Access to Funding by European Banks and the Financial Crisis*

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Abstract

Several theoretical and empirical contributions have been devoted to analyze specific determinants of bank debt issuance as well as its impact on banks' and markets' performance. These contributions frequently offer conflicting results and this mixed evidence is partly due to the lack of available data. In this paper, we use a rich database of 71 major listed European bank holdings from 2003 to 2011 to explore the determinants of bank debt issuance. We distinguish between collateralized and uncollateralized debt, and include a wide set of factors such as financial soundness indicators, bank reputation, macroeconomic and market fundamentals, issuance characteristics, and official liquidity support by central banks and governments. Regime-shifts between pre-crisis and crisis years and non-linearities are also considered using a Tobit quantile regression approach. Our results suggest that financial soundness indicators are only significant drivers of banks' debt funding for large issuance volumes. Bank reputation (market value and ratings) are found to be significant determinants of the issuance of uncollateralized debt but they are only statistically relevant for large volumes of collateralized debt. It is also shown that official support mechanisms during the crisis -such as the Covered Bond purchase programme of the ECB for collateralised debt and government guarantees for uncollateralized debt- have a large and positive impact on bank debt funding.

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1 Introduction

Over the last forty years financial institutions have progressively found different ways of issuing debt as a source of funding that complement deposits. As the range of debt instruments have enlarged, the financial structure of banks has become more complex and the variety of implications of the funding choices have increased accordingly. Traditional insured debt holdings (deposits) have been progressively accompanied by a substantial expansion of secured and unsecured securitization instruments. Hence, traditional theories that mainly dealt with deposits as the main type of liquidity source which protects relatively uninformed agents have required a major revision. Specifically, liquidity tensions and banks' market complexity and growth have given rise to a number of new bank debt instruments and a variety of new banking practices with many different implications for bank performance and risk as well as on financial stability.

The most common theoretical framework to analyze the way banks issue debt has been one in which banks face some constraints in deposit supply and access wholesale debt markets to get funding. In this context, debt issuance has been related to key strategic issues for banks such as liquidity generation (see for example, Gorton and Pennacchi, 2005; Diamond and Rajan, 2001; Fecht, Nyborg, and Rocholl, 2011; Loutskina, 2011), risk management (Calomiris and Kahn, 1991; Diamond and Rajan, 2005, 2011; Reinhart and Rogoff, 2011), and solvency (Diamond and Rajan, 2001; Repullo, 2004). Most of these relationships also depend on the type of debt instruments that banks are willing (or able) to issue. Importantly, the rationale for banks to issue debt may also vary depending on whether the economy is facing an upturn or a recession. Related to this fact, bank debt issuance has become a fundamental policy challenge during the financial crisis as the pricing of the securities and the access of banks to the debt markets have been largely conditioned by macroeconomic instability and have been also affected by the related tensions in sovereign debt, in particular in Europe.

Hence, there are a large number of factors that may affect bank debt issuance. However, the lack of detailed data has not permitted to undertake a comprehensive empirical analysis of the determinants of the bank debt issuance over the business cycle. In this paper, we undertake an analysis of the determinants of bank debt issuance using a unique database that provides detailed quarterly information on 71 major listed European banks from 2003Q1 to 2012Q1, thereby covering the pre-crisis years as well as the crisis years. The database combines banks' balance sheet data with banks' debt issuance activity. Importantly, we identify aggregated issuance volumes by collateralized or uncollateralized type. We also incorporate

data on the average rating of the bank in every quarter. This data permits us to cover a wide number of dimensions that may determine the ex-ante determinants of bank debt issuance both in normal and in difficult times.

The baseline empirical approach in this paper consists of estimating the probabilities of issuing debt at banks using a Tobit regression model with random effects. This model overcomes some of the main identification and endogeneity problems related to bank debt issuance decisions. We also complement this analysis with a series of quantile Tobit regressions that allows us to address potential nonlinearities associated with the distributional assumptions of debt issuance decisions. These findings confirm some theoretical predictions and contribute to shed some light on the market and bank circumstances under which those predictions work. In particular, our results suggest that the determinants of bank debt funding vary significantly for collateralized and uncollateralized debt. Financial soundness indicators are only found to affect large volumes of bank debt issuance. Other factors such as ratings and market volumes for uncollateralized debt (and only for large volumes of uncollateralized debt). As for market volatility, it is found to have a negative, large and significant effect for collateralized debt in the pre-crisis years. Importantly, official support vehicles -such as the ECB covered bond purchase program for collateralized debt and government guarantees for uncollateralized debt- are found to play a large, positive and significant role in bank debt funding during the crisis.

The paper has the following structure. In section 2, we describe the different factors that have been identified in the literature as potential reasons to issue bank debt. Section 3 provides details of our database. Section 4 presents are empirical strategy with our empirical results presented in section 5. Finally, 6 concludes.

2 Why do banks issue debt? A background

The classical financial intermediation theory refers to bank credit risk and liquidity management as the main interactions between banks and financial markets which explains the existence of financial intermediaries. Most of the contributions to the financial intermediation theory (see for example, Diamond, 2000; Campbell and Krakaw, 1980; Allen and Santomero, 1998; Allen and Gale, 2004) focus on these efficient lending/liquidity arrangements provided when there are information asymmetries between borrowers and lenders as the main rationale for banks to exist. However, this approach focuses solely on the asset

side of intermediaries. Since the seminal contribution of Diamond and Dybvig (1983) the role of bank liquidity in these models is acting as risk sharing arrangement to insure against depositors' random consumption needs. Therefore, bank funding in these models consists basically in deposit taking. Therefore a broader picture of the liability side of the banks was mostly neglected as a rationale for the existence of financial intermediaries in those models.

Nevertheless, another strand of the literature also looks as bank debt issuance as another rationale for the existence of financial intermediaries. A reference in this context is Gorton and Pennacchi (2005) who show that banks issue both debt and equity securities, thereby splitting the cash flows of their asset portfolio. Therefore, intermediaries explicitly create a new, liquid security and justify the existence of banks from principles different from risk sharing. Other studies have further elaborated on the role of debt issuance at banks. In particular, bank debt has been considered as a way of exploiting valuable investment opportunities to overcome local deposit supply constraints and not just as a way of covering the risk of unexpected retail withdrawals Goodfriend and King (1988). In this type of studies, wholesale funding is considered to provide banks not only with liquidity but also with market discipline Calomiris (1999) even forcing liquidations on loss-making ones Calomiris and Kahn (1991).

Nevertheless, most of the supposed benefits of bank debt issuance on bank liquidity have been questioned. Huang and Ratnovski (2011) show that banks can use wholesale funds to aggressively expand lending and compromise credit quality, particularly when debt holders exert an inefficient market discipline. Then, when uncertainty and instability arise, debt holders may abruptly withdraw their debt holdings, triggering inefficient liquidations at banks. This may occur, *inter alia*, because short-term wholesale funding suppliers have lower incentives to conduct costly monitoring in uncertain times. This situation aggravates in the presence of financial instability as competition and liquidity tensions may force banks to promise depositors more, increasing intervention and making the system worse off (Diamond and Rajan, 2012).

As private liquidity squeezes during crisis periods, this creates some segmentation between banks with easier access to liquidity and banks with difficult access to liquidity. As shown by Fecht, Nyborg, and Rocholl (2011), the prices that individual banks pay for liquidity is a function of market conditions and bank characteristics. In turbulent times, these prices depend in particular on the distribution of liquidity across banks. The smaller players -with lower asset and liability diversification- seem to be more vulnerable. Moreover, small banks

pay more for liquidity in this situation and that makes them more vulnerable to liquidity squeezes. In this context, State guarantees have been found to reduce the price of liquidity but do not protect against squeezes.

Securitization, as a major source of bank funding in recent years, has also been found to have a significant impact on bank funding practices and, overall on banks' financial fragility. Loutskina (2011) shows that by allowing banks to convert illiquid loans into liquid funds, securitization reduces banks' holdings of liquid securities and increases their lending ability. However, it is also shown that securitization weakens the ability of the monetary authority to affect banks' lending activity making banks more susceptible to liquidity and funding crisis when the securitization market is shutdown. Hence securitization can potentially reduce lenders' incentives to carefully screen and monitor borrowers thereby affecting loan quality Keys, Mukherjee, Seru, and Vig (2010). In any event, there are different types of securitization instruments and the determinants for their use -as well as their overall impact on banks' risk and performance- may depend critically on some of the differences between them. For example, banks may decide to issue different types of securitization instruments depending on whether they are collateralized or uncollateralized. In particular, the degree of collateralization - which is for example typical of covered bonds as less frequent for mortgage-backed securities- may determine the extent to which banks issue securities for reasons such as balance sheet management, liquidity creation or even agency reasons (Purnanandam, 2011; Carbo-Valverde, Rosen, and Rodriguez-Fernandez, 2011).

The interaction between liquidity and risk is also very important in defining why banks issue debt. Some studies suggest that higher capital improves banks' ability to absorb risk, so that higher capital ratios may allow banks to create more liquidity (Bhattacharya and Thakor, 1993; Repullo, 2004). However, some other studies suggest that well-capitalized banks create less liquidity. (Diamond and Rajan, 2000, 2001) argue that highly leveraged banks are more fragile and are those in needs of more liquidity while well-capitalized banks will need to generate less liquidity. Additionally, anticipating a potential fire sale, liquid buyers expect high returns, reducing their incentive to lend, Diamond and Rajan (2012). Millon-Cornett, McNutt, Strahan, and Tehranian (2011) provide evidence on this negative relationship between capital and liquidity creation. They show that when liquidity dried up during the financial crisis (they cover the period 2007-2009) banks that relied more heavily on core deposit and equity capital financing continued to lend relative to other banks. Banks that held more illiquid assets on their balance sheets, in contrast, increased asset liquidity and reduced lending.

Reputation issues have also progressively become a very relevant factor for bank debt issuance. Narayanan, Rangan, and Rangan (2007) show that in the absence of bond market reputation -as it is sometimes the case during financial crises- private-debt-market reputation enables commercial banks to win underwriting mandates from their loan clients and allows them to credibly commit to investors against opportunistically using lending information. Aiyar (2012) shows that reputation issues goes beyond the bank domestic market and have more widespread effects during financial crises. In particular, by analyzing foreign funding shock to banks' domestic credit supply in the United Kingdom he shows how problems originating in one asset class in one country propagate internationally, sparking financial instability. Reputation issues have also important implications for the economy overall, with bank debt issuance being an important transmission channel. In particular, Sufi (2009) refers to reputation issues analyzing the impact of ratings on bank debt issuance by showing that the introduction of bank loan ratings leads to an increase in the use of debt not only by banks but also by firms that obtain a rating, and also increases in firms' asset growth, cash acquisitions, and investment in working capital. In this context, it is also important to notice that reputation issues extend from private (bank) debt to public debt and they interact as a common issue in most banking crises, see e.g. Reinhart and Rogoff (2011).

