Seeking My Supervisor:
Evidence from the Centralization of Banking Supervision in Europe

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Abstract

We study the behavior of banks around the announcement of the centralization of banking supervision in Europe. On December 2012, European authorities announced that within a year the supervisory responsibilities for mid-size and large banks would be transferred to the European Central Bank. We document that following the announcement banks around the size threshold shrank their assets by contracting their credit book and liquid assets. Then, we use the size threshold to measure the effects of central supervision on banks. After accounting for banks' strategic behavior, the effects of central supervision are materially larger than previously-thought.

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1 Introduction

Banking supervisors play a major role as the main agents responsible for mitigating the likelihood and severity of banking crises. This is a crucial task as throughout history as banking crises tend to be followed by protracted economic recoveries, large fiscal costs and, at times, political unrest. The inherent fragility of the financial system—subject to runs, contagion, and fire sales—and the practical inability of bank creditors to understand the risk undertaken by financial institutions gives rise to supervision. Supervisors which are the agents operating on behalf of bank depositors and taxpayers with specific expertise in reining in excessive risk-taking by financial institutions. While bank supervision is thought of creating value by mitigating banking crises, individuals bank owners and managers do not internalize these benefits. Thus, banks generally seek supervisors who are likely to be soft on them through various channels such as changes in their charter, location or through mergers and acquisitions (Peek, Rosengren, and Tootell, 1999; Rosen, 2003 and 2005; Rezende, 2014; Agarwal, Lucca, Seru, and Trebbi, 2014; Karolyi and Taboada, 2015). Due to their central role a deeper understanding of the constraints and incentives of supervisors is of much interest to academics and policymakers. In particular, assessing the extent to which banks are willing to go to avoid supervision is important in understanding the shadow cost of supervision, i.e., cost that supervisors impose on banks.

We study banks' behavior around the introduction of a historical event: the centralization of banking supervision in Europe. Specifically, we test whether banks manipulated their assets around the asset-size threshold, which was used to determine which banks would be centrally-supervised by the European Central Bank (ECB). We document the actions that banks took to lower their asset size around the size cutoff. Once accounting for the banks' strategic actions, we set to measure the economic impact of the centralization of supervision in Europe. We also provide

some suggestions as of how to measure the impact of any policy in presence of strategic behavior around a public threshold.

The European Union announced at the end of 2012 that a major reorganization of the bank supervision mechanism in Europe would take place in November 2014. The responsibility for supervising the largest banks in most European Union countries was transferred from national supervisory authorities (or National Competent Authorities, NCAs henceforth) to the ECB.[1] A year following the announcement, at the end of 2013, the ECB classified banks as *Significant* or *Less-significant* primarily according to whether their asset value exceeded €30 billion or not. The supervision of Significant banks was transferred to a newly-formed supervisory arm of the ECB, while the supervision of Less-significant institutions remained under the NCAs. Supervision standards are coordinated under the Single Supervisory Mechanism (SSM), but the supervision is conducted at two distinctly different levels (national versus supranational) depending on where the responsibility lies (NCAs versus ECB).

This paper has three parts. In the first, we explore whether banks strategically managed their assets following the announcement of the SSM to fall in the left side of the threshold, i.e., manipulate the decision on the identity of the supervisor (NCA or ECB). We track bank asset size evolution around 2012 (announcement) and 2013 (allocation of banks to supervisors) across the size spectrum and find that around the €30 billion asset size threshold several banks have experienced an abnormal decline in their asset size during 2013 (the "interim" year). We label the banks *Sorters*. We complement this casual observation with a statistical test based on density discontinuity to measure strategic behavior (or manipulation) around a threshold (Cattaneo,

[1] The new institution that coordinates supervision in the Euro area, labeled the Single Supervisory Mechanism (SSM), has been integrated into the European Central Bank (ECB), responsible also for setting monetary policy for the Euro area.

Jansson, and Ma, 2018). The fact that banks managed their assets down and not up suggests that banks perceived that the ECB's supervisory standards to be tighter than those of their local supervisors.

In the second part, we investigate the actions taken by banks around the threshold to shrink their assets. We show that the decline in asset size was achieved either by actual scaling down in certain actual business activities—e.g., decrease in net loans and other fixed assets—as well as by changes in the accounting of existing operations (e.g., reclassifying loans and recognizing losses), including running spin-offs of certain business activities or changes in accounting of their derivative exposures.

In the third part of the study, we use the threshold to explore the effects of supranational supervision on bank behavior, accounting for banks' strategic behavior. Clearly the presence of strategic behavior impairs the validity of any estimation using the threshold as an instrument to assess the impact of any given policy. Several previous studies have examined this question with similar empirical settings to the one in our work, however, did not account for the strategic behavior of banks.[2] The identifying assumption of a regression discontinuity design (RDD), is that banks do not choose which side of the threshold to be on. When this assumption does not hold, the estimation is of the effect of treatment is biased.[3]

Given these insights, we set to assess the impact of centralized supervision while accounting for the strategic sorting. We perform three different econometric approaches that specifically account for the biases introduced by banks' strategic behavior. In principal, all three methods give lower weight to banks that are likely to be sorters. We start by running a *reweighted*

[2] Previous studies attempting to measure supervision's effect without accounting for sorting behavior: Eber and Minoiu (2016), Fiordelisi, Ricci, and Stentella Lopes (2017), and Bouwman, Shuting Hu, and Johnson (2018).
[3] The local randomization assumption demands that within a window around the size threshold treatment is essentially randomly determined.

differences-in-differences in means estimator (R-DIM) in which we underweight institutions more likely to engage in sorting. The results suggest that the centralization of supervision led to more stringent standards, as indicated by a significant relative decline in nonperforming loans (about 4 percent) and have large implications for the supply of bank credit, as centralization was connected to a relative decrease in total credit (about 8 percent). We assess the validity of our results conducting three additional econometric methods that correct for the biases introduced by sorting behavior: A local average treatment effect (LATE) corrected as in Imbens and Angrist (1994), and a reweighted sharp regression discontinuity model (WRR). The results in all these methods are in line with our first estimation: that the centralization of banking supervision led to a more conservative supervision, potentially justifying banks' motivation to eschew the centralized supervision. Relative to previous studies examining the effects of the SSM on banks' behavior (Eber and Minoiu, 2016; Fiordelisi, Ricci, and Stentella Lopes, 2017), our results are larger because previous studies included Sorters among the Less-significant Banks. As Sorters purposely reduced significantly their total assets following the announcement, their inclusion in the Less-significant group underplays the effects of the supranational supervision.

The remainder of the paper is organized as follows. We begin by providing a brief institutional background on the centralization of banking supervision in Europe and a brief overview on previous literature in Section 2, and proceed to describe our data in Section 3. In Section 4 we show that following the announcement of the SSM, some European banks strategically managed their assets to select their supervisor (NCAs or ECB). In Section 5 explore how banks shrank their balance sheets. In Section 6 we measure the effect of the centralization of supervision on banks' behavior, accounting for banks' strategic behavior. Conclusions are drawn in Section 7.

2 Background

On September 7, 2012, Vítor Constâncio, vice president of the ECB, referred in a public speech to the crucial importance of centralizing the supervision of large European banking groups operating internationally to ensure the solvency of European banks (Constâncio, 2012). Later that year, in December 2012, the Economic and Financial Affairs Council (ECOFIN, 2012) reached a landmark agreement that created the SSM and spelled out the criteria that the ECB would use to identify those banks subject to the supervision of the ECB's supervisory arm. By the end of 2013, banks operating in the Euro area would be classified as Significant if one of the following conditions are met: (i) the value of their total assets exceeds €30 billion, or 20 percent of national GDP,[4] (ii) it is one of the three largest institutions established in a member State, and (iii) the ratio of its cross border liabilities in more than one other participating member State to its assets is above 20 percent.[5] We report the main events around the SSM launch in the Table 1.

<< INSERT TABLE 1 >>

There are various reasons explaining why European banks would believe that the launch of the SSM would lead to more demanding supervisory standards. First, the motivation of the ECB to establish a supranational authority was implement a single supervision standard across countries. From the very beginning, the ECB's supervisory arm focused on three strategic directions which suggest more stringent supervision: achieving a sounder capital base, reducing credit risks and harmonize supervisory standards. The first priority of the newly-established ECB's supervisory arm was to rebuild confidence in the banking sector and address its weaknesses (Draghi, 2014). Indeed an essential part of the preparation for the SSM was the Comprehensive

[4] Unless the total value of assets is below €5 billion.
[5] Unless the total value of assets is below €5 billion.

Assessment (CA) carried out under the leadership of the ECB to "provide the necessary clarity on the banks that will be subject to the ECB's direct supervision" (ECB 2013, p. 1).[6] Compared to other stress test exercises conducted in Europe or in the U.S., the CA is particularly interesting as it was launched as a preliminary step for a much larger process, the SSM implementation. The CA focused on evaluating banks' lending activity[7] and ensuring sound capitalization of the significant banks.

Second, banks could also anticipate that local banks would be easier to deal with given the cultural familiarity and political influence. Agarwal, Lucca, Seru, and Trebbi (2014) find that there are systematic differences among different supervisors on their treatment *to same bank* in the U.S. They find that the switch from a state to a federal supervisor implies tougher supervision suggesting that geographical closeness to supervisors leads to leniency over time on the part of the local supervisor.

Third, large banks are complex organizations and there are efficiencies of scale and learning in one organization that supervises them. Thus, a supranational supervisor is expected to be more efficient, and therefore less manipulable, than NCAs. Supporting this idea of enhanced supervisory independence, the supervision of each significant bank is entrusted to a Joint-Supervisory Team (JST). JSTs, are managed and respond to the authority of the ECB, also to

[6] Announced on the 23 October 2013 and completed on 26 October 2014.

