Bank equity valuations and credit supply*

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Abstract

The recent financial crisis has rekindled interest in the consequences of financial market stress on the real economy. While the importance of equity on bank behaviour has been increasingly acknowledged over recent years, the causal link between fluctuations in the cost of bank equity, as captured by fluctuations in equity valuations, and credit provision has remained a neglected topic. In line with the bank capital channel of monetary policy, we argue that the cost of bank equity – as well as its realised market return– can affect credit supply. When making marginal funding decisions, banks dynamically optimise their capital structure, possibly deviating from regulatory debt/equity ratios in the short run. However, they target the regulatory ratio in the long run, so that on average credit growth must be funded with the regulatory mix of debt and equity – plus a buffer of equity. The more costly bank equity is the lower is, ceteris paribus, the incentive to expand credit supply. We quantify this causal link, controlling for confounding factors that may drive the co-movement of equity valuations and (equilibrium) credit growth. Overall, we estimate that a 10% drop of a bank's equity valuation slows down credit supply to non-financial corporations by 0.5 percentage points. Analogously, each percentage point increase in the cost of bank equity leads to a 0.4 percentage point slowdown. This estimate is robust to issues of simultaneity of credit demand, endogeneity of equity prices (to earning prospects) and banks' characteristics. Given the underperformance of banks' stock prices over recent years, these findings are potentially important for monetary policy transmission.

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1. Introduction

The financial crisis has renewed interest in how strains in the banking sector and financial markets can impact credit provision (Gambacorta and Marques-Ibanez (2011) and Peek and Rosengren (2013)) and in the relevance of bank equity for the transmission of monetary policy to the real economy (van den Heuvel (2002)). However, there has been limited research into the effect of banks' equity price valuations and the consequent changes in the cost of equity (COE) on credit supply. The main reason why fluctuations in equity valuations, and the resulting change in COE, are relevant for banks' intermediation capacity is capital regulation. In optimising their capital structure, banks must target a mixture of equity and debt that satisfies regulatory capital requirements (plus an optimal buffer). Therefore, even though a banks' optimal funding mix for a new loan (retained earnings, equity or debt) may vary in the short run, to fund credit growth in the long run they must raise (or retain) equity to satisfy regulatory capital requirements. In this way, changes in bank equity prices, and consequently the cost of equity, have the potential to affect the propensity of banks to supply credit.

Historically, bank equity prices and the cost of equity are correlated with subsequent credit growth, in particular to non-financial corporations (See Charts 1 and 2). However, establishing a causal link is not straightforward given the endogeneity of factors that may drive the co-movement – such as demand, banks' balance sheet health and earnings prospects. To identify loan supply as distinct from demand, the Bank Lending Survey (BLS) is a useful resource, as banks are asked directly whether they changed their credit standards and the reasons for changes. Using banks' responses from the BLS and matching them to their equity price changes reveals evidence in support of our hypothesis. Chart 3 shows that when banks' equity price performance worsens, they tend to report tighter credit supply due to their capital position. The chart shows equity prices and BLS responses in deviation to the country average, therefore excluding any co-movement driven by the macroeconomic environment. While the chart only contains data on a limited number of banks across a subset of euro area countries and does not control for any other confounding bank level characteristics, it certainly points in the direction of our hypothesis that equity price changes can affect banks' credit supply decisions.

In this paper we set forth the economic rationale for this connection between a bank's cost and value of equity on the one hand, and their credit supply on the other. By establishing a link between banks' COE, as represented by changes in equity valuations, and their lending behaviour, we provide direct evidence of a bank capital channel. We quantify to what extent such a relationship exists by controlling for simultaneity of demand and endogeneity of equity prices. As with the existing literature on the bank capital channel, our paper hinges on the failure of the Modigliani-Miller capital irrelevance theorem. Using individual bank balance sheet information across a number of euro area countries, we show that even after controlling for macro conditions and bank balance sheet characteristics that simultaneously affect equity prices and credit supply, there remains a negative effect from equity price developments on bank

credit supply. We also present our findings in terms of cost of equity, which captures the long run cost of funding bank lending, and we find similar results. Overall, we find that a 10% fall in the price of equity leads to approximately 0.5 percentage point decline in loan supply to NFCs, all other things equal. The underperformance of banks' equity prices during the financial crisis therefore has implications for the transmission of monetary policy to the extent that credit supply to the non-financial private sector was adversely impacted.

