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Determinants of the impact of Quantitative Easing policy on the link between bank loans growth and capital ratio in Europe

Summary of doctoral dissertation

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Contents

1. Topic justification and research motivation

A research question concerning an actual form of the relationship between bank loans growth and capital ratio and the potential factors that may influence it, though now recognized as crucial (Kim and Sohn, 2017, p. 95), has been relatively neglected by financial researchers and experts in the field of banking and monetary analysis over the last decades. One of the fundamental factors that could change this relationship in recent years is unconventional monetary policy adopted by major central banks in the world, especially in the form known as Quantitative Easing (QE) policy.

With the availability of new and large data sets on banks and the banking practices (see Kashyap and Stein, 2000), and the occurrence of the global financial crisis of 2008, interest in the link between the amount of bank loans and bank capital (ratios) has increased and regained its deserving position on the research agendas across many leading academic and research institutions in the world.

The present dissertation identifies a research gap at the intersection area of two strands of the literature and the corresponding research areas, namely finance and banking (the capital regulatory perspective) and central banking (the monetary policy perspective). In this light, understanding the relationship between bank lending and bank capital is an objective of immense significance. There exist at least three reasons why studying this phenomenon is important.

First of all, during the recent financial crisis, it was in a large part a shortage of bank capital that made banks and other financial institutions unable to extend more credit and grant new loans (cf. Gambacorta & Marques-Ibanez, 2011). Policy measures such as Troubled Asset Relief Program (TARP) in the US were explicitly designed to inject capital into banks through the Capital Purchase Program (CPP). The effectiveness of such programs, defined as the impact of a particular program on activities in the real sector of economy, largely depended on the postulated effect of these capital injections on bank lending growth (Berrospide and Edge, 2010, p. 6).

Secondly, the transmission mechanism of monetary policy impulses was recognized to operate through the bank-capital channel which is fundamentally based on the investigated link between bank lending and capital – moderated by monetary policy shocks (see Kim and Sohn, 2017; Meh, 2011; Van den Heuvel, 2002). An importance of bank capital to the effective operation of monetary policy has been recently emphasized by Gambacorta & Shin (2018) who

found that bank equity is a very important determinant of both the bank's level of funding cost and bank lending growth in Europe (Gambacorta & Shin, 2018, p. 17).

Thirdly, the direction of causation (or the lack thereof) in the examined relationship is important from the theoretical perspective, insofar as new competing theories have been put forward and the need of their verification has increased significantly. Two particular hypotheses that have emerged in the literature in recent years are 'financial fragility-crowding out' hypothesis and 'risk absorption' hypothesis (Berger and Bouwman, 2009, pp. 3786-88). Notably, the two hypotheses contradict each other as they postulate that the causality runs in the opposing directions (Kim and Sohn, 2017, p. 97).

Another crucial insight stemming from the research in this field is that bank-specific characteristics matter. Among the most important factors being bank's size, liquidity ratios, and initial level of a capital ratio (cf. Brei, Gambacorta, & von Peter, 2013; Kim & Sohn, 2017).

Importantly, the QE policy can also influence the investigated relation to a large extent. An examination of what factors determine the QE's impact on the relationship between the bank lending activities and bank capital ratios is the primary objective of the present dissertation[1]. Logically, it has to be done in two steps. Firstly, it should be established that QE policy is indeed a significant factor that affects the relationship between bank loans and capital. Subsequently, a range of potential factors that might change the QE's impact (i.e., variables that moderate it) must be empirically identified, studied and assessed.

2. Research objective and questions of the thesis

The issue of appropriateness and effectiveness of Quantitative Easing policy has been largely covered in the literature related to the latter, nonetheless leaving many questions and much research space within the field of the former. The impact of QE policy on an individual bank financial position and behavior is still a relatively unexplored research area. In general, however, the ongoing research within this field has brought some interesting findings in recent years.

