional" in this context is a misnomer, since even our "non-traditional" channel (ie the credit channel) has a lengthy history in the economics literature. The primary distinction that we wish to emphasize is between channels that are widely (traditionally) incorporated in macroeconometric forecasting models, and those channels that feature little, if at all, in such models.

alone. Section 3 shows that financial market outcomes may have important real effects for the economy and they may affect the implementation of monetary policy.

In section 4 we discuss how monetary policy affects credit conditions and the economy at large. We note that few, if any, central banks formally model the credit channel, although they do use and interpret a broad array of information from credit markets. We also note that developments in credit markets do *materially* affect the implementation of monetary policy. For instance, the Federal Reserve System of the United States eased monetary policy in the wake of the Russian government's default on debt in August 1998 and the subsequent losses experienced by a major hedge fund, Long-Term Capital Management (LTCM). Monetary policy was eased to forestall a disruption of real activity. Similarly, the Reserve Bank of New Zealand has committed itself to ensuring that the New Zealand financial system has enough liquidity in the New Year, to nullify concerns about Y2K issues in the financial sector.

In section 5 we discuss ways in which empirical models try to account for the credit channel. In recent years, a great deal of progress has been made in theoretical modelling of the credit channel. However, a number of issues have yet to be resolved. Currently, the credit channel has not been imbedded in a model of an open economy with floating exchange rates. Clearly, a formal, empirical model of the New Zealand economy that hoped to incorporate a role for the credit channel would also need to take account of the integration of New Zealand's capital markets with foreign capital markets, in the context of a floating exchange rate.

The empirical importance of the credit channel is a matter of some dispute. Moreover, we do not know whether a formal macroeconometric model that includes a credit channel would lead to markedly superior forecasts, relative to extant forecasting models that only informally account for financial market conditions. Until formal macroeconometric models have been developed that do incorporate the credit channel, we are not really in a position to address either of these questions. What we can say, however, is that models *are* being developed in the economics literature that will enable us to both ask and answer these questions.

Section 6 provides some concluding remarks.

2 The "traditional" channels of the transmission mechanism

It is widely agreed that monetary policy can affect economic activity over the business cycle. What is more controversial is the relative importance of the various channels through which monetary policy does so.[3] In this section we discuss the transmission mechanism as it is commonly incorporated into macroeconometric forecasting models (for lack of a better name we call this the "traditional" mechanism). By the "traditional" mechanism we mean monetary policy's influence on the economy through:

- short-term interest rates;
- the direct and indirect effects of the exchange rate;
- expectations;
- wealth.

"Traditional" influences exclude, among other things, interest rate spreads, the extent of non-performing loans at banks, the value of collateral, other non-price terms of lending (eg the ratio of income to debt-servicing payments needed to qualify for a loan), and the quantity of money and credit outstanding. In section 4 we argue that influences such as the quality and structure of firms' balance sheets affect and are affected by monetary policy in ways not captured by these "traditional" effects.

Perhaps the most obvious channel of monetary policy is that of interest rates. The Reserve Bank of New Zealand uses the Official Cash Rate (OCR) as its instrument in implementing monetary policy.[4] The OCR is the mid-point around which the Reserve Bank absorbs and supplies settlement cash to the inter-bank market. Settlement cash is used to fulfil obligations arising from securities and foreign exchange

[3] See Taylor (1995) and Bernanke and Gertler (1995) for contrasting views on this point.

[4] Archer, Brookes and Reddell (1999) discuss the role of the OCR in the implementation of monetary policy.

transactions, transactions with government, and other transactions intermediated by banks. The need to settle such transactions is an important reason why banks hold settlement cash. How, then, does the OCR affect prices and output?

Movements in the OCR anchor short-term market interest rates. In turn, short-term market interest rates influence the interest rates at which financial institutions take deposits and lend to businesses and consumers. The OCR also has an indirect influence on longer-term interest rates, through its influence on expectations of *future* short-term interest rates. Because movements in the OCR affect the spectrum of interest rates, changes in the OCR alter the costs of investing and consuming now as opposed to later. Thus, monetary policy affects the current demand for investment goods and consumption goods, and this has a direct effect on aggregate demand.[5]

Monetary policy also affects output and inflation via the exchange rate. In open, competitive financial markets, interest rate changes closely interact with the exchange rate. A tightening of monetary policy, which raises domestic interest rates relative to foreign interest rates, tends to increase the attractiveness of local currency investments. With a floating exchange rate, this increased demand for local currency investments puts upward pressure on the exchange rate.[6] Exchange rate movements have a *direct* impact on the New Zealand dollar cost of imports, which has a near-term influence on New Zealand's inflation rate. Exchange rate movements also have an *indirect* impact on inflation since they alter the demand for imports and exports, both at home and abroad, thereby influencing aggregate demand for domestic output and hence domestic inflation pressures.

Although interest rates and exchange rates are important determinants of aggregate demand, they are by no means the only determinants. Expectations also play an important role in transmitting monetary policy changes to the economy. Decisions to spend or save, and to invest or consume, depend on expectations of future inflation, income, interest rates and exchange rates. By altering interest rates the Reserve Bank can affect expectations of these variables, and such expectations have implications for current variables, such as current inflation.

