The changing nature of financial intermediation and its implications for monetary policy

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Introduction

Monetary policy influences the economy through its effects on credit conditions facing households and firms, for example, the interest rates available on bank deposits and bank loans, and the cost of capital for firms, be it in the form of bank credit, debt issued on the capital market, or equity. While it is convenient for analytical purposes to assume that the monetary authority controls the relevant credit conditions directly through its control of a short-term policy interest rate, this simplification leaves no role for a banking system or for financial intermediation more generally. It thus precludes an analysis of how changes in the nature of financial intermediation may impact the conduct of monetary policy.

This paper builds on a relatively recent but growing literature which puts financial intermediation and financial intermediaries back into macroeconomic models and attempts to draw some conclusions about how central bank policy may need to adjust to accommodate changes in the structure of financial intermediation. It starts by documenting the evolution of financial intermediaries and financial intermediation as observed mainly in developed economies, although arguably this will become a feature of emerging-market and developing economies as well. It is suggested that the traditional distinction between bank-based and market-based financial systems is becoming outdated and should be replaced by a distinction between relationship-based and arm's length interaction between borrowers and lenders. Developments also suggest that markets are becoming more complete and that risk management and distribution by both institutions and households is becoming more efficient.

Implications of these developments for monetary policy are discussed in Sections 2 and 3. In the former it is briefly pointed out that central bank operating procedures will be made more flexible as financial markets develop, allowing central banks that are currently still constrained to using direct instruments of monetary control to switch to more efficient indirect policy instruments.

Section 3 discusses the implications for a central bank's interest rate policy. It is argued that changes in the nature of financial intermediation may alter the neutral interest rate a central bank should aim for as well as the horizon at which it seeks to achieve the inflation target. Furthermore, a case can be made that movements in asset prices and balance sheet aggregates may provide information that is useful for setting monetary policy.

1. Transformation of financial intermediation

1.1 What do financial intermediaries do?

The simplest view of financial intermediation is that it serves to transfer financial resources from net savers in an economy to net investors. While it is of course true that this is an

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important function of financial intermediaries, this description suggests a far too limited role for intermediation in financial markets, since it emphasises only net financial flows. A more complete picture would reveal that net savers in an economy are often both sources and recipients of funds from intermediaries and likewise for net investors. The same household will typically have deposits with a bank or mutual fund while at the same time holding a significant mortgage liability. Similarly a firm may be issuing equity shares or commercial paper to finance its operations, even as it has substantial financial asset holdings through an internally managed pension fund. The recent growth in securitisation has also led to the emergence of financial institutions that intermediate between other financial intermediaries. In an international context current account positions and net international investment positions of economies are often dwarfed by gross financial flows and gross claims and debts, again an illustration of a wider role of financial intermediation than matching only excess demands and excess supplies of funds.

One aspect of the value-added of a financial intermediary is that it transforms assets in several dimensions; in terms of size when it combines small denomination deposits into large loans, in terms of credit quality when it adds its name to portfolios of loans to make them more readily acceptable to investors, in terms of maturity by accepting short-term liabilities as counterparts to long-term loans, and in terms of currency composition when it borrows abroad in foreign currency and extends domestic-currency loans. Each of these transformations will of course entail its own specific risk – liquidity risk, credit risk, interest risk, or currency risk – and the intermediary will have to manage these risks.

One strand of the literature on financial intermediation has devoted considerable attention to the question of why financial intermediation is carried out indirectly by specific institutions rather than directly by corresponding markets. At the most general level the answer lies in differential transaction costs between the two modes of intermediation. More specifically, asymmetric information between borrowers and lenders is often invoked as a reason for the emergence of specialised intermediation institutions. This asymmetric information can potentially lead to adverse selection and moral hazard problems which require screening of borrowers, preventing opportunistic behaviour, as well as verification of the outcome of projects for which a loan has been extended. Significant economies of scale in these monitoring functions can explain the existence of specialist lending institutions. Furthermore, economies of scope between deposit taking and lending activities can explain the emergence of traditional banks.

In light of this brief description, changes in the financial intermediation landscape can be due to the introduction of both new institutions and new instruments. The underlying causes of such changes can be traced to changes in legislation, technological developments, theoretical developments, and even the choice of monetary policy strategy itself. Examples of legislation-driven financial liberalisation include relieving banks from the obligation to lend to “priority” sectors, allowing foreign financial institutions to operate in the economy, extending the range of instruments in which insurance companies may invest, etc. Improvements in information technology and theoretical advances in asset pricing have led to the invention of a vast number of new financial instruments and their use in investment strategies and risk management. This in turn has permitted the transfer of risk with implications for incentives to monitor borrowers, for the dynamics of price adjustments in financial markets, and ultimately for financial and macroeconomic stability, i.e. for outcomes with which central banks are principally concerned. The influence of the choice of monetary policy strategy on the development of financial markets refers to the possibility that the adoption of a particular operating procedure for monetary policy will have a direct influence on the development of financial markets, and it will be discussed further in Section 2 below.

