
Credit channel effects in the monetary transmission mechanism

By Simon Hall of the Bank's International Finance Division.

Economic models often assume that the impact on the wider economy of changes in financial conditions can be summarised by a relatively limited range of financial variables, such as risk-free interest rates and long-term government bond rates. But changes in financial conditions can at times have important effects, which these variables do not necessarily indicate. This article reviews so-called 'credit channel' models, which consider how changes in the financial positions of lenders and borrowers can affect spending in the economy. These models provide a useful framework for analysing some potentially important interactions between the monetary stability and financial stability objectives of central banks. Subsequent articles in this Bulletin use a specific 'credit channel' model to illustrate the potential for these interactions in the UK corporate and household sectors.

Introduction

Economic models often assume for simplicity that the impact on the wider economy of changes in financial conditions can be summarised by a relatively limited set of financial variables, such as short-term risk-free interest rates and long-term government bond rates. However, financial developments can, at times, have important effects on the economy, which these variables would not necessarily indicate. For example, following the suspension of debt payments by Russia in the summer of 1998 and the emergence shortly afterwards of problems at the hedge fund Long Term Capital Management (LTCM), interest rates on corporate debt rose relative to rates on government debt, and a number of central banks reduced official interest rates to mitigate possible effects on spending in the wider economy. In practice, policy-makers take account of a wide range of information on conditions in financial markets to monitor, and potentially respond to, these sorts of developments.⁽¹⁾

This article reviews so-called 'credit channel' models, which consider explicitly how changes in financial conditions can affect monetary policy. These models provide a useful framework for analysing and simulating some potential important interactions and feedbacks between the monetary stability and financial stability objectives of central banks. In particular, these models

suggest that fluctuations over time in the financial position of lenders and borrowers—financial stability considerations—can influence how official interest rate changes affect spending and inflation—monetary stability considerations. The article concludes by reviewing a specific 'credit channel' model, developed by Bernanke, Gertler and Gilchrist (1999). The following two articles in this *Bulletin*⁽²⁾ use this model to show how credit channel effects may affect spending in the UK corporate and household sectors.

The pecking order of finance

Much of mainstream macroeconomic theory is based on the simplifying assumption that financial structure—particularly the composition of companies' and households' balance sheets—is irrelevant to spending behaviour. Under this approach, borrowers are indifferent between alternative sources of finance. Firms face the same cost of financing investment spending whether they use retained internal funds, bank borrowing or equity finance. And consumers are indifferent between spending out of current income and borrowing against future income. In this world, spending decisions depend on factors such as tastes and production technologies, with financing responding passively in the background. In addition, policy-makers can monitor financial conditions by looking at a relatively narrow range of indicators, such as

(1) Developments in financial indicators are discussed in detail in the Bank's *Financial Stability Review* and in the 'Money and asset prices' section of the *Inflation Report*.

(2) See Hall, 'Financial effects on corporate investment in UK business cycles' on pages 449–59, and Aoki, Proudman and Vlieghe, 'Why house prices matter', on pages 460–68.

short-term risk-free interest rates and long-term bond rates.

This irrelevance of finance to other economic decisions relies on some strong assumptions. In particular, capital markets must function in a frictionless way. To do so, lenders and borrowers need to have the same information about the risks and returns to lending. Borrowers must face no search costs in finding suitable lenders and no transactions costs in writing financial contacts. And there must be no concerns about corporate control, and no tax advantages favouring particular sources of finance.

These assumptions do not generally hold in actual financial markets and borrowers do seem to care about their source of finance. In practice households and companies often spend out of their own income before borrowing. For example, retained internal funds accounted for about half of all new corporate financing in the 1990s.⁽¹⁾ In terms of external finance flows, equity issuance has grown to be the largest source of overall UK corporate external financing in recent years, partly as a result of a number of large equity-financed mergers and acquisitions. But for many individuals and smaller firms, bank loans remain the most important source of external finance. For example, in 1997–99 bank borrowing represented around 60% of all external finance for small firms.⁽²⁾

These preferences for retained incomes and/or bank borrowing mean that changes in the relative cost and/or the availability of these sources of finance can have distinct economic effects. The next section considers possible explanations for these preferences. The subsequent section shows how these in turn provide the economic foundations for macroeconomic credit channel models.

