CHAPTER 2

MONETARY POLICY AND THE RISE OF NONBANK FINANCE

Summary

The structure of financial markets has been changing considerably. Ongoing financial innovation, weakened bank balance sheets following the financial crisis, changes in business models, and strengthened bank regulation have all supported a strong shift from bank lending to bond issuance. This has allowed a larger role for nonbanks, such as insurance companies, pension funds, and asset managers. Nonbanks are very important for financial intermediation in the United States and have become significantly more important in Europe and some emerging market economies.

Has the rise of nonbank financing rendered monetary policy less powerful? Some have argued that the impact of monetary policy action on economic activity has lessened because one of the traditionally key transmission channels—bank lending—has become less important. In theory, nonbanks can either dampen or amplify the transmission of monetary policy. On the one hand, nonbanks may be able to step in to lend in lieu of banks if their funding cost is not as strongly affected as that of banks by changes in monetary policy, or if they are not subject to the same regulatory constraints, potentially dampening the transmission of monetary policy. On the other hand, nonbanks may amplify the transmission of monetary policy if their risk appetite is more sensitive to changes in monetary policy. This chapter explores this important but relatively uncharted territory, first laying out a conceptual framework, and then examining the empirical evidence with novel analyses.

The chapter finds that the increasing importance of nonbanks for financial intermediation has, if anything, strengthened monetary policy transmission over the past 15 years. The potency of monetary policy appears to have risen in various countries and seems to be, on average, stronger in countries with larger nonbank financial sectors. Like banks, nonbanks contract their balance sheets when monetary policy tightens, and, in general, nonbank financial intermediaries contract them more than banks. This behavior is in part explained by the effect of monetary policy on risk taking, particularly in the asset management sector. As a result, bond yields and risk premiums move, affecting the cost of borrowing and real activity. Thus, the composition of the nonbank financial sector matters for the transmission of monetary policy.

The growing role of nonbanks implies that the conduct of monetary policy will need to continue to adapt to changes in the transmission mechanism. The dosage and timing of monetary policy actions must be continuously recalibrated as their impact and the speed of their effect change. For example, as the relative importance of the risk-taking channel grows, the effects of monetary policy changes on the real economy may become more rapid and marked. Although not a focus of this chapter, changes in the regulatory framework are likely to affect the strength of monetary policy transmission because some of the differences in banks' and nonbanks' responses to monetary shocks reflect differences in their regulatory regimes.

The effects of monetary policy on financial stability are becoming more important. For instance, monetary policy actions are likely to have stronger consequences for the financial soundness of banks and nonbank financial institutions because the risk-taking channel seems to be an increasingly important mechanism in driving the responses of financial intermediaries. This suggests the need for greater vigilance by prudential and regulatory authorities.

Monetary policy needs to take into account the size and composition of balance sheets of key financial intermediaries to better gauge changes in financial institutions' risk appetite. Given the growth of the nonbank financial sector, the information contained in the balance sheets of nonbanks is potentially at least as useful as traditional measures of monetary aggregates. For instance, the leverage and changes in leverage of broker-dealers and total assets managed by bond funds can be informative for monetary policy. In this context, closing data gaps on nonbanks is essential.

Introduction

The structure of financial markets has changed considerably since the 1980s. Fast-paced financial innovation and, as a consequence of the financial crisis, weak bank balance sheets, changes in business models, and strengthened bank regulation have driven a strong shift from bank lending to bond issuance (Figure 2.1), which has permitted a larger role for nonbank financial intermediaries (henceforth nonbanks).[1] Nonbanks have recently grown, especially in Europe and some emerging market economies.[2] As banks retrench from certain activities, the role of asset managers has become more dominant (Chapter 3 of the April 2015 *Global Financial Stability Report* [GFSR]). At the same time, with interest rates at historically low levels in many countries, insurance companies have sought to increase returns on assets by intensifying their lending activities (Chapter 3 of the April 2016 GFSR).

Some have speculated that the rise in nonbank financing has weakened the transmission mechanism of monetary policy.[3] Traditionally, banks have played a key role in transmitting monetary impulses to the real economy, and it has been argued that other financial intermediaries may react very differently to monetary policy (Nelson, Pinter, and Theodoridis 2015). Similarly, in the past, leverage (borrowing) in the financial system has played an important role in amplifying the effects of monetary policy. As the role of asset managers with little leverage grows, is monetary policy still able to influence economic activity by affecting risk premiums—the required return on a risky asset relative to a safe asset—and longer-term rates?[4]

In theory, nonbanks can either dampen or amplify the effects of monetary policy. On the one hand, nonbanks may be able to step in to lend in lieu of banks if their funding cost is less strongly affected by monetary policy, if they are not subject to the same regulatory constraints, or if their risk-taking incentives are different. For example, increases in the regulatory gap between banks and nonbanks or in the ability of banks to securitize some of their loan portfolio may dampen the transmission mechanism.[5] On the other hand, nonbanks may amplify the transmission of monetary policy if their risk appetite is more sensitive to changes in monetary policy. Although it is of key policy relevance, so far, the literature on this topic is very scarce.

This chapter uses novel analyses to better understand the influence of nonbanks on the effectiveness of monetary policy by providing a cross-country perspective on the following questions:[6]

- Conceptually, given that banks and different types of nonbanks have different business models and face different constraints, how can the composition of the financial system affect the transmission of monetary policy?
- Empirically, does the presence of nonbanks affect the transmission of monetary policy? Specifically, how does lending by different types of financial institutions respond to monetary policy and what explains the differences?

The chapter lays out a conceptual framework to discuss potential differences in the monetary transmission brought about by a larger nonbank sector. It then conducts empirical analyses at both the aggregate and the microeconomic level.

The chapter finds that the increasing importance of nonbanks for financial intermediation has not weakened the transmission of monetary policy and, if anything, it

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[1]Although both banks and nonbanks are engaged in financial intermediation, a bank issues deposits that must be converted upon demand into cash (central bank money) or deposits in other banks at par. In contrast, nonbanks fund themselves mostly with liabilities at market prices. In this chapter, nonbanks include insurance companies; pension funds; and other financial intermediaries such as asset managers (hedge funds, mutual funds, and other investment funds), finance companies, investment banks (broker-dealers), and securitizers.

[2]Nonbanks are significantly more important in the United States because the process of bank disintermediation started much earlier, in the 1980s.

[3]For example, see Bini Smaghi 2010.

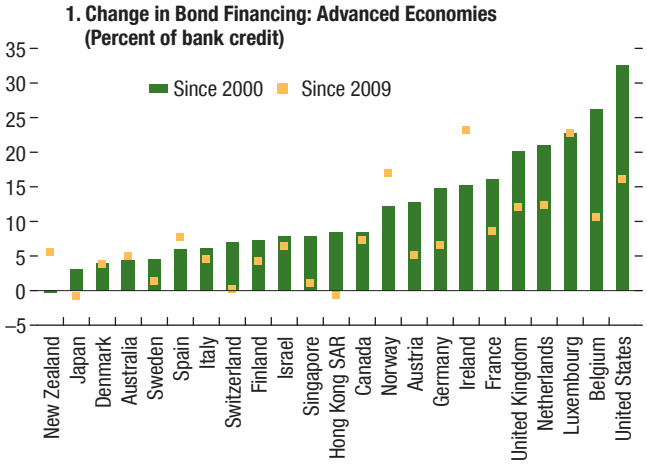
[4]Leverage measures a firm's total borrowing relative to the value of its equity or assets. In a financial sector dominated by asset managers, monetary policy can have large consequences for asset prices even if financial sector leverage is low.

[5]Changes in financial regulation since the crisis have likely tempered the risk appetite of banks and increased the role of nonbanks, dampening the transmission of monetary policy. On the other hand, the growth in securitization since the early 2000s may have lessened the effect of interest rates on credit origination by banks (Loutskina 2011).

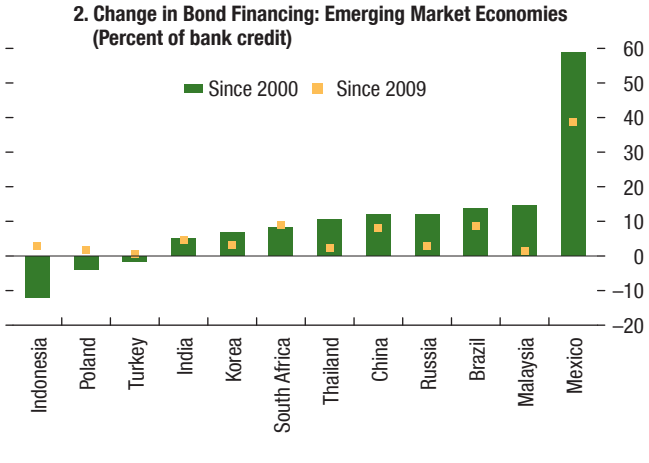
[6]Existing studies mainly examine parts of the financial system and rely mostly on data from the United States (Den Haan and Sterk 2011).

Figure 2.1. The Relative Importance of Nonbank Financial Intermediaries

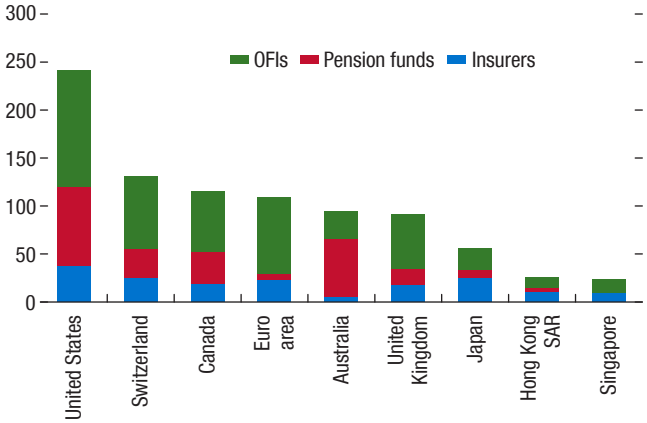
Since the 2007–09 crisis, bond financing has grown relative to bank loans in many advanced economies.



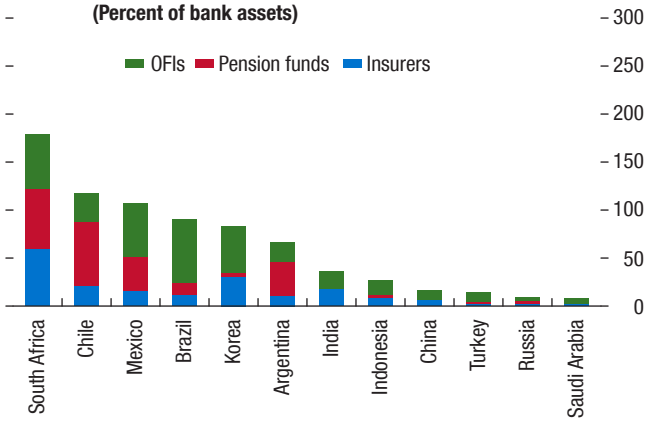
In emerging market economies, bond financing is becoming more prevalent.



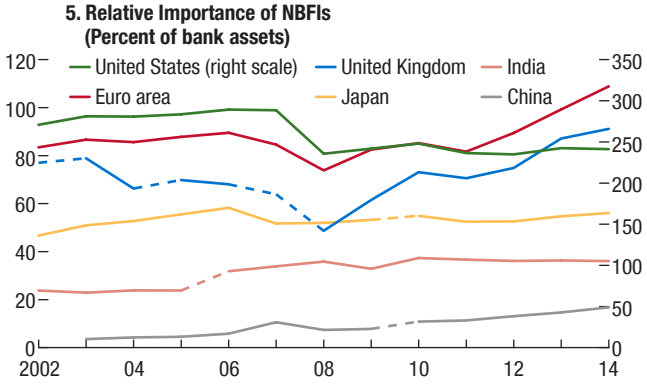
Among advanced economies, nonbanks are relatively less important in Asia.



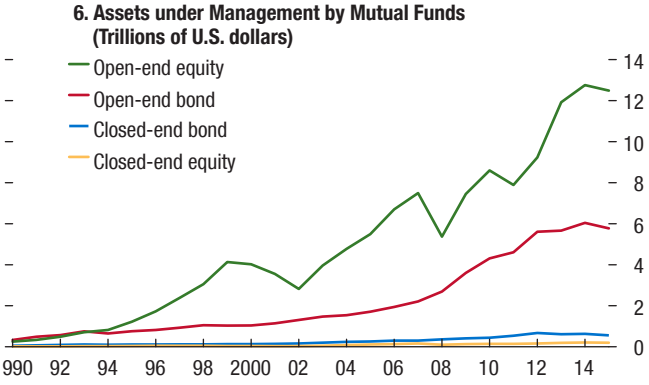
Among emerging market economies, South Africa has the largest nonbank sector relative to bank assets.



In Europe and China, nonbanks have grown in importance since the financial crisis.



Bond funds have become more important since the financial crisis.



Sources: Bank for International Settlements; Dealogic; Financial Stability Board; Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Panels 1 and 2 show the change in the ratio of outstanding bonds issued by nonfinancial firms (by parent nationality) to outstanding bank credit to the private nonfinancial sector. The figures may overestimate (underestimate) borrowing in countries that are sources (recipients) of foreign direct investment. Nonbank financial intermediaries (NBFIs) include insurance companies, pension funds, and other financial intermediaries (OFIs). In panels 3 to 5, the relative importance of NBFIs is measured as the ratio of NBFI total assets to bank total assets. Dashed lines in panel 5 signify breaks in the underlying series.

has strengthened it. In particular, the chapter presents the following main findings:

- The transmission of monetary policy seems to have strengthened in many countries and appears to be slightly stronger in countries with larger nonbank financial sectors.[7]
- Banks and most nonbanks contract their balance sheets when monetary policy tightens.
- In general, nonbank financial intermediaries contract or expand their balance sheets more than do banks in response to a monetary tightening or loosening and do not dampen the transmission of monetary policy.
- The risk-taking channel operating through changes in asset allocations seems to play an important role, particularly in the asset management sector.[8] The induced changes in risk premiums also affect banks' ability to lend because they affect their cost of funding.
- Changes in the supply of bank credit induced by monetary policy affect total credit and real activity because nonfinancial corporations find it difficult to substitute market financing (bonds) for bank financing (loans), even in economies with deep financial markets.

The growing role of nonbanks implies that the conduct of monetary policy will need to continue to adapt to changes in the transmission mechanism. The dosage and timing of monetary policy actions will have to be recalibrated continuously, as the impact of monetary actions and the time lags involved change. For example, as the relative importance of the risk-taking channel grows, the effects of monetary policy changes on the real economy may become more rapid and marked. At the same time, changes in the regulatory framework for nonbanks are likely to affect the strength of monetary policy transmission.

Monetary policy needs to take into account the size and composition of balance sheets of key financial intermediaries to better gauge changes in the risk appetite of financial institutions. Given the growth in the nonbank financial sector, the information contained in the balance sheets of nonbanks can be at least as useful as more traditional measures of monetary aggregates. For instance, the leverage and changes in leverage of broker-dealers and total assets managed by investment funds can be informative for monetary policy. In this context, it is important to continue to close data gaps in the nonbank sector.