[7] Although the stress test was designed to incorporate liquidity, interest rate, and market risks related to security holdings, the CA carried out under the leadership of the ECB mainly focused on credit risk. Specifically, the CA: a) reviewed over 800 specific loan portfolios (57% of the banks' risk-weighted assets (RWA)), involving more than 119,000 borrowers and about 170,000 collateral items; b) built 765 models to "challenge" the banks' own estimates of collectively assessed provisions; c) developed over 100 models to assess their CVA (Credit Valuation Adjustment) calculation; and d) revaluated over 5,000 of the most complex fair value exposures and over 100 complex valuation models. As noted by the ECB (2014), this process showed total adjustment to asset carrying values of €47.5 billion, due to 1) additional provisions resulting from non-performing, non-retail debtors (individually assessed, working on an exposure by exposure basis), 2) additional provisions identified through the collective provisioning assessment of all performing exposures and non-performing retail exposures, and 3) impacts from the fair value exposures review (including non-derivative revaluations, CVA adjustments, and adjustment to derivative pricing models). The last component, referred to as security holdings, accounted only for €4.6 billion, i.e., less than 10% of the total impact.

reduce pressures from any given country onto the supervisors. There is a JST for each bank, which perform the Supervisory Review and Evaluation Process, conduct the supervisory examination program and any supervisory decisions, and liaise and coordinate with the national supervisors. JSTs have a pan-European perspective and combine staff from different nationalities and include staff from the ECB and various national supervisors, including the competent authorities of the countries in which credit institutions, banking subsidiaries or significant cross-border branches of a given banking group are established, and it is generally directed by a person of a nationality different from the country in which the bank received its license.

In practical terms, banks realized that the time lag elapsed between the announcement of the criteria and its implementation could potentially be used by some institutions to avoid, or comply with, the threshold. Specifically, the asset size threshold was verified by the ECB looking at banking data as of end of 2013, one year after the announcement of the threshold while the ECB took the responsibility of supervising the largest institutions at the end of 2014. The decision of which banks would be above the threshold was undertaken rather mechanically by the ECB, subject to a predefined measure of size. This measure is known as the perimeter of consolidation and was also known by the banks in advance as it has been derived from accounting measures and agreed internationally by European Union banking supervisors.

Not surprisingly, there is a well-established literature that analyzes the impact of regulation on banks' behavior including its effects on lending (e.g., Li, Nandy, and Roberts, 2012; Carlson, Shan, and Warusawitharana, 2013; Ongena, Popov, and Udell, 2013; Agarwal, Lucca, Seru, and Trebbi, 2014), risk-taking (Harris and Raviv, 2014), equity issuance (Dinger and Vallascas, 2018), economic growth (Jayaratne and Strahan, 1996; Kroszner and Strahan, 1996; and Berger and

Hannan, 1998), banking competition (Calderon and Schaeck, 2018) as well as financial sector development (e.g., Levine, Loayza, and Back, 2000; Barth, Caprio, and Levine, 2004).

The literature analyzing the effectiveness of supervision is less developed. After the financial crisis, a growing number of papers have focused on the incentives of banking supervisors and whether they are ultimately aligned with those of depositors. In addition to the evidence from Agarwal, Lucca, Seru, and Trebbi (2014), described above, Rezende (2014) shows that banks that purposely change supervisory charters are more likely to be considered safer (i.e., better supervisory rating) compared to similar banks than do not switch.

Focusing on the centralization of banking supervision in Europe, there is some evidence comparing *sharply* banks subject to ECB and NCA's supervision. Fiordelisi, Ricci, and Stentella Lopes (2017) show that banks under the ECB's direct supervision reduced their lending activities more than those subject to NCAs supervision. They argue that European banks "perceived the risk of a supervisory inconsistency" between the ECB and the NCAs during the launch of the SSM. In this direction, Eber and Minoiu (2016) use a sharp discontinuity approach between significant and less-significant institutions to assess impact of the centralization of banking supervision. They find a substantial reduction in leverage, a decline in wholesale funding, and the supply of credit by ECB's supervised banks. There is also evidence from a detailed loan-level dataset from Germany that considers changes in loan specific risk weights (RWs) generated by banks using internal models around the implementation of the SSM (Haselmann, Singla, and Vig, 2018). They show that banks subject to ECB's supervision report significantly lower RWs (i.e., smaller probability of default) than banks subject to national supervisors *on the same borrower*. As a consequence, banks under ECB supervision reduce their lending and trading by more compared to banks

supervised by their NCA in the post-implementation period which is suggestive of more stringent supervision by the ECB compared to national supervisors.

3 Data

We collect annual data on banks' financial statements from the Bankscope and Orbis-Bank Focus databases focusing on those banks in the Eurozone that were affected by the SSM launch.[8] We collected data for all banks that have a consolidated balance sheet available and that are headquartered in the Euro area.[9] We exclude from the analysis very small banks, banks with a very low lending orientation, and banks that were nationalized after the recent financial crisis.[10]

Following the ECB criteria, we distinguish between Significant banks (those under the ECB's direct supervision after the SSM launch) and Less-significant banks (those under the direct supervision of NCAs). Most (but not all) Significant banks have total assets greater than €30 billion; most (but not all) Less-significant banks have total assets lower than €30 billion.

We use different subsamples in our tests. To test for the strategic behavior of banks, we focus on the 2012-2013 period since we argue that banks may have strategically manipulated their asset size during 2013: our (estimation) sample comprises around 800 banks in the Euro area. To test the effect of the centralization in banking supervision, net of the strategic behavior, we extend the sample period to 2011-2014: two years prior (2011 and 2012) and two years following (2013 and 2014) the SSM announcement.

[8] Both databases are managed by Bureau van Dijk. Bankscope ends its data collection in 2014; Bank Focus started the collection from 2011. As such, we collected data up to 2011 from Bankscope, and data after 2014 from Bank Focus. In the period 2011-2014, we collected data from both sources and we verify consistency of the data. We exclude banks headquartered in Luxembourg because they have a different business model than banks located in the rest of the Euro area.

[9] We exclude from the control sample securities firms, group finance companies, investment and trust corporations, clearing institutions, and custody and investment banks.

[10] We exclude from our sample banks in the bottom fifth percentile of the distribution of total assets and banks in the bottom fifth percentile of the distribution of the ratio of total loans-to-total assets. None of our results are qualitatively affected by including these banks in our analysis.

Tables 2 and 3 report the variables used in our empirical analysis and the summary statistics respectively.

<< INSERT TABLES 2 and 3 >>

4 Do Banks Manage Their Assets Around the Size Threshold?

4.1 Bank Size Distribution

To assess the possibility of strategic behavior, we first show graphical evidence that banks' assets around the size threshold shrink, and then test this formally following Cattaneo, Jansson, and Ma (2018) density discontinuity test.[11] These tests enable us to detect the presence of the so-called "sorting" mechanism put forward by banks in a neighborhood of the cutoff. Both pieces of evidence suggest strategic behavior.

In a first step, we focus on 2013 and we compare graphically the asset size of European banks between €20 and €40 billion in 2012 and 2013. Figure 1, Panel A, shows banks' asset sizes in 2012 and 2013. Banks above the 45-degrees line experienced asset growth between the years and banks below the 45-degrees line experienced asset growth. The figure shows that most banks experienced asset decline between these years. The vertical and horizontal lines mark the €30 billion critical size. Eight banks in the bottom-right quadrant, however, experienced an unusual asset size decline. These are the Sorters: banks that their 2012 asset size would classify them as Significant, however, due to decline in asset size in 2013 they are classified at Less-significant. As can be seen in the chart, degree of asset decline varies across Sorters.

<< INSERT FIGURE 1>>

[11] Proved to outperform the standard McCrary (2008) test.

Figure 1, Panel B, shows the Cattaneo, Jansson, and Ma (2018) sorting or manipulation test based on density discontinuity, constructed using the results for local polynomial density estimators. Compared to the manipulation test of McCrary (2008), this test exhibits better size and power properties. The left-hand graph of Panel B refers to 2012 and sets out a discontinuity in the estimated frequencies (i.e., the number of banks) at the threshold. This discontinuity disappears in 2013 (see the right-hand graph of Panel B) showing that, in between 2012 and 2013, a number of banks overcome the threshold by decreasing the frequency on the right of the cutoff. The larger frequency of banks immediately on the right of the threshold in 2012 does not signal a strategic behavior in place in 2012, rather reflect the structure of the European banking industry with a larger share banks with asset size greater than €30 billion.

As robustness, we run the Cattaneo, Jansson, and Ma (2018) manipulation test based on density discontinuity for two placebo asset cutoff points (€15 and €40 billion) in 2012-2013 and, then, for two time periods (2011-2012, and 2013-2014) for the same cutoff point (€30 billion). The results are presented in Figure 1, Panel C. In both cases, we find that there are differences in the bank distribution density across the €15 and €40 billion cutoff points (as for the €30 billion case), but we do not observe structural breaks around these placebo thresholds, as instead we find around the €30 billion cutoff point.

In Panel D, we also show that the €30 billion the structural break is specific to 2013, we do not find such break in the distribution density between 2011 and 2012 and between 2013 and 2014. Overall, Panels B, C, and D of Figure 1 provide evidence in line with the descriptive evidence drawn from Panel A, thus reinforcing the descriptive evidence that some sorting behavior took place between 2012 and 2013 around the €30 billion cutoff and this is specific to that asset level.

4.2 Growth Rate of Bank Balance Sheet Items

Another way to think about the anticipated-ECB supervision for banks with asset size above €30 billion is in a treatment-control framework. The announcement at the end of 2012 put banks that are above the €30 billion threshold in a dilemma. As discussed above, ECB supervision was likely to be perceived as tighter and thus expected to impose higher costs of supervision on banks that above the €30 billion cutoff. The cost of avoiding the ECB supervision is likely to increase with bank size: it is arguably easier to shrink a bank's balance sheet by one billion Euro than by ten or twenty billion Euro. Furthermore, the cost of being caught in manipulation is likely to be lower closer to the threshold: a bank that is close to the threshold and shrinks its assets might be thought as just having a bad year (unlucky). Conversely, a large bank shirking its assets dramatically to a level just below the threshold may be calling for a thorough investigation.

Thus, we can think about 2012 announcement as an imposing a future tighter supervision on banks with assets greater than €30 billion, and at the same time providing a *differential incentive* for banks to avoid this supervision. Our identifying assumption is that this incentive to avoid supervision depends at least partly on the distance from the threshold. As econometricians, we do not observe the cost-benefit calculation of banks do with respect to actively shrinking their balance sheets, so we pursue an Intention-to-Treat (ITT) approach (Angrist, Imbens, and Rubin, 1996), where we lump together all the banks that are likely to have higher propensity to take actions to reduce their balance sheet sizes. Our treated group (banks more likely to engage in manipulation), therefore, is the group of banks that are the closest to the €30 billion threshold, and the control (banks less likely to engage in manipulation) are larger banks. Since we do not know the exact cutoff that would separate these groups, we try several windows of bank sizes.

