BANK FOR INTERNATIONAL SETTLEMENTS

BIS Working Papers

No 754

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Monetary and Economic Department

November 2018

JEL classification: G21, E52, E43

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This publication is available on the BIS website (www.bis.org).

ISSN 1020-0959 (print)
ISSN 1682-7678 (online)

Euro area unconventional monetary policy and bank resilience

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Abstract

This paper examines whether euro area unconventional monetary policies have affected the loss-absorbing buffers (that is the resilience) of the banking industry. We employ various measures to capture the effect of the broad array of programmes used by the ECB to implement balance sheet policies, while we control for the effect of conventional and negative (or very low) interest rate policy. The results suggest that, above and away from the zero-lower bound, looser interest rate policy tends to weaken our measure of euro area banks' loss-absorbing buffers. On the contrary, further lowering interest rates near and below the zero lower bound seems to strengthen (or weaken less) such buffers, which points towards non-linearities arising in the vicinity of the lower bound. Moreover, balance sheet easing policies enhance bank level resilience overall. However, unconventional monetary policies seem to have increased the fragility of banks in the member states hardest hit by the 2011 sovereign debt crisis. In fact, the evidence presented in this paper suggest that the resilience gains of unconventional monetary policies have accrued mostly to banks headquartered in the so-called core euro area countries (Austria, Belgium, Finland, France, Germany, Luxembourg and Netherlands). Finally, unconventional monetary policies seem to have enhanced more the resilience of banks that were relatively stronger, i.e. that were in the higher deciles of the distribution of loss-absorbing buffers.

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[3] We would like to thank Heather Gibson, Boris Hofmann, George Hondroyiannis and Dimitris Maliaropoulos for fruitful discussions on earlier versions. Comments by several participants at the 2017 International Rome Conference on Money, Banking and Finance are gratefully appreciated. Part of this research was carried out whilst Emmanuel Mamatzakis was visiting researcher at the Bank of Greece from 2016 to 2017. The views expressed in this paper are those of the authors and do not necessarily represent those of the Bank of Greece or the Bank for International Settlements.

1. INTRODUCTION

When it comes to assessing the bank level impact of unconventional monetary policy (UMP thereafter) the literature to date remains rather inconclusive, not only for the euro area, but also for the United States, Japan and the United Kingdom. One may not have to look deep into the matter to realize why that is so: there exist a plethora of channels through which UMPs affect the economy and thereby also the banking industry, such as portfolio rebalancing, liquidity, and signalling channels (Gambacorta, 2009; Krishnamurthy and Vissing-Jorgensen, 2011; Cour-Thimann and Winkler, 2012; D'Amico et al., 2012; Sahuc, 2016; Altavilla, et al. 2016 and Altavilla et al. 2017; Boeckx et al. 2017; Borio et al. 2017; Abidi and Miquel-Flores, 2018; Lopez, et al. 2018). Some of those channels may also have a feedback effect from the banking sector towards UMPs. To make things more complicated, there exist also many aspects of banks' risk and behaviour that are affected by UMPs, and on which the researcher may choose to focus. Studies such as Lambert and Ueda (2014) investigate the influence of UMP on bank risk-taking in the United States, whereas Mamatzakis et al. (2016) examine the impact of quantitative easing on bank efficiency in Japan, and Mamatzakis and Bermpei (2016) regard the effect of UMPs on investment bank performance in the United States. Using a highly heterogenous sample of 28 European countries and Japan, Lopez, et al. (2018) argue that the nominal negative interest rates have little effect on bank profitability. In a recent paper, Heider et al. (2018) argue that negative rates could hamper the financial stability of the euro-area if bank lending is done mostly by high-deposit banks instead of low-deposit banks.

This study builds on the above studies and offers new insights into the effect of UMPs on bank level resilience across the euro-area. Departing from Lopez, et al. (2018), we focus on bank resilience rather than profitability as the benchmark to examine the effect of various monetary policy measures in the Euro area. We focus on this jurisdiction as it is of interest and has been less studied whereas it provides also recent new forms of UMPs.[4] The complexity of the ECB unconventional strategy introduces some non-trivial measurement issues that we endeavour to tackle herein. In fact, measuring bank resilience ex-ante is not straightforward either. In this paper we attempt to provide some new evidence for the euro area by focusing on a measure of the size of banks' loss-absorbing buffers. To the best of our knowledge, this study is the first to investigate the impact of ECB's UMPs on the bank resilience of the 19 euro-area member states using bank-level data.

Unconventional monetary policies gained prominence in the wake of the global financial crisis (GFC), as traditional monetary policy tools proved less effective in tackling the financial crisis and providing the required liquidity. Given the scale of the GFC, it is no surprise that UMPs have attracted the attention of policy makers and academics alike, whilst they have also been on the spotlight in the euro-area in recent years. The origins of UMPs, though, can be traced to measures taken by the Bank of Japan in March 2001, which deployed some form of quantitative easing (QE) to tackle economic stagnation and combat deflation. Since those initial steps, UMPs have evolved and have taken various forms: forward guidance (FG), negative interest rate policy (NIRP), and a variety of policies that exploit the balance sheets of central banks like the large-scale asset purchasing programmes implemented initially by the Federal Reserve and the Bank of England as a response to the financial meltdown in 2008. We refer to the latter generally as quantitative easing (QE) although they may involve other closely related operations, including the provision of long-term liquidity (see below). Since 2013 the Bank of Japan has also added another two dimensions to UMPs, by first implementing quantitative and qualitative easing (QQE), mainly increasing the purchases of different types of assets and

[4] Most studies of the ECB's quantitative easing policies report evidence about its effectiveness in stimulating economic activity, improving liquidity conditions, and reducing funding risk (Darracq-Paries, De Santis, 2015; Eser, Schwaab, 2016; Giannone et al., 2012).

expanding purchases to all maturities of Japanese government bonds, and then eventually targeting the yield on 10-year government bonds.

Not surprisingly, the higher the popularity of UMPs among policymakers, the higher the research interest. Studies have focused mainly on their effectiveness, underlying transmission mechanisms, and international spillovers (Lenza, Pill and Reichlin, 2010; Gagnon et al., 2011; Krishnamurthy and Vissing-Jorgensen, 2011; D'Amico et al., 2012; Bauer and Neely, 2014; Altavilla et al. 2016; Altavilla et al. 2017; Gambetti and Musso, 2017; Abidi and Miquel-Flores, 2018).

As the European Central Bank (ECB) adopted a number of measures that fell within the broad category of UMPs, there are also some prominent studies in the euro-area (Sinn and Wollmershauser, 2011; Joyse et al., 2012; Darracq-Paries, De Santis, 2015; Giannone et al., 2012; Eser, Schwaab, 2016; Altavilla, et al. 2016 and Altavilla et al. 2017; Gambetti and Musso, 2017; Abidi and Miquel-Flores, 2018; Heider et al. 2018). In fact, the ECB has been experimenting with a considerable plurality of UMPs. FG and NIRP have been part of the policy mix, as well as several measures aimed at providing long-term liquidity or implementing different versions of QE and/or enhancing its effects. Those include longer-term refinancing operations (LTROs), fixed-rate full allotment operations (FRFA), the securities market programme (SMP), the outright monetary transactions (OMT), various vintages of asset purchase programmes (APPs), and new collateral rules and reserve requirements. In other words, QE in the euro-area comprise multiple layers of open market operations that also have some qualitative characteristics.

This diversity poses significant challenges at the time of defining precisely the mechanisms and variables of study but responded to a crucial distinction in the challenges faced by the ECB: while the Fed or the Bank of England were trying to encourage real expenditure by boosting liquidity and reducing long-term interest rates in the aftermath of the financial crisis, the ECB's focus was arguably different. Joyse et al. (2012) argue that the ECB's QE programmes aimed at the same goal by primarily shoring up the banking system and stopping the momentum of a process that resembled a bank run, as deposits from the euro area periphery's banks shifted to the core's (see also Sinn and Wollmershauser, 2011). However, few papers address the question of whether the effects of UMPs in the euro area differed across Member States. In this study, we shall explore potential asymmetries of the impact of NIRP and a subset of ECB's QE programmes on bank resilience across the euro area, and seek evidence on their net impact.

The contributions of this study to the literature can be summarised as follows. First, we provide evidence on the impact of negative (or very low) interest rate policy (NIRP) and quantitative easing (QE) on European banks' shock absorbing buffers, which has not been studied in detail in the literature. We use different identification strategies, based on an IV estimation method that address the endogeneity issues that arise in this context, and consider the effect of conventional interest rate policy (CIRP) and bank-specific variables. Second, we investigate how the relationship between the studied UMPs and banks' buffers varies across sub-samples, in particular between some large euro area Member States and those euro-area countries more stressed during the sovereign debt crisis of 2011. Third, we propose and test a comprehensive list of the balance sheet policies employed by the ECB.

Our main findings suggest that UMPs would have a positive impact on European banks' shock absorbing buffers. Nevertheless, the effect is not homogeneous across subsamples. Banks headquartered in some Member States in the so-called euro area periphery, also with high nonperforming loan ratios and sovereign debt holdings, appear to become more fragile in the wake of QE. On the other hand, banks in the core of the Euro area mostly benefit from the studied UMPs, by means of sturdier buffers.

The rest of the paper is organised as follows. Section 2 reviews the related literature regarding UMPs and their impact on bank risk. Section 3 introduces the data and methodology. Section 4 presents and discusses the results. Section 5 concludes and offers some reflections on policy implementation.

2. UNCONVENTIONAL MONETARY POLICY AND BANKING: THE STORY SO FAR

Our paper focuses on the impact of unconventional monetary policy on bank loss-absorbing buffers in the euro area. It comes in a timely manner for the euro-area where discussions are taking place about the future directions of unconventional monetary policy and which role, if any, they would have in future policymaking. There is an extensive literature that examines the impact of UMPs on the macroeconomy of the countries involved, and the microeconomics of their banks. Since both dimensions are relevant to the ultimate financial stability considerations of our paper, in this section we briefly review that literature.