Our paper contributes to this literature in different dimensions. For the first time to our knowledge, a wide set of determinants of bank debt issuance are jointly considered and are examined for collateralized and uncollateralized debt types, including financial soundness indicators, bank reputation factors, market and macroeconomic fundamentals and issuance characteristics. Additionally, our approach considers both the pre-crisis and the crisis years and the regime-shift across both periods as well as the non-linearities that makes some of these determinants only statistically significant under for certain ranges of their distribution. Besides, the impact of different measures of central bank and government support for bank debt during the crisis years are also studied.

3 The data

Our sample contains data from 71 major listed European Bank holdings for which quarterly balance sheet data from the Thomsom Reuter's Worldscope database are available. Focus on major listed bank holdings ignores a large segment of the banking industry in

Europe. However, use of timely and reliable balance sheet data would be compromised otherwise. Quarterly data will allow to better identify financing tensions associated with certain market and economic conditions. Additionally, focus on holdings, rather than individual subsidiaries is justified by the fact that we have access to consolidated accounts, and furthermore, and given common issuance practice among European Banks, there would be difficulties in attributing to a certain subsidiary firm the debt issued by the holding, as it is common for banks to use special purpose entities to issue debt. Additionally, bank holding companies with subsidiaries often operate under their own internal capital markets and using consolidated statements addresses this issue. A full list with the names of the banking groups is provided in Table 1. The sample period is from 2003Q1 to 2012Q1. It provides enough observations as to potentially identify changes in the financing patterns of banks before and during the financial crisis of 2007-2012. Some cleaning of the data has been implemented. In particular, for certain banks, and over certain periods, bi-monthly reported records have been transformed into quarterly records by splitting the flow data in half over the quarters. Additionally, gaps in the reporting of some quarters for some banks have been filled by linear interpolation. Data on issuance activity has been obtained from Delogic DCM. Issuance volumes with a breakdown for maturity and type of debt have been computed using Dealogic DCM as source. We have aggregated issuance volumes by *collateralized* or *uncollateralized* type. Collateralized issuance relates to a) covered bonds, b) mortgage-backed securities and c) asset-backed securities. Uncollateralized issuance relates to a) Short and medium Term notes, b) Corporate bonds and c) Preferred shares. Additionally, information on the percentage of those types of debt that have been issued with a government guarantee is documented. The collateralized levels of debt have been divided by total assets in the regression analysis when used as dependent variable.

For our empirical analysis the chosen regressors can be grouped in five different blocks. First, *balance sheet indicators*, which serve as indicators of the financial soundness of the bank: core tier 1 capital ratio (tier 1 ratio) and return on equity (ROE), as well as bank characteristics which may be relevant to explain issuance (deposit ratio, loan ratio and size) which may proxy for the fact that traditional commercial banks are less likely to operate with large leverage ratios than bank groups with large investment banking operations. Second, *banks financial reputation*, or informed investors assessment of the business beyond the information provided by the balance sheet records. Credit ratings from major rating agencies (Rating), and changes in the market valuation of the bank in the stock exchange (market value), or the volatility of the share price of the bank in the stock exchange (volatility). Third, the *economic and financial environment* as proxied by a series of macroeconomic

conditions indicators: GDP growth (GDP), inflation (CPI), economic sentiment, and country level financial conditions indicators such as growth in country stock price index (SP) and the historical volatility of the country stock price index (VOL). Fourth, indicators that serve as proxies for the *monetary policy stance*. Beyond the standard short term interbank rate (r), the interest paid by governments for long term financing is a key reference rate for banks when raising funds in debt markets, we thus further include the long term government bond yield (yield) as one of the regressors. Of course, this variable will also reflect the impact of the tensions in euro area sovereign debt markets during the financial crisis. Further to setting the key reference policy rates, during the financial crisis, central banks were also ready to provide liquidity assistance to banks which faced difficulties raising funds. It seems thus sensible to include some proxies for the impact of those monetary policy actions. In particular, we will include the ratio of the total assets of the central bank to nominal GDP (TACB) as a proxy for liquidity assistance. For euro area countries, we further include two additional key dummy variables, one to account for the period over which fixed rate full allotment in regular liquidity providing open market operations was granted to banks (FRFA), and another to proxy for the period over which the 'Covered bond purchase programme', which resulted in purchases of covered bonds by the ECB with the intention of alleviating tensions in covered bond markets, was active (CBPP).[1] Finally, *issuance characteristics* that include an indicator on whether debt was issued with a bank guarantee (Govguar) and another indicator to show whether debt has been self-issued (Self). The latter serves to proxy for the amount of issuance that banks may choose to primarily place through their branching network and may thus proxy primarily for retail placements rather than issuance placed with major private investors. In all the list of series used in the analysis are the following:

Dependent variables:

- DC. Collateralized debt issuance over total assets.
- DU. Uncollateralized debt issuance over total assets.

Balance sheet indicators:

- tier 1 ratio. Core Tier 1 capital ratio.
- ROE. Return on Equity.

[1]The 'fixed rate full allotment' policy of the ECB has been in place since October 2008. The 'Covered Bond Purchases Programme' was active from June 2009 to June 2010 in its first phase, and reactivated from early November 2011 onwards, with bond purchases amounting to 60 billion euro and 40 billion euro in its first and second phases respectively. The dummies used to proxy for these policies take the value of 1 when active and a value of zero when not active. Ratios and growth rates are measured in percentage terms.

- deposits. Total deposits to total assets ratio.
- loans. Total loan to total assets ratio.
- size. (dummy) 1 if average total assets larger than 1 Tr. euro, zero otherwise.

Bank's financial reputation:

- Rating. Bank credit rating (1 to 6 scale).
- market value. Change in bank share price.
- volatility. Bank share price historical volatility.

Economic and financial environment:

- GDP. GDP growth.
- CPI. CPI inflation.
- ESI. Economic Sentiment indicator.
- SP. Country stock price index growth.
- VOL. country stock price index historical volatility.

Monetary policy Stance:

- r. 3-month short term interest rate.
- yield. 10-year government bond yield.
- TACB. Central Bank total assets to nominal GDP ratio.
- FRFA. (dummy) 1 for euro area countries if fixed rate full allotment active.
- CBPP. (dummy) 1 for euro area countries if Covered Bond Purchases programme active.

Issuance characteristics:

- GovGuar. (0-1 dummy) 1 if bank issued debt with government guarantee.
- Self. (0-1 dummy) 1 if bank issued debt as sole bookrunner.

Further details on these indicators and sources for the data are left for the appendix.

3.1 Descriptive Statistics

Despite the fact that our sample of banks is restricted to listed European banks which have survived the financial crisis, the sample is fairly heterogeneous. Out of a total of 71 banks, 12 have total assets exceeding 1 trillion euro and are thus classified as 'large' for the purposes of our regression analysis, see 1. A set of descriptive statistics for our data sample is provided

in tables 3 and 4. The sample covers sufficient length to include periods of expansion in economic activity as well as periods of contraction. The boom and contraction phases are also widely diverged across countries as shown in the statistics reported in tables 3 and 4 for variables associated with the business cycle. Financial market data are, not surprisingly, that displaying most sample heterogeneity, with changes in stock prices, or changes in return on equity displaying large extreme values at both ends of the distribution. Issuance ratios, reached on occasions values above 10% although such issuance volumes were very rare, and were primarily associated with issuance activity under government guarantee in times of financial crisis as part of the financial assistance programmes launched by the European governments.

4 Modelling strategy

4.1 Tobit model with random effects

Data on issuance activity is bounded by zero. In many quarters, issuance by certain banks is zero. A standard linear regression model would not take into account these features of the data. The Tobit regression model is the common approach to this econometric problem. We make use of the following Tobit regression model with random effects. We use the i sub-indices to denote a bank cluster, and the t index to denote time observations, N and T are the used to refer to the number of banks and number of time periods respectively in our sample. There is a latent dependent variable that we do not directly observed y_{it}^*, and exogenous regressors, $\boldsymbol{x}_{it}$ which we do observed denoted accordingly using those indexes. It is assumed that:

$$y_{it}^* = \boldsymbol{x}_{it}'\boldsymbol{\beta} + u_{it}$$

where $u_{it} = \mu_i + \varepsilon_{it}$, and the random variables μ_i and ε_{it} are independent and follow normal distributions with mean 0 and standard deviation σ_μ and σ_ε respectively. Additionally we observed $y_{it} = \max(0, y_{it}^*)$. Then, if we further define the indicator function I_{it} which takes the value of 0 if $y_{it} = 0$ and takes the value of 1 otherwise, we can define the likelihood as:

$$L = \prod_{i=1}^{N} \int_{-\infty}^{\infty} \left\{ \prod_{t=1}^{T_i} \left[1 - \Phi\left(\frac{-\boldsymbol{x}_{it}'\boldsymbol{\beta} - \mu_i}{\sigma_\varepsilon} \right) \right]^{I_i t} \left[\frac{1}{\sigma_\varepsilon} \phi\left(\frac{y_{it} - \boldsymbol{x}_{it}'\boldsymbol{\beta} - \mu_i}{\sigma_\varepsilon} \right) \right]^{(1-I_i t)} \right\} \phi\left(\frac{\mu_i}{\sigma_\mu} \right) d\mu_i$$

where $\phi(\cdot)$ and $\Phi(\cdot)$ are used to denote the density function and distribution function respectively of the standard normal distribution, and T_i is the number of available observations for bank i. Computation of the integral in the likelihood function can be done relatively efficiently by means of Gauss-Hermite quadrature methods.

4.2 Quantile Tobit model with random effects

The previous modelling technique may not potentially address some other relevant issues. In particular, there may be nonlinearities associated with the distributional assumptions of the dependent variable. The modelling responses of the dependent variable may change for different quantiles of the distribution. We are particularly interested in those cases where banks show a shortage of liquidity and/or market funding and cases where banks show less problems to get liquidity and market funding. The economic impact of the right-hand side variables for these groups may change significantly. This means that an important issue in our identification strategy will be the non-linearity and quantile structure of the distribution of the dependent variable. Quantile regression has the potential to uncover different shapes of a regression function for different quantiles of the dependent variable. We thus apply as an alternative estimation method a quantile Tobit regression model with random effects. We apply the inference procedure proposed by Wang and Fygenson (2009) for such models. Their method does not rely on the normal distributional assumptions stated above, but rather impose minimal assumptions on the error terms and is thus robust to distributional misspecifications. The only assumption made on the error term u_{it} is that its τth quantile is zero and that its density function is continuously differentiable around zero and bounded away from zero and infinity. For a given $\tau \in [0,1]$ the estimator $\boldsymbol{\beta}$ is the solution to the minimization problem:

$$\min_{\beta} Q_{N,T}\left(\boldsymbol{\beta}, \tau\right) = \sum_{i=1}^{N} \sum_{t=1}^{T_i} \rho_{\tau}\left\{y_{it} - \max\left(0, \boldsymbol{x}_{it}'\boldsymbol{\beta}\right)\right\}$$

where $\rho_{\tau}(s) = s \cdot \{\tau - I(u < 0)\}$ is the quantile loss function with the indicator function I taking a value of one if the expression in parenthesis is true and a value of zero otherwise. Under some boundedness conditions on the regressors asymptotic consistency and normality of the estimator follow. Asymptotic normality is, however, of little practical use as computation of the covariance matrix of the estimator of $\boldsymbol{\beta}$ is a function of the density function of the error term, which is left unspecified. Instead, in order to tests hypothesis on the coefficient estimator under this modelling framework, Wang and Fygenson (2009) proposed a Quantile Rank Score (QRS) test statistic. Confidence intervals for the coefficients can thus be computed by inverting the rank score test, see Wang and Fygenson (2009) and Chen and Wei (2005) for details.