Preferences for internal finance and for bank loans

One reason why borrowers may prefer to use internal funds rather than external finance might be to avoid external scrutiny, and possible intervention, in their financial affairs. This may be particularly important for small companies concerned that resort to external finance might constrain their management control over

their business, for example if loans include restrictive covenant clauses.⁽³⁾

In addition, borrowers often face search and transactions costs in obtaining external finance, which they do not incur when using internal funds. Banks may be the preferred source of external finance because they are able to save on these costs. Borrowers can often meet their total financing requirement from a single bank and through a unique loan contract rather than having to use a number of different sources.

Banks can also help to match the preferences of borrowers to those of lenders. These preferences often differ. Typically borrowers want to borrow long term with the option to default if they are unable to repay. By contrast, lenders (depositors in the case of banks) often prefer to hold their funds in an easily accessible and safe form. Without an intermediary, borrowers might need to refinance frequently, incurring search and transactions costs, and might have to pay substantial premia to lenders to cover default risk. An intermediary can use insurance principles to diversify risk across its entire loan book and can pool its short-term deposits to match the long-term maturity of its assets.

However, much of the economic literature on financial intermediation has focused on potential costs arising when lenders have imperfect information and are unable to observe and monitor perfectly the behaviour of borrowers. So-called ‘agency costs’ arise when lenders (‘principals’) are unable to ensure that borrowers (‘agents’) act in the lenders’ best interests. For example, if lenders are unable to observe directly the riskiness of borrowers and raise the cost of borrowing to compensate for potential default costs, they may attract higher-risk borrowers. Another possibility is that lenders cannot monitor the use of borrowed funds. Contrary to the wishes of lenders, highly indebted borrowers with limited liability may have an incentive to take more risks, raising the probability of default. Finally, lenders might face substantial costs in observing the true ability of borrowers to repay loans on maturity. Borrowers may have an incentive to understate the success of investment projects financed with external funds unless they expect that lenders will check on the actual outcome. If borrowers obtain funds from many different lenders, there may be either duplication of

(1) For a review of the role of corporate cash flow in investment, see Hubbard (1997). For a discussion of the influences of liquidity constraints on consumption, see Deaton (1994).

(2) These figures are based on a survey of UK small and medium-sized enterprises by the ESRC Centre for Business Research, Cambridge; see Cosh and Hughes (2000).

(3) Jensen and Meckling (1976) discuss the relationship between financial structure and corporate control.

monitoring costs and/or free-riding or insufficient monitoring.

In the absence of financial intermediaries, these potential agency costs could raise external finance charges above levels that would prevail in capital markets that have no informational problems, and might even lead to certain borrowers being denied funds completely.⁽¹⁾ Banks may have a comparative advantage in alleviating some of these potential costs. They typically have a stock of experience in screening and monitoring loans.⁽²⁾ They may also have specialist knowledge about borrowers' behaviour through their direct access to borrowers' deposit histories and/or ongoing customer relationships.⁽³⁾ But although banks may be able to reduce agency costs below levels in markets for direct (unintermediated) finance, it is unlikely that they will be able to reduce them to the extent that bank borrowing is as cheap to the firm or household as using their own funds.

Overall it seems likely that external finance will generally be more costly than internal funds, particularly where there are substantial transactions or agency costs. Financial intermediaries may be able to save borrowers some of these costs. That may make bank finance an important source of funds for borrowers who are particularly subject to these costs. For large firms, the fixed transactions costs of direct finance may be small relative to their overall financing needs and informational costs may be reduced by established reputations, bond ratings and published annual reports. But direct finance may be much more costly for individuals, small firms or first-time borrowers. These borrowers are likely to be more dependent on the cost-saving functions of banks, allowing a wedge (or spread) to develop between the costs they face for bank and direct finance. So any shock to banks' ability to lend may affect the cost of finance for these borrowers.

