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Monetary policy and the risk-taking channel[1]

This paper investigates the link between low interest rates and bank risk-taking. Monetary policy may influence banks' perceptions of, and attitude towards, risk in at least two ways: (i) through a search for yield process, especially in the case of nominal return targets; and (ii) by means of the impact of interest rates on valuations, incomes and cash flows, which in turn can modify how banks measure risk. Using a comprehensive dataset of listed banks, this paper finds that low interest rates over an extended period cause an increase in banks' risk-taking.

JEL classification: E44, E55, G21.

Easy monetary conditions are a classic ingredient of financial crises: low interest rates may contribute to an excessive expansion of credit, and hence to boom-bust type business fluctuations. In addition, some recent papers find a significant link between low interest rates and banks' risk-taking, pointing to a different dimension of the monetary transmission mechanism, the so-called risk-taking channel (Borio and Zhu (2008), Adrian and Shin (2009)). This channel may operate in at least two ways. First, low returns on investments, such as government (risk-free) securities, may increase incentives for banks, asset managers and insurance companies to take on more risk for contractual or institutional reasons (for example, to meet a target nominal return). Second, low interest rates affect valuations, incomes and cash flows, which in turn can modify how banks measure risk.

This article analyses empirically the link between monetary policy and risk-taking by banks in the run-up to the crisis. Using a comprehensive database of listed banks from the European Union and United States developed by Altunbas et al (2009), it finds evidence that banks' risk of default implied by asset prices shot up by a larger amount in countries where interest rates had remained low for an extended period prior to the crisis. This result is consistent with the existence of a risk-taking channel and holds even if one

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allows for the influence of a wide range of macroeconomic and microeconomic factors.

The article is organised as follows. The first section discusses the functioning of the risk-taking channel from a theoretical point of view. The second section summarises the main stylised facts and previous empirical evidence. The third section presents new results, based on an econometric exercise conducted on a dataset of around 600 listed banks operating in Europe and the United States. The last section concludes.

Inside the risk-taking channel: theory

The risk-taking channel may operate through an increase in search for yield …

There are a number of ways in which low interest rates can influence risk-taking. The first is through the search for yield (Rajan (2005)). Low interest rates may increase incentives for asset managers to take on more risks for contractual, behavioural or institutional reasons. For example, in 2003–04 many investors shifted from low-risk government bonds into higher-yielding but riskier corporate and emerging market bonds. They were seeking to meet the nominal returns they had been able to achieve when interest rates were higher (BIS (2004)).

… that reflects psychological, institutional or regulatory factors …

The inertia in nominal targets at a time of lower interest rates may reflect a number of factors. Some are psychological, such as money illusion: investors may ignore the fact that nominal interest rates may decline to compensate for lower inflation. Others may reflect institutional or regulatory constraints. For example, life insurance companies and pension funds typically manage their assets with reference to their liabilities. In some countries, liabilities are linked to a minimum guaranteed nominal rate of return or returns reflecting long-term actuarial assumptions rather than the current level of yields. Such minimum returns may be fixed by statute, as in Switzerland, or contractually, as in some cases in Japan and the United Kingdom in the recent past. In a period of declining interest rates, they may exceed the yields available on highly rated government bonds. The resulting gap can lead institutions to invest in higher-yielding, higher-risk instruments. More generally, financial institutions regularly enter into long-term contracts committing them to produce relatively high nominal rates of return. The same mechanism could be in place whenever private investors use short-term returns as a way of judging manager competence and withdraw funds after poor performance (Shleifer and Vishny (1997)).