4.3 Endogeneity issues

Some of the explanatory variables may be considered endogenous, as they may impact on the issuance ratio while possibly also being directly affected by that ratio. This is particularly

likely in the case of three of the right-hand-side variables: the deposit ratio, the loan ratio and the capital ratio. Our aim when including the loan and deposit ratio as right-hand-side variables is to distinguish issuance patterns across different types of banks or bank business models. For example, banks that have easier access to deposits may pursue less aggressive debt issuance policies, tapping financial markets less frequently. The inclusion of the capital ratio aims to capture the fact that less leveraged banks might be in a better position to tap financial markets than those with excessive leverage and thus perceived by potential lenders as more risky. At the same time, however, debt issuance expands the balance sheet of the bank and thus can affect the deposit, loan and/or capital ratios, which are all defined with respect to total assets. Debt issuance mechanically reduces the capital to assets ratio, but may reduce or increase the deposit to loans ratio. How precisely the latter is impacted by debt issuance decisions will depend on the use of the money raised (i.e. whether is used to fund further loans or alternative investments), and on the ability of the bank to capture through deposits some of the money employed, either as loans or as alternative investments. In econometric terms the endogeneity problem is defined by the correlation between the explanatory variable and the error term in the regression which thus renders the coefficient estimates inconsistent. To address the endogeneity problem, we replace the deposit, loan and capital ratio with mean lag values over the past four quarters. For the deposit and loan ratio, this avoids the correlation problem for the contemporaneous ratio, and by using the average it may better define a variable which serves to identify a certain 'characteristic of the bank'. By using the average of past lags also for the capital ratio, we implicitly assumed that markets focus on a certain track record, and thus build their good reputation in terms of leverage over a certain period of time.[2]

5 Empirical Results

5.1 Tobit Analysis: full sample results

As a baseline reference, the Tobit analysis estimation results are presented first for the full sample, estimating separately for collateralized and not collateralized debt issuance, and for each under three possible specifications, depending on whether or not a size or a country dummy, or both are included, see table 5. Seasonal dummies to take on board seasonality patterns in issuance activity are also incorporated in the regressions.

[2]The estimation technique usually employed when dealing with the endogeneity problem is the instrumental variable method. This technique is, however, not always amenable to implement. For the problem under study, the use of instrumental variable techniques would prove numerically very challenging for our panel tobit model, or, to our knowledge, not feasible altogether for the quantile panel tobit regression method also employed in this paper.

Under this specification, financial soundness indicators (Tier 1 ratio and ROE) are not significant to explain bank's issuance activity on both collateralized and uncollateralized debt instruments and this result will be confirmed when the pre-crisis and crisis periods are separated in the estimation (see next section).
As for financial reputation (Market Value, Volatility and Rating), variables overall do not play a strong role in determining issuance, while a more nuance picture emerges when estimating pre-crisis and crisis sample periods separately (see next section). Specifically, only the coefficient associated with the highest rating (Rating 6) is significant and positive to explain issuance of collateralized debt. In the case of uncollateralized debt, most of the reputation-related variables are found to be statistically significant. In particular, the sign of the coefficient for *market value* is positive and significant, as it should be expected. However, the coefficient for the rating dummies suggest that banks with A lower rating tend to issue more uncollateralized debt, other factors being the same, than banks with a higher rating. The only exception are the banks with the lowest rating (rating 1) where the sign of the coefficient is negative and suggesting that banks with the lowest reputation found difficulties in issuing debt, no matter if collateralized or uncollateralized.

The economic and financial environment variables turned out being of limited significance. The expansion phase of the business cycle (GDP), or bull periods in stock markets (SP) come with a positive sign for uncollateralized debt while only SP is significant for collateralized debt. Volatility in country equity markets has a positive and significant impact on collateralized debt but turns not to be statistically significant for uncollateralized debt. A potential explanation for the positive sign for collateralized debt may be associated with the higher demand for these products as a safe haven investment compared to alternative investment opportunities in equity, uncollateralized debt or even deposits which are subordinated to collateralized debt. However, overall for these macroeconomic variables, the sign and significance of coefficients will be found (see next section) to be rather sensitive to sample period and their interpretation should not be overemphasised.

As for monetary policy variables, they are only found to be statistically relevant to explain issuance of collateralized debt but not uncollateralized debt and here again results will turn out to be rather sensitive to sample periods, so their more detailed interpretation is discussed in the next session. Higher interest rates are in principle associated with larger issuance, albeit the effect is barely significant. On those variables associated with non-standard liquidity measures by the central bank (TACB) appears negative and significant of issuance of collateralised debt, indicating that central bank may have been a substitute

for issuance activity by banks. This variable is, however, insignificant for uncollateralised issuance. Additionally for euro area countries, the dummy on the provision of unlimited liquidity in auctions by the ECB (FRFA) comes significant but positive for issuance of collateralised debt, while significant and negative for uncollateralised debt. In this respect it should be recalled that financial institutions need to pledge valid collateral in exchange for liquidity at the ECB, and a large part of the collateral pool used by banks is related with marketable instruments like covered bonds and mortgage bank securities. This could have rendered holdings of collateralized debt (issued by other banks) more attractive, triggering a rebalancing of assets in banks' balance sheet towards collateralized debt and thus ultimately boosting demand for collateralized debt. Furthermore, covered bonds issued by banks may be retained in their balance sheet and, given their safe and high rating class status, still be pledged as eligible collateral with the ECB. In times when access to the interbank market was closing for many euro area banks, the issuance of covered bonds to be retained in their balance sheet helped to release financing pressures. The negative sign of the FRFA dummy for issuance of uncollateralised debt points indeed at the potential substitution of the need for market debt financing with ECB liquidity injections.
The covered bond purchase programme of the ECB does not appear to have had a significant impact on issuance activity.[3]

In the case of issuance characteristics, the ability to issue under government guarantee has a statistically significant and positive effect on the issuance of uncollateralized debt. It is also the case that the dummy for self-issuance, which potentially captures the ability of some banks to place debt through their branch network, has a strong and significant positive effect on the issuance of both collateralized and uncollateralized debt.

5.2 Tobit Analysis: split sample results

The sample under study, 2003Q1 to 2011Q4 spreads across two very different economic periods. The first part of the sample, 2003Q1 to 2007Q2, matches the expansion phase of the business cycle for most European economies in our sample. It is also characterised by a period of strong lending activity by banks, when according to some studies, see Marques-Ibanez and Gambacorta (2011) and Carbo-Valverde, Marques-Ibanez, and Rodriguez-Fernandez (2011),

[3]The CBPP was designed with a view of correcting the malfunctioning in covered bond markets, where the price of raising funds by means of covered bonds had escalated to record high values. The CBPP served to correct yields as it was designed to do, but did not trigger a boost, in issuance, although it may have contributed to avoid the collapse of debt issuance in covered bonds.

credit standards in bank lending to households and non-financial corporations were overly relaxed, and buoyant securitisation activity lead banks to have easy access to funding in markets. The second part of the sample, 2007Q3 to 2011Q4, matches not only the contractionary phase of the business cycle, but in effect the largest contraction of real activity since the Second World War seen in most European countries. The second period relates to the on-going financial crisis, when access to funding has been more restrictive and lending standards by banks have been significantly tightened. As far as liquidity provision is concerned, the pre-crisis years cover a period in which privately generated liquidity was far more relevant than central bank provided liquidity, which played a much important role during the crisis years.

It appears thus sensible to split the sample for our empirical analysis in those two sub-periods in order to account to structural changes in the aftermath of the financial crisis. Indeed, and as shown in table 6, when on the basis of our Tobit model with random effects we test the null hypothesis of no change in regime, this hypothesis is clearly rejected.[4].

Table 7 displays the estimation results for the sample period 2003Q1 to 2007Q2 and table 8 those for the sample period 2007Q3 to 2011Q4. On the basis of these estimation results, while some of the findings of the baseline (full sample) model are confirmed, some others need to be partly corrected

The result of statistical test for structural change across the two samples reported above together with the comparison of results for coefficient estimates across the two samples give a strong sense that the main determinants of debt issuance decisions and thus leveraging by banks have changed since 2008. Starting with business cycle and overall financial markets conditions variables, the comparison of results across the two samples suggests that in the 2003Q1-2007Q2 period, a key determinant for collateralised debt issuance was the real interest rate, as captured by the positive coefficient on central bank interest rates (r)(given the low level of interest rates over most of this period) and the negative one on consumer price inflation (CPI). The elevated coefficients (in absolute value) on inflation and their strong significance capture the stimulating effect of low (often negative) real interest rates on collateralised debt issuance and leveraging decisions by banks over this period. This stimulating impact of real interest rates is absent in the case of uncollateralised debt, which reveals non-significant coefficients for the level of the monetary policy interest rate and for

[4]The no change in regime hypothesis has been tested using a pseudo Chow test for parameter stability. An unrestricted model, with parameters not restricted to be the same over the two periods, was estimated, and the null of parameter equality was tested by means of a Wald-type test using the maximum likelihood estimates. Variables which are only formerly defined over the second sample, namely FRFA, CBPP, Govguar, are of course not included in the set of variables to be tested for parameter equality.

inflation. It thus appears that the self-reinforcing mechanics of low real interest and bank leveraging materialised primarily through the channel of collateralised bank instruments. The impact of real interest rates on collateralised debt issuance observed in the crisis run-up period is found to disappear in the crisis period. This should not be surprising, as banks tended to deleverage while real interest remained relatively high in a number of the countries in the sample (amid tight market financing conditions), making the observed statistical link between interest rates and inflation on the one hand and issuance decisions overall weaker. Estiamtes for the variables associated with non-standard liquidity measures by the central bank (TACB) remained unchanged with the split of the sample. Once more, this variable appears significant and negative for collateralised debt issuance, and insignificant for uncollateralised issuance. Results for the dummy on the provision of unlimited liquidity in auctions by the ECB (FRFA) are slightly more difficult to decipher. On the one hand the sign remains positive and significant for collateralised issuance for the second sample where this dummy is defined. However, it is not significant when estimated for uncollateralised issuance when using only the second part of the sample. This result may be driven by the fact that this dummy is almost always active over the second sample period and its effect and that of the intercept may be difficult to disentangle over this short sample period.