Implications for finance supply

Lenders are likely to adopt a variety of strategies to deal with potential agency costs in credit markets. Measures to improve information flows are likely to be particularly important. In traded debt and equity markets, borrowers have an incentive to disseminate information about their

prospects and cultivate reputations as reliable borrowers. Bank customers may not be able to provide such explicit information, or offer similar track records as careful borrowers. So banks will seek to develop their own expertise in assessing loan applications, for example by developing systems and models for evaluating and tracking risk.

Lenders may also look for signals about the riskiness of loans to borrowers and the potential for agency costs to arise. Lenders might use borrowers' own contributions to their finance needs (such as retained income, posted collateral, or, for consumers, the deposit on a house) as a signal of borrowers' likely incentives to act diligently and report project outcomes truthfully. Borrowers who are willing and able to meet a substantial share of their overall finance needs or post a large amount of collateral to back loans may be considered as better credit risks since they have more to lose by failing to repay loans. By contrast, borrowers who make little contribution to their financing from their own resources may have less well-defined incentives to avoid risk-taking and to ensure that loans are repaid.

Figure 1 illustrates how these effects might affect the cost and availability of external funds to borrowers.⁽⁴⁾ For financing needs up to F , a borrower can use internal finance at an opportunity cost of r_1 (which can be thought of as the sum of the economy-wide risk-free rate and a borrower-specific risk factor). If there were no informational problems, the borrower would demand $I_1 - F$ of external funds at an interest rate of r_1 . But for financing needs beyond F , the lender is not prepared to supply funds at this rate due to the expected impact of agency costs on returns. External borrowing is charged at a premium. This premium increases as the share of total external finance rises, as higher borrowing linked with limited liability potentially increases incentives to take risks and raises expected default rates. As a result, lenders require more compensation and so S_1 is upward-sloping beyond F . The equilibrium level of external finance is $I_1' - F$ charged at r_1' , with a premium (or spread) of $r_1' - r_1$. This external finance premium may also increase as interest rates rise as this may lower the present discounted value of collateral and/or reduce current cash flow, raising the probability of default. So if interest

(1) Models with quantitative credit rationing include Jaffee and Russell (1976) and Stiglitz and Weiss (1981).

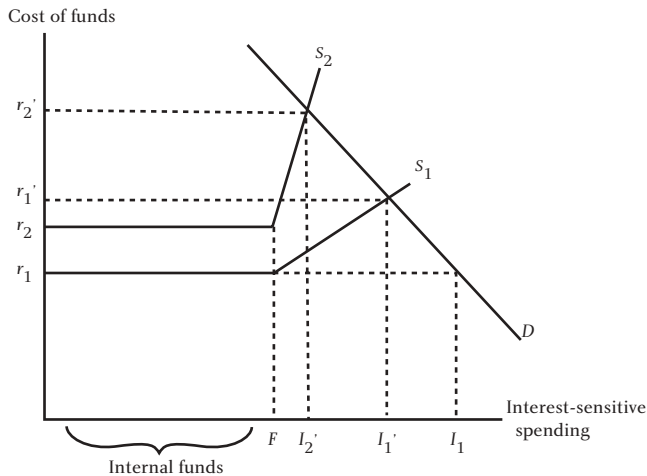
(2) Diamond (1984) suggests that financial intermediaries may have a role in economising on these monitoring costs by acting like an auditor hired by the ultimate lenders.

(3) As suggested by Fama (1985) and Leland and Pyle (1977).