… or through the ways banks measure risk

The second way low interest rates can make banks take on more risk is through their impact on valuations, incomes and cash flows.[2] A reduction in the policy rate boosts asset and collateral values, which in turn can modify bank estimates of probabilities of default, loss-given-default and volatilities. For example, low interest rates and increasing asset prices tend to reduce asset

[2] This is close in spirit to the familiar financial accelerator, in which increases in collateral values reduce borrowing constraints (Bernanke et al (1996)). Adrian and Shin (2009) claim that the risk-taking channel differs from and strengthens the financial accelerator because it focuses on amplification mechanisms due to financing frictions in the lending sector. See also Borio and Zhu (2008).

price volatility and thus risk perception: since a higher stock price increases the value of equity relative to corporate debt, a sharp increase in stock prices reduces corporate leverage and could thus decrease the risk of holding stocks.[3] This example can be applied to the widespread use of value-at-risk methodologies for economic and regulatory capital purposes (Danielsson et al (2004)). As volatility tends to decline in rising markets, it releases risk budgets of financial firms and encourages position-taking. A similar argument is provided in the model by Adrian and Shin (2009), who stress that changes in measured risk determine adjustments in bank balance sheets and leverage conditions, which, in turn, amplifies business cycle movements.[4]

Stylised facts and empirical evidence

The link between monetary policy and risk-taking has not yet been thoroughly explored

In the aftermath of the bursting of the dotcom bubble, many central banks lowered interest rates to combat recession. With inflation remaining remarkably stable, central banks in a number of developed countries kept interest rates below previous historical norms for some time (Taylor (2009) and Graph 1). The implication of these strategies for risk-taking did not loom large in policy decisions. First, most central banks around the world had progressively shifted to tight inflation objectives. Second, financial innovation had, for the most part, been regarded as a factor that would strengthen the resilience of the financial system, by resulting in a more efficient allocation of risk.

One reason for not focusing on the effects that low interest rates could have on risk-taking was the absence of any solid empirical evidence. Only recently have a few studies specifically tried to test for the existence of the risk-taking channel. In the remaining part of this section we summarise these studies.

There is evidence that low interest rates increase the riskiness of bank lending portfolios …

The paper by Jiménez et al (2009) uses micro data of the Spanish Credit Register over the period 1984–2006 to investigate whether the stance of monetary policy has an impact on the level of risk of individual bank loans.[5] They find that low interest rates affect the riskiness of the loan portfolio

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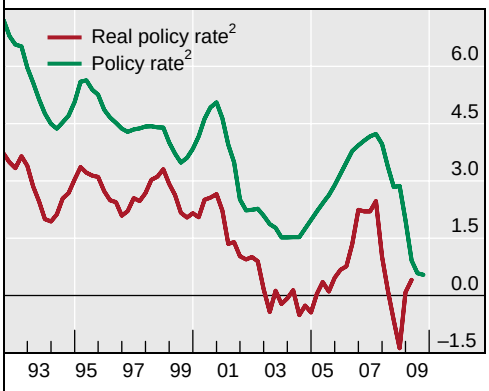
[3] For this reason, the link between asset prices and asset price volatility is sometimes described as the leverage effect. See eg Pagan and Schwert (1990) and the studies cited in Bollerslev et al (1992).

[4] Risk-taking may also be influenced by central banks' communication policies and the characteristics of policymakers' reaction functions. For example, a high degree of central bank predictability with regard to future policy decisions can reduce market uncertainty and thus lead banks to take on more risks. And agents' perception that a central bank will ease monetary policy in the event of bad economic outcomes can lower the probability of large downside risks, thereby producing an insurance effect. For this reason, Diamond and Rajan (2009) argue that in good times monetary policy should be kept tighter than strictly necessary based on current economic conditions, in order to diminish banks' incentive to take on liquidity risk.

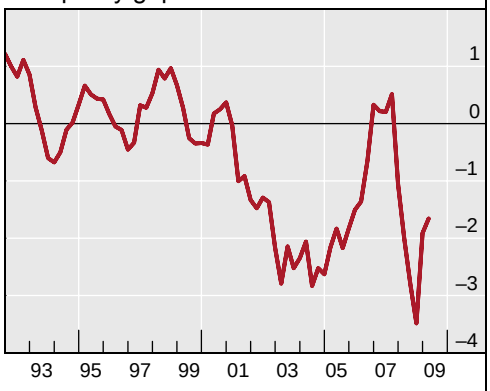
[5] To solve the endogeneity problem (in principle, bank risk could influence monetary policy rather than vice versa), Jiménez et al (2009) use a German rate as a measure of the stance of monetary policy for Spain before 1999 and euro area rates afterwards. The authors explain this choice with the fact that "during the period analysed short-term interest rates in Spain were decided mostly in Frankfurt, not in Madrid". This is because, implicitly from mid-1988 and explicitly from mid-1989 when Spain joined the European Monetary System and its exchange