When estimating the two sub-samples separately, bank-level balance sheet strength indicators (ROE, notably the Tier 1 capital ratio) remain, as when estimating with the full sample, statistically insignificant. This is the case for both collateralized and uncollateralized debt. While being a statistically robust result (confirmed across the different estimates) it is not subject to a single interpretation: It may be argued that, being a variable strongly influenced by regulations, the capital ratio shows lesser co-movement with unrestricted decisions. It could also be argued that better capitalised banks enjoy easier conditions to access and tap markets, but also lower financing needs, thus with supply and demand-side effects cancelling each other on average when compared to less capitalised firms decisions.

The role of the having a broader depositors base also reveals some differences across the two sample periods: in the pre-crisis period deposits and debt issuance appear as clear substitutes, with a stronger depositors base curbing the tendency to issue new debt. This substitution is observed both for collateralised and uncollateralised issuances, fairly symmetrically so. For the crisis period, the coefficients become smaller and less significant, becoming non-significant for the collateralised debt case. As funding and liquidity risks increased during the crisis, banks had to face more complex conditions to meet their financing needs and those who were in a position tended to build liquidity buffers, what may have reduced their

willingness to substitute across market sources on the margins.
The results for reputation-related variables overall suggest that the role of ratings of the issuing bank changed strongly in the run up compared to the crisis period, as there are marked differences across the two sub-samples and also for collateralized and uncollateralized debt: During the crisis run up period, the market value of the bank is found to be a positive and significant driver for both collateralized and uncollateralized debt issuance decisions. This significant driving role of market value largely disappears during crisis years, both for collateralized debt. By contrast, the role of ratings of the individual becomes more important during the crisis. Coefficients become larger and clearly more significant, suggesting that they enter more granularly in issuance decisions, likely as over the crisis period the demand side for the bank debt securities became more risk-sensitive and discriminating.

On the discussions on the impact of the economic and financial environment, and particularly those associated with the impact of developments in equity markets (SP and VOL), the results show that turmoil in equity markets during the first part of the sample did hamper issuance of collateralized debt. However, the opposite was the case during the financial crisis, where, either the boost in demand as a safe asset, or the need to raise valid collateral to pledge at the central bank in exchange of liquidity, may explain that higher volatility in equity markets was associated with larger issuance of collateralized debt.

It is also worth noting that the possibility of placing debt through a branching network (as proxied by the Self variable) had a much stronger effect during the period of financial turmoil.

5.3 Quantile Tobit Analysis

Some caveats on the series used for the quantile analysis should be taken into consideration when analyzing the empirical results of this section. A number of series are exclusively defined for a reduced set of banks, e.g. a certain rating class, the size dummy and the country dummy, leaving some explanatory variables for observations associated with a given quantile tranch unidentified. We deal with this issue by replacing the rating class indicator that is the dummies associated with every rating class, with a single numerical series where the rating is quantified with values in the range 1 to 6 (or 0 when not defined). We further do not employ country dummies for our quantile regression analysis, something further justified from our Tobit analysis which suggests that country dummies are not significant. We further exclude

the size dummy. This is somehow more controversial but is done on the sole basis of rendering the analysis numerically tractable. Due to heavy left-censoring of the data, as much as 30% for uncollateralized issuance and 50% for collateralized issuance, it was not possible to estimate quantile coefficients for quantiles lower than 40% for uncollateralized issuance and 50% for collateralized issuance. This setting does nonetheless allow to identify potential asymmetries in the impact of certain explanatory variables on the higher quantiles (higher issuance volumes) compared with the median quantile. Results are presented in charts 1 to 6.

The quantile approach helps us identify some exceptions on the unexpected lack of significant of financial soundness indicators found in the previous regressions. In particular, the lack of significance and even the negative sign of the coefficient of the core tier 1 ratio is better explained when looking at the quantiles. The quantile analsyis confirms that the core tier one ratio appears irrelevant to explain issuance of collateralized debt. However, large issuance, as associated with the larger quantiles, of uncollateralised debt, is positively affected by core tier 1 ratio, suggesting that the reputation effect of a higher tier 1 ratio manifests in terms of propensity to issuance when large volumes are offered.

The Tobit analysis on the previous two subsections had suggested that the credit rating of the bank was not truly relevant to explain issuance of collateralised debt. However, the quantile analysis suggests that for the large quantiles the credit rating is an important factor. Similarly, the quantile analysis reveals that the credit rating had always, before the financial crisis and during the financial crisis, a positive effect to explain the large quantile of uncollateralised issuance. Indicating that, while the ability to raise funds prior to the financial crisis was more widespread across banks, a poor rating would make it more difficult to increase leverage.

Some other control factors confirm some relevant finding in the quantile regression. For example, the Covered Bond Purchase Programme of the ECB had a positive role in explaining collateralised issuance for the upper quartiles, and thus the impact of the CBPP may have not only been associated with the impact on the prices of covered bonds but also on the volumes issued. Similarly, the positive sign of the coefficient of the short-term interest rate turns negative when explaining the largest quantiles of issuance both for collateralised and uncollateralised debt.

6 Conclusions

Debt issuance has become a major source of bank funding in recent times. Securitization, as well as other forms of debt, particularly expanded in the years prior to the crisis. However, the collapse of monetary markets with the financial crisis as well as bank solvency and macroeconomic negative outcomes have made debt issuance much more difficult for banks. In this sense, official (central bank) liquidity as well as government guarantees have become an important driver of banks' access to liquidity during the financial turmoil.

While there are several theoretical contributions on a number of issues related to debt issuance, including the relationships between solvency and liquidity generation, the determinants of securitization activities or the impact of reputation on debt, the empirical evidence is much more limited. Mainly due to the lack of data, the determinants of bank debt issuance have been only partially explored under restrictive environments. In this paper we try to make a comprehensive assessment of the determinants of bank access to funding through debt considering a wide set of factors, including both collateralized and uncollateralized debt issuance, financial soundness indicators, bank reputation factors, macroeconomic and market fundamentals, issuance characteristics, and official liquidity support such as central bank liquidity programs and government guarantees. As theoretical contributions suggest that these determinants may change on their significance and impact across time (pre-crisis vs. crisis years) and also show non-linearities, we also test a regime-shift model (to analyse changes across time) and a quantile regression approach (to identify changes in statistical and economic significance across quantiles).

Our results show that financial soundness indicators are not as relevant for bank debt issuance as expected, as only the level of bank solvency is found to be a significant driver of debt issuance and only for large issuance volumes. Additionally, bank reputation (market value and ratings) are invariably found to be significant determinants of the issuance of uncollateralized debt but they are only statistically relevant for large volumes of collateralized debt. Our results also suggest that market volatility in the years prior to the crisis had a negative, large and significant effect on the issuance of collateralized debt.

As for the impact of the official support on bank debt issuance, the Covered Bond purchase programme of the ECB launched during the crisis is found to have a positive impact on collateralised debt prices and volumes issued. Government guarantees during the crisis had a large, positive and significant effect on uncollateralized debt issuance.

Overall, the results in our paper reveal that the determinants of bank debt funding vary depending on the economic environment, bank reputation issues, and issuance characteristics. At the same time, the impact of these factors is shown to be very different depending on whether the debt is collateralized or uncollateralized. Additionally, the role of monetary policy and government support programs during the crisis is shown to be a large contributor for the survival of bank funding channels during turbulent times.

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Technical Appendix

A Data

Issuance volumes and issuance characteristics data are taken from the Dealogic databases. For the balance sheet data, used is made of the consolidated balance sheet records of the Worldscope database. Credit ratings are retrieved from Fitch, Moody's and Standard and Poor sources. We have further transformed the standard letter ratings into a numerical index using the relationhsip shown in Table 2 below. Use has been made of the worse of the three when more than one rating is available. Indicators of bank's financial reputation, namely share price indexes for the banks are taken from Thomsom Reuters Datastream. Similarly, indicators of the financial environment, namely country level stock price index and volatility of that index are taken from the Datastream sectoral stock prices database. Volatility of that index is a quarterly historical volatility estimate computed using the daily observations of that index. As for the economic indicators, GDP and CPI growth are taken from the International Financial Statistics Dataset of the IMF, and the Economic Sentiment indicator is taken from the European Commission's surveys published by DG-ECFIN. Finally, government bond yields are taken from the International Financial Statistics of the IMF. For euro area countries, the ratio of total assets of the central bank to nominal GDP is computed for the euro area as a whole using ECB data; for the other EU countries, total assets are taken from published series by the central bank, while nominal GDP is taken from the IFS database. The 3-month Euribor rate is used for euro area countries, while the ... is used for the United Kingdom, Denmark and Sweden respectively.

The data has been checked and clean for reporting errors. The focus of the analysis is on major and active banking groups. This allows to identify the volumes of issuance by the issuer parent identifier of the Dealogic database. Attributing issuance to dead banks would have been an enourmous task. Subsidiary firms for the banking group would have had to be identified and added up. But for a few exceptions, the chosen banking groups have remained relatively stable in composition during the crisis, and thus issuance volumes for the parent identifier should provide a reliable picture of issuance by the group. However, there are some notable exception to the composition rule that had to be addressed. For example, Commerzbank was merged with Dresdner Bank in May 2009 and became the sole majority owner of Eurohypo (previously owned jointly with Deutsche Bank and Dresdner Bank) in April 2006. Therefore, issuance activity by Eurohypo and by the Dresdner Bank prior to those dates cannot be solely attributed to the Commerzbank, or otherwise the isssuance over total assets ratio would have been very much inflated (as available Worldscope balance sheet data for the Commerzbank prior to those years does not include Eurohypo or Dresdner Bank

assets). To render the issuance ratio for those years sensible, we adjust the Dealogic issuance data under the parent issuer identifier removing issuance by financial institutions associated with Eurohypo and Dresdner Bank. A similar approach was pursued for Deutsche Bank which took majority control of Deustche Postbank in December 2010, and Banco Popular (takeover of Banco Pastor in December 2010), Banco de Sabadell (takeover of CAM in December 2011) and Danske Bank (takeover of Sampo in June 2008).