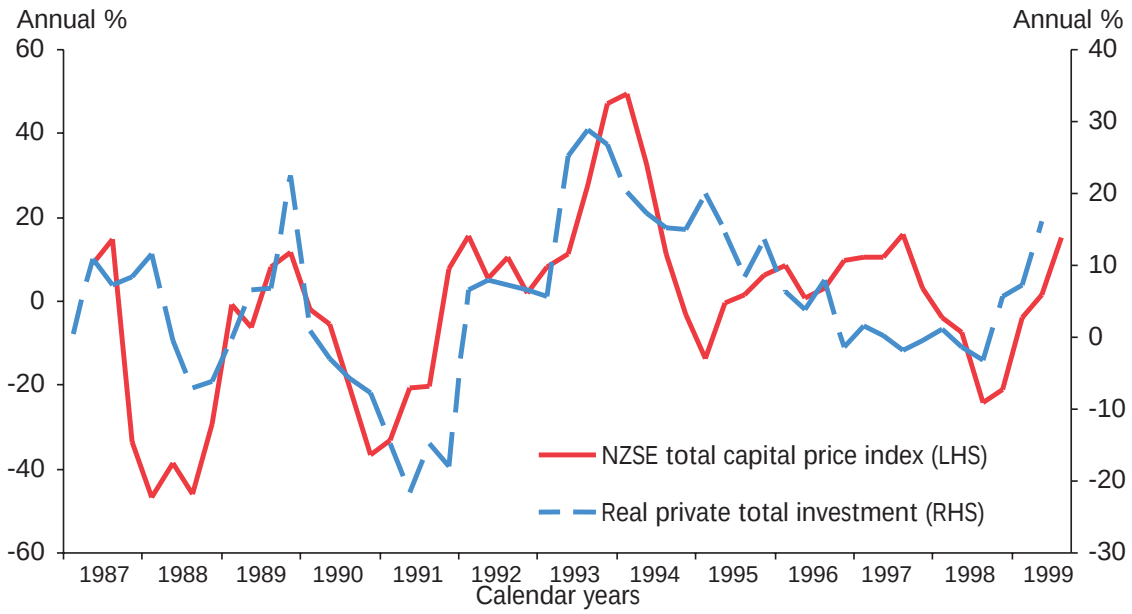
Macroeconomists also emphasise the role of wealth effects. In a sense, these wealth effects are merely a subset of expectational effects, since wealth embodies expectations of future income. An equity share, for example, represents a claim on the future dividend flow associated with a particular firm's capital. An increase in the value of a share should thus reflect an increase in the expected future earnings of the firm's capital or, equivalently, a higher stream of profits. Consumers are often assumed to "smooth" their lifetime consumption patterns, in which case an increase in expected future income will also increase *current* consumption. Expectations of profitability also affect the propensity to invest in capital goods, since greater profitability will make marginal investments feasible. Indeed, the growth rate of real investment appears to be correlated with movements in the New Zealand stock market index, which is a weighted average of the market value of listed companies in New Zealand (see figure 1).

There are additional kinds of wealth effects that are not captured in the "traditional" description of the transmission mechanism. For instance, in the credit literature tangible movements in asset prices have implications for access to credit. (Among other reasons, this is because movements in asset values affect the equity-participation of borrowers, and the value of collateral.) Thus, the empirical regularity described above, between equity prices and investment, is also consistent with the credit channel literature. Similarly, the rapid depreciation of Asian currencies in 1997 caused a sharp deterioration in the balance sheets of Asian corporations that had borrowed heavily in US dollars. This

[5] We are glossing over the distinction between nominal and real interest rates. Real rates more closely reflect the costs and benefits of deferring expenditure decisions than do nominal interest rates, since real interest rates account for the loss of purchasing power associated with inflation. Real interest rates, therefore, should drive expenditure decisions. However, prices do not adjust instantaneously, for example because of fixed nominal contracts. This means that (at least over short horizons) changes in short-term nominal interest rates tend to be closely correlated with changes in *real* interest rates.

[6] See Orr, Scott and White (1998), for a more elaborate discussion of the relationship between interest rates and the exchange rate.

Figure 1
Stock market growth and growth in real investment



deterioration disrupted credit lines and affected real activity. Consequently, many corporations in the region simply could not borrow – at *any* rate of interest. This kind of effect is not captured in what we have called the "traditional" transmission mechanism. We examine the role of asset prices more fully in section 4.

In the remainder of this article we canvass frameworks that encompass "non-traditional" elements. Recent theoretical developments and empirical events suggest that this is an opportune time to do so. As part of this re-evaluation, we explore how these insights might modify our thinking and our models of the monetary transmission mechanism.

3 Theories of financial intermediation

Financial intermediaries exist to bring borrowers and lenders together and to help allocate credit. While this may seem obvious, its implications for understanding how monetary policy affects the economy are perhaps less clear. Indeed, the key to understanding the differences between the "traditional" monetary transmission mechanism (through short-term interest rates, the exchange rate, expectations, and wealth) and the non-standard (ie credit channel) mechanisms we alluded to above is to understand why financial intermediaries exist at all. Therefore, in this section we provide a brief overview of the theories explaining the role of financial intermediaries.