Easy monetary conditions precede the crisis

Interest rates[1]



Real policy gap[2, 3]



[1] In per cent. [2] Weighted average of major OECD countries, based on 2005 GDP and PPP exchange rates. [3] Real policy rate minus natural rate. The real rate is the nominal rate adjusted for four-quarter consumer price inflation. The natural rate is defined as the average real rate in 1985–2000 (for Japan, 1985–95; for Switzerland, 2000–05) plus the four-quarter growth in potential output less its long-term average, in percentage points.

Sources: IMF; OECD; national data; BIS calculations. Graph 1

of Spanish banks in two conflicting ways. In the short term, low interest rates reduce the probability of default of *outstanding variable rate loans*, by reducing interest burdens of existing borrowers. In the medium term, however, due to the higher collateral values and the search for yield, banks tend to *grant more risky loans* and, in general, to soften their lending standards: they lend more to borrowers with bad credit histories and with more uncertain prospects. Overall, these results suggest that low interest rates reduce credit risk in banks' portfolios in the short term – since the volume of outstanding loans is larger than the volume of new loans – but raise it in the medium term.

… and reduce the loan rates of risky borrowers relative to those charged to less risky ones

Ioannidou et al (2009) take a different, complementary, perspective and analyse whether the risk-taking channel works not only on the quantity of new loans but also on their interest rates. The authors investigate the impact of changes in interest rates on loan pricing using Bolivian data over the period 1999–2003.[6] They find that, when interest rates are low, banks not only increase the number of new risky loans but also reduce the rates they charge risky borrowers relative to those they charge less risky ones. And interestingly, the reduction in the corresponding spread (and the extra risk) is higher for banks with lower capital ratios and more bad loans.

The risk-taking channel is effective at the international level

Altunbas et al (2009) take a more international perspective. They analyse the link between monetary policy and bank expected default frequencies (EDFs) using data for 600 European and US listed banks over the period 1999–2008.[7] From a macroeconomic point of view this analysis is relevant

rate mechanism, the exchange rate target with the Deutsche mark was one of the main objectives of its monetary policy.

[6] They also use an exogenous measure of monetary policy, the US federal funds rate, because during the sample period the Bolivian peso was pegged to the US dollar and the banking sector was almost completely dollarised.

[7] The EDF is a forward-looking indicator of credit risk computed by Moody's KMV, which builds on Merton's model to price corporate bond debt.

because the dataset represents more than two thirds of the total lending provided by banks in the European Union and the United States. In order to examine whether policy rates were historically low prior to the crisis they compare them with two benchmarks: (1) interest rates implied by Taylor rules and (2) natural interest rates, calculated as a smooth trend of past interest rate levels. They find evidence of a link between low interest rates for protracted periods and increased risk-taking by banks over the last decade. This result holds when controlling for a wide set of factors: changes in business cycle expectations, differences in the intensity of bank supervision and changes in bank competition. The next section presents a simple model that builds on the analysis of Altunbas et al and tries to shed some light on the link between low interest rates and bank risk-taking with explicit reference to the crisis period.