We start with defining the treated banks as those with total assets of €30 to €32.5 billion at the end of 2012. The question is whether this group of banks are inherently similar to banks that are larger. Table 4 presents the results. Column 1 shows that difference-in-means (DIM) for several key variables for the group of banks with total assets of €30 to €32.5 billion at the end of 2012 relative to larger banks. In 2010-2012, these two groups have statistically indistinguishable means for the key growth variables. This exercise is akin to both a parallel trends test, and these results verify that the banks just above the threshold at the end of 2012 did not behave differently compared to larger banks in prior years.

For the treatment year, 2013, Columns 1 and 2 show a statistically-significant difference in means between the treated group (€30 to €32.5 billion) and the control group (>€32.5 billion). On average, the treated group, just above the threshold, significantly shrank its assets, loans, increased its gross non-performing loans (NPL), decreased its total earning assets, and increased its equity. Since the treated group is based on intention-to-treat, this group includes both Sorters (who are compliers, in the econometric sense) and banks that did not alter their asset size or did not succeed doing so (non-compliers). The estimates in Column 1 show the average effects for both types combined.

In Columns 3 to 8, we increase the window of the banks that may be tempted to manipulate their assets. The results show that there is no material difference in means for all window width (except maybe the largest). Also, the effect in 2013 is the strongest when using the tighter window. Overall, these results support that the idea that the fact that the banks that happened to be located just above the €30 billion threshold are not materially different from the rest of larger banks, thus orthogonal with respect to the outcome variables and treated and untreated banks satisfy the parallel trend assumption.

<< INSERT TABLE 4>>

We also present the information in a graphical form. In Figure 2 we compare the growth rate of total assets of banks in a narrow band above the €30 billion threshold (e.g., €30 and €31 billion) to banks that surely do no have an incentive to manipulate their asset size: banks with total assets between €2 to €10 billion or greater than €100 billion. We include in our analysis the years 2010-2013, where 2010-2012 are the control years and 2013 is considered the treatment period.

We perform the analysis in two forms. In Figure 2, Panel A, we present the difference-in-difference (DID) estimator obtained from comparing banks in different windows to the control banks, whether window of the treated banks is at a constant width of €1 billion, and is moving from €30 to €35 billion. The x-axis shows the distance of the bandwidth from the €30 billion mark (the first tick is for banks between €30 and €31 billion, the second tick is for banks between €31 and €32 billion, etc.). The plot shows that banks with asset size between €30 and €32 billion in 2013 abnormally dropped their asset size by almost 20% relative to the control banks, and to their own growth rate in previous years.

In Figure 2, Panel B, we plot the DID estimates obtained by comparing banks in a window that grows wider to the control banks. In the first estimate, treated banks are those between €30 and €31 billion; in the second, treated banks are those between €30 and €32 billion, etc.). We cannot reject (at 5% confidence level) the null hypothesis of no strategic behavior for banks with total assets ranging between €30 and €45 billion.

<< INSERT FIGURE 2>>

Next, we present a similar analysis for the growth of the different balance sheet items. Figure 3, Panel A, shows the results from the marginal analysis. These results indicate that banks with an asset size between €30 and €32 billion strategically dropped their asset size by reducing

their loans, liquid assets and, overall, the earning assets. The magnitude of the mean decline is 6% for lending activities, 15% for liquid assets and 3.5% for total earning assets. Looking at the mean effect (Figure 3, Panel B), we cannot reject (at 5% confidence level) the null hypotheses of: (i) no strategic lending drop for banks with total assets ranging between €30 and €39 billion; (ii) no strategic liquid asset drop for banks with total assets ranging between €30 and €42 billion; and (iii) no strategic earning asset drop for banks with total assets ranging between €30 and €37 billion.

<< INSERT FIGURE 3>>

Interestingly, we find that impaired loans increased showing that banks dropped performing loans rather than impaired loans. This finding suggests that potentially banks reclassified loans that were considered previously performing as impaired. Also, banks with an asset size between €30 and €34 billion increased their reserve for impaired loans: while this is consistent with the increase of impaired loans, this also suggest that banks declined their asset size by recognizing losses for bad loans.

5 How Did Banks Shrink Their Balance Sheets?

In this section, we discuss the way Sorters were able to drop their asset size. As shown in the Figure 1, we identify eight banks with total assets greater than €30 billion in 2012, but lower in 2013. Two banks (labeled here as Banks 1 and 2) achieved a very high asset drop between 2012 and 2013 (55% and -86%, respectively): in both cases, such dramatic asset drop was obtained by the split of the bank in two smaller and distinct companies. In both cases, the European Central Bank classified the two groups of companies as Significant banks (assuming so the direct supervision), despite the breakup and the fact the banking units within the groups had total assets

that were lower than threshold. In the remaining of the paper—following the ECB decision—we include these two banks in the group of Significant banks and not in the group of Sorters.

The remaining six banks have been categorized by the ECB as Less-significant banks and so are directly supervised by NCAs. Among them, there is another bank (labeled as Bank 3) spin-off part of their business in another company and this resulted in an asset drop of 15% (from €30.5 to €26.0 billion). The remaining five Sorters (labeled as Banks 4 to 8) registered a lower assets drop that was due to a decline in various asset items, as net loans (-21% in Bank 6, and -28% in Banks 4 and 8), fixed assets (-33% in Bank 4, -21% in Bank 6, and -34% in Bank 8), and derivatives (-25% in Bank 4, -36% in Bank 5, -58% in Bank 6, and -24% in Bank 6). We report graphical evidence of changes for the banks. We reported graphical evidence of the evolution of Sorters' total assets, total loans, and fixed assets in the Figure 4.

It appears that a strategy that several banks took was to convert a significant portion of their loan portfolio to NPLs, and then build a reserve for future losses. This is apparent in Table 4: gross NPL increase dramatically for Sorters as loans decline. However, net NPL does not change. The difference between gross and net NPLs is the reserve, meaning that Sorters recognized a loss in 2013 in advance for future losses. This means that, in fact, Sorters are likely not to change their operations in order to reduce their assets, but rather to engage in manipulation of their financial statements.

<< INSERT FIGURE 4>>

6 Estimating the SSM Effect, Accounting for Banks' Strategic Behavior

In this section, we explore the effects of centralized supervision on the behavior of banks. Previous literature measured the effects of the SSM, by sharply comparing variables across the two sides of

the threshold and found that banks under the supervision of the ECB behaved in a more conservative way. Eber and Minou (2017) and Fiordelisi, Ricci, and Stentella Lopes (2017) use different subsets of our data to compare the behavior of banks in response to the supranational supervision. Specifically, they conduct DID and regression discontinuity design (RDD) analyses around the €30 billion threshold, comparing banks' lending behavior prior to the SSM announcement (2012 and/or earlier) to that following the announcement (2013 and/or later). The idea of these studies is that once the SSM was announced, banks adjusted their behavior in anticipation for the ECB comprehensive assessment ahead of the initiation of the supervision.

Given that some banks engaged in sorting behavior, the previous may have misestimated the effects of SSM. There are two reasons for this. First, Sorters could have been classified as Less-significant banks in 2013 and 2014 since they were considered Less-significant. Second, when measuring lending behavior or total assets growth, Sorters appear to have a very low growth in 2013, attenuating the estimation of the effect of SSM. The effects of Sorters would be generally important because the number of banks in these samples are generally small; they will be even more important when using RD, which puts heavier weight on observations near the cutoff: these are more likely to be Sorting banks.

In the current section, we implement three methods that account for the strategic behavior of banks around the threshold. Our results, across all tests, that the inclusion of the Sorters in the analysis biases upwards the estimation of the effects of SSM. More specifically, after accounting for sorting behavior, the estimates of loan growth of banks under the ECB supervision would be lower by a least 1.1 percentage points and asset growth would be lower by 2.0 percentage points. These revised estimations are lower by a relative magnitude of 20% or greater.

To account for the sorting mechanism and evaluate the causal effect of SSM introduction and bank behavior, we run three complementary approaches:

(i) a reweighted difference-in-means (R-DIM) approach, aimed at downsizing the weight of those banks expected to be more prone to sort;

(ii) a local average treatment effect (LATE) approach à la Imbens and Angrist (1994) aiming at restoring impact estimates consistency whenever an instrumental variable providing exogenous inducement to treatment is available; and

(iii) a reweighted sharp regression discontinuity model (WRR) estimating outcome discontinuity at threshold using "locally" the same weights employed for performing method (i).

The common principal for all these approaches is that observations close to the threshold might not be reliable because of the likelihood of being Sorters and thus need to be discounted. The methods defer from each other in the assumptions that they make, the weighting schemes, and estimation techniques.

6.1 Reweighted DIM Approach

To account for the sorting and safely apply the above described methods, one strategy was to develop an appropriate weighting scheme, giving the highest weights (weight of 1) to banks that did not engage in a sorting behavior between 2012 and 2013 and the lowest weight (weight of 0) to banks that strategically behaved.

The weighting system is based on two parameters: (i) the decrease in asset size between 2012 and 2013, and (ii) the asset distance from the €30 billion threshold. In the case of banks with an asset size either lower than €20 billion and greater than €100 billion, we assume that the distance

from the threshold was so high that that they could not manage their assets in order to eschew the supervision of the ECB, and thus will be classified as Less-significant or Significant, respectively. Both very small and very large banks receive a weight of 1 regardless their asset growth between 2012 and 2013.

In the case of banks with an asset size ranging between €20 and €100 billion, the weight is the geometric average of the standardized asset decrease (i.e., weight of 0 for the greatest decrease and 1for the lowest decrease) and the standardized asset distance from the threshold (i.e., 0 for the closest bank to the threshold; 1 for the largest distance from the threshold). As such, a bank (with assets of €20 to €100 billion) close to the asset threshold and/or with the largest asset declining rate receive a weight close zero. Conversely, a bank close to the upper or lower boundary (e.g., either close to €20 or €100 billion) and/or the lowest rate of asset growth receives a weight close to 1).

Table 5 presents the results of the reweighted DIM. As usual reweighting estimators, also this one entails a straightforward Weighted Least Squares (WLS) regression of the outcome on the treatment, using the weights built as explained in the previous section. Overall, our results still show significant effects of the SSM on the large majority of bank performance indicators. We begin with present the unweighted estimates in the odd columns. For example, Column 1 shows that a naïve implementation of the threshold cutoff would yield a decline of 7.2% in total assets of the banks under the ECB supervision. In contrast, reweighting the observations (Column 2) yields a decline of 9.2% in the assets of the Significant banks. Looking at the composition of the assets of banks, Columns 3 to 18 show that naïve implementation of the threshold rule would underestimate the growth of all items. In particular, Significant banks exhibit a decline of 7.5% of loans (Column 4), 3.5% of net NPLs (Column 8), 5.1% of liquid assets (Column 10), 3.0% of

securities (Column 12), and 1.8% of fixed assets (Column 14). Overall, Significant banks reduced their total earning assets by 5.5% (Column 16) and non-earning assets by 9.0% (Column 18).