While capital regulations are based on book values of equity, share prices impact the cost of equity and so alter the relative return on lending. Regulatory requirements induce banks to fund new credit with a share of equity close to that requested by capital regulation in the long run, even though the funding mix may vary in the short run. Equity that is not set aside from internal funds – undistributed Return on Equity (ROE) – must be raised on capital markets, where lower valuations imply a higher COE – holding earnings prospects constant. While in the short run a higher COE may induce banks to substitute equity with debt funding (and vice versa), in the long run banks that maximize the expected flow of future profits should on average fund new loans with a constant mix of equity and debt so as to maintain their capital ratio at a "safe" target level. At this optimal long run funding mix, banks set the growth rate of their credit supply so as to maximize profits. Moreover, given that the cost of equity increases with leverage as risk premia rise, there is a limit to banks willingness to fund lending with debt even in the short run (Admati et al. (2013)).

That equity price changes affect the cost of equity is uncontroversial; and there is existing evidence that the cost of equity affects lending (Celerier, Kick and Ongena, 2016). However, the aim of this paper is to quantify the *pure* effect of an exogenous equity price change on credit supply, by stripping out all the conflating factors. There are two predominant identification issues to overcome. First, there is a simultaneity problem as credit growth is an equilibrium quantity which is jointly determined by supply and demand. To overcome this we assume that demand faced by individual banks' depends on the country's aggregate level of credit demand – which is related to economic activity – and do not depend on unobserved individual characteristics of banks beyond the aggregate. Under this assumption, country time fixed-effects are used to partial out the contribution of demand, so that only variation across banks with the same country and time period are used to identify supply. The second issue is endogeneity between credit supply and equity returns. Even assuming that we can cleanly identify supply there will be simultaneous causality between equity returns and credit supply leading to bias in our estimates, if we do not control for confounding factors. Equity price changes can occur due to changes in earnings prospects or changes in the discounting of future earnings. Earnings prospects reflect banks' profitability prospects, balance sheet health and their strategic plans and therefore they are endogenous to credit supply. Using earnings prospects from analysts forecasts we can therefore exogenise bank equity returns. We can partial out the part of variation in equity prices driven by other omitted factors that may also be driving credit supply and we are left equity price change which is orthogonal to these confounding factors. Changes in

the discount factor occur due to changes in interest rates, general risk aversion and uncertainty around banks' earnings prospects. Country time dummies eliminate the first two of these factors. As for the third, once macroeconomic conditions are controlled for, there is no economic reason suggesting that earnings uncertainty should be correlated with future credit supply, and therefore endogeneity would not be a problem in this context. Our strategy allows for clean identification of the pure effects of equity price changes on credit supply that are not associated with other confounding factors which may be driving the relationship.

The rest of the paper proceeds as follows. Section 2 outlines the theory and literature underpinning our hypotheses in greater detail. Section 3 describes the data and the empirical methodology used. Section 4 presents our results and section 5 concludes.

2. Literature and hypotheses

As equity valuations reflect the expected rates of return required by stockholders and, hence, the cost of issuing equity capital, this cost should be factored in when a bank makes investment like a loan. Celerier, Kick and Ongena (2016) document three channels through which changes in the cost of equity owing to equity price movements can impact lending. First, additional funds obtained when issuing equity at a lower cost can give rise to an income effect; second, the lower cost of funding effect can impact interest rates on credit extended by banks; and finally a capital structure effect can operate whereby banks are induced to hold more capital and therefore can lend more without violating regulatory constraints. The authors study the effect of a tax change which reduces the cost of equity relative to debt and find that lending expands when the cost of equity decreases and the effect reverses when it increases. They find that a reduction in the cost of equity can simultaneously induce an increase in capital ratios and lending. Balduzzi, Brancati and Schinatarelli (2013) are concerned mostly with the cost of funding channel and find that banks' financial market valuations affect borrowing and investment of the firms that borrow from them.

Bank capital has long been recognised as an important factor in bank asset and liability management. Van den Heuvel (2006) shows that bank lending depends on the bank's capital structure, which in turn evolves endogenously. Van den Heuvel (2002) states that when the marginal cost of issuing equity is increasing in the value issued, the lending channel will be diminished in strength, even when the capital requirement is not currently binding, but may be binding in the future An important implication of the relevance of the bank's capital adequacy is that shocks to bank profits, such as loan defaults, can have a persistent impact on lending. This is akin to the 'financial accelerator' mechanism that arises in firm models with imperfect financial markets, such as Bernanke, Gertler and Gilchrist (1999). While these models usually focus on the firm's debt capacity being limited by the level of inside equity, for banks the

mechanism is operative even without an imperfect debt market, because the regulatory capital requirements make (inside or outside) equity itself indispensable.