Policymakers need to be mindful of the changing financial stability implications of monetary policy in light of the growing importance of nonbank lenders. Given that the risk-taking channel seems to be an increasingly important mechanism in driving the responses of financial intermediaries, monetary policy actions are likely to have stronger consequences for the financial soundness of banks and nonbank financial intermediaries. This does not, per se, imply a case for monetary policy to pursue financial stability objectives (IMF 2015), but suggests the need for greater vigilance by prudential and regulatory authorities.

Trends in the Transmission of Monetary Policy

Before embarking in further analysis, this section first takes a look at the evolution of monetary transmission. Has the impact of monetary policy diminished?

Evidence from a sample of 12 countries suggests that, on average, the transmission of monetary policy strengthened after 2000 (Figure 2.2). Compared with the period 1980–99, since 2000, the response of real GDP to changes in the monetary policy rate has increased in Korea, South Africa, Spain, Sweden, and the United States, but has declined in Norway.[9] For other countries, the responses are in general stronger after the year 2000, but not significantly different between the two periods.[10]

[7]The finding that the transmission of monetary policy has strengthened is based on a medium-term analysis; the chapter does not attempt to ascertain the strength of monetary policy at the current juncture in specific countries.

[8]The risk-taking channel of monetary policy describes how central banks can affect the risk-bearing capacity of financial institutions, namely by influencing short-term interest rates (Adrian and Shin 2011).

[9]Other studies for the United States have found a weakening of the transmission (Baumeister, Liu, and Mumtaz 2010; Boivin and Giannoni 2006; Boivin, Kiley, and Mishkin 2011), or no change (Primiceri 2005). However, these studies typically compare the magnitude of the transmission until the late 1970s and thereafter, and do not include recent years. The results shown in Figure 2.2 are broadly in line with the literature, although country studies using different methods have reached different estimates of the response of GDP to a monetary policy change. In the case of Japan, the standard specification seems to have failed to identify monetary policy shocks such that the response after 2000 has the wrong sign. Still, the analysis presented in Figure 2.2 is robust to alternative specifications and different measures of monetary policy. The findings for inflation (not shown) are also supportive of a strengthened transmission. See Annex 2.1.

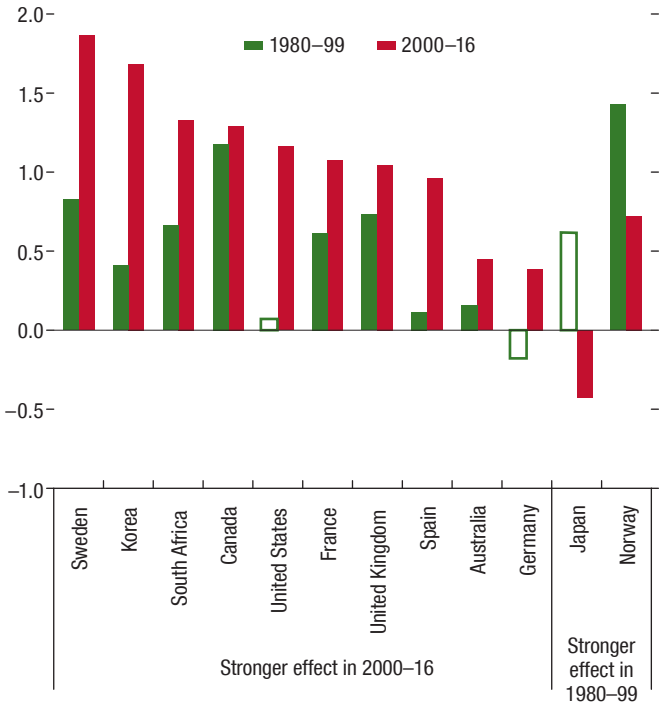
[10]In Figure 2.2, statistical significance is inferred based on one sigma, or 68 percent confidence intervals. In the vector autoregres-

Changes in the strength of monetary transmission and in the time frame of the response can likely be ascribed both to structural changes in the economy and to changes in the practice of monetary policy. Although the reasons behind such changes are multiple and difficult to determine, the literature has discussed three main possible reasons:

- *Changes in the conduct of monetary policy and in the way economic agents form expectations*—Since the early 1980s, the conduct of monetary policy has gradually shifted to better control of expectations and the buildup of credibility.[11] Better anchored expectations may have dampened the transmission of monetary policy (Boivin and Giannoni 2006).[12] However, these developments are consistent with a general weakening of transmission in 1980–99 compared with earlier years (not shown), but do not necessarily help explain developments since 2000.
- *Increased economic and financial integration*—In theory, greater economic openness and denser cross-border financial links should increase the chance for leakage and weaken the domestic transmission of monetary policy. However, the existing empirical evidence is not generally supportive of this mechanism, and it is possible that currency fluctuations induced by interest rate changes amplify the transmission of monetary policy through valuation effects of net long foreign exchange positions (Georgiadis and Mehl 2015). Nevertheless, there is mounting evidence that monetary policy shocks emanating from the United States are transmitted to other countries (especially those with large financial systems) via the global financial system (Rey 2016).[13]
- *Changes in the way financial markets work*—Changes in the regulation of banks and nonbanks, the rise of securitization, improved access to bank and nonbank credit by households and nonfinancial firms, and the ascendance of the asset management industry have transformed financial markets. The possible effects on the transmission of monetary policy of some of these trends are discussed next.

Figure 2.2. Trends in the Transmission of Monetary Policy
(Percent)

In most countries, the strength of the transmission of monetary policy has increased since 2000, especially in Korea, South Africa, Spain, Sweden, and the United States.



Sources: Federal Reserve System; Haver Analytics; IMF, International Financial Statistics database; Organisation for Economic Co-operation and Development; and IMF staff estimates.
Note: The figure shows the peak response of real GDP to a 1 percentage point decrease in the monetary policy rate. The response is estimated from a vector autoregression (VAR) of log real GDP, the log GDP deflator, the log of the nominal effective exchange rate, and the nominal interest rate (shadow policy rates for countries using unconventional monetary policy) using four lags (and a reunification dummy for Germany). The responses are identified using a Cholesky decomposition in which the interest rate is ordered last. Solid bars mean that the response is statistically significant using 68 percent confidence intervals. See Annex 2.1 for details.

Channels of Monetary Policy Transmission

This section discusses how the transmission of monetary policy may be affected by financial institutions. The focus of the discussion is on two main types of mechanisms:

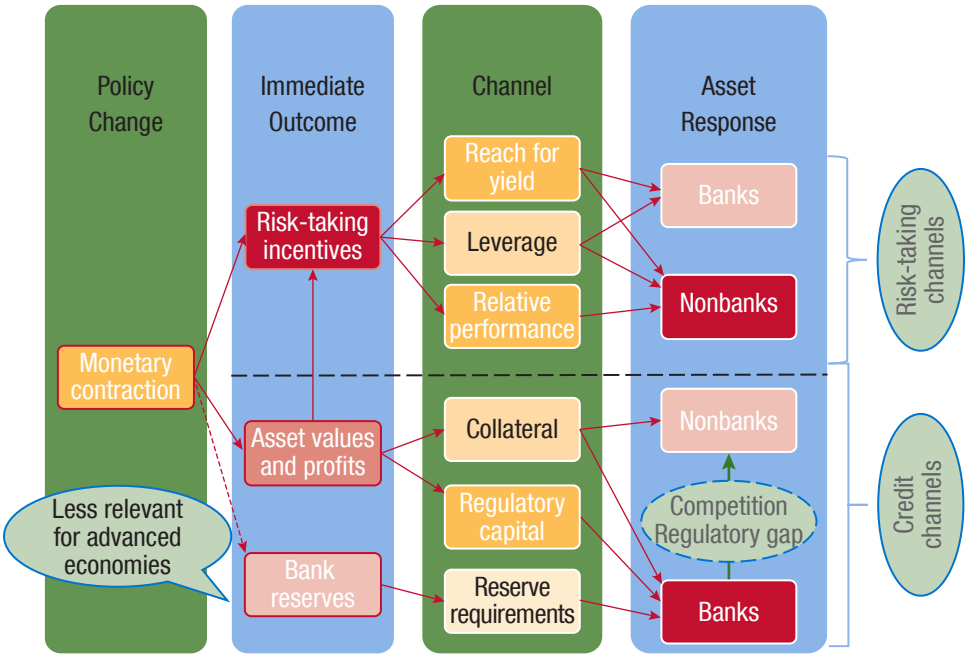
sion literature, which the analysis follows, it is common to infer significance from 68 percent confidence intervals. See Sims and Zha 1999 for a justification.

[11]This process has culminated in many countries with the adoption of inflation-targeting regimes, whereby the conduct of monetary policy is geared toward the management of inflation expectations and implies systematic and aggressive responses to output gaps and deviations from target inflation.

[12]When the central bank responds strongly to deviations of GDP from potential output and to deviations of inflation from its target, expectations for future income and inflation become more stable. Anchored expectations, in turn, cause actual spending to be more stable and to react less to monetary policy shocks (Boivin, Kiley, and Mishkin 2011).

[13]The increase in financial integration and associated monetary policy spillovers across countries complicates the identification of the effects of monetary policy on economic activity, especially after the year 2000.

Figure 2.3. Transmission of Monetary Policy through the Reaction of Financial Intermediaries



Source: IMF staff.
Note: A darker shade signifies a larger response. Red shades or arrows signify an adverse effect or response. A green arrow means that an adverse response from one sector may trigger a positive response from the other. A dashed red arrow means the effect of monetary policy through this channel is disputed.

those that affect the supply of credit by intermediaries and the risk-taking channel of monetary policy (Figure 2.3). In theory, both mechanisms help explain why the transmission of monetary policy may be different when nonbanks are more important.

Transmission through Effects on Aggregate Demand and Borrowers' Balance Sheets

The traditional discussion of monetary policy transmission emphasizes how changes in interest rates affect investment and consumption decisions. These channels operate through changes in the user cost of capital, intertemporal substitution effects, and wealth effects.[14] Similarly, changes in interest rates can induce exchange rate changes and therefore influence net exports. Although important, these channels for the transmission of monetary policy do not assign a particular role to financial intermediaries and, to a large extent, do not affect banks and nonbanks differently.

Monetary policy also affects the supply of loans through the balance sheets of borrowers. Banks and nonbanks lend to nonfinancial firms and households based on the ability of borrowers to post collateral—that is, on the basis of their net worth. By altering the net worth of borrowers and thereby their access to external finance, the effect of interest rate changes can be magnified through the balance sheet channel.[15] The

[14]Interest rates operate through these mechanisms as follows: First, they are an important component of the cost of using one unit of capital for one period (that is, the user cost of capital). Second, they drive the decision to forgo present consumption in order to achieve consumption in the future (that is, intertemporal substitution or saving). Third, they affect the value of households' wealth, changing their incentives to spend. However, the strength of these traditional monetary transmission channels may have changed over time. For instance, increased access to credit by households and firms from both bank and nonbank financial intermediaries may have increased the sensitivity of consumer spending and residential and business investment to asset prices and monetary policy rates via balance sheet effects (Iacoviello 2005).

[15]For instance, a cut in interest rates increases the expected future profits of a borrowing firm and, as a consequence, raises the value of the firm's equity or net worth. A higher value of the firm's equity, in turn, provides positive information to potential lenders about its

balance sheet channel is likely to be more important for nonbank finance because banks try to insulate lending from interest rate fluctuations in order to preserve the long-term relationships they have with their client base (Bolton and others 2016).

Imperfections in the Funding Markets of Financial Intermediaries that Affect Credit Supply

If monetary policy significantly affects the cost of funding for banks and nonbanks, their supply of credit will respond. Regulatory requirements for banks, in particular those regarding capital, may cause them to react differently than nonbanks.

Balance Sheets and the Supply of Credit by Banks and Nonbanks

Monetary policy affects the supply of loans through the balance sheets of financial intermediaries. An increase in short-term interest rates lowers the net worth of banks and nonbanks—because their assets typically have longer maturities than their liabilities—and thereby raises their funding costs (Bernanke 2007). Traditionally, this mechanism has played an important role in monetary policy transmission through banks. The reason is that changes in interest rates induce larger balance sheet changes for institutions with high levels of debt (that is, high leverage), such as banks, because the relative change in net worth is magnified.[16] At the same time, financial institutions with weaker access to capital markets will not be able to borrow when their net worth falls as a result of an interest rate hike. Consequently, their balance sheets will shrink more in response to a monetary policy contraction. The inability to switch to alternative sources of funding is reinforced by uncertainty about the value of financial institutions' assets (Stein 1998). Therefore, financial intermediaries that are smaller, are privately owned, have weaker capital ratios, have less-diversified funding structures, or do not have access to international capital markets will probably respond more to contractionary monetary policy actions.[17,18]

Market-consistent valuation strengthens these balance sheet effects on the supply of loans. Financial institutions that are required to mark to market a significant portion of their assets—that is, record and report the value of their assets at market prices or fair values—are likely to be more responsive to changes in the stance of monetary policy, since their reported asset values move more in tandem with the interest rate. Although banks are also required, in many jurisdictions, to mark to market some of their portfolios, for most, the share of fair-value assets is small and the impact on regulatory capital is slight (Figure 2.4; Badertscher, Burks, and Easton 2011). Thus, the more widespread use of mark-to-market accounting standards among nonbanks in itself will likely contribute to a strengthening of monetary policy transmission as the sector grows (Borio and Zhu 2012).

Bank Capital, Bank Regulation, and the Transmission of Monetary Policy

Monetary policy affects bank lending through its effect on bank capital and profits—the bank capital channel. Following monetary loosening, banks with low capital levels relative to regulatory requirements need to issue equity if they are to increase lending.[19] Raising equity, however, can be costly or even impossible for many banks. Thus, the ability of banks to expand credit is curtailed. Yet, over time, lower interest rates will likely relax the capital constraint for many banks, and the credit response will increase. When

credit risk and the value of available collateral, increasing their willingness to lend at a lower cost. This effect is known as the "financial accelerator" (Bernanke, Gertler, and Gilchrist 1996).

[16]For example, a 1 percent increase in the value of assets increases the net worth of a financial firm by 5 percent when the capital-to-assets ratio is 20 percent and by 10 percent when the capital-to-assets ratio is 10 percent.

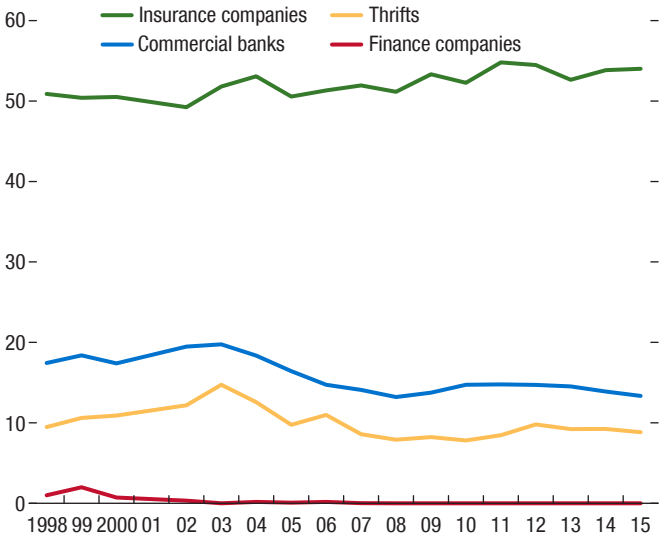
[17]Typically, smaller and unlisted intermediaries find it harder to issue securities because they do not have a track record in accessing bond and commercial paper markets, and are more opaque. Financial firms with lower net worth (that is, a lower market value of equity) will have to pay higher premiums in order to get wholesale funding and will cut lending more. In both cases, asymmetric information about the value of the firm's assets plays a major role (Van den Heuvel 2002).