1.2 A brief review of recent developments

During the past few decades significant development of financial intermediaries, financial instruments and financial markets has taken place, driven largely by deregulation, technological advancement and rapid globalisation. As a result, financial intermediation has also undergone remarkable changes, more so in developed countries but also in emerging economies. These changes have provided diverse choices and opportunities for households and firms in terms of their borrowing and financing as well as lending and investment decisions. For example, firms have been able to resort increasingly to bond and stock markets to obtain funds while households could begin to diversify their portfolios out of bank deposits into securities, mutual funds and derivatives.

One strand of the literature on financial intermediation compares the relative merits of bank-based financial systems, where banks play a leading role in mobilising savings, evaluating investments and managing risks, versus market-based systems, where capital markets are just as important in performing these roles (Levine and Zervos (1998)). In the traditional financial system, banks' intermediation can be described as simply transforming deposits into illiquid loans, and hence there was a clear separation between banks and markets. However, recent financial innovation and the development of non-bank intermediaries, as well as the creation of new instruments and new markets, have resulted in a breakdown of the clear separation between banks and markets.

A growing literature goes beyond the bank-based vs. market-based distinction, and characterises financial intermediation based on how financial transactions are conducted. In this literature, relationship-based intermediation, which depends on a long-term relationship and the sharing of private information between the borrower and the lender, is contrasted with arm's length intermediation, which depends on publicly available information and contract enforcement. Financial deregulation and innovation have blurred the borders between commercial banking and other financial activities such as investment banking and asset management, and the roles of financial markets and banks in both households' and firms' financing and asset allocation have become more integrated. In view of these developments, we could look at financial intermediation by differentiating the system into relationship-based traditional business by banks, arm's length based intermediation by financial institutions, and intermediation through capital markets. Despite the varying pace of developments and important differences across countries (and regions), several general trends in financial intermediation can be observed.

First, most countries are seeing a declining role of relationship-based banking activity. While banks have traditionally played a very important role in channelling funds from savers to borrowers, and they remain the most important single source of finance in many countries, their role in intermediation has declined. For major OECD countries, on average, banks intermediated less than 30% of non-financial sector (including household, non-financial corporate, and government) assets and liabilities in 2004.[2] Even in countries where banks still account for a higher share in intermediation, the importance of relationship-based banking business should be weakened by the observed trend of intense competition in the banking industry and increased credit information availability and information disclosure.

Second, many countries are seeing an increase in the importance of arm's length financial intermediations, which include activities by non-bank intermediaries such as pension funds, mutual funds and insurance companies, non-traditional banking activities such as banks borrowing from and lending to non-bank institutions, and activities related to financial innovations and new risk-management practices such as loan securitisation and trades of derivative products. Recent developments in these areas have resulted in more complete

[2] Sources: IMF (2006), OECD, Eurostat.

financial intermediations, allowing agents to insure and diversify a broader range of risks and allowing risks to be transferred to parties who are willing to assume them.

Non-bank intermediaries are generally found to be performing an increasing role in channelling funds between savers and borrowers (in advanced economies). In the US, around 50% of households' assets are held with non-bank financial institutions.[3] Improvements in information technology have also lowered transaction costs and allowed more accurate risk assessment by non-bank intermediaries, resulting in more loan originations which have eroded banks' traditional lending role. In response to such competition, banks have diversified their lines of business and expanded to off-balance sheet and non-interest income activities as mentioned above. A notable example is the rapid development of the asset-backed securities market, where banks originate, pool and distribute credit risks by repackaging a portfolio of debt instruments (such as collateralised debt obligations) and selling them to different investors such as insurance and fund management companies.

Moreover, with the expansion of financial instruments and services, domestic financial institutions have become increasingly interdependent, as reflected in the increase in the shares of both banks' liabilities and assets vis-à-vis non-bank financial institutions (in advanced economies). It is common for banks to borrow from or lend to other institutions, or own securities issued by other institutions, or have other institutions as counterparties in various financial contracts they possess. By contrast, in a traditional financial system, domestic financial institutions tended to be rather insulated from one another as banks, insurance companies and brokerage firms each operated in relatively separate markets and managed different products. It is also worth mentioning that national markets are also increasingly interlinked with global markets through increased cross-border borrowing and lending by various financial institutions.