Monetary policy can focus exclusively on a very limited set of financial market *prices* (ie short-term interest rates and the exchange rate) if information can be obtained at no cost, if financial transactions are costless, and if other frictions are also absent. Given these preconditions, the Modigliani and Miller (1958) theorem states that the value of a firm and its investment decisions are independent of the source of finance. In other words, a firm is indifferent to funding a given capital project through debt or equity. This means that if a bank refused to fund a worthwhile project, a firm could always turn to the equity market or to another financial institution to raise the requisite funds. Given an appropriate set of prices, all markets clear in this frictionless world, including credit markets.

With respect to the monetary transmission mechanism, the important point is that *if* the Modigliani-Miller theorem holds, it implies a particular kind of separation between the financial and real sectors of the economy. Once the level of short-term interest rates and the exchange rate are known, the financial sector is irrelevant to an understanding of macroeconomic developments. This has a number of practical implications. First, it means that central banks can ignore financial *quantities*, such as the quantity of credit extended by banks and measures of the money stock.

Secondly, it means that macroeconometric forecasting models need not bother with financial sector developments, once a single interest rate and the exchange rate have been taken into account. Thirdly, it means that monetary policymakers can ignore signals such as the quality of bank loans, the net worth of firms, and the capital of financial intermediaries. And it also means they can ignore signals from "credit spreads", which are the differences between interest rates paid on risky debt instruments and those paid on risk-less government securities.

In practice, central bankers certainly do not ignore such information. As mentioned in the introduction, the Federal Reserve System in the United States increased liquidity in the wake of the Russian government's default on its debt and the subsequent near-failure of LTCM, a Cayman Islands' hedge fund that operated in the United States. This increase in liquidity was, in part, adjudged necessary because of the conditions that already prevailed: recent events at that time had unsettled financial markets, elevated credit spreads and put downward pressure on the prices of risky assets (Greenspan 1998). The point is twofold. Central banks take account of financial markets because credit conditions sometimes change independently of the actions of central banks. Secondly, changes in financial market conditions, over and above those captured by movements in risk-less interest rates and the exchange rate, sometimes warrant policy adjustments – as in the case of LTCM.

As Modigliani and Miller themselves note, the assumptions underlying their model are "drastic" simplifications that need to "be relaxed in the direction of greater realism and relevance". For instance, an unrealistic implication of these conditions is that there would be no reason for financial intermediaries to exist. Individuals could *costlessly* perform exactly the same services provided by financial institutions. In other words, no one would ever pay any financial intermediary any fee to obtain a loan. Nor would any investor looking to place funds in a suitable project ever enlist the help of a financial intermediary. Thus, the implications of the Modigliani-Miller theorem are difficult to reconcile with the fact that financial intermediaries *do* exist, and with a commonly held belief that financial institutions are central to the efficient functioning of modern economies.

We explore two strands of literature that explain the existence of financial intermediaries: one strand emphasises intermediaries' provision of liquidity, while the other strand focuses on intermediaries' ability to lower the risks of lending. In both cases, financial intermediation leads to a more efficient allocation of resources. This is because financial intermediaries can reduce the cost of channelling funds between borrowers and lenders.

Provision of liquidity

The first strand of literature focuses on financial intermediaries' provision of liquidity. Financial intermediaries "borrow short" (offer demand deposits, for instance) and "lend long" (offer mortgages, for example). Without an intermediary, investors are locked into long-term investments that might preclude their desired consumption patterns and would make them vulnerable to unforeseen cash shortfalls. Financial intermediaries can mismatch the maturity of liabilities and assets because it is rarely the case that all depositors will wish to withdraw their funds at the same time. The transformation of illiquid assets into liquid assets does, however, make financial intermediaries (particularly banks) susceptible to runs. A bank run occurs when depositors simultaneously seek to withdraw their funds because of concerns about whether a bank will be able to meet its obligations. There is an extensive literature on bank runs and systemic risks in general, of which one of the most influential is the model of Diamond and Dybvig (1983). A bank run may be contagious, in that concerns about one institution may lead to concerns about other financial institutions, irrespective of whether there are direct links between the two. Contagious bank runs may disrupt financial intermediation, disrupting real activity. Bernanke (1983) suggests that this was an important element of the Great Depression.

Transformation of risk

The second strand of the literature focuses on intermediaries' ability to transform the risk characteristics of assets. This ability is founded on three core features:

- borrowers and lenders rarely possess the same information (there is *information asymmetry*);

- financial intermediaries have a *cost advantage* in acquiring and processing information;
- information asymmetries lead to *moral hazard* and *adverse selection* problems.

We now discuss these features in turn.

Information asymmetries

Information asymmetries arise because borrowers generally know more about their investment projects than do potential lenders. The information asymmetry can occur "ex-ante" or "ex-post." Ex-ante information asymmetries arise when lenders have difficulty distinguishing between higher-risk and lower-risk borrowers before issuing loans. The most prominent example of an ex-ante information asymmetry is the used car market; the buyer of a used car has much less information about its quality than does the seller. An ex-post information asymmetry means that only borrowers can observe actual returns after project completion. Ex-ante and ex-post information asymmetries mean that lenders will not know whether a project is worth funding unless they obtain costly, additional information about the borrower and the project.