The present thesis, therefore, tries to answer the question whether the European Central Bank's (ECB) Quantitative Easing (QE) policy has affected the relationship between bank loans

[1] From the accounting view and a perspective of balance sheets, the QE policy can be regarded as a liquidity-improving tool in the unconventional monetary policy toolkit (Bezemer, 2010, 2016; Lavoie & Fiebiger, 2018). According to this view, the research objective of the present dissertation is closely related to the issue of 'liquidity impact' on the relationship between bank lending and capital – the phenomenon investigated in detail by Kim and Sohn (2017).

growth and equity capital ratio (ECR) in Europe. The dissertation thus seeks to establish the determinants of the QE policy impact on the relationship between bank lending growth and equity capital ratio in the European banking sector. In other words, it investigates the conditions under which the unconventional monetary policy in the form of QE policy, such as ECB's Asset Purchase Program (APP), can be effective in strengthening (or weakening) the link between bank lending and bank capital ratios in Europe.

In order to achieve its research objective, the dissertation aims to answer the specific research question about the determinants of the QE policy impact on the relationship between bank lending growth and equity capital ratio in the European banking sector. Particularly, in relation to the sample used, there are five specific research questions investigated in this thesis:

1. Was the relationship between bank capital ratios and bank loans growth for European banks in the 2011-2018 period non-linear?
2. Was the sign in the relationship between bank capital ratios and bank loans growth for European banks in the 2011-2018 period in general positive?
3. Did the relationship between bank capital ratios and bank lending growth depend on a bank's size and specialization in the 2011-2018 period for European banks?
4. Did the relationship between bank capital ratios and bank lending growth depend on the bank's initial level of capitalization (that is, the initial capital-to-asset ratio) in the 2011-2018 period for European banks?
5. Did the relationship between bank capital ratios and bank lending depend on the bank's relative liquidity position expressed in its liquidity ratios in the 2011-2018 period for European banks?

3. Methodology and definitions

The applied method of research is statistical and econometrical analysis of panel data. Using bank institution-level financial data, the dynamic fixed-effects model is estimated both in the baseline form with bank-specific variables and macroeconomic control variables, and in the extended form including crucial interaction terms that measure effects of capital, liquidity and the ECB's quantitative easing policy on bank loans growth.

Model diagnostics is based on results of the standard Durbin–Wu–Hausman (DWH) test, widely regarded as the Hausman (1978) specification test. In this panel-data procedure, both fixed effect and random effect estimates of coefficients are obtained and compared. The results

of the Hausman test and other relevant statistics, such as results of the Breusch and Pagan's (1980) Lagrange multiplier (LM) test for random effects are assessed in order to determine the optimal model and estimator.

An empirical method applied in the research also consists in estimating and graphing panel data marginal effects that reflect a bank lending growth elasticity with respect to changes in a capital ratio. The marginal effects are juxtaposed for various bank category variables based on bank size, initial equity capital ratio, liquidity ratio, and two country-specific criteria for two groups of banks: those from QE-affected countries and other banks, proxied by APP dummy variable.

Various data sources are used in the empirical part of the thesis. The main source of institution-level financial data on European banks is Bank Orbis Focus database. It provides a large bank-level financial dataset. The study uses annual observations on 3,494 active banks from Europe, spanning the period from 2011 to 2018 (inclusive). Data covers 54 European countries with the total of 27,952 observations. Such large sample size is due to the extensive cross-sectional dimension of the used dataset.

Other data sources include European Central Bank's Statistical Data Warehouse which provides data on QE-related variables. Country-specific and regulatory, i.e., micro and macro-prudential data for European countries come from various sources. Source of information on micro-prudential indicators and on the capital adequacy standards restrictiveness is a large financial dataset created by Barth, Caprio, and Levine (2013) (henceforth BCL). The primary source of macroprudential regulations overall restrictiveness, and in particular of the international "Macroprudential Policy Index" is an extensive data set of Cerutti, Claessens, and Laeven (2015). Data on market structure and development, such as bank concentration indicator (based on bank total assets) and the share of government-owned banks in the banking system are derived from the BCL dataset for 2011. The data on banking market concentration is consistent with the World Bank's "Global Financial Development Database" (GFDD). Information on euro area membership is obtained from the European Commission. The source of the economic data on the real GDP and inflation is the World Bank's database "World Development Indicators" covering most of the countries in the sample. Data on the short-term rate of interest is the OECD's Financial data set. Eurostat is a source for data on long-term interest rate; and the Centre for Economic Policy Research is a source of data on the periods of recessions in the euro area.