Table 1: List of Banks in the Sample.

index	Bank	Country	Total assets	large
1	Erste Group Bank	Austria	215536	-
2	Raiffeisen Bank Intl.	Austria	147932	-
3	Oest.Volksbanken Pc.	Austria	87709	-
4	Oberbank	Austria	17071	-
5	Bk.Fur Tirol Und Vbg.	Austria	9227	-
6	Dexia	Belgium	647027	-
7	Kbc Group	Belgium	381920	-
8	Bank Of Cyprus	Cyprus	43197	-
9	Marfin Popular Bank	Cyprus	43287	-
10	Hellenic Bank	Cyprus	8866	-
11	Danske Bank	Denmark	475952	-
12	Jyske Bank	Denmark	33441	-
13	Sydbank	Denmark	21670	-
14	Spar Nord Bank	Denmark	9644	-
15	Pohjola Pankki A	Finland	40977	-
16	Aktia 'A'	Finland	11180	-
17	Alandsbanken 'A'	Finland	3615	-
18	Bnp Paribas	France	2289322	Yes
19	Credit Agricole	France	1758771	Yes
20	Societe Generale	France	1247000	Yes
21	Deutsche Bank	Germany	2305337	Yes
22	Commerzbank	Germany	1011535	Yes
23	National Bk.Of Greece	Greece	123055	-
24	Efg Eurobank Ergasias	Greece	86867	-
25	Alpha Bank	Greece	73709	-
26	Bank Of Piraeus	Greece	57263	-
27	Agri.Bank Of Greece	Greece	33256	-
28	Tt Hellenic Postbank	Greece	17896	-
29	Attica Bank	Greece	5236	-
30	Bank Of Ireland	Ireland	199891	-
31	Allied Irish Banks	Ireland	182685	-
32	Unicredit	Italy	1052838	Yes
33	Intesa Sanpaolo	Italy	677378	-
34	Banca Monte Dei Paschi	Italy	254743	-
35	Banco Popolare	Italy	138908	-
36	Ubi Banca	Italy	131683	-
37	Mediobanca	Italy	76323	-
38	Banca Ppo.Emilia Romagna	Italy	59948	-
39	Banca Popolare Di Milano	Italy	55639	-
40	Banca Carige	Italy	42040	-
41	Credito Emiliano	Italy	30501	-
42	Credito Valtellines	Italy	28315	-
43	Banca Ppo.Di Sondrio	Italy	28014	-
44	Banco Di Sardegna Rsp	Italy	14039	-
45	Banca Popolare Etruria	Italy	11498	-
46	Bnc.Di Desio E Delb.	Italy	8653	-
47	Van Lanschot	Netherlands	21760	-
48	Sns Reaal	Netherlands	130723	-
49	Ing Groep	Netherlands	1369848	Yes
50	Banco Comr.Portugues 'R'	Portugal	99321	-
51	Banco Espirito Santo	Portugal	84636	-
52	Banco Bpi	Portugal	48948	-
53	Banif-Sgps	Portugal	16919	-
54	Banco Santander	Spain	1250476	Yes
55	Bbv.Argentaria	Spain	584438	-
56	Bankia	Spain	303190	-
57	Banco Popular Espanol	Spain	131686	-
58	Banco De Sabadell	Spain	96176	-
59	Banca Civica	Spain	72402	-
60	Bankinter 'R'	Spain	61991	-
61	Caixabank	Spain	273387	-
62	Banco De Valencia	Spain	24416	-
63	Nordea Bank	Sweden	669176	-
64	Seb 'A'	Sweden	256039	-
65	Svenska Handbkn.'A'	Sweden	268612	-
66	Swedbank 'A'	Sweden	204562	-
67	Royal Bank Of Sctl.Gp.	United Kingdom	2583668	Yes
68	Barclays	United Kingdom	2120610	Yes
69	HSBC Holding	United Kingdom	2024362	Yes
70	Lloyds Banking Group	United Kingdom	1249906	Yes
71	Standard Chartered	United Kingdom	392063	-

NOTE: Total assets value refers to largest value in Mln of euros recorded over the period 2003Q1-2012Q1.

Table 2: Quantification of qualitative credit ratings.

Fitch		Moody's		Standard and Poor's		index
LT	ST	LT	ST	LT	ST	
AAA	F1+	Aaa	P-1	AAA	A-1+	6
AA+		Aa1		AA+		
AA		Aa2		AA		
AA-		Aa3		AA-		
A+	F1	A1		A+	A-1	5
A		A2		A		
A-	F2	A3	P-2	A-	A-2	
BBB+	F3	Baa1	P-3	BBB+	A-3	4
BBB		Baa2		BBB		
BBB-		Baa3		BBB-		
BB+	B	Ba1	Not prime	BB+	B	3
BB		Ba2		BB		
BB-		Ba3		BB-		
B+		B1		B+		2
B		B2		B		
B-		B3		B-		
CCC	C	Caa1		CCC+	C	1
		Caa2		CCC		
		Caa3		CCC-		
		Ca		CC		
				C		
DDD	/	C		D	/	
DD						
D						

NOTE: LT stands for long term, and ST for short term.

Table 3: Descriptive Statistics of Data.

Series	Number of observations	Min	1st Quantile	Median	3rd Quantile	Maximum	Mean	standard deviation
			2003Q1 - 2012Q1					
loans	2331	3	60	69	77	157	67	15
deposits	2328	4.6	34.9	45.4	55.9	98.9	46.4	17.1
tier 1 ratio	1999	-7.3	7.4	8.5	10.1	19.1	8.9	2.3
ROE	2351	-193.5	5.5	11.3	16.7	39.6	9.2	17.4
market value	2440	0.02	3.6	5.9	9.8	43.0	7.4	5.6
volatility	2440	0.00	0.17	0.26	0.39	4.09	0.32	0.25
Rating Long	2590	0.0	0.0	5.0	5.0	6.0	3.6	2.4
Rating Short	2590	0.0	0.0	5.0	6.0	6.0	3.7	2.5
CO Amount	2590	0.00	0.00	0.00	0.16	17.16	0.33	1.02
CO Self	2590	0.00	0.00	0.00	0.00	1.00	0.11	0.28
UNCO Amount	2590	0.00	0.00	0.23	1.00	10.39	0.76	1.23
UNCO GovGuar	2590	0.00	0.00	0.00	0.00	1.0	0.06	0.23
UNCO Self	2590	0.00	0.00	0.00	0.11	1.00	0.16	0.31
GDP	2583	-9.7	0.05	1.7	3.1	8.1	1.1	3.0
CPI	2590	-6.1	1.6	2.3	3.1	5.6	2.3	1.3
yield	2590	1.8	3.8	4.2	4.5	24.7	4.4	2.0
SP	2590	-40.2	-6.0	2.5	8.4	39.6	0.8	11.7
VOL	2590	0.05	0.12	0.17	0.25	0.6	0.2	0.98
ESI	2590	69.1	93.3	100.2	105.3	118.0	98.6	9.9
TACB	2590	22	45	55	85	150	65	25
r	2590	0.16	1.41	2.14	3.59	6.31	2.46	1.36

Table 4: Descriptive Statistics of Data. Mean at country level.

series	AT	BE	CY	DK	FI	FR	DE	GR	IE	IT	NL	PT	SP	SW	UK
	2003Q1 - 2012Q1														
loans	70	55	58	63	69	37	36	73	70	72	86	76	77	69	53
deposits	46	37	84	42	38	32	29	65	45	46	67	47	47	31	40
tier 1 ratio	9.0	10.5	9.3	10.6	9.1	9.0	9.6	9.7	8.3	8.3	9.6	7.7	8.4	9.1	9.5
ROE	5.6	3.0	5.2	12.4	11.4	10.4	4.5	6.1	6.1	7.6	10.3	11.2	12.4	14.4	12.9
market value	6.1	4.4	8.7	7.4	5.1	3.4	2.4	11.1	7.3	7.9	3.6	7.0	11.4	5.8	6.1
volatility	0.24	0.40	0.34	0.25	0.31	0.35	0.36	0.46	0.57	0.28	0.33	0.27	0.28	0.31	0.34
Rating Long	1.6	5.6	2.3	2.2	2.0	5.9	5.3	2.6	5.5	3.8	5.2	4.6	3.0	5.3	3.8
Rating Short	1.8	5.6	2.6	2.2	2.0	6.0	6.0	2.9	5.7	3.8	5.3	4.8	3.2	5.5	3.8
CO Amount	0.05	0.48	0.05	0.07	0.11	0.10	0.36	0.26	0.48	0.23	0.31	0.49	0.76	0.27	0.77
CO Self	0.18	0.40	0.00	0.02	0.00	0.24	0.34	0.03	0.08	0.07	0.04	0.06	0.13	0.12	0.30
UNCO Amount	0.44	0.44	0.31	0.55	0.86	0.28	0.77	0.96	0.85	0.77	0.69	1.07	1.03	0.81	0.74
UNCO GovGuar	0.03	0.13	0.00	0.05	0.00	0.04	0.03	0.06	0.20	0.02	0.06	0.05	0.11	0.03	0.11
UNCO Self	0.14	0.25	0.07	0.03	0.02	0.29	0.49	0.13	0.01	0.16	0.05	0.25	0.14	0.12	0.31
GDP	1.80	1.50	2.26	0.64	1.94	1.12	1.20	0.63	1.66	0.20	1.38	0.16	1.64	2.42	1.29
CPI	2.0	2.3	2.7	2.1	1.7	1.8	1.6	3.2	2.0	2.2	1.7	2.3	2.7	1.5	2.6
yield	3.8	4.0	4.9	3.7	3.7	3.8	3.5	6.7	5.0	4.4	3.7	5.2	4.2	3.6	4.2
SP	2.34	1.62	-1.67	2.827	0.71	1.23	2.14	-1.19	0.50	-0.025	0.81	0.62	1.09	2.78	1.56
VOL	0.19	0.17	0.26	0.18	0.23	0.19	0.18	0.23	0.21	0.18	0.19	0.15	0.19	0.21	0.17
ESI	101	101	99	102	102	101	99	94	97	98	97	93	97	104	99
TACB	66	66	66	109	66	66	66	66	66	66	66	66	66	42	41
r	2.4	2.4	2.4	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.1	3.5

Table 5: Panel Tobit model estimation results. 2003Q1 - 2012Q1.

