



EUROPEAN CENTRAL BANK

EUROSYSTEM

Working Paper Series

Miguel Ampudia, Thorsten Beck,
Andreas Beyer, Jean-Edouard Colliard,
Agnese Leonello, Angela Maddaloni,
David Marques-Ibanez

The architecture of supervision

Discussion Papers

No 2287 / May 2019

Disclaimer: This paper should not be reported as representing the views of the European Central Bank (ECB). The views expressed are those of the authors and do not necessarily reflect those of the ECB.

Discussion papers

Discussion papers are research-based papers on policy relevant topics. They are singled out from standard Working Papers in that they offer a broader and more balanced perspective. While being partly based on original research, they place the analysis in the wider context of the literature on the topic. They also consider explicitly the policy perspective, with a view to develop a number of key policy messages. Their format offers the advantage that alternative analyses and perspectives can be combined, including theoretical and empirical work.

Discussion papers are written in a style that is more broadly accessible compared to standard Working Papers. They are light on formulas and regression tables, at least in the main text.

The selection and distribution of discussion papers are subject to the approval of the Director General of the Directorate General Research.

Abstract

The *architecture of supervision* – how we define the allocation of supervisory powers to different policy institutions – can have implications for policy conduct and for the economic and financial environment in which these policies are implemented. Theoretically, an integrated structure for monetary policy and supervision brings important benefits arising from better information flow and policy coordination. Aggregate supervisory information may significantly improve the conduct of monetary policy and the effectiveness of the *lender of last resort* function. As long as the process towards an integrated structure does not shrink the set of available tools, monetary policy and supervision are no less effective in pursuing their objectives than a separated structure. Additionally, an integrated structure does not seem to be correlated with more price and/or financial instability, as suggested by analysing a large global set of countries with different supervisory set-ups. A centralised structure for supervision entails significant benefits in terms of fewer opportunities for supervisory arbitrage by banks and less informational asymmetry. A large central supervisor can take advantage of economies of scale and scope in supervision and gain a broader perspective on the stability of the entire banking sector, which should result in improved financial stability. Potential drawbacks of a centralised supervisory structure are the possible lack of specialisation relative to local supervisors and the increased distance between the supervisor and the supervised institutions. We discuss the implications of our findings in the euro area context and in relation to the design of the Single Supervisory Mechanism (SSM).

JEL Codes: E5, G21, G38

Keywords: Supervisory structure, central banks, lender of last resort, policy coordination

Non-technical summary

The allocation of supervisory powers and responsibilities – and whether these should be assigned to the central bank – has been at the centre of an intense debate among policymakers and academics in recent years. The *architecture of supervision*, in other words how we define this allocation of powers, can have implications both for the conduct of policy and for the economic and financial environment in which these policies are implemented. In this paper we address these issues through the lense of economic research and derive some guidance concerning the characteristics that an *optimal* supervisory architecture should have.

An integrated structure for monetary policy and supervisory powers entails important benefits in terms of better policy coordination and easier information flow. An integrated structure may be better placed to manage the conflicts of interest arising from pursuing the distinct, but related, objectives of price and financial stability and to foster better coordination. We also provide some suggestive evidence, using global data from a large set of countries with different set-ups for monetary and supervisory functions, that an integrated structure is not more correlated to price or financial instability than a separated structure.

There are both theoretical and empirical arguments supporting the benefits of an easier transfer of information between supervisors and central bankers. For example, extensive supervisory information has the potential to improve the conduct of monetary policy and the effectiveness of the *lender of last resort* function significantly.

The presence of significant risks to the reputation of the central bank is often mentioned as an argument supporting a clear separation between the central banking and supervisory functions. While these risks are relevant, we argue that a separated structure would not prevent these risks from materialising, especially during times of financial distress in which the central bank is called on to intervene, for example as *lender of last resort*. At the same time, placing the supervisory authority within the central bank seems to have the additional advantage of shielding the supervisor from political pressure and regulatory capture.

The second part of the paper addresses the costs and benefits arising from a centralised supervisory system, as opposed to a decentralised one. Local and central supervisors differ in terms of acquisition of information and incentives.

In relation to the structure of supervision, centralisation of supervision seems to entail significant benefits in terms of fewer opportunities for supervisory arbitrage by banks and lower informational

asymmetry. The use of common and standardised rules and data to assess banks' health drastically reduces the possibility of regulatory/supervisory shopping for banks. Furthermore, a large central supervisor can take advantage of economies of scale and scope in supervision and gain a broader perspective on the stability of the banking sector as a whole.

Potential drawbacks of a centralised supervisory structure are the possible lack of specialisation relative to local supervisors and the increased distance between the supervisor and the supervised institutions. These may translate into a more limited knowledge of the markets in which banks operate their organisational structures and of the products they offer.

In the euro area, the current architecture of supervision is based on a hybrid system, where the functions of monetary policy and supervision are not fully integrated and the SSM directly supervises only significant institutions. In this respect, there seems to be room for fostering the flow of information between the monetary and supervisory functions also in the euro area setting, while respecting the *separation principle*, whereby the European Central Bank (ECB) ensures a separation of objectives, decision-making processes and tasks.

The centralisation of supervisory powers has fostered the use of standardised rules and data, providing a level playing field. Still, centralised supervision in this setting crucially relies on the expertise of local supervisors. Thus, the challenge of the current set-up is to strike the right balance between retaining the superior local information while maintaining a high level of supervisory independence. In this context, it seems important to strive for more aligned incentives between central (SSM) and national supervisors. The harmonisation of the legal protection of supervisors working in different countries could represent a useful intervention to achieve improved consistency in supervisory standards. At the same time, the inclusion of additional criteria, such as a reference to bank business models, to those determining whether or not a bank falls under SSM supervision, may be beneficial in limiting strategic behaviour of regulated intermediaries.

1 Introduction

The allocation of supervisory responsibilities and powers has been at the centre of an intense debate among both policymakers and academics in recent years. The *great financial crisis* and the successive reforms to the supervisory and regulatory framework around the world have further contributed to revive the debate.

In the past, the discussion regarding optimal supervisory architecture centred on the issue of whether or not supervisory powers should be assigned to the central bank. *Is an integrated structure of central banking and supervision conducive to greater price and financial stability? What are, if any, the risks of having both monetary policy and supervision within the central bank?* In more recent years, the debate has been enriched with an additional dimension concerning the geographical allocation of supervisory powers. *Is centralised (supranational) supervision preferable to decentralised (national) one? What are the relevant trade-offs to consider?*

In this paper we address these issues through the lense of economic research and obtain certain guidance regarding the characteristics that an *optimal* supervisory architecture should have. We take stock of the existing literature, complement it with some original analyses and outline the main implications. We investigate the optimal allocation of responsibilities and powers aimed at preserving the safety and soundness of financial institutions and, in turn, financial stability. We refer to the allocation of supervisory powers and implementation of prudential policies as **supervisory architecture**.

The question of how supervisory responsibilities and tasks should be organised is quite broad and entails different dimensions. This is due to the fact that supervisory architecture does not only substantially vary across countries, but also that, over the years, very different structures have emerged. In our analysis, we provide an overview of these implications and analyse the issue in two dimensions: the relation between the functions of bank supervision and central banking and the geographical allocation of supervisory powers, considering centralised versus decentralised structures. These issues became prominent in the European debate during the creation of the banking union, which has assigned to the Single Supervisory Mechanism (SSM), residing with the ECB, the responsibility to supervise the most significant financial institutions in the euro area.

We analyse the optimal supervisory architecture in steps. First, it is important to disentangle the interdependences between monetary policy and supervision, as well as the interactions between the objectives of price and financial stability. Second, once the spillovers between monetary policy and supervision are clearly identified, the analysis addresses the potential benefits and costs of an integrated versus a separated structure of central banking and supervision.

In Section 2 and 3, we review the ample academic literature addressing the interaction between price and financial stability and the policies to achieve them. Figure 1 graphically illustrates the relevant interactions. First, there are clear positive spillovers between price stability and the safety and soundness of financial institutions (see the black thick arrow). A well-functioning financial system ensures an effective transmission of monetary policy and in turn its effect on price stability. On the other hand, good macroeconomic conditions spurred by price stability support financial stability. In terms of policies, the interaction between monetary policy and supervision is more involved, as prudential and monetary policies affect one another and their respective objectives both directly and indirectly via their effects on banks' behaviours.

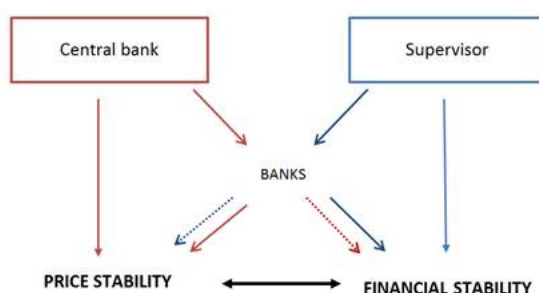


Figure 1: Interactions between prudential and monetary policy and their respective objectives. The figure illustrates the channels through which central banking and supervision affect one another. The solid lines capture the effect that the central bank and the supervisor have on price and financial stability, respectively. The red line identifies the impact of central bank policies on price stability, while the blue one corresponds to the effect of supervision on financial stability. The dashed lines represent the spillovers between monetary policy and supervision. The red dashed line captures the effect that the central bank has on financial stability, while the blue dashed line the effect that the supervisor has on price stability. Finally, the black thick line symbolises the spillovers between price and financial stability. Importantly, the figure highlights the pivotal role that banks play in the transmission of central banking and supervisory policies.

A central bank implements monetary policy (interest rates setting and unconventional policy) and provides emergency liquidity, through its *lender of last resort* (LOLR) function with the objective of minimising deviations from inflation target (monetary policy) and potential losses incurred in the event of a bank failure (LOLR).¹ These actions impact price stability by affecting aggregate demand and, through banks, by inducing changes in their behaviour and supporting the smooth functioning of the financial sector (see the red solid arrow in Figure 1).² At the same time both monetary policy and the LOLR function also affect financial stability. Financial intermediaries and in particular banks play

¹ We adopt here a narrow definition of the central bank mandate, in line with the ECB's primary objective of maintaining price stability.

² We do not discuss these effects in detail in the paper.

a pivotal role in this transmission, as captured by the red dashed arrows in Figure 1. For example, changes in the policy rates by the central bank translate into changes in bank funding conditions and/or in their intermediation margins, thus impacting bank risk-taking decisions and distress probability.

Supervisors can take a broad set of actions to foster the stability of financial institutions and minimise the associated costs. They collect and process information about the health of individual institutions or the banking sector as a whole and decide to implement prudential policies and corrective actions.³ These actions affect financial stability by directly impacting supervised institutions and the financial sector as a whole. For example, supervisory actions affect banks' balance sheet variables, their risk-taking behaviour, as well as the likelihood of bank failures. Also, communication about the stability of supervised institutions has an effect on the financial system at large (see blue solid arrows). At the same time, supervision has implications for price stability, by affecting the health of the banking sector and therefore the transmission channels of monetary policy (see dashed blue lines).

Once the interdependences between monetary policy and supervision are clearly identified, we discuss whether it is optimal to have the central bank and the supervisor in the same institution. In doing this, we consider separately the role of the central bank in pursuing price stability (Section 2.2) and as the lender of last resort (see Section 3.2). The arguments in those sections hinge on the potential benefits and costs associated with the two authorities either coordinating their actions or acting non-cooperatively. Regarding these issues, the discussion in the academic and policy fora has focused on three key topics: information, reputation and distortions from optimal policy conduct.

Regarding information, there is evidence that supervisory information can improve the conduct of monetary policy, as it improves the forecast of key macroeconomic variables. Thus, under the assumption that a unified structure of central banking and supervision minimises the informational frictions and allows a better transfer of information, such structure is preferable to a separated one.

The arguments surrounding reputation are more mixed. On the one hand, it is usually acknowledged that the supervisor could benefit from the reputation and independence of the central bank, thus being less subject to external pressures, i.e. *regulatory capture*. On the other hand, those supporting the optimality of a separated structure argue that the reputation of the central bank and, in turn, its credibility and effectiveness, could be negatively impacted by damages to the reputation of the supervisor following a bank failure. While this is certainly an important and plausible argument, it is

³ For the supervisor, we consider a broad set of actions, similarly to Eisenbach, Lucca and Townsend (2016). This specification attributes to the supervisory authority the design of prudential policies and other corrective actions that in reality are not always fully in the supervisor's sphere of responsibilities. The underlying idea is that, in the presence of a separation between the supervisor and the regulator, the frictions existing between the two authorities are minimal. In this case, the regulator perfectly responds to information about banks' health conveyed by the supervisor by designing adequate prudential policies and corrective actions.

also important to point out whether such negative reputational spillovers would only emerge in the case of a unified structure or are rather somewhat independent of the architecture. In relation to this, it is important to note that the LOLR function links the reputation of the central bank to the health of the financial institutions.

Finally, potential distortions in the conduct of monetary policy and supervision deriving from a unified structure have been used as the main argument supporting a separation of the two policy functions. These distortions are usually referred to as *financial dominance* and *supervisory forbearance*. The former refers to the scenario where the central bank deviates from the optimal conduct of monetary policy in an attempt to preserve the stability of financial institutions. Supervisory forbearance refers to the scenario where the supervisor is too lenient in its attempt to reduce the losses borne by the central bank in the event that its counterparties –i.e. banks– fail. In the paper, we review all the above arguments and highlight how they depend on the particular supervisory structure. In addition, we present empirical evidence suggesting that an integrated structure does not seem to negatively affect either monetary or financial stability (see Section 2.3).

The discussion in Section 2 and 3 also suggests that the assessment of benefits and costs of an integrated versus a separated structure cannot abstract from the geographical allocation of supervisory responsibilities and powers. In particular the difference between local and centralised supervisors may crucially affect objectives and abilities of supervisors. We discuss these issues in detail in section 4. The analysis in this part also proceeds in steps. First, we identify the strengths and weaknesses of both centralised (supranational) and decentralised (national) supervision, focusing specifically on information, resources, reputation, and independence. The basic idea is that local supervisors have information advantages relative to centralised supervisors. However, the latter rely on a more effective organisational structure and have a broader view of the whole financial sector, which allows them to also perform useful “peer comparisons” and to support a level playing field. Second, central and local supervisors differ in terms of incentives, which usually result in central supervisors being less lenient. After having identified the benefits and costs associated with central and local supervision, we discuss the characteristics of the optimal architecture and use it as a benchmark to assess the benefits and shortcomings of the current supervisory set-up in the euro area.

The paper proceeds as follows. Section 2 tackles the question of whether monetary policy and supervision should be allocated to a single institution. To this end, it first disentangles the possible conflicts between the objectives of price and financial stability and then discusses the optimal institutional arrangement. Section 3 conducts a similar analysis but focusing on the question of whether LOLR function and supervision should be allocated to the same institution. Section 4 focuses on the trade-offs associated with allocating supervision to a “central” authority instead of a “local”

authority and discusses the specific institutional arrangement in the euro area. Section 5 concludes and draws policy lessons.

2 Monetary policy and supervision

In this section, we consider the question of whether monetary policy and supervision should be allocated to a single institution (i.e. the central bank) or to two separated ones. To this end, we first disentangle the channels of interaction between monetary and prudential policies and the possible conflicts between the objectives of price and financial stability. Then, based on these interdependences, we discuss the optimal institutional arrangement.

2.1 Policy interactions

In terms of objectives, there are clear positive spillovers between price stability and the safety and soundness of financial institutions, which hinge on the improved macroeconomic conditions, as well as on the enhancement of the monetary policy transmission channels. In terms of policies, the interaction between monetary policy and supervision is more complex, as prudential and monetary policies affect one another and their respective objectives both directly and indirectly via their effects on banks' behaviours.

2.1.1 Effect of monetary policy on financial stability

The central bank chooses the interest rate policies with the objective of minimising deviations from the inflation target.⁴ Such a choice affects financial stability through a number of different channels.⁵

Because we are exploring the interaction of monetary and prudential policies, we limit attention to the monetary policy transmission channels involving banks. Monetary policy, including both conventional (interest rates) and unconventional policies, has a direct impact on the balance sheets composition of the banks. Relevant from a financial stability point of view is how these changes may result in increasing financial risk, which can materialise with detrimental consequences for the banking sector as a whole.

An accommodative monetary policy may lead to an increase in financial fragility, especially when accompanied by other concurrent factors. Low policy rates, coupled with financial innovation and low supervisory standards have been recognised as one of the key determinants of the great financial crisis

⁴ We abstract in this section from the LOLR function performed by the central bank. We will analyse the LOLR function in detail in Section 3.3.

⁵ The academic literature analysing the effects of monetary policy on financial stability is quite large. For a comprehensive survey of the literature, see the ECB Occasional paper (2017), "The transmission channels of monetary, macro- and microprudential policies and their interrelations" and the IMF Policy paper (2013), "Interaction between monetary and macroprudential policies".

