Depressing depositors and cheering up borrowers: The effects of bank bailouts on banking competition and the evolution of zombie banks

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Abstract

We investigate how government interventions such as blanket guarantees, liquidity support, recapitalizations, and nationalizations during banking crises affect banking competition. This issue is critical for stability, access to finance, and economic growth. Exploiting cross-country and cross-time variation in the timing of interventions and accounting for their non-random assignment, we document that liquidity support, recapitalizations, and nationalizations trigger economically large increases in competition. Moreover, zombie banks become collectively more important, increase market shares, and contribute to shifts in market conduct by affecting the pricing of deposits and loans following such interventions. Finally, while liquidity support, recapitalizations, and nationalizations reduce deposit rates they also decrease loan rates.

1. Introduction

Banking systems have been profoundly reshaped by crises and the concomitant policy responses. In recent years, governments and other authorities designated with bank regulation and supervision issued blanket guarantees, extended liquidity support, injected capital, and nationalized banks on an unprecedented scale (Hoshi and Kashyap (2010); Bayazitova and Shivdasani (2012); Philippon and Schnabl (2013); Duchin and Sosyura (forthcoming)). During tranquil periods, competitive effects of these policy responses tend to be limited to distressed institutions and their immediate competitors (Gropp, Hakenes and Schnabel (2011)). However, interventions during banking crises affect large numbers of institutions because such interventions send strong signals to all banks in the market, and make them anticipate future bailouts. This distorts their incentives with potential implications for competition (Acharya and Yorulmazer (2007)). Moreover, interventions can undermine the Schumpeterian process of creative destruction. Weak banks may not exit the market and evolve as economically unviable zombie banks, i.e. banks that have an economic net worth below zero. These zombie banks may crowd out their healthy competitors (Claessens (2009a)).

In this paper, we contribute to the debate about the unintended effects of government aid for the banking sector using a large dataset for 124 countries, 41 experienced banking crises between 1996 and 2010. While the recent crisis has shown that government interventions can have stabilizing effects, we ask what the effects are of blanket guarantees, liquidity support, recapitalizations, and nationalizations on banking competition during crises. We also establish

how these interventions correlate with the evolution of zombie banks, and we document their implications for deposit and loan rates. Although a growing literature started examining the effects of such interventions on risk-taking on the bank level which distinguishes between the behavior of rescued banks and the conduct of protected banks' competitors, no effort has been devoted to the effects on competition for the entire industry, despite the relevance for policy, regulation, and the pricing of banking products. We therefore perform our empirical tests on the aggregate level of the banking system, i.e., on the country level, to take the signalling effects for all banks into account. This is useful because the effects for the bank level studies yield ambiguous results.

While theoretical work and empirical evidence offer no *direct* predictions about the effect of government interventions on competition on the banking system level, several related studies on the bank level provide indications about how these interventions may affect bank conduct. Common to these interventions is that they supplant market discipline on the liability side and constitute a source of moral hazard on the asset side of banks' balance sheet. Focusing on asymmetric bailout policies, Hakenes and Schnabel (2010) and Acharya and Kulkarni (2013) show that guarantees for distressed banks provide them banks with competitive advantages in funding markets. Richardson and Troost (2009) show that liquidity support increases distressed banks' survival odds, and Berger and Bouwman (2013) document the same effect for banks with higher capital ratios, and they also show that better capitalized banks expand their market shares. On the other hand, Cordella and Yeyati (2003) predict that recapitalizations make banks less aggressive due to increases in charter values. Moral hazard effects from guarantees are documented in Gropp, Gruendl, and Guettler (forthcoming). Similarly, Freixas

(1999) highlights that central bank liquidity support creates moral hazard, and Duchin and Sosyura (forthcoming) discuss moral hazard implications of recapitalizations. .

Given these inconclusive theoretical predictions and the lack of comprehensive evidence, empirical work is necessary to establish the effects of government interventions on banking competition. However, in the absence of a natural experiment it is challenging to econometrically identify causal effects of interventions with cross-country data. Before employing difference-in-difference estimations for our main tests which exploit the variation of interventions across countries across time, we first carefully demonstrate that interventions are orthogonal with respect to the competitive environment, measured by Lerner indices and net interest margins. Moreover, we also offer visual and econometric evidence that treatment and control group countries satisfy the parallel trends assumption.

Our main results, unique in the literature, highlight economically large increases in competition from liquidity support, recapitalizations, and nationalizations. We can rule out that compressed interest income during crises, poor demand conditions, low monetary policy rates, and the recent crisis drive these results.

Disentangling reactions to banking crises from the responses to interventions is another challenge. Crises may cause similar effects than the government interventions on the outcomes we study, and in many instances the onset of crises coincides with the announcement of interventions. While our data do not permit comparing crisis countries with and without interventions because crisis countries also experience interventions, we show that the competition-increasing effects remain in place when we omit countries with systemic banking crises and constrain treatment countries to those which experience borderline (i.e., non-systemic) crises. We also observe increases in competition once we drop countries that

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witnessed the most intensive crises in terms of their rescue cost, and EU countries where rescue measures have been conditional on pro-competitive bank restructurings. In addition, we validate that the competition-increasing effects can only be observed using falsification tests based on relaxations of banks' activity restrictions and fake crises.

A final econometric challenge arises from the non-random assignment of interventions. We deal with this selection issue using instrumental variables which exploit plausibly exogenous variation in the in the political environment, design features of the regulatory architecture, spatial characteristics of whether a country shares a common border with a crisis country and is a member of the EU, and in the opacity of the banking system. While our instruments are strong, the availability of identifying covariates reduces the sample and the regressions estimate the effects with less precision. Nevertheless, they further support the key results.

Our main results represent the average effect of interventions. However, it is useful from a policy perspective to know if banking systems react to the interventions in a predictive way to aid the decisions about which measures to deploy. Exploiting heterogeneities in our sample and focusing on the initial conditions prior to interventions, we show that the competition-increasing effects of liquidity support, recapitalizations, and nationalizations are larger in concentrated and less contestable banking systems. In contrast, deposit insurance offsets the impact of these measures. The main results are further nuanced when we examine two other key characteristics of banking systems: transparency and charter values. We find disclosure requirements mitigate the competition-increasing effects. Charter values, however, make no difference. This result challenges theories which emphasise the role of charter values.

What drives the shift towards more competition? Previous work suggests that government support suppresses the shakeout of unviable institutions, and these zombie banks prey on the

remaining healthy institutions' market shares (Claessens (2009a)). We advance this line of research to examine if zombie banks crowd out their competitors. Our tests provide some evidence for positive associations between liquidity support and recapitalizations on the one hand, and the number of zombie banks on the other hand. We also find that the number of zombie banks and their market shares increase in countries with multiple interventions, and that the increase in competition is largest in countries where zombie banks are most prevalent. The importance of zombie banks becomes most evident when we only include crisis countries in the tests. We are the first to show that liquidity support and recapitalizations correlate significantly positively with the number of zombie banks and their market shares.

Our final set of tests closes the loop and sheds light onto the effects of government interventions on average deposit and loan rates. Liquidity support, recapitalizations, and nationalizations depress deposit rates to the disadvantage of depositors, but at the same time benefit borrowers by reducing loan rates. The role of zombie banks as driver behind the results becomes again obvious when we replicate the tests on subsamples that exclude years with zombie banks. The coefficients on the intervention variables shrink in magnitude. In contrast, running tests on subsamples of countries with at least one year of zombie banks increases the key coefficients. These results suggest that prior research has underestimated the role of zombie banks for loan and deposit pricing and highlights their impact on market conduct.

This research is important for three reasons. First, banking competition is assumed to be linked with financial stability, and this link dominates the policy debate and influences the architecture of regulatory frameworks (Claessens (2009b)). While it is beyond the scope of our study to examine effects of interventions on risk taking, it is essential to stress that the risk shifting effect arising from interventions for market discipline and moral hazard discussed in

this literature also matters for our research. Typically, competition is seen as undesirable as it incentivizes banks to take risk and increases the cost of government interventions.

Second, banking competition affects the availability of credit, access to finance, and, ultimately economic growth (Claessens and Laeven (2005)). To the extent that interventions, via their effect on competition, affect banks' ability to supply credit as shown in Giannetti and Simonov (2013), the competitive effects are likely to spill over into the real economy.

Third, academics, policy makers, and international organizations not only voiced concerns that the rescue measures affect competition as reflected in the quotes above, but the European Commission made it a policy objective to limit competitive effects as they believe rescued banks gain market power over their peers (Claessens (2009a)). As a result, the European Commission (2009) has made state aid conditional on restructuring plans for supported institutions. These conditions include, *inter alia*, divestments of subsidiaries, branch networks, and limits on deposit pricing. Such conditions have been introduced in a few cases.[1]

The nature of the interventions means that countries tend to adopt multiple interventions simultaneously, and some countries may also rely on implicit guarantees and other policies that are difficult to measure in practice. Beyond taking the signalling effects from recapitalizations and nationalizations for the rescued banks' competitors into account, our cross-country setting with analyses performed at the aggregate level provides a number of other advantages. Given the implications for banks' incentives arising from interventions, it is beneficial to identify the 'right' way of interventions (Diamond and Rajan (2005)). Our results allow some insights into the relative importance of the four most frequently deployed interventions. We find a less prominent role for blanket guarantees, but liquidity support, recapitalizations, and

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[1] See press releases by the European Commission (Royal Bank of Scotland, IP/09/1915; Lloyds Banking Group, IP/09/1728).

nationalizations display similar effects on competition. Another advantage of our setting is that the results not only generalize beyond a single country but also allow digging deeper to establish which characteristics of banking markets moderate increases in competition.

Our research speaks to the literature on the design of bank bailouts. Aghion, Bolton, and Fries (1999) discuss closure rules and banks' incentives, and Gorton and Huang (2004) propose that government interventions improve welfare when private parties cannot provide liquidity. This view of a 'bright side' of interventions is also supported by Dwyer and Hasan (2007) who show suspending convertibility reduces the number of bank failures. In contrast, Diamond and Rajan (2005) illustrate a 'dark side' of bailouts because they may trigger increased demand for liquidity and additional bank insolvencies.

We proceed as follows. Section 2 discusses the data, and Section presents 3 main results. Section 4 explores the roles of initial conditions, transparency, and charter values, and we also examine the role of zombie banks. Section 5 documents pricing effects. Section 6 concludes.