Estimating the effects of low interest rates on bank risk-taking

Increase in bank risk materialises in a non-linear way…

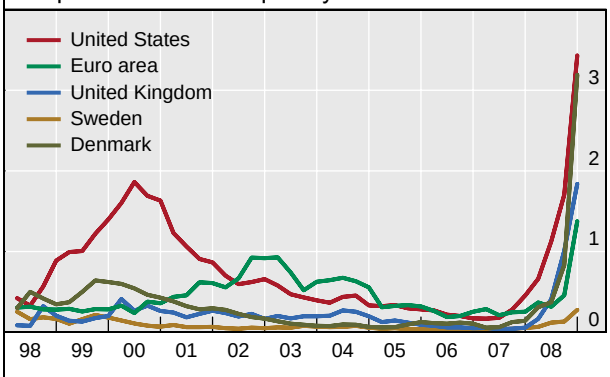
The recent crisis has reminded us that risks can materialise in non-linear ways. The left-hand panel of Graph 2 shows the evolution of banks' EDFs over the last decade. Notice how the consequences of banks' risk-taking started to emerge suddenly in the third quarter of 2007, triggered by the subprime crisis, and became even more apparent after the Lehman Brothers bankruptcy in September 2008.

… in both interest rate spreads and bank lending supply …

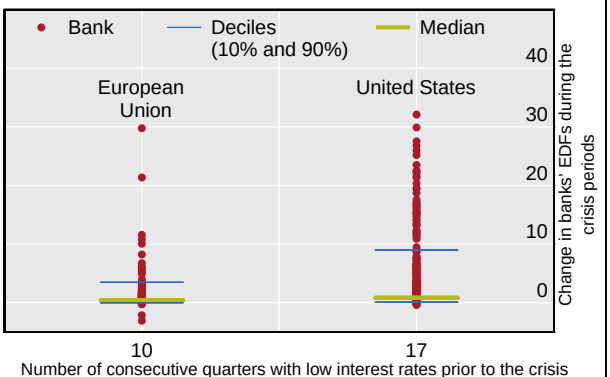
This section tests empirically if low interest rates for an extended period prior to the crisis could have led banks to take on more risks. The right-hand panel of Graph 2 shows some preliminary descriptive evidence. In the United States, where the federal funds rate was below the benchmarks used by Altunbas et al (2009) for 17 consecutive quarters in 2002–06, the subsequent increase in banks' EDFs was greater than in EU countries, where the policy rate was below the benchmark for only 10 quarters on average. If the risk-taking channel is at work, in line with the findings by Ioannidou et al (2009), we should observe a progressive reduction of spreads and lending standards prior

Bank risk materialised suddenly after an extended period of low interest rates

Expected default frequency of banks[1]



Low interest rates and bank risk[2]



[1] Over a one-year-ahead horizon; averages by country or group of countries. [2] Cross-sectional analysis for a sample of 588 listed banks. On the horizontal axis, interest rates have been considered low if below both the natural rate and the interest rate implied by a Taylor rule. For more details, see Altunbas et al (2009).

Sources: Altunbas et al (2009); Moody's KMV. Graph 2

to the crisis. The left-hand panel of Graph 3 shows the difference between the interest rate paid on bonds by BBB- and AAA-rated firms, a proxy for the spread on risky relative to less risky borrowers. This spread narrowed significantly in both the euro area and the United States during the period of very low interest rates.

Bank lending surveys, in which bank loan officers are asked directly about their willingness to grant credit, provide further information on attitudes towards risk. The right-hand panel of Graph 3 reports the results from both the ECB Bank Lending Survey and the US Senior Loan Officer Opinion Survey on Bank Lending. This measure of credit conditions is the difference between the number of banks that reported a tightening in a given quarter and the number that reported an easing. We see that the crisis was preceded by a prolonged period of lending expansion. The subsequent manifestation of credit risk at the beginning of 2007 caused a significant drop in the quantity of lending (Chari et al (2008), Cohen-Cole et al (2008)).

… and more in countries where policy rates are low for an extended period of time