[18]Imperfect competition in bank markets is an alternative market failure that can affect the transmission of monetary policy, but the effects discussed in the literature are ambiguous. On the one hand, a policy rate hike may increase banks' market power in the market for bank deposits and cause them to further restrict the supply of deposits (Drechsler, Savov, and Schnabl 2016). On the other hand, banks that have market power in the mortgage lending business seem to be less responsive to monetary policy because they dampen the response of lending rates by adjusting markups (Scharfstein and Sunderam 2014).

[19]To keep the same capital ratio, banks need to fund new loans with the same capital-to-debt ratio—hence the need to raise equity to expand lending.

Figure 2.4. Marked-to-Market Assets by Sector
(Percent)

Marked-to-market assets have fallen in banks and remain high for insurers.



Sources: SNL Financial; and IMF staff calculations.
Note: The figure shows the median value of assets recorded at fair value as a percentage of total assets, by sector, using a sample of financial institutions from various countries. Fair-value assets are trading account securities and securities available for sale and are marked to market.

many banks are facing binding capital constraints, the effect of monetary policy through banks can be small in the short term but large in the medium term (Van den Heuvel 2002).[20,21]

[20]Even if banks have enough capital to meet regulatory requirements, bank capital will still affect the transmission of monetary policy. As long as a monetary policy tightening reduces bank profits—either through the maturity gap or through a reduction in the demand for credit—it will make banks more likely to breach the capital requirement in the future. Hence, to reduce the likelihood of having to issue new equity, banks will prefer to shed assets, forgo new lending opportunities, or even contract lending (Van den Heuvel 2007). In theory, this effect will be larger for banks that are more engaged in maturity transformation (that is, retail banks), those that have a positive duration gap (for instance, mortgage banks), and those that rely less on financial derivatives to hedge interest rate risk (such as smaller banks; see Flannery 1981).

[21]According to the academic literature, monetary policy also influences bank reserves and thus their ability to lend—the bank lending channel. A monetary policy contraction through an outright sale of securities reduces the amount of reserves available to the banking system, and, hence, the amount of bank core deposits. If banks cannot substitute core deposits with some other source of funding, they may need to sell or liquidate some of their assets. However, as reserve requirements have become less prevalent and wholesale funding markets have developed, the relevance of this channel has diminished (Bernanke 2007). In fact, many central banks change interbank rates through signaling effects (that is, merely by announcing their target rates) without actually changing bank reserves (Disyatat 2011).

The impact of changes in bank loan supply on real economic activity depends on the degree to which borrowers can substitute bonds for loans (Bernanke and Blinder 1992). As capital markets develop, borrowers should find it easier to issue bonds. However, in many economies, even large firms are still heavily dependent on bank financing. Certain types of nonbanks can provide alternatives to bank financing following a tightening of monetary conditions. For instance, large institutional investors, such as insurance companies and pension funds, are often willing to buy newly issued private debt securities. In addition, investment banks that specialize in the underwriting and marketing of bond issues can facilitate alternatives to bank financing.

If the regulatory gap between banks and nonbanks increases, the significance of monetary policy transmission via bank lending may decline. The growth of nonbank financial intermediation has been fostered by tighter bank regulation (Chapter 2 of the October 2014 GFSR). At the same time, important sections of the nonbank financial sector remain lightly regulated.

Monetary Policy and Risk Taking by Financial Institutions

Expansionary monetary policy, such as an interest rate cut, can increase the risk-bearing capacity of financial institutions, thus increasing lending. In addition, incentives related to performance measurement and risk management can further enhance the risk-taking channel and suggest that even financial institutions without significant leverage can amplify the transmission of monetary policy.

Accommodative monetary policy—namely through interest rate cuts—can encourage financial intermediaries to take more risk and thus reduce the cost of borrowing. Through this mechanism, changes in short-term policy rates can have a large effect on long-term rates by reducing term premiums and thereby boosting economic activity, even if expectations about future short-term rates are unchanged.[22] This can happen in several ways.

[22]The macroeconomic response to central bank actions depends a great deal on whether a change in the short-term interest rate is transmitted to long-term rates (which are more relevant for aggregate demand). Under the expectations channel of monetary policy, central banks can affect long-term interest rates—and thereby

First, lower interest rates can encourage risk taking by financial institutions through greater leverage.[23] Since many financial institutions are engaged in maturity transformation, their profits tend to increase when monetary policy rates decline, at least in the short term.[24] This effect, in theory, should be more significant for financial intermediaries that rely more heavily on short-term wholesale funding (such as investment banks) than for those with more stable funding sources (such as commercial banks or thrifts). Higher profits, in turn, enhance their risk-bearing capacity—that is, their ability to take on more debt and expand their balance sheets (Adrian and Shin 2011).[25] Increased lending or asset purchases by these institutions will raise asset prices and reduce the price of risk, thus enhancing the transmission of monetary policy.

Second, accommodative monetary policy can also encourage risk taking by financial intermediaries that promise fixed nominal yields. Lower interest rates may induce financial intermediaries to buy higher-yield but riskier assets (reach for yield), which can drive up the price of risky assets and reduce the cost of borrowing. For instance, publicly traded commercial banks that do not mark to market most of their assets, and that are subject to regulatory capital constraints based on book values, have a strong incentive to boost reported earnings by replacing low-yielding with high-yielding assets (Hanson and Stein 2015). Similarly, insurance companies typically also have an incentive to reach for yield when funding conditions are loose (Becker and Ivashina 2015).[26]

Third, a large asset management industry largely driven by concerns about relative performance can also amplify the transmission of monetary policy. The growth of asset managers since the financial crisis has been remarkable (Chapter 3 of the April 2015 GFSR). Typically, funds are rewarded based on how their performance compares with that of their peers (Chevalier and Ellison 1997). This compensation structure, in turn, leads asset managers to be especially sensitive to changes in short-term rates and to the behavior of other asset managers, thus triggering significant asset price movements (Morris and Shin 2015).[27] In addition, investors may perceive a first-mover advantage when responding to changes in fund performance arising from a change in interest rates; they do not want to be the last to redeem if the fund sells its most liquid assets first (Feroli and others 2014; April 2015 GFSR). When both effects (relative performance concerns of fund managers and quick redemptions by ultimate investors) combine, the magnitude of the effect of monetary contractions on asset prices is further amplified. Thus, as the size of the asset management industry grows, an increase is likely in the effect of monetary policy on asset prices—as well as an increase in the resulting effect on credit and economic activity via the balance sheet channel.[28]

Finally, the risk-taking channel of monetary policy can operate through risk-management models used by financial institutions. A reduction in interest rates boosts asset valuations. One of the expected consequences of rising valuations is a drop in asset price volatility. This, in turn, can encourage risk taking by both banks and nonbanks by relaxing internal risk models based on value at risk (VaR). Thus, a more

aggregate demand—by signaling a path for future short-term interest rates (Woodford 2005). Alternatively, under the risk-taking channel, monetary policy affects long-term interest rates chiefly through its effect on risk premiums.

[23]Evidence in Cecchetti, Mancini-Griffoli, and Narita (forthcoming) suggests that borrowing (or leverage) by banks and insurance companies increases with the length of the period of monetary easing. There is also substantial empirical evidence showing that banks lower their lending standards with more accommodative monetary policy (Dell'Ariccia, Laeven, and Suarez 2016; Jiménez and others 2014).

[24]Alessandri and Nelson (2015) and Busch and Memmel (2015) show that higher interest rates dampen bank profits in the short term but have the opposite effect over the long term.

[25]The difference between this mechanism and the balance sheet effects previously discussed is that the latter relate to the ability to provide more credit because collateral constraints of borrowers are less binding, while the former considers the effect of monetary policy on institutions' willingness to take on risk via leverage targets or monetary policy's effect on target rates of return on investment (see Dell'Ariccia, Laeven, and Marquez 2014).

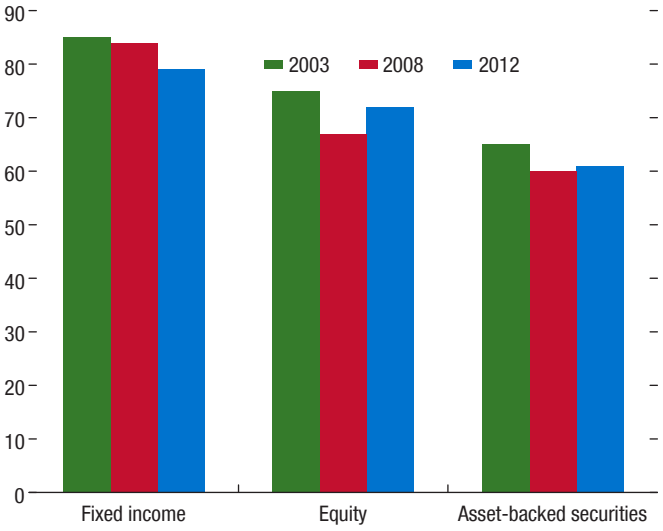
[26]For instance, by taking on poorly assessed tail risks or by buying assets based only on coarse credit rating categories in order to comply with capital requirements.

[27]The strategic interactions, in addition to the ones coming from first-mover advantages and relative performance concerns, can also result from implicit or explicit guarantees provided to asset managers by other institutions (Parlatore 2016). In addition, the presence of leverage among these asset managers will likely enhance the risk-taking channel.

[28]The empirical literature on the effect of monetary policy on asset prices and asset allocation has found that an expansionary monetary policy is associated with higher stock market valuations (Thorbecke 1997) and causes a shift in mutual funds' portfolios away from fixed income and into equity (Hau and Lai 2016).

Figure 2.5. Value at Risk in Risk Management by Asset Class and Year
(Percent)

Value at risk (VaR) has become slightly less popular but is still widely used by financial firms.



Source: Global Risk Management Survey (Deloitte 2004, 2009, 2013).
Note: The figure shows the percentage of surveyed financial firms that report using VaR to assess and manage market risk for fixed income, equity, and asset-backed securities.

pervasive use of such models by nonbank financial intermediaries will likely magnify the transmission of monetary policy. The evidence, however, suggests that these models, although still popular, have become less widespread since the 2007–09 financial crisis (Figure 2.5).

Empirical Evidence on the Transmission of Monetary Policy

This section examines the effect of monetary policy changes on credit provided or total assets owned by banks and nonbanks.

Most of the existing empirical literature on the role of nonbanks in monetary transmission either applies only to the United States or takes a narrow view of the nonbank financial sector. These studies suggest that nonbanks have similar, but more muted, responses to monetary policy relative to banks or may even respond in the opposite direction. For instance, in the United States, securities broker-dealers seem to be less responsive to monetary policy than banks but only money market funds show contrarian responses (Igan and others 2013). Other studies examining U.S. flow-of-funds data find that monetary tightening actually increases asset holdings of nonbank financial institutions (Den Haan and Sterk 2011).

A first look at cross-country evidence suggests that the aggregate macroeconomic response to monetary policy changes is stronger in countries with larger nonbank sectors. This result is based on the analysis of a panel of developed and emerging market economies, controlling for the level of financial market development (Figure 2.6).[29] However, there are important differences across countries in the composition of financial systems and in the characteristics of nonbanks, which cloud the analysis. Therefore, the remainder of this section examines detailed evidence across countries and different types of financial intermediaries.

To identify the effects of monetary policy, the empirical analysis to follow largely relies on two complementary strategies. First, it quantifies the aggregate effect of monetary policy on different types of financial intermediaries by looking at the responses of total real assets—adjusted for valuation changes and excluding equity and government securities—held by banks, insurance companies and pension funds, and other financial intermediaries.[30] Second, it uses microeconomic data to improve the identification of the effect of monetary policy on the supply of credit by different types of financial intermediaries.[31] Last, to gauge the potential for substitution between bank and nonbank financial intermediation, it estimates the ability of nonfinancial borrowers to use bond financing instead of bank loans after a monetary policy contraction.

[29]The results for banks and nonbanks are not necessarily different from a statistical point of view because the responses are not very precisely estimated (see Annex 2.1). Furthermore, the use of the same simple specification for all countries, as is usual in the literature, may mean that monetary policy is not adequately identified for every country.

[30]The results are based on vector autoregression (VAR) analyses. The main problem with the identification of monetary transmission is that the direction of causality between monetary policy and the provision of credit by financial intermediaries is difficult to establish.

[31]The aggregate data analysis can provide a sense of the overall magnitude of the effects, but compared with the firm-level analysis, it offers limited insight into the underlying mechanisms, is less able to deal with endogeneity, and is less robust to changes in the composition of the financial sector.

Analysis Based on Aggregate Data

This section estimates how bank and nonbank subsectors react to monetary policy changes in terms of total credit. The analysis helps to infer how the magnitude of monetary policy transmission is affected by the composition of the financial sector.

For the most part, other financial intermediaries respond more strongly to monetary policy than do banks, insurance companies, and pension funds.[32] Bank assets decline with a considerable lag after a monetary contraction, but the response of the nonbank financial sector varies across countries. In general, the analysis does not corroborate previous empirical studies showing a more muted or even opposite response of nonbanks relative to banks.[33] The results, by country (Figure 2.7), suggest that the difference in responses of other financial intermediaries to monetary policy derives from country-specific characteristics, including different compositions of these nonbank financial sectors. For instance, in the United Kingdom, other financial intermediaries include mostly mutual and hedge funds, which are most likely affected by monetary policy through the risk-taking channel. In the United States, they are composed of investment funds, government-sponsored enterprises, broker-dealers, issuers of asset-backed securities, and finance companies, which respond to monetary policy in different ways.[34]

[32]The analysis uses a VAR with six variables: the natural logarithms of real GDP, of the GDP deflator, and of real total assets (adjusted for valuation effects) of banks, of insurance companies and pension funds, and of other financial intermediaries, and the nominal monetary policy rate. Total assets, which approximate lending by banks and nonbanks, are deflated and adjusted for valuation changes and do not include equity and government securities. The analysis considers data from Australia, Canada, Korea, South Africa, the United Kingdom, and the United States. It extends work by Den Haan and Sterk (2011); Nelson, Pinter, and Theodoridis (2015); and Herman, Igan, and Solé (2015), and is robust to various possible sources of misspecification. See Annex 2.1.