<< INSERT TABLE 5>>

6.2 The LATE Approach

As discussed above, a main issue of the sorting behavior is that banks take actions to move from one side of the threshold to the other. Here, we apply insights from Imbens and Angrists' (1994) local average treatment effect (LATE) instrumental variable application. Instead of using the banks' ex-post allocation to Significant and Less-significant, we instrument their classification using their 2012 position (prior to the announcement) above or below the threshold. Hence, the first stage regression is a regression of an indicator to whether a bank is above or below the cutoff in 2013 (after the announcement), and the instrument is an indicator to whether a bank is above or below the cutoff in 2012 (prior to the announcement) in addition to controls. The second stage uses the predicted value of whether a bank is above or below the threshold as the main variable of interest. Appendix A provides more detailed motivation for using 2012 bank position as an instrument.

Table 6 shows the LATE estimation in our case, where estimates are also adjusted for some covariates. Again, results show that the SSM was effective on pretty all the outcome variables obtained. Furthermore, we can trust these results, as the first-stage results are very good (see the odd columns of the table for each outcome). Our results are strongly consistent with those obtained by the reweighted DIM. Specifically, we document (Column 2) an 8.8% asset decline between 2012 and 2013 generated by the SSM: this was achieved by a decline in various items, and in

particular a decline of 6.7% in total loans (Column 3), 7.5% in liquid-asset (Column 6), and 8.9% in non-earning assets (Column 10).

Effectively, this instrument does two things. First, it "returns" banks to their original position as in 2012. A bank that crossed the threshold (in either direction) would have a predicted value pointing to its original location. Second, the instrument tones down the magnitude of the difference between the growth rates on the two sides of the threshold (the coefficient value is lower than 1), downplaying the effect of unusually-large negative growth of Sorters.

<< INSERT TABLE 6>>

6.3 Reweighted Regression Discontinuity Design

Given the sorting behavior of some banks, a sharp RDD that identifies the effect using observations around the threshold is inappropriate because this is exactly where sorting is most likely to take place. To tackle the problem of unreliable observations around the cutoff, we run a reweighted RDD procedure, that is, one that reweights observations by given lower weights to potential Sorters. We pursue the same reweighting scheme as in Section 6.1 Weights are 1 for banks that are not likely to engage in Sorting (very small or very large). Weights are smaller than 1 for observations that are close to the threshold and/or that have large negative changes in balance sheet items.

We perform the weighted estimation using different bandwidths around the €30 billion threshold (€10, €15, €20, €50, and €100 billion). To estimate the discontinuity at the cutoff, we use quadratic polynomials from both sides of the threshold. In Table 7, we provide the estimations for the different bandwidths. Across all variables, the estimation becomes more precise and with smaller absolute magnitude as we expand the bandwidth. Even in the widest bandwidth (banks

between 0 and €130 billion), the estimate of asset growth and loan growth, -14.1% and -15.3%, respectively, are as double as large as previously found.

<< INSERT TABLE 7>>

7 Conclusion

The centralization of banking supervision in Europe was an historic event. For the first time, 19 national states surrender their responsibility for supervising their largest banks to the ECB. A major problem in assessing this phenomenon is the presence of the so-called "sorting" mechanism as some banks did have the incentives to avoid supervision by the ECB thereby biasing the validity of the threshold as an instrument.

We show that some banks did some sorting in the interim by declining their total assets in an effort to avoid the €30 billion asset threshold. To account for the sorting mechanism and evaluate the causal effect of SSM introduction and bank behavior, we run three complementary econometric approaches. Our results, across all tests, show that previous studies substantially underestimate the effects of SSM and we provide robust evidence that the SSM generated an asset decline (at least 9.5%) between 2012 and 2013, mainly obtained by a combination of conservative accounting as well as actual decline in credit: reducing net loans, non-performing loans, and total securities.

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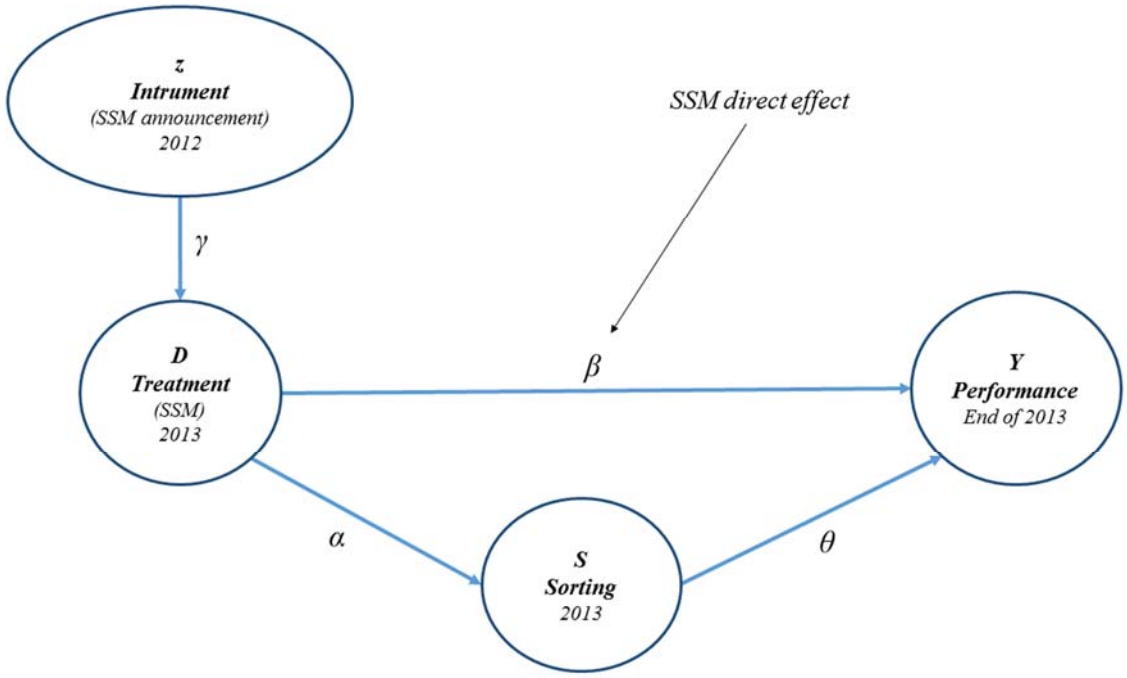
Appendix A:
Motivation for LATE Approach

Because of bank sorting, the naïve comparison between the performance of banks on the left and banks on the right of the threshold at the end of 2013 is biased, as the ECB's policy induced a non-random treatment setting, where both observable and unobservable-to-analyst factors could explain the departure from a perfectly natural experiment. The figure below provides the causal path diagram explain this occurrence:



First, we are interested in estimating β, the direct effect of D (i.e., the ECB's participation dummy) on a given performance (Y). Nonetheless, the anticipated disclosure of criteria for identifying Significant banks (under the ECB direct supervision) induced a sorting behavior (S) which runs as a mediator in the path between D and Y, thus generating an indirect effect of D on Y (measured by the product of the coefficients α and θ). As S in not directly observable, we cannot estimate the direct ECB's supervision effect from the total effect of D on Y, unless an instrument z would be available. The announcement of the upcoming SSM policy at the end of 2012 comes however in

handy as possible instrument, as it took the form of an exogenous shock. This shock can serve as instrument in the regression of D on Y. This is the prototypal setting of random treatment with imperfect compliance with z playing the role of the instrument. Imbens and Angrist (1994) showed that an instrumental variable estimation of D on Y, using z as instrument, provides identification of β as a local average treatment effect (LATE), which is the policy effect on the compliers' subpopulation. The external validity of LATE estimation is as larger as the parameter γ—the inducement to treatment—is sizeable and statistically significant. The formula of the LATE is just the ratio between an OLS of Y on z and of D on z:

$$LATE = \frac{E(Y \mid z = 1) - E(Y \mid z = 0)}{E(D \mid z = 1) - E(D \mid z = 0)}.$$

Table 1:
Events in the Launch of the Single Supervisory Mechanism (SSM)

This table reports the main events related to the SSM launch.

September 7, 2012	ECB vice president's speech at the Duisenberg School of Finance titled "Toward a European Banking Union."
September 12, 2012	The European Commission adopts two proposals for the establishment of a Single Supervisor Mechanism (SSM) for banks led by the European Central Bank (ECB).
December 14, 2012	• The Economic and Financial Affairs Council (ECOFIN) reaches a landmark agreement on the establishment of the SSM. • Disclosure of the criteria adopted by the ECB to identify Significant banks.
February 12, 2013	ECB vice president's speech at the Warwick Economics Summit titled "Financial Stability Risks, Monetary Policy and the Need for Macro-Prudential Policy."
September 12, 2013	ECB welcomes European Parliament vote to create the SSM.
October 23, 2013	ECB starts comprehensive assessment in advance of its supervisory role.
December 16, 2013	Danièle Nouy appointed as chair of the SSM Supervisory Board.
January 9, 2014	New director general for supervision appoints four new directors general to take up positions in early 2014.
January 22, 2014	ECB proposes candidate for vice chair of the SSM Supervisory Board.
February 3, 2014	ECB makes progress with asset quality review and confirms stress-test parameters for comprehensive assessment.
February 7, 2014	ECB launches public consultation on draft ECB SSM Framework Regulation.
March 7, 2014	Supervisory board members appointed.
March 11, 2014	ECB publishes manual for Asset Quality Review (AQR).
April 25, 2014	ECB publishes SSM Framework Regulation.
April 29, 2014	ECB gives banks 6-9 months to cover capital shortfalls following comprehensive assessment.
May 27, 2014	ECB launches public consultation on draft ECB regulation on supervisory fees.
July 17, 2014	ECB publishes disclosure process for comprehensive assessment.
July 23, 2014	Lithuania to join Euro area and the SSM on January 1, 2015.
September 4, 2014	ECB publishes final list of Significant credit institutions.
September 8, 2014	Members of the Administrative Board of Review appointed.
October 10, 2014	ECB discloses final results of comprehensive assessment.
October 22, 2014	Statement about media reports ahead of comprehensive assessment results.
October 23, 2014	ECB launches public consultation on draft regulation on reporting of supervisory financial information.
October 26, 2014	ECB's in-depth review shows banks need to take further action.
November 4, 2014	SSM begins.