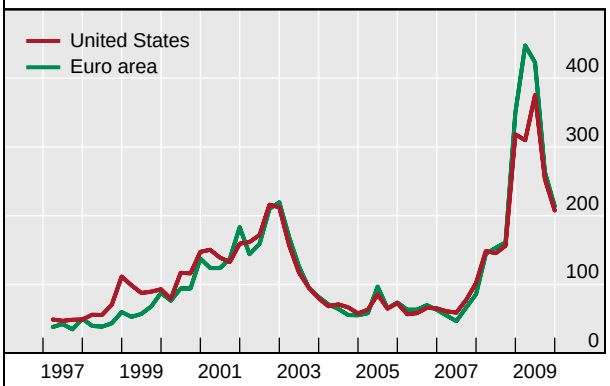
Next, we turn to a more formal econometric analysis. The following identification strategy is used: since monetary policy conditions vary across countries, the hypothesis of the risk-taking channel would suggest that bank risk increases by more in countries where interest rates have been relatively low (below both the Taylor rule and the natural rate that reflects national economic conditions) for a greater number of consecutive quarters prior to the crisis. The use of microeconomic data allows us to rule out the possibility that the increase in banks' EDFs is simply caused by the realisation of a negative shock which affects all financial intermediaries in the same way, and to control for the impact on risk-taking of bank-specific characteristics.

The econometric analysis relates change in bank EDFs during the crisis to low interest rate periods

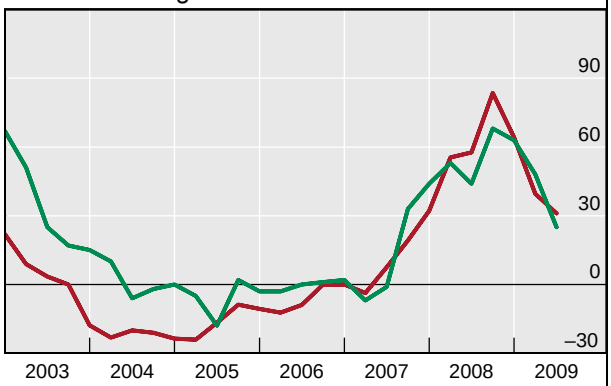
The econometric model (described in more detail in the box) relates the change in the EDF of a given bank during the crisis period (Q2 2007–Q4 2008) to average bank-specific characteristics and macroeconomic conditions of the country where the financial intermediary has its head office in the six years prior to the crisis (Q2 2001–Q2 2007).

Evolution of corporate bond spreads and bank lending standards

Corporate bond spreads: BBB–AAA[1]



Changes in credit standards for bank lending to medium and large firms[2]



[1] Difference between the corporate bond rates paid by BBB- and AAA-rated firms, in basis points. [2] Net percentage of banks contributing to tightening standards to large and medium enterprises, for the United States, and to large firms, for the euro area. Tightening (+) / easing (–).

Sources: ECB; Federal Reserve Board; Merrill Lynch. Graph 3

We relate changes in bank EDFs to country-specific macro variables because intermediation activity, which is the most important part of banks' business, is done mainly towards residents. Nevertheless, we are aware that a part of bank activities takes place on international markets and that national conditions could be less important for a number of big European banks located in small countries. However, if this were the case we should observe a less significant link between changes in individual bank risk and low interest rates in the country where the bank is headquartered. In other words, if a risk-taking channel is detected using our identification strategy, the strength of this channel would be expected to be even more significant when controlling for multinational activity.

The model is estimated using balance sheet data for some 600 listed banks operating in the European Union and the United States, enriched with individual proxies of bank risk. In the analysis we consider a number of bank-specific characteristics (size, liquidity, capitalisation, profitability, lending growth and degree of securitisation activity) and macroeconomic variables (change in nominal GDP, slope of the yield curve and real housing and stock market returns). We also include institutional characteristics, such as the intensity of regulation of bank activities.

Econometric results are consistent with the existence of a risk-taking channel …

Consistent with the risk-taking channel hypothesis, we see that when interest rates are low for an extended period banks' EDFs tend to increase. This is obviously not the conclusive test for the existence of a risk-taking channel, but, taken at face value, the estimation result suggests that if interest rates are maintained below the benchmark for 10 consecutive quarters, ceteris paribus, the probability of default of an average bank increases by 3.3%.[8]

… and confirm that developments in the housing market …

The empirical exercise points to a number of other interesting findings. First, developments in housing prices prior to the crisis appear to have contributed to bank risk-taking. An inflation-adjusted house price growth rate that is 1 percentage point above its long-run average for six consecutive years leading up to the crisis increases the probability of default of the average bank by 1.5%. This result is in line with the view that the housing market had a substantial role in the crisis and that banking distress was typically more severe in countries that experienced a more pronounced boom-bust cycle in house prices.