At the macro level, there is a well-documented body of evidence on the impact of unconventional monetary policy on economic growth, aggregate demand, and prices (Ugai, 2007; Girardin and Moussa, 2011; Lyonnet and Werner, 2012; Ueda, 2012; Gambacorta et al., 2014; Michaelis and Watzka, 2017; Altavilla, et al. 2016 and Altavilla et al. 2017; Bernhard and Ebner, 2017; Gambetti and Musso, 2017; Abidi and Miquel-Flores, 2018). There is some variability in the findings, though a moderate demand boost in the wake of UMPs implementation is often reported. Also in the euro area, ECB non-standard measures appeared effective in stimulating economic activity, as reported in Giannone et al. (2012).

Turning to the sectoral evidence, Carpenter et al. (2014) model bank loan supply and demand, and report that relaxed conditions in money markets – as a result of non-standard measures – led to an increase in bank lending via a reduction in bank funding volatility. They studied the impact of the term auction facility (TAF) and the troubled asset relief programme (TARP) in the United States, and the fixed-rate tender with full allotment (FRFA) and the securities markets programmes (SMP) in the euro area. Long-term refinancing operations (LTRO), main refinancing operations (MRO), and banks' excess reserves above the requirements are also included in their model. Many studies on ECB's UMPs focus on LTROs rather on APPs, Covered Bond Purchase Programs (CBPPs), and SMPs (Ciccarelli, et al. 2013; Darracq-Paries and De Santis, 2015; Pelizzon et al., 2016; Abidi and Miquel-Flores, 2018). For the three CBPPs, evidence from Markmann and Zietz (2017) shows that the first one was the most effective in terms of lowering yields and thus increasing the supply of credit. It is suggested that the second and third programmes were not introduced at the right time, i.e. the markets were already in sound conditions and market participants could anticipate the outcome of these subsequent programmes.

The subject of whether UMP enhances or hinders bank stability is at the centre of a lively debate. As UMPs have been implemented when interest rates were very low, it is important to consider and identify the effects of low interest rates on banks' risk taking when analysing the relationship between UMPs and bank stability (Buch et al., 2014; Heider et al. 2018). On the one hand, low interest rates reduce the debt burden of borrowers, increasing collateral values and raising the likelihood of repayment. This should enhance bank stability. On the other hand, low interest rates may encourage banks to fund riskier projects: higher asset prices may result in loan sizes representing a larger proportion of pledged assets than they would if these were more fairly priced (Ioannidou, et al. 2015; Jiménez et al., 2014). Consequently, the upshot could end up being greater overall credit risk and bank fragility. In other words, the rise in asset and collateral values may subsequently compromise risk-absorbing capacity (Borio and Zhu, 2012). Examining the United States and the euro area, Maddaloni and Peydró (2011) find a significant positive impact of low short-term interest rates on the net percentage of banks in each country reporting a softening of credit standards. The results for low long-term interest rates, arguably targeted by QE and FG, suggest that lending standards are not affected, but the results are not robust.

It is worth noting that UMPs could be accompanied by lax lending standards as banks expand their lending in response to loose monetary policy. Ciccarelli et al. (2013) show that the ECB's non-standard measures of liquidity provision, LTROs and FRFA in particular, have eased credit frictions in bank lending and softened lending conditions. Using the 3-year LTROs, Darracq-Paries and De Santis (2015) reach a similar conclusion: ECB non-standard measures resulted in relaxed lending standards through the alleviation of liquidity and funding risks. Once again, the relaxation of lending standards in turn could increase the number of risky borrowers receiving new loans (Maddaloni and Peydró, 2011; Jiménez et al., 2014; Ioannidou et al., 2015; Heider et al. 2018), hence raising credit risk. [5]

Low interest rates can also induce banks' risk-taking by affecting the way they perceive risks and thus '*search for yield*' (Altunbas et al., 2014; Gambacorta, 2009; Sahuc, 2006). Banks alter their risk measures downward in a low interest rate environment with accelerating asset prices because price volatility is expected to decline while the value of equity relative to debt increases (also reducing leverage). Therefore, the risk of holding the assets is considered lower, which in turn liberates risk budget and encourages banks to engage in riskier activities. '*Search for*

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[5] Banks reallocate their portfolio due to the scarcity of safe assets being purchased by central banks, leading to high demand for other assets, consequently raising their prices and lowering their yields. Borrowers, subsequently, benefit from the reduction in borrowing costs thanks to lower yields. APPs inject liquidity to the banking system, allowing banks to expand their supply of credit, by making them less dependent on very short-term financing, and to reduce uncertainty regarding liquidity positions. LSAPs also signal to the market about the state of the economy and the path of future short-term interest rates. The expectation of a further period of low interest rates accommodate bank risk measurements. Yet, it may in turn lead to greater bank risk-taking, and deteriorating risk quality. Heider et al. (2018) also shows that high-deposit banks would contribute to higher risk to financial stability as interest rates move into negative territory.

yield' (Rajan, 2005) explains the incentives of asset managers to take on more risk in order to achieve the greater returns previously available with higher interest rates. Relatedly, De Nicolò et al. (2010) find evidence that monetary easing increases more the risk-taking of well-capitalised banks compared to their less-capitalised peers.

3. EMPIRICAL APROACH AND DATA

3.1. The empirical model

The main regression model presents bank level ln Z-scores as the dependent variables for bank *i*, in country *j* during period *t*, in a linear specification that includes the following covariates:

$$\ln Z_{ijt} = f\left(X_{ijt}, M_{jt}^{i}, CIRP_t, UMP_t\right) + \varepsilon_{ijt} \qquad (1)$$

where *X* is a vector of bank-specific control variables (as listed in section 3.2) for bank *i* in country *j* and period *t*, and *M* include macroeconomic control variables of country *j* for period *t*, where the bank *i* is headquartered. UMP and CIRP are the proxies of unconventional monetary policy, referring to QE and NIRP, and conventional interest rate policy, respectively. As described below, we employ alternatively six proxies of UMPs (including threshold interest rate effects of NIRP) and three proxies of CIRP in the estimation. Once again, in our taxonomy QE will comprise an assortment of measures that are ultimately anchored by the ECB balance sheet, including extended liquidity provision, targeted asset purchases and large asset purchases. Note that in the empirical analysis we chose not to consider forward guidance, since in the present study our focus is on providing evidence of UMPs using hard data. Moreover, FG was implemented contemporaneously with other UMPs, and its qualitative message has not changed significantly during the sampling period. Furthermore, we briefly consider the impact of the programme of Outright Monetary Transactions, authorised in 2012 but never effectively activated, so that it has not left a footprint in the ECB balance sheet.

The dependent variable is computed as

$$Z_{it} = \frac{(ROA_{it} + CR_{it})}{\sigma_{it}^{ROA}} \qquad (2)$$

where *ROA* is the return on assets of bank *i* in year *t*, *CR* is the capital ratio of bank *i* at the close of year *t*, and the denominator is the standard deviation of weekly measures of each bank's annual ROA over the respective calendar year.[6] Intuitively, this measure captures bank resilience as it is the size (in standard deviations of each bank ROA) of the loss that would result in insolvency by depleting the capital of the bank (Beck, De Jonghe, Schepens, 2013).

There are several sources of endogeneity which could hamper the identification of UMPs effects. First, financial dominance: if the ECB policies are at least in part spurred by the weakness of banks in the euro area, reverse causality would explain part of the correlations measured by the coefficients. That is particularly important for the subsample analysis: rather than causing a differential effect on the loss-absorbing buffers of banks headquartered in different jurisdictions, ECB policy may be merely accommodating a market driven reallocation of resources towards banks or jurisdictions that are ex-ante perceived as more resilient or safer. Similarly, if banks' poor health impairs credit and decreases GDP growth, the ECB response to weak growth would also raise in part endogeneity concerns. Thus, the overall resilience of banks may drive monetary policy (conventional and/or unconventional), rather than the other way around.

In order to assess the impact of endogeneity on the identification of the model's parameters, we start with a simple fixed effects panel model for the whole sample. Then, to address

[6] We also test the Altman's z-score as an alternative measure of resilience. The Alman's z-score relies on the difference between current assets and current liabilities and specific coefficient weights. However, this measure introduces some strong assumptions that potentially create model dependence in the measure, so we preferred to report herein the results from the simpler version of z-score. Results using the Altman's z-score are available upon request.

endogeneity directly, we proceed to implement an instrumental variable estimation through a generalised two-stage least squares estimator (G2SLS) following Balestra and Varadharajan-Krishnakumar (1987). Then we focus on the differential impact of UMPs across alternative country groupings, repeating for them the G2SLS estimation. Finally, we conduct quantile regressions on the whole sample to ascertain the differential impact of UMPs on banks' resilience across the distribution of ln Z-score.

3.2. Bank-level and macroeconomic data

We collected a comprehensive data set that includes balance-sheet information for banks in 19 countries of the euro area for the period 2007-2015. All bank-specific variables are obtained from Bankscope, and we screened recent time observations for consistency using Orbis Bank Focus. The frequency is annual and all variables are in thousand euros. There are 23,917 observations, and the data set is unbalanced. The number of banks varies year to year from a minimum of 2691 to a maximum of 3050. Banks are categorised as commercial, investment, real estate and savings.

We include several bank specific control variables that are common in the literature, including size, asset diversification, efficiency, profitability, revenue diversification and liquidity.[7] Size is the natural logarithm of total assets (Beck et al., 2013; Delis, Kouretas, 2011; Liu, Wilson, 2013). Asset diversification is represented by the ratio of securities holdings to total assets (Altunbas et al., 2007; Jeon, Olivero, Wu, 2011), and efficiency is quantified as the ratio of operating costs to total operating income.[8] Profitability is measured through the return on

[7] The capital to asset ratio is usually among the control variables as bank capitalisation affects bank risk. Nevertheless, we do not include it as by definition, the z-score considers the capital to asset ratio. Hence, there may exist a mechanical relationship between them.