Capital requirements imply that the cost of issuing capital is relevant for banks' lending decisions, and the effect is particularly acute when equity is relatively expensive to raise (Aiyar, Calomiris and Wieladek (2014)). The financial crisis revealed the potentially hazardous consequences of a highly leveraged banking system and renewed the focus on capital requirements as a means of regulating bank behaviour. Fraisse, Le and Themar (2013), Aiyar, Calomiris and Wieladek (2012) and De Jonghe, Dewachter and Ongena (2016) find that increases in capital requirements lead to contractions in credit. These contributions assume that the Modigliani-Miller capital irrelevance principle is not fully valid.[4] Mishkin (2000) in a similar vein highlights that in reality capital is more costly than debt so that requirements determine how much capital a bank holds. In this context, binding capital regulations require that a bank takes immediate steps to restore its capital ratio when at risk of a violation, so that it either needs to issue fresh capital, or leave its capital unchanged and curtail its assets (Hanson et al 2010). However, binding capital constraints are not essential to make bank behaviour sensitive to the cost of equity. In line with Allen, Carletti and Marquez (2011) who find that banks choose to hold costly capital above the regulatory minimum due to market discipline, Gambacorta and Shin (2016) stress that banks' overall cost of funding is not independent of leverage as risk premiums will decrease with more equity.[5] Therefore, the hypothesis that banks' share price returns affect their lending supply goes beyond literature on capital requirements and is rooted in finance literature on capital structure.

The structure of banks' liabilities can influence their loan supply, especially since capital market imperfections lead to frictions in accessing sources of external financing and, as outlined in Kashyap and Stein (1995) and Stein (1998), this affects their lending behaviour. When deciding how to fund an investment like a loan, banks without an adequate capital buffer (above their regulatory minimum) or retained earnings must issue equity. As outlined by Majluf and Myers (1984), when making "issue-invest" decisions, firms will not want to issue shares when they are undervalued by the market and so often chose to hold "financial slack" so they do not have to issue stock on short notice. Likewise, Berger et al. (2008) suggest that excess capital buffers are evidence that raising equity on short notice to avoid violating capital requirements is costly due to transaction costs or possibly low share prices. Banks with an ex ante chosen capital structure and a given level of slack can, according to Froot and Stein (1998), alternatively adjust to shocks by budgeting their capital through hedging or adjusting their investment and lending strategy. In a similar way Peura and Keppo (2006) find that optimal bank capital (book equity) choice is a dynamic trade-off between the opportunity cost of equity, the loss of franchise value following a regulatory capital

[4] As outlined in Hanson et al. 2010 this principle is based on a number of unrealistic assumptions including no taxes, symmetric information, rational risk-based pricing, and cash flows that are independent of financial policy.

[5] This is aligned with a stream of literature that disputes that capital requirements are disruptive to lending. Admati et al. (2013) claims that high leverage distorts lending decisions and that credit crunches arise when banks are undercapitalized. It is likely that the effects of capital requirements vary over different horizons and in different scenarios, however this branch of literature is beyond the scope of this paper. Neither branch of the literature would invalidate the hypothesis that for a given level of capital, higher costs of issuing equity will curtail lending.

violation, and the cost of recapitalization. Adrian, Boyarchenko and Shin (2015) find that though long run leverage of a bank is built on the trend book equity, banks' assets and loans can fluctuate considerably depending on market conditions.

The bank lending channel literature is broad; however, the specific effect of equity price changes (that are not capturing the health of banks' balance sheets) has so far received limited attention, even though equity and its regulation has such an important impact on banks' behaviour. While there are already contributions looking at the relationship between equity performance and lending, these papers are distinct as they are concerned with causation in the opposite direction, as strong loan growth proxies excessive risk-taking.[6] Balduzzi, Brancati and Schinatarelli (2013), who study the effects of banks equity price changes on lending and investment of their borrowers, is probably more closely related to our hypotheses. However, they use the equity prices as a proxy for balance sheet health and so their effects include confounding factors, rather than the pure effect that we are interested in. Celerier, Kick and Ongena (2016) who are interested in the effect of an exogenous change in the cost of equity are also closely aligned with our hypothesis.