… together with excessive growth in bank lending, had a role in the crisis

Second, banks that experienced a higher growth rate of lending with respect to the industry average prior to the crisis proved to be riskier ex post. For example, lending of about 10% above average over the six years preceding the crisis caused an increase in bank probability of default by 3.9%.

Third, securitisation appears to play a secondary role in explaining the evolution of bank risk. Banks heavily involved in the securitisation market may

[8] The robustness of this result has been checked in several ways. First, we analysed different measures for bank risk (EDFs at different time horizons, credit default swaps, ratings), disentangled idiosyncratic and systematic risk components, and checked for the impact of business expectations. Second, the results were robust to different estimation methods (GMM, probit, logit). For a more complete list of robustness checks, see Altunbas et al (2009).

Does monetary policy affect bank risk-taking?

This box reports a simple econometric model that can shed light on which factors have influenced the evolution of bank risk in the current crisis. The model relates the change in the riskiness of a given bank *i* (proxied by its EDF) during the crisis period (Q2 2007–Q4 2008) to the macroeconomic conditions of the country where the financial intermediary is headquartered (*k*) and bank-specific characteristics over the six years prior to the crisis (Q2 2001–Q2 2007). The econometric model is given by the following equation:

$$\Delta EDF_{i,k} = \beta\, LOWINT_k + \chi\, \Delta GDPN_k + \delta\, SLOPE_k + +\vartheta ROA_{i,k} + \mu \Delta HP_k + \kappa \Delta SM_k + \alpha\, EDF_{i,k} + \\ + \varpi\, SIZE_{i,k} + \tau\, LIQ_{i,k} + \xi\, CAP_{i,k} + +\phi EXLEND_{i,k} + \psi\, SEC_{i,k} + \lambda REG_k + \varepsilon_i$$

where the variables are described in Table A.

Regression results

Dependant variable: Δ*EDF* during the crisis period (Q2 2007–Q4 2008)	Variable definition	Coef	Std err	*t*	*P* > *t*
LOWINT	Number of consecutive quarters with interest rate below both the natural rate and the rate implied by a Taylor rule in the six years prior to the crisis	0.328**	0.129	2.54	0.011
Δ*GDPN*	Average growth of nominal GDP	–1.347**	0.672	–2.00	0.046
SLOPE	Average slope of the yield curve	–0.693	0.600	–1.15	0.249
ROA	Return on assets	–0.629	0.524	–1.20	0.231
Δ*HP*	Change in housing price index corrected for inflation (de-meaned)	1.543***	0.336	4.59	0.000
Δ*SM*	Change in stock market returns corrected for inflation (de-meaned)	0.259	0.396	0.65	0.513
EDF	Average level of bank EDF prior to the crisis	1.762**	0.685	2.57	0.010
SIZE	Log of total assets (USD millions)	0.185	0.136	1.36	0.176
LIQ	Liquidity to total assets ratio	–0.041**	0.017	–2.37	0.018
CAP	Capital to total assets ratio	–0.024	0.042	–0.56	0.576
EXLEND	Credit expansion relative to banking industry average	0.378***	0.097	3.88	0.000
SEC	Securitised lending over total assets	0.749	0.467	1.60	0.109
REG	Regulatory index: extent to which banks may engage in security, insurance and real estate activities	0.112	0.121	0.92	0.356
Constant		–5.867*	3.165	–1.85	0.064

All variables, except Δ*EDF* and *LOWINT*, are averages of quarterly data over the period Q2 2001–Q2 2007. Robust standard errors. *, ** and *** represent significance levels of 10%, 5% and 1%, respectively. Number of observations = 588; F(13, 574) = 5.38. Prob > F = 0.00; R-squared = 0.1363. Table A

As is common in cross-section analysis, the R-squared of the regression is not very high (14%). This reflects the fact that the model captures only some of the underlying long-term causes of the financial turmoil and does not use any information from the crisis period. This means that it neglects all those factors, such as negative changes in expectations, difficulties in financial markets, liquidity interventions and, most important, bank idiosyncratic shocks, that unfolded after the summer of 2007.