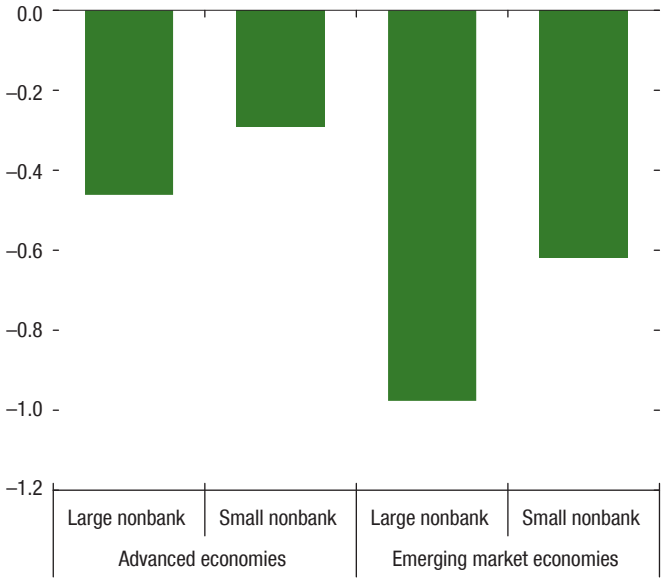
[33]The contrarian reaction of U.S. nonbank credit reported in Den Haan and Sterk 2011 seems to be driven by the narrow definition of credit used in that study—consumer and mortgage credit—as well as the time period, which ends in early 2008. In this chapter's analysis, the responses of other financial intermediaries and banks in the United States are not statistically different.

[34]In Australia, other financial intermediaries mostly comprise securitizers and investment funds; in Canada, the main other financial intermediaries are issuers of asset-backed securities, mutual funds, and other private financial institutions including holding companies; in Korea, other financial intermediaries mostly include finance companies such as credit card and leasing companies, and investment trusts; and in South Africa, other financial intermediaries are represented by investment trusts.

Figure 2.6. Transmission of Monetary Policy and Size of Nonbank Financial Sector

(Percent)

The transmission of monetary policy is slightly stronger in economies with large nonbank financial sectors.



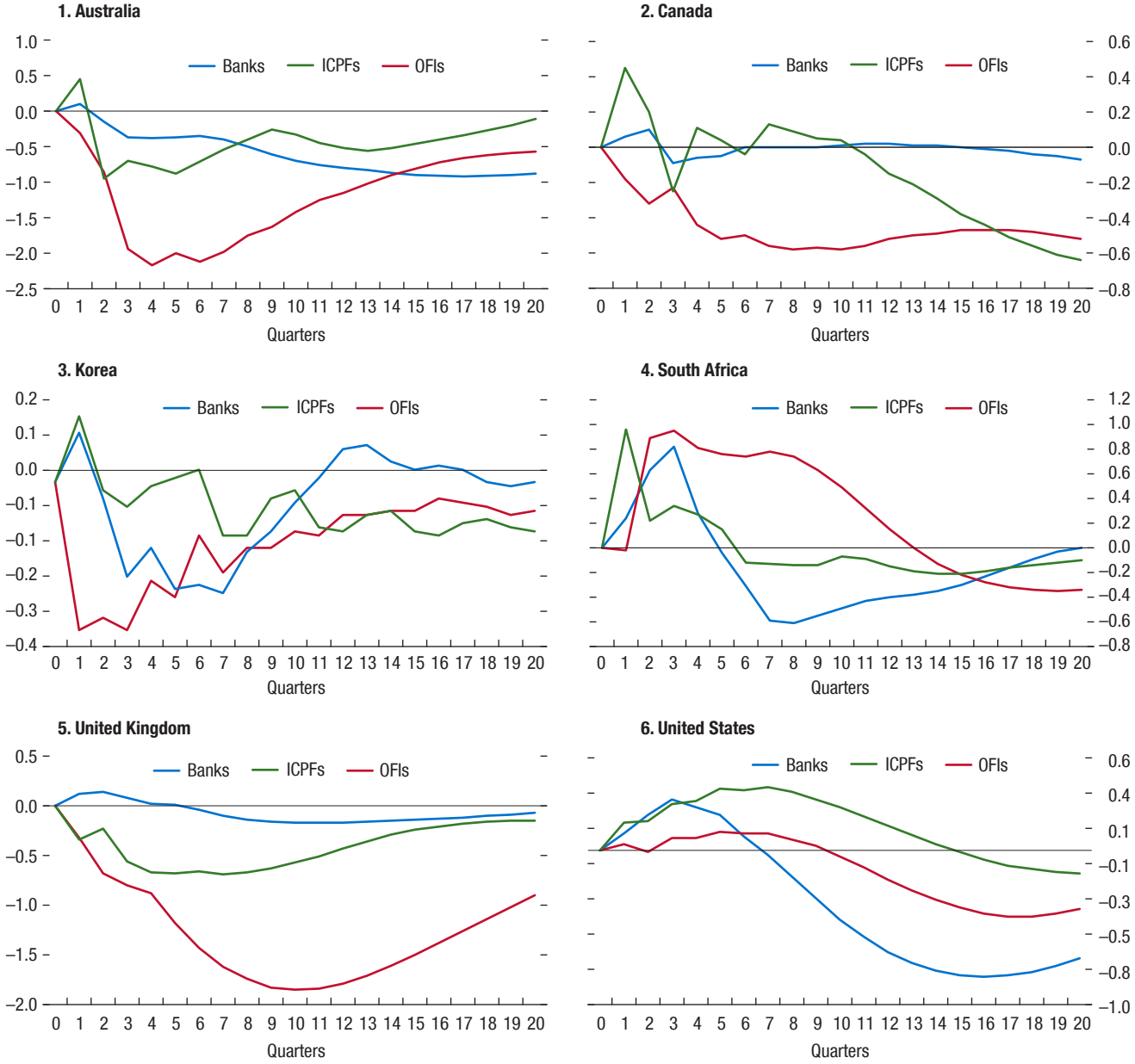
Sources: IMF, International Financial Statistics database; Organisation for Economic Co-operation and Development; World Bank; and IMF staff estimates.
Note: The figure shows the estimated peak response of GDP to a 1 percentage point increase in the nominal interest rate. The responses are estimated using a vector autoregression of log real GDP, log GDP deflator, the log of the nominal effective exchange rate, and the monetary policy interest rate (shadow policy rate for countries using unconventional monetary policy). The responses are identified using a Cholesky decomposition in which the interest rate is ordered last. See Annex 2.1.

Mutual funds, in particular, display responses to monetary policy consistent with the risk-taking channel. A closer look at other financial intermediaries shows that, after an increase in the monetary policy rate, total assets (in real terms) under management by equity funds consistently decline, whereas those of bond funds first decline and then increase (Figure 2.8, panel 1). This result suggests that, with some delay, investors switch from riskier assets (equity) to safer assets (bonds). On the other hand, money market mutual fund assets rise sharply following the monetary policy contraction, which is consistent with both a flight-to-quality effect and the bank-lending channel. Because many mutual funds invest internationally, the observed shifts in asset patterns likely represent an important mechanism for monetary spillovers.

Figure 2.7. Response to a Monetary Policy Contraction

(Percent)

Bank assets decline after a monetary contraction, but with a considerable lag. The response of insurance companies and pension funds (ICPFs) and other financial intermediaries (OFIs) varies across countries.

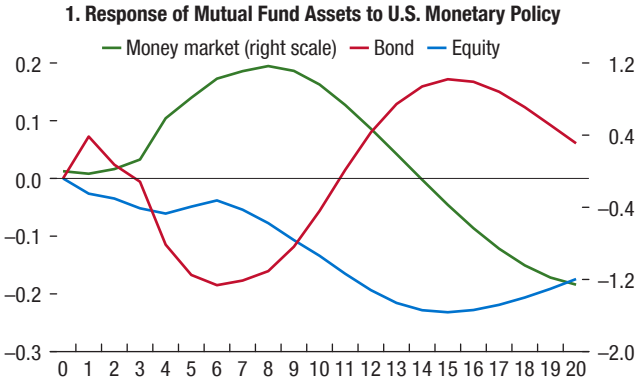


Sources: Bank of Canada; Bank of England; Bank of Korea; Federal Reserve System; Haver Analytics; Organisation for Economic Co-operation and Development; Reserve Bank of Australia; Reserve Bank of South Africa; and IMF staff estimates.
Note: The figure shows the response of total assets by sector to a 1 percent increase in the monetary policy rate. Banks' assets in the United Kingdom include those of the Bank of England. Monetary policy is measured with a shadow policy rate for countries using unconventional monetary policy. The responses are identified using a Cholesky decomposition in which the interest rate is ordered last. The results are robust to many possible sources of misspecification. ICPFs = insurance companies and pension funds; OFIs = other financial intermediaries. See Annex 2.1 for details.

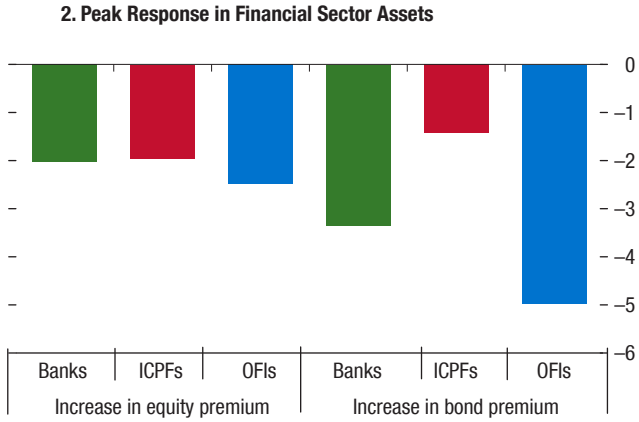
Figure 2.8. Risk Taking and Monetary Policy in the United States

(Percent)

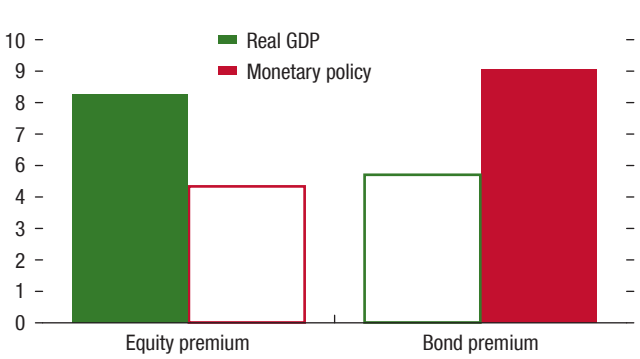
U.S. mutual funds display behavior consistent with the risk-taking channel of monetary policy.



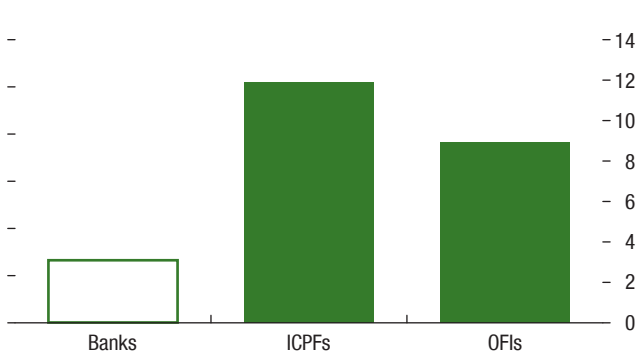
All financial intermediaries are affected by changes in risk premiums in the United States.



U.S. monetary policy seems to matter more for risk appetite in fixed income markets.



Nonbanks contribute more to the behavior of the excess bond premium in the United States.



Sources: Federal Reserve System; Haver Analytics; Organisation for Economic Co-Operation and Development; and Thomson Reuters Datastream.
Note: Panel 1 shows the response of total assets net of valuation by type of mutual fund to an orthogonal monetary policy innovation. The response is estimated with a vector autoregression (VAR), which also includes real GDP, the GDP deflator, shadow rate, total assets for the banking, and insurance and pension sectors, and a trend with a break in the postcrisis period. Panel 2 shows the peak response of each variable on the *x*-axis to orthogonal shocks to the equity and bond premiums. The VAR, in this case, includes real GDP, the GDP deflator, total assets for each financial subsector, the U.S. shadow policy rate from Ichiue and Ueno 2016 to take into account the use of unconventional monetary policy, the Gilchrist and Zakrajšek 2012 excess bond premium, and the equity risk premium from Absolute Strategy Research. Panel 3 shows the contribution of real GDP and monetary policy to the behavior of risk premiums, using a 16-quarter-ahead forecast-error variance decomposition based on the preceding VAR (solid bars are statistically significant at the 68 percent level). Panel 4 shows the contribution of each financial subsector to the behavior of the excess bond premium, using the same method as in panel 3. ICPFs = insurance companies and pension funds; OFIs = other financial intermediaries. See Annex 2.1 for details.

At least for the United States, the risk-taking channel of monetary policy seems to operate mostly through nonbank financial intermediaries. An extension to the aggregate analysis discussed earlier shows that a drop in the risk appetite in credit markets—measured by a rise in the return that investors require to hold bonds in excess of the risk-free rate of return, that is, a rise in the bond risk premium[35]—is followed by a large decline in total assets owned by other financial intermediaries, in the United States (Figure 2.8, panel 2).[36] This sug-

[35]The bond risk premium is captured by Gilchrist and Zakrajšek's (2012) excess bond premium.

[36]However, the responses to increases in the equity risk premium—the return that investors require to hold equity in excess of the risk-free rate of return—are more muted.

gests that nonbanks are very responsive to changes in risk appetite. The bond risk premium, in turn, is significantly affected by monetary policy (Figure 2.8, panel 3) and by nonbanks (Figure 2.8, panel 4). An open question is whether the risk-taking channel of monetary policy will remain significant as monetary policy normalizes and interest rates increase.

Digging Deeper: Micro Data on Bank and Nonbanks

To better understand the differences behind the behavior of heterogeneous nonbank sectors and to better identify some of the mechanisms discussed earlier, this section estimates the response of bank and nonbank financial intermediaries to policy shocks, exploiting firm-level characteristics.

With the exception of finance companies, both banks and nonbanks reduce their balance sheets three years after an interest rate increase (Figure 2.9, panel 1). In particular, peak responses tend to occur 12 quarters after the monetary policy shock and are statistically significant for all types of financial intermediaries.[37] Investment banks and insurance companies react in the same direction as banks, and appear to respond more strongly.[38] The reaction is different for finance companies, supporting the view that they act as substitutes for banks and dampen the monetary transmission mechanism. However, the substitution between banks and finance companies is unlikely to be relevant for the aggregate economy because the latter usually represent a relatively small share of financial sector assets. Furthermore, evidence based on stock returns confirms that banks' and nonbanks' reactions to unconventional monetary policies are not substantially different overall (Box 2.1).

The response of banks and nonbanks to monetary policy depends on their leverage, size, and access to wholesale funding. First, smaller banks are more responsive to monetary policy (Figure 2.9, panel 3), but there is no consistent relationship with size for nonbanks (whose different sizes may in fact represent very different business models). Second, a higher reliance on wholesale funding by banks and life insurance companies seems to dampen the response to monetary policy (Figure 2.9, panel 4).[39] Since financial institutions that are able to access wholesale markets easily are the least financially constrained, these findings are broadly in line with the channels of monetary policy that emphasize the presence of imperfections in the market for debt and equity issued by financial intermediaries. However, just as in Xie 2016, this study finds no consistent relationship between the percentage of assets marked to market and the response of total assets to monetary policy.

The substitution between banks and finance companies is stronger in countries with stricter bank regulation. In countries with stricter bank capital regulation, in response to monetary tightening, banks reduce their total assets more than banks subject to less-strict regulation. In line with greater substitution between bank and nonbank credit, finance companies increase their assets more when bank capital regulation is stricter (Figure 2.10).