Third, stock and debt securities markets in most countries have achieved remarkable development over the past decades, becoming significant sources of finance for firms and investment vehicles for households. In countries like the US, debt and equity of non-financial corporates as a percentage of non-financial corporates' total liabilities reached about 70% in 2004, indicating a dominant role of capital markets in providing financing for firms.[4] While the pace of developments varies significantly across countries and across markets, in part depending on the institutional infrastructure (such as protection of legal rights, enforcement mechanisms and other factors such as information disclosure and accounting standards), in general, most countries have seen improved market access, with firms more easily able to obtain external financing and increasing numbers of listed companies. Domestic bond and stock markets have also increased their liquidity and depth, as reflected in higher transaction volumes and rising market capitalisation and turnovers.

In view of the obvious importance of financial markets for the transmission of monetary policy, it is natural to ask how the conduct of such policy might be affected by the ongoing transformation of financial intermediation. There are two aspects to this question; operational on the one hand and strategic on the other.[5] The next two sections deal with each in turn.

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[3] Sources: IMF (2006), OECD, Eurostat.

[4] Sources: IMF (2006), OECD, Eurostat.

[5] Developments in financial intermediation also have implications for financial stability, as events in the major financial markets during August and September 2007 vividly showed. These aspects fall outside the scope of this paper.

2. Financial intermediation and monetary policy operating procedures

This section looks briefly at the relationship between changes in the structure of financial intermediation and operational aspects of monetary policy.[6] The focus will be on the choice of policy instrument and the interaction between operating procedures and financial structure.

The most basic distinction to be made is between direct and indirect instruments of monetary policy. Where financial markets are primitive, the central bank may not be able to influence credit conditions other than by setting targets for bank lending, using liquidity ratios to steer lending towards "priority" sectors, setting reserve ratios, and imposing similar more or less quantitative restrictions on the ability of banks to intermediate credit. As financial markets develop, greater use of indirect policy measures can be made. Operations in the domestic interbank market or a short-term bills market will be possible, and when a liquid market for government bonds at a variety of tenures has been established, the central bank could even contemplate operating at different segments of the maturity structure. It is tempting, but not correct (see Archer (2006)), to think of the switch from using direct instruments to market-based ones as being dictated by an exogenously determined pace of reform of financial markets. Rather, the reforms and changes in operating procedures often appear to be mutually reinforcing. As a central bank starts to conduct, say, open market operations in central bank bills, the financial system adjusts and develops so that trading in secondary markets becomes more active, which in turn makes the conduct of open market operations increasingly effective.

The exact form the implementation of indirect monetary policy takes varies across countries depending on the specificity of the market structure that has emerged. For example, while most financially highly developed economies have carried out open market operations using central bank or government liabilities, the Swiss National Bank for many years did so using repurchase agreements in the foreign exchange market. The reason was simply that this market was very much more liquid and could therefore transmit policy impulses more reliably. Unorthodox as it may have been, the practice of carrying out monetary policy through the foreign exchange market does not appear to have materially altered its effectiveness in terms of influencing credit conditions in the economy.

As a first approximation, when different segments of the financial markets are highly integrated with each other there is a presumption that the impact of central bank actions on the structure of interest rates is independent of which segment of the market the central bank is targeting for intervention. This seems to be the view adhered to in a majority of central banks in jurisdictions with well developed markets, as they predominantly conduct policy using short-term instruments.

In developing and emerging markets the choice of instrument is arguably more important. First of all, the graduation from conducting policy based on direct controls to using indirect instruments is important as it spreads the effect of policies more evenly across institutions and markets and reduces the arbitrariness often associated with direct controls. Furthermore, as the choice of indirect policy instrument has an impact on the liquidity and breadth of the chosen segment of the market, the central bank has an important role to play in supporting the development of the financial sector of the economy.

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[6] Archer (2006) contains a detailed analysis including references to practices in emerging markets. McCauley (2007) emphasises the link between the development of financial markets and the choice of monetary policy instrument.

3. Monetary policy when financial intermediation is taken seriously: is the "Taylor rule" enough?

The main focus of this paper is on how the introduction of financial intermediaries into the analysis of monetary policy influences the conclusions we draw as to the appropriate conduct of such policy. We start by reviewing briefly three analytical frameworks that contain an explicit role for financial intermediation in otherwise standard macroeconomic models. That is followed by a stylised representation of these frameworks which allows us to point to the key relationship that distinguishes models that allow for a role of financial intermediation and those that assume that the central bank has full control of credit conditions. After a review of empirical evidence on this relationship, we discuss the implication for monetary policy by asking whether the well known Taylor rule provides a sufficient benchmark against which an effective monetary policy can be judged.