2. Data and overview about policy responses to banking crises

We use data for 124 countries, 41 of them experienced banking crises. The crisis data are obtained from Laeven and Valencia (2010, 2013) for 1996-2010. Of those crises, 29 are systemic, and 12 are borderline crises. A country is classified as having a systemic crisis if the banking system exhibited stress, reflected in significant runs, losses, and/or liquidations, and, additionally, if significant interventions can be observed. Countries that "almost met" the definition of a systemic crisis are classified as borderline crises. Interventions are considered significant if 3 out of the following 6 events can be observed: (1) significant guarantees, (2) liquidity support (5% of deposits and liabilities to nonresidents), (3) recapitalizations with public funds (exceeding 3% of GDP), (4) significant nationalizations, (5) significant asset

purchases, and (6) deposit freezes or bank holidays. Information for policy responses is taken from Laeven and Valencia (2010, 2013). Crises responses consist of an initial phase concerned with containing liquidity strain, protecting liabilities, and limiting fire sales. The containment phase triggers liquidity support, and guarantees on banks' liabilities, and, less frequently, deposit freezes and bank holidays. Subsequently, balance sheet restructuring takes center stage: banks are resolved, recapitalized, and nationalized. While deposit freezes and bank holidays have no prediction as to how they affect competition, other policy responses translate into precise predictions. We constrain our study to blanket guarantees, liquidity support, recapitalizations, and nationalizations because the literature offers indications for how these interventions affect competition.[2] Common to them is they provide signals to market participants about governments' commitment to rescue banks which raises expectations about future bailouts.[3] Table A.1 in the Supplementary Appendix presents details.

Blanket guarantees. A common response to runs are blanket guarantees. They are defined as full protection of bank liabilities or instances in which non-deposit liabilities of banks are protected. Since runs destabilize payment systems, guarantees can restore confidence during the containment phase. Theory offers clear predictions for the effect of (asymmetric) guarantees. Hakenes and Schnabel (2010) show that guarantees affect protected banks and

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[2]   Theoretically, all interventions can be seen as combinations of liquidity infusions and recapitalizations. Diamond and Rajan (2005) show that a central authority which taxes claimants on liquidity and lends it back to the system at interest rates below those that taxpayers would choose increases supply of liquidity. When such a loan is at the market rate, this operation is a pure liquidity infusion. In contrast, if the central authority relies on taxation power and allocates a gift of future value to a particular bank, e.g., a claim on goods in the future, such an operation is a pure recapitalization. Gifts of current goods to banks represent liquidity infusions equal to the quantity of current goods plus a recapitalization equal to the future value of those goods, evaluated at market rates.

[3]   Unlike interventions during the containment phase, interventions in the resolution phase are observed on the bank level. We focus on industry effects and therefore analyze recapitalizations and nationalizations on the aggregate level to capture signalling effect. Table A.2 in the Supplementary Appendix presents bank level evidence. Using a hand-collected sample of 589 recapitalizations and 26 nationalizations, we confirm competition-increasing effects of recapitalizations and nationalizations (except for nationalizations on net interest margins). To strengthen identification, we run these tests with bank fixed effects, year fixed effects, and also include specifications with an interaction of country fixed and year fixed effects. These tests purge time invariant bank specific heterogeneities and time varying effects and also any unobserved time varying effect on the country level we may have omitted in our main regressions on the system level.

their competitors. Guarantees reduce margins and charter values of the protected banks' competitors which arises from aggressive competition from banks that refinance at subsidized rates. This makes competitors more aggressively; a prediction confirmed by Gropp, Hakenes, and Schnabel (2011). Similarly, Acharya and Kulkarni (2013) show that guarantees yield competitive advantages for public sector banks in deposit markets, and Gropp, Gruendl, and Guettler (forthcoming) show that guarantees supplant market discipline. They find removing German savings banks' guarantees curbed moral hazard.

Liquidity support also plays a role in containing crises. We consider instances of liquidity support when the ratio of central bank claims on the financial sector to deposits and foreign liabilities exceeds 5 percent and more than doubles relative to its pre-crisis level. We also consider any liquidity support extended by the Treasury. The premise is that extending loans to troubled banks is less costly than no intervention at all. Richardson and Troost (2009) show that monetary intervention can be effective because emergency lending raises distressed banks' probability for survival. However, the increase in survival odds for supported banks provides them also with competitive advantages. Theoretical work in this area focuses on moral hazard. Freixas (1999) shows the lender of last resort should not support all banks. However, when large banks (the too-big-to-fail phenomenon) or many banks are distressed (the too-many-to-fail phenomenon), supporting the large bank or all distressed banks is the preferred action. Both the too-big-to-fail and the too-many-to-fail effect change incentives and give rise to moral hazard.

Recapitalizations. A cornerstone during the resolution phase is the provision of capital support. We define recapitalizations as instances in which the cost of recapitalizing banks exceed 3 percent of GDP. Beyond the moral hazard effect from recapitalizations documented by

Dam and Koetter (2012) and Duchin and Sosyura (forthcoming), several studies describe the link between capital and competition which provides insights for our work. While Allen, Carletti, and Marquez (2011) predict higher capital ratios enable banks to compete effectively for loans and deposits and increase market shares, Cordella and Yeyati (2003) focus on bailouts in the form of recapitalizations, and argue recapitalizations reduce banks' propensity to compete because capital injections increase charter values. Empirical work also yields conflicting results. While Berger and Bouwman (2013) illustrate that better capitalized banks have higher market shares and higher survival odds, Lyandres (2006) shows that less levered non-financial firms compete less aggressively.

Nationalizations are takeovers of systemically important financial institutions and extend only to cases where the government takes majority ownership stakes in the banks. In some crises, nationalizations take place at a large scale and all major banks are taken into state ownership. Studies on government ownership of banks suggest state ownership allows banks to lend at lower loan rates relative to privately owned banks (Sapienza (2004). This effect is attributed to reduced funding costs from government support (Acharya and Kulkarni (2013)). In turn, market discipline is undermined, reducing banks' monitoring incentives. This results also in moral hazard since nationalizations de facto guarantee bank debt.

All interventions are related via the effects on refinancing costs and moral hazard. We therefore first establish the overall effect on competition using Lerner indices and net interest margins. Importantly, while the market discipline effect operates on the liability side of the balance sheet, the moral hazard effect operates on the asset side. We consequently also document pricing effects for deposits and loans. For blanket guarantees, liquidity support and

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nationalizations, we expect supplanted market discipline to result in lower average deposit rates. Moral hazard should show up in lower average loan rates.

3. Effects of government interventions on banking competition

Various approaches exist to measure banking competition (Claessens (2009b)). We employ two alternative measures: the Lerner index, and the net interest margin. Since our tests are performed at the banking system level, we use the average Lerner index and the average net interest margin per country per year. The Lerner index captures market power by calculating the mark up of prices above marginal costs which are the main channel by which government subsidies increase competition. We use 181,830 bank-year observations for 21,988 banks in 124 countries, obtained from BankScope, to compute the index. Details are provided in Supplementary Appendix A.3. BankScope is the limiting factor for the sample period. The Lerner index is a widely used measure of competition. By including non-interest income and non-interest costs, the index captures competition in broad activities. In addition, we also use the net interest margin because competition in traditional activities which dominate less developed banking systems is best reflected by the spread between lending and deposit taking. Since our data contain many emerging markets, relying on the net interest margin provides a sensitivity check. The two measures are not significantly correlated, the coefficient is -0.014.

The key explanatory variables are coded as binary variables and take the value of one in the year the intervention was announced and subsequently if a country is still affected by the intervention (Laeven and Valencia (2010, 2012, 2013)). We register 11 blanket guarantees. The dummy for liquidity support takes on the value one if liquidity support by the central bank is at least 5% of deposits and liabilities to nonresidents/GDP (34 instances). Our dummy for recapitalizations is restricted to recapitalizations whose costs exceed 3% of GDP (32 instances).

We code takeovers of systemically important banks and instances where the government takes a majority stake in banks' equity capital as nationalizations (26 instances).

3.1 Preliminary inspection

In a preliminary inspection, we demonstrate for each country which announced blanket guarantees, liquidity support, recapitalizations, and nationalizations the change in average Lerner indices and average net interest margins. Figure 1 also shows the corresponding change for the control group, defined as countries without crises and not being subject to interventions over the same period. Each subpanel illustrates the effect of one intervention. Treatment countries are represented by triangles and ISO codes, and squares depict the control group. All countries whose ISO codes are below the zero line have contractions in competition. For example, Thailand issued blanket guarantees in 1997 (at the bottom left-hand corner in the left hand side of Figure 1 in the panel with blanket guarantees) when the Lerner index dropped by 0.14. At the same time, the control group experienced an increase in the Lerner index by 0.04.

[FIGURE 1: The effects of government interventions on Lerner indices and net interest margins]

The empirical patterns are striking. Many countries experience reductions in Lerner indices and net interest margins following interventions. Increases in competition occur primarily after recapitalizations and liquidity support, but nationalizations also reduce margins. Yet, the effects are not uniform. While several countries such as Thailand and Ecuador display declines in competition, other countries do not post such declines, suggesting the effects of interventions are amplified or mitigated depending on other characteristics, e.g., the conditions in a banking system prior to these measures. We explore these issues in Section 4 below.

3.2 Identification strategy

We turn to difference-in-difference estimations to compare treatment countries, i.e., countries which experienced interventions with countries in a control group before and after

the treatment. The control group consists of countries without interventions (i.e., non-crisis countries). Our estimator considers the time difference of the group differences, i.e., it accounts for omitted variables that affect treated and untreated countries alike. For example, Basel II may coincide with changes in competition, but as such changes affect all banks, the estimator only attributes the *additional* changes in competition to interventions. We estimate

$$C_{it} = \alpha + \beta I_{it} + \rho X_{it} + A_i + B_t + \varepsilon_{it} \tag{1}$$

where the dependent variable C_{it} denotes competition in country *i* during year *t*. The panel structure permits inclusion of dummy variables to eliminate time-varying omitted variables. We include country *(A)* and year dummy variables *(B)* to capture cross-country heterogeneity and year fixed effects. The country fixed effects net out any time-invariant unobserved country-specific factors. The year fixed effects difference away trends that affect treatment and control group countries such as changes in contestability, and changes in technology that could affect competition over time. We also include dummies for World Bank income categories to account for time-invariant similarities across countries in terms of economic development. Their inclusion is possible because several countries change over time. The vector *X* captures time-varying country-level control variables explained below, and ε_{it} is the error term. Our coefficient of interest is β for the dummy that equals one in the years affected by the intervention *I* (blanket guarantee, liquidity support, recapitalization, nationalization), or zero otherwise. The slope β provides information about the effect of interventions. Our measures of competition are decreasing in competition. A positive coefficient suggests decreases in competition, whereas a negative slope signals increases in competition.