The behavior of mutual funds in response to monetary policy changes is consistent with the risk-taking channel. Fund-level data on portfolio allocations by equity and bond mutual funds in the United States show that fund managers tilt their allocations toward riskier assets after an expansionary monetary policy change (Figure 2.11).[40] In particular, in response to monetary policy loosening, bond funds significantly increase their allocations to high-yield and long-term bonds in their portfolios. In addition, U.S. bond funds and, to a smaller extent, U.S. equity funds increase their investments in countries with speculative-grade sovereign credit ratings.

How Easily Do Borrowers Substitute Market Financing for Bank Financing?

This section examines how nonfinancial firms' reliance on bank and nonbank financing changes in response to monetary policy actions. If this substitution is seamless, the impact of monetary policy on real activity through its effect on the relative supply of credit by banks (as opposed to nonbanks) is likely to be unimportant.

[37]Although the average response of banks is not significant at the 90 percent confidence level, those of investment banks, finance companies, and small banks are significant (Figure 2.9, panel 3). The analysis found no robust evidence of asymmetric responses to monetary policy contractions and expansions.

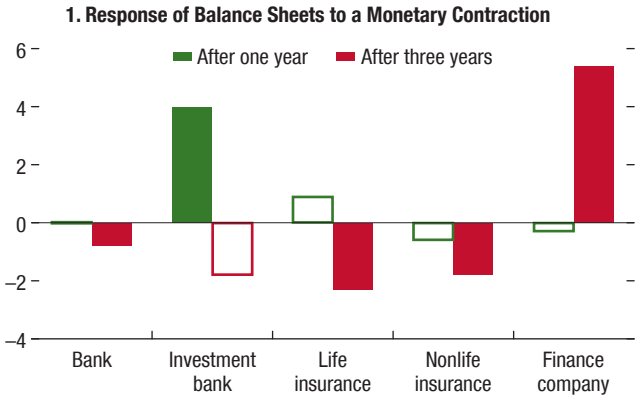
[38]The estimates are not precise enough to be unequivocal.

[39]The finding that greater access to wholesale finance dampens the response of banks and life insurers remains significant at a 90 percent significance level. However, the relationship between capital and monetary policy is no longer significant (Figure 2.9, panel 2). Furthermore, there is no consistent relation between the change in assets following monetary policy changes and the proportion of liquid assets.

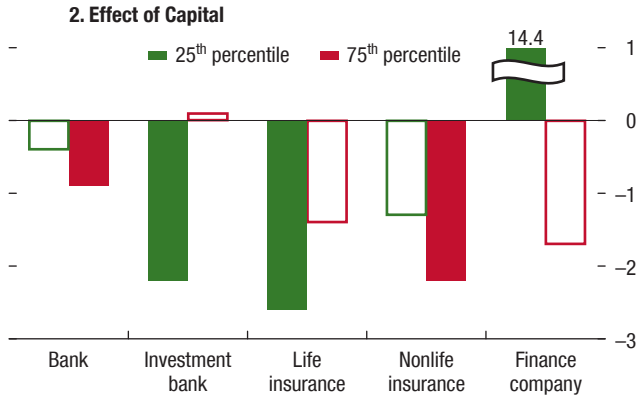
[40]Hau and Lai (2016) report similar findings for European mutual funds.

Figure 2.9. Monetary Policy and Total Assets Owned by Financial Intermediaries
(Percent)

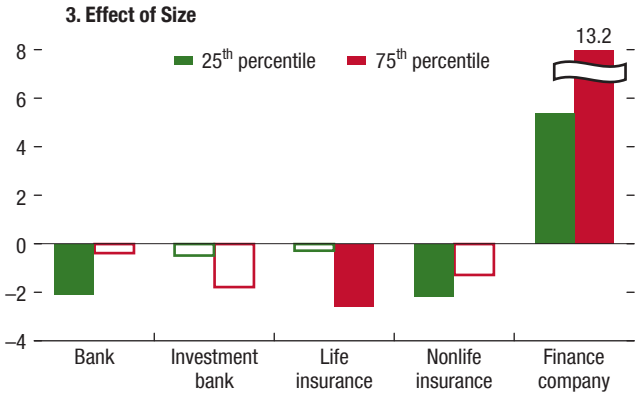
Banks', investment banks', and insurers' balance sheets shrink following a monetary contraction while finance companies show the opposite reaction.



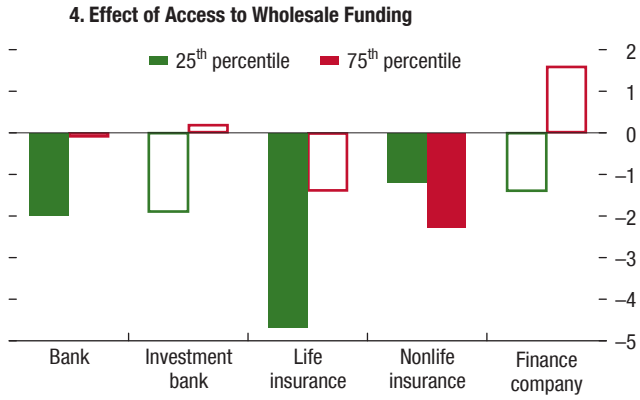
More highly capitalized banks contract lending more in response to a monetary contraction while more leveraged finance companies expand more.



Smaller banks are more responsive but the opposite holds true for finance companies.



More wholesale funding dampens the response to monetary policy.



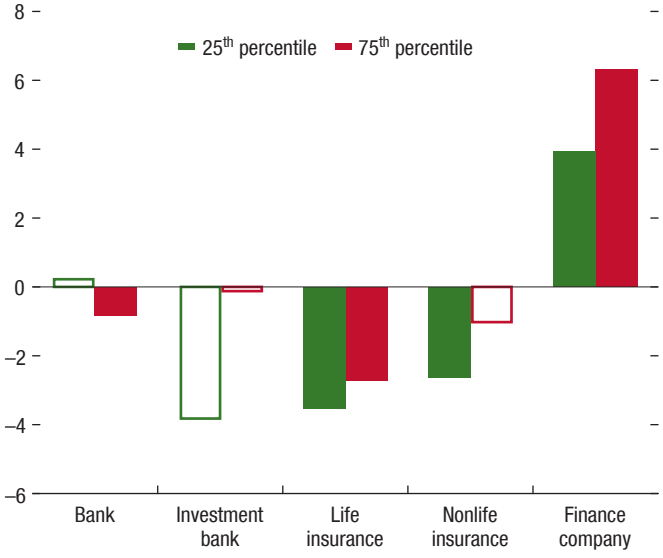
Sources: SNL Financial; Thomson Reuters Datastream; and IMF staff estimates.
Note: Panel 1 shows the estimated response of total real assets of financial institutions to a one percentage point monetary policy change. Panels 2 to 4 show the impulse responses after three years at the 25th and 75th percentiles of the interaction variable (that is, the equity to asset ratio, balance sheet size, and wholesale funding ratio, respectively). The responses are drawn from impulse responses based on a firm-level panel vector autoregression (VAR). The monetary policy measure is the orthogonal innovation to the monetary policy rate from a VAR analysis that also includes real GDP and the real GDP deflator. The VAR uses the shadow policy rate for countries using unconventional monetary policies. The sample covers listed financial institutions from advanced economies from 1998 to 2015, at quarterly frequency. Solid bars mean the responses are significant using a 68 percent confidence interval. See Annex 2.2 for details.

In general, the extent to which firms use bond financing depends on the overall level of financial market development.[41] A number of factors affect firms' choices between bank loans and bonds. First, issuing bonds entails substantial issuance costs, including a large fixed component. Second, bonds may be more difficult to renegotiate in times of stress. Third, banks may be better suited than the public or even institutional investors to obtain information about firms. The data show that the reliance on loan versus bond financing varies significantly across countries. Bond financing is favored in countries with deeper financial markets and by larger firms (Figure 2.12). In addition, firms in countries that have experienced large increases in the relative size of the nonbank financial intermediation sector since 2010—

[41]This section focuses on corporate borrowing because nonfinancial firms have more access to market financing than do households and because of data availability.

Figure 2.10. Bank Regulation, Monetary Policy, and Total Assets Owned by Financial Institutions
(Percent)

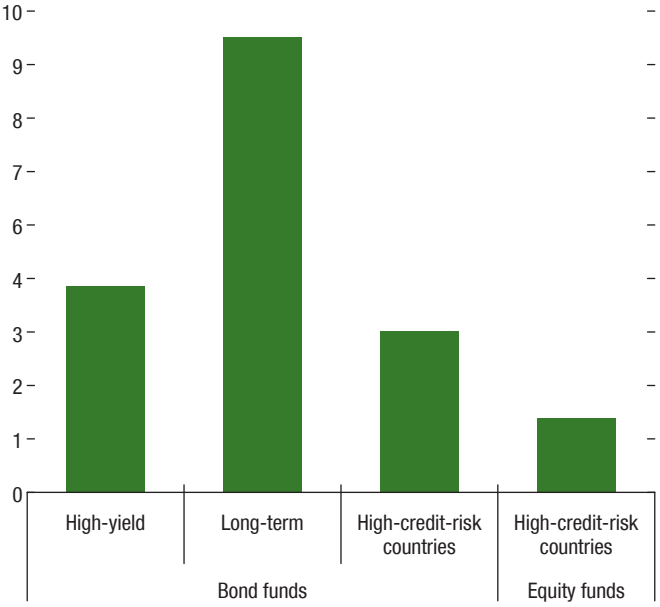
Bank regulation may induce the substitution between bank and nonbank credit.



Sources: Barth, Caprio, and Levine 2013; Thomson Reuters Datastream; and IMF staff estimates.
Note: The figure shows the impulse responses after three years at the 25th and 75th percentiles of the interaction variable (Barth, Caprio, and Levine 2013 index of stringency of bank capital regulations), as in Figure 2.9. Solid bars indicate that the estimate is significant using a 68 percent confidence interval.

Figure 2.11. Risk Taking by Mutual Funds and Monetary Policy
(Percent of total assets)

Mutual funds in the United States increase the riskiness of their portfolios after an accommodative monetary policy change.



Sources: EPFR Global; Lipper Global Mutual Fund Holdings; and IMF staff estimates.
Note: The figure shows the estimated change in the allocations of mutual funds' portfolios into each asset class, after a 1 percentage point decrease in Wu and Xia's (2016) shadow policy rate. The shadow policy rate takes into account the use of unconventional monetary policies. All estimates are significant at least at the 10 percent significance level. See Annex 2.2 for details.

such as Brazil, Canada, Germany, and the United Kingdom—on average reduced their reliance on bank financing significantly more than those in countries where the nonbank sector has not increased (Japan, United States).

Overall, borrowing companies show a limited ability to substitute between market and bank financing following a monetary policy change. An analysis using data for nonfinancial firms in Europe, Japan, and the United States for 1993–2015 finds that the choice between the issuance of bonds and syndicated loans is affected by monetary policy—but the effect is small. On average, an increase in the monetary policy rate of roughly 2 percentage points reduces firms' probability of bank financing in favor of bond issuance by only 3 percentage points (Figure 2.13, panel 1). The evidence of limited substitutability between bond and bank financing is especially significant given that the firms in the sample are very large listed companies that should have relatively easy access to bond markets.[42] The limited substitution between bank and market financing suggests that shocks to the supply of bank loans caused by monetary policy changes can have significant effects on total credit and economic activity.

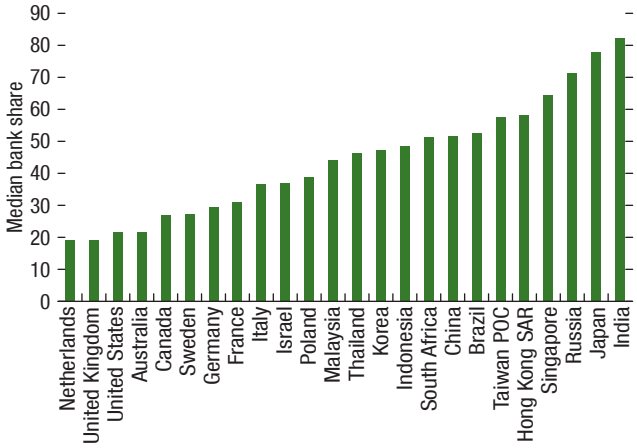
Nonfinancial firms with more tangible assets can more easily switch to market financing after a monetary contraction. Although firm size does not seem to significantly influence the way monetary policy affects firms' financing choices, the amount of tangible assets does (Figure 2.13, panel 2), probably because tangible

[42]The lack of substitution between bond and bank financing reflects difficulty in accessing bond markets even for large firms and borrowing conditions in bond markets that closely mirror those for bank loans. That is, the lack of substitution may reflect either that firms cannot substitute or that they can but do not have an incentive to do so. Unfortunately, empirically it is difficult to distinguish unambiguously between the two possible explanations. However, the fact that firms do not appreciably substitute bonds for loans when banks' lending standards tighten suggests that they cannot easily substitute bank loans.

Figure 2.12. Bond Finance around the World

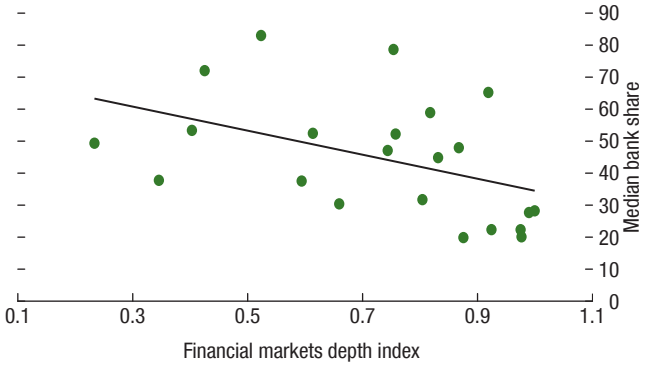
The reliance of listed companies on loan versus bond financing varies significantly across countries.

1. Loan versus Bond Financing, 2014
(Percent)



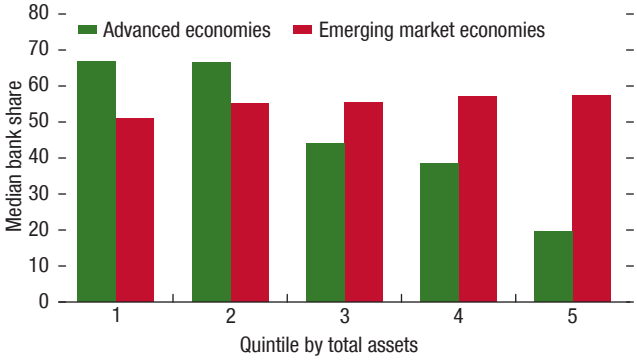
Bond financing is favored in deeper financial markets.