Cost advantages

Financial intermediaries have a cost advantage in acquiring or processing information. One reason for this advantage is that financial intermediation avoids duplication of information collection (having a financial intermediary collect and process information means that investors do not have to duplicate one another's efforts). Also, financial intermediaries are better able to assess the likelihood that a prospective borrower will default, because of their past experience with borrowers. This cost advantage means that some agents – the intermediaries – specialise in the provision of financial services and, as a result, resources can be allocated more efficiently.

Adverse selection and moral hazard

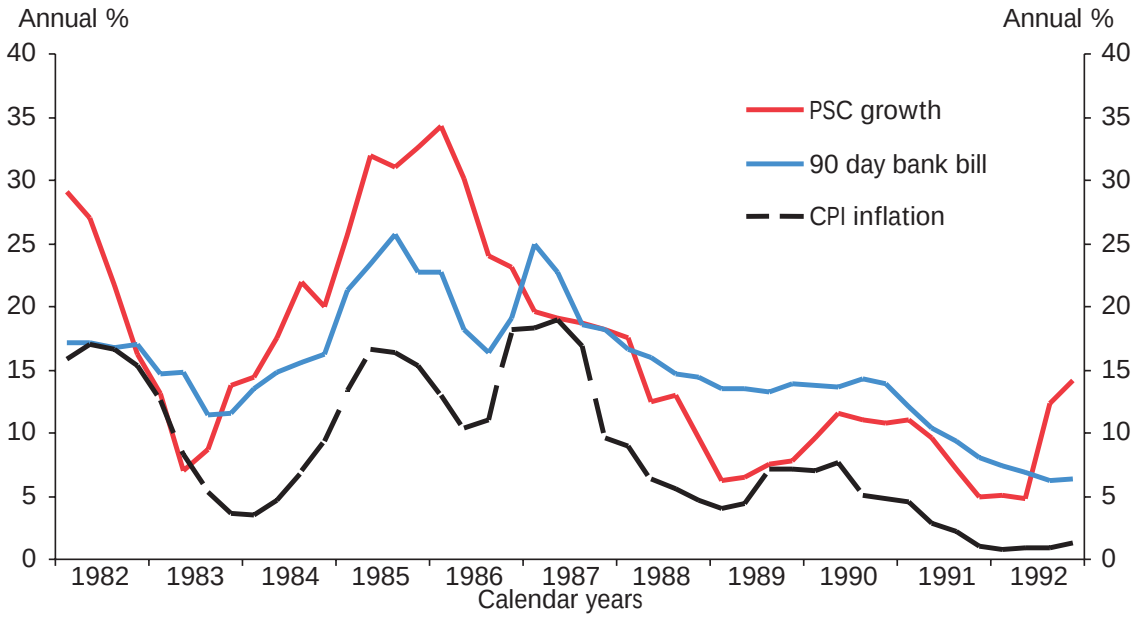
In financial markets, adverse selection results from an ex-ante information asymmetry. Adverse selection occurs when an increase in interest rates leaves only the most risky borrowers in the market for funds. In general, investors have a hard time distinguishing between borrowers that are "good" and "bad" credit risks. When interest rates rise, financial intermediaries are more likely to be lending to high-risk borrowers, because those who are willing to pay high interest rates may, on average, be worse risks. Thus, the interest rate may fail to allocate credit to the projects with the highest expected returns. Consequently, financial intermediaries use additional devices to allocate credit, such as requiring borrowers to put equity into projects that the financial intermediaries are helping to fund. Borrowers who provide more equity for their projects are probably more certain they will be successful, since borrowers *lose* their equity when a project fails (see Leland and Pyle 1977). Equity also lowers the financial intermediaries' losses from default. The key insight regarding adverse selection is that the price mechanism alone (ie interest rates) will not necessarily allocate credit to the borrowers with the best projects.

Moral hazard arises when a borrower engages in activity that reduces the likelihood of a loan being repaid. A common example of moral hazard is fire insurance. Homeowners may exercise less care to prevent fires if they have fire insurance. To get around such problems, financial intermediaries write debt contracts. Such contracts must give borrowers appropriate incentives to provide care or effort, to ensure that the loan is repaid under all reasonable circumstances. The role of financial intermediaries is to monitor these contracts to ensure that the terms of the contracts are honoured. One model that captures these features is Diamond (1984).

Credit rationing

Credit rationing can arise because of adverse selection and moral hazard. There are two types of credit rationing. First, lenders may supply a smaller-sized loan than a borrower demands at the quoted interest rate, as in Jaffee and Russell (1976). Secondly, some borrowers simply do not receive the loans they want, as in Stiglitz and Weiss (1981) and Williamson (1986). Either way, the market does not clear since the demand for loans exceeds the supply of loanable funds at the going interest rate. Credit rationing has important implications for the monetary transmission mechanism, since it implies that there does not exist a one-

Figure 2
Credit growth and short-term interest rates



to-one relationship between interest rates and the extension of credit. If aggregate demand were a function of credit extension, then summarising financial markets using a single short-term interest rate would omit valuable information.