Overall, our hypotheses can be summarised as follows:

- Hyp. 1: The growth rate of banks' credit supply should be positively related to the market returns of holding their equity (growth rate of their equity prices);
- Hyp. 2: The growth rate of banks' credit supply should be negatively related to their COE and positively to their ROE;
- Hyp. 3: These two effects should be stronger the higher the capital charge of a type of credit – for example, the effect should be stronger for loans to Non-Financial Corporations (NFCs) than for those to Households (HHs), which tend to carry lower capital charges as they are generally less risky and more collateralized.

3. Data and empirical framework

This section sets out the empirical framework used to test the hypotheses presented above. Here we outline the issues related to identification and how they are addressed. In the remainder of the text we will follow the convention that "ROE" refers to "book return on bank equity" and "Return" refers to "market return of holding bank equity" (the percentage change of equity prices). Quantifying the testable implications of the previous section, and establishing a causal nexus between bank equity prices and credit supply, poses two challenging identification problems:

I. Credit growth is an equilibrium quantity, jointly determined by demand and supply. Thus the correlation of its growth with equity Returns and COE, per se, would say little about the causal impact on credit supply;

[6] This is based on the premise that banks tend to make riskier loans when they lend more and fail to provision adequately for these loans leading to losses (Fahlenbrach et al. (2016) and Baron and Xiong (2014)).

II. Equity Returns are partly "endogenous" to credit supply, as both depend on the health and profitability of banks. Thus, even if credit supply growth could be observed –i.e. identified from demand– its correlation with market returns would say little about the causal impact of the latter, as inference would be biased by endogeneity.

The first issue is the standard problem of simultaneity dictated by "equilibrium" effects: making statements about supply requires accounting for variations of demand. Unless this is econometrically accounted for, correlation between equity Returns and credit growth does not establish any causal link. There is no simple way of accounting for this source of bias with aggregate time series data, except for strong assumptions. Therefore, this paper moves from the simple analysis of Chart 1 to a granular dataset on individual bank balance sheets. At the individual bank level, the assumptions necessary to control for individual credit demand, when making statements about individual credit supply, are weaker than those necessary for time series analysis.

This analysis assumes that, within each country-year cluster, all banks face identical credit demand conditions. This is equivalent to assuming that individual banks' credit demand conditions only depend on the country's aggregate level of credit demand – which is related to economic activity – and do not depend on unobserved individual characteristics of banks beyond the aggregate. This is a mild assumption, compared to those necessary for aggregate analysis. Under this assumption, a fixed-effect (country-year) regression successfully partials out the contribution of individual demand. Only variation across banks within a country-year cluster is exploited for estimation.[7]

The second issue is the standard problem of "omitted variable" bias. If unobserved factors, omitted from the analysis, cause both equity Returns / COE and future credit supply, any inference on the causal link would be biased. In order to make causal statements, estimates should only exploit the variation of equity Returns / COE that is orthogonal to the unobserved factors causing credit. There are two ways of achieving this goal: exploiting the orthogonal variation of a credible instrument or using a proxy to partial out the unobserved factors. The analysis in this paper choses the latter solution and the reasons why this is a valid choice are outlined below.

Returns on holding bank equity can be successfully exogenized. Price changes originate from two causes: changes of earnings prospects and changes in the discounting of future earnings. Changes of earnings prospects are "endogenous" – to the growth rate of future credit supply – by nature, as they reflect banks' long run profitability prospects, which may in turn also affect future credit supply. However, even though unobservable, they can be convincingly proxied using surveys of analysts' estimates, hence exogenized. Changes of the discount factor stem from three ingredients: changes of interest rates, changes of investors' risk aversion and changes of uncertainty about the individual bank's earnings prospects. Country-time fixed effects partial out the first two factors, exogenizing them. As for the third factor, a problem of endogeneity would only rise if, within each country-time cluster, banks' earnings uncertainty were correlated with factors determining their future credit supply. As there is no

[7] A further relaxation of this assumption would require a more granular (loan-level) dataset or, alternatively, the use of bank-level survey data. Unfortunately, such data sources are at this time not available for a comprehensive sample of euro area banks.

obvious economic reason why this should be the case, after controlling for earnings expectations, it can safely be assumed exogenous.