2. Bank Financing and Financial Development, 2014
(Percent)



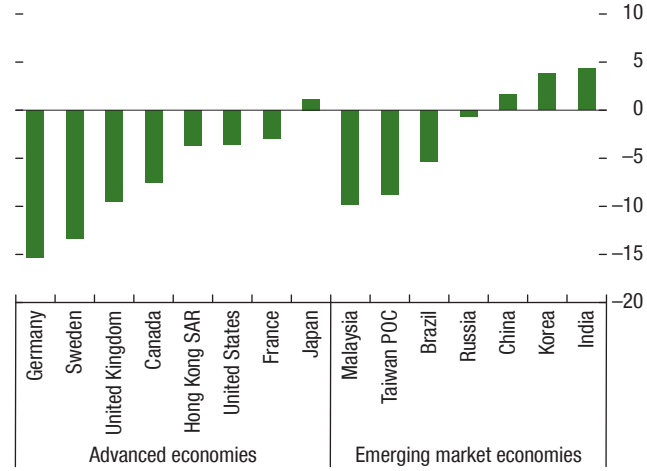
Larger firms rely more on bond financing in advanced economies.

3. Bank Financing by Firm Size, 2014
(Percent)



Bond financing increased in most countries after the crisis.

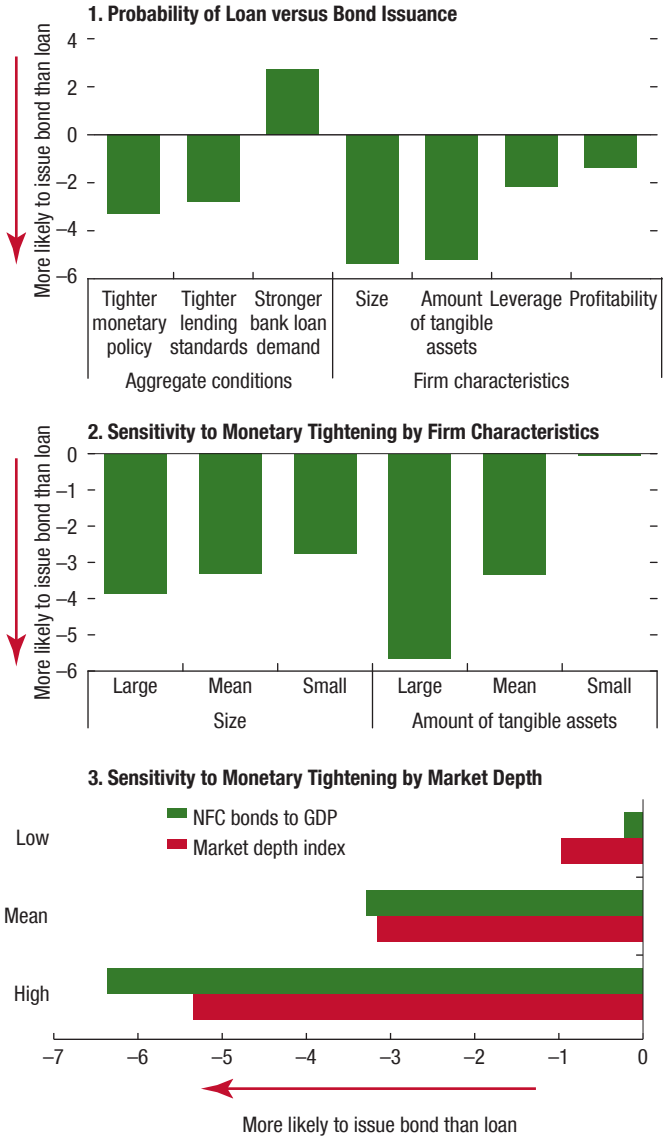
4. Change in Median Bank Financing, 2009–14
(Balanced panel; percentage points)



Sources: Dealogic; FactSet; IMF, World Economic Outlook database; Svirydzenka 2016; and IMF staff calculations.
Note: Firms' reliance on bank financing is computed as the ratio of loan liabilities to the sum of loan, note, and bond liabilities. In panel 2, the financial markets depth index (Svirydzenka 2016) takes into account the depth of equity and bond markets (including government, financial, and nonfinancial bond markets). In panel 3, quintiles are in ascending order by firm size, measured by total assets. Taiwan POC = Taiwan Province of China. See Annex 2.3 for details.

Figure 2.13. Bond Financing and Monetary Policy
(Percentage points)

The effect of monetary policy on the substitution between bank loans and bond issuance is stronger for firms that have more tangible assets and firms from countries with deeper financial markets.



Sources: Bank of England; Bank of Japan; Dealogic; European Central Bank; FactSet; Federal Reserve Board; IMF, World Economic Outlook database; Svirydzenka 2016; Thomson Reuters Datastream; and IMF staff calculations.
Note: Panel 1 shows the estimated response of the probability of a firm taking a loan instead of issuing a bond when each explanatory variable increases by one standard deviation (about 2 percentage points for the monetary policy measure). Panel 2 shows how the sensitivity to a one standard deviation tightening in monetary policy changes by firm characteristics (size and amount of tangible assets). Panel 3 shows how the sensitivity to a 1 percentage point tightening in monetary policy varies with market depth. Panels 1 and 2 are estimated using data for listed nonfinancial firms in Europe, Japan, and the United States during 1993 to 2015. Panel 3 is estimated for 2010 to 2015 using an unbalanced panel of nonfinancial firms in 23 advanced and emerging market economies. For countries using unconventional monetary policies, the monetary policy measure is based on a shadow policy rate. All estimates are significant at least at the 10 percent significance level. NFC = nonfinancial corporation. See Annex 2.3 for details.

assets can more easily be used as collateral. Finally, the formal analysis confirms that firms can more readily resort to bond financing when they are located in countries with deeper markets (Figure 2.13, panel 3).

Policy Discussion

Implications of the Increase in Nonbanks for Monetary Policy Implementation

Regardless of how effective monetary policy may be at the current juncture of very low interest rates, the growth in the nonbank financial sector around the world will have important implications for the conduct of monetary policy.[43] Although the nature of those implications is still not well understood, fears that monetary policy will become less effective because of nonbanks seem unfounded. First, the increasing role of the risk-taking channel through nonbanks may mean shorter transmission lags for monetary policy. Second, changes in the regulatory framework for nonbanks (in particular, efforts to close the regulatory gap with banks) are likely to affect the strength of monetary policy transmission. Third, because other financial intermediaries seem to react more to monetary policy actions, the dosage of such actions will need to be continuously recalibrated as the sector gains in importance.

To better calibrate their actions, monetary policymakers need to monitor the information provided by the balance sheets of key financial intermediaries. In light of the evidence of monetary policy transmission through the risk-taking channel, central banks should be mindful of the level and growth in leverage in financial institutions and of lending in short-term funding markets. Given the growth of the nonbank financial sector, the information contained in the balance sheets of nonbanks may be more useful than more traditional measures of monetary aggregates (Adrian and Shin 2011). Leverage among financial institutions has the potential to amplify the transmission of short-term interest movements to asset prices. The same is true for relative performance concerns among asset managers. Consequently, more than in

[43]It is also plausible that changes in the conduct of monetary policy since the financial crisis have facilitated the growth of nonbanks. For instance, the recent expansion of collateral frameworks to include certain assets made it easier for certain nonbank lenders, such as automobile lenders, to securitize their claims and expand their balance sheets.

the past, monetary policymakers need to monitor the behavior of investment funds, given their role as drivers of sharp fluctuations in risk premiums.

Better data on the activities of nonbanks are needed. Significant data gaps persist concerning the activities and exposures of nonbanks. For instance, most emerging market economies collect very limited data on nonbank balance sheets. The lack of data on the amount of financial intermediation by the nonbank sector may lead to the underestimation of both the level and growth of total credit, with implications for both monetary and prudential policies. There is also limited information on certain exposures, including to foreign exchange risk. The latter gap is especially significant, given the constraints that such exposures may impose on the conduct of monetary policy (Box 2.2).

The Impact of Monetary Policy on Financial Stability

Financial sector supervisors need to be mindful of the changing financial stability implications of monetary policy in light of the growing importance of nonbank lenders. Given that the risk-taking channel seems to be an increasingly important mechanism in driving the responses of financial intermediaries, monetary policy actions are likely to have stronger consequences for the soundness of the financial sector. This does not imply that monetary policy should pursue financial stability objectives (IMF 2015), but it does suggest the need for greater vigilance by prudential and regulatory authorities. It also underscores the need for further research to better understand the impact of monetary policy on risk taking by different financial institutions.

Conclusions and Policy Recommendations

Overall, the chapter finds that the growth of the nonbank financial sector has not weakened the impact of monetary policy on economic activity. The chapter's specific findings are that:

- Over the past 15 years, the transmission of monetary policy seems to have strengthened in many countries.[44] Transmission, on average, appears to be somewhat stronger in countries with larger nonbank sectors, but the differences are small.
- With the exception of finance companies, banks and nonbanks contract their balance sheets when monetary policy tightens. For the most part, nonbanks react more to monetary policy than do banks, but there are important country differences. Therefore, following a monetary policy contraction, a reduction in the supply of credit by one type of financial intermediary is likely to be accompanied by a similar reduction in total credit. Banks and nonbanks with easier access to funding reduce their balance sheets less, dampening the transmission of monetary policy.
- Changes in credit supply by banks remain important for real economic activity because following a monetary policy contraction, even very large nonfinancial firms have a limited ability to issue bonds in order to replace bank loans.
- The risk-taking channel, through changes in asset allocations, seems to play an important role in explaining the strengthening of the transmission of monetary policy. Changes in the asset allocations of funds also entail the potential for international monetary spillovers.

The chapter offers four main policy recommendations:

- *The conduct of monetary policy will need to continue to adapt to changes in the transmission mechanism as nonbank financial intermediation grows.* For example, as the relative importance of the risk-taking channel increases, the effects of monetary policy changes on the real economy may become more rapid and marked. At the same time, changes in nonbank regulation will also affect monetary policy transmission.
- *Monetary policymakers need to monitor the size and composition of key financial intermediaries' balance sheets.* This is important in order to assess changes in the risk appetite of financial institutions.
- *Policymakers need to be mindful of the changing financial stability implications of monetary policy.* Monetary policy actions are likely to have stronger consequences for financial soundness because they increasingly affect the risk-taking behavior of financial intermediaries. This suggests the need for greater vigilance by prudential and regulatory authorities.
- *Data provision on nonbank financial intermediaries needs to continue to be enhanced.* In particular, many emerging market economies should collect more data on nonbank balance sheets.

[44]The chapter did not attempt to ascertain the strength of monetary policy at the current juncture.

Additional research on the role of nonbanks is needed to better design monetary policy responses over the business cycle. Understanding the role of nonbanks in the transmission of monetary policy is important for the proper design and implementation of macroeconomic stabilization policies. Although the overall response to monetary expansions and contractions of financial intermediation by nonbanks is not qualitatively different from that of banks, important gaps remain in our knowledge of how monetary policy can act through nonbanks. In particular, more effort is needed to better understand the risk-taking channel of monetary policy and the role of asset managers.

Box 2.1. Monetary Policy and the Stock Returns of Banks and Nonbanks

Monetary policy influences output and prices indirectly and often with a lag, but its influence on asset prices is straightforward and immediate. This box finds that the stock prices of banks and nonbanks respond similarly to unconventional monetary policy surprises in the United States, consistent with the view that nonbanks are unlikely to weaken the transmission of monetary policy. The analysis also shows that, for the United States, financial intermediaries respond more to positive surprises.

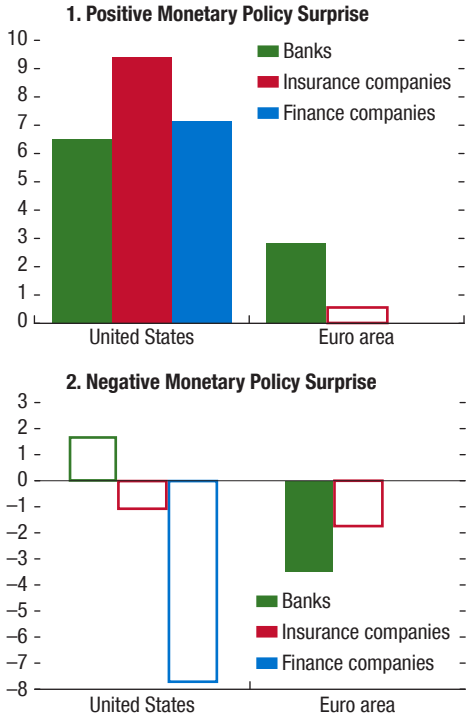
The reaction of the stock market to changes in monetary policy can provide useful insights into the transmission of monetary policy. Unlike balance sheets, stock prices are forward looking: A firm's stock price reflects the value of all its future expected cash flows discounted at an appropriate rate (the risk-free rate plus a risk premium).[1] Therefore, monetary policy surprises can increase stock prices either by improving the expectations about future cash flows, lowering the real risk-free rate, or decreasing the risk premium.

Should the stock prices of banks and nonbank financial intermediaries respond differently to monetary policy? Banks and nonbanks' stock prices may respond differently to monetary policy if they have differential access to debt markets, possibly because some businesses are more transparent than others. Different exposures to interest rate risk, different risk-taking incentives, and different exposure of their client bases to cyclical factors—namely to monetary policy—also affect the way these institutions' stock prices respond to monetary policy. The stock returns of firms that are smaller, have poorer credit ratings, are financially constrained, or belong to cyclical sectors such as technology or communications, are more sensitive to monetary policy (Ehrmann and Fratzscher 2004).

The impact of unconventional monetary policy announcements on equity returns in the United States does not seem to be significantly different between banks and nonbanks. Based on an event

Figure 2.1.1. Stock Price Responses to Unconventional Monetary Policy
(Percent)

In the United States, bank and nonbank stocks respond similarly to monetary policy surprises.



Sources: Bloomberg L.P.; and Thomson Reuters Datastream.
Note: The panels show the estimated response of stock prices (in excess of the aggregate market response) to unconventional monetary policy announcements between November 2008 and December 2013. The stock response is measured by the change in stock return on the day of a monetary policy announcement that cannot be explained by the change in the overall stock market return over the same period. The monetary policy surprise is based on yields for 10-year government bond futures in the United States and a spread between German and Spanish or Italian 10-year government bonds for the euro area. Sufficient data for finance companies are not available for the euro area. Solid bars represent responses that are significant at the 10 percent level.

This box was prepared by Luis Brandão-Marques and Garence Staraci.

[1]Stock prices react quickly to an unexpected monetary policy change because of their forward-looking nature (the expected component should already be incorporated into prices). Although monetary policy seems to affect aggregate stock market returns mostly through the risk premium, its effect on cash flows explains a significant portion of the effect on the cross-section of returns (Maio 2014). Hence, differences in responses by banks and nonbanks offer information about the expected effect of monetary policy on the current and future profitability of each sector.

Box 2.1 *(continued)*

study with daily data, nonbanks (insurance companies and finance companies) and banks tend to respond more to monetary policy than the market average (Figure 2.1.1).[2] There is a considerable degree of asymmetry in the responses to positive or negative monetary surprises. In the United States, responses are stronger for positive monetary policy surprises; by contrast, in the euro area, the stocks of financial institutions are more responsive to negative surprises. Nonbanks tend to have slightly stronger responses than banks but the differences are small and, in general, not significantly different from a statistical perspective. However, in the euro area, banks respond more than insurance companies do to monetary policy surprises.