(see Maddaloni and Peydró, 2011 and Martinez-Miera and Repullo, 2017). There are different channels through which low interest rates affect banks' risk-taking. Lower interest rates tend to decrease the profitability margins and the charter value of banks, thus decreasing their incentives to behave prudently and monitor their borrowers (Dell'Ariccia, Laeven and Marquez, 2014). Also, in order to make up for the decline in profitability, banks may actively "search for yield" investing in riskier activities (see Martinez-Miera and Repullo, 2017). When the reduction in the interest rates makes safe assets relatively less profitable, banks may have an incentive to reallocate their resources towards riskier assets with detrimental implications for financial stability (e.g. Rajan, 2006). Jimenez, Ongena, Peydró and Saurina (2014) provide empirical evidence of the dangers of a (long) period of low interest rates. Specifically, they show that low rates lead to poorly capitalised banks granting more credit to riskier borrowers with lower collateral requirements. This behaviour sows the seeds of financial fragility, which then materialises when a (sudden) tightening of monetary policy takes place. Finally, changes in monetary policy rates affect the net worth of banks' borrowers (both households and non-financial corporations), in particular the value of the assets that they can pledge as collateral and the net present value of their investment opportunities. Access to credit is easier, which is one of the objectives of accommodative monetary policy, but banks may take higher risk not accounted for, by relaxing their lending standards (see for example Ciccarelli, Maddaloni and Peydró, 2015). Monetary policy influences financial stability by affecting the riskiness of banks' borrowers and their ability to repay their debt.

A change in the monetary policy stance also affects banks' liabilities: a tightening in the monetary policy stance results in a shift in the short-term deposit rate and, as a result, may increase banks' exposure to runs.⁶ In a recent paper, Choi and Choi (2017) show that a change in the monetary policy stance also affects the composition of banks' liabilities, that is, the reliance on and concentration of wholesale funding in the banking sector. In their paper, thus, a monetary tightening, translates into increased fragility as the banking sector becomes more exposed to liquidity funding risk.

To evaluate the full impact of changes to monetary policy on financial stability, it is important to consider banks' entire balance sheet. Dell'Ariccia, Laeven and Marquez (2014) combine in a unified framework the impact of changes in the monetary policy stance on both the assets and the liabilities of banks' balance sheets, focusing specifically on the impact on risk-taking. They show that the overall effect of a change in the monetary policy stance on risk-taking crucially depends on banks' ability to adjust their capital structure in response to a change in the policy rate. In particular, a reduction in the policy rates encourages banks to be more leveraged and, in turn, all else being equal, to take more risk.

⁶ Concerning the impact of deposit rates on banks' exposure to runs, see, among others, Diamond and Dybvig (1983) and Goldstein and Pauzner (2005).

Recent academic literature has also focused on the impact of very low, also negative, nominal interest rates. Brunnermeier and Koby (2016) argue that for levels of interest rates that are *very low*, accommodative monetary policy can become contractionary and have a detrimental impact on credit provision. Lower rates decrease funding costs for the banks but also their interest rate margins. When the costs of the latter offset the benefits of the former, banks' net worth declines and capital constraints become binding. The determinants of the reversal interest rates lie in the relative importance of assets and liabilities at fixed rates and on the capital constraints faced by the banks. This also brings up the importance of heterogeneity in the impact of monetary policy. There are heterogeneous effects across regions where monetary policy operates, being possibly expansionary in one region and contractionary in another. Similarly, Hoffmann et al. (2018) show that banks' exposure to interest rate risk is small on aggregate, but heterogeneous in the cross-section. Net worth is increasing in interest rates for approximately half of the institutions in their sample and the cross-sectional variation in banks' exposures is driven by cross-country differences in loan-rate fixation for mortgages.

Important heterogeneities arise also when assessing the impact of negative policy rates. Heider, Saidi, Schepens (2017) show that banks with a high deposit base are constrained in their ability to pass-through negative rates to depositors. This results in a squeeze in the intermediation margins and in higher risk-taking incentives. They found evidence that banks relying more on deposit funding lend to somewhat riskier borrowers. Using similar identification strategies, other research looks at how negative policy rates are transmitted through the banking sector and how they affect credit supply and equity valuation (see for example Ampudia and van den Heuvel, 2018; Basten and Mariathasan, 2018; Eisenschmidt and Smets, 2017 for an overview).

Ampudia and Van den Heuvel (2018) show that further rate reductions in a negative rate environment, which result in a flattening of the yield curve due to the impossibility for banks to pass on the negative rates to depositors, are detrimental for bank equity values. Thus, a change in the monetary policy stance leading to a reduction in the spread between long- and short-term rates can have a detrimental impact on financial stability.

An important dimension also to consider is the impact of non-conventional monetary policy on financial stability. For example, a useful illustration of a non-conventional monetary policy measure was the announcement, on 26 July 2012, by the ECB's president Mario Draghi to do "whatever it takes" to preserve the Euro, which subsequently led to the launch of the Outright Monetary Transactions (OMT) Programme. This resulted in a significant increase in the value of sovereign bonds issued by European periphery countries, leading to an improvement in the financial conditions of euro area banks.

Alcaraz et al. (2018) analysed the impact of this announcement on banks' risk-taking. Their results suggest that this announcement supported the financial stability of euro area banks. To control for endogeneity problems – where local demand shocks and macroeconomic risks are hard to insulate from the effects of the intervention – they assess the effect of the announcement on the lending conditions implemented by euro area banks when granting loans in Mexico. By comparing lending conditions applied to the same borrower by the euro area and local Mexican banks, they show that the intervention was effective in reducing euro area banks' risk-taking. Analysing the impact of the same announcement on lending provision in the euro area, Acharya et al. (2017) show that, following the announcement, banks indeed benefited from increased recapitalisation. At the same time though, they extended loans to existing low-quality borrowers at very low interest rates. Hence, the announcement had no positive effect on investment and employment.

2.1.2 Effect of supervision on price stability

Supervisory information affects the conduct of monetary policy in a number of ways. Financial stability is an important condition for an effective transmission of standard monetary policy and the actions of supervisors are conducive to financial stability. For example, detailed information about banks' health published by supervisors in the context of stress testing may reduce banks' opaqueness, thus generating beneficial effects on the stability of the sector. The beneficial effect of information on financial stability mainly comes from the improved market discipline: having insights regarding banks' risk positions allows their creditors to promptly react to them, by either running or by adequately pricing risk, thus curbing banks' excessive risk-taking.⁷

Having access to better information on the exposures and health of the financial sector, the central bank can manage risk more effectively and improve the conduct of monetary policy. Using US data, Peek, Rosengren and Tootell (1999) show that confidential supervisory assessments improve the forecasting of macroeconomic variables, such as inflation and unemployment. Furthermore, they also show that confidential supervisory information is effectively used by the members of the Federal Open Market Committee (FOMC) when taking their voting decisions and this improves the conduct of monetary policy.

In a more recent paper, Peek, Rosengren and Tootell (2016) discuss whether the Fed is following a ternary mandate. In their underlying model the dual mandate objective function of monetary policy is expanded by a third objective of financial stability. Accordingly, the derived modified Taylor rule contains not only the output (or unemployment) and inflation gap, but also a term that explicitly

⁷ See Goldstein and Sapra (2014) for an analysis of the benefits and costs of disclosure and transparency.

accounts for financial stability imbalances. In their empirical study they find evidence that word counts of terms related to financial instability do correlate with monetary policy decisions.

Beyer and Homar (2019) investigate whether financial stability variables help explaining the dynamics of euro area short term interest rates, as measured by the EONIA. They measure financial instability by a financial stress indicator (FSI). The indicator captures the share of institutions under the supervision of the SSM that are considered a concern for financial stability. More precisely, the indicator is given by the ratio between total assets of such banks and total assets of all banks directly supervised by the ECB. First, they define thresholds for a set of basic bank risk indicators to determine whether a bank should be considered low or high risk for financial stability. Next, they define composite indicators that combine the multiple basic indicators to assess bank risk from four main risk perspectives (profitability, credit risk, capital and liquidity). Finally, they construct the overall FSI based on these four risks. The analysis in Beyer and Homar (2019) shows that including different variants of their FSI helps to improve the statistical and out-of-sample forecast properties of a Taylor rule, compared with an estimated benchmark rule that does not contain the FSI (see Box 1 for details of their analysis).

Besides information, supervision affects the design and implementation of monetary policy also through the enforcement of prudential policy instruments and corrective actions. On the one hand the enforcement of prudential policies and corrective actions may affect the transmission channels of monetary policy by constraining banks' activities and affecting the composition of assets and liabilities. On the other hand, capital and liquidity regulation also have a direct impact on the implementation of monetary policy and, thus, on price stability.

Bech and Keister (2017) study the implications of the liquidity coverage ratio (LCR) on the implementation of monetary policy. The key insight in their analysis is that the introduction of liquidity requirements affects the demand and supply and, in turn, the value of specific classes of assets. In this context, any change in the LCR and therefore in the associated premium will lead to a shift in interest rates that is disconnected from the monetary policy stance.⁸ Liquidity regulation also affects the strength of the transmission of monetary policy, as shown by Choi and Choi (2017). In their framework, the transmission of monetary policy is weakened as banks can smooth their lending by substituting deposits with wholesale funding when monetary policy becomes less accommodative. Liquidity regulation can therefore improve the transmission of monetary policy by making it more costly for banks to increase their reliance on wholesale funding and so avoiding such substitution.

⁸ Bindseil and Lamoot, (2011) and Bindseil (2013) also consider the implications of liquidity regulation on monetary policy implementation.

Capital regulation may also have an impact on the design and implementation of monetary policy and, in turn, on price stability. Such interaction crucially hinges on the effect that capital regulation has on the macroeconomic cycle, whereby specific tools may exacerbate or reduce cyclical fluctuations, and the similar role played by monetary policy. A number of papers (e.g. Cecchetti and Li, 2008; and Angeloni and Faia, 2013) have analysed the design and the implementation of monetary policy in a context where output fluctuations are exacerbated by the presence of procyclical capital regulation (e.g. Basel II capital requirements), which, in the presence of negative shocks, induces banks to reduce lending as a way to improve their capital position.

The discussion above regarding the implications of monetary policy and supervision for financial and price stability highlights the existence of relevant interactions and potential conflicts of objectives between the two policies. As we will discuss in details below, the existence of these interdependences is key in assessing the optimality of a particular architecture allocating central banking and supervision either to the same institution or to two separate institutions.

Box 1: An Example for Using Anonymised Aggregate Supervisory Data

Based on a model for an empirical policy rule by Beyer and Homar (2019), we show that financial stability variables help to explain the dynamics of euro area short term interest rates, as measured by the EONIA.

Their estimated “Taylor Rule” in first differences for changes in the EONIA is augmented by three different “Stress Variables” (SV), using quarterly data from 2000 - 2016:

$$\Delta R_t = \gamma \Delta R_{t-1} + \beta E_{t-1}(\pi gap_{t+4}) + \lambda(ygap)_{t-1} + \phi SV_t + \varepsilon_t \quad (1)$$

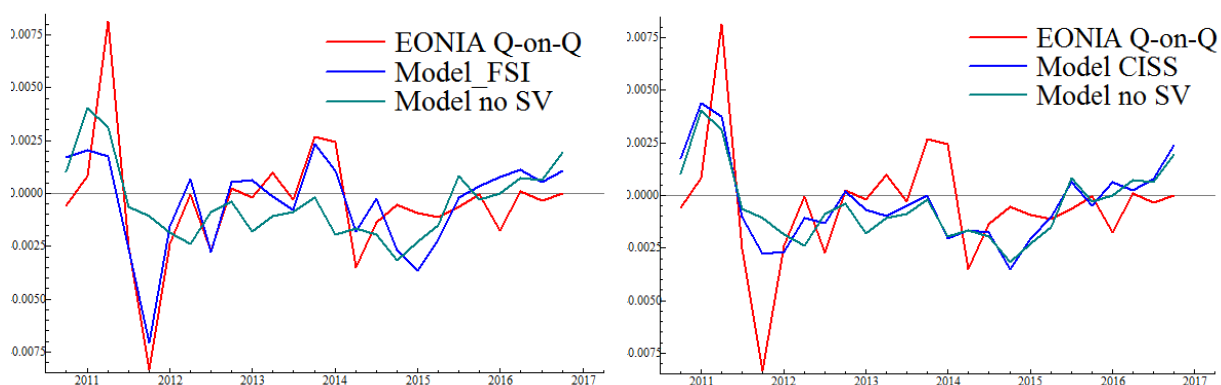
R = EONIA; πgap = previous quarter expectation of 12-month ahead inflation forecast minus 1.9%, $ygap$ = output gap; ε = error term. The Stress Variables are FSI: Financial Stress Indicator (Beyer and Homar); CISS: Composite Indicator of Systemic Stress (Hollo et al. 2012); SysE: Probability of adverse systemic events (ECB, Financial Stability Review 12-2007).

Parameter	Stress variable	FSI	SysE	None
γ	0.77 (4.2)	0.82 (4.1)	0.83 (2.6)	0.82 (2.2)
$\beta, \{\beta^*\}$	0.46 {2.01} (4.8)	0.37 {1.94} (3.61)	0.40 {2.10} (3.4)	0.46 {2.50} (3.8)
$\lambda, \{\lambda^*\}$	0.15 {0.65} (5.2)	0.13 {0.68} (4.35)	0.12 {0.63} (3.5)	0.11 {0.61} (3.3)
ϕ	-0.07 (5.4)	-0.06 (4.9)	-0.008 (1.9)	
Likelihood	334	331	322	319
Standard Dev.	1.9	2.0	2.3	2.4
R^2	0.80	0.77	0.68	0.67

Note: absolute t-values in round brackets; implied “standard” Taylor Rule parameters β^* and λ^* , after lag-transformation, in curly brackets.

By inserting β^* and λ^* , Model (1) implies a standard Taylor Rule (2) in terms of the levels of EONIA where the “Taylor Principle” holds for all specifications:

$$R_t = \gamma^* R(L)_{t-1} + \beta^* E_{t-1}(\pi gap_{t+4}) + \lambda^*(ygap)_{t-1} + \phi SV_t \quad (2)$$



Source: Beyer and Homar (2019)

Background: Beyer and Homar (2019) estimate a quarterly Taylor-Rule for the euro area (2000Q1 to 2016Q4) using EONIA. It is explained by its lag, the output gap and a 12-month ahead forecast of the inflation gap. That model has stable coefficient estimates over the entire sample and very good statistical properties until 2008. When the model is augmented with a Financial Stress Indicator (FSI) which contains observations from 2010 onwards the statistical properties and the goodness of fit improve significantly for the period after 2010. In particular, the dynamics of EONIA after the seven subsequent decisions to lower interest rates between 2011Q4 and 2014Q3 are remarkably well tracked by the augmented model. The FSI is constructed as an indicator function of a composite indicator, based on aggregated supervisory bank balance sheet data. Notice that when estimating the model instead with DG-MF's probability measure of systemic banking events (SysE, based on CDS data) the results are very similar. A formal "Encompassing"-Test shows, however, that FSI provides more information when estimated jointly with SysE. The hypothesis that SysE does not provide additional information when estimated jointly with FSI is not rejected at 25% while the converse is not true (FSI not providing additional info is rejected at 2%). Using the CISS Index variable of Hollo et al. (2012) – based on publicly available data – the model is less able to track the EONIA movements over the same sample period. The coefficient on CISS is only weakly significant and the statistical properties of the model are less favourable. The correlation coefficient between FSI and CISS is only 0.5. However, the CISS-augmented model has slightly better statistical properties than the model without any Stress Variable.

2.2 Should monetary policy and supervision be under the same roof?

In an ideal world, with no frictions or constraints to the ability of monetary policy and supervision to achieve their respective objectives, any potential trade-off between price and financial stability would be fully regulated away. In this case, the precise institutional arrangement would not matter: having supervision and monetary policy within the same institution or in two separate ones would be equally good.

In reality, monetary policy and supervision are *de facto* constrained in their ability to achieve their respective objectives. In view of this, given the numerous and intricate interactions between monetary policy and supervision, as highlighted above, it is paramount that the "side effects" of each policy are accounted for. In this respect, a unified structure, where supervision and monetary policy are carried out by the same institution, seems to provide a better framework to achieve this than a separated structure. In broad terms, a unified structure

of central banking and supervision would help prevent the coordination failure that arises when two distinct but interdependent objectives are assigned to two separate institutions.⁹ This coordination failure can be interpreted as the result of the monetary and supervisory authorities essentially playing a non-cooperative game and takes the form of *push-me-pull-you* behaviour. In the academic literature (see, for example, Bean, Paustian, Penalver and Taylor, 2010; De Paoli, Paustian, 2017; and Angelini, Neri and Panetta, 2011) such behaviour takes different forms, depending on how the two authorities' objectives are specified and how the associated inefficiencies are measured.

Despite the specific differences in the modelling assumptions, in these papers the coordination failure, spurred by a separation between the central bank and the supervisory authority, arises because the relevant institutions fail to internalise the spillovers existing between their own policies and objectives. By not internalising the implications that specific prudential policies may have for price stability, the supervisor does not take into account how its decision affects the conduct of monetary policy. Similarly, by not accounting for the effects that its interest rate policy may have on financial stability, the central bank does not consider how the conduct of monetary policy affects the implementation and the costs associated with prudential policies. As described by Smets (2014), the lack of coordination and the presence of spillovers between policies and objectives result in a suboptimal allocation where each authority uses its own policy instruments to offset and counterbalance the side effects triggered by the other authority's action.