The vector of control variables *X* contains determinants of competition. GDP growth, inflation, and real GDP per capita account for macroeconomic conditions. Claessens and Laeven

(2004) show that concentration affects competition. We therefore include an asset-based Herfindahl-Hirschman index (HHI).[4] Since we compare HHIs across markets, we also include banking system assets (ln) to account for the size of the industry. To account for the government's role in formulating regulation, we use a regulatory quality index which is increasing in regulatory quality, and is normalized between -2.5 and +2.5 (Kaufmann, Kraay, and Mastruzzi (2009)). Provided that interventions are more pronounced when banking systems play a bigger role in the economy, we also include a dummy that takes on the value of one if Beck, Clarke, Groff, Keefer, and Walsh (2001) classify a financial system as bank-based, and an index ranging from 1 to 3 that classifies the depth of a banking system by provision of domestic credit (scaled by GDP). We also control for loan impairment charges to loans as reductions in interest income during crises can reduce Lerner indices and net interest margins. Since many countries adopt multiple interventions, we also include a dummy for multiple interventions that takes on the value of one if a country experienced more than one intervention. This variable mitigates concerns that the coefficient for the individual intervention is confounded by the other three interventions excluded from the regression.[5] We also use a dummy for assisted mergers. These mergers affect market structure and, indirectly, the way banks compete. Finally, we control for government expenditure consumption (in % of GDP) to account for governments' ability to bail out banks, and money market rates (ln) as a proxy for monetary conditions. Doing so is crucial as Landier, Sraer, and Thesmar (2013) have shown that monetary policy eases after crises. Banks may experience declines in revenues

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[4] To investigate whether any joint determination of concentration and competition potentially drives our findings, we omit the HHI in unreported tests from the regressions. The results remain virtually unchanged.

[5] The interventions are collinear as many of them are adopted at the same time (Supplementary Appendix A.1). While only 13.5% of crises countries adopt one measure, 25% adopt at least two types of rescue measures; over 31% announce three measures. All four types of interventions are used by 30% of the countries. We cannot include them in the same regression and therefore estimate regressions separately for each type of intervention. See also Table 3 for the inclusion of a dummy variable that takes on the value of one if any one of the four types of interventions was observed.

when short term rates decline. Table 1 shows summary statistics. All variables, except for the dummy variables, are winsorized at the 1st and 99th percentile.[6]

[TABLE 1: Summary statistics]

Difference-in-difference estimations require two assumptions. First, assignment to treatment is plausibly exogenous with respect to competition, suggesting competition is not driving the interventions. Second, in the absence of treatment, changes in competition are similar for treatment and control groups. This is the "parallel trends" assumption.

We first examine the exogeneity of the interventions. The correlation coefficients in Panel A and B of Table 2 between the average level of competition prior to the interventions and the announcement year of the interventions are inconsistent in terms of the direction, and they remain insignificant. Next, we use Cox proportional hazard models to estimate the conditional probability of interventions. Our key explanatory variable captures competition prior to the intervention, and we also include the control variables discussed above. We focus on the time from the start of our sample to the occurrence of interventions. The hazard rate $h(t)$ represents the likelihood that an intervention is observed at time t in country i, given that there was no intervention until t. In employing duration analysis, we can impose a structure on the hazard function. Since we have no reason to assume duration dependence in the data, we use a Cox model that does not impose a shape on the hazard function. The model takes the form

$$h(t|x_i)=h_0(t)exp(x_i\beta_x) \tag{2}$$

where $h_0(t)$ denotes the baseline hazard, and β_x is the vector of parameters. A positive coefficient for the competition measure increases the hazard of interventions. Panel A in Table

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[6] A possible argument could be made that banks change their loan portfolio composition in response to government interventions which may also affect their ability to generate revenues. In unreported tests, we include the change in a Herfindahl Hirschman index of loan portfolio concentration based on residential mortgage loans, other consumer and retail loans, and corporate and commercial loans, all scaled by total net loans. Our results are virtually unchanged.

2 reports the results for Lerner indices, and Panel B shows the effects for net interest margins. The competition measures are insignificant. In combination with the correlations between average levels of competition prior to the interventions and the announcement year of the interventions at the top of Table 2, we conclude that interventions are not related to the competitive conditions. The tests also mitigate concerns related to reverse causality.[7]

[TABLE 2: Exogeneity of interventions, correlations, and parallel trends]

We now examine the parallel trends assumption. It requires similar changes in competition between countries with interventions and the control group. This assumption does not require identical levels of competition between treatment and control groups, they are differenced out. Figure 2 shows patterns that support parallel trends, and Panel D in Table 2 presents *t*-tests for differences in means for changes in competition measures between treatment and control groups over the three years prior to interventions. All *t*-tests remain insignificant.

[FIGURE 2: Parallel trends: Behavior of competition measures]

3.3 Main results

Table 3 presents our main results for the Lerner index (Panel A) and the net interest margin (Panel B). We cluster heteroskedasticity-adjusted standard errors on the country level to allow for serial correlation in the errors. We use annual data, and we drop countries with multiple crises (Russia and Ukraine). The results are not affected when these countries are included.

[TABLE 3: The effect of government interventions on banking competition]

Irrespective of the inclusion of control variables, all coefficients for the interventions enter negatively. The inclusion of controls increases the efficiency of the estimation and reduces the error variance but their inclusion has little effect on the coefficients. All subsequent analyses

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[7]   All interventions are positively correlated (Table 2, Panel C).

therefore always include these controls. Liquidity support and recapitalizations assume significance in Panel A of Table 3, and they increase competition. Panel B confirms the competition-increasing effects for liquidity support, capital injections, and nationalizations. The control variables exhibit intuitive signs.

The magnitudes of the coefficients are economically substantial. We illustrate the effects based on the regressions including control variables. Thailand represents the median country in terms of the Lerner index. Provision of liquidity support in 1997 increases competition (i.e., reduces the Lerner index from 0.221 to 0.189) to a level equivalent to Australia, located at the 33rd percentile. Similarly, nationalizations shift the average net interest margin of 0.055 in Latvia in 2008 to 0.017, the level of the Slovak Republic, located at the 27th percentile.

The volumes of liquidity support (in % of deposits and foreign liabilities) and recapitalizations (in % of GDP) may also matter for changes in competition. We run t-tests and compare changes in the two competition measures for countries where the volumes of liquidity support and recapitalizations are below and above the median. The volumes do not matter. For liquidity support, the tests display values of 0.61 for the Lerner indices and -1.37 for the net interest margins. For recapitalizations, the t-tests are -0.24 and -0.09, respectively.

Blanket guarantees remain insignificant. Guarantees not accompanied by other measures may not be credible, foreign creditors ignore them, and some countries introduced unfavourable tax policies, e.g., Ecuador. The absence of an effect may also reflect the small number of guarantees. Moreover, in some countries, such as Ireland, blanket guarantees exceed GDP, and question the sovereigns' ability to service such commitments.

The last columns in Panel A and Panel B replace the individual dummies for the four interventions with a dummy that takes on the value of one if at least one or more of these

measures were observed. The idea is to consider that several countries adopt multiple measures simultaneously. These tests also point towards competition-increasing effects. [8]

3.4 Alternative explanations, falsification tests, and sensitivity checks

Next, we confront alternative explanations. A common shock, i.e., a banking crisis, rather than interventions may affect competition. However, we show in Section 3.2 that our data satisfy the key identification assumption of parallel trends. Further, not all coefficients display the same effect. If interventions simply serve as a proxy for crises, they should display identical effects with similar economic magnitudes. This is not the case. An *F*-tes*t* for the null that the coefficients on the four interventions are equal across the regressions is rejected at the one percent significance level ($\chi2$-value: 11.57, *p*-value: 0.00). Moreover, crisis durations are short (3.03 years) whereas interventions remain in place for many years. For example, blanket guarantees lasted 78 months in Indonesia. On average, blanket guarantees remain in place for 5.2 years, and the public sector retained its equity participation for over 10 years in Japan.

We first examine whether our results are driven by systemic crises. The first test in the first subpanel in Table 4 replicates the main regressions but excludes countries with systemic crises. We only consider interventions in countries with borderline crises. The test reduces the number of interventions, but we still obtain competition-increasing effects for liquidity support and recapitalizations for the Lerner index, suggesting we can rule out that our results are attributable to systemic crises. Likewise, we confirm a negatively significant effect of nationalizations on net interest margins. There are no blanket guarantees in countries with borderline crises. An alternative way to investigate whether our results reflect responses to systemic crises is to omit the most intensive crises, i.e., those with the greatest rescue cost in %

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[8] Supplementary Appendix A.4 offers visual evidence about the persistence of the competitive effects. Lerner indices remain below the initial level following interventions, and the effects are particularly strong in the first three years. Interest margins experience a drop in the first two years (with the exception of blanket guarantees), and remain compressed.

of GDP. If so, removing these countries should render our key coefficients insignificant. Omitting countries where rescue cost are equal to or exceed the 75th quartile of the rescue cost in the second test of the first subpanel also leave the key results intact.

The second subpanel offers falsification tests. The idea is to establish that the significant effects can only be observed when governments really intervene. The first falsification test rules out that any type of crisis affects the evolution of competition between treatment and control groups differently. To this end, we find an event that increases competition but is unrelated to crises and then assign placebo interventions. Specifically, we eliminate the key confounding factor, i.e., crisis observations from our sample, and look for instances where we observe a decline in an index which provides information about restrictions on bank activities (Barth, Caprio, and Levine (2004)). The index increases in restrictiveness, ranging from 3 to 12. It provides information about banks' ability to engage in non-traditional activities (securities, insurance, and real estate), and restrictions on conglomerates. Since relaxations in activity restrictions increase competition we can analyze if such drops create similar treatment-control group patterns that we uncover in our main tests with the difference that the placebo interventions do not coincide with crises. If this falsification exercise also yields significant effects, we could not rule out the possibility that effects like deregulation create similar patterns in the data. The placebo interventions are assigned to the first year in which a country relaxes activity restrictions. The durations of these placebo interventions are randomly generated based on the durations of the actual durations of the four interventions. To avoid confounding effects of multiple relaxations of activity restrictions per country, we omit countries with multiple reductions of the index, resulting in 37 placebo interventions. None of these placebo interventions displays significance. The second falsification test simulates fake

crises. We define fake crises as periods of at least three consecutive years of declines in bank capital during periods when our database does not classify a country as having experienced a banking crisis. We assign placebo interventions to the first year in which a country experienced a fake crisis, and the durations of these placebo interventions are again randomly generated using the distributions of the actual durations of the interventions. The 60 placebo interventions remain indistinguishable from zero.