Overall, the evidence presented here is consistent with the view that nonbanks are unlikely to weaken the transmission of monetary policy. The analysis shows that the stocks of nonbanks and banks react similarly to positive monetary policy surprises. In addition, because finance companies also seem to benefit from monetary expansions to a greater extent than the rest of the market, the results of this analysis suggest that the substitution between banks and finance companies is limited. Therefore, it is plausible that the heightened reaction of financial sector stock prices to accommodative monetary policy signals an expectation of higher future profits and an expansion of balance sheets for the entire financial sector.

[2]The event study controls for market expectations by identifying the surprise component of policy announcements as the change in long-term government bond futures prices (or yields) around the time of policy announcements. The stock price response is measured on a daily basis because the novelty of unconventional policies may mean that it takes time for a policy shock to be properly reflected in asset returns. The time frame considered is November 2008 to December 2013. During this period, there were 47 monetary policy announcements in the United States and 63 in Europe (euro area). Under the term "announcement," the study also includes monetary policy committee meetings with no significant announcement because such decisions can sometimes be considered surprises by the market. The results presented here, albeit using a different method, confirm the findings of Chodorow-Reich 2014 for the United States.

Box 2.2. Exchange Rate Volatility, Monetary Policy, and Nonbanks

This box discusses the effects of monetary policy on financial institutions through changes in exchange rates. For the case of emerging markets, it uncovers the constraints posed by financial structures on monetary policy when the central bank targets the exchange rate.

The exchange rate channel of monetary policy does not work homogeneously across the financial system; financial firms in emerging market economies, on average, seem more exposed to foreign currency changes. Exchange rate changes may affect banks and nonbanks differently, depending on their balance sheet exposures, and their financial and operational ("natural") hedges. Net foreign exchange exposures are indirectly estimated for listed financial firms using the sensitivity of their stock returns to changes in trade-weighted exchange rates.[1] The estimated coefficients (Figure 2.2.1) highlight the different effects that exchange rate variations may have on banks and nonbanks. In the United States, Europe (excluding the United Kingdom), and emerging market economies, the returns of bank stocks are more negatively affected than those of nonbanks following a currency depreciation. Furthermore, the stock returns of emerging market financial institutions are more sensitive to exchange rates than are their counterparts in advanced economies.

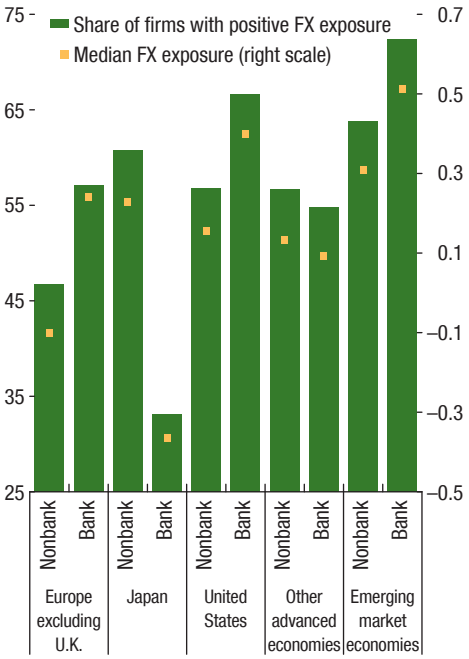
Central banks in emerging market economies may be inclined to avoid large exchange rate fluctuations,

This box was prepared by Nicolás Arregui and Nicolás Magud.

[1]See Adler and Dumas 1984; and Bartram and Bodnar 2007.

Figure 2.2.1. Sensitivity of Financial Firms to Exchange Rate Changes, 1995–2016
(Percent)

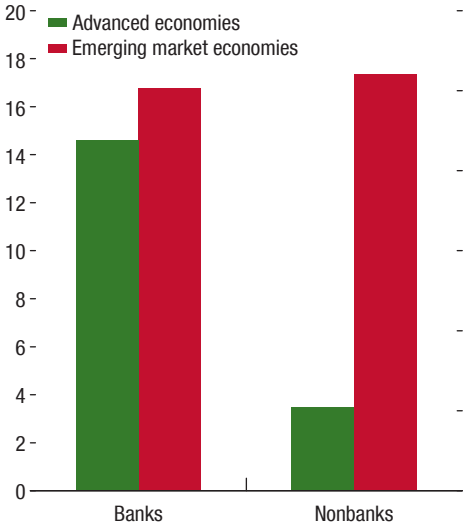
Returns of banks and nonbanks are more sensitive to exchange rate fluctuations in emerging market economies.



Sources: IMF, International Financial Statistics database; Thomson Reuters Datastream; and IMF staff calculations.
Note: Emerging market economies = Brazil, Chile, China, Colombia, Czech Republic, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Philippines, Poland, Russia, South Africa, Taiwan Province of China, Thailand, Turkey. Other advanced economies = Australia, Canada, Hong Kong SAR, New Zealand, Singapore, United Kingdom. The figure shows the estimated response of expected stock returns to a 1 percentage point appreciation in the trade-weighted nominal exchange rate. The estimates are based on an augmented capital asset pricing model and a sample of listed financial firms in 23 advanced economies and 19 emerging market economies from 1995 to 2015. FX = foreign exchange.

Figure 2.2.2. Foreign Currency Liabilities of Banks and Nonbanks, 2001–14
(Percent of total liabilities)

Nonbanks in emerging market economies have a significantly higher fraction of their debt in foreign currency than in advanced economies.



Sources: IMF, Monetary and Financial Statistics database; and IMF staff calculations.
Note: The figure shows average foreign currency liabilities in percent of total liabilities owed by banks and nonbanks (other financial intermediaries) in emerging market economies and advanced economies. The difference between the average of nonbank foreign currency liabilities in advanced economies and emerging market economies is statistically significant at least at the 10 percent level.

Box 2.2 *(continued)*

given the presence of significant foreign exchange exposures among financial intermediaries. The foreign-exchange-denominated liabilities of nonbanks are significantly larger in emerging market economies than in advanced economies (Figure 2.2.2). Central banks tend to intervene in foreign currency markets, limiting exchange rate volatility, in order to mitigate financial instability and adverse effects on investment—especially during episodes of depreciation. In contrast, advanced economies generally welcome a depreciation of their domestic currency because of its expansionary effect—by stimulating exports and reducing imports. Furthermore, in less-developed financial markets, hedging against currency risk is limited, increasing banks' and nonbanks' vulnerability to exchange rate fluctuations.

Contrary to banks, nonbank financial intermediaries can neither receive liquidity financing from the central bank, nor do they have access to a lender of last resort. Thus, the fragility of nonbanks to large and unexpected oscillations in exchange rates is potentially greater than that of banks and can constrain monetary policy in emerging market economies.

Annex 2.1. Aggregate Vector Autoregression Analysis

Changes over Time in the Transmission of Monetary Policy

The estimates of the response of GDP to a monetary policy change presented in Figure 2.2 are based on a vector autoregression (VAR) estimated separately for two periods: 1980 through 1999, and 2000 through the first quarter of 2016. The responses are estimated using a four-lag VAR model of the level of real GDP, the GDP deflator, the nominal effective exchange rate (all in logarithms), and a monetary policy interest rate or close substitute.[45] For the euro area, Japan, the United Kingdom, and the United States, the study uses a shadow policy rate after the third quarter of 2008 to take into account the effects of unconventional monetary policy (sourced from Krippner 2016 for Japan and from Wu and Xia 2016 for the rest). The data are quarterly and seasonally adjusted, when needed. The responses are drawn from Cholesky decompositions under the assumption that interest rates move last and real GDP moves first. All standard errors are estimated using a nonparametric bootstrap and 200 replications.

The estimates of the change in the transmission of monetary policy are robust to alternative specifications and measures of monetary policy changes. A three-variable VAR that excludes the nominal effective exchange rate and a five-variable VAR that uses real household consumption and business investment, in addition to real GDP, prices, and the interest rate, produce qualitatively similar results (Annex Figure 2.1.1). For the case of the United States, the results are also robust to using the same specification as Boivin and Giannoni 2006—that is, estimating a VAR of detrended log real GDP, inflation (the first difference of the logarithm of the GDP deflator), and the nominal interest rate. In addition, also for the United States, the results are robust to using Gertler and Karadi's (2015) high-frequency identification measure of monetary policy, graciously provided by Peter Karadi.

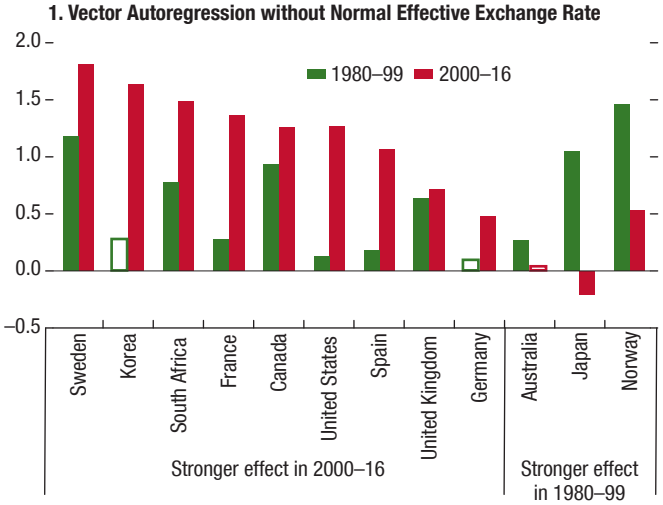
The Transmission of Monetary Policy According to the Size of the Nonbank Financial Sector

The cross-country study of the transmission of monetary policy according to size of the nonbank financial sector is based on a panel VAR of output, prices, the exchange rate, and a measure of monetary policy. Output is measured as the level of real GDP, prices are the level of the GDP deflator, and the exchange rate is the nominal effective exchange rate (all in logarithms). Monetary policy is measured with a monetary-policy-related interest rate (usually a central bank discount rate

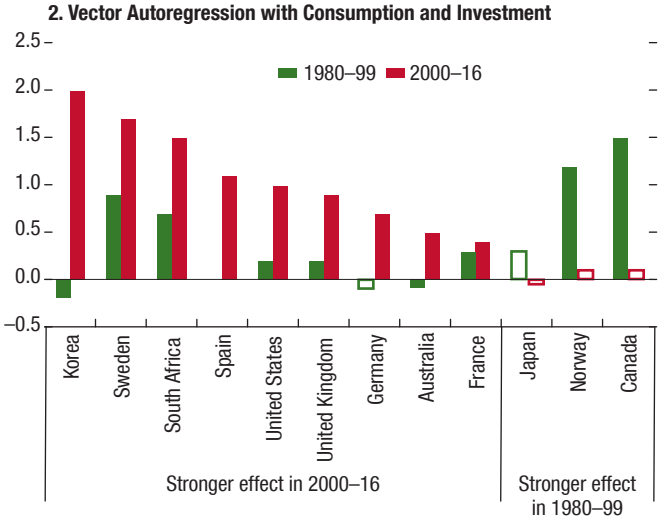
[45]The VAR for Germany includes a dummy for the reunification (1991:Q1). There is also statistical evidence of cointegration relationships, which strengthen the case for estimating the VAR in levels.

Annex Figure 2.1.1. Trends in the Transmission of Monetary Policy—Robustness

The exclusion of the nominal effective exchange rate does not significantly change the response of real GDP to a monetary policy rate cut.



Neither does the inclusion of real household consumption and real business investment.



Sources: Krippner 2016; Organisation for Economic Co-operation and Development; Wu and Xia 2016; and IMF staff estimates.
Note: Solid bars mean that the responses are statistically significant using 68 percent confidence intervals.

or a short-term money market rate). As in the previous analysis, policy rates are adjusted for unconventional monetary policy with the use of shadow policy rates. The total sample consists of 44 countries and uses quarterly data from 1998 to 2015. The sample is split into four groups based on whether their economies have developed (24 countries) or emerging markets (20 countries) and on whether the absolute size of their nonbank financial sector is large or small.[46] The size of the nonbank sector is the sum of corporate bonds outstanding and credit extended to the private sector by nonbank financial intermediaries, as measured by the World Bank's Global Financial Development Database for 2002–13.

The results are robust to the use of alternative estimation methods and definitions of the importance of the nonbank financial sector. The VAR, which yields the results in Figure 2.6, is estimated with four lags using Pesaran, Shin, and Smith's (1999) mean group estimator, which is consistent in the presence of dynamic heterogeneity. The results are broadly the same if the VAR is estimated in first differences, if it excludes the exchange rate, or if it includes the logarithms of investment or M3—a measure of money supply—instead. The panel VAR is also estimated using a least-squares dummy variable estimator, but the results are similar.[47] The results are robust to splitting the sample according to the size of the nonbank sector relative to the size of the banking sector, but only for economies with developed financial markets. In most cases, the differences in the strength of the transmission of monetary policy are small and not statistically significant.

The Transmission of Monetary Policy and the Financial Sector in Select Countries

The single-country VAR study uses claims of three types of financial institutions on private nonfinancial firms and households. Claims are obtained from financial accounts data of six countries. Although the availability of disaggregated data differs across countries, the other types of claims, such as government and foreign bonds as well as interbank loans, are excluded to a large extent. Book values, which are immune to valuation effects, are used for the United States. For the other countries, book values are estimated by accumulating flows to the extent possible.[48]

The VAR uses six variables: the natural logarithms of real GDP, of the GDP deflator, and of real claims of banks, of insurance companies and pension funds, and of other financial intermediaries, and the nominal short-term interest rate.[49] The lag length is four, which is standard for quarterly data. Seasonal dummies are included because the claims are not seasonally adjusted. For the United States, a shadow interest rate estimated by Ichiue and Ueno (2016), instead of the short-term rate, is used.[50] The monetary policy shock is identified using the Cholesky decomposition with the interest rate ordered last.[51] All standard errors are estimated using a bootstrap and 200 replications.[52] The estimates are robust to various possible sources of misspecification, including: (1) adjusting the sample to exclude the crisis and postcrisis period from the estimation, and (2) for the United States (a) using other available measures of monetary policy such as the three-month Treasury bill rate and the measures from Gertler and Karadi (2015) and Romer and Romer (2004); (b) including investment in the VAR; (c) separating mortgage-backed securities from total assets owned by the financial sector; and (d) changing the ordering of the shadow policy rate in the identification of the impulse responses.

The study of the risk-taking channel in the United States presented in Figure 2.8 uses the same VAR

[46]That is, for each type of economy—developed or emerging market—the sample is ranked by size of the nonbank financial sector and divided in half. This procedure yields 12 developed market economies and 10 emerging market economies with a large nonbank financial sector and the same for those with a small nonbank financial sector.

[47]The sample is sufficiently long (72 quarters) and a generalized method of moments estimator is not necessary.

[48]The estimated book value is normalized so that this equals the corresponding stock at the earliest date. If a negative value is obtained, the book values are shifted upward in parallel fashion so that the minimum value equals one-tenth of the maximum value.

[49]The study uses logarithms of levels instead of the growth rates in order to avoid dropping valuable information about the long-term relationship between variables (Sims 1980). See Enders 2010, 396–97, as well.