A key argument supporting the desirability of a unified structure of central banking and supervision is precisely that, in such an institutional arrangement, it would be easier to account for the interdependencies between price and financial stability and their designated policy instruments. The model by Carillo *et al.* (2017) provides a quantitative assessment of the advantages of the coordination between monetary policy and financial stability, in a DSGE framework with risk shocks. In their study, monetary policy is modelled as a standard Taylor rule governing the nominal interest rate, while the policy designed to maintain financial stability takes the form of a subsidy on investment targeting a specific credit spread. The two policies and their objectives are interdependent. On the one hand, inflation is affected by the financial authority's subsidy on investment, through its effect on aggregate

⁹ On this point, see the speech given by B. Bernanke "Central Banking and Bank Supervision in the United States" at the Allied Social Science Association Annual Meeting, Chicago, Illinois in January 2007, available at <https://www.federalreserve.gov/newsevents/speech/bernanke20070105a.htm>.

demand. On the other hand, the credit spread is affected by the central bank's interest policy because of the effect that the nominal interest rate has on the terms of the contract between banks and their borrowers (i.e. entrepreneurs). In this context, Carillo *et al.* (2017) show that the non-cooperative allocation entails a significant welfare loss relative to the one where monetary and financial policies are jointly determined.¹⁰

Beside the key advantage of accounting for the interdependencies between policies and their targets, having a single institution responsible for both monetary policy and supervision entails additional benefits. First, having the central bank and the supervisor within the same institution is likely to reduce the frictions and costs associated with the transfer of information between the two authorities, thus making it possible to fully exploit beneficial informational spillovers. As we have shown in Section 2.1.1, the central bank can significantly benefit from having access to supervisory information as this improves the conduct of monetary policy. Symmetrically, the supervisory authority may also benefit from the information collected by the central bank on the macroeconomic situation and on developments in financial markets. Finally, central banks can benefit from easy access to supervisory information in their lender of last resort activities (Goodhart and Schoenmaker, 1995, see also Section 3).

Second, a unified structure of central banking and supervision makes it possible for the supervisor to benefit from the independence and the reputation of the central bank, thus being less subject to political interference and external pressures, i.e. regulatory capture. This is an important advantage, as we will show in detail in Section 4, since the proximity of supervisors to national authorities, local stakeholders and special interest groups can influence their decisions and result in them being too lenient. More broadly, the arguments behind the benefits of having an independent supervisor are similar to those used to claim central bank independence. They have to do with the beneficial role that independence has in enhancing commitment and in limiting the time inconsistency problem. The lack of supervisory independence, whereby the supervisor's action can be possibly prejudiced by the short-termism of the interests of other stakeholders, undermines its ability to commit to specific policies and, in turn, the effectiveness of its intervention in curbing banks' risk-taking incentives and the resulting increased fragility.

¹⁰ They mention a welfare loss of 6%. Still in the context of DSGE models, Angelini, Neri and Panetta (2014), Bodenstein, Guerrieri, La Briola (2014), De Paoli and Paustian (2017) and Van der Gote (2017) also find gains from cooperation, although smaller.

Proximity to external stakeholders and political interference may prevent the supervisors from taking specific actions in line with their financial stability objective but particularly costly for those external parties. In other words, due to proximity, the local supervisor may be more prone than a centralised one to internalise the costs of external parties in its decision making process, thus deviating from its optimal conduct. By way of example, the liquidation of an insolvent bank may be the optimal action to take in order to minimise the losses associated with a bank failure, but can be particularly costly for political forces in power in terms of reputation. Internalising these reputational costs may mean the supervisor will be more lenient to the point that, if those costs are very large, it may decide not to liquidate banks that are insolvent.¹¹ Furthermore, supervisory forbearance also increases the risk of and the costs associated with financial distress, thus leading to suboptimal allocations by inducing banks to take excessive risk. Thus, the increased independence that a supervisor enjoys within a unified structure of supervision and central banking can generate significant efficiency gains by fostering better supervision, and, in turn, limiting excessive risk-taking by banks and enhancing financial stability.

The above arguments highlight the advantages of a unified structure of central banking and supervision relative to a separated one. However, in policy and academic debates the issue surrounding having a single institution to conduct both monetary policy and supervision seems not to be resolved and there are influential positions in favour of a separation between the two functions.¹² In a recent paper, Rutkowski and Schnabel (2017) provide evidence that, while some coordination between the central bank and supervisors is advisable, transferring supervisory tasks to the central bank may be conducive to higher inflation and not entail a significant beneficial effect on financial stability. Older papers (e.g. Di Noia and Di Giorgio, 1999; Copelovitch and Singer, 2008) also pointed to a positive correlation between the central bank's involvement in supervisory tasks and inflation. This would result from central bankers deviating from their optimal monetary policy path in order to "accommodate" the stability of financial institutions.

¹¹ When a bank failure has an impact on politicians, for example by negatively affecting their chances of being reelected, having an independent supervisor avoids those (private) concerns from entering into the liquidation decision.

¹² In her speech at the 19th Handelsblatt Annual Conference in 2014, Claudia Buch, Vice-President of the German central bank, identified the allocation of the SSM within the ECB as a main source of risk. She stated "Alongside its actual task of monetary policy, the ECB Governing Council is ultimately also responsible for supervisory issues. These relate to microprudential and macroprudential supervision, with the latter addressing the stability of the financial system as a whole. If, however, monetary policy decisions are influenced by supervisory considerations, this would significantly impact on the credibility of monetary policy."

More broadly, there are two main arguments used to support the allocation of monetary policy and supervision to two separated institutions: reputational risks and conflicts of interest. We are going to discuss them in turn.

Reputational risk refers to the negative impact that the distress or the failure of a bank may have on the reputation of the supervisory authority, as it suggests its inability or unwillingness to address banks' problems in a timely and effective manner. One of the main arguments supporting the separation between central banking and supervision is that, within a unified structure, such a reputational bias would apply to the whole institution, thus potentially affecting also the reputation (and so the effectiveness) of the authority conducting the monetary policy (Goodhart, 2000; and Haubrich, 1996).¹³

While it is true that reputation is an extremely sensitive issue for supervisors, it is not clear that the reputational risk for the central bank would be present only in a unified architecture. Due to its role as lender of last resort, it is likely that the central bank and its reputation are going to be negatively affected by the distress of financial institutions, irrespective of the institutional architecture. In this regard, the UK experience after the failure of Northern Rock offers interesting insights. In the UK, after 1997, supervisory powers were assigned to the Financial Service Authority (FSA). However, the Bank of England still retained the lender of last resort function. While the failure of Northern Rock was rooted in risky funding strategies adopted by the bank and the lack of a proper oversight by the supervisory authority, it was triggered by a severe liquidity dry-up in the market for wholesale funding.¹⁴ The important role that liquidity played in the bank failure and the lack of a swift intervention of the central bank in providing emergency liquidity were precisely the reasons why the Bank of England was also blamed and considered responsible for the failure of Northern Rock.

The UK case described above seems to suggest that reputational risk is not an inherent and exclusive feature of a unified structure, but could also emerge in contexts where monetary policy and supervision are separated. The main reason for this hinges on the fact that the

¹³ Referring to regulators, the importance of reputational spillovers and their potential detrimental effects have been formalised in Morrison and White (2013). In their framework, sharing a common regulator represents a channel of contagion between otherwise unconnected banks. When a bank fails, the confidence in the regulator's competence and its ability to assess the viability of a bank are negatively affected. As a result, investors become worried about the soundness of the banks under the same regulator and, as a result, withdraw their investments. A related argument could apply to our framework, given the role of emergency liquidity provider played by the central bank. When a bank is in distress, it becomes difficult to assess the actual responsibility for the failure, thus casting doubts on the ability of both the supervisor and the LOLR to assess banks' soundness and design effective interventions.

¹⁴ For a description of the events leading to the fall of Northern Rock, see among others, the article in The Economist "Lesson of the Fall", available at <http://www.economist.com/node/9988865>.

central bank also contributes to and is responsible for maintaining financial stability in its role as LOLR. Irrespective of the institutional architecture, the supervisory authority and the central bank, in its role as emergency liquidity provider, have complementary roles in fostering financial stability. The former is responsible for preventing banks from taking excessive risks and triggering proper corrective actions, thereby reducing the overall likelihood of a crisis. The latter, instead, is responsible for intervening when a crisis hits or a financial institution becomes distressed.

The role of the central bank as LOLR is also a key issue that can serve to defeat the conflict of interest argument used to support the separation between supervision and central banking. In the current debate, the conflicts of interest between the central bank and the supervisor are described as the risks of *financial dominance* and (*excessive*) *supervisory forbearance*. The former is seen as the risk that the central bank will deviate from the optimal conduct of monetary policy and, thus, from the inflation target, in an attempt to pursue financial stability objectives. The latter emerges when the supervisor is too lenient in the attempt to reduce the losses borne by the central bank in the event that its counterparties – i.e. banks – fail.

As we discussed in detail above, trade-offs between price and financial stability arise both in the conduct of monetary policy and supervision. Changes in the monetary policy stance aimed at reaching price stability can lead to more risk-taking by banks and so negatively affect financial stability. Symmetrically, supervisory actions (e.g. prudential policy) may have negative implications for price stability. This implies that, at times, price and financial stability can have conflicting objectives. However, it is precisely the existence of these interdependences between monetary policy and supervision that makes their coordination, and, in turn, a unified structure desirable. In the absence of frictions, this would allow fully internalising the “side” effect of each policy, thus improving their effectiveness in reaching their respective goals. Based on these considerations, then, one could argue that taking into account the conflicting objectives and compromising to a certain extent on either monetary or financial stability should not be seen as a risk but rather as an advantage of a unified structure.

The above arguments hint at a more beneficial assessment of a unified structure of central banking and supervision than the one emerging in the current debate. How can we, then, reconcile our discussion with the current debate? To do this, there are two key questions to answer. First, what are the frictions that make a unified structure of central banking and

supervision not optimal? Second, assuming that *financial dominance* and *supervisory forbearance* are indeed risks, are these specific to a unified structure or would they also emerge in the presence of a separated structure of central banking and supervision?

Regarding the first question, one possible case is when the creation of a single institution responsible for both supervision and monetary policy shrinks the set of available tools to achieve the two policy objectives (e.g. if the central bank could only use interest rate policy for both). In this case, two separated institutions, with two separated objectives and sets of tools would be preferable. A recent paper by Carillo *et al.* (2017) shows that an institutional arrangement where monetary policy and financial stability are provided with two separated instruments is better than one where the central bank uses its own instrument to address financial stability concerns, captured in the framework by an augmented Taylor rule for the central bank. Their result can be interpreted as supporting the Tinbergen's rule prescribing the need of two policy instruments for two policy targets. The analysis also highlights that the risk of financial dominance and associated inefficiencies can be material if the attribution of more responsibilities to the central bank is not complemented by an enlarged set of policy instruments.

Another possible issue associated with a unified structure regards the allocation of resources to the two policy functions. In other words, the question is whether or not there are economies of scale to exploit within a unified architecture. The high need for specialisation required to carry out both monetary policy and supervision tends to suggest that a unified structure may suffer from a reduced efficiency if resulting from the attribution of supervisory powers to the central bank without a sufficient increase in the staff count and/or adequate investments in staff training. In this case, the work overload for the staff could undermine their performance and so have a detrimental effect on the achievement of both price and financial stability.

In this framework, we could consider a scenario where the unification leads to a reduction in the effectiveness of the supervisor or the central bank in achieving their objectives, resulting, for example, from the existence of reputational risks and political influence. In this situation, then, the benefits of internalising the spillovers between the policies could be offset by the fact that they are less effective in pursuing their respective objectives.

Regarding the role that specific institutional arrangements may have on the emergence of *financial dominance* and *supervisory forbearance* risks, similar arguments used for the reputational risk apply. Thus, the emergence of a conflict of interest between the central bank and the supervisor does not seem to be specific to the unified structure. In other words, they could emerge even in scenarios where monetary policy and supervision are assigned to two separated institutions. The reason for this is that, even when the central bank is separated from the supervisor, it is still responsible for guaranteeing financial stability, in particular through its role as provider of emergency liquidity. As we shall discuss in detail in the next section, the provision of emergency liquidity by the central bank also gives rise to risks and possible conflicts of interest with the supervisory authority.

2.3 Supervisory structure and economic outcomes: an empirical investigation

In this section we will present some tentative evidence on the relation between institutional structure of prudential and central banking functions and macroeconomic outcome. When analysing this evidence, there are important caveats to consider. First, the cross-country indicator of the institutional structure of prudential policy does not fully capture the nuances of institutional arrangements, such as overlapping board members, cooperation agreements or intra-institutional firewalls. A second caveat to note is that these comparisons do not necessarily imply causality.

This simple empirical analysis is related to a number of other research projects, including the recent one by Rutkowski and Schnabel (2017). They assess empirical associations of cooperation between bank supervisory authorities and central banks and institutional structure (separation and unification), with inflation outcomes and probability of banking crises. The analysis can be brought a step further to explore 1) whether there is a relationship between the institutional structure and the likelihood that a credit boom will turn “bad” (a financial crisis materialises) and 2) link this probability to the use of macroprudential tools by either a stand-alone supervisor or a central bank.

Our first exercise focuses on macroeconomic outcome variables, specifically GDP growth and deviations from inflation target. Based on different fixed- and random-effects models¹⁵, we do not find evidence that GDP growth is lower in countries and years where bank supervision is integrated into the Central Bank (see Tables 1 and 2). Actually, some of the results point to a positive relation. We also find no evidence of higher deviations from the inflation target if bank supervision is integrated into the central bank. These results are not robust across different specifications and also

¹⁵ See Appendix for a detailed description of the econometric specification and variables used. Full tables for the estimations are also reported (appendix tables 1 and 2), as well as a robustness check in which only non-euro area countries are included (appendix table 3).

vary significantly in economic magnitude, and therefore they should be taken with care. At the same time, we can conclude from this exercise that we do not find empirical evidence supporting the idea that an integrated structure negatively affects the conduct of monetary policy.

Table 1

	(1)	(2)	(3)	(4)	(5)	(6)
	GDP growth	GDP growth	GDP growth	GDP growth	GDP growth	GDP growth
Integrated model	0.925** (0.363)	1.103 (0.777)	0.462 (0.335)	1.220 (0.832)	0.253 (0.651)	4.151 (3.934)
Observations	1,216	1,216	1,216	1,216	1,038	1,038
Number of countries	97	97	97	97	97	97

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: GDP growth is the annual GDP growth rate in %, “integrated model” is a dummy variable which takes the value 1 if the central bank is responsible for bank supervision and 0 otherwise. Year dummies included in all specifications, country fixed effects used in (2), (4), (5), (6), random effects in (1) and (3), ln(GDP/capita) and corruption control index included in (3), (4), (5) and (6), lagged GDP growth included in (5) and Arellano-Bond estimator in (6).

Table 2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Inflation deviation from target						log(Inflation deviation from target)					
Integrated model	-0.296 (1.162)	-2.786* (1.551)	-1.763 (1.156)	-5.457* (2.921)	-0.699 (0.473)	-3.158** (1.352)	0.146 (0.152)	-0.0272 (0.216)	-0.0868 (0.139)	-0.172 (0.216)	0.0845 (0.152)	-0.481 (0.387)
Observations	1,182	1,182	1,178	1,178	999	906	1,182	1,182	1,178	1,178	999	906
R-squared	0.046	0.047	0.062	0.083	0.411	-	0.098	0.098	0.105	0.107	0.140	-
Number of countries	94	94	94	94	93	93	94	94	94	94	93	93

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Inflation deviation from target is absolute difference between inflation rate and inflation target for a specific country taken from <http://www.centralbanknews.info/p/inflation-targets.html> (a “virtual” inflation target of 2% is used whenever another explicit target is not available), “integrated model” is a dummy variable which takes the value 1 if the central bank is responsible for bank supervision and 0 otherwise. Year dummies included in all specifications, country fixed effects used in (2), (4), (6), (8), random effects in (1) and (3), ln(GDP/capita) and corruption control index included in (3), (4), (9) and (10), lagged GDP growth included in (5) and (11) and Arellano-Bond estimator in (6) and (12).

We will now focus on a more specific outcome variable, more directly related to policy tools used by monetary and prudential authorities: credit cycles. Specifically, we follow a model by Dell’Ariccia et al. (2016) who identify boom episodes by comparing the credit-to-GDP ratio in each year t and country i to a backward-looking, rolling, country-specific, cubic trend estimated over the period between years $t-10$ and t and classify an episode as a boom if either one of the following two conditions is satisfied: (i) the deviation from trend is greater than 1.5 times its standard deviation and the annual growth rate of the credit-to-GDP ratio exceeds 10 percent; or (ii) the annual growth rate of the credit-to-GDP ratio exceeds 20 percent. Dell’Ariccia et al. (2016) show that only one in three credit booms ends in a crisis and that the likelihood of a credit boom turning into a crisis increases with the length of the boom, the growth rate of credit and the initial level of credit to GDP. Finally, the authors present suggestive evidence that macroprudential policies have some role to play in

avoiding the negative end scenarios for credit booms, while there is no evidence that monetary or fiscal policies are useful in this context.

We build on their study and gauge whether there is variation in the likelihood of a credit boom turning bad (i.e. ending in a crisis) across different supervisory structures. First, we find a difference in the likelihood that a credit boom will end in a crisis between countries where banking supervision is housed in an independent institution or in the central bank. As reported in Panel A below, in 14% (24/173) of country-year pairs where there was a boom in the previous two years, we find a banking crisis in the same or two subsequent years if bank supervision is housed in the central bank. The corresponding share is 23% (26/112) among country-year pairs where bank supervision is undertaken outside the Central Bank. This suggests a more than 50% higher probability of a credit boom turning into a banking crisis in countries where bank supervision is outside the central bank.