Formalising the discussion above, the empirical analysis hinges on the estimation of the equations presented below, which allow for a direct test of the 3 hypotheses outlined in the previous section:

$$\Delta L_{i,s,t} = \beta Return_{i,t-1} + \delta Controls_{i,t-1} + \gamma_{c,t} + \varepsilon_{i,t} \quad (1)$$

$$\Delta L_{i,s,t} = \alpha COE_{i,t-1} + \tau ROE_{i,t-1} + \delta Controls_{i,t-1} + \gamma_{c,t} + \varepsilon_{i,t} \quad (2)$$

The variable $\Delta L_{i,s,t}$ is the year-on-year growth rate of loans granted by bank *i* in year *t* to sector *s*, where *s* comprises the non-financial private sector, non-financial corporations and households. $Return_{i,t-1}$ is the market return from holding equity of bank *i* in the previous year, so that according to Hyp. 1 one would expect β to carry a positive sign. $COE_{i,t-1}$ and $ROE_{i,t-1}$ are, respectively, the cost of issuing equity and the return on equity for bank *i* in the previous year. As such, according to Hyp. 2, one would expect to find $\alpha < 0$ and $\tau > 0$. $\gamma_{c,t}$ are country-time dummy variables which control for credit demand. $Controls_{i,t-1}$ represents a vector of variables chosen to address the problem of "omitted variable" bias discussed above. In particular, this vector includes the common equity tier 1 (CET1) capital ratio in order to control for how binding the capital constraint is likely to be for each bank. We include also a squared term of the capital ratio, so as to allow for non-linearities: the importance of the regulatory capital ratio should be lower the higher its level, i.e. the less binding is the constraint.[8] The ratio of non-performing loans (NPL) proxies for the quality of legacy assets, which may impair the supply of credit. For equation (1), the vector of control variables includes also controls for profitability ($ROE_{i,t-1}$) and for earnings expectations which, as described above, are crucial for the identification of the relationship between equity prices and credit supply. In particular, we control for year-on-year changes in earnings expectations for the following year ($\Delta\ Earnings\ expectations_{i,t-1}$) and for the average expected long term earnings growth. The COE is approximated as the ratio between long term earnings expectations and the equity price. The timeframe of the analysis is assumed to be yearly. We take a conservative approach and use non-overlapping returns to avoid biases in computing t-statistics (as in Hodrick (1992) and Baron and Xiong (2016)) and cluster our standard errors at the country level. It is appropriate to assume that prices affect credit with a 12 months lag, for two reasons: (i) informal aggregate time series evidence suggests that at this lag correlation is the highest; (ii) changes of prices and credit are measured over a calendar year, so as to align the analysis to balance sheet data.

Loan growth data are taken from a unique, proprietary data set of balance sheet items at bank level (Individual Balance Sheet Items, or IBSI), which is compiled by the Eurosystem for a sample of over 300 banks. The analysis is focused on yearly data for the period 2007-2015. There are three main reasons why this dataset is central for our analysis. First, it includes a time-series of loans at the bank-level, allowing for

[8] This approach is followed in Brei, Gambacorta and von Peter (2013). Over the sample period, regulatory capital requirements and government interventions to support capital ratios varied considerably. As we lack individual data on government recapitalisations and capital requirements, the squared capital ratio also corrects for some of these non-linearities.

the identification of loans to NFC which, as discussed above, should be more directly affected by constrains on supply. The time period is adequate to test our hypotheses as it covers the recent financial crisis, with changes in regulation that led to an increase capital requirements and significant shocks to banks' equity valuations. Second, the dataset includes series adjusted for reclassifications, loan write-offs/write-downs, and loan sales and securitisations. Stocks available in commercial databases do not include these adjustments and, as such, do not allow the derivation of meaningful transaction measures which are central to an analysis focused on credit growth. Finally, the dataset includes subsidiaries of the same bank operating in different countries. This ensures that we observe banks with exactly the same developments in equity prices but subject to different demand conditions, strengthening the identification. This dataset is matched with information on bank stock returns taken from Bloomberg and Datastream, with bank balance sheet data taken from SNL and with earnings expectations data are taken from I/B/E/S. Measures of earnings expectations at the bank-level are derived from the average of the figures provided by each contributor to the database. The final dataset covers the period 2008-2015 for 168 banks across 18 euro area countries. Table 1 shows summary statistics of the variables used.