[8] On the measurement of efficiency, and as part of sensitivity analysis we also employ stochastic frontier analysis (SFA) of a translog cost function to derive efficiency scores from the residuals. Herein we opt for a simple definition of efficiency based on operating costs that does not depend on the underlying hypotheses of the distribution of errors of a typical stochastic frontier modelling. Results using an efficiency measure based on SFA are available upon request.

average assets (ROAA) of the banks in our sample over the corresponding calendar year. The impact of revenue diversification is measured by the ratio of non-interest income to total operating income, and liquidity is measured as the ratio of liquid assets to total assets (Beck et al., 2013; Anginer, Demirguc-Kunt, Zhu, 2014).[9]

Table 1 presents the summary statistics of the bank level data.

[TABLE 1 ABOUT HERE]

Some interesting facts arise. The mean of the ln Z-score indicates that on average, the shock absorbing buffer of European banks was more than 6 times the standard deviation of ROA during the sample period although the dispersion, as measured by the standard deviation, was also high. On average, European banks on this period held 23% of their assets in securities, and almost 18% were highly liquid assets. Also, on average non-interest income represented 20% of total operating income, and costs 80% of the same. The relatively large standard deviations of all these variables suggest that our sample encompasses a broad and comprehensive spectrum of banks across the euro area.

Finally, note that we also include country-specific macroeconomic controls, in particular annual GDP growth and inflation of the country where each bank *i* in our sample is headquartered, to reflect the influence of the macroeconomic environment on banks' buffers (Jiménez, Lopez, Saurina, 2013). Data for GDP growth and inflation are available from World Bank database and IMF Statistics.

3.3. Measures of unconventional and conventional monetary policy

Regarding QE, there are three proxies from the ECB Statistical Data Warehouse. The first proxy (APP&LTRO) is the total amount of reserves directly injected into the banking system

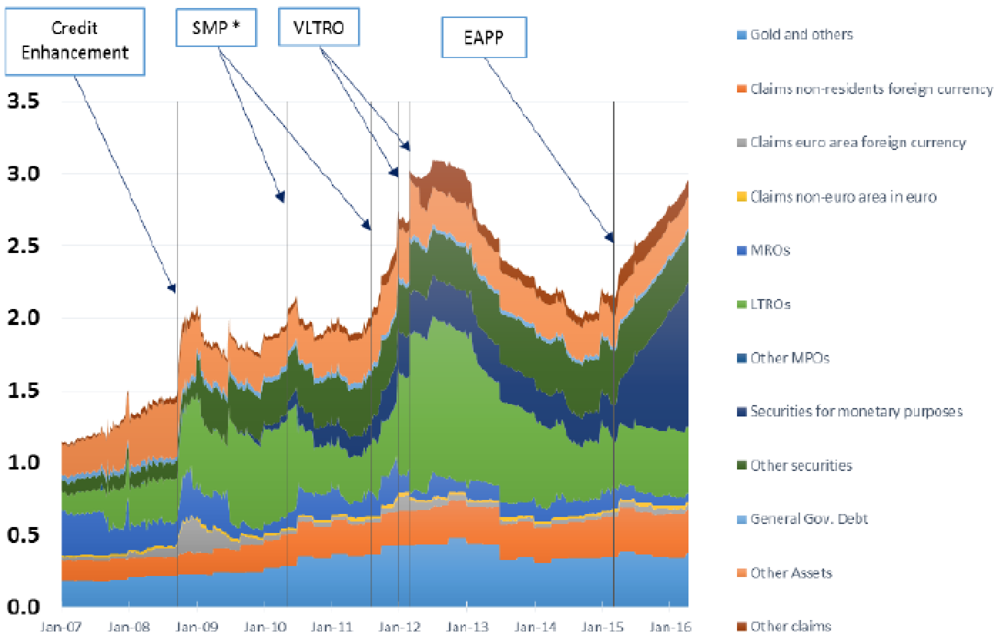
[9] Liquid assets are also obtained from Bankscope.

through asset purchase programmes for the whole Eurosystem (APP) and longer-term refinancing operations (LTROs). We follow Bluwstein and Canova (2016) in computing this variable by including all the amounts of the different asset purchase programmes since 2009 as they are implemented (rather than announced) and reported as a total figure under the '*Securities Held for Monetary Policy Purposes*' in the ECB's annual balance sheets. To this total, we add the outstanding amount of the LTROs, also available from the ECB's annual balance sheets. This convention allows us to overcome the discontinuity of the different QE programmes.

The list of programmes included is long. Three-year LTROs were announced on 20/12/2011 and 28/02/2012, and carried out as fixed rate tender procedures with full allotment.[10] Previously, six-month LTROs were announced on 28/03/2008 and 04/09/2008 with variable rate tender procedures and pre-set amounts.[11] The one-year LTROs were subsequently announced on 23/06/2009, 29/09/2009, and 15/12/2009.[12] APPs comprise the Securities Market Programme (SMP, effective from 05/2010 to 09/2012), the Covered Bond Purchase Programmes 1 and 2 (CBPP 1, CBPP 2, both terminated), and the current Asset Purchase Programme. CBPP 1 was in effect from 06/2009 to 06/2010, while the second one was carried out between 11/2011 and 10/2012. Figure 1 depicts the expansion of ECB's balance sheet as a result of the subsequent rounds of QE in recent years.

[10] Source : https://www.ecb.europa.eu/press/pr/date/2011/html/pr111208_1.en.html
[11] Source : https://www.ecb.europa.eu/press/pr/date/2008/html/pr080328.en.html; https://www.ecb.europa.eu/press/pr/date/2008/html/pr080904_3.en.html
[12] Source : https://www.ecb.europa.eu/press/pr/date/2009/html/pr090507_2.en.html

Figure 1: ECB's QE (€ trillions).



*The SMP indicated the start of Greek, Portuguese and Irish bonds buyout and later the Spanish and Italia bond buyouts.

Note: ECB statistics.

The ongoing (expanded) Asset Purchase Programme has been in place since 2014 and extended at least through September 2018, and consists of purchases of public and private sector securities. The expanded APPs includes several programmes: the CBPP 3 (since 20/10/2014), Asset-backed Securities Purchase Programme (ABSPP, started on 21/11/2014), Public Sector Purchase Programme (PSPP, started 09/03/2015), and Corporate Sector Purchase Programme (CSPP, since 08/06/2016). Since the time span of the annual data is 2007-2015, the CSPP is not included in our analysis. The securities covered by the PSPP comprise: i) nominal and inflation-linked central government bonds, ii) bonds issued by recognised agencies, regional and local governments, international organisations and multilateral development banks located in the euro area.

Following the literature, we include two additional proxies for QE, namely (i) the ECB's total assets and (ii) excess reserves of the banking system, both available from the ECB Statistical

Data Warehouse.[13] As Lyonnet and Werner (2012) argue, central banks can use both sides of the balance sheet to shape the impact of asset purchases. While the asset side provides an alternative source for private financing through outright purchase of credit products, the liability side captures a cushion for funding liquidity risk. For instance, Gambacorta et al. (2014) use central bank assets to represent the QE instrument in a cross-country study of UMPs effectiveness.

To account for conventional interest rate policy (CIRP), we alternatively use the level of the marginal lending facility rate (MLF), the deposit facility rate (DF), and the main refinancing operation rate (MRO). These variables are also available from the ECB's website. Cour-Thimann and Winkler (2012) emphasise that ECB's non-standard measures complement key interest rate decisions rather than acting as a substitute. In order to capture potential non-linear effects created by very low and/or negative interest rates, we also include a dummy variable (NIRP), which is equal to one during the period when the deposit facility rate stayed at levels equal or less than 0.25%, as well as the interaction between this dummy variable and each of the three CIRP measures just described.

Table 2 presents the summary statistics of the QE monetary policy measures of the euro-area.

[TABLE 2 ABOUT HERE]

4. RESULTS

4.1. Baseline estimation: maximum likelihood with fixed effects

Table 3 shows the results from the maximum likelihood estimation of different specifications of the model. As indicated, the specifications test three alternative definitions of the CIRP

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[13] More precisely, excess reserves encompass the total excess reserves of credit institutions subject to minimum reserve requirement in the euro area.

instrument (the three alternative interest rates the ECB manages), add the possibility of a non-linear effect when the deposit facility interest rate is very low or negative, and also test the three alternative measures of QE described above. We include fixed effects that control for the impact of heterogeneity across Member States of the Euro area where banks are headquartered, bank specialisation (i.e. commercial banks, investment banks, real estate and saving banks) and time. To save space in Table 3 and all subsequent ones, we present only the results for the MRO rate since the qualitative insights are broadly similar across all policy rate options.[14]

We start by presenting the results for CIRP, which will help us to frame the results for UMPs. MRO rates carry a positive sign indicating a directly proportional impact of policy rates on bank-level ln(Z-score). In other words, ECB's looser interest rate policy appears to weaken bank resilience across the euro area (i.e. their ability to weather out a large negative shock). Given our definition of loss-absorbing buffers, the weaker resilience is likely to have resulted from a reduction of the underlying banks' ROA, or an increase in the volatility of ROA. On the other hand, a reduction in policy rates is unlikely to have driven a fall in their capital ratio.

[TABLE 3 ABOUT HERE]

Overall, our findings suggest that accommodating UMPs strengthen banks' resilience. QE has a significant positive impact on banks' shock absorbing buffers as all QE measures have positive and highly significant coefficients.[15] Moreover, the interaction between the NIRP dummy variable and the policy rate measures has a negative coefficient, showing that a non-linear effect actually arises for very low and negative levels of the policy rates (i.e. when the DF rate drops below 0.25%): further reductions in policy rates in this environment are less detrimental to buffers, and they may even contribute to strengthen them. In fact, the coefficients

[14] Results for the remaining policy rates, i.e. DF and MLF, are available from the authors upon request.
[15] An exception occurs with the ECB total assets when paired with the deposit facility rate.

for the interactions between NIRP and the policy rates (whether it is the MRO, the DF, or the MLF rate) are much larger in absolute value than their direct individual coefficients. These results are consistent with Borio et al. (2017) who show the existence of non-linearities in the effect of interest rates on net interest margins. Along these lines, as short-term interest rates turned increasingly negative, investors searching for yield and duration would cause fixed income yields to become increasingly compressed (see Domanski et al, 2017). In this event, gains in banks' security portfolios might have also enhanced ROA and capital ratios, and thereby our measure of banks' loss-absorbing buffers. Moreover, another recent study of Swedish and Danish banks by Madaschi and Pablos-Nuevo (2017) shows that bank profitability improves as increased volume in loans compensates for lower interest income per loan in an environment of negative interest rates.