The driving force behind the Stiglitz and Weiss model is the adverse selection problem. In that model a change in interest rates affects the quality of loans and therefore banks' expected returns from loans. Higher interest rates induce firms to undertake projects with lower probabilities of success but higher payoffs when successful. Therefore an increase in interest rates, instigated for example by tighter monetary policy, may lead to a reduction in loan quality, and therefore a greater tendency of banks to ration credit. Thus a tightening of monetary policy will not only reduce the demand for funds, but will also reduce the extension of credit, as banks tighten lending standards in response to adverse selection. It is this latter effect (which in the extreme case may result in a "credit crunch") which is not well captured by macroeconometric forecasting models.

Credit quantities or credit market conditions more generally could also be useful indicators. The information in interest rates, for example, was quite different from that in financial market quantities following the deregulation of the New Zealand financial system in the mid-1980s. Financial deregulation resulted in heightened competition for lending opportunities and significantly *lowered* credit standards. As a result, credit growth was extremely high, even taking into consideration the high inflation rates and the high interest rates that prevailed over this period. The result was a very large increase in the supply of credit – notwithstanding that interest rates over the same period were increased substantially in order to bring down inflation (see figure 2). A surge in asset (real estate and share) prices provided borrowers with collateral against which to borrow. Eventually, however, the effect of the high interest rates prevailed. Cash flows proved insufficient to service debts and the "bubble" imploded. The subsequent stresses within the banking system caused a tightening of lending standards. Credit, which until then had been extended quite freely, became more difficult to obtain, as banks attempted to rationalise their asset portfolios. Tightening of lending standards by banks may have contributed to the recession in New Zealand over the subsequent years.

Of course, without formal econometric models to back it up, one might contest the view that the credit growth of the mid-1980s was peculiarly large. For instance, during this period inflation was particularly high. Without econometric models it is difficult to distinguish the impact of such variables. Notwithstanding this, there is a wealth of anecdotal evidence that supports the view that credit markets were behaving in an atypical manner. In a subsequent *Bulletin* article, econometric models will be developed that examine the

behaviour of money and credit aggregates, though the emphasis will be on the most recent decade.

Recent economic developments in Japan also illustrate that interest rates can provide an incomplete picture. Nominal interest rates are remarkably low (indeed the policy interest rate is effectively zero) yet there is no corresponding surge in credit extension. One possible explanation is that investors may have expectations of *disinflation*, which would mean that real interest rates may actually be larger than the observed nominal interest rates. However, it seems likely that issues of loan quality, at least in recent years, have affected the extension of credit. To assess the state of the economy correctly, it is therefore important that policymakers consider both quantities and prices, or financial market conditions more generally.

In summary, the Modigliani-Miller theorem is unlikely to hold in practice because of information asymmetries. Banks and other financial intermediaries exist because they help resolve these problems. Moreover, information asymmetries mean that loan markets will not always clear. These considerations suggest that, at least theoretically, conditions in financial and credit markets *can* affect the real economy in ways not fully captured by financial market prices.

4 The credit channel

We now discuss the credit channel as it is currently characterised in the literature. Generally, there are two views about how credit markets influence the transmission of monetary shocks. The *bank lending* channel focuses on the possible effect of monetary policy on the supply of loans by depository institutions. The *balance sheet* channel focuses on the potential feedback between monetary policy and borrowers' balance sheets and income statements, including net worth, cash flow, and liquid assets. These variables are posited to be important signals of creditworthiness. As such, deterioration in these variables impinges on firms' ability to obtain finance.

The lending channel

The bank lending channel focuses on the ability of monetary policy to influence the *supply* of intermediated credit (specifically loans by banks).[7] Banks assume this central role because they are the dominant source of intermediated credit in many countries. The bank lending channel may play an important role in the economy if bank loans are not perfect substitutes for other types of credit, or if banks ration credit. For example, some borrowers do not have access to securities markets, implying imperfect substitution between the two markets. In this case, macroeconometric forecasting models may need to take account of both the price (rate of interest) of bank loans and the price of other forms of credit (eg corporate securities), because the two prices need not move together.[8] In principle, one might wish to consider the whole interest rate spectrum, across all levels of risk and maturity, though in practice one will inevitably limit the number of interest rates that are actually considered. The literature on the bank lending channel also implies that bank-dependent firms – firms that are reliant on banks as a source of finance – may be disproportionately affected by changes in monetary policy, because of the difficulty they have in accessing alternative sources of finance.[9]

If the supply of bank loans is disturbed, then bank-dependent firms are likely to incur greater costs in meeting their financial needs. For instance they may need to search across more institutions to obtain credit if their usual sources of credit are disrupted. A reduction in the supply of bank credit will thus reduce real activity. For example, during the Asian crisis increased uncertainty meant that Korean importers could

[7] In Bernanke and Blinder (1988) the central bank affects the extension of credit through reserves, and a reserve requirement. Nowadays, of course, most central banks specify the price at which they are prepared to make liquid assets available to banks. Adverse selection provides another reason why monetary policy may affect the extension of credit.

[8] Bernanke and Gertler (1995) observe that the behaviour of interest rate spreads is consistent with both the lending channel described by Bernanke and Blinder (1988) and with the balance sheet channel (discussed in the next section). Since balance sheets will change in response to interest rates it is likely to be difficult, if not impossible, to distinguish the bank lending channel from balance sheet effects. Notwithstanding this difficulty, we – like Bernanke and Gertler (1995) – are confident that the credit channel as a whole does exist.