4. Results

As discussed above, anecdotal evidence shows that there is a strong correlation between share price developments and future loan growth, suggesting that changes in equity valuations can serve as a useful indicator for credit supply in the following year (see Chart 1). However, a lot of this co-movement is driven by endogenous factors that affect both share prices and loan growth, such as demand and bank balance sheet quality. This section tests the hypotheses outlined above for the euro area, by estimating equations (1) and (2) so as to identify the effect of annual bank equity Returns / COE on annual loan growth, while controlling for demand, balance sheet characteristics and earnings expectations.

Table 2 shows the relationship between equity price changes and loan growth to the non-financial private sector, NFCs and households respectively across a number of different specifications. To adequately control for any macroeconomic factors affecting the relationship, all regressions include country-year fixed effects. The first specification looks only at the effects of changes in the stock price controlling for these effects. The second controls for bank level characteristics that are commonly used in the literature on the bank lending channel – namely profitability, capital ratios and non-performing loan ratios. The third specification introduces long term earnings expectations and the annual change in the 12 months forward earnings expectations. These measures control for any movements in the price that are driven by future prospects or changes in prospects, which would affect both investors' valuations and potentially future loan growth.

The results show that stock returns remain positively correlated with future loan supply after controlling for credit demand (as shown in Columns 1, 4 and 7). When controlling for bank balance sheet variables and for earnings estimates the relationship weakens and ultimately becomes insignificant for households and for the non-financial private sector as a whole (Columns 3 and 9). In contrast, for loans to NFCs, the relationship remains statistically significant even when including all the controls (column 6). The effect is also significant from an economic perspective: a decline in equity prices of 10% is expected to lead to a 0.5 percentage point decline in loan supply to NFCs in the following year. As for the effects of the control variables, the coefficients on the return on equity are as expected and mostly significant whereas the signs on the capital measures are also as expected but tend not to be significant. NPLs are always negatively related to future loan growth but are not significant once controlling for the earnings expectations. The change in expected earnings is positively related to future lending, but is not significant for household loans and our measure of expected long term earning growth is never significant.

Changes in equity prices could impact on lending via the cost of capital, which when increasing would decrease the net return on lending, and could therefore alter banks' propensity to supply credit. For this reason we also analyse the effect of the cost of equity – proxied by earnings divided by the share price for each bank – and the gap between the cost of equity and the return on equity. Chart 2 shows the close positive relationship between this gap and the future lending growth rate. Again, Table 3 follows the strategy outlined in the previous section in order to quantify the effect on lending supply. It shows the results of regressions of lending to non-financial private sector, NFCs and households respectively on

cost of equity, both cost and return on equity and the gap between the two, while controlling for other important bank characteristics and demand effects.

Table 3 shows that a higher cost of equity is indeed negatively related to future lending growth. In turn, return on equity is positively related to future credit supply, which reflects the relative equivalence of external and internal funding sources that these measures respectively capture. Taking these results together we can see that the gap between these measures is relevant for future loan growth, in particular to NFCs. Columns (4), (8) and (12) show that the positive effect remains for the ROE-COE gap, even after controlling for bank characteristics.

5. Conclusions

Recent decreases in the value of euro area bank equity prices have been a cause for concern, owing to their historic correlation with loan growth in subsequent periods – in particular to non-financial corporations. However, it is difficult to establish any causal link, given the endogeneity of factors that may drive the co-movement – such as demand, banks' balance sheet health and earnings prospects. This paper sets forth an economic rationale for why the growth rate of banks' credit supply should be affected by the cost of their equity and / or by the past market return of holding it. It also quantifies this causal link, using bank level data to control for simultaneity of demand and endogeneity of equity prices. When making funding decisions, banks optimise their capital structure by targeting a mixture of equity and debt that satisfies regulatory capital requirements (plus an optimal buffer) in the long run. Thus they need to raise (or retain) equity to fund credit growth. Hence, an exogenous decrease in their share prices – with resulting increase in their cost of equity – makes new loans more costly to fund and less profitable. Overall, we estimate that a 10% reduction in bank's share prices leads to a 0.5 percentage point slowdown of loan supply to NFCs. Given the underperformance of banks' stock prices over recent years and the uncertainty about future and supervisory regulatory action, which limits banks' willingness to draw on their capital buffers; these findings are potentially important for monetary policy transmission.