In this thesis, the adopted definition of a capital ratio is as follows. A capital ratio is a simple accounting measure that reflects bank's financial health and soundness because it points

to the amount of safe capital or equity, acting as a cushion or 'shock-absorber' against unexpected bank losses, in relation to the amount of risky financial assets that a bank holds on its balance sheet (cf. Farag, Harland, & Nixon, 2013). In order to increase the robustness of results, three different measures of a capital ratio are exploited. Two of them are regulatory risk-based ratios (as defined by the Basel Committee), that is the Tier 1 ratio and Total capital ratio measured as ratios of Tier 1 capital to risk-weighted assets (RWA) and Total capital to RWA, accordingly. A third measure of a bank capital ratio is the ratio of equity capital to total assets (henceforth equity capital ratio or ECR). There are two important advantages of using the ECR, that is its high coverage in the data sample and its high usage in the relevant literature. In regard to the definition of the quantitative easing policy pursued by the ECB and implemented by the Eurosystem[2], following the approach of Pyka et al. (2016), three types of QE-type policies need to be distinguished. That is, first, (i) indirect quantitative easing; second, (ii) direct quantitative easing; and third, (iii) direct credit easing (Pyka et al., 2016, p. 89).

The ECB introduced different unconventional monetary policy measures. First, operations that were focused solely on the provision of bank liquidity at long-term maturities involve the Longer-Term Refinancing Operations (LTROs) and Targeted Longer-Term Refinancing Operations (TLTROs). These policy operations can be classified under the indirect quantitative easing category. Second, programs that were specifically designed to ease credit conditions and make markets for particular securities more liquid, such as the Covered Bond Purchase Program (CBPP) or Securities Markets Program (SMP) can be classified as direct credit easing policy. Third, a major and widely discussed (later on also expanded) Asset Purchases Program (APP) was launched in October 2014 with monthly purchases starting in March 2015 with an average pace of between 15 to 80 billion euro per month (according to the official information provided by the ECB). The APP involved several other programs that were designed to facilitate purchases of specifically stipulated categories of financial assets[3]. The APP and its subprograms can be classified as direct quantitative easing policy. In this dissertation, the quantitative easing (QE) policy is defined as any unconventional monetary policy measure or instrument that belongs to the last-mentioned category.

[2] The Eurosystem comprises the European Central Bank (ECB) and the National Central Banks (NCBs) of those countries that adopted the euro as a single currency.

[3] Importantly, the present dissertation examines specifically the ECB's Asset Purchase Program (APP) that includes the following four programs: Corporate Sector Purchase Program (CSPP), Public Sector Purchase Program (PSPP), Asset-Backed Securities Purchase Program (ABSPP), third Covered Bond Purchase Program (CBPP3).

4. Outline and hypotheses

The rest of this thesis is structured as follows. It involves an introduction, four main chapters and the conclusions.

Chapter 1 reviews the literature with regard to bank capital as a determinant of bank lending. Using a stylized balance sheet of a commercial bank, it is shown that bank profitability which in theory is the main supply-side determinant of bank lending is highly procyclical. This view is consistent with financial accelerator hypothesis also presented and discussed in this chapter. In Chapter 1, I argue that lending activities of banks can actually be constrained by capital rather than central bank reserves. In essence, the central bank in its lender-of-last-resort function has to fully accommodate the demand for reserves to ensure the financial stability and smooth functioning of the payment system. Additionally, the existence of interbank market for bank reserves makes it a relatively cheap source of funding. In contrast, equity finance is limited in size and costly. Issuing new equity to raise additional bank capital, in particular during crises or economic downturns.