[9] Gertler and Gilchrist's (1994) work on the United States suggests that smaller firms account for a disproportionately large share of declines in manufacturing. They argue that firm size is a reasonable proxy for access to capital markets. Thus, the empirical evidence is suggestive of the lending channel.

not obtain letters of credit to purchase logs. As a result, sawn logs piled up on New Zealand docks, with no place to go.

The bank credit channel is sometimes criticised on the grounds that many firms have access to securities markets. This implies that such firms are not dependent on banks for finance. Such a criticism is particularly telling in the United States, since US securities markets are deep and well-developed. However, even in the United States the bank lending channel may still be operative, particularly in times of financial stress. For instance, securities markets began to seize up in the wake of the Russian default and LCTM's failure in 1998: not even investment grade bond issuers could find reasonable takers (Greenspan 1999). As a result, firms that would ordinarily access securities markets began to use backup sources of finance, primarily established lines of credit

Figure 3
Corporate interest rates less government interest rates

at commercial banks. Even firms that ordinarily have direct access to capital markets may be bank dependent in times of financial stress. Moreover, many of the US firms that are able to access capital markets – especially the commercial paper market – can only do so if they have credit endorsements from a bank. New Zealand securities markets are by no means as deep as those in the United States, and therefore the bank lending channel is likely to assume even greater importance in New Zealand.

The blow-out in interest rate spreads referred to by Greenspan was also evident in the spread between New Zealand corporate and New Zealand government bonds. Figure 3 indicates that the spread almost doubled between April 1998 and October 1998. Over that period short-term government interest rates clearly provided a very incomplete picture of the distressed state of world financial markets, and thus an incomplete picture of the impact that financial market conditions were likely to have on the real economy.

The balance sheet channel

The second channel, the balance sheet channel, focuses on the links between monetary policy and borrowers' financial positions.[10]

Tight monetary policy directly weakens borrowers' balance sheets, since rising interest rates directly increase interest expenses.[11] When the economy slows (eg in response to an increase in interest rates arising from monetary policy) inventories are likely to accumulate. The increase in inventories must be financed, causing interest expenses to rise even further. Interest expenses are likely to remain high for some time, even after short-term interest rates have started dropping, because of the rise in short-term debt outstanding. Contractionary monetary policy may thus cause firms' balance sheets to deteriorate because it reduces cash flow. This is important because cash flow is a source of funds used by firms to service debt. The effects of the corporate cash squeeze on economic behaviour depend largely on firms' ability to smooth the drop in cash flows by borrowing. Empirical work suggests that cash flows are important signals for financial intermediaries, in making decisions about the extension of credit.[12]

Rising interest rates are also typically associated with declines in asset prices. For instance, an increase in interest rates leads, by definition, to a decline in bond prices. The market value of equity may fall as well, because future earnings are discounted at a higher interest rate. A reduction in asset

[10] The following discussion focuses on firms, but the arguments apply equally to financial intermediaries and households. For example, credit market frictions would also affect borrowing and spending decisions by households, particularly spending on costly durable items such as automobiles and houses.

[11] The rise in borrowers' interest expenses represents a redistribution from borrowers to lenders. Such a redistribution can affect real activity if, for example, lenders and borrowers do not have access to the same investment and spending opportunities.

[12] See Alexander (1993) and Harvey (1989).

prices also reduces the value of collateral. In these circumstances, loans may not be rolled over upon maturity, or may even be prematurely recalled. As a result, firms may be forced to use up cash to meet their obligations. When they run short of cash they may be forced to raise additional funds by selling assets. This can lead to fire sales, depressing asset prices further.

These effects will reduce net worth, the difference between borrowers' assets (what they own) and their liabilities (what they owe). Lower net worth means that lenders have less collateral to pledge against their loans, and so banks' potential losses from adverse selection are higher. Lower net worth also increases the moral hazard problem because owners will have a lower equity stake in their firms, giving them more incentive to engage in risky investment projects.

5 Incorporating the credit channel into macroeconomic models

Before we begin to discuss *how* the credit channel is proxied in macroeconomic models, we first discuss why the credit channel typically has *not* been incorporated into macroeconomic models. We believe that this omission has occurred for both theoretical and empirical reasons. We then briefly touch on some of the informal and ad hoc mechanisms that are used to "capture" credit channel effects. Lastly, we highlight areas that need to be developed further, if formal models of the credit channel are to be applied to New Zealand.

Central bankers and academic economists have long appreciated the importance of financial market conditions for the macroeconomy. For example, in the first volume of *Econometrica* in 1933, Fisher attributed the severity of the Great Depression, in part, to the heavy indebtedness of firms and households. As the price level fell during the early 1930s the real value of debts increased, setting off a wave of corporate and household bankruptcies. These bankruptcies exacerbated the downturn in economic activity. These kinds of effects have not yet been fully (or perhaps consistently) incorporated into macroeconometric forecasting models.