The results confirm the existence of a risk-taking channel: there is a positive and significant link between the number of consecutive quarters in which interest rates have been below the benchmark (*LOWINT*) and changes in the EDF of individual banks.

The empirical exercise also sheds light on other factors that may have influenced the evolution of risk. Better economic conditions (high $\Delta GDPN$) increase the number of projects becoming profitable in terms of expected net present value, thereby reducing the overall credit risk of the bank.

A steeper yield curve (*SLOPE*) increases bank profits (and decreases EDF) because of the typical maturity transformation function performed by banks (their assets have a longer maturity than liabilities). The effect is, however, not statistically significant even if we introduce the return on assets (*ROA*) directly.

The effects of improvements in borrowers' net worth and collateral are taken into account through the evolution of asset prices, where ΔHP and ΔSM are, respectively, the average quarterly changes in real housing and stock market returns over the five years prior to the crisis. The introduction of these variables accounts for the effects of the standard financial accelerator mechanism through which financing frictions on firms and households amplify or propagate exogenous disturbances (Bernanke and Gertler (1989)). With a given bank risk aversion (or tolerance), the coefficients of both variables should be negative: a boost in asset prices increases the value of collateral and reduces overall credit risk. By contrast, a positive coefficient should capture the fact that the market perception of risk could fall in good times and increase suddenly in bad ones (Borio et al (2001)). The results show that only the coefficient for housing prices has a statistically positive influence on bank risk. This result is in line with the view that the housing market had a major role in the crisis (Ellis (2008)).

The link between monetary policy and bank risk could also be influenced by balance sheet characteristics that summarise the ability and willingness of banks to supply additional loans or to tap funds on the market (Ehrmann et al (2003)). The specification also includes *SIZE*, the log of total assets; *LIQ*, securities and other liquid assets over total assets; and *CAP*, the capital-to-asset ratio. All other things being equal, liquid and well capitalised banks are less risky. However, only the effect of the liquidity ratio on bank risk appears to be particularly relevant, confirming the fact that the credit crisis has been characterised by a sudden shortage of liquidity.

Other variables affecting the increase in banks' EDFs during the crisis are excessive lending relative to the banking industry average (*EXLEND*) and the use of securitisation instruments (*SEC*) prior to the crisis, although the significance of the latter effect is statistically weak. The equation also includes an index developed in Barth et al (2004) that measures the extent to which banks are allowed to engage in securities, insurance and real estate activity (*REG*). In this case, too, the impact is positive but not statistically significant.

not have enough incentives to screen borrowers and monitor loans, which could result in underestimation of risk. Drucker and Puri (2007) argue that securitised loans tend to be less informationally sensitive than loans held by banks, ie banks sell loans such as mortgages for which screening and monitoring are comparatively less important. The econometric results show that banks that securitised a higher proportion of their assets before the crisis did become riskier during the crisis, but the effect is statistically weak.

Conclusions

The current credit crisis has drawn the attention of researchers and policymakers to the link between monetary policy and risk perceptions and attitudes (Borio and Zhu (2008), Adrian and Shin (2009)). Recent econometric studies have found a significant link between low interest rates and banks' risk-taking based on evidence from Spain and Bolivia (Jiménez et al (2009), Ioannidou et al (2009)). This special feature has confirmed these findings, drawing on a comprehensive database of listed banks operating in the European Union and the United States. Building on the econometric work by Altunbas et al (2009), the analysis finds evidence of a significant link between

an extended period of low interest rates prior to the crisis and banks' risk-taking.

The main implication of these findings is that monetary policy is not fully neutral from a financial stability perspective. This is of interest to both monetary and supervisory authorities. It is important that monetary authorities learn how to factor in the effect of their policies on risk-taking, and that prudential authorities be especially vigilant during periods of unusually low interest rates, particularly if they are accompanied by other signs of risk-taking, such as rapid credit and asset price increases.

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