Panel A: Likelihood of a credit boom turning into a financial crisis

	<i>Separated Model</i>		<i>Integrated Model</i>	
	<i>No crisis</i>	<i>Crisis</i>	<i>No crisis</i>	<i>Crisis</i>
<i>No boom</i>	243	62	447	73
<i>Boom</i>	86	26	149	24

Notes: Boom episodes and Crisis identified as in Dell’Ariccia et al. (2016). Integrated Model refers to scenarios where the central bank is responsible for bank supervision and Separated Model to those where it is not. Each cell counts the number of country-year observations.

In a second step, we explore whether the use of different policy tools might explain these differences. Dell’Ariccia et al. (2016) provide tentative evidence that the use of macroprudential tools can reduce the likelihood of a credit boom turning into a crisis. Similarly, other country-level research has shown that the use of macroprudential tools can reduce credit cycles and fragility (Jimenez et al., 2017; Vandebussche, Vogel and Detragiache, 2015). We therefore explore whether bank supervisors under different institutional arrangements show a differential propensity to use specific macroprudential tools. We focus on one specific macroprudential tool, the *loan-to-value* ratio, which has been used to dampen housing price and real estate credit cycles. Results are reported in Panel B. As before, we present data in quadrants, distinguishing between country-year pairs with and without boom, using or not using the LTV ratio as a macroprudential tool, and with independent bank supervisors and with bank supervisors inside the central bank. We find that where bank supervision is inside the central

bank, the LTV ratio was used in 25% (26/104) of all credit boom years, while it was used in 9% (5/55) of all credit boom years in countries where the bank supervisor was outside the Central Bank.

Panel B: Use of macroprudential tools

	<i>Separated Model</i>		<i>Integrated Model</i>	
	<i>No LTV</i>	<i>LTV</i>	<i>No LTV</i>	<i>LTV</i>
<i>No boom</i>	207	67	363	126
<i>boom</i>	50	5	78	26

Notes: Boom episodes and LTV identified as in Dell’Ariccia et al. (2016). Integrated Model refers to scenarios where the central bank is responsible for bank supervision and Separated Model to those where it is not. Each cell counts the number of country-year observations.

Summing up the results shown in Panels A and B together, we find that in country-year pairs where bank supervision is in the Central Bank, there is a higher likelihood that LTV ratios are being used as macroprudential tools during credit booms and that credit booms are less likely to turn into crises. While we cannot establish a robust link between these two findings (i.e. use of LTV resulting in lower crisis probability), our work is at least suggestive that this might be the case. The evidence presented in this section does not support the concerns related to both financial dominance and supervisory forbearance in the case of supervision being housed in central banks. Rather it suggests a higher likelihood that central banks use an additional policy tool (macroprudential tools) in addition to microprudential instruments to overcome the possible conflicts of interest.

3 The lender of last resort function

3.1 Interactions

In its role as provider of emergency liquidity, the central bank shares the goal of preserving financial stability with the supervisor.

The effect of the LOLR function on financial stability is twofold. By providing emergency liquidity to banks and by limiting the scope and extent of costly liquidation and fire sales, the LOLR has a direct beneficial effect on financial stability. Beside this direct effect, the LOLR also indirectly affects bank

stability. On the one hand, withdrawal decisions of bank creditors' are affected by the presence of the LOLR. On the other hand, LOLR impacts banks' behaviour and brings about a shift in their risk-taking incentives.

The support offered by the LOLR to banks has a positive impact on bank creditors' withdrawal decisions, thus reducing the risk and extent of a run. The idea is that, by reducing the costs associated with a premature liquidation of the banks' assets, the anticipation of liquidity provision by the central bank eases the coordination problem among bank creditors, which is one of the main sources of banks' illiquidity and, in turn, an important driver of banking crises.¹⁶ Rochet and Vives (2004) show that LOLR is an effective way, as well as less costly than solvency and liquidity regulations, to limit the coordination failure among bank creditors and, thus, to prevent the occurrence of bank runs.

Regarding the impact on banks' risk-taking incentives, the common view is that LOLR, similarly to other forms of public intervention, may lead to excessive risk-taking if not adequately priced and targeted. Ratnovski (2009) shows that the possibility of accessing LOLR support leads to banks making suboptimal liquidity choices.¹⁷ In Freixas, Parigi and Rochet (2004), instead, the distortions take the form of inefficient investment decisions. In their framework, the provision of emergency liquidity prompts some insolvent banks to *gamble for resurrection* and thus to use the loan received by the LOLR to finance a project with a negative net present value (NPV).

Traditionally, because of the distortions associated with LOLR and, in particular, in an attempt to limit the associated potential losses, the provision of emergency liquidity by the central bank has followed the principles that the lender of last resort should lend freely to illiquid but solvent banks, at a *high interest rate* and against good collateral valued at pre-panic prices.¹⁸ While these principles have significantly influenced central bank intervention in the last hundred years, their applicability and potential side effects have been the subject of an intense debate.

High interest rates (penalty rates) have been considered to play a role in the provision of emergency liquidity that is equivalent to that of fair prices in the context of insurance. In other words, they have been recognised as a way to discourage banks to exploit the support offered by the central bank and, in turn, to limit the potential losses for the LOLR. This is the case in Freixas, Parigi and Rochet (2004), where penalty rates prevent insolvent banks from accessing emergency liquidity, thus limiting the losses for the LOLR associated with their default.

¹⁶ When the premature liquidation of banks' assets is costly, bank runs can be the result of a coordination failure among depositors. Each depositor runs because he/she expects the others to do the same and, since a bank's resources are not enough to repay everybody, he/she wants to avoid being the last in the line. See Diamond and Dybvig (1983).

¹⁷ Focusing on an international lender of last resort, Corsetti, Guimaraes and Roubini (2006) show that, by reducing the likelihood of failures and their costs, the emergency liquidity assistance may encourage the beneficiary (in their case the government) to reduce risk-taking and behave more prudently.

¹⁸ See Bagehot (1873).

Despite their potential benefits, a number of drawbacks have been associated with the use of penalty rates. Lending at penalty rates may aggravate bank distress, generating even more instability when rates are too high. This effect is in line with the analysis in Rochet and Vives (2004). Indeed, they show that the LOLR should instead lend at a rate below the market rate. The reason is that, by reducing banks' charter value, penalty rates may distort bank managers' incentives and encourage them to pursue riskier strategies, thus increasing instability.

Lending only against a limited pool of high quality collateral may also have detrimental consequences for financial stability. In a recent paper, Choi, Santos and Yorulmazer (2017) show that lending only against high quality collateral may have a negative impact on the functioning of private markets and, in turn, on credit provision. In their analysis, when the best collateral is tied up with the central bank, the quality of the pool of collateral available in the market worsens, thus impairing the functioning of the private markets. Furthermore, the task of distinguishing between bank illiquidity and bank insolvency and assessing the quality of banks' collateral can be particularly difficult, especially in crisis times.

An important aspect that emerges in the discussion above is that the applicability of the Bagehot's principles and their effectiveness in curbing moral hazard may be weakened when the LOLR has access only to limited information about bank health (Santos and Suarez, 2018). As a result, the beneficial effect of LOLR on financial stability is also weakened.

Relatedly, Drechsler *et al.* (2016) examine the LOLR intervention undertaken by the ECB during the European crisis. They show that, in the years prior to the introduction of the SSM, weakly capitalised banks borrowed more from the ECB and used riskier collateral than strongly capitalised banks. The authors argue that, in the euro area, the separation between the LOLR function, which is conducted by the central bank and broadly centralised at the ECB level, and the supervisory function which was not centralised and conducted by national supervisory authorities, provided incentives to banks to risk-shift. National supervisory authorities would not have sufficient incentives to exercise appropriate stringent supervision in a situation of distress and the LOLR would not be able to evaluate the true solvency of banks. This interpretation supports an institutional framework in which bank supervision and LOLR reside within a single central entity. We are going to discuss the benefits and costs of a unified structure of supervision and LOLR in the next section.

3.2 Should the lender of last resort function and supervision be included under the same umbrella?

The discussion in Section 2.2 concerning the benefits and costs of a unified structure of supervision and central banking also extends to the LOLR function performed by the central bank. The

assessment of the desirability of a unified structure relies crucially on the analysis of how the specific institutional arrangement affects the LOLR function and supervisor's decisions about information collection and banks' liquidation, as well as the flow of information between the two authorities.

A central bank's decision regarding the provision of emergency liquidity depends on whether it expects the bank to default and, in turn, on the information available to assess banks' solvency. Having the central bank and the supervisory authority within the same institution is usually considered an effective way to minimise the informational frictions, thus generating beneficial informational spillovers between the two authorities. The analysis in Repullo (2000) highlights the importance of supervisory information for the LOLR function and concludes that a unified structure of LOLR and supervision is desirable, as it allows maximising the informational benefits while reducing the costs related to information acquisition. Santos and Suarez (2018) emphasise the beneficial effect that liquidity regulation can have on the LOLR function. The regulation gives the central bank more time to acquire information on banks' health and to adequately design emergency liquidity provision. Thus, their analysis can be interpreted as supporting institutional arrangements, such as a unified structure, fostering the coordination between prudential policies and emergency liquidity provision.

The possibility for the LOLR to access precise information regarding banks' solvency is relevant in two respects. First, it allows the central bank to minimise the losses associated with the provision of emergency liquidity to banks, as it makes it possible for the LOLR to target its intervention only to illiquid but solvent banks. Second, more precise information available to the LOLR translates into a lower probability of bank failure. The theoretical underpinnings of this result, as presented in Corsetti, Guimaraes and Roubini (2006), hinge on the fact that the more precise the information of the LOLR is, the lower bank creditors' incentive to run. As the precision of the LOLR's information on a bank's solvency increases, the less worried bank creditors are about the LOLR deviating from its optimal strategy.

Importantly, the argument in Corsetti, Guimaraes and Roubini (2006) works provided that the bank creditors know the LOLR's optimal strategy. However, while in principle the LOLR should lend only to illiquid but solvent banks, the central bank may find it optimal to deviate from such a strategy. In this case, bank creditors may not be able to assess LOLR's optimal strategy precisely, with the result that the benefits of having the LOLR accessing precise information on a bank's health disappear. Thus, it is important to determine what may cause the LOLR to deviate from Bagehot's principle of lending only to solvent banks and how the specific institutional arrangement of central banking and supervision affect this.

As in the analysis concerning the optimality of a unified structure of central banking and supervision, there are other potential benefits of having the LOLR and the supervisory authority within the same institution besides improved information. We are going to discuss them in turn.

First, a unified structure allows overcoming potential coordination failure. While the LOLR and supervisor share the same objective of guaranteeing financial stability, their actions tend to occur at different times. The supervisor's actions aim to prevent the occurrence of a crisis or financial distress, while the provision of emergency liquidity is supposed to take place when a (liquidity) crisis is already under way.¹⁹ Such structure can mean the supervisors avoid taking costly actions, thus shifting the burden of resolving a crisis to the LOLR. A unified structure of LOLR and supervision has the potential to resolve this inefficiency as the supervisory authority internalises the higher costs that the LOLR is going to face due to its inaction and, as a result, fosters a more efficient allocation.

Second, a unified structure of LOLR and supervision facilitate the maximisation of independence and reputation across the two institutions. In other words, a unified structure allows transferring the reputation and independence of the stronger institution to the weaker one, thus generating positive effects for financial stability. As we discuss in section 2.2, transferring supervisory powers to the central bank, which is also responsible for LOLR, would make it possible for the supervisor to benefit from the higher reputation and independence of the central bank.

The discussion above hints at a unified structure of LOLR and supervision being preferable, as it allows maximising informational gains, mitigating possible coordination failures and enhancing overall independence and reputation. However, there are a number of caveats to be considered.

First, a unified structure of LOLR and supervision may lead to allocations where the LOLR deviates from Bagehot's principle of providing emergency liquidity only to illiquid but solvent banks and/or the supervisor may be too lenient by choosing not to act against insolvent banks. Such deviations from what is perceived to be the "optimal" conduct of LOLR and supervision result from the fact that each institution internalises the costs that a bank's failure has on the other. These deviations are akin to the concepts of *financial dominance* and *(excessive) supervisory forbearance* discussed in Section 2 and thus may represent important risks associated with a unified structure of supervision. In this spirit, Kahn and Santos (2005) show that a separation between the LOLR and the supervisor is desirable, especially when bank illiquidity is severe. This result hinges on the fact that a unified structure leads to excessive forbearance, since, by internalising the negative implications of a premature liquidation on the LOLR, the supervisor refrains from shutting down insolvent banks.

¹⁹ Note that the LOLR also works at preventing liquidity-driven runs. Since creditors anticipate that the bank would receive emergency liquidity, they no longer have the incentive to run (see Diamond and Dybvig, 1983).

An important element in Kahn and Santos (2005) regards the interpretation of the costs suffered by the LOLR in the case of a bank's premature liquidation. The authors take a political economy perspective and consider those costs as capturing the reputational concerns for the civil servant employed in each institution. In this case, as emerges from their analysis, the unified structure is inefficient as it distorts supervisors' actions. Similarly for the LOLR, if the provision of emergency liquidity to insolvent banks is driven by the LOLR internalising the reputational costs suffered by the supervisor in the event of a bank failure, then a unified structure would be dominated by a separated one. In these cases, the deviations in the LOLR and supervisor behaviour are likely not to lead to higher welfare.

However, the distortions in LOLR and/or supervisor behaviour could also emerge as a result of the fact that the unified structure allows them to take a broader perspective and internalise welfare costs, such as implications for systemic stability, negative spillovers to the real economy etc. In this case, the unified structure gets closer to the maximisation of social welfare and is then preferable. Thus, this argument is analogous to the one used in the discussion of the risks of *financial dominance* and *excessive supervisory forbearance* in Section 2.2. Distortions in what is perceived to be the "optimal" conduct of LOLR and supervision should not be seen as a risk *per se* and used as an argument against a unified structure. The reason for this is that such distortions may simply be a result of the LOLR and the supervisor choosing their actions by internalising the effects that their actions jointly have on welfare and, thus, maximising overall welfare. In the absence of frictions, given the above described achievements, a unified structure is indeed better.

The second caveat in the argument supporting a unified structure of LOLR and supervision concerns whether the unification in fact leads to more independent and less politically biased institutions.

Conceptually, the LOLR's decisions to act hinge on the size of the costs that the central bank bears in the event of a bank's failure. Political independence plays a role for the provision of emergency liquidity as it affects the costs associated with a bank's failure and, therefore, the LOLR's decision on whether and to whom to provide emergency liquidity. Hence, the key issue is to determine whether or not a unified structure leads to less political influence.²⁰

Finally, bringing the discussion to the current set-up in the euro area, it is important to point out that in the case of the unification of the central banking function and supervision, a unified structure would always translate into a centralised (supranational) institution, as it has been the case when the ECB has been assigned supervisory powers. In the case of the LOLR, however, this may not be the case in that unification of the LOLR and supervision could both result in a unified centralised institution and in a

²⁰ The same argument can be applied to the supervisor. If the LOLR is centralised and has a large political independence and strong reputation, then a unified structure allows extending those features to the supervisor, with the result of limiting the distortions in supervisory actions.

unified decentralised institution. In the current euro area framework the LOLR function (here strictly meant as emergency liquidity assistance – i.e., ELA), is not centralised and only the largest and most significant banks are supervised centrally by the SSM.²¹ This is an important point as the effects of having both the LOLR function and supervision in a single institution could be detrimental in terms of lower political independence if the unification leads to a less centralised (and so less independent) institution. We discuss the benefits and costs of centralised and decentralised supervision in detail in the next section.

4 Centralised versus decentralised supervision

In this section, we now consider the question of how the bank supervision agency should be organised. In particular, we will focus on the trade-offs associated with allocating supervision to a “central” authority rather than to a “local” authority.

There are two main examples of supervisory architectures with a central and a local supervisor. In the euro area, banks are directly supervised either by a national supervisor (local) or by the ECB, a supranational (central) supervisor. In the United States, banks can be supervised either by State supervisors (local) or by different Federal supervisors (central). In both cases, the supervisory architecture relies on both levels. In the euro area, the ECB is responsible for the supervision of the “most significant banks”, but supervisory activities are conducted by “joint supervisory teams” (JSTs) involving both ECB employees and national supervisors. The less significant banks are primarily supervised by national authorities.²² In the United States, State banks are primarily supervised by a State supervisor, but are in addition subject to the supervision of either the Federal Reserve or the Federal Deposit Insurance Corporation (FDIC), which are both Federal agencies.

Evaluating the benefits and costs associated with a specific supervisory structure requires disentangling the effects of a supervisor’s actions on banks’ behaviour. We also need to consider that the supervisor’s actions vary with the specific supervisory architecture in place.

The analysis in the next sections will follow exactly this structure. First, we study how supervisory architecture affects the actions of the supervisor. In doing this, we specifically focus on how central and local supervisors differ in terms of their ability to acquire information and their incentives to act on the basis of such information. Then, we highlight how these differences affect supervisory leniency

²¹ In the euro area, the main responsibility for the provision of ELA lies at the national level, with the National Central Banks concerned. For details about the regulation of emergency liquidity provision in the euro area, see https://www.ecb.europa.eu/pub/pdf/other/Agreement_on_emergency_liquidity_assistance_20170517.en.pdf?23bb6a68e85e0715839088d0a23011db.

²² The ECB oversees the supervision of less-significant banks carried out by national competent authorities, and has the option to intervene further, if necessary.

and, as a result, impact banks' decisions. We conclude with some open questions associated with supranational supervision in the euro area.