The third subpanel offers a standard placebo test where we pretend the interventions occurred two years prior to the actual occurrence. Unlike the other regressions in Table 4, this test does not aim to disentangle crises from interventions. Rather, the point is to lend more support to the key identifying assumption of parallel trends. If our identification strategy is correct, an insignificant placebo treatment effect suggests that the relationships in Table 3 are only observable when countries experience actual interventions. The placebo treatments remain insignificant. Finally, we examine pro-competitive restructuring policies in the EU. If our findings are driven by forced branch divestments, disposals of subsidiaries, and other measures by the EU to maintain a level playing field of competition following interventions, removing these countries should render our key coefficients insignificant. This is not the case.

To rule out that demand effects are driving our results, the final subpanel presents auxiliary regressions for the associations between Lerner indices and net interest margins and GDP growth as a proxy for demand conditions. During crises loan demand may be weak or banks may be risk averse and shift lending to higher quality borrowers. These phenomena could reduce Lerner indices and net interest margins. We first run these regressions of the two competition measures on GDP growth and a set of year and country dummies for the full sample, and also show the results for subsamples that omit crises but constrain the tests to

recession periods (defined as at least two consecutive years of contractions of GDP growth). All correlations remain insignificant. These tests mitigate concerns that poor demand causes the declines in our competition measures.

[TABLE 4: Robustness: Alternative explanations and falsification tests]

We relegate additional tests to the Supplementary Appendix. Table A.5 examines alternative ways of clustering standard errors by years, and we include additional control variables to consider that some countries set up asset management agencies to absorb distressed banks' assets. We also test if the too-big-to-fail and the too-many-to-fail phenomena drive our findings, and we examine subsamples of countries which omit high income economies and emerging market economies. Further tests weight our regressions with the inverse of the number of interventions per country to assign less importance to countries with multiple interventions, and we also include a dummy variable for the onset of a financial crisis. Table A.6, Panel A in the Supplementary Appendix replicates our main tests with an alternative measure of competition, the Panzar and Rosse (1987) H-Statistic, which gauges bank revenue elasticity with respect to changes in factor input prices.[9] Our key results remain similar across all tests.

3.5 Instrumental variable regressions

Above, we mentioned that policy actions may not occur randomly which gives rise to a selection problem and could bias our coefficients. We address this problem with an instrumental variables approach using a two-stage estimator. We use a linear probability model in the first stage, and we rely on the same set of instruments for all types of interventions. The second stage uses the estimated probabilities.

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[9] To offer an additional check whether the effects are driven by shifts in monetary policy, we examine correlations of money market rates with Lerner indices and net interest margins because low monetary policy rates may make banks more aggressive. Table A.6, Panel B in the Supplementary Appendix shows a negative correlation between money market rates and Lerner indices but a positive association of money market rates with net interest margins.

Our instruments draw from different strands of literature. First, Brown and Dinc (2005) show bailouts occur shortly after elections, whereas the period before an election reduces the likelihood of interventions. Two instruments capture the electoral cycle. The first one is a dummy that takes on the value of one in the year a parliamentary election takes place, and the second one provides information about the time (years) since the last parliamentary election.[10] Both variables should correlate negatively with interventions. A further instrument provides information about the orientation of the largest government party. We use a dummy that takes on the value of one if the largest government party has a right-wing orientation. Governments led by such parties focus on market-oriented policies to increase chances of re-election (Bortolotti and Faccio (2009)). Moreover, their partisan orientation impacts bailout propensities. While left-wing governments are keen to intervene into the economy to preserve jobs, right-wing governments oppose such actions (Garrett and Lange (1991)). As an additional variable we use population (log) to reflect on the fact that smaller countries such as Ireland and Iceland deployed massive bank rescue packages as their financial sector is large relative to the economy. This relationship is less pronounced in larger economies. We expect a negative coefficient for this variable.

Second, we build on the idea that the regulatory architecture matters for the likelihood of bailouts. We use a prompt corrective power index which captures legal requirements that establish levels of bank solvency deterioration that trigger regulatory enforcements and the scope of supervisors in applying such powers. The index increases in corrective power, ranging from 0 to 6. We expect powerful regulators to press for bailout packages. In addition, we also use information about the number of bank supervisors with more than ten years of experience

as such key staff is more likely to detect the build-up of problems and take corrective measures in the banks prior to the evolution of crises. We expect a negative sign. Moreover, a regulator with a large budget is also more likely to embark on rescue activities. We therefore also include the budget of the supervisory agency and expect a positive coefficient.

Third, we consider Europe specifically where concerns about crisis contagion have been prominent. We include a dummy variable for EU membership, and we also include a dummy variable for a crisis in a contiguous country. To reflect on the problems in Europe, we use an interaction term between these variables and expect it to enter positively.

Finally, we exploit ideas according to which bailouts occur because of doubts about the accuracy with which markets assess banks' asset value. Flannery, Kwan, and Nimalendran (2013) argue interventions occur because markets cannot differentiate between sound and unsound banks during crises. This spike in information asymmetries motivates bailouts. To capture opacity, we focus on asset composition, and examine banks' securities portfolios because security portfolio composition is informative about opacity. As instruments, we use available for sale (AFS) and held to maturity (HTM) securities, scaled by total securities. The former are marked at fair value and should reduce opacity and the likelihood of interventions, and the latter are reported at amortized cost, and make balance sheets more opaque.

Panel A of Table 5 confirms the previous results. While the sample shrinks due to the availability of identifying covariates and we remain careful assigning much weight to these tests, we obtain negatively significant coefficients for liquidity support and recapitalizations for the Lerner index, and we confirm all previous effects for net interest margins.

Panel B shows the results for the 1st stage. All instruments exhibit the anticipated sign and are significant in at least one of the four first stage regressions, except for the number of

supervisors with more than ten years of experience and the dummy for crises in contiguous counties. The Hansen *J*-Statistic for the null that the instruments are uncorrelated with the error cannot reject their exogeneity with the exception of the regression for blanket guarantees. All first stage *F*-Tests are above the rule of thumb of ten, and the Kleibergen-Paap tests reject weak instruments. For all specifications, we obtain statistics above the tabulated critical values for a size bias of ten % relative to OLS. At the bottom of the table, we show the (adjusted) partial R2 associated with the instruments. To further test instrument strength, we run the 1st stage regressions without the instruments and compute the (adjusted) partial R2 as the difference between 1st stage regressions including the instruments and those excluding the instruments. The (adjusted) partial R2 values range between 11 and 15 %. These figures represent increases of between 27 and 92% relative to the 1st stage regressions without the inclusion of instruments, suggesting our instruments are strong.

[TABLE 5: Instrumental variable regressions]

4. Extensions

To understand mitigating or amplifying factors for the effects of bailouts on competition, we offer several extensions that focus on other characteristics of banking systems. Subsequently, we also examine the extent to which zombie banks drive the increase in competition.

4.1 The role of initial conditions in banking systems prior to government interventions

Figures 1 indicates the interventions do not affect all countries equally. We now investigate whether the initial conditions play a role. From a policy perspective, it is useful to understand if the competitive response to interventions varies in a predictive way to aid policymakers' actions.

Claessens and Laeven (2004) show that market characteristics such as structure, contestability, and moral hazard are related to competition. We illustrate our arguments about

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initial conditions as follows. If blanket guarantees boost competition by giving rise to moral hazard if a country had no deposit insurance before announcing blanket guarantees, then the effect of such guarantees should be greater in countries without deposit insurance. Foreign banks may also play a role because their presence suggests greater contestability. If foreign banks are well represented prior to nationalizations, the competition-increasing effect may be limited. Likewise, if a country does not have a contestable banking system prior to a crisis reflected in activity and entry restrictions, the competition-enhancing effect of liquidity support is likely to be muted.

We use the HHI to measure market structure. Foreign bank penetration, reflected in the share of foreign-owned banks, indicates contestability. Contestability is also reflected in entry barriers and activity restrictions. The entry restrictions index summarizes the requirements to obtain a bank license, the percentage of denied applications for licenses, and the minimum capital required. The index ranges between 0 and 8; it is increasing in restrictions. We capture activity restrictions with the activity restrictions index described in Section 3.4. To approximate moral hazard, we use a dummy that takes on the value one if a country has explicit deposit insurance. To calculate initial conditions for concentration, foreign ownership, and activity and entry restrictions, we take the mean value of these variables in the treatment countries prior to the announcement of the intervention. For the initial conditions of deposit insurance, we code the variable as one if a country had explicit deposit insurance in place. Since we need to define the initial conditions also for control groups, we use a *1:n* matching procedure that finds at least one country from the non-crisis countries. Further, we use World Bank income categories to compare countries with similar levels of development.

Each cell in Table 6 represents a single regression. We only show the interaction term of the interventions with the corresponding initial condition. Since these regressions include country fixed effects the initial condition itself is dropped from the regression. Panel A shows the results for the Lerner index. The increase in competition is significantly greater in magnitude in concentrated markets. Figure 1 reinforces this point. Concentration in Malaysia (0.101) and Ireland (0.289) is below the mean, suggesting that the effect of blanket guarantees is mitigated. Regarding foreign banks, we find a positively significant coefficient, except for blanket guarantees. The negative relation between interventions and competition is mitigated in countries with more foreign banks because such banks are not intervened. Figure 1 illustrates this phenomenon. Ireland and Latvia exhibit high foreign bank presence (0.63 and 0.66% of banks are foreign owned; sample mean 0.36%). Upon announcement of liquidity support, Lerner indices increase relative to the control groups. Activity restrictions have a weaker interaction with interventions. They are only significant for recapitalizations and nationalizations. Increases in competition from recapitalizations and nationalizations are reaped in less contestable markets. Reductions in the Lerner index induced by interventions tend to be larger in systems with more entry restrictions, except for liquidity support. Deposit insurance only matters for nationalizations. Deposit insurance mitigates increases in competition. The initial conditions play little role in Panel B, reflecting less cross-country variation in net interest margins. The exception is deposit insurance. The interaction term, except for blanket guarantee, implies that deposit insurance offsets the former effect.