	collateralized debt issuance						uncollateralized debt issuance					
	β	p.v.	β	p.v.	β	p.v.	β	p.v.	β	p.v.	β	p.v.
Intercept	-2.77	0.01	-3.98	0.00	-3.85	0.00	0.35	0.66	0.26	0.75	-0.24	0.78
Q2	0.02	0.89	0.01	0.96	0.02	0.91	0.09	0.37	0.09	0.37	0.14	0.14
Q3	0.06	0.66	0.06	0.66	0.00	0.99	-0.40	0.00	-0.40	0.00	-0.40	0.00
Q4	0.05	0.74	0.06	0.67	0.01	0.94	-0.08	0.40	-0.09	0.39	-0.06	0.53
loans	0.01	0.11	0.02	0.00	0.01	0.02	0.02	0.00	0.02	0.00	0.02	0.00
deposits	-0.01	0.21	-0.01	0.04	-0.02	0.02	-0.02	0.00	-0.02	0.00	-0.02	0.00
tier 1 ratio	-0.03	0.46	-0.01	0.87	-0.03	0.44	-0.03	0.21	-0.03	0.22	-0.02	0.51
ROE	0.00	0.46	0.00	0.36	0.00	0.72	0.00	0.20	0.00	0.20	0.00	0.28
size	-	-	0.43	0.01	0.35	0.08	-	-	0.05	0.72	0.11	0.59
market value	0.01	0.48	0.01	0.50	0.02	0.31	0.03	0.00	0.03	0.00	0.03	0.03
volatility	0.41	0.27	0.44	0.17	0.24	0.42	0.31	0.16	0.30	0.17	0.20	0.37
Rating 1	0.25	0.83	-0.17	0.88	0.01	0.99	-0.95	0.26	-0.95	0.26	-1.02	0.21
Rating 2	0.49	0.65	0.14	0.90	0.26	0.81	-	-	-	-	-	-
Rating 3	0.66	0.23	0.40	0.48	0.52	0.37	1.30	0.00	1.30	0.00	1.09	0.01
Rating 4	0.36	0.21	0.26	0.35	0.24	0.44	0.93	0.00	0.93	0.00	0.72	0.03
Rating 5	0.29	0.16	0.35	0.05	0.28	0.15	0.42	0.00	0.43	0.00	0.28	0.10
Rating 6	1.05	0.00	1.16	0.00	1.13	0.00	0.90	0.00	0.91	0.00	0.78	0.00
GDP	0.02	0.61	0.01	0.71	0.01	0.70	0.06	0.01	0.06	0.01	0.06	0.02
CPI	0.08	0.12	0.08	0.09	0.06	0.24	-0.10	0.00	-0.11	0.00	-0.11	0.00
SP	0.02	0.01	0.02	0.00	0.02	0.01	0.01	0.04	0.01	0.04	0.01	0.05
VOL	1.45	0.16	2.18	0.04	1.93	0.09	0.91	0.20	0.97	0.19	1.12	0.17
ESI	0.00	0.67	0.01	0.41	0.01	0.41	-0.01	0.40	-0.01	0.43	0.00	0.64
r	0.15	0.02	0.12	0.08	0.12	0.13	-0.04	0.40	-0.05	0.36	-0.05	0.35
yield	-0.06	0.32	-0.03	0.69	-0.07	0.31	-0.04	0.33	-0.04	0.34	-0.08	0.07
TACB	-0.01	0.01	-0.01	0.00	0.00	0.74	0.00	0.44	0.00	0.40	0.01	0.26
FRFA	1.02	0.00	1.00	0.00	0.73	0.02	-0.35	0.06	-0.37	0.06	-0.52	0.03
CBPP	0.06	0.71	0.09	0.58	-0.07	0.69	-0.25	0.04	-0.26	0.04	-0.34	0.01
Self	1.55	0.00	1.42	0.00	1.47	0.00	0.46	0.00	0.46	0.00	0.54	0.00
GovGuar	-	-	-	-	-	-	1.34	0.00	1.34	0.00	1.33	0.00
country effects	-	-	-	-	Yes	0.88	-	-	-	-	Yes	0.06
$\ln(\sigma_\mu)$	-0.10	0.26	0.06	0.50	0.13	0.17	-0.24	0.00	-0.25	0.00	-0.32	0.00
$\ln(\sigma_u)$	0.37	0.00	0.38	0.00	0.37	0.00	0.26	0.00	0.26	0.00	0.22	0.00
Log-lik	-1541	-	-1539	-	-1615	-	-2384	-	-2384	-	-2252	-
Obs	1698	-	1698	-	1698	-	1698	-	1698	-	1698	-
l.c.obs	1031	-	1031	-	1031	-	471	-	471	-	471	-

NOTE: Values reported under the heading p.v. are probability values. l.c. denotes the number of left censored observations. When the model contains coutry effect dummies, the probability value is computed by means of a Wald-type test using the maximum likelihood estimates.

Table 6: Chow test of parameter stability.

	collateralized debt issuance			uncollateralized debt issuance		
with size dummy	No	Yes	Yes	No	Yes	Yes
with country dummy	No	No	Yes	No	No	Yes
Wald statistic	143.9	100.9				
pv	0.000	0.000				

NOTE: Values reported under the heading p.v. are probability values. l.c. denotes the number of left censored observations. When the model contains coutry effect dummies, the probability value is computed by means of a Wald-type test using the maximum likelihood estimates.

Table 7: Panel Tobit model estimation results. 2003Q1 - 2007Q2.

	collateralized debt issuance						uncollateralized debt issuance					
	β	p.v.	β	p.v.	β	p.v.	β	p.v.	β	p.v.	β	p.v.
Intercept	1.06	0.57	0.12	0.95	3.86	0.21	-0.99	0.64	-2.52	0.28	-4.01	0.14
Q2	0.25	0.16	0.23	0.22	0.34	0.07	0.06	0.75	0.05	0.80	0.01	0.96
Q3	0.01	0.98	-0.01	0.97	0.13	0.53	-0.45	0.02	-0.48	0.01	-0.54	0.01
Q4	0.16	0.41	0.20	0.30	0.29	0.14	0.10	0.58	0.10	0.60	0.04	0.85
loans	0.01	0.25	0.00	0.86	0.01	0.41	0.02	0.01	0.03	0.00	0.03	0.02
deposits	-0.03	0.00	-0.03	0.00	-0.03	0.01	-0.02	0.01	-0.02	0.00	-0.03	0.00
tier 1 ratio	-0.14	0.04	-0.07	0.35	-0.11	0.21	-0.03	0.75	-0.02	0.80	-0.15	0.06
ROE	-0.03	0.09	-0.03	0.12	-0.03	0.23	0.02	0.36	0.02	0.31	0.01	0.52
size	-	-	0.53	0.02	1.69	0.00	-	-	0.78	0.06	0.20	0.69
market value	0.08	0.00	0.07	0.00	0.07	0.02	0.06	0.04	0.06	0.01	0.09	0.00
volatility	-0.47	0.63	-0.28	0.77	-0.17	0.87	0.91	0.32	0.91	0.31	0.55	0.55
Rating 3	1.46	0.04	1.01	0.16	0.97	0.29	0.68	0.53	0.54	0.59	0.36	0.74
Rating 4	0.26	0.76	0.10	0.89	0.18	0.86	0.26	0.87	0.13	0.93	-0.04	0.98
Rating 5	0.25	0.40	0.24	0.41	0.20	0.65	0.87	0.00	1.03	0.00	0.73	0.02
Rating 6	0.93	0.01	0.77	0.01	0.48	0.17	1.12	0.00	1.14	0.00	0.95	0.00
GDP	0.08	0.19	0.09	0.15	0.13	0.12	0.07	0.28	0.07	0.27	-0.01	0.91
CPI	0.49	0.00	0.48	0.00	0.39	0.00	-0.01	0.91	-0.02	0.86	-0.04	0.79
SP	-0.02	0.12	-0.02	0.22	-0.02	0.13	-0.01	0.50	-0.01	0.64	-0.01	0.72
VOL	-5.20	0.03	-4.48	0.07	-5.18	0.05	-2.47	0.24	-1.60	0.45	-1.28	0.60
ESI	-0.01	0.46	-0.02	0.42	-0.01	0.77	0.00	0.95	0.01	0.75	0.02	0.29
r	0.42	0.00	0.34	0.03	0.53	0.01	0.18	0.23	0.08	0.59	-0.06	0.72
yield	-0.13	0.64	0.00	0.99	-0.30	0.36	-0.20	0.45	-0.19	0.46	-0.10	0.71
TACB	-0.02	0.03	-0.01	0.54	-0.09	0.01	0.00	0.99	0.01	0.41	0.03	0.09
Self	0.79	0.00	0.67	0.00	0.58	0.00	0.28	0.21	0.21	0.32	0.36	0.09
country effect	-	-	-	-	Yes	0.61	-	-	-	-	Yes	0.86
$\ln(\sigma_\mu)$	0.09	0.54	0.12	0.42	-0.07	0.85	-0.23	0.15	-0.28	0.06	-0.61	0.00
$\ln(\sigma_u)$	0.10	0.05	0.10	0.04	0.09	0.12	0.38	0.00	0.38	0.00	0.38	0.00
Log-lik	-477	-	-474	-	-466	-	-948	-	-946	-	-938	-
Obs	608	-	608	-	608	-	608	-	608	-	608	-
l.c.obs	381	-	381	-	381	-	148	-	148	-	148	-

NOTE: Values reported under the heading p.v. are probability values. l.c. denotes the number of left censored observations. When the model contains coutry effect dummies, the probability value is computed by means of a Wald-type test using the maximum likelihood estimates.

Table 8: Panel Tobit model estimation results. 2007Q3 - 2012Q1.

	collateralized debt issuance						uncollateralized debt issuance					
	β	p.v.	β	p.v.	β	p.v.	β	p.v.	β	p.v.	β	p.v.
Intercept	-3.51	0.06	-4.00	0.02	-4.54	0.01	-1.78	0.09	-1.48	0.17	-1.54	0.15
Q2	-0.14	0.47	-0.14	0.49	-0.14	0.48	0.05	0.67	0.05	0.69	0.05	0.66
Q3	0.21	0.26	0.19	0.32	0.15	0.44	-0.23	0.05	-0.21	0.07	-0.23	0.05
Q4	0.03	0.89	0.02	0.92	-0.02	0.93	-0.24	0.04	-0.24	0.04	-0.25	0.03
loans	0.01	0.18	0.01	0.08	0.01	0.11	0.02	0.00	0.02	0.00	0.02	0.00
deposits	-0.01	0.43	-0.01	0.48	-0.01	0.25	-0.01	0.03	-0.01	0.03	-0.02	0.00
tier 1 ratio	-0.01	0.91	0.00	0.94	-0.01	0.88	0.05	0.17	0.05	0.18	0.04	0.27
ROE	0.01	0.19	0.01	0.23	0.01	0.23	0.00	0.37	0.00	0.38	0.00	0.39
size	-	-	0.55	0.07	0.23	0.61	-	-	-0.36	0.19	-0.53	0.04
market value	-0.04	0.17	-0.04	0.21	-0.06	0.09	0.00	0.86	0.00	0.90	-0.01	0.46
volatility	0.51	0.15	0.47	0.18	0.41	0.24	0.17	0.45	0.18	0.41	0.15	0.50
Rating 1	-0.01	1.00	-0.13	0.92	-0.23	0.87	-0.55	0.50	-0.60	0.46	-0.57	0.49
Rating 2	0.63	0.63	0.54	0.67	0.37	0.77	-	-	-	-	-	-
Rating 3	0.64	0.45	0.61	0.46	0.51	0.52	1.35	0.00	1.29	0.00	1.31	0.00
Rating 4	1.24	0.01	1.21	0.01	1.07	0.01	0.97	0.00	0.92	0.01	0.98	0.00
Rating 5	1.29	0.00	1.27	0.00	1.26	0.00	0.75	0.00	0.71	0.00	0.69	0.00
Rating 6	1.92	0.00	1.99	0.00	1.90	0.00	0.97	0.00	0.92	0.00	0.93	0.00
GDP	0.03	0.53	0.03	0.51	0.02	0.67	0.03	0.22	0.03	0.22	0.03	0.20
CPI	0.06	0.37	0.05	0.50	0.03	0.64	-0.08	0.06	-0.07	0.12	-0.09	0.04
SP	0.01	0.10	0.01	0.08	0.01	0.06	0.00	0.35	0.00	0.38	0.00	0.28
VOL	1.20	0.42	1.54	0.31	1.21	0.42	0.54	0.54	0.35	0.69	0.26	0.77
ESI	0.00	0.75	0.00	0.81	0.00	0.79	-0.01	0.45	-0.01	0.37	0.00	0.65
r	0.16	0.27	0.13	0.37	0.17	0.26	0.12	0.17	0.14	0.12	0.15	0.09
yield	-0.01	0.89	0.00	0.98	-0.03	0.72	-0.05	0.27	-0.05	0.25	-0.08	0.08
TACB	-0.01	0.22	-0.01	0.37	0.00	0.80	0.00	0.84	0.00	0.91	0.00	0.42
FRFA	0.96	0.09	0.82	0.14	0.70	0.22	0.17	0.62	0.26	0.45	0.17	0.64
CBPP	0.14	0.56	0.08	0.73	0.03	0.91	-0.01	0.93	0.02	0.88	-0.03	0.86
Self	1.93	0.00	1.89	0.00	1.89	0.00	0.81	0.00	0.83	0.00	0.82	0.00
GovGuar	-	-	-	-	-	-	1.30	0.00	1.31	0.00	1.30	0.00
country effects	-	-	-	-	Yes	0.80	-	-	-	-	Yes	0.26
$\ln(\sigma_\mu)$	-0.39	0.05	-0.32	0.14	-0.44	0.05	-0.55	0.00	-0.62	0.00	-0.73	0.00
$\ln(\sigma_u)$	0.44	0.00	0.43	0.00	0.44	0.00	0.11	0.00	0.11	0.00	0.11	0.00
Log-lik	-1034	-	-1033	-	-1028	-	-1378	-	-1377	-	-1370	-
Obs	1090	-	1090	-	1090	-	1090	-	1090	-	1090	-
l.c.obs	650	-	650	-	650	-	323	-	323	-	323	-