Turning to the other bank-specific variables, the results show that liquidity, asset diversification, and efficiency ratios have a negative relation with the ln Z-score. It appears that the more liquid assets relative to total assets banks hold do not make them stronger. In the context of our measure of bank strength, a potential explanation is that holding liquid assets could reduce bank profits and ROA, which is involved in the construction of the ln Z-score (Tabak et al, 2012). Liquid assets tend to generate lower returns than less liquid assets, at least in the short run. There is then a trade-off between liquidity and profitability (Rose and Hudgins, 2006). Lower profits, ceteris paribus, lead to lower Z-score. On the other hand, holding more liquid assets can reduce liquidity risk, and reduce capital requirements (another negative impact on Z-score). However, it could also reduce the volatility of ROA. In a similar vein, Tabak, et al. (2012) report that banks with more liquidity appear farther from the stability frontier. Also, this can be the result of these banks knowing that they are fragile, which moves them to hold more liquidity as they would be more exposed to runs. This finding also supports Altunbas et al. (2007). Their study provides evidence that European banks with higher liquidity levels take higher risks.

Higher asset diversification is not beneficial for bank resilience either. This finding implies that a larger percentage of investment securities (relative to total assets) would make banks riskier, indirectly suggesting that traditional lending activities would be safer for the banking business. This is, admittedly, a relatively narrow definition of diversification, but the finding coincides with those of Turk and Ariss (2010), who also report that, in developing countries, banks having larger loan to asset ratios are less exposed to overall bank risk.

A higher cost-to-income ratio, an indicator of bank efficiency, reduces bank resilience, in line with the findings of Liu and Wilson (2013). A higher cost-to-income ratio is associated with higher inefficiency. Inefficient banks, in turn, may take on more risk to improve their performance (Liu and Wilson, 2013). This positive relationship between inefficiency and risk can also be explained through the rationale of the '*bad management'* hypothesis (Berger and DeYoung, 1997). This hypothesis argues that the rise in nonperforming loans or credit risk is a result of bank managers' incompetence in credit screening and loan monitoring. Such bank managers are also more likely to be cost-inefficient in their day-to-day operations. Ultimately, as is the case with the liquidity ratio, higher costs would negatively affect the return of average assets (ROAA).

On the other hand, an increase in the ratio of revenue diversification enhances bank buffers. This finding gives support to Nguyen et al. (2012) who report similar results for South Asian banks. Bank profitability, as depicted by the ROAA also improves our measure of bank resilience, in line with other studies in this field (Mamatzakis et al., 2016; Mamatzakis and Bermpei, 2016). Finally, bank size has a negative elasticity, as larger banks held relatively lower loss absorbing buffers than smaller banks. Schaeck and Cihák (2014) also report a negative relation between bank size and Z-score for a sample of European banks during 1995-2005. The lower buffers of the larger banks may be explained in terms of their implicit reliance on their *'too-big-to-fail'* character. An alternative interpretation may argue that given their balance sheet size, large banks are necessarily subject to diminishing returns to scale, because they will have to fund relatively less profitable (and possibly riskier) projects, which would reduce their profitability (and then our Z-score measure) in the same way as the return of an investment fund typically declines as assets under management increase.[16]

Finally, the macroeconomic controls produce results consistent with other studies and intuition. Higher GDP growth enhances the Z-score, as would be expected given the improved financial health of existing and potential borrowers, and the better lending opportunities and projects. Soedarmono et al. (2013) find a similar positive relationship between GDP growth and bank soundness. The impact of inflation is less clear, as coefficient signs and statistical significances shift across subsequent specifications of Table 3.

4.2. The impact of OMT: fixed effects estimation

In this section we present analysis that attempts to capture the effect on bank resilience of one of the most significant ECB UMPs, the Outright Monetary Transactions programme (OMT). Although the OMT was never activated and thus was never reflected in the ECB balance sheet, it nevertheless might have had an impact on bank resilience, as it seemed to have a sizable

[16] This empirical finding has been documented in numerous studies for investment funds, including among others Jensen (1968), Gruber (1996), Carhart (1997) and a broad survey by Berk and Green (2004). More recent evidence relates the lack of persistence in fund performance to fund family size and its impact on diversification and investment strategies, as in Pollet and Wilson (2008) and Bessler et al (2016).

impact on the credit spreads of euro area sovereigns and has been credited with putting an end to the worst phase of the sovereign debt crisis.[17]

The Governing Council of the ECB announced the OMT in August 2012. Therefore, we control for the impact of this programme by introducing in our previous set up a dummy variable that adopts the value of one for that year, and zero elsewhere. The results are reported in Table 4.

[TABLE 4 ABOUT HERE]

The reported evidence shows that OMT, across all panel fixed effects regressions, has a positive and statistically significant impact on banks' shock absorbing buffers. These results augment previous studies that show OMT lowering sovereign yields in stressed Member States of the Euro area (Altavilla et al. 2015; Krishnamurthy et al. 2018), despite the fact that OMT has never been implemented. In fact, given the strong connections between banks and sovereigns in the euro area at the time, it is not surprising that a measure that effectively stabilised sovereign yields in the euro area, eventually improved as well the overall strength of euro area banks. The mere boost to sovereign bond prices must have had a positive impact on capital ratios and return on assets. Along these lines, Fratzscher et al. (2014) argues that OMT had global spillover effects as it reduced credit risk among G20 countries, whilst Georgiadis and Grab (2016) show that the OMT announcement resulted in a depreciation of the euro that in turn supported the recovery of the euro area.

The remaining results presented in Table 4 support our previous findings. In particular, QE improves the resilience of euro area banks, and negative (or very low) interest rate policy also would enhance loss-absorbing buffers through non-linear effects that moderate the detrimental

[17] It is worth noting that OMT did have a credible impact on the spreads of some of the periphery countries at the time. Krishnamurthy et al. (2018) provide evidence that as a result of OMT sovereign bonds fell in Italy, Spain and Portugal, whilst a positive impact on stock exchanges of these countries is also reported.

impact of lower rates in the vicinity of the zero lower bound. In the rest of the paper we continue with a more parsimonious specification that does not include special controls for OMT.

4.3. G2SLS (instrumental variable) estimations: full sample results

Up to this point, we provided evidence for the relationships between three forms of UMPs (NIRP, OMT and QE) and our measure of individual bank resilience, as well as the impact of key control variables. We have relied on country, time and bank-specialization fixed effects to control for endogeneity. In the rest of the paper, we alternately address these endogeneity issues by using an instrumental variables estimator.

We rely on a two-stage least squares estimator to fit the underlying unbalanced panel-data. In effect, the estimator we employ comes from Balestra and Varadharajan-Krishnakumar (1987), and it is a two-stage least-squares generalization (G2SLS) of fixed effects panel-data estimator for exogenous variables. This estimator models the idiosyncratic error term as having zero mean and to be uncorrelated with the exogenous variables. To deal with the effects of endogenous covariates that could be correlated with the exogenous variables, the G2SLS estimates coefficients, also, of time-variant variables. Moreover, the G2SLS employs the exogenous variables after the latter have been modified by the feasible GLS transformation.

Table 5 presents the results for the full sample. All the main results are robust to the change in the estimation strategy, in particular about the impact of UMPs. Conventional monetary policy, as described by the policy rates managed by the ECB, continue to have a directly proportional and significant impact on banks' buffers, and in fact the size of the coefficients is very similar to the maximum likelihood estimates in Table 3. And the coefficients for the interactions of NIRP with the policy rates are still negative, statistically significant, but their absolute value is much lower than in Table 3. While the initial conclusion from MLE was that NIRP may actually enhance financial stability by improving banks' loss absorbing buffers, the G2SLS results suggest that, once the zero lower bound is attained, further interest rate cuts have neutral or slightly negative net effect on bank resilience. Moreover, the effect of QE still seems to contribute to financial stability, but the coefficients are lower and less significant. In particular, the coefficients for ECB total assets become negative but statistically non-significant at conventional confidence levels. Overall, we can conclude as before that in the whole sample QE increases bank resilience to large losses, while very low or negative interest rates seem to have a neutral or slightly unfavourable effect.

The impacts of size, liquidity, asset and revenue diversification, efficiency and profitability on bank soundness are qualitatively similar to those reported in Table 3. Better economic environment indicated by higher GDP growth also boosts bank stability in all models. Finally, the sign of the coefficients of inflation are now typically negative but most coefficients are not statistically significant.

[TABLE 5 ABOUT HERE]

4.4. Robustness analysis: euro-area periphery vs the core

For the next stage of analysis, we investigate whether the results hold for different country sub-samples. As argued by Eichler and Hielscher (2012), the ECB implements monetary policy for the euro area as a whole, thus it could be hard to achieve the same impact across every Member State at all times. Despite the fact that we do include country fixed effects and time effects in the maximum likelihood estimation, some residual heterogeneity related to the financial conditions of countries, and the way they were affected by the global financial crisis, may be masked by the imposition of a single coefficient per variable for all jurisdictions.