In Chapter 1, I provide theoretical background and empirical evidence on the effects of capital ratio. In the aftermath of the 1990-1991 recession, Bernanke & Lown (1991) put forward the 'credit crunch' hypothesis. Syron (1991), who at the time was the President of Federal Reserve Bank of Boston, proposed a term 'capital crunch' to describe it. He argued that a sudden and sharp decline in bank credit was a consequence (rather than a cause) of the capital crunch in the US banking sector (Syron, 1991, p. 4). Consequently, the issue of sign of the relationship between bank lending and capital ratio emerged as an important research question. Based on the literature review, I formulate five research questions. In particular, they concern the potential non-linear nature of the studied relationship, the sign of it, and the relevance of its bank-specific determinants such as bank's size and specialization, bank's initial level of capitalization, and bank's relative liquidity position expressed in its liquidity ratios.

Chapter 2 conducts a literature review on the monetary policy as a determinant of bank lending and, based on it, formulates empirical hypotheses. Since the early 1990s and after the outburst of Global Financial Crisis, a large body of the literature and empirical research have emerged to describe, analyze and draw policy implications in the field of the credit channel of monetary policy. In this chapter, I point to a number of academic articles and papers that in fact focused on a separate channel within the credit channel, that is the bank capital channel of the monetary policy transmission (see Borio & Zhu, 2012; Markovic, 2006; Meh, 2011; Van den Heuvel, 2009).

Based on the original general monetary policy transmission mechanism, and building on the 'decoupling principle' of Borio & Disyatat (2009), I examined effects of conventional and unconventional monetary policy. Direct effects of unconventional monetary policy such as QE works mainly via the portfolio rebalance effect, within which the scarcity, signaling and duration effects can be distinguished. All of them are interdepended and not mutually exclusive, as argued in for example Bailey, Bridges, Harrison, Jones, & Mankodi (2020). The ultimate outcome of these three effects is to directly reduce long-term interest rate, i.e. it leads to decreased yields (and increased asset prices) on bonds and other debt instruments being purchased.

However, such a decline in long-term interest rates is not necessarily transmitted through the bank lending channel into lower loan rates and higher growth of bank loans (see Butt, Churm, McMahon, Morotz, & Schanz (2014); Gambacorta & Marques-Ibanez (2011). Instead, in the environment of very low interest rates, the QE policy seems to work mainly via the portfolio rebalance and bank risk-taking channel, producing still further increases in prices of private risky assets, through the 'search for yields' phenomenon and an inertia in nominal return targets (Gambacorta, 2009). All in all, this analysis shows the importance of bank capital for monetary transmission mechanism (i.e., the bank capital channel). This insight is in line with conclusions of Gambacorta & Shin (2018) who found that a 1-percentage point increase in the bank equity capital ratio (equity-to-total assets ratio) leads to four basis points reduction in bank debt funding and 0.6 percentage points increase in annual loan growth of European banks (Gambacorta & Shin, 2018, p. 17). This result suggests that if the banking sector is undercapitalized or weakly capitalized as a whole, both conventional and unconventional monetary policy transmission is impeded, and thus it is becoming ineffective in boosting bank lending.

In Chapter 3, I describe methodology of the empirical research conducted in the thesis. A range of panel data estimators including within-groups and between fixed effects estimators are carefully described and assessed. Thereafter, data sources and definitions of variables are provided. Chapter 3 also shows the initial data treatment which involves constructing bank-specific and country-specific categories; management of data outliers using winsorization and identifying and dealing with mergers and acquisitions (M&As). Preliminary statistical analysis conducted on the final unconsolidated data indicates high heterogeneity among banks with regard to bank's size. The analysis confirms that the growth rate of loans supplied by small banks has exhibited on average higher amplitude of fluctuations in comparison to large and medium-sized banks. Chapter 3 concludes by pointing out that a median small bank over the

2012-2018 period held on average a significantly higher amount of equity capital in relation to total assets than large banks.

Chapter 4 describes the main research results, interprets them and discusses the findings and linking them to the relevant literature. Estimated fixed-effects econometric models with interaction terms, i.e. interactive models, are based on the sample of annual data obtained from a major banking database – adjusted for outliers and M&As – which in its final form contains institution-level information on up to 2,335 banks from 47 European countries observed in the 2011-2018 period[4]. The empirical investigation carried out in Chapter 4 has brought several important findings. Above all, the obtained results indicate that the QE policy adopted by the ECB was indeed a significant factor that affects the relationship between bank loans growth and the key capital adequacy ratios. In Chapter 4, five research questions have been answered. Controlling for effects of macroeconomic variables, changes in the conventional monetary policy (interest rates shocks) and macroprudential policy, proxied by the macroprudential policy index created by Cerutti et al. (2015), the results show that in the 2011-2018 period the relationship between bank capital ratios and lending growth of European banks depended on a number of bank-specific characteristics, namely on the bank size and specialization, bank's initial level of capitalization, and bank liquidity ratios.