(4) This example is based on Oliner and Rudebusch (1996).

rates rise to r_2 , the finance supply schedule may become S_2 , which is steeper than S_1 .⁽¹⁾

Figure 1
Financial conditions and the marginal cost of finance



This simple example illustrates potential links between borrower financial positions, agency costs and the cost of external finance. These links imply that firms that are prepared to post more 'collateral' per unit of external finance or to finance a greater proportion of an investment project from internal cash flow are likely to face a lower external finance premium. These mechanisms open up potential channels for the cost and/or the availability of finance to depend on borrower-specific financial positions.

Macroeconomic models of the credit channel

The credit channel literature discusses two distinct (but complementary) ways that financial market imperfections might affect the wider economy. The *bank lending channel* focuses on the impact of shocks to banks' balance sheets on the cost and/or availability of finance for borrowers who depend on these banks as lenders. Under the *balance sheet channel* it is the balance sheet of borrowers, rather than lenders, which matters for finance costs.

Bank lending channel

The bank lending channel describes how monetary (or other) shocks to banks' balance sheets might affect the cost of finance for certain borrowers over and above the

standard impact on finance costs of higher official interest rates.⁽²⁾ This channel may be potentially significant if increases in interest rates lead to a reduction in the supply of bank loans and if these loans are imperfect substitutes for other forms of finance.

Following a monetary tightening, banks may find that their ability to obtain external funds to fund lending, such as deposits (or traded liabilities like certificates of deposit), declines. This might happen, for example, if banks face the same restrictions on raising external finance as other firms, as described above. If banks cannot adjust their balance sheets simply by reducing holdings of short-term assets (such as government debt), this might restrict their ability to extend new loans.

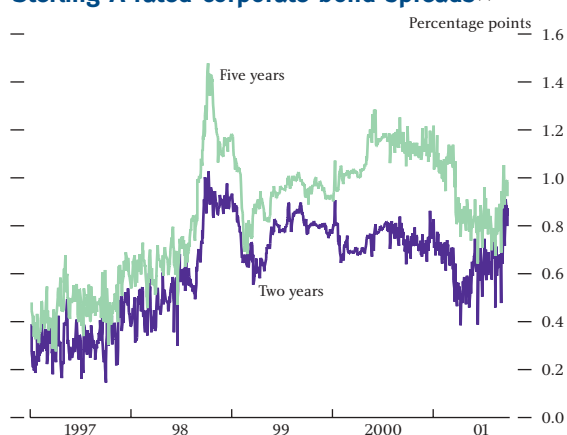
Highly creditworthy borrowers—such as large firms—may be able to substitute readily other forms of finance for bank funds. For them the change in finance costs following the monetary tightening is the same regardless of their source of finance, and can be summarised by changes in risk-free interest rates. But other borrowers—such as small firms and individuals—may be unable to switch readily from banks to alternative finance sources. It is possible that the cost of bank loans for these borrowers may overshoot changes in market interest rates as they compete for a smaller pool of bank loans.⁽³⁾ This may be associated with a rise in the actual price or spread demanded on the loan and/or a tightening in non-price conditions (such as covenants or collateral requirements). In addition, the quantity of credit may become (more) rationed, although this is not a strictly necessary component of the bank lending channel.

The resultant tightening in loan supply under the bank lending channel is often termed a '*credit crunch*'. What matters in a '*credit crunch*' is that changes in official interest rates no longer summarise changes in the cost of finance for certain borrowers. The credit channel effect here can be thought of as the additional adjustment in spending arising from the differential movement of bank loan rates to official rates (or from changes in the degree of quantitative loan rationing). For borrowers affected by a '*credit crunch*', loan spreads and quantities of lending will be important indicators of the cost and/or availability of finance.