Table 2:
Variable Definitions

This table defines the variables used in the paper.

Variables	Definition and calculation method
Assets Growth (A_t/A_{t-1})	The growth rate of total assets (A) over two consecutive years.
Loans Growth (L_t/L_{t-1})	The growth rate of total loans (L) over two consecutive years.
Gross Non-Performing Loans Growth ($G\text{-}NPL_t/ G\text{-}NPL_{t-1}$)	The gross impaired loans (G-NPL) growth rate over two consecutive years.
Net Non-Performing Loans Growth ($N\text{-}NPL_t/ N\text{-}NPL_{t-1}$)	The net impaired loans (N-NPL) is the gross NPL value minus the reserve for impaired losses, growth rate over two consecutive years.
Liquid Assets Growth (LA_t/LA_{t-1})	The liquid assets (LA) is the sum of all of the bank's earning assets excluding loans to consumers and to other banks, growth rate over two consecutive years.
Securities Growth (Se_t/Se_{t-1})	The Total Securities (Se) is the sum of all securities hold by the bank, growth rate over two consecutive years.
Total Earning Assets Growth (EA_t/EA_{t-1})	The growth of earning assets (EA) is the sum of all of the bank's earning assets excluding total loans, over two consecutive years.
Equity Growth (E_t/E_{t-1})	The growth of the total equity (E) over two consecutive years.
Size	The natural log of total assets.
Return on Assets	The ratio of pre-tax profits-to-total assets. Return on Assets (ROA) measures bank profitability while avoiding the effect of fiscal differences among countries.
Capital Ratio	The ratio of total equity and total assets (i.e., Equity-to-Total Assets, E/TA). The Capital Ratio measures bank capital adequacy.

Table 3:
Summary Statistics

This table reports the summary statistics of the sample, between 2011 and 2013, for all of the variables used in the paper. We use both Significant and Less-significant European banks (following the ECB's definition of Significant). Data is winsorized at 1% and 99%.

Variable	Obs	Mean	Std. Dev.	Min	Max
Asset Growth	3986	0.0345	0.1318	-0.4038	0.9481
Loans Growth	3983	0.0389	0.1364	-0.4164	1.0333
Gross NPL Growth	2060	0.1047	0.2332	-0.2575	0.5489
Net NPL Growth	2367	0.1033	0.2117	-0.2033	0.5352
Liquid Assets Growth	4046	-0.8617	0.1105	-0.9983	-0.1411
Total Earning Assets Growth	3984	0.0257	0.0667	-0.0783	0.1618
Total Non-Earning Assets Growth	3985	0.0504	0.2673	-0.3111	0.5588
Equity Growth	3986	0.0853	0.1967	-0.5060	1.1090
Total Assets (in billion EUR)	4049	38.0022	165.1504	1.0013	2440.1140
Total Loans over Total Assets	4049	0.6979	0.1603	0.3300	0.9999
Capital Ratio	4049	0.0877	0.0646	0.0043	0.9871
Return on Assets	4046	0.0045	0.0123	-0.0676	0.0760

Source of data: Bankscope database

Table 4:
Difference-in-Means (DIM) Estimator of the Banks' Key Variables Before and After the SSM Launch

The table compares the growth rate of banks that are likely to be tempted to manipulate their asset size as a response to the SSM in 2013 to larger banks. For example, Column 1 compares the means of variables of the group of banks with asset size of €30 to €32.5 billion at the end of 2012 to banks larger than €32.5 billion, in each of the years. Columns 1, 3, 5, and 7 present the difference in means between treated and untreated banks, and Columns 2, 4, 6, and 8 show *p*-values from a *t*-test. The variable construction is reported in Table 1. *, **, *** indicate significance at the 1, 5%, and 10% levels, respectively.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Assets window (in billion EUR) as of the end of 2012:	30–32.5		30–35		30–40		30–45	
Year		*Difference*	*P-value*	*Difference*	*P-value*	*Difference*	*P-value*	*Difference*	*P-value*
2010	Asset growth	0.027	0.617	0.009	0.799	0.002	0.947	-0.007	0.737
	Loans growth	-0.029	0.637	0.046	0.248	0.020	0.486	0.005	0.851
	Gross NPL growth	-0.117	0.401	0.065	0.510	0.078	0.202	0.033	0.515
	Net NPL growth	-0.088	0.332	-0.024	0.719	0.033	0.466	0.018	0.638
	Liquid Assets growth	-0.081	0.522	-0.110	0.182	-0.073	0.223	-0.077	0.125
	Total Earning Assets growth	0.036	0.159	0.011	0.502	0.008	0.525	-0.000	0.998
	Equity growth	0.039	0.546	0.037	0.384	-0.018	0.569	-0.031	0.226
2011	Asset growth	0.065	0.309	0.018	0.635	-0.001	0.960	-0.020	0.400
	Loans growth	0.079	0.209	0.023	0.534	0.004	0.887	-0.008	0.733
	Gross NPL growth	0.044	0.696	-0.013	0.860	0.007	0.905	-0.000	0.996
	Net NPL growth	0.050	0.577	-0.046	0.425	-0.012	0.790	-0.005	0.900
	Liquid Assets growth	-0.173	0.227	-0.103	0.231	-0.068	0.272	-0.119	0.023**
	Total Earning Assets growth	0.032	0.248	0.020	0.229	0.008	0.526	-0.007	0.493
	Equity growth	0.032	0.733	-0.052	0.352	-0.037	0.362	-0.077	0.025**
2012	Asset growth	0.030	0.622	0.003	0.938	-0.030	0.330	-0.061	0.007***
	Loans growth	0.051	0.380	0.048	0.218	0.015	0.597	-0.022	0.304
	Gross NPL growth	0.090	0.458	0.090	0.296	0.082	0.212	0.061	0.186
	Net NPL growth	0.019	0.839	0.026	0.694	0.034	0.532	0.008	0.838
	Liquid Assets growth	0.211	0.115	0.092	0.310	0.011	0.871	0.016	0.741
	Total Earning Assets growth	-0.004	0.872	-0.010	0.604	-0.028	0.044*	-0.036	0.000***
	Equity growth	-0.029	0.692	0.041	0.412	0.017	0.658	0.059	0.034**
2013	Asset growth	-0.151	0.001***	-0.136	0.000***	-0.101	0.000***	-0.072	0.001***
	Loans growth	-0.121	0.014**	-0.095	0.007***	-0.068	0.009***	-0.056	0.009***
	Gross NPL growth	0.248	0.017**	0.093	0.166	0.046	0.380	0.079	0.055*
	Net NPL growth	-0.023	0.774	-0.056	0.316	-0.024	0.592	0.023	0.538
	Liquid Assets growth	-0.129	0.190	-0.158	0.027**	-0.099	0.063*	-0.020	0.656
	Total Earning Assets growth	-0.070	0.000***	-0.067	0.000***	-0.059	0.000***	-0.047	0.000***
	Equity growth	0.155	0.008***	0.031	0.455	-0.011	0.734	-0.026	0.312

Table 5:
SSM Effect on Assets and Liabilities Using the *Reweighted Difference-in-Means* (R-DIM)

This table reports the reweighted Difference-in-Means (R-DIM) estimator of the effect of SSM on assets and liabilities. This is based on a Weighted Least Squares (WLS) regression of the outcome on the treatment, using appropriate unit weights. The applied weighting scheme is based on two parameters: (1) the decline in the asset size between 2012 and 2013; (2) the asset distance from the €30 billion threshold. Each bank weight is calculated as a geometric mean of standardized measures of the previous two indicators. The variable of interest is the dummy. *, **, *** indicate significance at the 1, 5%, and 10% levels, respectively.

	(1) Assets growth *DIM*	(2) Assets growth *Weighted*	(3) Loans growth *DIM*	(4) Loans growth *Weighted*	(5) G-NPL growth *DIM*	(6) G-NPL growth *Weighted*	(7) N-NPL growth *DIM*	(8) N-NPL growth *Weighted*	(9) Liquid A. growth *DIM*	(10) Liquid A. growth *Weighted*
Cutoff (2013)	-0.0721***	-0.0923***	-0.0542***	-0.0746***	0.0339*	0.0259	-0.0208	-0.0346**	-0.0321*	-0.0507**
	(0.00808)	(0.00817)	(0.00874)	(0.00920)	(0.0186)	(0.0200)	(0.0144)	(0.0157)	(0.0193)	(0.0197)
Observations	2,780	2,762	2,722	2,705	1,807	1,802	1,944	1,927	2,769	2,751
Robust	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

(cont'd)	(11) Securities growth *DIM*	(12) Securities growth *Weighted*	(13) Fixed Assets growth *DIM*	(14) Fixed Assets growth *Weighted*	(15) Earning Ass. growth *DIM*	(16) Earning Ass. growth *Weighted*	(17) Non-Earning Ass. growth *DIM*	(18) Non-Earning Ass. growth *Weighted*
Cutoff (2013)	-0.0286**	-0.0295*	-0.0179***	-0.0180**	-0.0429***	-0.0545***	-0.0638***	-0.0901***
	(0.0145)	(0.0159)	(0.00672)	(0.00758)	(0.00485)	(0.00479)	(0.0181)	(0.0189)
Observations	2,677	2,659	2,685	2,668	2,775	2,757	2,776	2,758
Adjusted R^2	0.001	0.001	0.001	0.001	0.032	0.032	0.005	0.005
Robust	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 6:
Estimates of the Covariate Local Average Treatment Effect (C-LATE)

This table illustrates the estimates of the Covariate Local Average Treatment Effect (C-LATE). Column 1 presents the first-stage results. The first stage is common to all regressions in Columns 2 to 10. *I(Above Cutoff (2012))* is an indicator whether the bank's asset size is greater than €30 billion in 2012. *I(Above Cutoff (2013))* is an indicator whether the bank's asset size is greater than €30 billion in 2013. *IV(I(Above Cutoff (2013)))* is the predicted value based on the first-stage regression. *, **, *** indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: The response of Assets items

	(1) I(Above Cutoff (2013))	(2) Assets growth	(3) Loans growth	(4) G-NPL growth	(5) N-NPL growth	(6) Liquid Assets gr	(7) Securities growth	(8) Fixed Assets gr	(9) Earning Assets gr	(10) Non-Earning Assets gr
IV(I(Above Cutoff (2013)))		-0.088***	-0.067***	-0.000	-0.041*	-0.075**	-0.048**	-0.020*	-0.056***	-0.089***
		(0.012)	(0.013)	(0.022)	(0.019)	(0.025)	(0.018)	(0.010)	(0.006)	(0.024)
I(Above Cutoff (2012))	0.963***									
	(0.016)									
ROA (t-2)	-0.071	-0.199	-0.664	-0.492	-0.932	0.390	1.461*	0.693*	0.586**	-1.163
	(0.046)	(0.758)	(0.797)	(0.668)	(0.615)	(0.837)	(0.677)	(0.278)	(0.206)	(0.704)
Liq. Asset Ratio (t-2)	-0.020	-0.025	0.107*	-0.129	-0.109*	-0.346***	0.022	-0.006	-0.006	-0.143*
	(0.013)	(0.046)	(0.046)	(0.066)	(0.055)	(0.066)	(0.050)	(0.023)	(0.018)	(0.063)
Capital Ratio (t-2)	0.000	0.002*	0.002*	-0.000	-0.001	0.001	0.000	0.000	0.000	0.002
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)
Observations	1836	1837	1837	1368	1441	1836	1808	1817	1837	1837
Adjusted R^2		0.074	0.085	0.276	0.374	0.026	0.242	0.016	0.138	0.108
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Robust	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 6:
Estimates of the Covariate Local Average Treatment Effect (C-LATE) (Cont.)