As institutional and macroeconomic heterogeneity exists[18], we consider that ECB's UMPs may affect differently different groups of euro area's Member States. To this end, we start by selecting two sub-groups. The first one comprises Member States which have been under the sharpest financial distress during the European sovereign financial crisis and are located in the periphery of the euro area. These are Cyprus, Italy, Ireland, Portugal, Slovenia and Spain, called the periphery herein. These are also the countries with high nonperforming loan ratios as reported in 2016 by the European Banking Authority.[19] In this first stage, Greece is excluded from the sub-sample as its liabilities are not eligible for any of the several QE programmes launched by the ECB. For the six countries in the periphery, the breakdown of debt securities purchased under the PSPP shows that until 30 April 2017, Italian securities have seen the largest cumulative monthly net purchases of EUR 255.3 billion, followed by Spanish securities (EUR 182.5 billion). Purchases of Cyprus' securities have been the lowest, with a monthly cumulative net amount of EUR 248 million. Therefore, we would like to explore first whether there is any variation in the effect of UMPs on bank strength between the periphery of the euro area and the remaining countries.

Then in a second stage we analyse the impact of UMPs on the bank buffers of two other sub-groups, namely the countries on the so-called periphery of the euro area or GIIPS (Greece, Italy, Ireland, Portugal, and Spain) and the countries that are at the '*core*' of the euro area or CEA (Austria, Belgium, Finland, France, Germany, Luxembourg, and Netherlands). GIIPS were widely regarded as the most vulnerable EMU member countries, and were the most affected by the 2011 sovereign debt crisis (Eichler and Hielscher, 2012), while CEA are the euro-area members perceived as the financial core of the euro (Reichlin, 2014).

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[18] See Eichler, Hielscher (2012) for the literature on EMU member countries' differences or divergence in business cycles, labour markets, and inflation rates.

[19] https://www.eba.europa.eu/documents/10180/1360107/EBA+Report+on+NPLs.pdf

We continue with the G2SLS regressions in these sub-sample analyses. Tables 6 and 7 show the results for the euro area periphery and the remaining Member States of the euro area, respectively. The most interesting result is the difference in the impact of both QE and NIRP. For the periphery of the euro area, we find a negative and statistically significant association between QE and bank stability (see Table 6), when QE is measured by the impact on ECB total assets and banks' excess reserves. As before, there is a positive relationship between interest rates and bank resilience (see Table 7, all columns). But when interest rates become very low, they do not soften or revert their impact on Z-scores as the outcome of the full sample suggested. To the contrary, for the banks headquartered in the periphery, further cuts to the policy rate after reaching the zero-lower bound compound the detrimental effect on bank resilience. These results denote that both low interest rates and QE unambiguously increase bank fragility in this group. For banks in Member States outside the periphery, the opposite is observed, in line with the results for the full sample: QE positively and significantly affects bank Z-score in all cases. Moreover, in all model specifications, negative interest rates are found to increase bank Z-score, or rather, to moderate the overall detrimental impact of a loosening of the monetary policy stance. The take-away is that, at least in our sample period, the menu of non-standard measures deployed by the ECB has not contributed to build up bank resilience in those jurisdictions which have experienced financial distress. Nevertheless, it has been beneficial for the remaining and more stable countries of the European Monetary Union, in terms of enhancing bank soundness.[20]

[TABLE 6 ABOUT HERE]

[TABLE 7 ABOUT HERE]

[20] This type of variability of the effect of negative interest rates is also observed in Lopez et al. (2018). However, the authors argue that negative interest rates, overall, have little effect on banks in Europe and Japan.

The asymmetry of the effect stemming out of UMPs seems to provide further evidence of the damaging impact of low bank capitalization, such as the one documented in most of the banks of the Euro area periphery during at least part of the sample period. Boeckx et al (2017) argues along the same lines, in addition suggesting that the banks most affected by the financial crisis would not receive the intended impact of the ECB UMPs, or would see a rather anemic impact (more on this below).

UMPs were designed with the ultimate purpose of achieving a certain inflation target, and any financial stability outcomes are essentially side effects. So, it could be the case that the UMPs, as implemented, had the unintended consequence of directing a large amount of support towards banks in Member States different of the periphery. For instance, the capital key that guides the jurisdictional distribution of ECB asset purchases do not take into consideration the outstanding size of national bond markets, or the stress level of the different jurisdictions, so it is likely to deliver highly asymmetric degrees of support. Note that in this study, we are interested in the microeconomic impact of QE rather than the macroeconomic outcome pursued through QE implementation. In Table 8 we report figures per country for the public-sector purchase programme of the ECB as of 31 August 2017. The Table reports monthly net purchases, cumulative monthly net purchases, outstanding amounts of sovereign bonds as of the third quarter of 2017, the share of outstanding sovereign bonds held by the ECB and the remaining weighted average maturity (WAM) in years. It is worth noting that for large Member States, namely Germany, France and Italy, and to a lesser extent Spain, the net purchases are the highest among all countries, but Italy has a much larger amount of sovereign debt outstanding than any of the others, while receiving about 70% of the cumulative purchases that the top jurisdiction did. As a result, the ECB was holding about 35% of the total outstanding German government debt securities and about 15% of the debt issued by the Italian sovereign, as of the third quarter of 2017.

[TABLE 8 ABOUT HERE]

Alternatively, we cannot rule out the possibility that, at least during the sample period, banks in vulnerable countries anticipated that continued ECB support would allow them to relax their buffer building discipline. In other words, this could be a typical case of moral hazard. Eichler and Hielscher (2012) find that the ECB acted as a lender of last resort during the subprime crisis for the GIIPS countries. Afterwards, the ECB has increased lending and lowered interest rates in response to a rise in the vulnerability of these countries. They argue that in doing so, the ECB's purpose was to keep member countries within the EMU rather than solely pursue macro-economic stabilisation. Third, differences in terms of macroeconomic conditions could be also among the reasons explaining QE's dissimilar impact on bank resilience. Banducci, et al. (2009) document that differences in national economic cycles and structures lead to heterogeneous effects of monetary policy decisions on member countries.

In terms of the macroeconomic controls we considered, higher GDP growth results in lower bank Z-score for the periphery of the euro area, probably because support by the ECB and the respective governments backstopped the results and capital of these banks even on the face of very challenging macroeconomic conditions. The contrary is reported for the remaining Member States, in line with intuition and the results for the full sample. Inflation affects negatively the Z-score of banks in both groups, although its effect is stronger in the periphery of the euro area. There are also some differences in the relationship between revenue diversification and bank risk. Banks in the periphery of the euro area appear to lose resilience as the proportion of non-interest income relative to total operating income increases (Table 6, all models). In contrast, banks in all the remaining Member States of the euro area benefit from greater bank stability by diversifying income (Table 7, all models). Regarding other bank-specific control variables, including bank size, liquidity ratio, asset diversification, efficiency and profitability, the results for the Member States outside the periphery essentially mimic the findings of the full sample (Table 7, all models). In the periphery of the euro area, the coefficients of size, efficiency and profitability repeat the findings of the full sample, while liquidity and asset diversification have the opposite sign, although these covariates are not statistically significant (Table 7, all models).

4.5. Robustness analysis (continued): the importance of Germany and the core

Note that in our sample, Germany is the most dominant country with respect to the number of banks. Banks in Germany make up for more than 53% of the total number of banks in the full sample, and more than 70% of the total number of banks in Member States outside the periphery. As noted, Germany is also the country that received the largest cumulative monthly net purchases from the PSPP (EUR 413.8 billion as at 31/08/2017, see Table 8). Accordingly, it may be the case that the results in all Member States but the periphery are driven by the effects of QE in German banks. Therefore, we proceed to repeat the IV regressions for Germany on its own. Panel A of Table 9 reports the coefficient estimates for the monetary policy variables.[21]

[TABLE 9 ABOUT HERE]

Regression results for the impact of monetary policy on bank stability in Germany mirror those reported in Table 7 for all Member States but the periphery. As policy rates decrease, bank buffers weaken, but when they turn very low or negative the detrimental impact moderates, and in the case of Germany it appears to be marginally reversed (i.e. the interaction coefficients are larger than the direct coefficients). Despite the fact that not all of our proxies of QE seem

[21] The coefficient estimates of the bank-specific and macroeconomic variables are qualitatively similar to those for all Member States but the periphery, except for the GIIPS (Greece, Ireland, Italy, Portugal and Spain), whose results qualitatively resemble results for the periphery. All those results are available from the authors upon request.

equally informative, banks' excess reserves (ECBER) clearly signal that QE enhances bank resilience: its coefficients are positive and statistically significant at the 5 or even 1% confidence level.

We go a step further in this group analysis by contrasting the experience of the countries at the epicentre of the 2011 sovereign debt crisis (Greece, Ireland, Italy, Portugal and Spain, *'GIIPS'*) with the countries widely regarded as the financial core of the euro area: Austria, Belgium, Finland, France, Germany, Luxembourg and Netherlands (*'CEA'*). The results are presented in panels B (CEA) and C (GIIPS) of Table 9 and resemble those results from Tables 7 and 6, respectively (or in the case of the '*core*' countries, they are very close to Germany's results). For GIIPS, the estimates suggest that unconventional monetary policy is not effective in stabilising the banking system. Both easing policy rates (CIRP and NIRP) and QE reveal a detrimental effect to banks' resilience. The results portray the opposite picture for CEA, which mimic the results of Table 7, and deliver slightly stronger results than Panel A for Germany. Once again, NIRP partially compensates the direct negative effect of loosening the conventional monetary stance. And even though the amount of cash directly injected by APP and LTRO still has little information content, the broader measures of QE impact on both sides of the ECB balance sheet (total assets and banks' excess reserves) clearly suggest that these programmes have strengthened the buffers of banks headquartered in these countries. The impact of most bank-specific and macroeconomic control variables (not reported) is similar to that observed in those previous tables. Minor variations exist. For instance, asset diversification can lead to less overall risk in GIIPS banks, while revenue diversification does not seem to have a significant effect on CEA banks.

To complete this stage of analysis, we ran G2SLS regressions for the whole sample excluding the banks headquartered in the core euro area countries, with the results presented in panel D of Table 9. The findings for this group are at the crossroads between CEA and GIIPS. First, interest rate policy does exhibit non-linearities, so that NIRP does have a moderating effect on the overall detrimental impact of lower policy rates over bank resilience. But QE appears to have an impact that ranges between neutral and slightly harmful: the coefficients for the different measures are typically negative, but not always statistically significant. In any case, the evidence suggests that QE has no beneficial effect on bank resilience outside those banks headquartered in the core countries.