[50]Ichiue and Ueno (2016) use survey forecasts of macroeconomic variables to estimate the shadow rate. The estimated shadow rate largely followed Wu and Xia's (2016) estimate until 2014. The results using Wu and Xia's shadow rate for the United States are similar.

[51]The average of daily interest rates during the last month of the quarter is used for Korea while the end-of-quarter rate is used for the other countries. The results of the United States are broadly robust to using Gertler and Karadi's (2015) monetary policy shocks.

[52]The data period is 1988:Q2–2015:Q3 for Australia, 1989:Q4–2015:Q4 for Canada, 2002:Q4–15:Q4 for Korea, 1991:Q3–2015:Q4 for South Africa, 1987:Q1–2008:Q4 for the United Kingdom, and 1983:Q1–2015:Q4 for the United States. The data from 2009 are not used for the United Kingdom because the financial accounts data for banks include the central bank, which could seriously distort the results.

representation augmented by measures of risk taking in the equity and bond markets. In particular, the VAR in Figure 2.8 includes a measure of the equity risk premium calculated by Absolute Strategy Research (available from Thomson Reuters Datastream) and Gilchrist and Zakrajšek's (2012) excess bond premium (http://people.bu.edu/sgilchri/Data/data.htm), which are ordered last. The variance decompositions presented in panels 3 and 4 of Figure 2.8 are based on forecast-errors at the 16-quarter horizon.

Annex 2.2. Microanalysis of the Behavior of Financial Firms

Estimating the Transmission of Monetary Policy from Financial Intermediaries' Balance Sheet Data

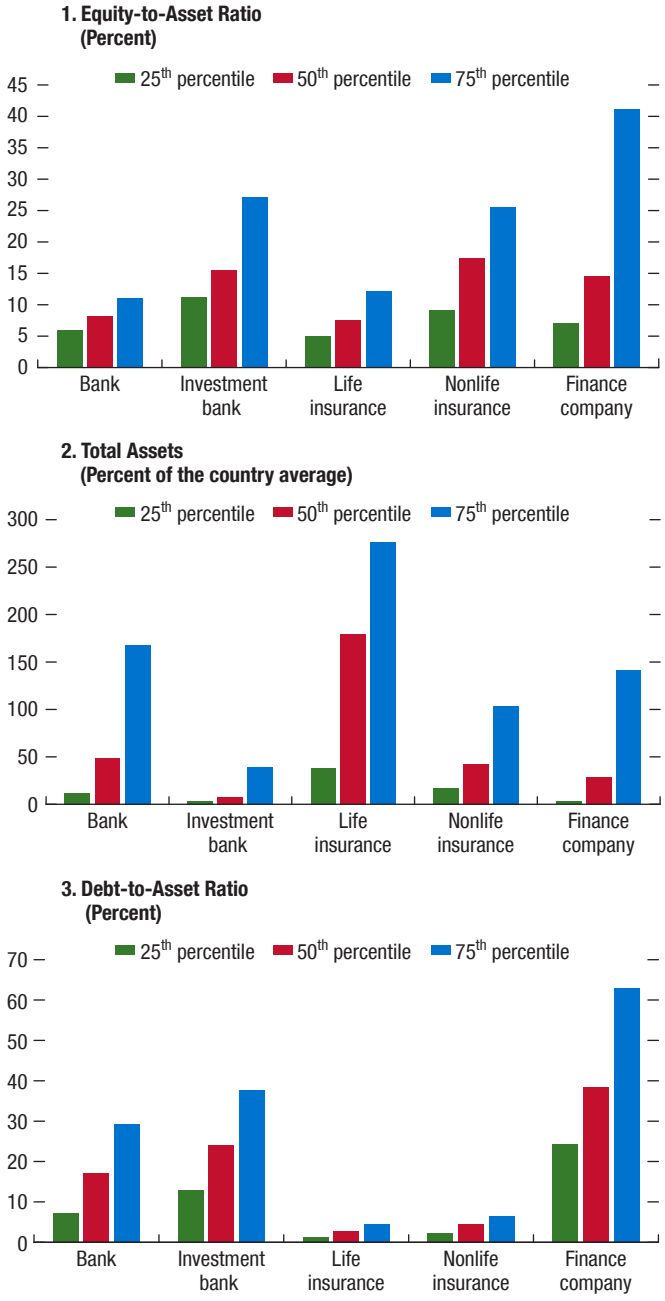
The analysis on the firm-level responses of financial intermediaries to monetary policy changes (Figures 2.9 and 2.10) uses a sample of financial firms from several advanced economies and two emerging market economies. The study uses balance sheet data for 368 publicly listed financial firms from Austria, Belgium, Brazil, Canada, Germany, Finland, Ireland, Italy, Japan, Korea, Mexico, the Netherlands, Portugal, Spain, Sweden, and the United States. Data on total assets at book value for financial companies come from Worldscope via Thomson-Reuters Datastream. Data on the monetary policy rate are nominal policy interest rates or shadow short rate estimates from Krippner 2016. The coverage goes from 1998 to 2015 and is at the quarterly frequency, but coverage by firm varies. The summary statistics are shown in Annex Figure 2.2.1.

The analysis uses the local projection method of Jordà (2005) and Teulings and Zubanov (2014) to estimate the impulse response function of firm assets to a monetary policy shock. Each h step-ahead impulse response is given by β_j^h for each sector j, from the following regression:

$$
\begin{aligned}
L_{it+h} = \alpha_i &+ \sum_{j\in\{sectors\}} \beta_j^h \cdot \varepsilon_t^P \cdot I_{j,i} \\
&+ \sum_{r=1}^{R} \left\{ \sum_{j\in\{sectors\}} \delta_{1j,r}^h \varepsilon_{t-r}^P \cdot I_{j,i} + \delta_{2,r}^h X_{t-r} \right\} \\
&+ \sum_{r=1}^{R} \delta_l^h \cdot Y_{it-r} \\
&+ \sum_{k=0}^{h-1} \left\{ \sum_{j\in\{sectors\}} \gamma_{1k}^h \cdot \varepsilon_{t+h-k}^P \cdot I_{j,i} + \gamma_{2,k}^h \cdot X_{t+h-k} \right\} \\
&+ \eta_{it+h}, \qquad \text{(A2.2.1)}
\end{aligned}
$$

in which L_{it} is the natural logarithm of real total assets owned by financial institution i, ε_t^P is a monetary pol-

Annex Figure 2.2.1. Summary Statistics



Sources: Thomson Reuters Datastream; and IMF staff calculations.
Note: The figure shows the quartiles of each variable, using data for a total of 368 publicly listed financial firms from Austria, Belgium, Brazil, Canada, Germany, Finland, Ireland, Italy, Japan, Korea, Mexico, the Netherlands, Portugal, Spain, Sweden, and the United States from 1998:Q1 to 2015:Q4. For each variable, we first take firm-level medians, and then industry-level medians of the firm-level medians, in order to avoid the overrepresentation of firms with many observations.

icy shock,[53] and for firms from outside of the United States, X_{t+h-k} is the U.S. monetary policy shock (to account for the cross-border effects of U.S. monetary policy). To assist with the identification of the response of financial firms' assets to monetary policy changes, the regression is extended to include interactions with firm-level characteristics. In this case, the conditional impulse response is given by $\beta^h_{1,j} + \beta^{h,z}_{2,j} \cdot z_{i,t-1}$ from the following equation:

$$
\begin{aligned}
L_{it+h} = {} & \alpha_i + \sum_{j\in\{sectors\}} \left\{ \beta^h_{1,j} \cdot \varepsilon^P_t \cdot I_{j,i} + \beta^{h,z}_{2,j} \varepsilon^P_t \cdot I_{j,i} \cdot z_{i,t-1} \right\} \\
& + \sum_{r=1}^{R} \delta^h_1 Y_{it-r} \\
& + \sum_{r=1}^{R} \left[\sum_{j\in\{sectors\}} \right. \\
& \left. \left\{ \delta^h_{1,j} \cdot \varepsilon^P_{t-r} \cdot I_{j,i} + \delta^{h,z}_{2,j} \varepsilon^P_{t-r} \cdot I_{j,i} \cdot z_{i,t-r-1} \right\} + \delta^h_{3,r} X_{t-r} \right] \\
& + \sum_{k=0}^{h-1} \left[\sum_{j\in\{sectors\}} \right. \\
& \left. \left\{ \left(\gamma^h_{1,k} \cdot \varepsilon^P_{t+h-k} \cdot I_{j,i} + \gamma^h_{2,r} \cdot \varepsilon^P_{t+h-k} \cdot I_{j,i} \cdot z_{i,t+h-k-1} \right) \right\} \right. \\
& \left. + \gamma^h_{3,r} X_{t+h-k} \right] + \eta_{it+h}, \qquad \text{(A2.2.2)}
\end{aligned}
$$

in which z_i is a conditioning firm-level variable such as the log of total assets, the equity-to-asset ratio, or the wholesale funding ratio (the ratio of nondeposit debt liabilities to total liabilities). The inference is based on robust standard errors according to Driscoll and Kraay (1998).

The Risk-Taking Channel of Monetary Policy through Mutual Funds

The analyses use monthly data on global mutual funds domiciled in the United States, from 2004 to 2015. The analysis of the response of bond funds in terms of high-yield or long-maturity bonds is based on data from Lipper's Global Mutual Fund Holdings database and covers, at each month, the 50 largest portfolios by total net assets size. The analysis of the response of country allocations of global equity and bonds uses data from EPFR Global on 267 and 30 funds, respectively.

[53]The monetary policy measure is the orthogonal innovation of the nominal monetary policy rate derived from a three-way VAR and identified using a Cholesky ordering. The VAR includes real GDP (in logs), the GDP deflator (in logs), and a policy rate, and is estimated country by country. For some countries, namely the United States, the VAR is extended to include a measure of financial stress (for instance, Gilchrist and Zakrajšek [2012] excess bond premium) but the resulting measure of monetary policy behaves similarly. For robustness, the study also uses the Gertler and Karadi (2015) data based on a high-frequency identification approach, for the United States, with similar results.

The analysis of the response of mutual funds to monetary policy changes consists of several exercises that estimated the fund-level reallocation of portfolios toward riskier assets. The analysis uses the following generic specification:

$$
Alloc^{risky}_{i,t} - Alloc^{safe}_{i,t} = \alpha_i + \beta \Delta MP_t + \gamma R_t + \varepsilon_{i,t}, \quad \text{(A2.2.3)}
$$

where *Alloc* is the percentage of total assets that portfolio *i* has allocated, at month *t*, to risky or safe assets. Specifically, *risky* includes, for bond funds, high-yield bonds (ratings lower than BBB) and longer-maturity bonds (in excess of five years), and *safe* is its complement. In addition, for both bond and equity funds, *risky* can also mean the portfolio weight of investments in countries with speculative-grade sovereign credit ratings. *MP* is Wu and Xia's (2016) shadow policy rate and R_t is the difference between the return of the risky and safe asset classes.[54] The coefficient of interest is β. The results are robust to the inclusion of the portfolio's lagged return as an additional control.

Annex 2.3. Microanalysis of Borrower Behavior

The analysis uses data on bond and syndicated loan borrowings from Dealogic combined with firm-level characteristics (balance sheet and income statement data) obtained from Thomson Reuters Datastream. The analysis focuses on firms that have issued at least one bond and one syndicated loan since 1993, and excludes financial and government-related firms. The focus is on borrowing in each firm's domestic market. That is, the study excludes bonds and syndicated loan deals outside a firm's country of risk, as reported by Dealogic. Public firms typically comply with certain reporting requirements and are larger than nonpublic firms, and are therefore better suited to access bond markets. Data availability determines the country coverage, which includes Japan, the United States, and

[54]For global equity country-level investments, the study uses as *R* the difference between monthly (percentage) returns of the MSCI-G7 and Emerging Market Indices. For global bond funds' country-level allocations, it uses the difference between monthly (percentage) returns of the Citigroup Broad Investment Grade Bond Index and the JP Morgan EMBI Global Total Return Index. For bond fund allocations by credit quality of the investments, the analysis uses the difference between monthly returns of the Citigroup Broad Investment Grade Bond Index and the Bank of America High Yield Corporate Master II index. Finally, for bond fund allocations by maturity of the investments, it uses the difference between the monthly returns of Bank of America Corporate Bond Indexes of one to three years and more than 15 years.

a group of European countries (France, Germany, Italy, Netherlands, Spain, United Kingdom).

The study uses two groups of aggregate variables b to capture the firm's willingness to substitute between bank and market financing. First, data from surveys of senior loan officers are collected from the respective central banks (and the European Central Bank). In particular, the analysis focuses on banks' reported tightening in lending standards or perceived stronger demand for bank loans as reported in those surveys.[55] Second, the stance of monetary policy is measured by the deviation of monetary policy (as measured by shadow policy rates) from target. Monetary policy targets are determined by estimating contemporaneous Taylor rules until the global financial crisis.

The analysis relies on a linear probability model to estimate the firms' choice between (syndicated) loan and bond financing when bank lending conditions change. Following Becker and Ivashina (2014), the analysis excludes firm/quarter observations when no new debt is issued (either in the form of bonds or syndicated loans). That is, the inference is based on firms that have positive demand for external funds. Specifically, given the binary variable D_{it},

$$\begin{cases} D_{i,t} = 1 \text{ if firm } i \text{ obtained a loan at } t, \\ D_{i,t} = 0 \text{ if firm } i \text{ issued a bond at } t, \end{cases} \quad \text{(A2.3.1)}$$

the following model is estimated by ordinary least squares (OLS) with errors clustered by firm/quarter and firm fixed effects:

$$D_{it} = \alpha_i + \beta b_{t-1} + \gamma\, FirmCharac_{it-1} + \delta b_{t-1}\, FirmCharac_{it-1} + u_{it}, \quad \text{(A2.3.2)}$$

using data at the quarterly frequency.[56] The inclusion of fixed effects implies that firm averages are not used for identification, and a β coefficient different from zero would be obtained only to the extent that firms significantly substitute between the two sources of financing. As mentioned, the focus is on firms that have issued at least one bond and one syndicated loan over the sample period. The model includes quarterly dummies, and a crisis and a post-crisis dummy.

The main results are robust to estimating the model separately for Japan, the United States, and the European countries; using standard errors clustered at the industry/quarter level; estimating the model only until the global financial crisis (2008); and computing the deviation from target in a variety of ways.[57] Finally, an analogous exercise is conducted using an unbalanced panel of firms in 23 advanced and emerging market economies from 2010 to 2015 (Figure 2.13, panel 3). The binary dependent variable is defined as one if there is a quarterly increase in a firm's loan liabilities and a decrease in its note and bond liabilities, and zero if the opposite is true. Firm-level data were obtained from FactSet.

[55]The United Kingdom started conducting its credit conditions survey only in 2007. The study therefore considers an additional version that assigns European Central Bank aggregates (dating back to 2003) to all European countries in the sample.

[56]Multiple bond or loan issuances in one quarter are counted as one. Firm-quarter observations with issuance of both loans and bonds are excluded.

[57]The study estimates three different versions using contemporaneous inflation, and real GDP growth, real GDP deviation from a Hodrick-Prescott trend, or real GDP deviation from a cubic polynomial trend. Additionally, it considers the rule proposed by Taylor (1993).

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