4.1 Why are central and local supervisors different?

Recent and robust evidence on the different behaviours of local and central supervisors is provided in the study by Agarwal et al. (2014). They use the fact that State-chartered banks in the United States are supervised by either a State or a Federal supervisor, on a rotating basis. The supervisor in charge issues a rating for the bank, known as a CAMELS rating, which summarises a bank's soundness and compliance with prudential regulation. Since the rotation mechanism is exogenous to the bank's financial condition, if State and Federal supervisors behaved in the same way there should be no difference between the ratings issued by both types of supervisors. The data lead the authors to reject this hypothesis: they show that Federal supervisors are twice as likely as State supervisors to downgrade the bank they supervise. The evidence thus points towards State supervisors (i.e. local supervisors) being more lenient than Federal ones (i.e. central supervisors).

How to explain this difference in supervisory leniency? There are two broad potential explanations for this discrepancy between central and local supervisors: i) the cost of collecting information about the health of the supervised bank is different; ii) different supervisors have different incentives to act on the information they collect.

a. Information

In terms of information collection, there are arguments supporting informational advantages for both supervisors. Conceptually, there are several reasons why local supervisors may be less efficient in collecting information than central supervisors, and therefore possibly miscalculate banks' risks. For example, local authorities may have fewer resources and have to rely on less numerous and/or less qualified staff than central supervisors. Not being able to offer sufficiently attractive salaries or career prospects can be particularly damaging for supervisory effectiveness, as it may create a gap of expertise between the supervisors and the bankers they supervise (Bond and Glode, 2014). Even with similar resources, central supervisors may be able to use them more efficiently. There are economies of scale in bank supervision (Eisenbach, Lucca, and Townsend 2016), so that a large central authority may be more efficient than smaller local ones. Also, a central authority has a broader view of the banking sector, which allows benchmarking the different banks against each other. This reduces informational asymmetries, which can be particularly advantageous as the banking sector becomes more complex. Finally, central supervisors keep a level playing field perspective which translates into consistent supervisory standards, more effective enforcement and less room for regulatory arbitrage.

Symmetrically, a number of arguments can be made supporting the view that local supervisors indeed do have some informational advantages. What local supervisors lose in economies of scale and scope, they may gain in specialisation: local supervisors can be expected to have a better knowledge of their local lending market, the legal and managerial structure of the banks they supervise, the specific products they offer, the securities they issue, etc. This is even more evident in the European case, in which banks in different countries operate in different languages and under different national laws and standards (despite significant harmonisation at the EU-level).

The evidence on the information advantage of supervisors is mixed. On the one hand, Rezende (2011) studies how State and Federal supervisors coordinate their inspections, and finds evidence that State supervisors with larger budgets are more likely to conduct independent inspections, while State supervisors with lower budgets are more likely to receive support from Federal supervisors, in particular for larger and more complex banks. This suggests that some local agencies may indeed suffer from insufficient resources to conduct supervision. On the other hand, Gopalan, Kalda, and Manela (2017) show that closing local branches of the Office of the Comptroller of the Currency (OCC), the Federal authority responsible for supervising nationally-chartered banks in the United States, leads neighbouring banks to take significantly more risks. This is remarkable because these banks are still supervised by the same agency, only the geographical location of their supervisor becomes more remote. Thus simple geographical proximity between banks and their supervisors seems to improve supervision. The importance of geographical proximity could be related to the key role played by on-site examinations in ensuring the stability of the system (Quintyn and Taylor, 2003). In a recent study, Delis and Staikouras (2011) analyse the relationship between the number of on-site inspections and bank risk and also suggests that there might be a minimum number of on-site audits that clearly reduce bank risk.

In the European context, the structure of the SSM, which relies on joint supervisory teams, aims to reap the informational advantage of local supervisors. The joint supervisory teams are supposed to build on the knowledge of national supervisors, and to collect and jointly analyse the relevant information. At the same time, the joint supervisory teams aim to retain the benefits linked to the geographical proximity between supervisors and the supervised institutions.

b. Incentives

Local and central authorities may have different mandates and objectives, giving them different incentives to exercise adequate supervision. Beck, Todorov, and Wagner (2013) study whether national bank supervisors in Europe give a larger weight to national shareholders and creditors than to foreign ones. Exercising tougher supervision on a bank is typically beneficial to creditors and harmful to shareholders. If the former are mostly foreign and the latter national, then a national supervisor may

be too lenient. Conversely, if the bank has more foreign shareholders than creditors, the national supervisor may be too tough. Analysing a global sample of supervisory interventions on banks during the Global Financial Crisis, the authors find evidence for national bias. In the European context this would imply that, to the extent that a supranational supervisor such as the ECB treated shareholders and creditors of different (European) countries equally, it should lead to a more stringent supervision of banks with more European foreign creditors.

Carletti, Dell’Ariccia, and Marquez (2016) model the Single Supervisory Mechanism by considering a supervisory architecture in which decisions are taken by a central supervisory authority, but information (on-site monitoring) is collected by local supervisors. If national and central supervisors do not share the same objectives, national supervisors anticipate that the information they provide to the central authority may be used against the national interests, a fact which decreases their incentives to collect information. The authors show that even if national supervisors tend to be too lenient with the banks they supervise, removing the decision power from the national level and giving it to a central authority may in the end lead to even more leniency, by reducing information collection. More generally, this paper suggests assessing the architecture of bank supervision through the lens of organisation theory (Aghion and Tirole 1997).

Repullo (2018) develops a theoretical framework to investigate the optimal allocation of responsibilities — i.e. information collection and liquidation decisions – between a local and a central supervisor. In the model, central and local supervisors differ in terms of the costs associated with these two functions: The cost of liquidating a bank is lower for a central supervisor than for a local supervisor, while the opposite holds for the cost associated with information acquisition. If the cost for the central supervisor to obtain information on banks’ health is low and, at the same time, the local supervisor’s bias is large, an optimal structure entails a hierarchical supervisory architecture in which the central supervisor takes the liquidation decision and the local supervisor collects information. On the contrary, when those costs exceed certain thresholds, allocating all powers to the central supervisor is optimal.

The results of the paper on the optimality of different supervisory architectures provide a rationale for the current design of the Single Supervisory Mechanism (SSM). The SSM resembles the hierarchical supervisory model characterised in the paper. The ECB (i.e. a central supervisor) is responsible for the supervision of significant banks in cooperation with local supervisors through the Joint Supervisory Teams (JSTs), while less significant banks are supervised only by local supervisors. Under the assumption that information acquisition for supervising large banks entails only a small cost advantage for a local supervisor relative to a central supervisor, while the risk of being exposed to regulatory capture is potentially very large, the implications of the model are consistent with the design of the SSM.

The fees levied by supervisors on the banks they supervise may also play an important role in shaping supervisory incentives. Using data on supervisory actions taken by the OCC and the Office of Thrift Supervision (OTS), Kisin and Manela (2018) show that banks that pay higher fees face more lenient supervision and are allowed to take more risk. They show that this is due to the large impact that these fees have on the budget of the supervisory authority, especially when supervising small and mid-size banks. Supervisors whose funding relies on supervisory fees are reluctant to take actions that would diminish a bank's assets (and hence the fees it pays), or even encourage the bank to change its charter and hence its primary supervisor ("regulatory shopping").

In the European context, this mechanism suggests additional benefits resulting from the structure of the SSM: i) a European multinational bank can move some of its assets to different subsidiaries in different countries and exert a form of regulatory shopping with national supervisors, but it cannot escape ECB supervision within the SSM, unless by moving its headquarter outside the euro area;²³ ii) the fees paid by a single large European bank may represent a large fraction of its national supervisor's funding, but it is less important for the central supervisor; iii) despite relying on supervisory fees for its functioning, the supervision arm of the ECB is ultimately backed by the central bank, and thus enjoys more funding independence (see related arguments in Section 3.2).²⁴

An important dimension to consider when analysing supervisors' incentives is the legal protection enjoyed by supervisors. This may be a very important consideration for supervisors when taking important decisions, like declaring a bank likely to fail or inducing changes in the composition of the bank's board. For example Viñals et al. (2010) introduced the concept of "will to act" which complements the "ability" to supervise. This *will to act* results from the operational independence of supervisors but also from their accountability, and, therefore, their legal protection. Khan (2018) argues that legal protection is particularly important to safeguard the independence of the central bank and the supervisory authority. At the same time, to preserve accountability, appropriate legal protection is needed and possibly closely related to the functions that are carried out by the supervisors. Relating these issues to the European case, it is important to note that there is no common approach to financial supervisory liability in the EU/euro area (see Dijkstra, 2012). As a consequence, a different legal protection framework may apply to supervisors working in a national supervisory authority or in the SSM which in turn may affect their incentives.

²³ In this paper we do not discuss in detail the relation between the SSM and banks headquartered outside the euro area.

²⁴ Related to this, it may be that the ownership structure of national supervisory authorities could also influence supervisors' incentives. Indeed, in some jurisdictions relevant shares of the capital of central banks/supervisory authorities are held by supervised entities. Some evidence based on the governance of central banks is provided in Adams (2017) and Black and Dlugosz (2018).

4.2 How do market participants react to central and local supervision?

Changing the supervisory architecture affects the behaviour of bank supervisors, and hence leads banks to adjust their strategies. The impact of a centralised architecture on bank behaviour ultimately depends on how supervision changes. The different effects can be classified into two groups.

a. Supervisory forbearance: The central supervisor is tougher

A first hypothesis is that, due to different incentives or to having a more effective organisational structure, a central supervisor is ultimately tougher on supervised banks than a local supervisor. As mentioned above, this hypothesis is supported by the findings by Agarwal et al. (2014) that show that Federal supervisors in the United States are less lenient than local (i.e. State) supervisors. How would this increased toughness affect commercial banks' behaviour? Specifically, how do banks' risk-profile and credit provision change when supervision becomes tougher?

In Europe, the establishment of the SSM provides a case study with which to investigate these issues. Fiordelisi, Ricci and Stentella Lopes (2017) show that, while the SSM was being implemented, the most significant banks (i.e. those banks affected by the change in supervisory authority) reduced their lending activities and increased their capital ratios in comparison with less significant banks (i.e. those banks below the asset threshold for supervision by the SSM). This is in line with the findings of Eber and Minoiu (2016), which show that SSM banks reduced their asset size and reliance on wholesale debt over the period 2012-15, compared with banks that did not fall under the supervision of the SSM. In particular, weaker banks reduced origination of new loans. SSM-banks adjusted their securities holdings more than their loan books: in particular, they sold sovereign bonds with lower yields. Indeed, while different sovereign bonds are treated similarly in the computation of capital ratios, selling a high-yield bond during the crisis implied the immediate recognition of a credit loss, which would presumably negatively affect profitability.

Both papers identify how banks reacted to the Comprehensive Assessment exercise carried out before the SSM officially took over bank supervision at the end of 2014 and how they acted in anticipation of ECB supervision. Fiordelisi, Ricci and Stentella Lopes (2017) interpret their findings as evidence that SSM banks anticipated that the ECB would be tougher than national supervisors, and wanted to increase their capital ratios before the change.

b. Supervisory bias: The central supervisor is less nationally-oriented

A somewhat different effect of a centralised supervisory architecture is that it may reduce the national bias in supervision. Colliard (2015) proposes a model of central versus local supervision that studies the consequences of the biases identified in Beck, Todorov, and Wagner (2013): If local supervisors

are too lenient with banks that have too many foreign creditors, this should limit the ability of banks to borrow from foreign agents, who fear their interests will not be protected by national authorities. Conversely, introducing a central supervisor should remove this barrier, and allow banks to borrow more easily internationally, and at lower rates. Central supervision would, as a result, indirectly contribute to financial integration. Barbiero, Colliard and Popov (2017) provide some supporting evidence based on changes in the liability structure of euro area banks, which may have been brought about by the implementation of the SSM. They show that banks supervised by the SSM pay lower deposit rates to their customers – both households and non-financial corporations. Moreover, they find that these banks also changed somewhat the composition of their liabilities, reducing reliance on deposits and increasing securities issuance, which is consistent with a positive market signalling effect arising from the SSM “certification.”

Central supervision can have additional effects on financial integration through the structure of multinational banks (MNBs), which have subsidiaries and branches in different countries. In most jurisdictions, when a principle of multiple recognition is in place, a subsidiary of a bank in a foreign (host) country is supervised by the host country’s supervisor, whereas a branch is still supervised by the home country. Calzolari, Colliard, and Loranth (2017) study the impact of the centralisation of supervision on the structure of MNBs. Under local supervision, the different subsidiaries of a MNB in different countries are supervised by different national supervisors, who may have conflicting objectives.²⁵ The authors highlight two different externalities that are not internalised by the local supervisor of a subsidiary: (i) A monitoring externality: by carefully monitoring the subsidiary, the foreign supervisor generates useful information for the home supervisor. Due to this effect, a supranational supervisor would optimally exert more monitoring than the local supervisor of the foreign unit; (ii) An intervention externality: supervisory interventions in the foreign unit reduce its profitability, so that lower revenues can be used to offset potential losses in the home unit of the MNB. Due to this effect, a supranational supervisor would optimally be more lenient with the foreign unit than the local supervisor. The impact of supranational supervision depends on the balance between these two externalities. For banks where the monitoring externality dominates, supranational supervision becomes tougher on subsidiaries, which gives an incentive to use a branch structure rather than a subsidiary structure. For banks where the intervention externality dominates, supranational supervision is more lenient on subsidiaries, which gives an incentive to use this structure rather than a branch.

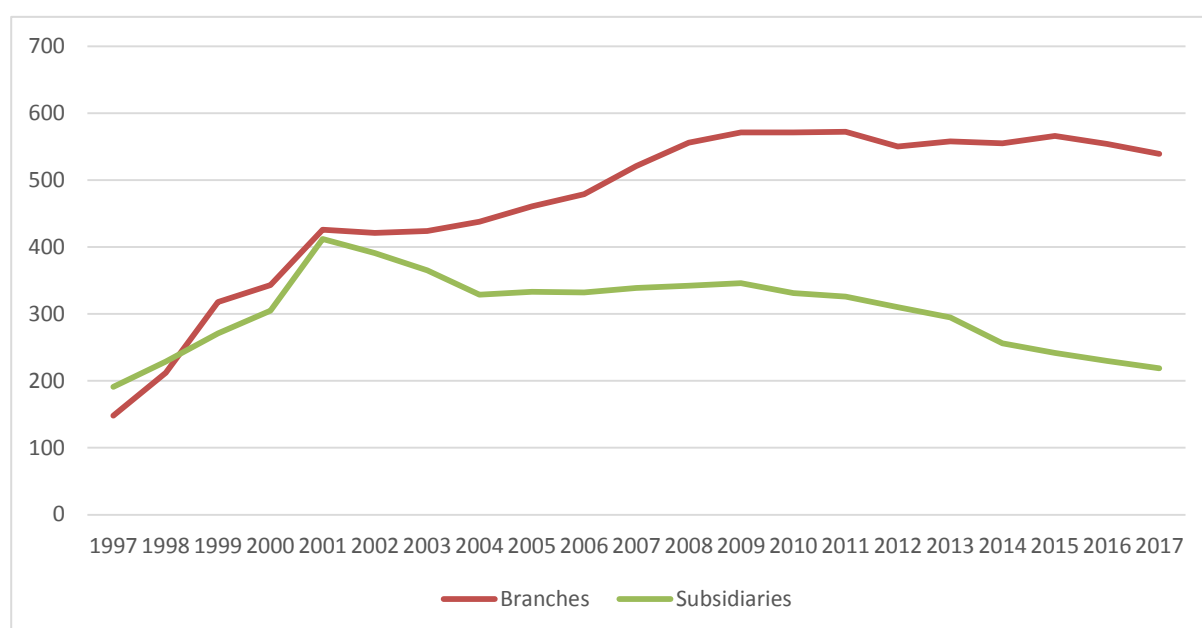
An implication of the analysis is that, by inducing a change in the MNB’s structure, centralising supervision changes the allocation of losses in the case of a bank failure. More specifically, the shift from subsidiaries to branches increases the burden on the deposit insurance fund of countries that host

²⁵ See also Calzolari and Loranth (2011) and Holthausen and Ronde (2004).

more headquarters, whereas the shift from branches to subsidiaries leads to the opposite. Moreover, this strategic change of an MNB's structure can be inefficient. To solve this problem, the authors suggest making deposit insurance premia dependent on the MNB's structure, as ultimately MNBs' decision to change their structure reflects the possibility of extracting (implicit) subsidies from the deposit insurance funds. One can also interpret this finding as implying a need for centralised deposit insurance. This is a relevant point as it hints at the need for coordination between reforms to the supervisory architecture and policies focusing on the design of deposit insurance funds.

The figures on the number of cross-border branches and subsidiaries in the euro area relating to the implementation of the SSM suggest limited changes in the structure of multinational banks possibly linked to the centralisation of supervisory powers. As shown in Chart 2, the number of subsidiaries did indeed decline over the last few years, while the number of branches remained substantially stable.

Chart 2: Cross-border branches and subsidiaries in the euro area



Source: ECB, Banking Structural Financial Indicators

4.3 Optimal and equilibrium supervision architecture

Given how the chosen architecture affects bank supervision, and thus indirectly bank behaviour, we now move to the question of when it is more efficient to allocate bank supervision to a central authority. Then, we discuss to what extent banks can influence the way they are supervised, and thus potentially undo the effect of central supervision.

a. Optimal supervisory architecture

The optimality of centralised supervision crucially depends on the frictions that central supervision is supposed to resolve. In Beck and Wagner (2016), national supervisors do not take into account cross-border externalities. Thus, the benefit of a centralised (supranational) supervisor is that it internalises these externalities. The cost of centralising supervision, in their framework, is that uniform standards are applied to banks in countries that may (significantly) differ in terms of preferences regarding supervision. Such heterogeneity is captured, for example, by differences in bank failure costs. Beck and Wagner (2016), then, argue that centralised supervision is optimal if cross-border externalities are large relative to the heterogeneity of preferences across countries.