- (1) The supply curve may eventually become vertical as the impact on returns of incentive and sorting effects becomes unacceptable to lenders. This is the limit case of quantity rationing suggested by Stiglitz and Weiss (1981).
- (2) There is no reason here in principle to focus exclusively on the impact on finance supply of shocks to balance sheets of deposit-taking institutions. If shocks inhibit the ability of any finance supplier whose funds are imperfectly substitutable for some class of borrowers, then there could be credit effects.
- (3) Of course, it is possible that lenders may be concerned that higher loan rates could damage the quality of their existing loan portfolios by raising default rates. In this case, loan rates for current borrowers may be sticky, with price or quantitative restrictions on loans more apparent for new borrowers.

Non-monetary shocks might also lead to changes in bank loan supply. Lending capacity might be reduced by shocks to the financial health of the banking sector. For example, loan losses or a fall in bank equity prices might reduce bank capital. Alternatively, changes in prudential regulation might reduce bank capital adequacy and banks may not be able easily to replenish capital—as in Figure 1 above, they too may face an upward-sloping supply curve for new external finance. When bank lending (and the activity of bank-dependent borrowers) is constrained by the availability of economic or regulatory capital, this is often termed a ‘*capital crunch*’. Finally, banks’ (or other lenders’) risk appetites and their desire for liquidity on their balance sheet may occasionally change markedly—bank willingness (rather than capacity) to lend to borrowers of unchanged risk falls. This was evident in the autumn of 1998 following the Russian debt default and the problems at the hedge fund LTCM when markets’ perception of risk appeared to change sharply, leading to an increased demand for liquidity and a marked widening in credit spreads (see Chart 1)—a ‘*market credit crunch*’.

Chart 1
Sterling A-rated corporate bond spreads^(a)



(a) Derived from Bloomberg par yields for A-rated sterling-denominated corporate bonds and UK government bond par yields.

Sporadic or continuous?

Critics of the bank lending channel have argued that monetary shocks are unlikely to have a significant incremental impact on bank loan supply in countries with well-functioning financial systems. They point to the easy access banks have to sources of liquidity and the absence in general of binding regulatory constraints on bank reserves or capital. A credit or capital crunch is

perhaps more likely to matter in less developed financial markets when a substantial proportion of loans is intermediated by small and/or poorly capitalised banks with limited buffer stocks of liquid securities. In addition, bank lending channel effects may arise from episodic non-monetary shocks rather than be a continuous feature of the monetary transmission mechanism. For example, experience suggests that bank lending channel effects have been important following changes in regulatory requirements (as in Japan following the introduction of Basle capital requirements); when substantial loan losses (as in the Latin American lending crisis in the 1980s) have reduced or eliminated banks’ buffers of excess capital over regulatory requirements; or when there has been a large shift in actual or perceived default risk on bank portfolios (for example, following the Russian debt default).⁽¹⁾ Even if these effects have been infrequent, this potential for substantial spillovers from financial instability to the real economy highlights the need for careful monitoring of banking system health and lending behaviour.

The balance sheet channel

As noted earlier, although banks can reduce some of the costs involved in raising external finance, external funds tend to be more expensive than internal funds, reflecting an external finance premium. As outlined above, informational costs in the supply of external finance, and this premium, may vary with borrower financial positions. The *balance sheet channel* describes how the financial health of borrowers can affect finance supply and cause and/or amplify shocks to economy-wide spending.⁽²⁾

The balance sheet channel operates by generating changes in agency costs and the external finance premium as borrower financial positions change in response to economic shocks. In practice there are a number of ways of modelling interactions between financial positions and finance costs.⁽³⁾ Here we focus on a representative approach adopted by Bernanke, Gertler and Gilchrist (BGG) (1999). This model forms the basis of the analyses of potential balance sheet credit channel effects in the UK corporate and household sectors in the following two articles in this *Bulletin*.

(1) Of course, these shocks may or may not ultimately derive indirectly from monetary policy impulses. For example, increases in official interest rates might weaken bank balance sheets by reducing bank equity prices or by raising the risk associated with bank loan portfolios.
 (2) The distinction between the bank lending and balance sheet channels is in some ways artificial. In principle, the balance sheet channel can affect any recipient of external finance, be it final borrowers or banks.
 (3) Examples include Kiyotaki and Moore (1997) and Carlstrom and Fuerst (1997).