NOTE: Values reported under the heading p.v. are probability values. l.c. denotes the number of left censored observations. When the model contains coutry effect dummies, the probability value is computed by means of a Wald-type test using the maximum likelihood estimates.

Figure 1: Tobit Quantile Regression: 2003Q1 - 2012Q1. Collaterilized debt.

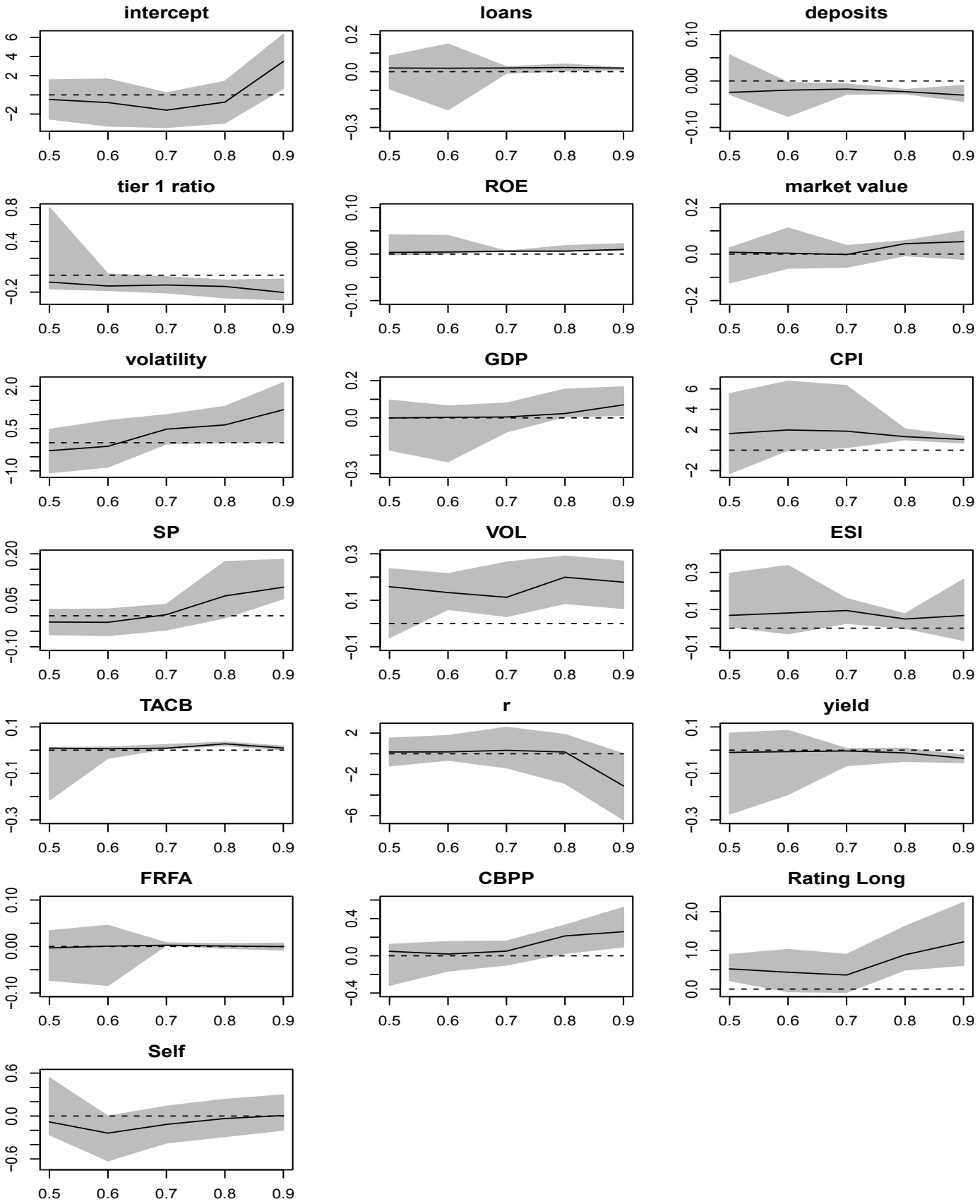

Figure 2: Tobit Quantile Regression with random Effects, 2003Q1 - 2012Q1. Uncollaterilized debt.

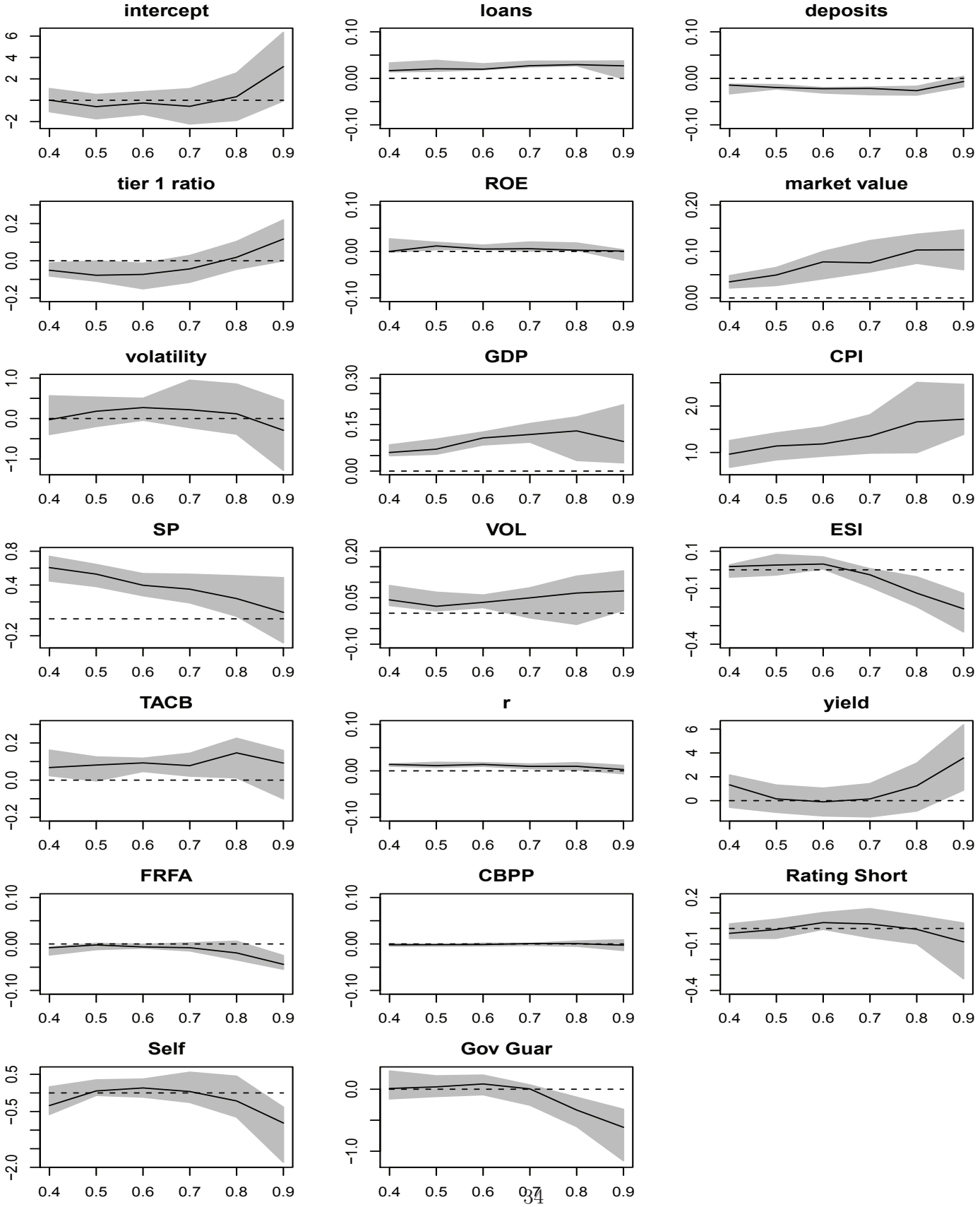

Figure 3: Tobit Quantile Regression: 2003Q1 - 2007Q2. Collaterilized debt.