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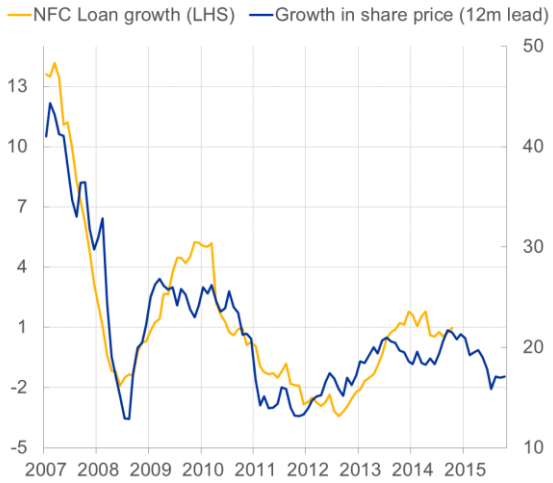
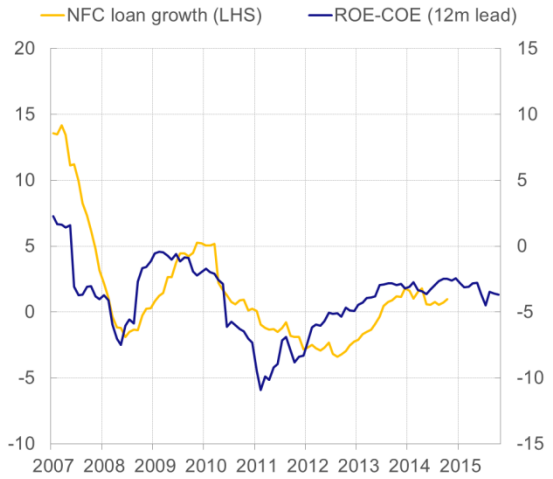
7. Appendix

Chart 1. Equity prices and loan growth



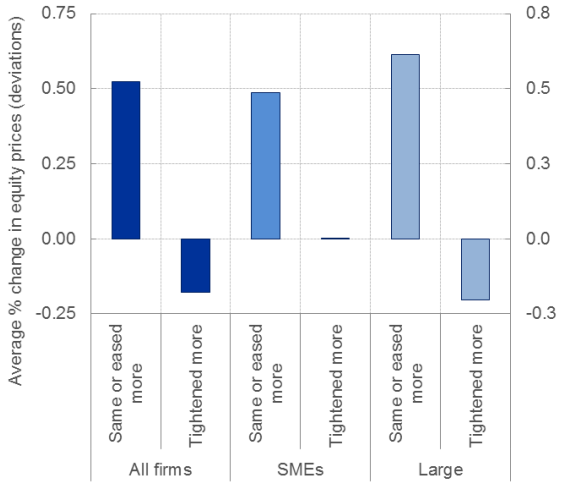
Notes: Loans are in annual growth rates lagging share price by 12 months. Share prices and loan growth are weighted averages of iBSI data for the euro area.

Chart 2. ROE-COE gap and future loan growth



Notes: Loans are in annual growth rates lagging share price by 12 months. Loan growth and the ROE-COE gap are weighted averages of iBSI data for the euro area.

Chart 3. Survey evidence: Share price change according to the effect of banks' capital position on credit supply to enterprises



Notes: Results are based on banks' responses in the BLS matched with their equity prices from 2003 until 2016. The sample contains information on 57 banks from 11 countries. The panel shows the deviation of each bank's share price from the average in the country in each quarter according to their deviation from the average BLS response in the country in the same quarter, where the country averages are weighted by the loans to the non-financial private sector of each bank from iBSI. averages of iBSI data for the euro area.

Table 1: Descriptive statistics

	Mean	Std. Dev.	p25	p50	p75	N
NFPS loan growth $_{i,t}$	1.72	11.43	-3.87	0.60	6.16	904
NFC loan growth $_{i,t}$	0.81	13.24	-5.66	-0.28	5.48	825
HH loan growth $_{i,t}$	2.84	8.77	-2.49	1.41	6.28	704
Stock return $_{i,t-1}$	-3.78	35.56	-30.16	-0.30	24.82	908
⊿ Earnings expectations $_{i,t-1}$	-12.36	44.70	-30.32	-10.48	8.30	676
Expected long term eranings growth $_{i,t-1}$	29.90	66.76	11.79	18.50	29.69	670
CET1 Capital Ratio $_{i,t-1}$	10.24	2.18	8.56	10.15	11.57	766
NPL Ratio $_{i,t-1}$	7.18	5.44	3.18	6.08	9.41	747
ROE $_{i,t-1}$	2.91	7.72	0.38	4.22	7.68	748
COE $_{i,t-1}$	15.53	5.87	11.64	14.42	17.82	550
Gap (ROE-COE) $_{i,t-1}$	-12.40	8.84	-15.68	-10.58	-6.42	478

Notes: Based on an unbalanced panel of yearly data from 2008 to 2015 for 168 banks across 18 euro area countries. Standard errors are clustered at the country level and shown in parentheses. ***, ** and * denote statistical significance at the 99%, 95% and 90% levels..