[TABLE 6: Extensions: Initial market conditions]

4.2 The role of transparency

An important argument we make is that interventions undermine market discipline. Since transparency is a key condition for markets to exert such discipline it is reasonable to assume

that transparency plays a role for the extent to which interventions affect competition (Hakenes and Schnabel (2010)). The basic premise is that transparency mitigates competitive effects of bailouts. In a transparent system, depositors can easily observe risk because they have precise information. Thus, they will discipline banks if they compete too aggressively. In contrast, in opaque systems, it is difficult to infer information about the banks' condition, so that market discipline remains muted, amplifying the competitive effects of interventions.

To test these ideas, we create a Transparency index, ranging from 0 to 5 following Barth et al. (2004). The index consists of a dummy that takes on the value of one if an external audit is required for banks and an accounting index which increases in the quality of accounts. The index considers information about whether income statements include accrued or unpaid interest or principal on nonperforming loans and whether banks have consolidated statements. The first subpanel in Table 7 presents the effects of interventions on competition augmented by interaction terms with the transparency index. Except for blanket guarantees for Lerner indices, all coefficients for interventions enter negatively and significantly, and the interactions display positive signs. Thus, the effect of interventions is limited as transparency increases.

[TABLE 7: Extensions: Transparency and bank charter values]

4.3 The role of charter values

Another set of studies emphasizes the role of charter values to limit competition. Keeley (1990) shows that banks with valuable charters have little incentive to compete because future rents will be lost in case of failure. Cordella and Yeyati (2003) build on this idea in the context of bailouts. They propose two offsetting effects. One effect induces moral hazard and leads to more competition, and a competing effect which raises charter values and creates incentives for less aggressive conduct. The charter value effect outweighs the moral hazard effect if central banks announce and commit ex ante to rescue troubled banks during macroeconomic stress.

The second subpanel in Table 7 includes interaction terms between the interventions and the charter value, reflected in the ratio of current deposits to total deposits, and money market and short-term funding, measured at the mean bank for each country per year. The baseline effect of charter values displays a positive insignificant effect, and the interaction terms are also insignificant. These findings indicate charter values are not a disincentive to compete.

4.4 Evolution of zombie banks

We now examine what drives the shift to more competition. It is plausible to assume that interventions keep unviable banks in business as a going concern. If so, the Schumpeterian process of creative destruction is suppressed, and the insolvent zombie banks originate risky loans with upside potential. Limited liability in combination with government support puts them in a no-lose situation. Zombies are incentivized to compete and prey on their rivals' market shares. If these conjectures are true, we expect to find positive associations between zombie banks, in terms of their numbers and market shares, and government interventions.

We classify banks into viable and unviable ones, i.e., zombies with economic net worth below zero. Following Kroszner and Strahan (1996), we compute tangible capital as common equity minus intangible assets, consisting of goodwill, other intangibles, and deferred tax assets. To identify zombies, we code a dummy that takes on the value one if tangible capital is negative. We then calculate three indicators for zombie banks: the number of zombie banks in % of the total number of banks, and we also calculate their loan and deposit market shares. Figure 3 shows the evolution of zombies for a time window of +/- 5 years, centered on the interventions. Except for blanket guarantees where zombie banks increase prior to the interventions, the number of zombies increases immediately after interventions and then starts declining. In the second year after the announcement of the interventions, zombie banks that are not dismantled

increase market share to up to 9% in the case of blanket guarantees. For liquidity support, recapitalizations, and nationalizations, zombie banks' market shares increase to up to 5%.

[FIGURE 4: Evolution of zombie banks]

There is some support for the role played by zombie banks for the shift in competition. Table 8 shows regressions with the proportion of zombie banks and their market shares as dependent variables. Liquidity support and recapitalizations are weakly significantly positively related to the proportion of zombie banks in Panel A. Recapitalizations do not eradicate zombie banks. This finding, however, does not manifest itself in greater market shares. Panel B restricts the sample to crisis countries where the effects should be stronger. We now find significant effects for zombie banks' proportions and market shares for liquidity support and recapitalizations with greater magnitudes of the coefficients. Panel C offers support for the idea that zombie banks evolve simultaneously with interventions. We find a monotonous relationship between the number of interventions and zombie banks. While this may reflect crisis intensity, Panel D shows the largest increases in competition coincide with the largest zombie bank presence. These tests offer some evidence that zombie banks drive the increase in competition by collectively increasing market shares and crowding out healthy competitors.

[TABLE 8: Extensions: Zombie banks]

5. Effects of interventions on borrowers and depositors

So far, we documented how interventions affect producer welfare. We now examine how consumers are affected. While there are stabilizing effects arising from the interventions as they help restore confidence in the banking system, increase banks' probability of survival, and avoid disruptive bank closures, our focus here is on pricing effects. Such an analysis allows evaluating which parties benefit from increases in competition. Further, we can test whether increases in competition are driven by supplanted market discipline which shows up in lower

deposit rates, or, alternatively, if the effects are due to moral hazard, reflected in lower loan rates. Last, the benefits of rescuing banks come at high costs which result in governments levying taxes. Our final analysis compares the net effect on bank customers from the increase in competition with the cost of restructuring banking systems.

5.1 Pricing effects: Loan and deposit rates

Table 9 documents pricing effects. We replace the competition measures as dependent variables with average deposit and average loan rates. Panel A shows that liquidity support, recapitalizations, and nationalizations enhance deposit market power as they undermine market discipline and reduce funding costs. This is not surprising. The interventions make banks safer and depositors require lower returns. Importantly, our results for the rate-reducing effect from recapitalizations support the theory by Allen, Carletti, and Marquez (2011). They propose more capital enables banks to compete more effectively.[11]

Our analysis of loan rates in Panel B of Table 9 documents moral hazard. We find rate-reducing effects for liquidity support and recapitalizations. The latter finding is consistent with the findings for the U.S. Black and Hazelwood (forthcoming) show that TARP banks charge lower rates. Nationalizations also reduce loan rates, in line with the results reported for government ownership (Sapienza (2004)). Note that effects for the pricing of loans and deposits are obtained after controlling for money market rates. Our tests highlight the

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[11] The results for deposit rate-decreasing effects of recapitalizations may be intensified by more intensive monitoring by banks which is associated with higher capital (Holmstrom and Tirole (1997); Mehran and Thakor (2011)). Since more monitoring provides banks with a competitive advantage, these theories also support our argument about the effect of recapitalizations. Moreover, the findings may also be driven by flights to safety from non-bank depositors to government-supported banks, and some countries increased deposit insurance coverage in recent years (Acharya and Mora (2013)). To rule out that these alternative forces drive our results, Panel A in Table A.8 in the Supplementary Appendix demonstrates that deposit volumes do not significantly differ in the years prior to and following interventions, i.e., declines in deposit rates are unlikely to be driven by increased deposit supply. We also obtain similar coefficients when we omit countries whose deposit insurance coverage limits increased (see Panel B of Table A.8).

disparate pricing effects. While interventions help borrowers, they harm depositors.[12]

Moreover, the magnitudes of the coefficients in the loan rate equations are greater than in the

deposit rate equations. We verify this, and test the equality of the coefficients for each one of

the interventions across the equations for loan and deposit rates. With the exception of blanket

guarantees where the *p*-value is 0.218, *F*-tests reject the equality of the coefficients with *p*-

values of 0.041 (liquidity support), 0.093 (recapitalizations), and 0.024 (nationalizations).

Thus, the moral hazard effect dominates advantages from supplanted market discipline.[13]

Next, we revisit our argument from Section 4.4 that zombie banks drive increases in

competition. If so, the effects of interventions on interest rates should be less pronounced once

we omit years with zombie banks, but they should be greater once we examine only countries

where zombie banks exist. Indeed, the magnitudes and significance levels decline in Panel C

and D when we drop years with zombie banks. In contrast, they increase in Panel E and F

where we focus exclusively on countries that have at least one year of data with zombie banks.

[TABLE 9: Pricing effects: Deposit and loan rates]

5.2 Net effects for borrowers and depositors and the cost of crises

We now compare the net effects for borrowers and depositors with the cost of restructuring

banking systems. While this is not a welfare analysis because our tests remain inconclusive as

the benefits of rescuing banks and restoring confidence are difficult to quantify, our tests in

Table 9 allow computing the *direct* benefits for borrowers arising from aggregate reductions in

loan rates and the corresponding *direct* negative effect for depositors arising from the

aggregate reductions in deposit rates, expressed in % of GDP. Table 10 presents results.

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[12] Such disparate effects are not uncommon. Park and Pennacchi (2009) illustrate countervailing effects in loan and deposit markets following market-extension bank mergers the U.S. While large multi-market bank presence enhances competition in loan markets, it harms competition in deposit markets.

[13] As an alternative way to examine this, Panel C in Table A.8 shows the components of the Lerner index, marginal cost and the product price as dependent variables. Prices are reduced and marginal costs decline. The coefficients for price declines are always greater than the reductions in marginal cost, thus banks' market power shrinks and competition increases.

For example, Malaysia with a GDP of 100,168mn USD in 1997, had loans of 95,466mn USD (average loan rate 10.62%), deposits of 135,070mn USD (average deposit rate 7.77%), and experienced all four interventions in that year. Evaluated at the point estimate, borrowers are better off by 5,126mn USD (5.12% of GDP), but the average negative effects for depositors amount to -7,925mn USD (-7.91% of GDP), yielding a net effect of -2,798mn USD (-2.79% of GDP).[14] Our tests suggest that only Croatia, Denmark, Hungary, Latvia, the Netherlands, Slovenia, Spain, and Sweden experience net increases. While the positive net effects appear limited, we need to consider that governments use taxes to fund interventions. Since levying taxes reduces welfare, we compare the effects for bank customers with the cost of the rescue measures. Table 10 reports the fiscal cost in % of GDP arising from the fiscal outlays due to rescue packages, and shows whether these costs exceed the net effects. The results illustrate a redistributive effect. Taxpayers not only pay for interventions, but with the exception of Denmark and Sweden, the gains for bank customers remain below the rescues costs.

[TABLE 10: Borrower and depositor effects and fiscal cost of rescue measures]

6. Concluding remarks

The effects of government aid for the banking sector are not yet well understood. We document how blanket guarantees, liquidity support, recapitalizations, and nationalizations affect banking competition. In addition, we show how zombie banks evolve following such interventions, and we evaluate how such interventions affect the pricing of deposits and loans.