3.1 Three models of financial intermediation

(i) Bernanke and Blinder (1988)

Bernanke and Blinder introduce a distinction between interest rates on bank loans and bonds in a simple macro model to explore the implications of a credit market for aggregate demand. They extend the standard IS/LM model by adding bank loans as a third asset in addition to money and bonds.[7] Their specification of the demand for loans by firms and the supply of credit by banks leads to an equilibrium in which the interest rate on bank loans can differ from the policy interest rate depending on the state of the business cycle (because this is one of the determinants of the demand for loans by firms), on the portfolio preferences of households (because they influence the supply of deposits to banks), and on parameters such as reserve requirements that determine the cost of bank intermediation. Although the authors do not explore the effects of changes in the intermediation technology of banks, their model implies that changes in this technology would alter the equilibrium relationship between the two interest rates.

The implication of this model for the conduct of monetary policy is that the central bank needs to monitor shocks in the market for bank loans and react to these shocks in order to stabilise output and inflation, and it needs to be mindful of possible changes in the equilibrium real policy rate brought about by changes in the bank intermediation process.

(ii) The financial accelerator model[8]

The financial accelerator is based on the fact that credit markets are imperfect due to the existence of asymmetric information and costly monitoring of borrowers by lenders. As a result, a firm that wants to borrow on the market will have to pay a premium over the opportunity cost of internally generated funds. The size of the premium depends, inter alia, on the size of the collateral the firm is able to post, the size of its cash flows, and the monitoring technology available to the borrower.

It is not difficult to grasp intuitively why the effect of a shock in the economy on the business cycle should be amplified in this context. A negative shock to consumption, say, would reduce cash flows of firms, which in turn would increase their external finance premium.

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[7] Brunner and Meltzer and Tobin had earlier emphasised the importance of assets other than money and bonds for the monetary transmission mechanism. See, for example, Brunner and Meltzer (1963) and Tobin (1969). Meltzer (1995) contains an accessible survey.

[8] See, for example, Bernanke and Gertler (1995), and Bernanke et al (1996) and (1999).

Facing a higher cost of borrowing, firms would cut back on investment, which would lead to a further reduction in demand and productive capacity. Similarly, an increase in asset prices would lead to a reduction in borrowing costs due to the increased value of firms' collateral and could therefore have a larger effect on aggregate output than one would expect based only on a wealth effect on consumption. The size of the effect of monetary policy on output would likewise be amplified as the initial impact on cash flows and net worth would influence the external finance premium and lead to further changes in firms' investments.

For our purposes the existence of a financial accelerator means that monetary policy is more potent, and that variables governing the financial intermediation process may have an independent influence on aggregate demand over and above that of monetary policy interest rates.[9]

(iii) Goodfriend and McCallum (2007)

Goodfriend and McCallum explore the quantitative implications of a dynamic stochastic general equilibrium (DSGE) model of the new Keynesian variety in which a banking sector has been incorporated and given a non-trivial role as a financial intermediary. In the model, banks serve an essential function since their monetary deposit liabilities are required for consumption goods purchases by consumers, and their loans are required to finance the hiring of capital by entrepreneurs. Loan management by banks requires labour inputs and collateral in the form of government bonds and capital. Financial intermediation is hence modelled as an economic activity that requires real resources and is subject to technological progress and shocks. The specification implies that different assets yield different returns in equilibrium. Government bonds require a lower rate of return than capital because they provide greater collateral services in the loan management function of banks. Interbank deposits, identified as a policy interest rate, yield a lower rate still because of the resource costs associated with banks' lending to entrepreneurs.

As in the case of the two previous analytical frameworks, the Goodfriend-McCallum model implies that there will be a wedge between the central bank's policy rate and the interest rates that determine households' and firms' intertemporal expenditure decisions. This wedge is not constant but will depend, inter alia, on banks' intermediation technology ("loan management" technology in their terminology) and on the cost of inputs, labour and capital in the intermediation process. Goodfriend and McCallum show that for plausible parameterisation of their model the nature of financial intermediation will have quantitatively significant influences on both the steady state equilibrium value of the policy interest rate and the nature of the dynamic adjustment of inflation and consumption to shocks.