Chapter 4 successfully contributes to the achievement of the objective of the present thesis. In this Chapter, I estimated models with bank-specific and country-specific interactions allowed me to verify five empirical hypotheses developed in Chapter 2. These empirical hypotheses are as follows:

1. The effect of bank capital ratios on bank lending is negatively associated with the Quantitative Easing policy of the ECB.
2. The effect of bank capital ratios on bank lending is positively associated with the Quantitative Easing policy of the ECB only for large banks with sufficient level of liquidity.
3. The effect of bank capital ratios on bank lending is positively associated with the Quantitative Easing policy of the ECB only for well-capitalized banks with sufficient level of liquidity.
4. The effect of bank capital ratios on bank lending is negatively associated with the Quantitative Easing policy of the ECB only for banks from countries characterized by

[4] The number of total observations in the final sample of unconsolidated data equals N = 11,597.

more restrictive capital regulations and more stringent overall restrictions on banking activities.

5. The effect of bank capital ratios on bank lending is positively associated with the Quantitative Easing policy of the ECB only for banks from countries characterized by more concentrated structure of the banking sector and higher share of state-owned banks.

5. Main findings and policy implications

In the estimated dynamic linear-multiplicate models several interactions terms that moderate this relationship were found significant. This confirms the previous findings in the literature that the relationship between bank loans growth and bank capital ratios is essentially non-linear. The sign of this relationship is found to be contingent on the adopted measure of a capital ratio. Regulatory capital ratios such as Tier 1 ratio and Total capital ratio exert a significantly positive effect on bank lending, while the equity capital ratio affects the net loans growth negatively. This finding is robust to using the alternative liquidity ratio. Therefore, it can be viewed as an important contribution to the relevant literature. This finding implies that efforts of regulators and macroprudential policymakers are effective in constraining bank lending only when they impose restrictions on banks in reference to the capital adequacy requirements set by the Basel Committee on Banking Supervision.

A major finding of the thesis is that unconventional monetary policy in the form of the Asset Purchase Program of the ECB has strengthen the positive link between regulatory capital ratios and bank loan growth. Thus, it implies a rejection of Hypothesis 1. In ECR regression, the ECB's QE policy significantly enhances the effect of an increase in the bank equity capital on the growth rate of lending by European banks. Since these effects are robust to using an alternative liquidity ratio across all of the adopted measure of capital ratio, this finding can be regarded as an important contribution to the literature.

This evidence also points to some important policy implications. The quantitative easing policy in Europe has been successful in making banks more responsive to capital ratios in their lending activities. The QE policy of the ECB has thus effectively contributed to removing a liquidity constraint for less liquid banks, but on the other hand, it has made them less resilient (i.e., more responsive) to capital shocks. This evidence implies that policy actions should be aimed both at improving bank liquidity ratios (by means of QE-style central bank balance sheet policies) and simultaneously at providing banks with resources to strengthen their capital ratios

by official state-contingent capital injections or bank equity purchases programs. This evidence also reinforces the conclusions of Thornton & Tommaso (2020) that bank capital and liquidity position are complementary, mutually depended and crucially important for European banks to sustain the growth of bank lending.

The obtained results suggest that Hypothesis 2 and Hypothesis 3 can only be partly accepted, hence as such they shall be rejected. Nonetheless, the revealed empirical evidence has enabled me to adjust them and restate them in a form consistent with obtained findings. These can be summarized in a few points. Regarding both Hypotheses 2 and 3, first of all, the positive impact of the QE is higher in regressions with regulatory binding risk-based ratios than in regressions with the equity capital ratio. Second, the most pronounced positive effects of QE are detected for small banks with low level of liquidity, and for banks with the medium level of initial capital ratio. Third, the least responsive in their lending to capital shocks are well-capitalized banks, for which the positive impact of QE is the most limited. Fourth, the positive QE effects diminishes as bank liquidity increases. This evidence allows to draw an important policy recommendation. Proposed state-contingent official capital injections or bank equity purchases programs should focus on providing additional bank equity especially for banks with low and medium level of capital ratios. Moreover, the ECB's QE policy is the most effective in strengthening the link between capital ratios and lending growth when applied to small banks experiencing liquidity constraints.