Panel B: The response of Liabilities and Equity items

	(1) I(Above Cutoff (2013))	(2) Equity	(3) Customer Deposits	(4) Deposits
IV(I(Above Cutoff (2013)))		-0.049**	-0.022**	-0.043
		(0.018)	(0.008)	(0.027)
I(Above Cutoff (2012))	0.963***			
	(0.016)			
ROA (t-2)	-0.081	-1.104	0.167	2.064*
	(0.055)	(0.749)	(0.264)	(1.029)
Liq. Assets Ratio (t-2)	-0.021	-0.047	-0.041	0.059
	(0.014)	(0.043)	(0.021)	(0.073)
Capital Ratio (t-2)	0.000	0.000	0.000	0.001
	(0.000)	(0.001)	(0.000)	(0.002)
Observations	1887	1927	1891	1887
Adjusted R^2		0.069	0.107	0.082
Country Fixed Effects	Yes	Yes	Yes	Yes
Robust	Yes	Yes	Yes	Yes

Table 7:
SSM Impact Estimate on Assets and Liabilities Using Sharp Weighted Regression Discontinuity

This table sets out the estimates results of the impact of the SSM on assets and liabilities items, using a sharp Weighted Regression Discontinuity Design. The standard RDD setting is unsuited to recover the effect of SSM because of the bank sorting at threshold. To tackle this problem, the "reweighted RDD" reweights observation by given lower weights to Sorters. As the optimal bandwidths of Calonico, Cattaneo, and Titiunik (2014) are not valid for reweighted RDD, we provide results for several bandwidth (*h*). Standard errors are presented in parentheses. *, **, *** indicate significance at the 1%, 5%, and 10% levels, respectively.

Bandwidth (billion Euros):	h = 10	h = 15	h = 20	h = 50	h = 100
Asset Growth	-0.361*	-0.275*	-0.194	-0.157**	-0.141**
	(0.194)	(0.165)	(0.127)	(0.069)	(0.066)
N	100	169	294	2879	2914
R^2	0.162	0.109	0.0578	0.0099	0.0134
Loan Growth	-0.544**	-0.328	-0.273	-0.159*	-0.153*
	(0.277)	(0.250)	(0.174)	(0.088)	(0.086)
N	98	163	283	2803	2837
R^2	0.253	0.127	0.0769	0.0079	0.0117
Gross NPL Growth	-0.289*	-0.179	-0.208	-0.0811	-0.0955
	(0.162)	(0.165)	(0.150)	(0.101)	(0.094)
N	70	121	209	1827	1854
R^2	0.149	0.0429	0.0402	0.00192	0.00197
Net NPL Growth	-0.12	-0.118	-0.0695	-0.0845	-0.0667
	(0.212)	(0.163)	(0.139)	(0.089)	(0.081)
N	84	140	238	2003	2034
R^2	0.0288	0.0175	0.0119	0.000568	0.00223
Liquid Asset Growth	-0.0723	-0.157	-0.059	-0.0445	-0.00214
	(0.191)	(0.193)	(0.157)	(0.098)	(0.090)
N	100	169	294	2859	2894
R^2	0.0962	0.0106	0.00511	0.00149	0.0016
Securities Growth	-0.086	-0.0534	-0.086	-0.0559	-0.0283
	(0.124)	(0.120)	(0.110)	(0.074)	(0.066)
N	95	162	282	2733	2767
R^2	0.0123	0.018	0.0261	0.00147	0.00146

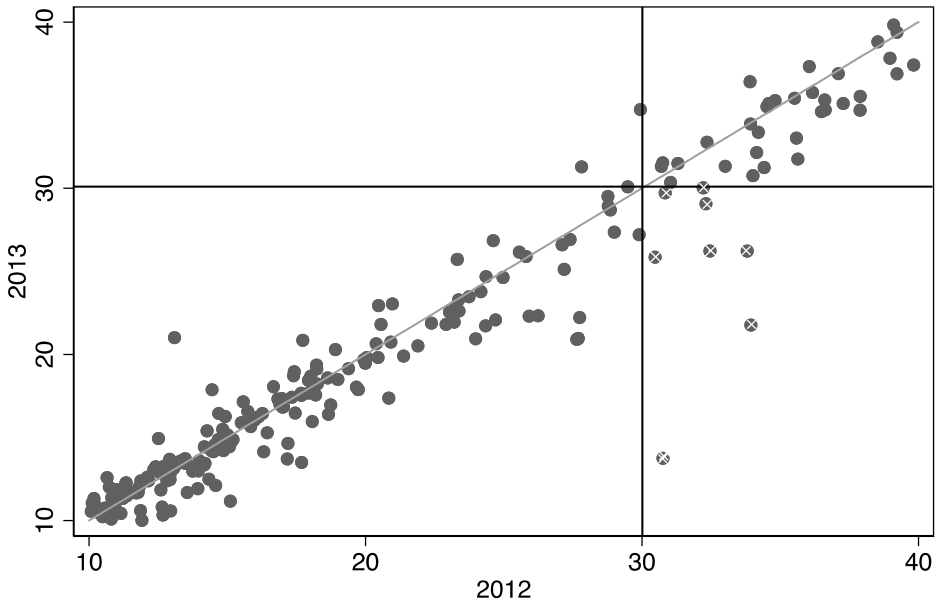
Table 7:
SSM Impact Estimate on Assets and Liabilities Using Sharp Weighted Regression Discontinuity (Cont.)

Bandwidth (billion Euros):	h = 10	h = 15	h = 20	h = 50	h = 100
Fixed Asset Growth	-0.168**	-0.125*	-0.128**	-0.086**	-0.092***
	(0.071)	(0.066)	(0.054)	(0.037)	(0.033)
N	93	157	278	2760	2790
R^2	0.0887	0.0379	0.0401	0.00436	0.00455
Earning Asset Growth	-0.0724	-0.0723	-0.074*	-0.059**	-0.053**
	(0.060)	(0.050)	(0.042)	(0.026)	(0.023)
N	100	169	294	2868	2903
R^2	0.109	0.0772	0.0525	0.0143	0.0204
Non-Earning Asset Growth	-0.518***	-0.297*	-0.191	-0.180**	-0.177**
	(0.151)	(0.171)	(0.135)	(0.090)	(0.081)
N	100	169	294	2874	2909
R^2	0.0663	0.0593	0.0246	0.00297	0.00419
Equity Growth	-0.251	-0.150	-0.137	-0.210**	-0.0619
	(0.273)	(0.214)	(0.168)	(0.106)	(0.094)
N	100	169	294	2878	2913
R^2	0.0916	0.0469	0.03	0.00646	0.00484
Customer Deposit Growth	-0.0847	-0.0655	-0.0468	-0.0603*	-0.052*
	(0.059)	(0.056)	(0.046)	(0.032)	(0.029)
N	93	155	274	2716	2744
R^2	0.0641	0.0418	0.0252	0.00305	0.00549
Deposit Growth	0.271	0.161	0.0762	0.0211	0.0152
	(0.173)	(0.187)	(0.161)	(0.109)	(0.094)
N	97	161	282	2700	2733
R^2	0.0457	0.00956	0.0119	0.000397	0.000382

Figure 1:
Evidence of Bank Sorting in Single Supervisory Mechanism (SSM)

The figure reports the graphical representation of the sorting process operated by banks in responding to SSM. Panel A illustrates banks' total assets in 2012 and 2013 around the €30 billion asset SSM threshold: the right-down quadrant displays banks with total assets greater than €30 billion at the end of 2012 and lower of €30 billion at the end of 2013. Using the Cattaneo, Jansson, and Ma (2018) sorting test based on density discontinuity (constructed using the results for local polynomial density estimators), Panel B shows the density discontinuity of Total assets around the €30 billion asset threshold at the end of the years 2012 and 2013, Panel C shows the density discontinuity of Total assets around the €15 and €45 billion asset thresholds in the period 2012-2013; Panel D shows the density discontinuity of Total assets around the €30 billion asset threshold in the periods 2011-2012 and 2013-2014.