3.2 An illustrative analytic framework

We next ask whether and how the central idea in the above models – that the interest rate relevant for aggregate demand can differ from the monetary policy interest rate depending on the state of the economy and on the nature of the financial intermediation process – influences the analysis of monetary policy. For the sake of concreteness the discussion will be framed in a simple analytical model commonly used to discuss monetary policy. It contains just four equations, but the general conclusions that will be extracted from it will

[9] As a matter of wording, it is not clear whether the speed, as distinct from the size, of the adjustment of the economy to changes in monetary policy will be affected by the financial accelerator mechanism. Simulations in Bernanke et al (1999) indicate that only the size of the impact is affected.

apply to more complete settings. For simplicity it abstracts from open-economy considerations.[10]

The model consists of an aggregate supply relationship, or Phillips curve

$$\pi_t = ... + \alpha_2 ygap_t + \varepsilon_t^{\pi}, \quad (1)$$

an IS relationship,

$$ygap_t = ... + \beta_3 (i_t^l - \pi_t^{\exp}) + \beta_4 z_t + \varepsilon_t^{y}, \quad (2)$$

a policy interest rate rule

$$i_t^p = \gamma_0 + \gamma_1 (\pi_{t+h}^{\exp} - \pi^T) + \gamma_2 ygap_t + \varepsilon_t^{i^p}, \quad (3)$$

and a relationship linking the policy interest rate and the interest rate relevant for aggregate demand,

$$i_t^l = ... + \delta_1 i_t^p + \delta_2 x_t + \varepsilon_t^{i^l}. \quad (4)$$

As these equations are well known, only brief comments on each of them will be given, focusing on issues that are relevant for the potential impact of changes in the nature of financial intermediation. As a first general remark it should be kept in mind that the dynamic aspects in the equations are kept very simple for ease of notation. It is quite possible that some or all of the α:s, β:s, γ:s, and δ:s would be functions of a lag operator, in which case these functions might be influenced by changes in the financial system. This possibility, which is illustrated by the series of dots (…..) in the equations, will be discussed in the next section.

With regard to the aggregate supply, or Phillips curve, equation (equation (1)) the only remark is that in some specifications, the output gap measure is replaced by a measure of the marginal cost of production. In this case, and where the marginal cost of production would include costs of capital or financing of purchases of intermediate goods, the relevant borrowing costs would be included as a direct determinant of current, and hence expected future, inflation. As these borrowing costs would influence the aggregate demand equation in the model, we leave them out of equation (1) for simplicity.

The aggregate demand equation depends on the nominal rate of interest on bank loans, i^l, adjusted by the corresponding expected inflation rate to obtain a measure of the real cost of bank credit to households and firms. In addition, to allow for other forms of financial intermediation than through banks, aggregate demand is assumed to depend on a set of variables, z_t, which are meant to capture the cost and availability of these alternative sources of credit for households and firms.[11] It is through these variables that the effect of changes in the structure of financial intermediation will have most of its impact in our model, and therefore potentially on the conduct of monetary policy.

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[10] Allowing for a foreign sector would introduce additional reasons why there might be differences between domestic policy interest rates and the terms on which the private sector can get credit, since in this scenario such credit could be obtained through intermediation from abroad. This would not alter the principal conclusions of our analysis.

[11] In this exposition the variables in *z* are treated as exogenous for simplicity. In a complete analysis at least some of them would have to be endogenised. For example, as will become clear later, some of the variables in *z* represent the cost of borrowing in the capital market, which clearly should be an endogenous variable in a full analysis of the financial intermediation process. As we are only illustrating the mechanisms through which changes in this process will affect monetary policy, however, it is not crucial to present a complete general equilibrium model.

Equation (3) represents a standard reaction function of the central bank which sets the policy interest rate in response to the output gap and to deviations of expected inflation from the target rate at horizon *h*, as suggested by the well known Taylor rule.

Finally, there is a relationship between the nominal interest rate on bank loans which determines spending and the nominal policy rate. As written, this relationship will be able to illustrate the consequences of a variety of models of financial intermediation. For example, if the liabilities of the central bank and bank loans are perfect substitutes then $\delta_1=1$ and $\delta_2=0$ so that i^p and i^l will be equal, and the term $\beta_4 z_t$ will be redundant in the aggregate demand relationship, in which case the central bank has perfect control over the borrowing conditions for households and firms. If i^l represents a long-term interest rate and i^p a short rate, and if the expectations theory of the term structure links the two perfectly, then the *x* variables in equation (4) contain expected future values of the policy interest rate. In neither of these cases will the structure of financial intermediation have any impact on the determination of output and inflation in our model because the central bank can set the relevant interest rate directly. So the only interesting case for the purpose of this paper is when either (or both) bank loans and alternative sources of private sector credit are not perfect substitutes with central bank liabilities. In this case a model for the determinants of their relationship will include some additional variables summarised in the vector *x* in equation (4).