Chapter 4 also highlights the importance of the examined country-specific variables. The results have confirmed both Hypothesis 4 and Hypothesis 5. They show that in the case of regulatory capital ratios the effect of bank capital ratios on bank lending is negatively associated with the QE policy for banks from countries characterized by more restrictive capital regulations and more stringent restrictions on banking activities. On the other hand, the effect of bank capital ratios on bank lending is found to be positively associated with the QE policy only for banks from countries with small concentration of the banking sector and with low share of state-owned banks. Regarding both Hypotheses 4 and 5, importantly, the examined effects of the QE policy tend to be unrelated to the level of bank liquidity ratios, across all of the adopted measures of capital ratio.

Regulators and bank supervisors in order to prevent the build-up of imbalances in the economy should constantly monitor the level of bank capitalization, both at the individual and system-wide level. As results of the present thesis show, any adverse capital shocks can be swiftly propagated to the real economy via a severe decline in bank credit. A sudden drop in bank lending (i.e., credit crunch) is in turn likely to cause a slowdown of economic growth. In

addition, the results show that proposed state-contingent official capital injections or bank equity purchases programs should focus on providing additional bank equity especially for banks with low and medium level of capital ratios. Moreover, the ECB's QE policy is found to be the most effective in strengthening the link between capital ratios and lending growth when applied to small banks experiencing liquidity problems.

Findings obtained in the present thesis will allow researchers, bank supervisors and policymakers to better understand the consequences of the ECB's large-scale asset purchase program for lending, liquidity and capital dynamics of individual banks in Europe. This, in turn, can contribute to designing better informed monetary and macroprudential policies and bank regulations.

6. Study limitations and future research

There are some limitations of the conducted empirical study. They can be connected to various directions for future research.

First, due to some specific data limitations such as a relatively short time period of the panel, the binary variable that proxies the ECB's quantitative easing policy may have captured only a general country-related effect of this unconventional policy. In future research, it could be replaced with one or all subprograms of the ECB's APP program as a continuous (stock) variable or a flow variable. Such type of a QE proxy could then account for changes and the pace of adjustments in the targeted quantities of purchases under APP subprograms. It remains one of the potential directions for future research.

Second, in the aftermath of the Covid pandemic in 2020, many central banks have launched or significantly updated their asset purchases programs. Relatedly, future research can use recent international QE experiences to compare the QE effects on the link between bank ratios and loan growth in different countries and using a richer panel of data. Increased number of time periods would allow researchers to apply various other estimators and econometric techniques, such as the GMM estimator or panel VAR model.

Finally, different country-specific factors could be explored as potential determinants of effects of the QE policy on the examined relationship. For example, in the future research a degree of capitalization of the whole banking sector could be exploited and checked in the interactive models for its consequences for general results. The other research could focus on matching different combinations of country-specific factors than proposed in this thesis. It is important to examine these proposals to ensure that policymakers can appropriately design

unconventional monetary policy measures to achieve the desired goals of financial and price stability.

7. Bibliography

Bailey, A., Bridges, J., Harrison, R., Jones, J., & Mankodi, A. (2020). The central bank balance sheet as a policy tool: past , present and future. In *Economic Policy Symposium in Jackson Hole*, 1–51.

Barth, J. R., Caprio, G., & Levine, R. (2013). Bank Regulation and Supervision in 180 Countries from 1999 to 2011. *NBER Working Paper Series*, *18733*, 1–110.

Berger, A. N., & Bouwman, C. H. S. (2009). Bank Liquidity Creation. *Review of Financial Studies*, *22*(9), 3779–3837.