Table 2: Estimation results on the effect of changes in bank equity prices on lending supply

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	$NFPS\ loan\ growth_{t+12}$			$NFC\ loan\ growth_{t+12}$			$HH\ loan\ growth_{t+12}$		
$Annual\ stock\ return_t$	0.0543***	0.0443*	0.0230	0.0675***	0.0727***	0.0497*	0.0257**	0.0247	0.00970
	(0.0115)	(0.0220)	(0.0204)	(0.0170)	(0.0240)	(0.0269)	(0.0102)	(0.0172)	(0.0235)
ROE_t		0.362***	0.159*		0.380**	0.180		0.167**	0.171*
		(0.101)	(0.0843)		(0.160)	(0.134)		(0.0618)	(0.0951)
$Capital\ Ratio_t$		3.639	3.241		3.332	2.453		2.528	2.243
		(2.484)	(3.290)		(3.779)	(4.867)		(2.207)	(2.850)
$Capital\ ratio_t^{\ 2}$		-0.223*	-0.194		-0.234	-0.172		-0.157	-0.146
		(0.114)	(0.164)		(0.170)	(0.236)		(0.0966)	(0.121)
$NPL\ ratio_t$		-0.335**	-0.124		-0.357**	-0.106		-0.235**	-0.161
			(0.155)		(0.149)	(0.169)		(0.110)	(0.197)
$\Delta\ Earnings\ expectations_t$			0.0314*			0.0351**			0.00993
			(0.0167)			(0.0127)			(0.0341)
$Expected\ long\ term\ earnings\ growth_{\ t}$			-0.0148			0.00194			-0.0269
			(0.0192)			(0.0220)			(0.0209)
Country - year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	902	593	462	823	541	423	699	463	342
R^2	0.201	0.285	0.287	0.159	0.233	0.226	0.410	0.450	0.448

Notes: Standard errors are clustered at the country level and shown in parentheses. ***, ** and * denote statistical significance at the 99%, 95% and 90% levels.

Table 3: Estimation results on the effect of cost of and return on equity prices on lending supply

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
		$NFPS\ loan\ growth_{t+12}$				$NFC\ loan\ growth_{t+12}$				$HH\ loan\ growth_{t+12}$		
COE_t	-0.176*	-0.280**	-0.222*		-0.275**	-0.406***	-0.347**		-0.100	-0.208	-0.143	
	(0.0893)	(0.121)	(0.123)		(0.0937)	(0.112)	(0.127)		(0.120)	(0.176)	(0.151)	
ROE_t			0.190***				0.215**				0.135	
			(0.0618)				(0.0856)				(0.0801)	
$Gap\ (ROE - COE)_t$				0.198***				0.247***				0.137
				(0.0632)				(0.0683)				(0.0920)
$Capital\ Ratio_t$		3.028	2.525	2.468		3.095	2.754	2.508		2.497**	2.160	2.144
		(3.217)	(3.307)	(3.378)		(4.281)	(4.339)	(4.356)		(0.967)	(1.462)	(1.487)
$Capital\ ratio_t{}^2$		-0.158	-0.142	-0.139		-0.171	-0.163	-0.152		-0.143***	-0.134**	-0.133**
		(0.159)	(0.162)	(0.165)		(0.198)	(0.198)	(0.199)		(0.0374)	(0.0546)	(0.0548)
$NPL\ ratio_t$		-0.218*	-0.116	-0.109		-0.0927	0.0209	0.0509		-0.346**	-0.292**	-0.290**
		(0.115)	(0.114)	(0.122)		(0.109)	(0.126)	(0.135)		(0.136)	(0.128)	(0.121)
Country - year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	660	501	497	497	609	463	459	459	493	369	363	363
R^2	0.338	0.330	0.345	0.345	0.280	0.256	0.269	0.269	0.474	0.511	0.507	0.507

Notes: Standard errors are clustered at the country level and shown in parentheses. ***, ** and * denote statistical significance at the 99%, 95% and 90% levels.