Panel A. Bank Total Assets levels in 2012 and 2013 around the €30 billion asset SSM threshold



Panel B. D *2013*

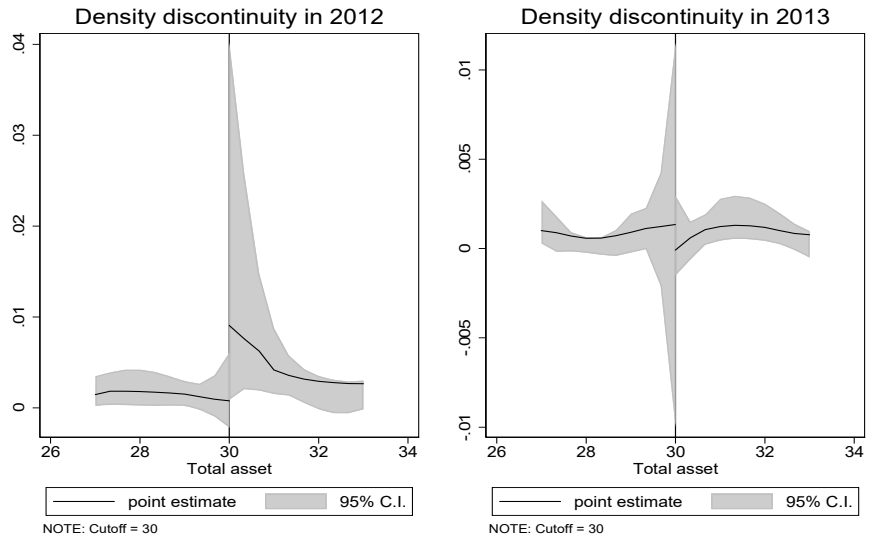
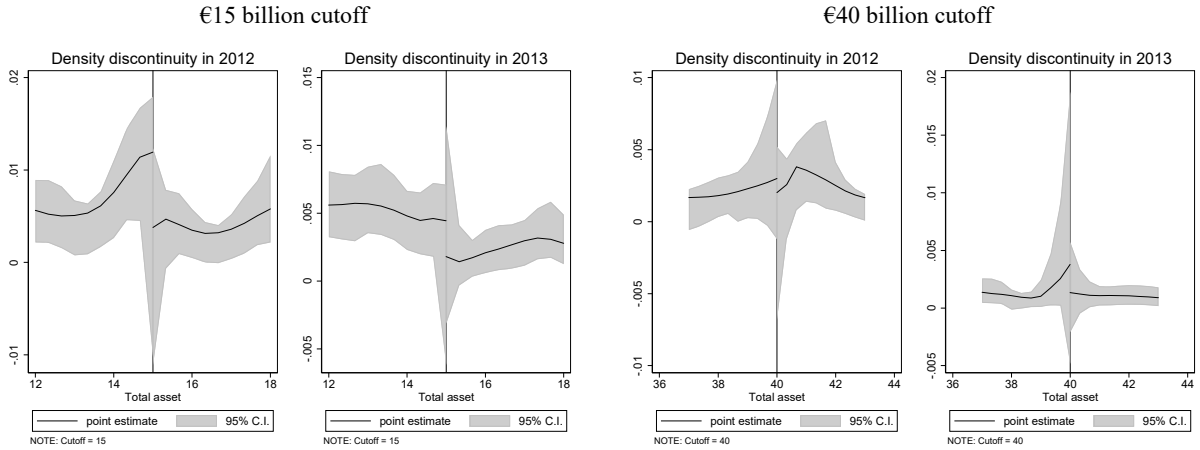


Figure 1:
Evidence of Bank Sorting in Single Supervisory Mechanism (SSM) (Cont.)

Panel C. Density discontinuity of Total Assets around the €15 and €40 billion asset threshold



Panel D. Density discontinuity of Total Assets around the €30 billion asset threshold in 2012 and 2014

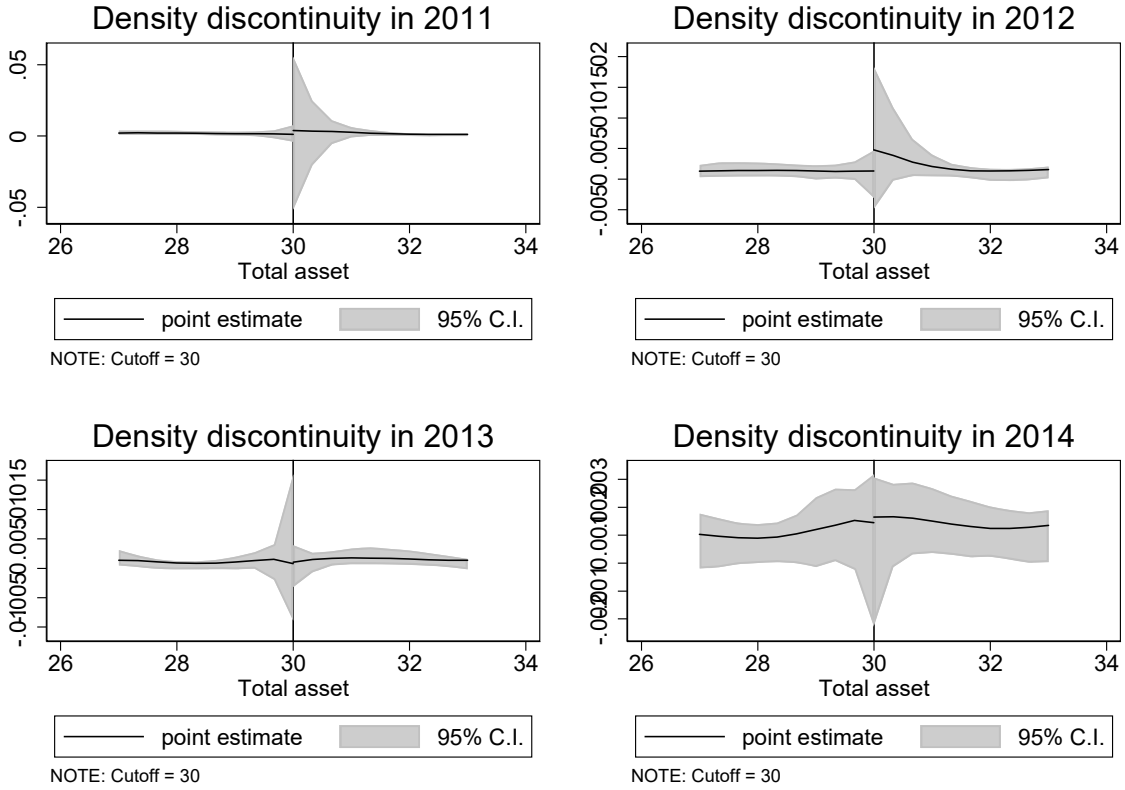
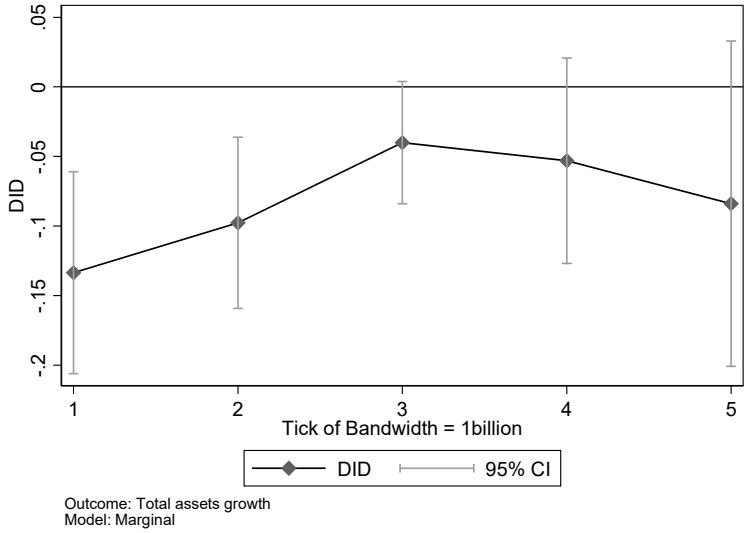


Figure 2:
The Strategic Use of the Asset Threshold in the Single Supervisory Mechanism (SSM): the Total Assets Drop between 2012 and 2013

The figure reports the graphical representation of the results of the DID model. In Panel A, we set out the DID estimate obtained by a marginal asset increase (i.e., in the first regression, treated banks are the ones between €30 and €31 billion; in the second, treated banks are the ones between €31 and €32 billion, in the third, banks between €32 and €33 billion, etc.). In Panel B, we plot the DID estimates obtained by *cumulating* the asset increase (i.e., in the first regression treated banks are those between €30 and €31 billion; in the second, treated banks are the ones between €30 and €32 billion, in the third, banks between €30 and €33 billion, etc.). The dependent variable is the annual total assets growth rate. The confidence intervals represent two standard errors.

Panel A: Marginal effect



Panel B: Mean effect

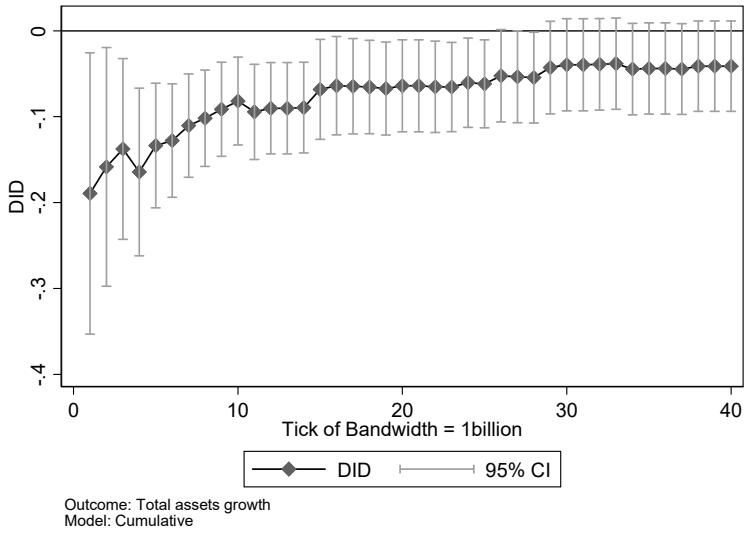


Figure 3:
The Strategic Use of the Asset Threshold in the Single Supervisory Mechanism (SSM): Asset Items Changes between 2012 and 2013

The figure reports the graphical representation of the results of the DID model in the Equation 2. In Panel A, we set out the DID estimate obtained by a marginal asset increase (i.e., in the first regression, treated banks are the ones between €30 and €32 billion; in the second, treated banks are the ones between €33 and €34 billion, in the third, banks between €34 and €36 billion, etc.). In Panel B, we plot the DID estimates obtained by *cumulating* the asset increase (i.e., in the first regression treated banks are those between €30 and €32 billion; in the second, treated banks are the ones between €30 and €34 billion, in the third, banks between €30 and €36 billion, etc.). The dependent variable is the annual total loan growth rate (in top left plot), the annual total liquid asset growth rate (in top central plot), the annual total earning assets growth rate (in top right plot), the annual total equity growth rate (in bottom left plot), the impaired loans (in bottom central plot), and the annual reserve for impaired loans (in bottom right plot).