The BGG financial accelerator model is, in most respects, a standard macroeconomic model. However, the model differs by including an imperfect information problem in the supply of external finance to the corporate sector.⁽¹⁾ Specifically, BGG assume that lenders face costs in observing the outcome of borrowers' investment projects. As a result, lenders charge borrowers a premium to cover their expected monitoring costs. A key innovation in the model is that corporate net worth—firms' financial positions—determines this external finance premium. In standard models, without financial accelerator effects, firms would increase their capital stock until the expected return on capital was equal to the firm's own opportunity cost of funds. However, in this model when a substantial portion of corporate investment is funded internally (ie borrowing and capital gearing are low), the external finance premium is small (tending to zero for investment that is fully internally funded or collateralised), raising investment. When corporate investment is mainly funded through external borrowing (ie capital gearing is high), the premium is high, depressing investment. The intuition for this is that corporate net worth represents borrowers' own stake in an investment project and serves as a signal to lenders of borrowers' likely incentive to default on loans. For lenders to offer funds to borrowers they require a premium sufficient to offset the greater likelihood that the borrower will default (and the lender will incur default/monitoring costs) when the borrower's stake in a project is low.

This added element provides for greater amplitude and persistence in the economy's response to shocks, and for inter-relationships between spending behaviour and financial positions that are not available in standard models. For example, the model offers two key additional monetary transmission mechanisms. First, there is a role for corporate cash flow. An unexpected rise in interest rates (or a fall in productivity) reduces output, lowers cash flow and raises the proportion of a given investment project that must be financed from external funds. This increases expected agency costs and the external finance premium, reducing investment and subsequent output, revenue and cash flow. Second, asset prices play an active role in transmitting shocks through their impact on the value of collateral. An unanticipated monetary tightening reduces the demand for physical capital and lowers asset prices. This reduces the value of collateral available to back loans, raises the external finance premium and reduces current investment and

subsequent output and cash flow. And expectations of future declines in cash flow and investment exacerbate current movements in (forward-looking) asset prices.

In addition, the initial financial position of the corporate sector becomes critical in determining the response of corporate net worth, the cost of finance and investment to economic shocks. For a highly-g geared corporate sector, a shock to project returns will have a far more marked impact on internal cash flow (and external finance premia) than in a corporate sector with low levels of borrowing. The BGG model therefore provides theoretical grounding for the intuition that more heavily indebted economies tend to be more vulnerable to adverse shocks. It also suggests that the strength of credit effects may vary over time as financial positions fluctuate over the course of the business cycle.

Conclusions

This article has reviewed potential theoretical explanations for two features of finance provision—the apparent preference by many borrowers to finance spending using own funds, and for many of those who do borrow, to rely on bank rather than capital market finance. These so-called 'credit channel' models help to explain why borrowers' financial positions might affect their spending, and why shocks to banks can have a marked impact on borrowers that are particularly dependent on bank finance. As such, these models illustrate some important interactions between the monetary and financial stability objectives of central banks and highlight the need for policy-makers to monitor a wide range of financial indicators.

In practice, banking system distress and significant disruptions to bank loan supply are relatively rare in developed banking sectors, as in the United Kingdom. As such, bank lending credit channel effects may be relatively infrequent. Balance sheet credit channel effects probably play a more continuous role in the economy, but they too will likely vary in strength over time, reflecting structural changes in the financial system and cyclical fluctuations in borrower financial health. This article focuses on a representative model of balance sheet effects by Bernanke, Gertler and Gilchrist (1999). The following two articles in this *Bulletin* use the framework of this model to show how credit channel effects may affect spending in the UK corporate and household sectors.

(1) In the article by Aoki *et al* (see pages 460–68), this information problem in the supply of finance is analysed for the household sector.

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