Although a number of economists followed on from the insights of Fisher, showing that financial market conditions may have real effects (eg Gurley and Shaw 1955), for the most part mainstream economic thought left Fisher's explanation of business cycles by the wayside. In part, this abeyance arose because of Modigliani and Miller's demonstration that (under certain assumptions) decisions regarding the source of finance were irrelevant to the determination of real activity. This encouraged economists to abstract from consideration of credit market conditions. Both monetarist and Keynesian economic theory further reinforced this abstraction. Monetarist theory, in particular Friedman and Schwartz's (1963) influential history of the American financial system, led to an emphasis on money but not credit. Keynes' (1936) discussion of liquidity preference also led economists to concentrate on the interaction of money supply and money demand as the determinants of the interest rate. Ignoring credit markets could also be justified by invoking Walras' law, which says that if *n-1* markets are in equilibrium – in a world with *n* markets – then the last market must also be in equilibrium. The credit market has typically been treated as this last market. By definition then, the credit market was assumed to be in equilibrium, with the price of credit (interest rates) set such that the demand for credit equalled the supply of credit.

The credit market channel also lacked convincing micro-foundations (built up from models of individual behaviour), in sharp contrast to the Modigliani-Miller theorem. Modelling market imperfections and establishing the implications of imperfect information is extremely difficult. Consequently, it was not until the 1970s that convincing foundations began to be developed that posited an important role for credit market frictions. Although the role of credit markets in the business cycle was not entirely ignored during this period, it would be fair to say that it did not feature prominently in the economics literature as a whole.[13] More recently, however, analyses of credit markets have re-entered mainstream economic thought.

Macroeconometric forecasting models do make some attempt to incorporate credit channel effects. However, such effects tend to be incorporated into models in various, rather

[13] See for example Minsky (1977).

ad hoc ways. For instance, in the Federal Reserve Board of Governors' FRB/US model constraints are imposed to try to mimic the behaviour of credit-constrained households and firms.[14] Additionally, the investment equation in the FRB/US model is augmented with cash flow.

In the Reserve Bank's Forecasting and Policy System (FPS), the Reserve Bank's model of the New Zealand economy, the stock of household assets and the future path of labour income determine the sustainable, long-run flow of consumption.[15] Credit constraints are a feature of the model to some degree, in that some consumers consume all their current period income. This can be interpreted as a credit constraint where some individuals do not have access to credit markets and are hence unable to smooth consumption by borrowing against their future labour income. Relative price movements lead those agents who are not credit-constrained to adjust their *current* demand for goods and services, relative to their future demand. The description of the *extension* of credit and its relationship to, for instance, asset values does not really feature in the model. In particular, such interactions do not affect the short-run dynamics of investment and consumption.

In recent years a number of models have been developed that try to model the credit channel in a convincing, rigorous manner. For instance, Edwards and Végh (1997) introduce the bank lending channel into a theoretical model of a small open economy with predetermined exchange rates. They analyse how the existence of banks affects the way in which shocks impact on the economy. In particular, they show that the world business cycle and shocks to the banking system can affect output and employment through fluctuations in bank credit. An advantage of the Edwards and Végh model is that it explicitly models financial intermediaries and allows for a foreign sector. However, it incorporates only the bank lending channel, and ignores the balance sheet channel. This appears to be an important omission, since work elsewhere suggests that the lending channel *by itself* cannot explain the macroeconomic fluctuations observed following a monetary policy shock (eg Fisher 1999).

Attempts have also been made to incorporate balance sheet effects rigorously in a macroeconomic model. The work of Bernanke, Gertler and Gilchrist (1998) is potentially quite important. In their model, endogenous developments in credit markets propagate and amplify shocks to the economy, which they refer to as a "financial accelerator". The model developed by Bernanke, Gertler and Gilchrist is based on fairly standard mathematical techniques, which should make it accessible to macroeconomists familiar with modern approaches to macroeconometric modelling. Unlike Edwards and Végh's model, Bernanke, Gertler and Gilchrist incorporate balance sheet effects, but they do not explicitly model the banking sector.

Although there are formal models of either the bank lending or balance sheet channels, we believe that these models probably require further development if they are to be used to model the New Zealand economy. In particular, a model of the New Zealand economy should:

- Explicitly model financial intermediaries (banks), in addition to households, producers, and a monetary authority.
- Capture balance sheet effects by making expenditure decisions dependent on net worth.
- Account for the foreign sector, in a floating exchange rate context. Firms, households and financial intermediaries should have access to foreign capital markets.

Together, these three elements provide a direction for future research.

6 Concluding remarks

In this article we have argued that credit market conditions may have important implications for the propagation of monetary policy. The existence of banks and other financial intermediaries indicates that credit market frictions are important. Theoretical models show that, in these circumstances, financial and credit markets may affect the real economy; imperfect information and other frictions in

[14] A discussion of FRB/US can be found in Brayton and Tinsley (1996).

[15] Black et al (1997) discuss the Forecasting and Policy System.

credit markets may magnify monetary policy's impact on the cost of borrowing, affecting both real spending and real activity.

By and large, the macroeconometric forecasting models used by central banks do not formally model the credit channel, though they often include wealth or credit constraints in various forms. Since these wealth and credit constraints are not derived from models of individual behaviour, they cannot be considered entirely adequate representations of the credit channel.