In Colliard (2019), the benefit of central supervision is still represented by the internalisation of cross-border externalities, but the cost is that tougher supervision by a central supervisor may encourage the bank to hide more information from supervisory authorities.²⁶ The optimal supervisory architecture seems to depend therefore on the banks that are supervised, in particular on whether their business model makes it likely that they can easily hide risks from the supervisors.

Interestingly, neither theory suggests that larger banks should be supervised centrally, even though this is the main criterion for European banks to be part of the SSM. The reason is that, in those papers, both the costs and the benefits of centralised supervision can be scaled up with size. This argument implies that a non-monotonic relationship between the optimality of centralised supervision and size may emerge. Whether this is the case is ultimately an empirical question as benefits and costs of centralised supervision, as well as their relationship with size, may significantly vary across jurisdictions and legal systems. Similarly to bank size, it is also not clear whether the supervision of riskier banks would benefit the most from central supervision. In Colliard (2019), the riskiest banks are such that both central and local supervisors want to take a supervisory action against them. Conversely, no supervisor wants to act against a very safe bank. Centralisation of supervision thus implies a difference only for intermediate banks, which are treated more leniently by local

²⁶ Behn, Haselmann, and Vig (2015) empirically identify a similar trade-off for bank bail-outs. They consider German savings banks, in which local politicians sit on the board. A politician's relationship with the bank is a source of information, which can be used for deciding whether a failing bank should be bailed-out. At the same time, this proximity may result in the politician being too generous with the bank. Empirically, it appears that the second effect dominates and that this structure leads to distorted bail-out decisions.

supervisors. Both size and riskiness are criteria in line with the idea that central supervision can reinforce the supervision framework (by having a more effective organisational structure and ensuring a level playing field) rather than changing the incentives or the mandate of supervisors.

An additional complication is that the allocation of a given bank to either local or central supervisors is a dynamic problem. Colliard (2019) shows that central supervision should make it easier for banks to attract foreign funding, which implies that moving to centralised supervision would result in more internationally integrated banks. Since international integration is itself a source of cross-border externalities and a rationale for centralising supervision, an implication is that centrally supervised banks may endogenously adapt in a way that makes it optimal to supervise them centrally.²⁷ Conversely, adopting a static view of which bank should fall under central supervision runs the risk of being trapped in an inferior equilibrium: banks are poorly integrated because supervision is fragmented, and supervision is fragmented because the low level of integration does not justify centralised supervision.

The analysis of Lucas, Schaumburg and Schwaab (2018) also supports the view that allocating banks to either central or local supervision is essentially a dynamic problem. While Colliard (2019) emphasises the role of cross-border activities by banks, the analysis by Lucas and co-authors hinges on the fact that bank business models evolve over time, depending on the market conditions (e.g. crisis versus non-crisis times), and in response to changes in the yield curve (see Box 3 for the details of the analysis). Understanding changes in bank business models and, relatedly, the implications for level and sources of risk is key to designing and implementing an optimal supervisory framework.

²⁷ There is a parallel with the idea that economies sharing the same currency will become more correlated over time and may endogenously become an optimal monetary area (Frankel and Rose, 1998).

Box 2: Understanding bank business models

*prepared by Bernd Schwaab**

Not all banks are the same. To better understand observed differences across banks, one option is to create a smaller number of peer groups, or clusters, into which to classify the banks appropriately. Robustly constructing such peer groups for a large number of banks, taking into account the numerous balance sheet items for each bank and a range of time periods, is not a straightforward matter, however. In a recent paper, Lucas, Schaumburg and Schwaab (2018) present a novel modelling framework for reliably classifying banks into a smaller number of peer groups, each reflecting a different bank business model. Their analysis extends standard clustering analysis to a multivariate panel data setting and accommodates time varying group characteristics. This novel feature makes the framework particularly applicable for financial stability surveillance and microprudential supervision purposes.

Using data for 208 European banks over the period Q1 2008 to Q4 2015, Lucas et al. (2018) classify banks into six different business model groups: 1) large universal banks, including globally systemically important banks (G-SIBs); 2) international diversified lenders; 3) fee-based banks/asset managers; 4) domestic diversified lenders; 5) domestic retail lenders; and 6) small international banks. The business model classification is constructed based on the assumption that banks differ along six dimensions: size, complexity, activities, geographical reach, funding strategy and ownership. A number of indicators are then used to classify the banks: banks' total assets and leverage with respect to CET 1 capital as measures of size; the net loans-to-assets ratio, risk profile, assets held for trading and the size of banks' derivatives books as capturing banks' complexity; the share of net interest income, share of net fee and commissions income, share of trading income, and share of retail loans to total loans to measure banks' sources of revenue; the ratio of domestic loans to total loans to measure banks' geographic dimension; the loans-to-deposit ratio to capture banks' funding structure; and finally a categorical variable to take into account banks' organisation and ownership structure.

The classification obtained using these variables suggests that European banks' responses to the 2007-09 global financial crisis and the 2010-12 euro area sovereign debt crisis differed across business model groups. For example, smaller and more traditional banks appear to have been less negatively affected by either crisis. By contrast, large and internationally active banks were relatively more affected. Following the crises, smaller and more traditional banks could increase leverage and expand their balance sheets more aggressively.

Studying the differential behaviour of bank business model groups can further help to deepen our understanding of the effects of financial shocks. In particular, banks with different business models differ in their response to changes in the yield curve. For example, traditional banks with high

deposit-to-loans ratios appear to be particularly affected by negative short term interest rates. The analysis thus allows studying monetary policy transmission in more detail, and the potential risks to financial stability that need to be assessed.

* European Central Bank

b. Equilibrium architecture

As the supervisory architecture specifies the conditions under which a bank is supervised either by a local or by a central authority, banks may strategically choose whether to fulfil these conditions. This depends on whether central supervision is more profitable than local supervision from the point of view of the banks to be supervised.

In general, the effect of central supervision on bank profitability is ambiguous. If the central supervisor is tougher than the local supervisor, for example by imposing higher capital requirements for riskier but more profitable activities, banks' profitability may decrease over the short term. However, a certification effect arising from tougher supervision could allow banks to borrow at lower rates from (foreign) creditors, which would increase profit margins. For example banks operating in countries with a deficit of savings that need to borrow heavily from foreign investors may have a beneficial impact on profitability from centralised supervision.

A more strictly supervised bank may manage its assets better, as it benefits from the extra expertise of bank examiners. In line with this idea, Rezende and Wu (2014) show that more frequent supervisory examinations in the United States have a positive causal effect on banks' return on equity. Hirtle, Kovner, and Plosser (2018) show that an increase in supervisory oversight reduces the riskiness of the bank's assets, without negatively affecting the average return, and is thus profitable for the bank. In reality, banks can, to some extent, choose their supervisors. For instance, in 2015, Citigroup Inc. combined its subsidiaries in Dublin and in London to form a new unit large enough to be subject to ECB supervision. While this move was probably not primarily driven by the objective to fall under ECB supervision, it is clear that Citigroup had the opportunity to keep the status quo and remain supervised at the national level only. More recently, Goldman Sachs considered moving more of its European assets to its Frankfurt subsidiary, so as to fall under ECB supervision.^{28,29} In 2018, Nordea decided to move its headquarters from Sweden to Finland and therefore enter the Banking Union and fall under SSM supervision. The decision was motivated with an emphasis on the benefits arising

²⁸ See <https://www.bloomberg.com/news/articles/2015-12-07/citigroup-said-to-fall-under-ecb-supervision-after-units-combine> and <http://uk.reuters.com/article/us-britain-eu-goldmansachs-exclusive-idUKKBN13435B>.

²⁹ This strategic use of size thresholds has been documented also for other types of financial regulations. Ivanov, Ranish, and Wang (2017) show that US banks avoid syndicated loan deals involving more than two banks, in order to avoid detailed loan-level supervision by bank examiners. See also Chhaochharia, Otto, and Vig (2011) on threshold effects of the Sarbanes-Oxley Act.

from group supervision (same supervisors for the entire group) and a level playing field with other, similar, multinational banks.³⁰

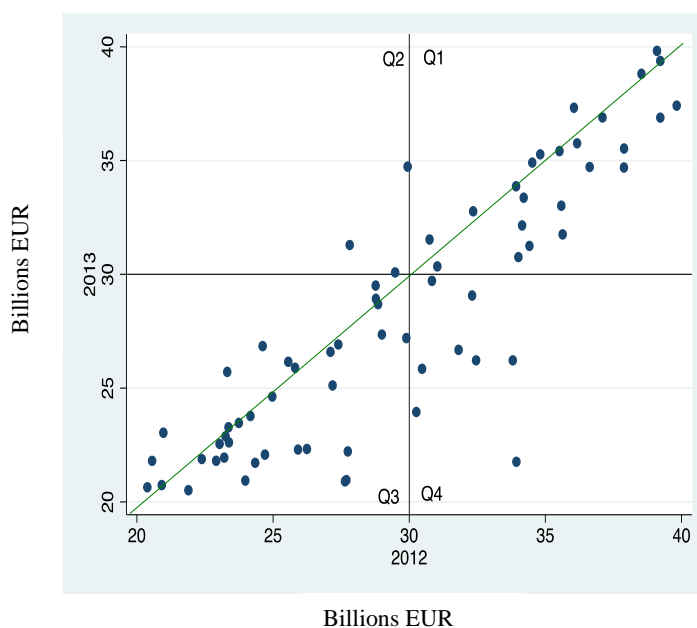
This problem has an equivalent in the United States, where banks can change their charter to be subject to a different Federal supervisor. For instance, a State bank that becomes a national bank can replace the FDIC, or the Federal Reserve, with the OCC as its supervisor. A State bank can also join the Federal Reserve System and replace the FDIC with the Federal Reserve. Rosen (2005) highlights the positive aspect of this competition between US Federal supervisors, and shows that banks that switch supervisor increase their return without failing more often. However, Rezende (2016) shows that supervisors give more favourable ratings to banks that just switched charters, which suggests some regulatory arbitrage.

In this vein, Ben-David *et al.* (2018) use the centralisation of banking supervision in Europe to test for banks' strategic behaviour. More specifically, they exploit the announcement of a threshold-based selection criterion for centralised bank supervision. In late 2012 the European authorities publicly disclosed the transfer of banking supervisory responsibilities of large banks from the national to a supranational authority. By the end of 2014, banks with assets larger than 30 billion Euro were no longer supervised by their national competent authorities but by the European Central Bank.

Ben-David *et al.* (2018) show econometric evidence suggesting that following this announcement on the transfer of banking supervisory responsibilities some banks behaved strategically and seem to have “chosen” their supervisors. Some European banks that in 2012 were just above the threshold (30 billion Euro) strategically shrank their assets during 2013 (see Chart 3 for a simplified illustration). At the same time, some banks just below the asset threshold in 2012 also decreased substantially their assets perhaps fearing that they might be supervised by the ECB if they were sufficiently close, but below, the threshold. Compared with their peers, banks exercising strategic behaviour showed over time greater increase in impaired loans and greater reduction in liquid assets. The authors argue that banks probably expected the SSM supervision to be “tougher” or “more intrusive” than national supervisors.

³⁰ See the press release “Why we propose to move into the Banking Union”, <https://www.nordea.com/en/press-and-news/news-and-press-releases/news-group/2018/why-we-propose-to-move-into-the-banking-union.html>

Chart 3: Change in bank' size during the implementation of the SSM



Source: Ben-David et al. (2018). Note: Dots in this Chart depict euro area banks with the total assets ranging from 20 to 40 billion EUR. For each bank, the Y axis shows its total assets in 2013 while the X axis represents its total assets in 2012.

Finally, an important way for banks to avoid stricter supervision is lobbying. Lambert (2015) shows that US supervisors are less likely to take action against lobbying banks, even though they are riskier and more likely to fail than non-lobbying ones. This evidence would support the presence of regulatory capture.³¹

Would central supervision be more robust to regulatory capture than local supervision? Consider a supervisory action that would hurt the profits of all euro area banks. For such an issue, all else being equal, the central supervisor is less robust to capture, as the lobbying efforts of all affected banks can focus on the same agency and thus add up. If instead one considers an action that would harm some banks but be profitable to others, the central supervisor is actually more robust to capture, as the lobbying efforts of the banks with opposite objectives offset each other.

Relating to this discussion to the European context, the hybrid structure of the SSM may make lobbying more difficult and reduce its effect. The increased geographical and cultural distance between banks and the central supervisor may decrease the ability of banks to influence supervisory

³¹ Another important concern is the presence of *revolving doors*, where bank supervisors are overly lenient with the bank they supervise and are then hired by the same bank as a reward. While worker flows between banks and regulatory agencies are important, the pattern of these flows does not seem to correspond to the revolving doors hypothesis (Lucca, Seru, and Trebbi, 2014).

outcomes by resorting to political and/or financial networks, which are prevalent at the country level (Faccio, 2006). At the same time, as the size of the supervisor increases, lobbying for a more lenient treatment might be more costly, since the size of the contribution to obtain preferential treatment is positively correlated with the size of the supervisor (de Figueiredo and Richter, 2014).

4.4 Open issues and challenges

We conclude this section with a brief overview of some of the challenges associated with centralised supervision, and on which there is so far little research.

a. Governance

The SSM is one of the few examples of a truly supranational bank supervisor. The ECB's supervision arm is headed by a Supervisory Board which currently consists of 32 members (Chair, Vice-Chair, four representatives of the ECB, and representatives of national supervisors in each participating country). In addition, there is a leaner Steering Committee with 8 members. Only five countries are represented on the steering committee, on a rotating basis that partly reflects the different sizes of the different countries.

In the context of monetary policy decisions, there is some research showing that the rotation system of the FOMC matters, in that some voting members seem to be biased towards their own district (Jung and Latsos, 2015; see also Bouvet and King, 2013 for recent European evidence). While the question has never been empirically studied for bank supervision, the potential for a similar bias exists.

Different countries may not derive the same gains or costs from common supervision. For example, if decisions taken by the SSM reflect some average preference regarding bank stability across the participating countries, then countries with preferences far away from the mean may lose out (Beck and Wagner, 2016). In the framework of Calzolari, Colliard, and Loranth (2017), countries that are home to large multinational banks face more pressure on their national deposit insurance funds as centrally supervised MNBs convert their foreign subsidiaries into branches. However, they do not recover the control over supervision of these foreign units, since supervision is in the hands of the central supervisor. This combination could represent a net loss for these countries.³²

These issues can be important for the balance of interests between different countries in the governance of the SSM, and they may also matter for its geographical extension. Indeed, while the

³² The discrepancy between the level at which deposit insurance is provided and the level at which supervision is conducted is a unique feature of the current set-up in the euro area, due to the lack of a full deposit insurance scheme at the banking union level. In the United States, access to Federal deposit insurance is consubstantial with having a Federal supervisor. See also Gornicka and Zoican (2016) on how the use of national vs. supranational public funds for bank resolution impacts bank risk-taking.

current extension of the banking union is limited to the euro area, it is in principle open to other EU countries.³³ Whether additional countries have an incentive to join is not obvious. Dell’Ariccia and Marquez (2006) observe that it is difficult to complete “partial” regulatory unions. Indeed, the main incentive to join such union is at the beginning: each country adopts stricter regulations, in exchange for other countries adopting the same regulations and making their banks safer. The cost of joining is a loss in national decision power, and the benefit is lower externalities imposed by unsound banks in neighbouring countries. However, once a regulatory union has been formed, a country outside of the union already enjoys the benefits of foreign banks being safer, but still faces the cost of joining. This creates an incentive to free-ride on an existing regulatory union.

The Basel agreements are the best example of a regulatory union that has been successful at overcoming this problem. While the Basel agreements were initially foreseen for G-10 countries only, the number of countries following the Basel standards has gradually increased over time (see Financial Stability Institute, 2015 for recent figures). A key factor in this successful extension is that adopting the Basel standards has come to be seen as an important “stamp of quality” for a banking sector. Similarly, the extension of the SSM to additional countries may crucially depend on the SSM building a strong enough reputation for efficient bank supervision.

b. Public perception and reputation effects

Private incentives have a crucial role in shaping supervisors’ actions. Boot and Thakor (1993) show that, when the supervisors care about their own reputation and their ability is not perfectly observable by the public, the desire to be recognised as capable distorts their actions. This in turn may raise bank risk-taking incentives, fostering bank instability and increasing the costs associated with public guarantees to banks and bank resolution. As, for various reasons, private incentives may differ between local and central supervisors, they could be an important factor in explaining the differences in their behaviours.

It is important for bank supervisors to build a reputation for being tough and proactive, so as to make preemptive runs on banks unnecessary. This goal greatly complicates the task of the supervisor. For instance, during the ECB’s 2014 Comprehensive Assessment, markets perceived a tough assessment of the European banking sector as a condition to establish the ECB’s credibility. At the same time, doubts were raised about the opportunity to balance this need with the appropriate timing of the regulatory actions needed to address problems in the banking sector (see e.g. Steffen, 2014 for a discussion).

³³ See <http://bruegel.org/2016/02/should-the-outs-join-the-european-banking-union/> for a discussion.