Panel A: Marginal effect

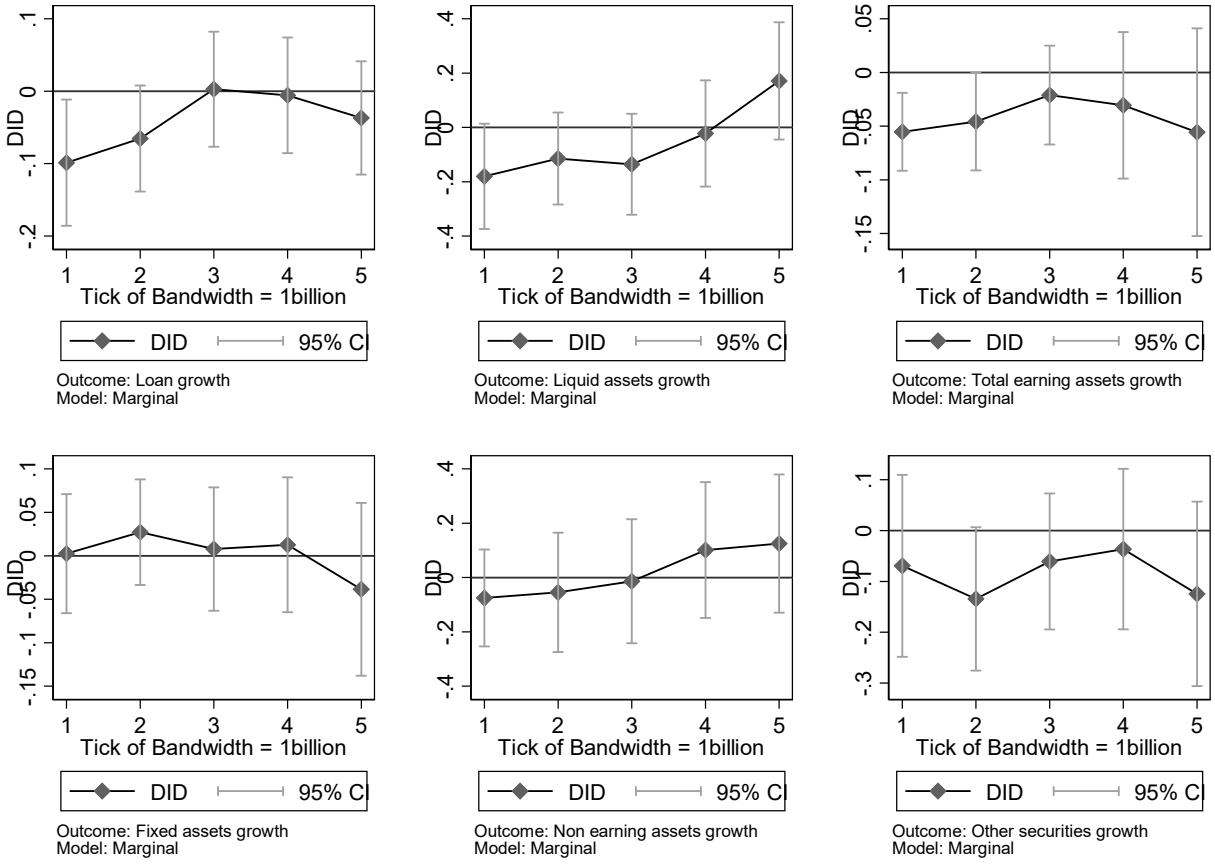


Figure 3:
The Strategic Use of the Asset Threshold in the Single Supervisory Mechanism (SSM): Asset Items Changes between 2012 and 2013 (Cont.)

Panel B: Mean effect

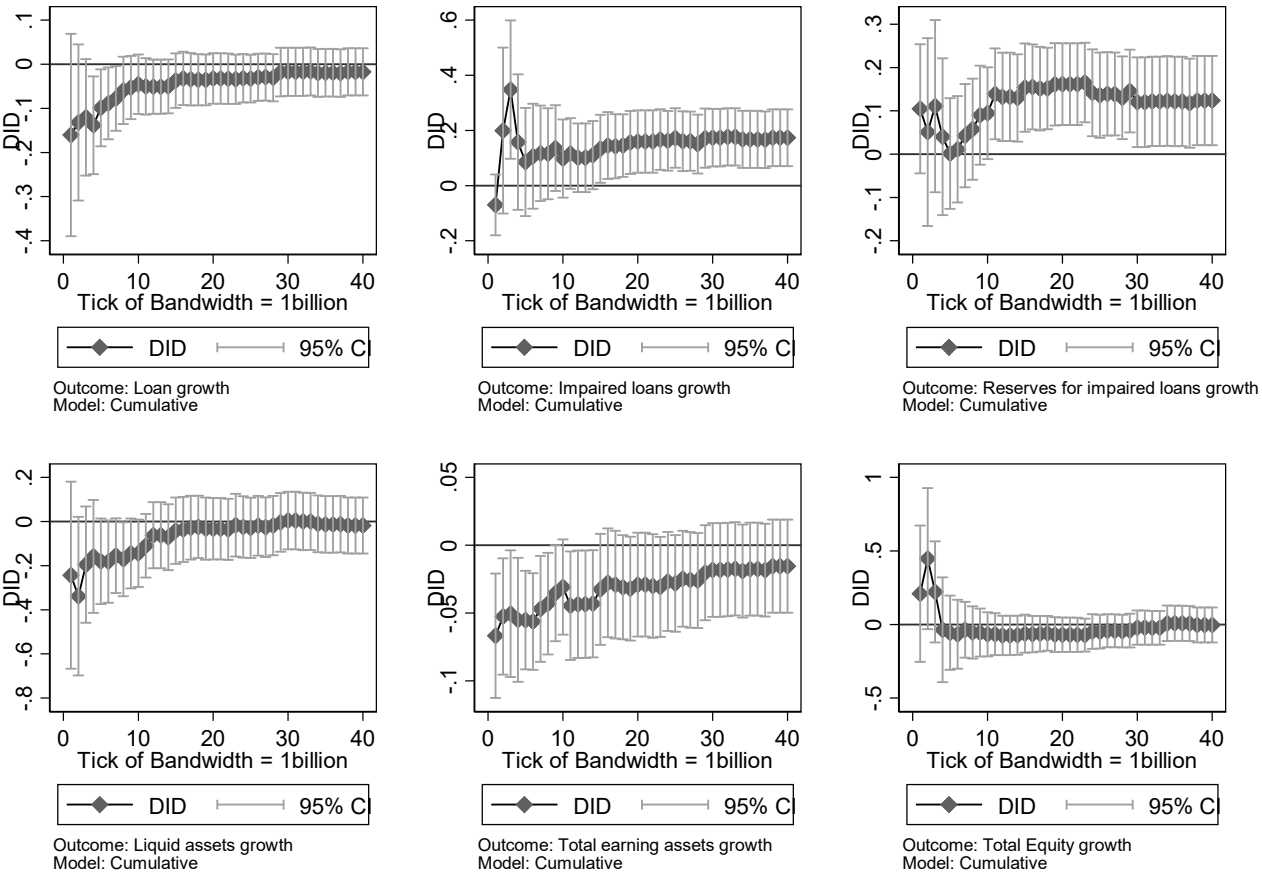
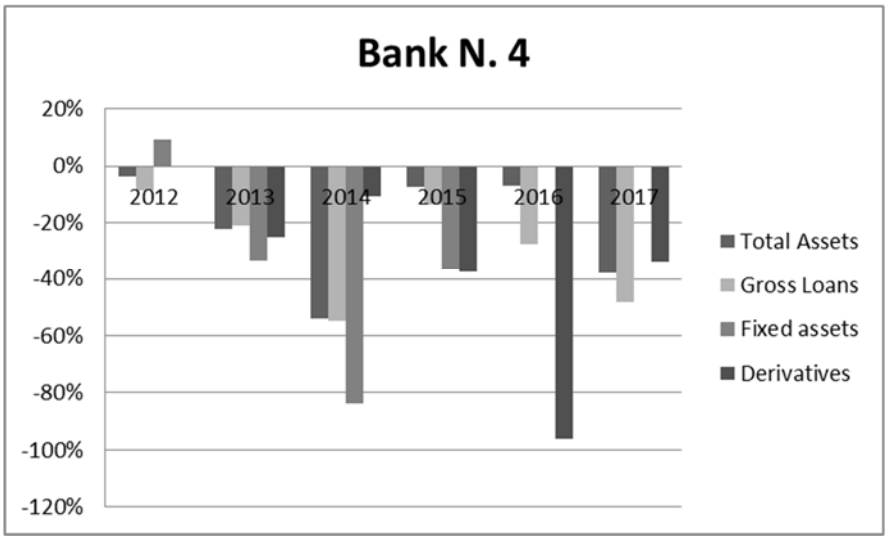


Figure 4:
Evidence of Bank Sorting in Single Supervisory Mechanism (SSM)

The figure reports the graphical representation of the annual rate of change of the Sorter Banks's total assets and main asset items from 2012 to 2017. The year of interest is the 2013 (i.e., the interim SSM period) where banks had the possibility to modify their asset composition.



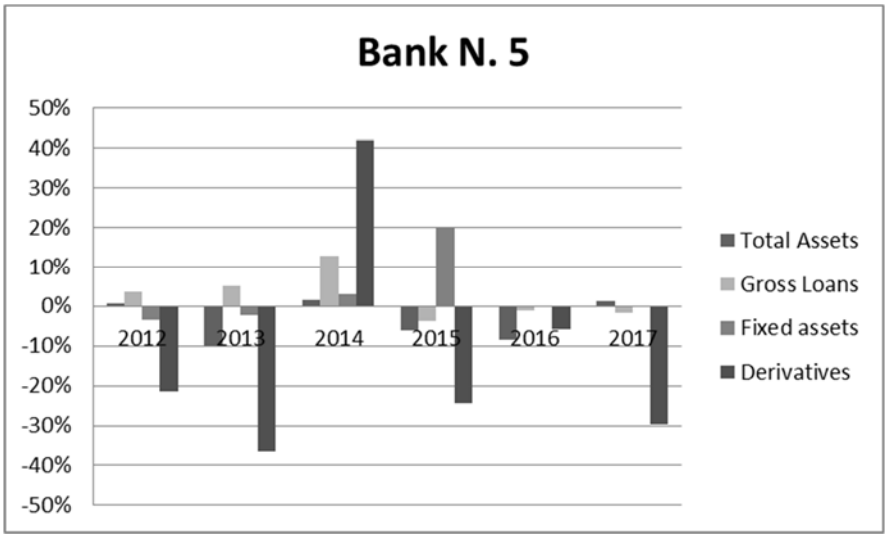


Figure 4:
Evidence of Bank Sorting in Single Supervisory Mechanism (SSM) (Cont.)