For future references it is useful to substitute (4) into (2) to obtain

$$ygap_t = ... + \delta_2 x_t + \beta_3 (i_t^p - \pi_t^{\exp}) + \beta_4 z_t + \varepsilon_t^y + \varepsilon_t^{i^m} \tag{2'}$$

which shows that aggregate demand will depend on the nature of the financial intermediation process through the variables in *x* and through $\varepsilon_t^{i^m}$. Furthermore, it is convenient to "solve" the equations for inflation and output in terms of the underlying disturbances in the economy as in (5) and (6).

$$\pi_t = \Pi(\varepsilon^\pi, \varepsilon^y, \varepsilon^{i^p}, \varepsilon^{i^l}, \varepsilon^x, \varepsilon^z) \tag{5}$$

$$\text{ygap}_t = \text{Y}(\varepsilon^\pi, \varepsilon^y, \varepsilon^{i^p}, \varepsilon^{i^l}, \varepsilon^x, \varepsilon^z) \tag{6}$$

where it should be understood that the functions include past and expected future values of the ε:s in addition to current values. The point of this last expression is to make explicit that shocks in the financial intermediation sector ($\varepsilon_t^{i^l}, \varepsilon^x$) are part of the solution for inflation and output, contrary to the common specification where the policy interest rate enters directly into the aggregate demand equation.

It is also useful to characterise the equilibrium real interest rate on bank loans as well as the equilibrium policy rate. Solving (4) for the bank loan rate when the output gap is zero and the inflation rate is at the target level gives

$$i^{l^{eqm}} = \pi^T - \frac{\beta_4}{\beta_3} z_t , \tag{7}$$

and from (4) the policy rate must be set so that in a full equilibrium it will equal

$$i^{l^{eqm}} = i^{p^{eqm}} - \delta_2 x_t = \pi^T - \frac{\beta_4}{\beta_3} z_t - \delta_2 x_t . \tag{8}$$

Hence, in the policy reaction function we must have

$$\gamma_0 = \pi^T - \frac{\beta_4}{\beta_3} z_t - \delta_2 x_t \tag{9}$$

in order for a stationary equilibrium to be attained. In words, the so called "neutral" level of the policy interest rate depends on features of the financial intermediation process through the variables *x* and *z*. For example, suppose risk aversion or the perceived credit risk associated with lending to firms or households increases. This will lead to an increase in the spread between the risk-free short-term policy rate and the longer-term interest rate on loans. As far as investment or consumption decisions are concerned, monetary conditions have tightened. To maintain a neutral monetary policy stance, the policy rate should decline. Similarly, a structural change in the financial intermediation sector that reduces the costs of financial intermediation implies easier monetary conditions unless it is counteracted by an increase in the policy rate.

This conclusion is a special case of that reached by Svensson (2003) in his analysis of the use of "judgement" by monetary policy makers. Svensson introduces judgement in inflation and output equations by adding variables he refers to as the "deviation". Apart from differences in lag structures these variables are identical to those I have labelled *x* and *z* in equations (2) and (4). This means that what Svensson calls a central banker's "judgement" can be thought of as referring to the use of a more elaborate or different (hence his term "deviation") model than the bare-bones structure involving only the output gap, the inflation rate, and the policy interest rate which is so popular in analytical treatments of monetary policy. Not surprisingly, Svensson concludes that the additional variables (judgement) should be allowed to play a role in the setting of a central bank's monetary policy instrument. In the context where financial intermediaries are an important element of the economy, the implication is that the nature of the financial intermediation sector should have an impact on the conduct of monetary policy as I have argued above.

3.3 Empirical issues

That the financial sector has an influence on how monetary policy affects the economy is well established both empirically and theoretically.[12] But in order to assess the implications for the conduct of monetary policy it is important to distinguish between three ways in which this influence can manifest itself. First, the size and speed of the response of aggregate demand to changes in market interest rate and credit conditions may depend on the nature of the financial intermediation process. This response is captured by the coefficient β_3 in equation (2) of our stylised model. Second, the size and speed of the response of market interest rates to monetary policy interest rates, measured by the coefficient δ_1 in equation (4), can be affected. Third, market interest rates and credit conditions may be influenced by other factors than monetary policy. This is illustrated by the terms $\beta_4 z_t$ and $\delta_2 x_t$ in the model. The frequency, size and persistence of this influence can be of fundamental importance for monetary conditions in the economy as already noted.

What is known about these factors? Singh et al (2007) contains a thorough review of the literature relating to the second issue, the pass-through from policy interest rates to market rates, as well as original empirical results comparing economies with different degrees of financial development. The empirical results suggest that "countries with more developed financial markets – in terms of higher levels of bank competitiveness and breadth and depth of bond and equity markets – tend to have stronger interest rate pass-through". Results are also consistent with the view that the speed of adjustment of market rates to policy rates is faster in economies with more developed financial markets.