Concerning the issues analysed in our study, a key question is whether reputation management is different at the local and at the central level. In Morrison and White (2013), reputation problems create an incentive for bank supervisors to be lenient with banks. For instance, closing down a bank may signal to the market that the supervisory agency is slow to detect problems in the banking sector, and cause a loss of reputation. If this loss is large enough, it may trigger a run on other banks, so that the supervisor is better off not closing down the bank in the first place. One may fear that centralising supervision makes this problem worse: as the supervisor is in charge of more banks, the impact of a reputational hit is higher, and the incentives to hide problems stronger. At the same time, building a reputation for good supervision should also be quicker. While the total effect on incentives to be tough or lenient is unclear, it seems that in any case centralising supervision increases the stakes of reputation management.³⁴

Despite a growing literature on reputation and communication in the context of stress-test exercises (see Goldstein and Sapra, 2014), the issue of reputation management by bank supervisors is not well analysed yet. In particular, there is no existing research on the type of supervisory architectures which may help reputation building.

c. Other factors impacting on effective supervision

Another possibly relevant consideration to the quality of supervision might be how supervision is practically implemented. Following the crisis, in 2012, the Basel Committee on Banking Supervision completed its review of the core principles for effective banking supervision. These principles include most angles of supervisory practice. While these principles refer broadly to concepts such as effective internal corporate governance of supervision, a crucial component is how the institutional settings *within* the organisation impact on the incentives of supervisors.

For instance there is extensive evidence showing that incentives within bureaucracies, such as supervisory bodies, are often biased. Due to a market failure related to agency problems, this evidence shows that employee performance assessment within bureaucracies is not conducive to more effective supervision (Prendergast, 2007).

Hence, a carefully designed and institutional setting of the supervisory agency is warranted in order to minimise supervisory biases. In this respect, accountability and appropriate internal corporate

³⁴ As for the SSM, all the cases of “failing or likely to fail” called by the ECB since the establishment of the SSM (Banco Popular, Popolare di Vicenza, Veneto Banca, ABLV) seem to have rather contributed to building the reputation as a tough supervisor. At the same time, it should be acknowledged that this is probably due to the fact that, during these first years of activity of the SSM, the causes leading to those banking crisis were perceived more as a legacy from pre-SSM supervision.

governance seem to be important factors that must be emphasised, particularly for large supervisory agencies.

One concrete example in this respect could be the creation of an internal group, largely independent and responding directly to the head of the institution, assessing the quality and alignment of supervisory standards across the institution.

5 Concluding remarks

In this paper, we have highlighted the benefits and costs associated with different supervisory architectures. The discussion in the paper suggests that an optimal architecture of supervision should contain some key elements.

Concerning the integration of monetary policy and supervisory functions, benefits seem tangible, while costs may be limited and could be minimised with an adequate organisational design. The benefits of an integrated structure of monetary policy and supervision mostly hinge on the better coordination of policies and the easier flow of information that a structure of this type allows. Coordination between the central bank and the supervisor enables each authority to account for the potential “side-effects” that its policy has on the other authority’s objective, thus reducing the scope and severity of the inefficiencies associated with a coordination failure. A regular flow of information between the monetary policy and supervisory authority increases the set of available information to each authority and makes it possible to consider a broader perspective when taking policy decisions. Regarding the potential costs associated with an integrated structure of monetary policy and supervision, we argue that, as long as the process of integration does not shrink the set of available tools to achieve the two policy objectives, and it is associated with a sufficient increase in the staff count and training, monetary policy and supervision would not be less effective in pursuing their respective objectives in an integrated structure rather than in a separated one. We provide some suggestive evidence based on a global sample of countries that an integrated model is not associated with heightened price or financial instability.

Achieving the integration of monetary policy and supervision by placing the supervisory authority within the central bank has the additional advantage of shielding the supervisor from political pressure and regulatory capture. Being part of the same institution as the central bank, the supervisor can benefit from the political independence and reputation of the monetary authority. In this case, an integrated structure of monetary policy and supervision can effectively reduce the conflicts of interest arising from the proximity of supervisors, political bodies and regulated entities, which should result in more effective supervision.

In relation to the supervision structure, centralisation of supervision seems to entail significant benefits in terms of fewer opportunities for supervisory arbitrage by banks and lower informational asymmetry. The use of common and standardised rules and data to assess banks' health drastically reduces the possibility of regulatory/supervisory shopping for banks. Furthermore, a large central supervisor can take advantage of economies of scale and scope in supervision and gain a broader perspective on the stability of the banking sector as a whole. For example, it can benchmark the different institutions against one another, thus reducing informational asymmetry and, in turn, improving financial stability.

Potential drawbacks of a centralised supervisory structure are the lack of specialisation of central supervisors relative to local supervisors and the increased distance between the supervisor and the supervised institutions. These may translate into a more limited knowledge of the markets in which banks operate, their organisational structures and of the products they offer. There is little empirical evidence on how material these costs are. However, it seems that such concerns could be addressed by adequately designing the organisational structure of the centralised supervisor.

In the euro area, with the establishment of the SSM, the supervision model resulted in an integrated and centralised structure. Supervision now resides within the ECB and supervisory standards and rules are defined at a central and supranational level. Nonetheless, in practice, there are several elements in this structure that make the SSM a hybrid arrangement, i.e. not fully integrated in the monetary policy authority, and not fully centralised. These elements are:

1. the SSM resides within the ECB, but a strict *separation principle* applies: Supervisory and monetary policy objectives are clearly separated, as well as the decision bodies and operational units;
2. the SSM directly supervises only significant institutions, but less significant ones are supervised indirectly (by local supervisors) following a common rulebook;
3. the SSM sets harmonised standards and rules on reporting, but relies for their collection on national supervisory authorities.

While this hybrid structure allows exploiting some of the benefits of coordination between monetary policy and supervision, even more coordination and interactions, especially at the operational units level, would be desirable. This in fact would improve the transfer of information between the central bank and the supervisors, which is desirable in both ways. A more intense transfer of information from the central bank to the supervisor would allow the latter to incorporate into its decisions crucial information regarding important macroeconomic variables, thus leading to a broader perspective of the financial institutions and markets. Symmetrically, improving the transfer of information on financial institutions and markets from the supervisors to the monetary policy units would also have

beneficial consequences by improving the conduct of monetary policy and the lender of last resort intervention. In particular, the latter would benefit from detailed information on individual institutions' health, as this would prevent a misuse of central bank liquidity and so minimise the associated distortions of banks' risk incentives.

Currently, emergency central bank liquidity can only be provided to banks as long as the supervisor assesses them to be solvent. This is done by the SSM for significant banks and by local supervisors for the less significant ones. Thus, this structure introduces the risk of potential disparity in the conditions to access central bank liquidity for banks and may, in turn, lead to distorted bank behaviours. As highlighted in the previous sections, there is some evidence supporting the idea that banks consider the SSM to be tougher than national supervisory authorities. Under this scenario, banks close to the thresholds for SSM supervision may have incentives to shrink their size so as to be subject to the more lenient assessment by national supervisors.

These considerations call for a more consistent approach in setting the requirements, standards and criteria of assessment applied to SSM and non-SSM banks. In other words, it is not only important that harmonised, and proportional, rules and standards exist, but also that those rules and standards are applied consistently across countries and banks. At the same time, it would be important to strive for more aligned incentives between central (SSM) and national supervisors. The harmonisation of the legal protection of national supervisors could represent a useful intervention to achieve more consistency in supervisory standards. Similarly, the inclusion of additional criteria, such as a reference to the bank business model, to those determining whether or not a bank falls under SSM supervision, may be beneficial in limiting the strategic behaviour of regulated intermediaries.

Overall, going forward, the challenge is to strike the right balance between higher supervisory independence, broader perspective and more effective organisational structure that is associated with a centralised supervisor, residing within the central bank and exploiting the superior information of national supervisors.

REFERENCES

- Acharya, V., Eisert, T., Eufinger, C. and Hirsch, C. (2017): “Whatever it takes: The Real Effects of Unconventional Monetary Policy”, *Safe Working Paper Series*, No 152.
- Adams, R.B. (2017): “Good News for Some Banks”, European Corporate Governance Institute (ECGI), *Finance Working Paper*, No 502/2017.
- Agarwal, S., Lucca, D., Seru, A. and Trebbi, F. (2014): “Inconsistent regulators: Evidence from banking”, *Quarterly Journal of Economics*, 129(2).
- Aghion, P., and Tirole, J. (1997): “Formal and real authority in organizations”, *Journal of Political Economy*, 105(1), 1-29.
- Alcaraz, C., S. Claessens, G. Cuadra, D. Marques-Ibanez and H, Saprizza, (2018), “Whatever it takes. What’s the impact of a major nonconventional monetary policy intervention?,” BIS Working Paper No 749.
- Ampudia, M. and Van den Heuvel, S. (2018): “Monetary policy and bank equity values in a time of low interest rates”, *Working Paper Series*, No 2199, ECB.
- Angelini, P., Neri, S. and Panetta, F. (2011): “Monetary and macroprudential policies”, *Working Paper Series*, No 1449, ECB.
- Angelini, P., Neri, S. and Panetta, F. (2014): “The Interaction between Capital Requirements and Monetary Policy”, *Journal of Money, Credit and Banking*, 46(6), 1073–1112.
- Angeloni, I. and Faia, E. (2013): “Capital Regulation and Monetary Policy with Fragile Banks”, *Journal of Monetary Economics*, 60(3), 3111-382.
- Bagehot, W. (1873): “Lombard Street: A Description of the Money Market”, H.S. King.
- Barbiero, F., Colliard, J.E. and Popov, A. (2017): “Prudential Supervision and Bank Funding: Evidence from the Implementation of the SSM”, work in progress.
- Basten, C. and Mariathasan, M. (2018): “How Banks Respond to Negative Interest Rates: Evidence from the Swiss Exemption Threshold”.
- Bean, C., Paustian, M., Penalver, A. and Taylor, T. (2010): “Monetary Policy after the Fall”, *Macroeconomic Challenges: The Decade Ahead*, Proceedings of the Federal Reserve Bank of Kansas City Economic Policy Symposium, Jackson Hole, Wyoming, August 26–28.
- Bech, M. and Keister, T. (2017): “Liquidity Regulation and the Implementation of Monetary Policy”, *Journal of Monetary Economics*, 92, 64-77.
- Beck, T., Todorov, R. and Wagner, W. (2013): “Supervising cross-border banks: theory, evidence and policy”, *Economic Policy*, 28(73).
- Beck, T. and Wagner, W. (2016): “Supranational supervision: How much and for whom?”, *International Journal of Central Banking*, 12(2), 221-268.
- Behn, M., Haselmann, R., Kick, T. and Vig, V. (2015): “The political economy of bank bailouts”, *IMFS Working Paper Series*.

Ben-David, I., Cerulli, G., Fiordelisi, F. and Marques-Ibanez, D. (2018): “Seeking My Supervisor: Evidence from the Centralization of Banking Supervision in Europe”.

Bernanke, B.S. (2007): “Central Banking and Bank Supervision in the United States”, speech given at the Allied Social Science Association Annual Meeting, Chicago, Illinois, available at <https://www.federalreserve.gov/newsevents/speech/bernanke20070105a.htm>.

Beyer, A. and Homar, T. (2019): “Supervisory Information and the conduct of monetary policy”, mimeo, ECB.

Beyer, A., Nicoletti, G., Papadopoulou, N., Papsdorf, P., Rünstler, G., Schwarz, C., Sousa, J., and Vergote, O. (2017): “The transmission channels of monetary, macro- and micro prudential policies and their interrelations”, *Occasional Paper Series*, No 191, ECB.

Bindseil, U. (2013): “Central bank collateral, asset fire sales, regulation and liquidity”, *Working Paper Series*, No 1610, ECB.

Bindseil, U., and Lamoot (2011): “The Basel III framework for liquidity standards and monetary policy implementation”, Discussion Paper 2011-41, Humboldt Universität Berlin, SFB 649,.

Black, L., & Dlugosz, J. (2018). Public service or private benefits? Bankers in the governance of the Federal Reserve System. Available at SSRN: <https://ssrn.com/abstract=2828340> or <http://dx.doi.org/10.2139/ssrn.2828340>

Bodenstein, M., Guerrieri, L. and LaBriola, J. (2018): “Macroeconomic policy games”, *Journal of Monetary Economics*.

Bond, P. and Glode, V. (2014): “The labor market for bankers and regulators”, *Review of Financial Studies*, 27(9), 2539-2579.

Boot, W.A. and Thakor, A. (1993): “Self-Interested Bank Regulation”, *American Economic Review, Papers and Proceedings*, 83(2), 206-212

Bouvet, F. and King, S. (2013): “Do national economic shocks influence European Central Bank interest rate decisions? The impact of the financial and sovereign debt crises”, *Journal of Common Market Studies*, 51(2), 212-231.

Brunnermeier, M.K. and Koby, Y. (2016): “The reversal interest rate: An effective lower bound on monetary policy”, unpublished paper, Princeton University.

Buch, C. (2014): “The banking union - setting the course for better integrated and more stable financial markets in Europe?”, speech by Prof Claudia Buch, Deputy President of the Deutsche Bundesbank, at the 19th Handelsblatt Annual Conference, available at https://www.bundesbank.de/Redaktion/EN/Reden/2014/2014_09_04_buch.html.

Calzolari, G., Colliard, J.-E. and Loranth, G. (2017): “Multinational banks and supranational supervision”, *Review of Financial Studies*, forthcoming.

Calzolari, G. and Loranth, G. (2011): “Regulation of multinational banks: A theoretical inquiry”, *Journal of Financial Intermediation*, 20(2).

Carrillo, J.A., Mendoza, E.G., Nuguer, V. and Roldán-Peña, J. (2017): “Tight money-tight credit: Coordination failure in the conduct of monetary and financial policies”, *NBER*

Working Paper, No 23151.

Carletti, E., Dell'Ariccia, G. and Marquez, R. (2016): "Supervisory incentives in a banking union", International Monetary Fund.

Cecchetti, S.G. and Li, L. (2008): "Do capital adequacy requirements matter for monetary policy?", *Economic Inquiry*, 46(4), 643–659.

Chhaochharia, V., Otto, C.A. and Vig, V. (2011): "The unintended effects of the Sarbanes-Oxley Act", *Journal of Institutional and Theoretical Economics*, 167(1), 149-164.

Choi, D.B. and Choi, H.S. (2017): "The Effect of Monetary Policy on Bank Wholesale Funding", *Staff Reports*, No 759, Federal Reserve Bank of New York.

Choi, D.B., Santos, J.A.C. and Yorulmazer, T. (2017): "A Theory of Collateral for the Lender of Last Resort".

Ciccarelli, M., Maddaloni, A. and Peydró, J.L. (2015): "Trusting the Bankers: A New Look at the Credit Channel of Monetary Policy", *Review of Economic Dynamics*, 18 (4). Colliard, J.E. (2015): "Optimal supervisory architecture and financial integration in a banking union", HEC Paris Research Paper, No FIN-2018-1319, *Review of Finance*, forthcoming.

Calzolari, G., Colliard, J. E., & Loranth, G. (2017). Multinational banks and supranational supervision. HEC Paris Research Paper No. FIN-2016-1152.

Colliard, J.-E., 2019, "Optimal Supervisory Architecture and Financial Integration in a Banking Union," *Review of Finance*, rfz004, <https://doi.org/10.1093/rof/rfz004>

Copelovitch, M.S. and Singer, D.A. (2008): "Financial Regulation, Monetary Policy, and Inflation in the Industrialized World", *The Journal of Politics*, 70(3), 663-680.

Corsetti, G., Guimaraes, B. and Roubini, N. (2006): "April 2006. International lending of last resort and moral hazard: A model of IMF's catalytic finance", *Journal of Monetary Economics*, 53(3), 441-471.

Delis, M.D. and Staikouras, P.K. (2011): "Supervisory effectiveness and bank risk", *Review of Finance*, 15(3), 511-543.

Dell'Ariccia, G., Laeven, L. and Marquez, R. (2014): "Real interest rates, leverage, and bank risk-taking", *Journal of Economic Theory*, 149, 65-99.

Dell'Ariccia, G. and Marquez, R. (2006): "Competition among regulators and credit market integration", *Journal of Financial Economics*, 79(2), 401-430.

Dell'Ariccia, G., Igan D., Laeven, L. and Tong, H. (2016): "Credit booms and macrofinancial stability", *Economic Policy*, 31, 86, 299-355.

De Paoli, B. and Paustian, M. (2017): "Coordinating monetary and macroprudential policies", *Journal of Money, Credit and Banking*, 49(2), 319–349.

Diamond, D.W. and Dybvig, P.H. (1983): "Bank Runs, Deposit Insurance and Liquidity", *Journal of Political Economy*, 91(3), 401-419.

Dijkstra, R.J. (2012), "Liability of Financial Supervisory Authorities in the European Union",

Journal of European Tort Law, 3, No 3, pp. 34-377.

Di Noia, C. and Di Giorgio, G. (1999): “Should banking supervision and monetary policy tasks be given to different agencies?”, *International Finance*, 2, 361-378.

Drechsler, I., Drechsel, T., Marques-Ibanez, D. and Schnabl, P. (2016): “Who borrows from the lender of last resort?”, *Journal of Finance*, 71(5), 1933–1974.

Eber, M. and Minoiu, C. (2016): “How do banks adjust to stricter supervision?”, Working paper.

Eisenbach, T.M., Lucca, D.O. and Townsend, R. M. (2016): “The economics of bank supervision”, *NBER Working Paper*, No 22201, National Bureau of Economic Research.

Eisenschmidt, J. and Smets, F. (2017): “Negative interest rates: Lessons from the euro area”, mimeo, ECB.