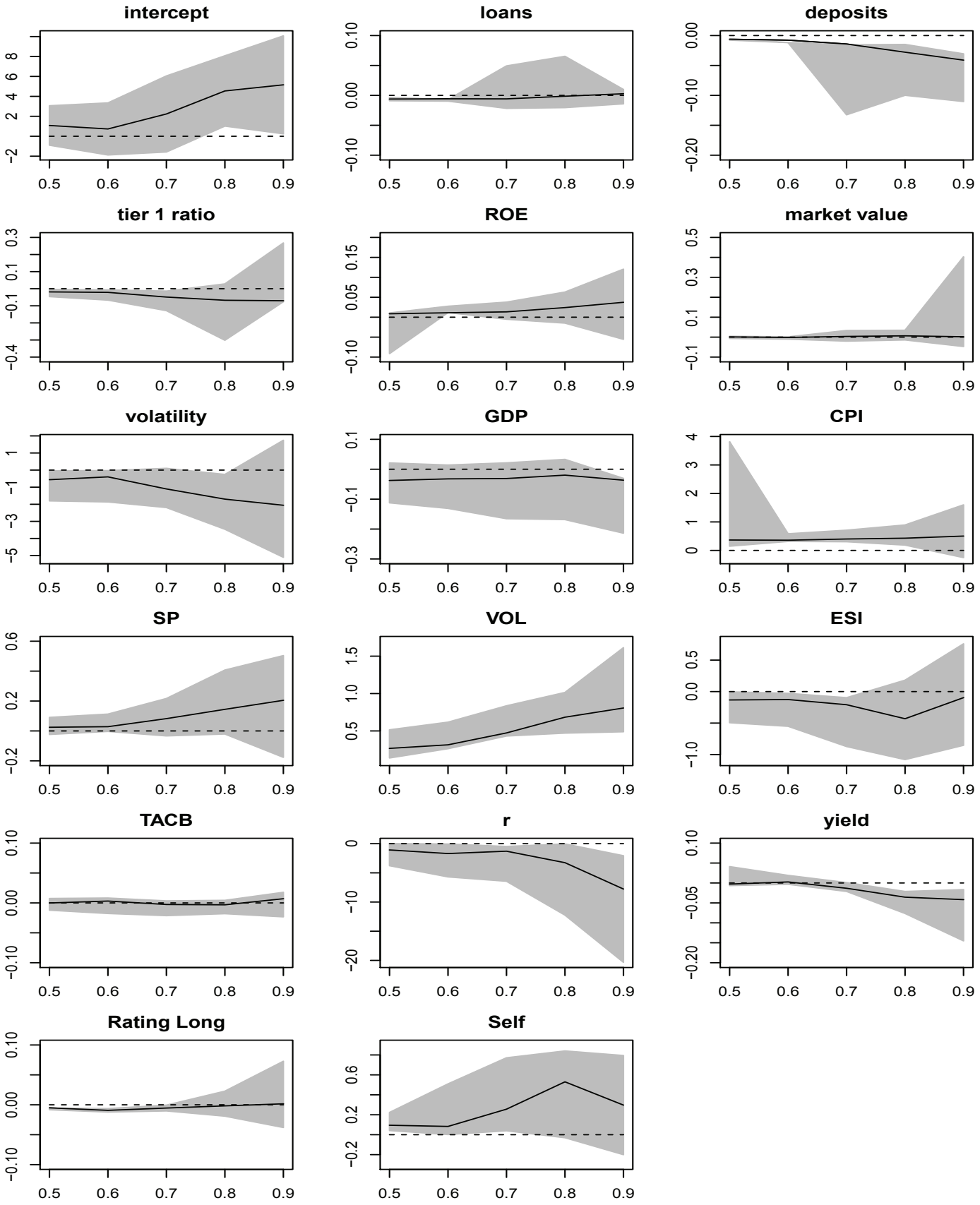

Figure 4: Tobit Quantile Regression: 2003Q1 - 2007Q2. Uncollaterilized debt.

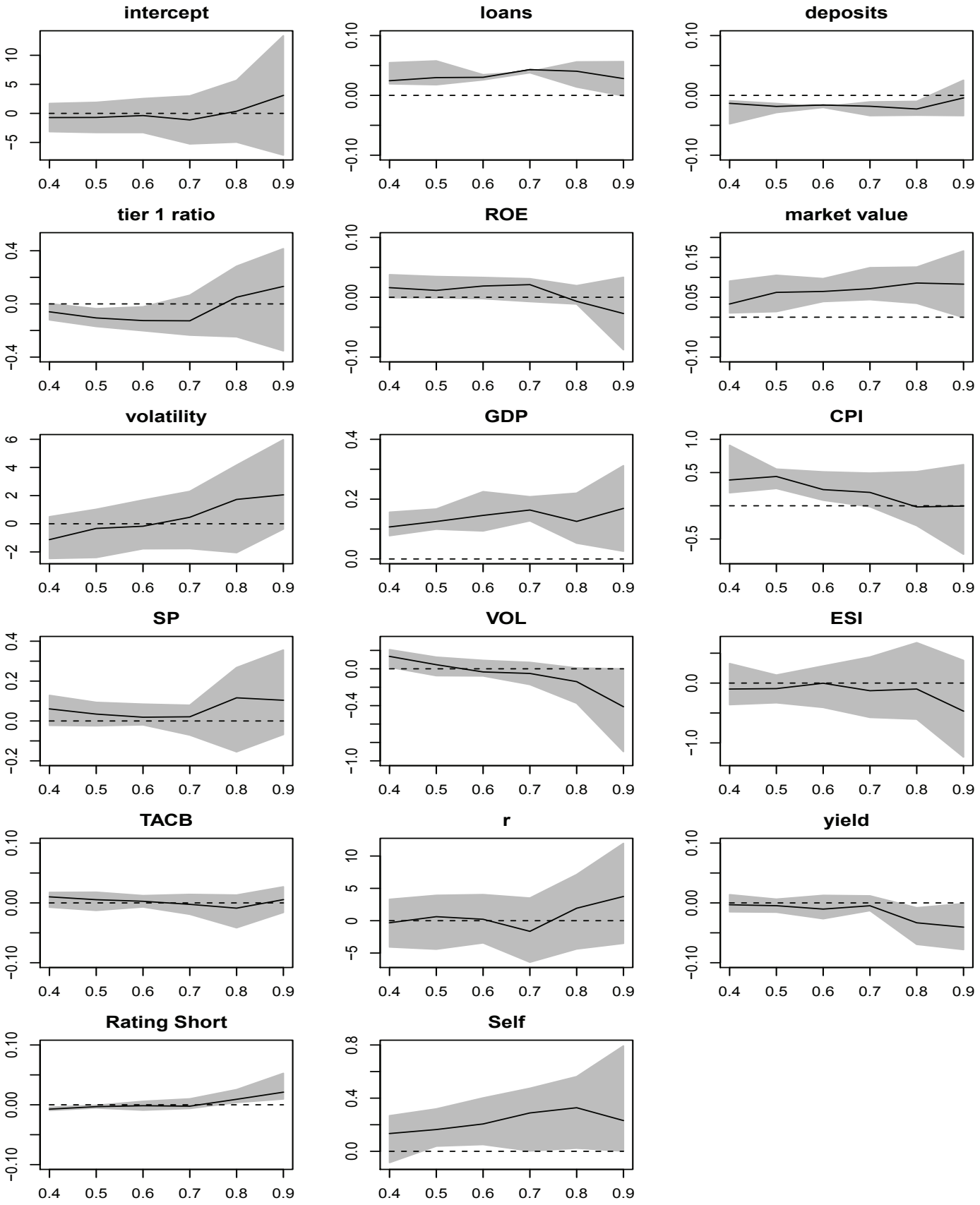

Figure 5: Tobit Quantile Regression: 2007Q3 - 2012Q1. Collaterilized debt.

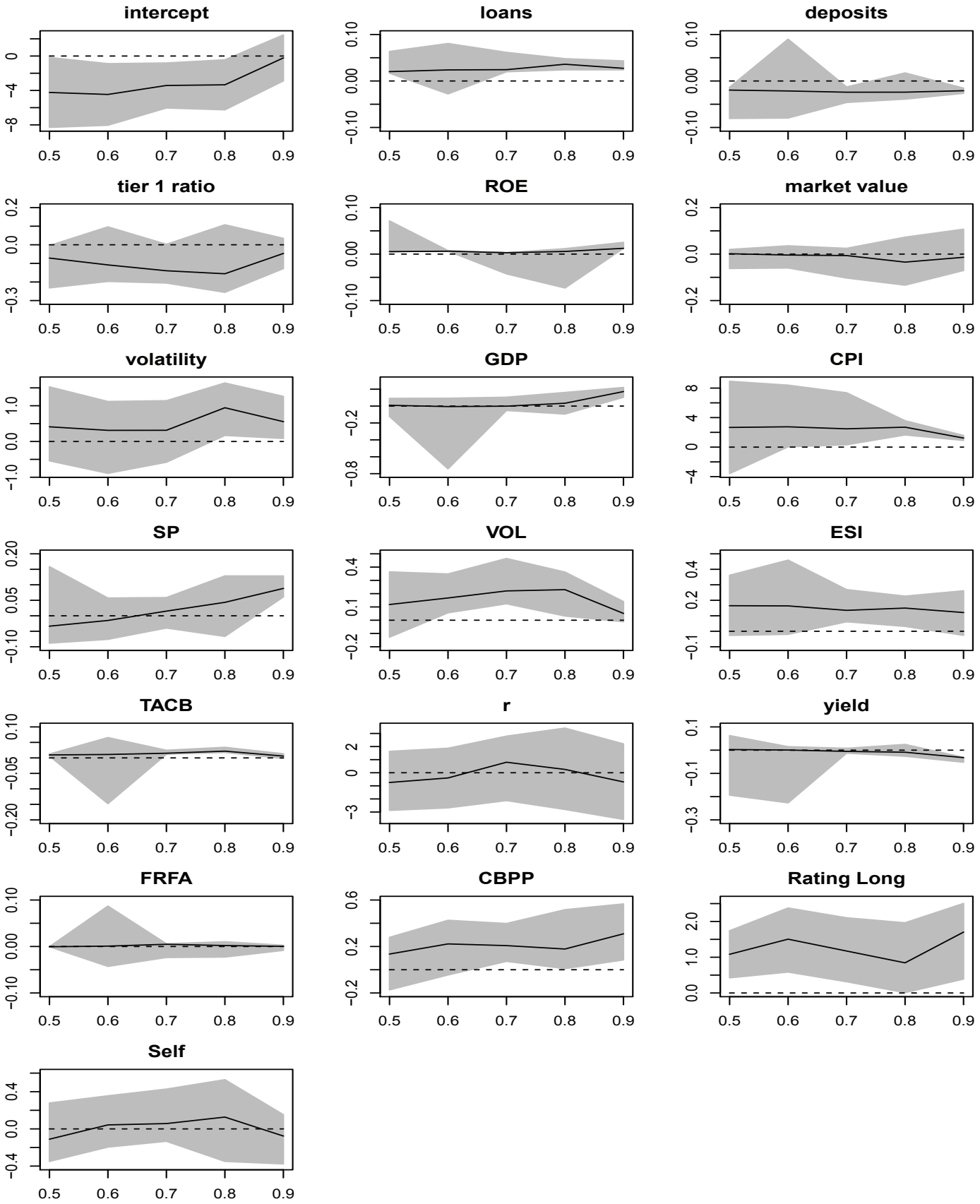

Figure 6: Tobit Quantile Regression: 2007Q3 - 2012Q1. Uncollaterilized debt.