Theory has demonstrated that the financial sector may play an important role in the transmission of monetary policy. Notwithstanding the credit literature, the empirical importance of the credit channel is still a matter of some dispute. Nor do we know whether formal models would improve upon the current ad hoc attempts that seek to account for credit effects. Until formal models are developed we are unable to answer such questions.

Perhaps more importantly, a unified model that incorporates the credit channel enables us to treat developments in the credit channel in a consistent fashion over time. Formal models clarify the role of "judgement", and make biases and parameter values explicit. This means that such attributes can be debated; formal models provide a common reference point that can be used to underpin such discussions.

The literature on the credit channel has made great strides in recent years, but significant issues still need to be addressed. To date, much of the credit literature has focused on the United States, which can be adequately modelled as a large, closed economy. This is clearly inappropriate for New Zealand. Consequently, we believe that it is important to imbed the credit channel into a model of a small, open economy with floating exchange rates. Further, we believe that it is important for credit channel models to incorporate the balance sheet channel and model the behaviour of financial intermediaries explicitly.

References

Alexander, P (1993), "Financial information used by bank lenders: an exploratory New Zealand survey." *Working Paper* No. 3/93. Department of Accountancy, University of Canterbury.

Archer D, A Brookes and M Reddell (1999), "A cash rate system for implementing monetary policy," *Reserve Bank of New Zealand Bulletin* 62, 51-61.

Bernanke, B S (1983), "Nonmonetary effects of the financial crisis in the propagation of the Great Depression," *American Economic Review* 73, 257-76.

Bernanke, B S and A S Blinder (1988), "Credit, money, and aggregate demand," *American Economic Review* 78, 435-9.

Bernanke, B S and M Gertler (1995), "Inside the black box: the credit channel of monetary policy propagation," *Journal of Economic Perspectives* 9, 27-48.

Bernanke, B S, M Gertler and S Gilchrist (1998), "The financial accelerator in a quantitative business cycle framework," *NBER Working Paper* No. 6455.

Black, R, V Cassino, A Drew, E Hansen, B Hunt, D Rose and A Scott (1997), "The Forecasting and Policy System: the core model," *Reserve Bank of New Zealand Research Paper* No. 43.

Brayton, F and P Tinsley (1996), "A guide to FRB/US: a macroeconomic model of the United States," Board of Governors of the Federal Reserve System, *Finance and Economics Discussion Series* No. 96-42.

Diamond D W (1984), "Financial intermediation and delegated monitoring," *Review of Economic Studies* 51, 393-414.

Diamond, D W and P H Dybvig, (1983), "Bank runs, deposit insurance, and liquidity," *Journal of Political Economy* 91, 401-19.

Edwards, S and C A Végh (1997), "Banks and macroeconomic disturbances under predetermined exchange rates," *Journal of Monetary Economics* 40, 239-78.

Fisher, I (1933), "The debt-deflation theory of great depressions," *Econometrica* 1, 337-357.

Fisher, J D M (1999), "Credit market imperfections and the heterogeneous response of firms to monetary shocks," *Journal of Money, Credit, and Banking* 31, 187-211.

Friedman, M and A J Schwartz (1963), *A Monetary History of the United States, 1867-1960*. Princeton: Princeton University Press.

Gertler, M and S Gilchrist (1994), "Monetary policy, business cycles, and the behavior of small manufacturing firms," *Quarterly Journal of Economics* 109, 309-40.

Greenspan, A (1998), "Private-sector refinancing of the large hedge fund, long-term capital management," *Testimony of Chairman Alan Greenspan before the Committee on Banking and Financial Services, US House of Representatives,* October.

Greenspan, A (1999), "Lessons from the global crises," Remarks before the World Bank Group and International Monetary Fund, Program of Seminars, Washington DC.

Gurley, J and E Shaw (1955), "Financial aspects of economic development," *American Economic Review* 45, 515-38.

Harvey D (1989), "Investment and financing decisions within business: the search for descriptive reality," *Discussion Paper* No. 82. Department of Accountancy, Massey University.

Jaffee, D M and T Russell (1976), "Imperfect information, uncertainty, and credit rationing," *Quarterly Journal of Economics* 90, 651-66.

Keynes, J M (1936), *The General Theory of Employment, Interest and Money*. London: Macmillan and Co Ltd.

Leland, H E and D H Pyle (1977), "Informational asymmetries, financial structure, and financial intermediation," *Journal of Finance* 32, 371-87.

Minsky H P (1977), "A theory of systematic fragility," In E I Altman and A W Sametz eds, *Financial Crises,* New York: Wiley.

Modigliani, F and M H Miller (1958), "The cost of capital, corporation finance and the theory of investment," *American Economic Review* 48, 268-97.

Orr, A, A Scott and B White (1998), "The exchange rate and inflation targeting," *Reserve Bank of New Zealand Bulletin* 61, 183-91.

Stiglitz, J E and A Weiss (1981), "Credit rationing in markets with imperfect information," *American Economic Review* 71, 393-410.

Taylor, J (1995), "The monetary propagation mechanism: an empirical framework," *Journal of Economic Perspectives* 9, 11-26.

Williamson, S D (1986), "Costly monitoring, financial intermediation, and equilibrium credit rationing," *Journal of Monetary Economics* 18, 159-79.