Bernanke, B. S., & Lown, C. S. (1991). The Credit Crunch. *Brookings Papers on Economic Activity*, *1991*(2), 205–247.

Berrospide, J. M., & Edge, R. M. (2010). The Effects of Bank Capital on Lending: What Do We Know, and What Does it Mean? *International Journal of Central Banking*, *6*(4), 5–54.

Bezemer, D. J. (2010). Understanding financial crisis through accounting models. *Accounting, Organizations and Society*, *35*, 676–688.

Bezemer, D. J. (2016). Towards an "accounting view" on money, banking and the macroeconomy: History, empirics, theory. *Cambridge Journal of Economics*, *40*, 1275–1295.

Borio, C., & Disyatat, P. (2009). Unconventional monetary policies: An appraisal. *BIS Working Papers*, (292), 1–29.

Borio, C., & Zhu, H. (2012). Capital regulation, risk-taking and monetary policy: A missing link in the transmission mechanism? *Journal of Financial Stability*, *8*(4), 236–251.

Brei, M., Gambacorta, L., & von Peter, G. (2013). Rescue packages and bank lending. *Journal of Banking and Finance*, *37*(2), 490–505.

Breusch, T. S., & Pagan, A. R. (1980). The Lagrange Multiplier Test and its Applications to Model Specification in Econometrics. *The Review of Economic Studies*, *47*(1), 239–253.

Butt, N., Churm, R., McMahon, M. F., Morotz, A., & Schanz, J. F. (2014). QE and the Bank Lending Channel in the United Kingdom. *Bank of England Working Paper*, 511, 1–41.

Cerutti, E., Claessens, S., & Laeven, L. (2015). The use and effectiveness of macroprudential policies: New evidence. *IMF Working Paper*, 1–42.

Farag, M., Harland, D., & Nixon, D. (2013). Bank capital and liquidity. *Bank of England Quarterly Bulletin*, *Q3*(1), 201–215.

Gambacorta, L. (2009). Monetary policy and the risk-taking channel. *BIS Quarterly Review*, *4*, 43–53.

Gambacorta, L., & Marques-Ibanez, D. (2011). The bank lending channel: lessons from the crisis. *Economic Policy*, *April*, 135–182.

Gambacorta, L., & Shin, H. S. (2018). Why bank capital matters for monetary policy. *Journal of Financial Intermediation*, *35*, 17–29.

Hausman, J. A. (1978). Specification Tests in Econometrics. *Econometrica*, *46*(6), 1251–1271.

Kashyap, A. K., & Stein, J. C. (2000). What Do a Million Observations on Banks Say About the Transmission of Monetary Policy? *The American Economic Review*, *90*(3), 407–428.

Kim, D., & Sohn, W. (2017). The effect of bank capital on lending: Does liquidity matter? *Journal of Banking and Finance*, *77*, 95–107.

Lavoie, M., & Fiebiger, B. (2018). Unconventional monetary policies, with a focus on quantitative easing. *European Journal of Economics and Economic Policies: Intervention*, *15*(2), 139–146.

Markovic, B. (2006). Bank Capital Channels in the Monetary Transmission Mechanism. *Bank of England Working Paper*, (313), 1–51.

Meh, C. (2011). Bank Balance Sheets, Deleveraging and the Transmission Mechanism. *Bank of Canada Review*, *Summer 201*, 23–34.

Pyka, I., Nocoń, A., & Cichorska, J. (2016). *Nadzwyczajna polityka monetarna banków centralnych a stabilność sektora bankowego*. Katowice: Wydawnictwo Uniwersytetu Ekonomicznego w Katowicach.

Syron, R. F. (1991). Are we experiencing a credit crunch? *New England Economic Review*, 3–10.

Thornton, J., & Tommaso, C. di. (2020). Liquidity and capital in bank lending: Evidence from European banks. *Finance Research Letters*, *34*, 1–8.

Van den Heuvel, S. J. (2002). Does bank capital matter for monetary transmission? *FRBNY Economic Policy Review*, 259–265.

Van den Heuvel, S. J. (2009). The Bank Capital Channel of Monetary Policy. *Federal Reserve Board Working Paper*, 1–52.