Our first key result suggests that reservations by policymakers that government interventions reduce banking competition are overstated. Despite a small number of instances in which we observe liquidity support, recapitalizations, and nationalizations, such

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[14] Reductions for depositors from guarantees, liquidity support, recapitalizations, and nationalizations are -11,893.07mn USD, -6,532.986mn USD, -5,543.328mn USD, and -7,731.235mn USD, respectively, resulting in an average of -7,929.15mn USD. Increases for borrowers are 4,913.834mn USD, 4,716.225mn USD, 4,564.008mn USD, and 6,311.370mn USD, respectively.

interventions trigger statistically and economically large increases in competition. We acknowledge two limitations. First, our data do not consider how interventions are administered. For instance, we cannot establish whether capital support was provided to the weakest banks in some countries while it may be given to healthier banks in other countries. Second, our tests leave open the possibility that unobservables which coincide with the interventions drive our inferences. Nevertheless, several sensitivity checks highlight the robustness of our findings. Zombie banks play a key role for the increase in competition. Their emergence correlates with liquidity support and recapitalizations, and their market shares increase when there are multiple interventions.

The second key result demonstrates that borrowers and depositors are affected disparately. Our finding that interest margins are reduced is primarily driven by lower loan rates, suggesting that borrowers benefit from liquidity support, recapitalizations, and nationalizations. However, deposit rates are reduced, and the magnitudes of these effects increase in countries with zombie banks.

In sum, we highlight that banks' conduct following government aid is conditional on the government measures. Beyond prolonged and misdirected support of zombie institutions which causes congestion as they prevent the exit of insolvent institutions, government aid shapes banks' expectations about future interventions. Reducing bailout expectations, tying government assistance to the restructuring of troubled assets, identifying zombie banks via stress tests, and facilitating their exit via effective resolution mechanisms appear important avenues for policy reform and future research.

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Table 1
Summary statistics

Variable	N	Mean	Min	Max	S.D.	Source
Dependent variables						
Lerner index	1687	0.247	0.026	0.616	0.117	BankScope, authors' calculations
Net interest margin	1687	0.064	-0.272	0.489	0.087	BankScope, authors' calculations
Deposit rate	1456	0.084	0	0.807	0.089	World Bank Development Indicators
Loan rate	1393	0.166	0	2.910	0.163	World Bank Development Indicators
Key variables						
Blanket guarantee	1687	0.069	0	1	0.255	Laeven and Valencia (2010, 2013)
Liquidity support	1687	0.136	0	1	0.343	Laeven and Valencia (2010, 2013)
Recapitalizations	1687	0.145	0	1	0.353	Laeven and Valencia (2010, 2013)
Nationalizations	1687	0.127	0	1	0.333	Laeven and Valencia (2010, 2013)
Control variables						
GDP growth	1687	0.042	-0.179	0.345	0.042	World Bank Development Indicators
Inflation	1687	0.074	-0.089	2.449	0.133	World Bank Development Indicators
Real GDP/Capita	1687	7669.311	111.312	41211.11	10259.77	World Bank Development Indicators
Concentration (assets, Herfindahl-Hirschman Index)	1687	0.321	0.041	1	0.229	BankScope, authors' calculations
Assisted mergers	1687	0.014	0	1	0.120	Laeven and Valencia (2010, 2013)
Total banking system assets (ln)	1687	9.837	4.588	16.986	2.748	BankScope, authors' calculations
Regulatory quality index	1687	0.230	-2.110	2.225	0.876	Kaufmann et al. (2009)
Bank-based financial system	1687	0.759	0	1	0.427	Beck et al. (2001)
Financial development indicator	1687	1.987	1	3	0.831	World Bank Development Indicators, authors' calculations
Loan impairment charges/Loans	1687	0.015	-0.274	0.390	0.027	BankScope, authors' calculations
Multiple interventions	1687	0.026	0	1	0.161	Laeven and Valencia (2010, 2013)
Government consumption expenditure/GDP	1687	0.393	0.043	22.144	1 855	World Bank Development Indicators
Money market rate (ln)	1687	1.470	-7.013	5.010	1.933	World Bank Development Indicators
Other variables						
Foreign-owned banks (assets in %)	1588	0.356	0	1	0.302	Barth et al. (2001, 2004)
Activity restrictions index	1313	6.771	3	12	1.785	Barth et al. (2001, 2004)
Entry restrictions index	1332	7.427	0	8	1.099	Barth et al. (2001, 2004)
Explicit deposit insurance	1326	0.658	0	1	0.474	Barth et al. (2001, 2004)
Transparency index	1142	4.498	2	5	0.656	Barth et al. (2001, 2004)
Charter value	1506	0.796	0.086	1	0.158	BankScope, authors' calculations
Number of zombie banks/Total number of banks	1528	0.010	0	1	0.046	BankScope, authors' calculations
Loan market share of zombie banks	1528	0.010	0	0.317	0.047	BankScope, authors' calculations
Deposit market share of zombie banks	1528	0.010	0	0.328	0.047	BankScope, authors' calculations
Fiscal cost in % of GDP	41	0.125	0	0.568	0.147	Laeven and Valencia (2013)
Fiscal cost in % of financial sector assets	39	0.226	0	0.367	1.428	Laeven and Valencia (2013)
Instruments						
Election year	929	0.210	0	1	0.408	Parties and Elections, Center on Democratic Performance, Electionresources.org
Time since last election	929	2.510	0	13	2.392	Parties and Elections, Center on Democratic Performance, Electionresources.org
Government party with right-wing orientation	929	0.326	0	1	0.469	Parties and Elections, Center on Democratic Performance, Electionresources.org
Population (log)	929	16.341	12.506	21.014	1.555	World Bank Development Indicators
Prompt corrective power	929	2.452	0	6	2.491	Barth et al. (2004)
Bank supervisors > 10 years of experience	929	78.856	0	2406.00	214.391	Barth et al. (2004)
Budget for supervision	929	424.894	0	28497.41	2667.968	Barth et al. (2004)
EU member country	929	0.1553	0	1	0.362	European Commission
AFS securities/Total securities	929	0.604	0	1	0.564	BankScope, author's calculations
Contiguous country with crisis	929	0.053	0	1	.22597	Laeven and Valencia (2010, 2013); CEPII http://www.cepii.fr/anglaisgraph/bdd/distances.htm
HTM securities/Total securities	929	0.280	0	1	0.036	BankScope, authors' calculations

Table 2

Exogeneity of government interventions, correlations, and parallel trends

The table presents correlation coefficients between the year in which the government interventions (blanket guarantees, liquidity support, significant recapitalizations, and nationalizations) can be observed and the average level of competition, measured by the Lerner index in Panel A and by the net interest margin in Panel B prior to these government interventions. In addition, we also present Cox proportional hazard (Cox PH) models to verify that blanket guarantees, liquidity support, significant recapitalizations, and nationalizations are exogenous with respect to competition. In the Cox proportional hazard models, the dependent variable denotes the hazard of observing blanket guarantees, liquidity support, significant recapitalizations, or nationalizations. Our sample period is 1996 – 2010. A country is dropped from the analysis once it experienced the intervention of interest. The vector of control variables (not shown) includes GDP growth, inflation, real GDP per capita, an asset based Herfindahl-Hirschman index to capture banking system concentration, a dummy that takes on the value of one if assisted mergers took place, banking system size measured by the natural logarithm of banking system assets, a regulatory quality index, a dummy variable that indicates whether the country's financial system is bank-based, an index ranging from 1 to 3 for the level of financial development (based on domestic credit in % of GDP), the ratio of loan impairment charges to loans, a dummy that takes on the value of one if a country announced multiple interventions, the ratio of government expenditure consumption to GDP, and money market rates (ln) as a proxy for monetary policy. Country, year, and income category dummies are included. Panel C shows correlations between the four dummy variables for government interventions (blanket guarantees, liquidity support, recapitalizations, and nationalizations). Panel D presents t-tests for the assumption of parallel trends in changes in the Lerner index and the net interest margin between treatment group countries and the control group for the three years prior to blanket guarantees, liquidity support, recapitalizations, or nationalizations. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered on the country level.

Panel A: Lerner index					Panel B: Net interest margin			
	Blanket guarantee	Liquidity support	Recapitalizations	Nationalizations	Blanket guarantee	Liquidity support	Recapitalizations	Nationalizations
Correlation with announcement year	-0.037	-0.214	0.002	-0.097	-0.119	-0.417	-0.514	-0.425
	Cox PH	Cox PH	Cox PH	Cox PH	Cox PH	Cox PH	Cox PH	Cox PH
Competition	-0.218	-0.718	-1.705	-3.063	1.826	-1.649	0.591	0.411
	(-0.05)	(-0.30)	(-0.60)	(-0.84)	(1.12)	(-1.12)	(0.37)	(0.26)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1430	1363	1327	1361	1430	1363	1327	1361

Panel C: Correlation matrix for government interventions

	Blanket guarantee	Liquidity support	Recapitalizations
Blanket guarantee	1		
Liquidity support	0.595***	1	
	(0.00)		
Recapitalizations	0.663***	0.780***	1
	(0.00)	(0.00)	
Nationalizations	0.717***	0.822***	0.859***
	(0.00)	(0.00)	(0.00)

Panel D: Parallel trends	Blanket guarantee			Liquidity support			Recapitalizations			Nationalizations		
	Treatment	Control	t-test	Treatment	Control	t-test	Treatment	Control	t-test	Treatment	Control	t-test
Δ Lerner index (t-1)	0.054	-0.022	-1.60	-0.000	-0.015	-0.63	-0.004	-0.023	-0.79	-0.005	-0.021	-0.52
Δ Lerner index (t-2)	0.016	-0.023	-1.05	-0.040	-0.041	-0.02	-0.044	-0.038	0.17	0.000	-0.030	-1.05
Δ Lerner index (t-3)	-0.019	0.017	1.05	0.009	0.029	0.77	0.012	0.030	0.61	0.005	0.024	0.46
Δ Net interest margin (t-1)	0.004	0.009	0.29	-0.001	0.003	0.35	-0.004	0.004	0.45	-0.006	0.008	0.59
Δ Net interest margin (t-2)	-0.006	-0.002	0.53	-0.006	-0.004	0.59	-0.007	-0.004	0.68	-0.005	-0.004	0.13
Δ Net interest margin (t-3)	0.068	0.047	-0.21	0.009	0.008	-0.02	0.011	0.012	0.05	0.021	0.017	-0.11

Table 3
Main results: The effect of government interventions on banking competition

The table presents difference-in-difference regressions of the effect of blanket guarantees, liquidity support, significant recapitalizations, and nationalizations on competition, measured by the Lerner index in Panel A and by the net interest margin in Panel B. We report regression excluding and including control variables, and the final column in each panel uses a dummy variable that takes on the value of one if at least one or more of these measures were observed. The control variables are GDP growth, inflation, real GDP per capita, an asset based Herfindahl-Hirschman index to capture banking system concentration, banking system size measured by the natural logarithm of banking system assets, a regulatory quality index, a dummy variable that indicates whether the country's financial system is bank-based, an index ranging from 1 to 3 for the level of financial development (based on domestic credit in % of GDP), the ratio of loan impairment charges to loans, a dummy that takes on the value of one if a country announced multiple interventions, a dummy that takes on the value of one if assisted mergers took place, the ratio of government expenditure consumption to GDP, and money market rates (ln) as a proxy for monetary policy. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Country, year, and income category dummies included. Standard errors are clustered on the country level.