Regarding the magnitude and speed of the effect of interest rate changes on aggregate demand, it is well known that in economies where mortgage lending is predominantly based

[12] References to some of the relevant literature have already been noted. See in particular Bernanke et al (1999) and Cecchetti (1999).

on floating rates the impact of interest rate changes is felt faster than in economies where fixed rate mortgages are more common. It is also possible that other aspects of the financial system impact the sensitivity of aggregate demand to interest rate changes, and it would be useful to investigate this possibility in a systematic cross-country study. Important as cross-country differences in financial systems may be, however, it is likely that changes in the financial system *within* a country will proceed relatively slowly. In this case the central bank will have time to adjust its monetary policy strategy accordingly, and the disruption to macroeconomic stability will be minor.

The third empirical issue concerns the importance of shocks in the credit market itself for macroeconomic outcomes. I will not attempt to survey the very large empirical literature on this subject, but rather use two examples to illustrate that such shocks can be significant. In an influential early study Friedman and Kuttner (1993) used standard VAR analysis to estimate the effects of shocks in the intermediation sector on economic activity. Results pointed to significant influences of shocks to bank capital on the spread between interest rates on commercial paper and Treasury bills, and significant influences of default risk shocks (as proxied by the spread between interest rates on commercial paper with different risk ratings) on output. These effects are closely related to what we have denoted $\beta_4 z_t$ and $\delta_2 x_t$ in the stylised model.

Lown and Morgan (2006) use data on bank lending standards collected by the Federal Reserve to study the effects of variations in non-price lending terms on loan volumes and economic activity, in other words whether other variables than interest rates have an impact on output. Their VAR estimates imply that "[i]nnovations in standards account for nearly a third of the error variance in output at four quarters, even more than is attributable to innovations in the federal funds rate". (p 1583). Like those of Friedman and Kuttner, these results indicate that the developments in the financial intermediation sector can have important macroeconomic effects, and that these should be taken into account in monetary policy decisions, the topic of the next section.

3.4 Changes in financial intermediation and the conduct of monetary policy

Based on our analytical framework it is now time to discuss the implications of changes in financial intermediation for the conduct of monetary policy. Following standard practice, let us assume that the objective of the monetary authority is to minimise a loss function that depends on the current and discounted future deviations of the inflation rate from its target value as well as on the current and discounted values of the economy's output gap. Let us further assume that financial intermediation plays a significant role in the economy along the lines discussed above. It then follows trivially from equations (5) and (6) that when the central bank decides on the policy interest rate it must take into account all shocks in the system, including those specific to the financial intermediation sector, as well as the parameters and functions that determine the response of the economy to these shocks. Changes in the process of financial intermediation that lead to changes in the speed and magnitude of the response of aggregate demand to loan rates and that bring about changes in the pass-through of policy interest rates to commercial loan rates must be factored into the monetary policy decisions.

As the output gap and the inflation rate also depend on all shocks in the economy, including those associated with the process of financial intermediation, it may be argued that a central bank which pays attention only to these ultimate target variables as suggested by the Taylor rule will automatically react appropriately to shocks and structural changes in the economy. Hence the question in the sub-title of this section: "Is the Taylor rule enough?".

If we interpret the Taylor rule broadly enough, the answer must be yes. For if the policy reaction of the central bank depends on the current level as well as forecasts of (all) future levels of the inflation and output gaps, then it follows trivially that the policy interest rate will react properly to all relevant shocks in the economy. But this is of course not very helpful,

since to be made operational the forecasts of future inflation and output gaps must be made on the basis of currently observed variables. Furthermore, the beauty of the Taylor rule presumably is that it is meant to reduce the complexity of the decision problem for the central bank. And indeed, as it is most often interpreted, the rule suggests that a robust policy response would be a stable function of the current output gap and the expected deviation of the inflation rate from the target at some fixed horizon, often taken to be around two years. Central banks which publish forecasts of inflation at a particular horizon presumably do so because they believe that focusing on this horizon provides a good summary of the relevant information to which they need to react.

Cast in these terms then, the relevant question is whether a Taylor rule as represented in equation (3) is general enough to capture most of the information a central bank needs to pay attention to, or whether additional variables could have a useful role to play. Following the previous analysis, we will discuss this with reference to how changes in financial intermediation may influence three aspects of the policy rule: the size of the reaction coefficients, the horizon of the inflation forecast, and the possible inclusion of additional variables in the rule.