It is not clear why UMPs would have a detrimental effect on GIIPS banks' resilience. One possibility is that, given the ongoing difficulties of those banks, UMPs failed to effectively reduce their funding cost, while still being effective in compressing the yields on their assets. More generally, the weak capital position of the GIIPS banks may have hampered the overall transmission of UMPs. This point may be highlighted by the coefficient of the NIRP dummy variable, which reflects the average level of the Z-score variable during the NIRP period, with respect to the previous period. The results suggest that during the whole NIRP period the Z-scores were significantly higher than before in core countries (including Germany), and not statistically different in non-core countries. In other words, the banks were well capitalised and showed relatively strong results in the core. In the GIIPS, on the other hand, banks' Z-scores were substantially below the pre-NIRP period, as these banks had to deal with large losses that eroded their capital base in the wake of the sovereign debt crisis. Therefore, the banks in these jurisdictions may have been unable to capitalise on the more forgiving financial conditions created by ECB support. This may have reflected a self-reinforcing feedback loop: as weaker banks failed to transmit the ECB stimulus, macroeconomic conditions in their jurisdictions were slow to improve, which in turn negated any boost to bank resilience. This interpretation would be consistent with Boeckx et al (2017), which also find smaller effects of UMP in the countries most exposed to the financial crisis, reflecting the lower capitalisation of the banks in those jurisdictions.

4.6. Sensitivity analysis: quantile regression results

The results reported above showed some variability in the response of bank level loss-absorption buffers to UMP across euro area national jurisdictions. As stated, this outcome could be a consequence of the initial conditions faced by the banks as regards their capitalisation or, more generally, the size of their loss-absorbing buffers. Thus, it could be the case that the tails of the underlying distributions of the log Z-score may harbour some additional variability. In order to investigate this possibility, as the final step in our analysis, we proceed to estimate quantile regression models. Table 10 reports the results for different model specifications and quantiles 0.25 and 0.75.

[TABLE 10 ABOUT HERE]

The overall messages of the exercise are rather clear. First, QE appears to strengthen the Z-score, and for any level of intensity in the use of QE, the banks with higher buffers benefit the most. The coefficients of the different proxies of QE for the 75 percentile are roughly between fifty and one hundred percent higher than the corresponding coefficients for the 25 percentile. The effect of NIRP is unambiguously detrimental. Overall, the more consistent results arise when the third proxy of QE, excess reserves, is in play (columns 3 and 6). In that case, we find that CIRP has a negative and statistically significant impact in all quantiles, i.e. lower interest rates strengthen the resilience of banks in all quantiles. But the effect of CIRP on the third quartile is roughly double the effect in the first one. The results for NIRP and QE, when the latter is proxied by excess reserves, coincide with the description above.

These results highlight the importance of the measure of QE to identify the effect of CIRP, which suggests that both types of policy cannot be fully disentangled in their overall impact. Moreover, the difference in coefficients across QE proxies suggest that not all of them are capturing the same phenomenon, and without more information it is impossible to determine which one is a better gauge of QE.

5. CONCLUSION

Quantitative easing, as well as other forms of unconventional monetary policies, have gained an increasing role among monetary policy tools in recent years, as the space for continuing accommodation through standard monetary policies waned. This paper complements previous studies by focusing on a different issue: the financial stability consequences. These are admittedly side-effects of unconventional policies, but nevertheless important from a policy perspective to assess their overall usefulness in the context of a full cost-benefit assessment.

We study the euro-area, where the impact of UMPs is of special importance (Giannone et al., 2012), in particular for bank stability, because of the interconnectedness, cross-jurisdictional activities, and the liberalisation of capital flows. The evidence herein shows that UMPs enhance bank soundness overall across the euro-area. Nevertheless, the effect varies in underlying sub-samples. For Member States at the periphery of the euro-area, which have experienced the sharpest financial distress, QE and very low interest rates seemed to have impaired bank stability by weakening the banks' loss absorbing buffers. The opposite is reported for the Member States at the core of the euro-area that have also experienced net inflows of bank deposits from the periphery. Also, the financial resilience benefits seem to have accrued mostly to banks that had stronger loss-absorbing buffers in the first place.

The results highlight that side-effects of ECB's non-conventional monetary policies may not have been symmetric across the euro-area, and they might have reduced overall bank resilience in its periphery. Differences in the institutional settings (i.e. in deposit insurance regimes) and the divergence in underlying economic fundamentals across Member States may have played a role in shaping the ultimate impact of the single monetary policy across Member States.

The paper opens a number of avenues for further research. For instance, although we document the weakening effect of UMPs on our measure of loss-absorbing buffers for some Member States of the euro area and we incorporate bank specific variables into our modelling, it might be worthwhile to focus on the underlying components of those buffers in some detail. By doing so, we could explore further the channels through which monetary policy has shaped the buffers, including bank capital, profitability, risk management and diversification.

Table 1. Summary Statistics of Bank-Level Data

Variable	Obs	Mean	S.D.	Min	Max
ln(Z-score)	23,917	1.8379	0.9164	0.0000	5.6529
SIZE	23,917	13.9240	1.8887	6.0798	21.9074
ROAA	23,917	0.36052	2.4006	-0.330	3.460
ASSETDIV	23,917	0.2314	0.1572	0.0000	0.9990
LIQRAT	23,917	0.1785	0.1726	0.0000	1.0000
REVDIV	23,917	0.2014	0.2834	0.0239	0.9999
COST2INC	23,917	0.8078	0.8688	0.0128	105.8750
INFLATION	23,917	0.0167	0.0109	0.0447	0.15430
GDP	23,917	0.6180	2.8244	-14.8142	11.0870

Notes: This table reports the descriptive statistics for the key variables employed. The ln(Z-score) is defined in the main text. SIZE = *ln*(total assets) by bank; ASSETDIV: asset diversification = securities/assets; LIQRAT: liquidity ratio = liquid assets/total assets, REVDIV: revenue diversification = non-interest incomes/total operating income; COST2INC: cost to total income ratio; ROAA: return on average weekly assets over a calendar year; INFLATION: inflation rate in the country where bank is headquartered (%); GDP: GDP growth (%); N: the number of observations; standard errors are in parentheses. The sample includes banks in 19 countries of the euro-area. The period is 2007-2015.

Table 2. Summary Statistics of the Euro Area QE

Variable	Obs	Mean	S.D.	Min	Max
APP&LTRO	23,917	20.6489	0.4450	19.7584	21.2964
ECBTA	23,917	21.8153	0.1784	21.4841	22.1103
ECBER	23,917	16.4268	2.4161	13.7934	20.1167
MRO	23,917	1.2354	1.1974	0.0500	4.0000
MLF	23,917	1.8759	1.3458	0.3000	5.0000
DF	23,917	0.6237	1.0547	-0.3000	3.0000

Notes: This table reports the descriptive statistics for the key variables. APP&LTRO: natural log of the sum of the amount of asset purchases under the Securities Markets Programme, Covered Bond Purchase Programmes (1 and 2), the current Asset Purchase Programme, and Longer-Term Refinancing Operations; ECBTA: natural log of the ECB's total assets; ECBER: natural log of banks excess reserves held at the ECB; MRO: Main Refinancing Operations rate; MLF: Marginal Lending Facility rate; DF: Deposit Facility rate; NIRP: is a dummy variable, equal to 1 in periods of negative and/or very low interest rate policy (that is DF ≤ 0.25), 0 otherwise. The sample includes banks headquartered in 19 countries of the euro-area. The period is 2007-2015.

Table 3: Fixed effects panel estimation for all banks in the euro area.

	1	2	3
SIZE	-0.01846+	-0.01790+	-0.01853+
	(0.006)	(0.006)	(0.006)
LIQRAT	-0.25919+	-0.25368+	-0.25482+
	(0.028)	(0.028)	(0.028)
ASSETDIV	-0.20021+	-0.20061+	-0.20597+
	(0.029)	(0.029)	(0.029)
REVDIV	0.02346+	0.02403+	0.02311+
	(0.008)	(0.008)	(0.008)
COST2INC	-0.01410+	-0.01391+	-0.01404+
	(0.002)	(0.002)	(0.002)
ROAA	0.05225+	0.05243+	0.05234+
	(0.001)	(0.001)	(0.001)
GDP	1.56465+	1.00492+	1.25297+
	(0.143)	(0.115)	(0.116)
INFLATION	0.44581*	0.26771	0.28922
	(0.259)	(0.276)	(0.263)
NIRP	0.55150+	0.44086+	0.35749+
	(0.044)	(0.045)	(0.030)
MRO	0.06444+	0.06247+	0.03396+
	(0.006)	(0.006)	(0.007)
NIRP*MRO	-0.29075+	-0.22465+	-0.16527+
	(0.028)	(0.030)	(0.018)
APP&LTRO	0.08556+		
	(0.011)		
ECBTA		0.11998+	
		(0.031)	
ECBER			0.01396+
			(0.002)
p	0.00000	0.00000	0.00000
N	23794	23794	23794

Notes: We include fixed effects that capture country, time, and bank specialisation (i.e. commercial, investment, savings). The estimation method is maximum likelihood and covers the whole sample. The dependent variable is ln(Z-score), where the Z-score is defined in the text. APP&LTRO: sum of the amount of asset purchases under the Securities Markets Programme, Covered Bond Purchase Programmes (1 and 2), the current Asset Purchase Programme, and Longer-Term Refinancing Operations; ECBTA: ECB's total assets; ECBER: banks excess reserves held at the ECB; MRO: Main Refinancing Operations rate; MLF: Marginal Lending Facility rate; DF: Deposit Facility rate; NIRP: is a dummy that is equal to 1 in years of negative and/or very low interest rate policy (that is DF ≤ 0.25), 0 otherwise; SIZE = *ln*(total assets); ASSETDIV: asset diversification = securities/assets; LIQRAT: liquidity ratio = liquid assets/total assets, REVDIV: revenue diversification = non-interest incomes/total operating income; COST2INC: cost to total income ratio; ROAA: return on average assets over a calendar year; INFLATION: inflation rate in the country where bank is headquartered (%); GDP: GDP growth (%); N: the number of observations; standard errors are in parentheses. The sample includes in 19 countries of the Euro-area. The period is 2007-2015. *,**, +: denote significance at the 10%, 5%, 1% confidence levels.