	Panel A: Lerner index									Panel B: Net interest margin								
	No controls	With controls	No controls	With controls	No controls	With controls	No controls	With controls	Any intervention	No controls	With controls	No controls	With controls	No controls	With controls	No controls	With controls	Any intervention
GDP growth		0.165		0.159		0.150		0.169	0.152		0.042		0.036		0.027		0.032	0.032
		(1.24)		(1.19)		(1.12)		(1.27)	(1.17)		(0.61)		(0.52)		(0.38)		(0.44)	(0.47)
Inflation		0.008		0.009		0.009		0.010	0.010		0.064		0.064		0.064		0.064	0.065
		(0.22)		(0.24)		(0.24)		(0.26)	(0.27)		(1.46)		(1.44)		(1.44)		(1.43)	(1.45)
Real GDP/capita		-0.000		-0.000		-0.000		-0.000	-0.000		-0.000		-0.000		-0.000		-0.000	-0.000
		(-0.29)		(-0.25)		(-0.25)		(-0.30)	(-0.29)		(-1.18)		(-1.13)		(-1.14)		(-1.19)	(-1.15)
Concentration (HHI)		-0.032		-0.032		-0.031		-0.032	-0.030		-0.016		-0.017		-0.016		-0.015	-0.016
		(-1.46)		(-1.47)		(-1.42)		(-1.44)	(-1.39)		(-1.38)		(-1.41)		(-1.35)		(-1.27)	(-1.36)
Total banking system assets (ln)		-0.023**		-0.022**		-0.023**		-0.023**	-0.022**		-0.015		-0.014		-0.015		-0.015*	-0.014
		(-2.33)		(-2.32)		(-2.36)		(-2.33)	(-2.32)		(-1.64)		(-1.62)		(-1.65)		(-1.67)	(-1.62)
Regulatory quality index		0.009		0.004		0.004		0.009	0.005		0.002		-0.003		-0.002		-0.003	-0.003
		(0.35)		(0.14)		(0.17)		(0.37)	(0.19)		(0.12)		(-0.16)		(-0.12)		(-0.18)	(-0.16)
Bank-based financial system		-0.061*		-0.114**		-0.135***		-0.058***	-0.132***		-0.065**		-0.060		-0.077*		-0.023*	-0.076*
		(-1.96)		(-2.60)		(-2.95)		(-2.74)	(-2.92)		(-2.38)		(-1.48)		(-1.86)		(-1.95)	(-1.82)
Financial development indicator		-0.021		-0.022		-0.012		0.023	-0.016		-0.024		-0.025		-0.016		0.006	-0.018
		(-0.75)		(-0.78)		(-0.41)		(1.31)	(-0.56)		(-1.04)		(-1.07)		(-0.70)		(0.40)	(-0.74)
Loan impairment charges/Gross loans		0.136		0.139		0.137		0.130	0.135		0.470***		0.475***		0.473***		0.474***	0.474***
		(0.90)		(0.94)		(0.93)		(0.87)	(0.92)		(2.67)		(2.72)		(2.71)		(2.72)	(2.72)
Multiple interventions		-0.016		-0.003		0.000		-0.015	-0.005		0.016		0.026		0.029		0.025	0.028
		(-0.86)		(-0.16)		(0.01)		(-0.80)	(-0.25)		(1.09)		(1.54)		(1.65)		(1.54)	(1.64)
Assisted mergers		0.002		0.003		0.004		-0.002	0.002		-0.009		-0.007		-0.007		-0.004	-0.006
		(0.11)		(0.15)		(0.16)		(-0.11)	(0.11)		(-0.75)		(-0.60)		(-0.60)		(-0.32)	(-0.49)
Government consumption expenditure/GDP		-0.001		-0.002		-0.002		-0.001	-0.002		0.002		0.002		0.002		0.002	0.002
		(-1.26)		(-1.46)		(-1.49)		(-1.22)	(-1.45)		(1.59)		(1.39)		(1.37)		(1.39)	(1.35)
Money market rate (ln)		0.001		0.000		0.000		0.001	-0.000		0.004		0.003		0.003		0.003	0.003
		(0.31)		(0.06)		(0.03)		(0.37)	(-0.04)		(1.65)		(1.51)		(1.47)		(1.52)	(1.43)
Blanket guarantee	-0.031	-0.026								-0.012	-0.013							-0.032**
	(-1.44)	(-1.09)								(-0.62)	(-0.52)							(-2.17)
Liquidity support			-0.036**	-0.033*								-0.022*	-0.027*					
			(-2.35)	(-1.97)								(-1.68)	(-1.82)					
Recapitalizations					-0.043***	-0.040**								-0.026**	-0.033**			
					(-2.65)	(-2.17)								(-2.07)	(-2.16)			
Nationalizations							-0.011	-0.002								-0.032**	-0.038**	
							(-0.62)	(-0.08)								(-2.01)	(-2.08)	
Any intervention									-0.029*									-0.032**
									(-1.69)									(-2.17)
Observations	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687
R-squared	0.230	0.241	0.233	0.242	0.234	0.243	0.230	0.240	0.243	0.624	0.661	0.626	0.664	0.626	0.665	0.627	0.665	0.665
Number of interventions	11	11	34	34	32	32	26	26	39	11	11	34	34	32	32	26	26	39

Table 4
Robustness: Alternative explanations, falsification tests, placebo tests, and the role of demand effects

The first subpanel rules out reactions to banking crises. We first run the regressions on a subsample where the treatment countries only include borderline crises. Since blanket guarantees do not occur in countries with borderline crises, we only consider the three remaining interventions. The second test in the first subpanel removes the most costly banking crises. Specifically, we omit countries where the fiscal cost in % of GDP of the crisis are equal to or above the 75th quartile of the distribution of the rescue cost of all crises as an alternative way to verify that our main results are not a reflection of a crisis. The second subpanel offers falsification tests. The first falsification test assigns interventions to countries that are likely to experience an increase in competition, reflected in a drop in an index that captures activity restrictions, and the second falsification test is based on fake crises, defined as episodes during which a country's banking system experiences contractions in the average' banks capital ratio in three consecutive years. The third subpanel offers standard placebo tests where we pretend that the interventions occurred two years prior to the actual announcement of the intervention. This subpanel also presents a test where we drop all EU countries from the sample to rule out that pro-competitive measures by the EU commission drive our key inferences. In the final subpanel we focus on the correlation between GDP growth as a proxy for demand effects and our two competition measures. We run regressions on the full sample, and also on a subsample which omits recession periods (defined as two consecutive years of contractions of GDP growth) and crisis periods. These regressions only include year dummies and country dummies, all other regressions in this table include the control variables which are explained in the notes to Table 3.We use the Lerner index in Panel A and the net interest margin in Panel B as dependent variable. Robust t-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Country, year, and income category dummies included. Standard errors clustered on the country level.

Panel A: Lerner index / Panel B: Net interest margins

Subpanel: Ruling out reactions to crises

	Panel A — Omitting systemic crises			Panel A — Removing costly crises				Panel B — Omitting systemic crises			Panel B — Removing costly crises			
Blanket guarantee	n/a			-0.029 (-1.42)				n/a			-0.012 (-0.41)			
Liquidity support	-0.043** (-2.25)				-0.032* (-1.94)			-0.040 (-1.30)				-0.028* (-1.76)		
Recapitalizations		-0.075*** (-4.33)				-0.039** (-2.15)			-0.053 (-1.41)				-0.034** (-2.10)	
Nationalizations			-0.010 (-0.26)				0.000 (0.03)			-0.095** (-2.05)				-0.039** (-2.00)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1296	1296	1296	1630	1630	1630	1630	1296	1296	1296	1630	1630	1630	1630
R-squared	0.256	0.258	0.254	0.247	0.249	0.250	0.247	0.679	0.680	0.682	0.664	0.667	0.668	0.668
Number of interventions	11	9	3	7	30	28	22	11	9	3	7	30	28	22

Subpanel: Falsification tests

	Panel A — Falsification test (drop in activity restrictions)				Panel A — Falsification test (fake crises)				Panel B — Falsification test (drop in activity restrictions)				Panel B — Falsification test (fake crises)			
Blanket guarantee (placebo)	-0.006 (-0.31)				0.001 (0.05)				-0.006 (-0.64)				0.004 (0.46)			
Liquidity support (placebo)		0.002 (0.12)				-0.010 (-0.65)				0.012 (1.34)				-0.000 (-0.01)		
Recapitalizations (placebo)			-0.001 (-0.08)				-0.004 (-0.24)				0.006 (0.79)				0.005 (0.65)	
Nationalizations (placebo)				-0.007 (-0.42)				-0.000 (-0.01)				-0.001 (-0.08)				0.010 (0.95)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	831	831	831	831	1687	1687	1687	1687	831	831	831	831	1687	1687	1687	1687
R-squared	0.288	0.288	0.288	0.288	0.240	0.241	0.240	0.240	0.645	0.646	0.645	0.645	0.661	0.661	0.661	0.662
Number of interventions	37	37	37	37	60	60	60	60	37	37	37	37	60	60	60	60

Subpanel: Placebo tests and removing EU countries

	Panel A — Standard placebo regressions				Panel A — Removing EU countries				Panel B — Standard placebo regressions				Panel B — Removing EU countries			
Blanket guarantee	-0.010 (-0.25)				-0.040 (-1.37)				0.001 (0.06)				-0.013 (-0.32)			
Liquidity support		-0.020 (-1.11)				-0.048** (-2.19)				-0.019 (-0.98)				-0.046* (-1.81)		
Recapitalizations			-0.011 (-0.53)				-0.045* (-1.93)				-0.026 (-1.37)				-0.051** (-2.20)	
Nationalizations				0.006 (0.25)				-0.016 (-0.68)				-0.024 (-1.14)				-0.061** (-2.29)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1644	1644	1644	1644	1425	1425	1425	1425	1644	1644	1644	1644	1425	1425	1425	1425
R-squared	0.249	0.249	0.249	0.249	0.249	0.251	0.251	0.248	0.673	0.674	0.675	0.674	0.654	0.658	0.659	0.661
Number of interventions	11	34	32	26	8	20	21	18	11	34	32	26	8	20	21	18