Faccio, M. (2006): “Politically connected firms”, *American Economic Review*, 96(1), 369-386.

de Figueiredo, J.M. and Richter, B.K. (2014), “Advancing the Empirical Research on Lobbying”, *Annual Review of Political Science*, Vol. 17, pp. 163-185

Financial Stability Institute (2015): “FSI survey: Basel II, 2.5 and III implementation”, Discussion Paper.

Fiordelisi, F., Ricci, O. and Lopes, F.S.S. (2017): “The unintended consequences of the launch of the single supervisory mechanism in Europe”, *Journal of Financial and Quantitative Analysis*, 52(6), 2809-2836.

Frankel, J.A. and Rose, A.K. (1998): “The endogeneity of the optimum currency area criteria”, *The Economic Journal*, 108(449), 1009-25.

Freixas, X., Rochet, J. C., & Parigi, B. M. (2004). The lender of last resort: A twenty-first century approach. *Journal of the european economic association*, 2(6), 1085-1115..

Goldstein, I. and Pauzner, A. (2005): "Demand-deposit contracts and the probability of bank runs", *The Journal of Finance*, 60(3), 1293-1327.

Goldstein, I. and Sapra, H. (2014): “Should banks' stress test results be disclosed? An analysis of the costs and benefits”, *Foundations and Trends® in Finance*, 8(1), 1-54.

Goodhart, C. (2000): “The Organizational Structure of Banking Supervision”, *Economic Notes*, 31(1), 1-32.

Goodhart, C. and Schoenmaker, D. (1995): “Should the Functions of Monetary Policy and Banking Supervision Be Separated?”, *Oxford Economic Papers*, 47(4), 539-560.

Gopalan, Y., Kalda A. and Manela, A. (2017): “Hub-and-spoke regulation and bank leverage”, Discussion Paper.

Górnicka, L.A. and Zoican, M.A. (2016): “Too-international-to-fail? Supranational bank resolution and market discipline”, *Journal of Banking & Finance*, 65, 41- 58.

Haubrich, J. (1996): “Combining bank supervision and monetary policy”, *Economic Commentaries*, Federal Reserve Bank of Cleveland.

Heider, F., Saidi, F. and Schepens, G. (2017): “Life Below Zero: Bank Lending Under Negative Policy Rates”, mimeo.

Hirtle, B., Kovner, A. and Plosser, M.C. (2018): “The impact of supervision on bank performance”, Staff Reports 768, Federal Reserve Bank of New York.

Hoffmann, P., Langfield, S., Pierobon, F. and Vuillemeys, G. (2018): “Who Bears Interest Rate Risk?”, *Review of Financial Studies*, forthcoming, available at SSRN: <https://ssrn.com/abstract=3062435> or <http://dx.doi.org/10.2139/ssrn.3062435>

Holthausen, C. and Ronde, T. (2004): “Cooperation in international banking supervision”, Working Paper Series, No 316, ECB, March 2004.

International Monetary Fund (2013): “Interaction between monetary and macro-prudential policies”, IMF Policy Paper.

Ivanov, I., Ranish, B. and Wang, J. (2018), “Strategic Response to Supervisory Coverage: Evidence from the Syndicated Loan Market”, available at SSRN: <https://ssrn.com/abstract=2921453> or <http://dx.doi.org/10.2139/ssrn.2921453>

Jimenez, G., Ongena, S., Peydró, J.L. and Saurina, J. (2014): “Hazardous times for monetary policy: What do twenty-three million bank loans say about the effects of monetary policy on credit risk-taking?”, *Econometrica*, 82(2), 463-505.

Jimenez, G., Ongena, S., Peydró, J.L. and Saurina, J. (2017): “Macroprudential policy, countercyclical bank capital buffers and credit supply: Evidence from the Spanish dynamic provisioning experiments”, *Journal of Political Economy*, 125(6), 2126-2177.

Jung, A. and Latsos, S. (2015): “Do federal reserve bank presidents have a regional bias?”, *European Journal of Political Economy*, 40, Part A, 173-183.

Khan, A., (2018): “Legal protection: Liability and Immunity Arrangements of Central Banks and Financial Supervisors”, *IMF Working Papers*, No 18/176.

Kahn, C. and Santos, J. (2005): “Allocating bank regulatory powers: Lender of last resort, deposit insurance and supervision”, *European Economic Review*, 49(8), 2107-2136.

Kisin, R. and Manela, A. (2018): “Funding and incentives of regulators: Evidence from banking” Available at SSRN: <https://ssrn.com/abstract=2527638> or <http://dx.doi.org/10.2139/ssrn.2527638>.

Lambert, T. (2015): “Lobbying on regulatory enforcement actions: Evidence from banking”.

Lucas, A., Schaumburg, J. and Schwaab, B. (2018): “Bank business models at zero interest rates”, *Journal of Business & Economic Statistics*, 1-14.

Lucca, D., Seru, A. and Trebbi, F. (2014): “The revolving door and worker flows in banking regulation”, *Journal of Monetary Economics*, 65, 17-32.

Maddaloni, A. and Peydró, J.L. (2011): “Bank risk-taking, securitisation, supervision, and low interest rates: Evidence from the Euro-area and the U.S. lending standards”, *Review of*

Financial Studies, 24(6), 2121-2165.

Martinez-Miera, D. and Repullo, R. (2017): "Search for yield", *Econometrica*, 85(2), 351-378.

Melecky, M. and Podpiera, A.M. (2013): "Institutional structures of financial sector supervision, their drivers and historical benchmarks", *Journal of Financial Stability*, 9(3), 428-444.

Morrison, A.D. and White, L. (2013): "Reputational contagion and optimal regulatory forbearance", *Journal of Financial Economics*, 110(3), 642-658.

Peek, J., Rosengren, E.S. and Tootell, G.M.B. (1999): "Is Bank Supervision Central to Central Banking?", *Quarterly Journal of Economics*, 114(2), 629-653.

Peek, J., Rosengren, E.S. and Tootell, G. (2016): "Does Fed policy reveal a ternary mandate?", *Working Papers*, 16-11, Federal Reserve Bank of Boston.

Prendergast, C. (2007): "The motivation and bias of bureaucrats", *American Economic Review*, 97(1), 180-196.

Quintyn, M. and Taylor, M.W. (2003): "Regulatory and supervisory independence and financial stability", *CESifo Economic Studies*, 49(2), 259-294.

Rajan, R.G. (2006): "Has finance made the world riskier?", *European Financial Management*, 12(4), 499-533.

Ratnovski, L. (2009): "Bank liquidity regulation and the lender of last resort", *Journal of Financial Intermediation*, 18(4), 541-558.

Repullo, R. (2000): "Who should act as lender of last resort? An incomplete contracts model", *Journal of Money, Credit and Banking*, 32, 580-605.

Repullo, R. (2018), "Hierarchical Bank Supervision," *SERIEs – Journal of the Spanish Economic Association*, 9 (2018), pp. 1-26.

Rezende, M. (2011): "How do joint supervisors examine financial institutions? The case of state banks", *Handbook of Central Banking, Financial Regulation and Supervision – After the Financial Crisis*, ed. by Eijffinger, S. and Masciandaro, D., Edward Elgar.

Rezende, M. (2016): "The effects of bank charter switching on supervisory ratings", *Board of Governors of the Federal Reserve System (U.S.) Finance and Economics Discussion Series* 2014-20.

Rezende, M. and J. Wu, 2014, "The Effects of Supervision on Bank Performance: Evidence from Discontinuous Examination Frequencies," Midwest Finance Association 2013 Annual Meeting Paper. Available at SSRN: <https://ssrn.com/abstract=2135017> or <http://dx.doi.org/10.2139/ssrn.2135017>

Rochet, J.C. and Vives, X. (2004): "Coordination failures and the lender of last resort: Was Bagehot right after all?", *Journal of the European Economic Association*, 2(6), 1116-1147.

Rosen, R.J. (2005): "Switching primary federal regulators: Is it beneficial for US banks?", *Economic Perspectives*, 29, 16-33, Federal Reserve Bank of Chicago.

Rutkowski, F. and Schnabel, I. (2017): “Should banking supervision and monetary policy be separated?”, mimeo, Bonn University.

Santos, J. and Suarez, J. (2018): “Liquidity standards and the value of an informed lender of last resort”, *Journal of Financial Economics*.

Smets, F. (2014): “Financial stability and monetary policy: How closely interlinked?”, *International Journal of Central Banking*, 10(2), 263-301.

Steffen, S. (2014): “Robustness, validity, and significance of the ECB’s asset quality review and stress test exercise”, Discussion Paper.

Vandenbussche, J., Vogel, U. and Detragiache, E. (2015): “Macroprudential policies and housing prices: A new database and empirical evidence for Central, Eastern, and Southeastern Europe”, *Journal of Money, Credit and Banking*, 47(S1), 343–377.

Van der Ghote, A. (2017): “Coordinating Monetary and Financial Regulatory Policies”, mimeo, Princeton University.

Viñals, J. and Fiechter, J. with Narain, A., Elliott, J., Tower, I., Bologna, P. and Hsu, M. (2010): “The Making of Good Supervision: Learning to Say “No””, International Monetary Fund.

Appendix

The equations estimated in Section 3.3 of the paper are the following:

$$GDPgrowth_{it} = \alpha_1 + \beta_1 Integrated_{it} + \delta_1 X_{it} + \varepsilon_{it}$$

$$|\pi_{it} - \pi_{it}^{target}| = \alpha_2 + \beta_2 Integrated_{it} + \delta_2 X_{it} + \eta_{it}$$

Where:

GDP growth is the annual GDP growth rate in % .

$|\pi_{it} - \pi_{it}^{target}|$ = Inflation deviation from target: absolute difference between inflation rate and inflation target for a specific country taken from <http://www.centralbanknews.info/p/inflation-targets.html>. A “virtual” inflation target of 2% is used whenever another explicit target is not available.

Integrated is a dummy variable which takes the value 1 if the central bank is responsible for bank supervision and 0 otherwise.

The sample contains 98 countries worldwide over period 1999-12. The dataset is constructed by Melecky and Podpiera (2013). In some specifications, a corruption control index provided by the World Bank is also included.

Appendix Table 1

	(1)	(2)	(3)	(4)	(5)	(6)
	GDP growth	GDP growth	GDP growth	GDP growth	GDP growth	GDP growth
Integrated model	0.925** (0.363)	1.103 (0.777)	0.462 (0.335)	1.220 (0.832)	0.253 (0.651)	4.151 (3.934)
Corruption control index			-0.166 (0.285)	1.179 (0.755)	1.091 (0.690)	4.469* (2.383)
ln(GDP/capita)			-0.618*** (0.238)	0.352 (0.571)	-1.337** (0.619)	-1.481 (1.262)
GDP growth (t-1)					0.309*** (0.0604)	0.359*** (0.0969)
GDP growth (t-2)					-0.0844** (0.0325)	-0.0714 (0.0548)
Constant	2.983*** (0.426)	2.304*** (0.695)	9.112*** (2.230)	-1.124 (4.869)	12.33** (5.283)	5.919 (12.633)
Observations	1,216	1,216	1,216	1,216	1,038	1,038
R-squared	0.332	0.332	0.329	0.335	0.428	-
Number of countries	97	97	97	97	97	97

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Notes: GDP growth is the annual GDP growth rate in %; "integrated model" is a dummy variable which takes the value 1 if the central bank is responsible for bank supervision and 0 otherwise; "corruption control index" is constructed and provided by the World Bank. Year dummies included in all specifications, country fixed effects used in (2), (4), (5), (6), random effects in (1) and (3), Arellano-Bond estimator in (6).

Appendix Table 2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
		inflation deviation from target						log(inflation deviation from target)					
Integrated model	-0.296 (1.162)	-2.786* (1.551)	-1.763 (1.156)	-5.457* (2.921)	-0.699 (0.473)	-3.158** (1.352)	0.146 (0.152)	-0.0272 (0.216)	-0.0868 (0.139)	-0.172 (0.216)	0.0845 (0.152)	-0.481 (0.387)	
Corruption control index			0.0873 (0.987)	2.254 (5.383)	-0.563 (0.985)	0.191 (1.177)			-0.227* (0.116)	-0.0362 (0.341)	0.217 (0.291)	0.614* (0.352)	
ln(GDP/capita)			-2.374*** (0.832)	-10.43* (5.714)	-1.080 (1.015)	-7.128*** (1.020)			-0.282*** (0.0977)	-0.561* (0.324)	-0.380 (0.272)	-2.680*** (0.292)	
inflation dev. from target (t-1)					0.379*** (0.0669)	0.286*** (0.0244)							
inflation dev. from target (t-2)					-0.0237 (0.0205)	-0.0111 (0.0150)							
log(inflation dev. from target (t-1))											0.165*** (0.0453)	-0.151*** (0.0315)	
log(inflation dev. from target (t-2))											-0.0248 (0.0343)	-0.224*** (0.0293)	
Constant	3.353** (1.394)	11.34*** (3.850)	26.50*** (7.778)	99.78* (50.67)	11.96 (8.871)	71.44*** (9.660)	0.496*** (0.169)	0.711*** (0.191)	3.361*** (0.914)	5.520** (2.744)	3.471 (2.344)	25.45*** (2.730)	
Observations	1,182	1,182	1,178	1,178	999	906	1,182	1,182	1,178	1,178	999	906	
R-squared	0.046	0.047	0.062	0.083	0.411	-	0.098	0.098	0.105	0.107	0.140	-	
Number of countries	94	94	94	94	93	93	94	94	94	94	93	93	

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Notes: Inflation deviation from target is absolute difference between inflation rate and inflation target for a specific country taken from <http://www.centralbanknews.info/p/inflation-targets.html> (a “virtual” inflation target of 2% is used whenever another explicit target is not available), “integrated model” is a dummy variable which takes the value 1 if the central bank is responsible for bank supervision and 0 otherwise, “corruption control index” is constructed and provided by the World Bank. Year dummies included in all specifications; country fixed effects in (2), (4), (8), (10); random effects in (1), (3), (7) and (9); Arellano-Bond estimator in (6) and (12)

Appendix Table 3: Non-EA countries

	(1)	(2)	(3)	(4)
	GDP growth (annual %)		Inflation deviation from target	
Integrated model	0.128 (1.312)	2.739 (1.998)	-7.465 (5.188)	-3.920 (2.516)
GDP growth (t-1)		-0.0727** (0.0368)		
GDP growth (t-2)		-0.237*** (0.0349)		
Corruption control index	0.605 (0.751)	0.889 (1.095)	3.159 (6.646)	0.797 (1.392)
ln(GDP/capita)	0.283 (0.611)	-5.829*** (0.766)	-12.01* (6.526)	-8.300*** (1.234)
Inflation deviation from target (t-1)				0.293*** (0.0270)
Inflation deviation from target (t-2)				-0.0170 (0.0167)
Constant	0.409 (5.096)	55.61*** (7.407)	112.9* (57.98)	81.05*** (11.39)
Observations	969	751	931	716
R-squared	0.309	-	0.098	-
Number of countries	78	78	75	74

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: GDP growth is the annual GDP growth rate in %, inflation deviation from target is absolute difference between inflation rate and inflation target for a specific country taken from <http://www.centralbanknews.info/p/inflation-targets.html> (a “virtual” inflation target of 2% is used whenever another explicit target is not available), “integrated model” is a dummy variable which takes the value 1 if the central bank is responsible for bank supervision and 0 otherwise, “corruption control index” is constructed and provided by the World Bank. Year dummies included in all specifications: country fixed effects in all specifications Arellano-Bond estimator in (2) and (4).

Acknowledgements

We would like to thank several colleagues who have provided valuable input during the preparation of this paper. In particular, Martina Alhofer, Olga Arratibel, Luc Laeven, Massimo Mangone, Philipp Hartmann, Rafael Repullo and all the participants at the ECB seminars. The views expressed in this paper are solely those of the authors and do not necessarily reflect the views of the European Central Bank or the Eurosystem.

Miguel Ampudia

European Central Bank, Frankfurt am Main, Germany; email: miguel.ampudia@ecb.europa.eu

Thorsten Beck

University of London, London, United Kingdom; email: thorsten.beck.1@city.ac.uk

Andreas Beyer

European Central Bank, Frankfurt am Main, Germany; email: andreas.beyer@ecb.europa.eu

Jean-Edouard Colliard

HEC Paris, Jouy-en-Josas, France; email: colliard@hec.fr

Agnese Leonello

European Central Bank, Frankfurt am Main, Germany; email: agnese.leonello@ecb.europa.eu

Angela Maddaloni

European Central Bank, Frankfurt am Main, Germany; email: angela.maddaloni@ecb.europa.eu

David Marques-Ibanez

European Central Bank, Frankfurt am Main, Germany; email: david.marques@ecb.europa.eu

© European Central Bank, 2019

Postal address 60640 Frankfurt am Main, Germany

Telephone +49 69 1344 0

Website www.ecb.europa.eu

All rights reserved. Any reproduction, publication and reprint in the form of a different publication, whether printed or produced electronically, in whole or in part, is permitted only with the explicit written authorisation of the ECB or the authors.

This paper can be downloaded without charge from www.ecb.europa.eu, from the [Social Science Research Network electronic library](#) or from [RePEc: Research Papers in Economics](#). Information on all of the papers published in the ECB Working Paper Series can be found on the [ECB's website](#).

PDF

ISBN 978-92-899-3549-4

ISSN 1725-2806

doi:10.2866/355828

QB-AR-19-068-EN-N