Table 4: The impact of OMT, fixed effects panel estimation.

	1	2	3
SIZE	-0.0332+	-0.0336+	-0.0336+
	(0.0060)	(0.0060)	(0.0060)
LIQRAT	-0.3006+	-0.2949+	-0.2979+
	(0.0279)	(0.0279)	(0.0279)
ASSETDIV	-0.1840+	-0.1796+	-0.1819+
	(0.0299)	(0.0299)	(0.0299)
REVDIV	0.0199+	0.0196+	0.0198+
	(0.0083)	(0.0082)	(0.0083)
COST2INC	-0.0149+	-0.0149	-0.0149+
	(0.0024)	(0.0024)	(0.0024)
ROAA	0.0527+	0.0526+	0.0527+
	(0.0010)	(0.0010)	(0.0010)
GDP	0.6340+	0.6858+	0.6337+
	(0.0744)	(0.0755)	(0.0744)
INFLATION	-0.4786+	0.0378	-0.2962+
	(0.2462)	(0.2767)	(0.2612)
OMT	0.0187+	0.0485+	0.0581+
	(0.0072)	(0.0102)	(0.0201)
MRO	0.0525+	0.0401+	0.0519+
	(0.0038)	(0.0049)	(0.0039)
NIRP	0.1362+	0.0763+	0.1272+
	(0.0232)	(0.0275)	(0.0236)
NRIP*MRO	-0.0260+	0.0069	-0.0192+
	(0.0084)	(0.0117)	(0.0090)
ECBTA		-0.0983+	
		(0.0241)	
ECBER			-0.0073+
			(0.0035)
p	0.00000	0.00000	0.00000
N	23794	23794	23794

Notes: We include fixed effects that capture country, time, and bank specialisation (i.e. commercial, investment, savings). The estimation method is maximum likelihood and covers the whole sample. The dependent variable is ln(Z-score), where the Z-score is defined in the text. APP&LTRO: sum of the amount of asset purchases under the Securities Markets Programme, Covered Bond Purchase Programmes (1 and 2), the current Asset Purchase Programme, and Longer-Term Refinancing Operations; ECBTA: ECB's total assets; ECBER: banks excess reserves held at the ECB; MRO: Main Refinancing Operations rate; OMT is a dummy variable that takes the value of 1 from 2012 onwards, 0 otherwise; SIZE = *ln*(total assets); ASSETDIV: asset diversification = securities/assets; LIQRAT: liquidity ratio = liquid assets/total assets, REVDIV: revenue diversification = non-interest incomes/total operating income; COST2INC: cost to total income ratio; ROAA: return on average assets over a calendar year; INFLATION: inflation rate in the country where bank is headquartered (%); GDP: GDP growth (%); N: the number of observations; standard errors are in parentheses. The sample includes in 19 countries of the Euro-area. The period is 2007-2015. *,**, +: denote significance at the 10%, 5%, 1% confidence levels.

Table 5: G2SLS, instrumental variable regression results for all banks in the euro area.

Variables	1	2	3
SIZE	-0.03419+	-0.03413+	-0.03431+
	(0.006)	(0.006)	(0.006)
LIQRAT	-0.32198+	-0.31750+	-0.32184+
	(0.032)	(0.032)	(0.032)
ASSETDIV	-0.16474+	-0.15950+	-0.16640+
	(0.034)	(0.034)	(0.034)
REVDIV	0.01724*	0.01738*	0.01711*
	(0.010)	(0.010)	(0.010)
COST2INC	-0.01547+	-0.01541+	-0.01547+
	(0.003)	(0.003)	(0.003)
ROAA	0.05250+	0.05245+	0.05251+
	(0.001)	(0.001)	(0.001)
GDP	0.66626+	0.59634+	0.64882+
	(0.091)	(0.083)	(0.086)
INFLATION	-0.47176	-0.10399	-0.53395*
	(0.294)	(0.324)	(0.301)
NIRP	0.19445+	0.19281+	0.16542+
	(0.022)	(0.022)	(0.026)
MRO	0.07648+	0.07086+	0.07022+
	(0.006)	(0.006)	(0.006)
NIRP*MRO	-0.05423+	-0.05252+	-0.03579+
	(0.009)	(0.009)	(0.013)
APP&LTRO	0.01316*		
	(0.008)		
ECBTA		-0.00977	
		(0.020)	
ECBER			0.00302*
			(0.002)
Chi2_p	0.000	0.000	0.000
R-square	1.39%	1.14%	0.50%
N	20491	20491	20491

Notes: Instrumental variables estimation method follows Balestra and Varadharajan-Krishnakumar (1987), which provides a two-stage least-squares generalization (G2SLS). We use the first lag of endogenous variables (QE proxies, conventional monetary policy proxies, GDP) as instruments. The dependent variable is the ln(Z-score), where the Z-score is defined in the text. APP&LTRO: sum of the amount of asset purchases under the Securities Markets Programme, Covered Bond Purchase Programmes (1 and 2), the current Asset Purchase Programme, and Longer-Term Refinancing Operations; ECBTA: ECB's total assets; ECBER: banks excess reserves held at the ECB; MRO: Main Refinancing Operations rate; MLF: Marginal Lending Facility rate; DF: Deposit Facility rate; NIRP is a dummy that is equal to 1 in years of negative and/or very low interest rate policy (that is DF ≤ 0.25), 0 otherwise; SIZE = *ln*(total assets); ASSETDIV: asset diversification = securities/assets; LIQRAT: liquidity ratio = liquid assets/total assets, REVDIV: revenue diversification = non-interest incomes/total operating income; COST2INC: cost to total income ratio; ROAA: return on average assets over a calendar year; INFLATION: inflation rate in the country where bank is headquartered (%); GDP: GDP growth (%). N is the number of observations; standard errors are in parentheses. *, **, +: denote significance at the 10%, 5%, 1% confidence levels.

Table 6: G2SLS, instrumental variable regression results for the euro area periphery.

Variables	1	2	3
SIZE	-0.03480+	-0.03491+	-0.03482+
	(0.007)	(0.007)	(0.007)
LIQRAT	0.05560	0.05524	0.05583
	(0.056)	(0.056)	(0.056)
ASSETDIV	0.09688	0.09632	0.09674
	(0.060)	(0.060)	(0.060)
REVDIV	-0.16576+	-0.16783+	-0.16650+
	(0.020)	(0.020)	(0.020)
COST2INC	-0.25160+	-0.25311+	-0.25218+
	(0.019)	(0.019)	(0.019)
ROAA	0.06646+	0.06635+	0.06642+
	(0.002)	(0.002)	(0.002)
GDP	-0.37685	-0.62461**	-0.58478**
	(0.279)	(0.243)	(0.269)
INFLATION	-2.77519+	-1.61919*	-2.14159+
	(0.655)	(0.833)	(0.735)
NIRP	-0.25351+	-0.22297+	-0.21223+
	(0.055)	(0.057)	(0.080)
MRO	0.06570+	0.05877+	0.06652+
	(0.015)	(0.015)	(0.016)
NIRP*MRO	0.09776+	0.08359+	0.07125
	(0.026)	(0.026)	(0.045)
APP&LTRO	0.01544		
	(0.022)		
ECBTA		-0.07480	
		(0.061)	
ECBER			-0.00271
			(0.005)
Chi2_p	0.000	0.000	0.000
R-square	2.99%	2.90%	2.79%
N	5084	5084	5084

Notes: Instrumental variables estimation method follows Balestra and Varadharajan-Krishnakumar (1987), which provides a two-stage least-squares generalization (G2SLS). The euro area periphery includes 6 countries: Cyprus, Ireland, Italy, Portugal, Slovenia, and Spain. We use the first lag of endogenous variables (QE proxies, conventional monetary policy proxies, GDP) as instruments. The dependent variable is the ln(Z-score), where the Z-score is defined in the text. APP&LTRO: sum of the amount of asset purchases under the Securities Markets Programme, Covered Bond Purchase Programmes (1 and 2), the current Asset Purchase Programme, and Longer-Term Refinancing Operations; ECBTA: ECB's total assets; ECBER: banks excess reserves held at the ECB; MRO: Main Refinancing Operations rate; MLF: Marginal Lending Facility rate; DF: Deposit Facility rate; NIRP: is a dummy that is equal to 1 in years of negative and/or very low interest rate policy (that is DF ≤ 0.25), 0 otherwise; SIZE = *ln*(total assets); ASSETDIV: asset diversification = securities/assets; LIQRAT: liquidity ratio = liquid assets/total assets, REVDIV: revenue diversification = non-interest incomes/total operating income; COST2INC: cost to total income ratio; ROAA: return on average assets over a calendar year; INFLATION: inflation rate in the country where bank is headquartered (%); GDP: GDP growth (%). N is the number of observations; standard errors are in parentheses. *, **, +: denote significance at the 10%, 5%, 1% confidence levels.

Table 7: G2SLS, instrumental variable regression results for all banks in the euro area Member States, but the periphery.