Changes in the sensitivity of the economy to interest rate movements would not require significant modifications in central bank reactions to incoming information, as it would only have to adjust the *size* of the interest rate response. Arguably, changes in the interest rate sensitivity of the economy would occur only gradually, so the risk of monetary policy going significantly off target is likely to be small. This conclusion is reinforced once it is recognised that our knowledge of the size of the impact of policy on inflation and economic activity is in any case relatively imprecise.

A potentially somewhat more significant change in the practice of monetary policy could be required if the *speed* of transmission of interest rate changes is altered as a result of changes in the intermediation process. Many inflation-targeting central banks describe their decision making process in terms of setting the policy interest rates so as to hit the inflation target at a specific horizon, typically that which corresponds to the presumed lag in the effect of monetary policy. If this lag becomes shorter, say, it is possible that policy reactions would be out of phase, requiring ex post explanations of why the target was missed. Again, to the extent that changes in the speed of transmission occur gradually, there would be opportunities for the central bank to adjust its reaction as evidence of the structural change accumulates. For central banks that communicate policy decisions with respect to a particular target horizon, it could become awkward if changes in this horizon were relatively frequent. It is perhaps for this reason that some central banks refrain from committing themselves to hitting the inflation target at any particular horizon.

Arguably the most important issue with respect to the adequacy of the Taylor rule as a complete guide for central bank policy is whether other variables than the inflation and output gaps should be included. Recently this debate has centred on whether or not monetary aggregates carry more information about future inflation and output gaps than what is already incorporated in the traditional variables in the Taylor rule.[13] In a context where the financial intermediation sector of the economy has a significant effect on macroeconomic outcomes, it may be argued that monetary and credit aggregates, interest spreads, and asset prices would be potentially useful indicators in a policy reaction function.[14]

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[13] See, for example, Reynard (2007) and Woodford (2007).

[14] See Cecchetti et al (2000). Note that a variable may figure in a central bank's policy reaction function even though it is not an ultimate target of monetary policy. This point has often been lost in the debate on whether or not monetary authorities should react to asset prices.

For example, a shock or a structural change that increases the credit extended by the banking system would in the first instance, i.e. before it had any effect on output and inflation, probably reduce credit spreads, increase asset prices, and increase the volume of money and credit in the economy. A central bank that adjusted its policy interest rate in response to these developments would act in a more timely fashion than one that looked only at the inflation rate and the output gap. The difficulty of course is that asset prices and monetary and credit aggregates respond not only to shocks in the financial intermediation sector but also to most other shocks in the economy. The central bank is hence faced with the usual signal extraction problem, which would prevent any *automatic* reaction to such variables. In the same way that the Taylor rule calls for different reactions to output movements depending on whether the economy has been subject to a demand or a supply shock, responses to financial aggregates, asset prices, and credit spreads would have to take into account the sources of movements in these variables, a difficult, but perhaps not always an impossible task.

In view of these considerations, a prudent conclusion to this section may be that following a Taylor rule may be a necessary but not a sufficient strategy for achieving the goal of price stability with minimal fluctuations in output. It is necessary because forceful policy reactions (i.e. strong enough to increase real interest rates when inflation threatens to exceed the target) would be needed to stabilise inflation when it deviates from the target rate. It is not sufficient, however, because structural changes in financial markets may require adjustments over time in the size of the reactions to inflation and the output gap as well as to the implicit equilibrium real policy rate. Furthermore, smoother paths of inflation and output might be obtained if attention was paid to financial variables that carry information about the underlying shocks in the economy.

4. Concluding remarks

Extending the scope of financial intermediation in an economy by means of having a greater number of firms involved, a greater variety of firms, and a greater variety of assets has been shown to impact the conduct of monetary policy in terms of both operating procedures and reacting to economic events. While it can be argued that documented changes in the financial system have made operating procedures more flexible and efficient, the same changes pose challenges for central banks in the day to day management of policy levers.

The analysis suggests that innovations in financial markets may change both the neutral policy interest rate and the horizon of the relevant inflation forecast in a Taylor-type rule. A policy maker who does not take this into account would potentially set the interest rate at an inappropriate level. However, even if interest rate policies of many central banks are characterised (and judged) as if they are (should be) set according to a Taylor rule, it is unlikely that, as a practical matter, central banks conduct monetary policy strictly according to a rigid interpretation of this rule with a fixed horizon and fixed coefficients. Monetary authorities are constantly learning about the structure of the economy and its implication for interest rate policy. Consequently there are reasons to be optimistic that monetary policy resolutely focused on price stability will continue to be successful even in the presence of continuous innovations in financial markets.

This being said, there is nevertheless a case for moving away from the notion of a fixed horizon for the attainment of an inflation target and for taking account of monetary, credit, and asset market indicators in the conduct of monetary policy to a greater extent than has been done heretofore.

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