Variables	1	2	3
SIZE	-0.02631+	-0.02641+	-0.02661+
	(0.007)	(0.007)	(0.007)
LIQRAT	-0.33628+	-0.33522+	-0.33627+
	(0.035)	(0.035)	(0.035)
ASSETDIV	-0.09627**	-0.09597**	-0.09968**
	(0.040)	(0.040)	(0.040)
REVDIV	0.04886+	0.04881+	0.04835+
	(0.014)	(0.014)	(0.014)
COST2INC	-0.00772+	-0.00769+	-0.00778+
	(0.003)	(0.003)	(0.003)
ROAA	0.04166+	0.04167+	0.04167+
	(0.001)	(0.001)	(0.001)
GDP	0.90224+	0.82946+	0.89332+
	(0.092)	(0.084)	(0.087)
INFLATION	-0.65175*	-0.65766*	-0.88138+
	(0.338)	(0.361)	(0.338)
NIRP	0.29974+	0.29817+	0.24903+
	(0.022)	(0.022)	(0.026)
MRO	0.07634+	0.07498+	0.06738+
	(0.007)	(0.007)	(0.006)
NIRP*MRO	-0.08420+	-0.08536+	-0.05178+
	(0.009)	(0.009)	(0.012)
APP&LTRO	0.01798**		
	(0.008)		
ECBTA		0.03695*	
		(0.020)	
ECBER			0.00557+
			(0.002)
Chi2_p	0.000	0.000	0.000
R-square	9.45%	9.45%	8.62%
N	15407	15407	15407

Notes: Instrumental variables estimation method follows Balestra and Varadharajan-Krishnakumar (1987), which provides a two-stage least-squares generalization (G2SLS). The sample includes all countries in the euro area but the periphery. We use the first lag of endogenous variables (QE proxies, conventional monetary policy proxies, GDP) as instruments. The dependent variable is the ln(Z-score), where the Z-score is defined in the text. APP&LTRO: sum of the amount of asset purchases under the Securities Markets Programme, Covered Bond Purchase Programmes (1 and 2), the current Asset Purchase Programme, and Longer-Term Refinancing Operations; ECBTA: ECB's total assets; ECBER: banks excess reserves held at the ECB; MRO: Main Refinancing Operations rate; MLF: Marginal Lending Facility rate; DF: Deposit Facility rate; NIRP: is a dummy that is equal to 1 in years of negative and/or very low interest rate policy (that is DF ≤ 0.25), 0 otherwise; SIZE = *ln*(total assets); ASSETDIV: asset diversification = securities/assets; LIQRAT: liquidity ratio = liquid assets/total assets, REVDIV: revenue diversification = non-interest incomes/total operating income; COST2INC: cost to total income ratio; ROAA: return on average assets over a calendar year; INFLATION: inflation rate in the country where bank is headquartered (%); GDP: GDP growth (%). N is the number of observations; standard errors are in parentheses. *, **, +: denote significance at the 10%, 5%, 1% confidence levels.

Table 8: Public sector purchase programme, ECB.

	Monthly net purchases*	Cumulative monthly net purchases*	Debt securities outstanding Q317*	ECB Holdings as share of outstanding	Remaining Weighted Average Maturity (WAM) in years
Austria	1,223	46,310	237,879	19.5%	9.15
Belgium	1,544	58,299	372,373	15.7%	10.22
Cyprus	0	215	6,870	3.1%	4.52
Germany	9,803	413,868	1,171,094	35.3%	6.89
Spain	5,086	206,189	918,650	22.4%	8.46
Finland	528	26,661	101,491	26.3%	7.22
France	9,270	334,568	1,710,652	19.6%	7.73
Ireland	488	22,873	135,849	16.8%	8.67
Italy	7,657	291,366	1,921,517	15,2%	8.47
Luxembourg	47	2,188	8,250	26.5%	5.70
Malta	27	994	5,371	18.5%	10.94
Netherlands	2,174	92,680	327,540	28.3%	7.63
Portugal	414	29,076	150,839	19.3%	8.64
Supranational	4,347	187,531	NA	NA	7.46

* Book value in euro million. Cumulative purchases as of 31 August 2017.
Source: ECB Asset Purchases Programme. Figures are preliminary and may be subject to revision. The monthly purchase volumes are reported net of redemptions. Principal payments on securities purchased under the PSPP are reinvested by the Eurosystem in a flexible and timely manner in the month they fall due or in the following months if needed. Therefore, net purchases may fluctuate owing to the timing of these reinvestments. The first principal payments occurred in March 2017.
Debt securities outstanding from Eurostat, Quarterly government debt (gov_10q_ggdebt).

Table 9: G2SLS instrumental variable regressions for alternative country groups.

Variables	1	2	3	4	5	6	7	8	9	10	11	12
	A. Germany			**B. Core euro area (CEA)**			**C. Euro area periphery (GIIPS)**			**D. Euro Area non-Core (all countries ex-CEA)**		
Control Vars	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
NIRP	0.3499+	0.3371+	0.2683+	0.2756+	0.2661+	0.2046+	-0.236+	-0.214+	-0.213+	0.0350	0.0441	0.0416
	(0.022)	(0.024)	(0.035)	(0.023)	(0.024)	(0.033)	(0.054)	(0.056)	(0.077)	(0.038)	(0.0423)	(0.0533)
MRO	0.0598+	0.0648+	0.0529+	0.0666+	0.0693+	0.0569+	0.0668+	0.0604+	0.0658+	0.0947+	0.0883+	0.094+
	(0.007)	(0.007)	(0.006)	(0.007)	(0.006)	(0.006)	(0.015)	(0.014)	(0.015)	(0.011)	(0.0117)	(0.0141)
NIRP*MRO	-0.083+	-0.086+	-0.042+	-0.065+	-0.0675+	-0.0248	0.0849+	0.0742+	0.0695	-0.044+	-0.042**	-0.045*
	(0.009)	(0.009)	(0.016)	(0.009)	(0.009)	(0.016)	(0.025)	(0.026)	(0.044)	(0.017)	(0.0255)	(0.0215)
APP&LTRO	0.0019			0.0127			0.0138			0.0026		
	(0.015)			(0.011)			(0.021)			(0.013)		
ECBTA		0.0571			0.0659**			-0.0588			-0.0563	
		(0.045)			(0.030)			(0.059)			(0.0331)	
ECBER			0.0071+			0.0066+			-0.0015			-0.001
			(0.002)			(0.002)			(0.005)			(0.003)
Chi2_p	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R-square	1.02%	1.02%	0.94%	1.64%	1.18%	3.04%	1.64%	1.18%	3.04%	2.54%	2.33%	1.98%
N	11006	11006	11006	13187	13187	13187	4966	4966	4966	8579	8579	8579

Notes: Instrumental variable estimation method follows Balestra and Varadharajan-Krishnakumar (1987), which provides a two-stage least-squares generalization (G2SLS). Control variables include: SIZE = *ln*(total assets); ASSETDIV: asset diversification = securities/assets; LIQRAT: liquidity ratio = liquid assets/total assets, REVDIV: revenue diversification = non-interest incomes/total operating income; COST2INC: cost to total income ratio; ROAA: weekly average return on assets over a calendar year; INFLATION: inflation rate in the country where bank is headquartered (%); GDP: GDP growth (%). The instruments are the first lag of endogenous variables (QE proxies, conventional monetary policy proxies, GDP, inflation). The dependent variable is the ln(Z-score), where the Z-score is defined in the text. APP&LTRO: sum of the amount of asset purchases under the Securities Markets Programme, Covered Bond Purchase Programmes (1 and 2), the current Asset Purchase Programme, and Longer-Term Refinancing Operations; ECBTA: ECB's total assets; ECBER: banks excess reserves held at the ECB; MRO: Main Refinancing Operations rate; MLF: Marginal Lending Facility rate; DF: Deposit Facility rate; NIRP: is a dummy that is equal to 1 in years of negative and/or very low interest rate policy (that is DF ≤ 0.25), 0 otherwise. Core euro area countries include Austria, Belgium, Finland, France, Germany, Luxembourg, and Netherlands. Euro area periphery (GIIPS) denote Greece, Ireland, Italy, Portugal and Spain. N is the number of observations; standard errors are in parentheses. *, **, +: denote significance at the 10%, 5%, 1% confidence levels.

Table 10: Quantile regression analysis.

	Quantile 0.25 results			Quantile 0.75 results		
Variables	1	2	3	4	5	6
NIRP	-0.35838+	-0.3942+	-0.8372+	-0.52992+	-0.56683+	-1.1745+
	-0.059	-0.055	-0.079	-0.145	-0.107	-0.143
MRO	0.02208	-0.00529	-0.0864+	0.00839	-0.03648	-0.1613+
	-0.018	-0.015	-0.015	-0.04	-0.036	-0.03
NIRP*MRO	0.20942+	0.19807+	0.5078+	0.24278+	0.23146+	0.6633+
	-0.024	-0.025	-0.045	-0.044	-0.032	-0.068
APP&LTRO	0.21917+			0.39111+		
	-0.024			-0.052		
ECBTA		0.40465+			0.67533+	
		-0.073			-0.135	
ECBER			0.04737+			0.06555+
			-0.005			-0.009
Control Vars	YES	YES	YES	YES	YES	YES
Pseudo R^2	0.2583	0.0559	0.1322	0.1231	0.0221	0.0672
N	23794	23794	23794	23794	23794	23794

Notes: Variables defined in Table 1. The dependent variable is the ln(Z-score), where the Z-score is defined in the text. APP&LTRO: sum of the amount of asset purchases under the Securities Markets Programme, Covered Bond Purchase Programmes (1 and 2), the current Asset Purchase Programme, and Longer-Term Refinancing Operations; ECBTA: ECB's total assets; ECBER: banks excess reserves held at the ECB; MRO: Main Refinancing Operations rate; MLF: Marginal Lending Facility rate; DF: Deposit Facility rate; NIRP: is a dummy that is equal to 1 in years of negative and/or very low interest rate policy (that is DF ≤ 0.25), 0 otherwise. Control variables include: SIZE = *ln*(total assets); ASSETDIV: asset diversification = securities/assets; LIQRAT: liquidity ratio = liquid assets/total assets, REVDIV: revenue diversification = non-interest incomes/total operating income; COST2INC: cost to total income ratio; ROAA: weekly average return on assets over a calendar year; INFLATION: inflation rate in the country where bank is headquartered (%); GDP: GDP growth (%). N is the number of observations; standard errors are in parentheses. The sample includes 3,229 banks in 19 countries of the euro-area. The sample period is 2007-2015. *, **, +: denote significance at the 10%, 5%, 1% confidence levels.

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