Subpanel: Demand effects

	Panel A — Full sample	Panel A — Sample excluding crisis years and recessions	Panel B — Full sample	Panel B — Sample excluding crisis years and recessions
GDP growth	0.157 (1.24)	0.222 (0.84)	-0.087 (-1.14)	0.186 (0.80)
Year dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
Observations	1687	237	1687	237
R-squared	0.231	0.566	0.624	0.778

Table 5
Instrumental variable regressions: Effects of government interventions on banking competition

We present two-stage least square regressions of the effect of blanket guarantees, liquidity support, recapitalizations, and nationalizations on Lerner indices and net interest margins. Panel A shows the results from the second stage, and Panel B shows the first stage. The first stage regressions use linear probability models. We use the same set of instruments for all four government interventions. The instruments are Population (log), and we also use information about the electoral cycle and the political environment. The election year dummy takes on the value one if a parliamentary election takes place in the corresponding year, and we additionally use the time since last election (in years). Further, we use a dummy that takes on the value of one if the largest government party has a right-wing orientation, and we use an instrument that provides information about the institutional environment: an index that provides information about the prompt corrective power (ranging from 0 to 6) of the regulatory agency in charge of supervising banks. The set of instruments is further complemented by information about the number of bank supervisors with more than 10 years of experience, and data about the budget (in Million USD) of the supervisory agency. We also rely on a dummy variable that takes on the value of one if a neighbourigh county with contiguous borders to the country we focus on experienced a banking crisis, and we include a dummy for EU membership. The latter two variables are also interacted with each other to consider fears of contagion in Europe. To consider the opacity of bank balance sheets, we also use data about securities holdings. Specifically, securities holdings are captured by the ratio of AFS (available for sale) securities to total securities, and HTM (held to maturity) securities to total securities. All regressions include the control variables discussed in the notes to Table 3. For reasons of brevity, the control variables are not shown. We present a Hansen test for the exclusion restrictions to test the null that the instruments are valid, i.e., uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated equation. An F-Test for the joint significance of the excluded instruments is also reported, and we also show Kleibergen-Paap's F-Test for weak identification. The null hypothesis is that the instruments are weak. At the bottom of the table, we present the critical values of the Stock and Yogo (2005) F-Statistics for a size biase of 10% relative to OLS, adjusted R-square values if the instruments are excluded in the 1st stage, the increase in the 1st stage adjusted R-squared attributed to the instruments, and the percentage increase in the 1st stage adjusted R-squared. Robust t-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Country, year, and income category dummies included. Standard errors clustered on the country level.

Panel A: Instrumental variable estimator 2nd stage

Dependent variable	Lerner index				Net interest margin			
Government interventions								
Blanket guarantee	-0.022				-0.036			
	(-0.44)				(-1.18)			
Liquidity support		-0.111*				-0.0788**		
		(-1.92)				(-2.35)		
Recapitalizations			-0.108*				-0.102***	
			(-1.78)				(-2.71)	
Nationalizations				-0.0664				-0.0938**
				(-1.21)				(-2.20)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	929	929	929	929	929	929	929	929
R-squared	0.065	0.035	0.043	0.047	0.292	0.187	0.169	0.201
Hansen J-Statistic	10.600	7.792	9.240	9.165	20.94	16.35	14.62	9.83
Hansen p-value	0.478	0.732	0.600	0.607	0.0340	0.129	0.201	0.4707

Panel B: Instrumental variable estimator 1st stage

Dependent variable	Blanket guarantees	Liquidity support	Recapitalizations	Nationalizations
Instruments				
Election year	-0.028*	-0.060***	-0.053***	-0.030*
	(-1.77)	(-3.11)	(-2.68)	(-1.67)
Time since last election (years)	-0.011*	-0.036***	-0.026***	-0.015**
	(-1.82)	(-4.12)	(-3.24)	(-2.00)
Government party with right-wing orientation	-0.019	-0.008	-0.005	-0.046**
	(-1.05)	(-0.31)	(-0.22)	(-2.18)
Population (log)	0.077	-0.716*	-1.126***	-1.044***
	(0.33)	(-1.92)	(-3.05)	(-2.77)
Prompt corrective power	0.008*	0.000	0.005	0.008
	(1.91)	(0.02)	(0.72)	(1.27)
Bank supervisors > 10 years of experience	-0.000	0.001	0.001	-0.002
	(-1.02)	(0.78)	(0.63)	(-1.65)
Budget for supervision	-0.000	0.001***	0.006***	0.001***
	(-1.08)	(3.66)	(3.54)	(2.97)
EU member country	-0.051**	-0.109**	-0.142***	-0.130***
	(-2.02)	(-2.07)	(-2.78)	(-3.00)
Contiguous country with crisis	-0.000	-0.029	-0.008	-0.001
	(-0.01)	(-0.86)	(-0.23)	(-0.03)
EU member country × Contiguous country with crisis	-0.001	0.164**	0.005	0.079
	(-0.01)	(2.05)	(0.08)	(1.06)
AFS securities/Total securities	-0.002***	-0.001	-0.002***	-0.002***
	(-3.53)	(-1.57)	(-2.64)	(-2.98)
HTM securities/Total securities	0.042***	0.019***	0.020***	0.024***
	(6.58)	(3.68)	(3.82)	(4.76)
Control variables	Yes	Yes	Yes	Yes
Observations	929	929	929	929
R-squared	0.328	0.512	0.494	0.428
Number of interventions	6	22	20	15
First stage F-Test (instruments)	21.60	16.20	14.61	17.74
Kleibergen-Paap weak identification F-Statistic	21.62	16.22	14.63	17.76
Stock and Yogo (2005) maximal IV relative bias 10 %	11.52	11.52	11.52	11.52
(adjusted) R-squared excluding instruments	0.170	0.401	0.382	0.288
(adjusted) Partial R-squared due to inclusion of instruments	0.157	0.110	0.112	0.139
Percentage increase in (adjusted) R-squared relative to no IV	92 %	27 %	29 %	48 %

Table 6

Extensions: Initial market conditions

The table presents slope coefficients obtained from difference-in-difference regressions of the effect of the interactions of blanket guarantees, liquidity support, significant recapitalizations, and nationalizations with the initial conditions of concentration, foreign bank ownership, activity restrictions, entry restrictions, and the presence of explicit deposit insurance on competition. Each cell in the table represents a single regression and we suppress all other coefficients to preserve space. All regressions include the control variables discussed in the notes to Table 3. Since our regressions include country fixed effects, the initial condition of concentration (measured by an asset based HHI) is dropped in these regressions. Panel A shows the results when competition is measured using the Lerner index, and Panel B presents the findings when competition is measured using the net interest margin. Since the difference-in-difference estimator requires a control group for which the initial conditions have to be defined, we use a *1:n* matching procedure that matches a country that recorded any one of these government interventions with a group of comparable countries based on year and World Bank income category. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Country, year, and income category dummies included. Standard errors are clustered on the country level.

Panel A: Lerner index	Market structure	Contestability	Contestability	Contestability	Moral hazard
Government intervention interacted with	Concentration	Foreign bank	Activity restrictions	Entry restrictions	Explicit deposit
	(HHI)	ownership	index	index	insurance
	(initial conditions)	*(initial conditions)*	*(initial conditions)*	*(initial conditions)*	*(initial conditions)*
Blanket guarantee × Column variable	-0.307***	0.082	-0.016	-0.050***	0.060
	(-6.22)	(1.66)	(-0.81)	(-3.55)	(0.55)
Liquidity support × Column variable	-0.185**	0.132**	-0.010	-0.023	0.046
	(-2.53)	(2.14)	(-1.23)	(-1.64)	(1.06)
Recapitalizations × Column variable	-0.250***	0.135**	-0.015*	-0.030**	0.059
	(-3.88)	(2.11)	(-1.89)	(-2.01)	(1.43)
Nationalizations × Column variable	-0.230**	0.148**	-0.016*	-0.028*	0.075*
	(-2.31)	(2.03)	(-1.88)	(-1.71)	(1.71)
Panel B: Net interest margin					
Blanket guarantee × Column variable	-0.063	-0.003	-0.016	0.009	0.021
	(-0.76)	(-0.07)	(-1.05)	(0.63)	(0.52)
Liquidity support × Column variable	-0.045	-0.035	-0.009	0.008	0.113***
	(-0.73)	(-0.73)	(-0.96)	(1.50)	(2.83)
Recapitalizations × Column variable	-0.061	-0.023	-0.009	0.004	0.123***
	(-0.96)	(-0.49)	(-1.08)	(0.66)	(3.53)
Nationalizations × Column variable	-0.081	-0.040	-0.009	0.005	0.111***
	(-1.16)	(-0.58)	(-0.99)	(1.04)	(2.70)

Table 7
Extensions: Transparency and bank charter values

The table presents regressions of the effect of blanket guarantees, liquidity support, significant recapitalizations, and nationalizations on competition, measured by the Lerner index in Panel A and by the net interest margin in Panel B. The first subpanel tests for the effect of transparency in banking systems using a Transparency index. This index consists of two components; one is a dummy variable that takes on the value one if a compulsory external audit is required and the second component is an accounting index that is increasing in the quality of bank accounts. The second subpanel tests the effect of charter values. We approximate bank charter values by the ratio of current deposits to total deposits and money market and short-term funding.. The control variables are explained in the notes to Table 3. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Country, year, and income category dummies included. Standard errors are clustered on the country level.

Panel A: Lerner index					Panel B: Net interest margin			
Subpanel: Transparency of banking systems								
Transparency index	-0.010	-0.013	-0.011	-0.012	-0.006	-0.008*	-0.007*	-0.008*
	(-1.01)	(-1.23)	(-1.15)	(-1.26)	(-1.47)	(-1.94)	(-1.71)	(-1.90)
Blanket guarantee	-0.217				-0.133**			
	(-0.98)				(-2.50)			
Blanket guarantee × Transparency	0.045				0.026**			
	(0.89)				(2.22)			
Liquidity support		-0.176**				-0.134**		
		(-2.13)				(-2.43)		
Liquidity support × Transparency		0.036**				0.028***		
		(2.07)				(2.81)		
Recapitalizations			-0.223**				-0.113*	
			(-2.19)				(-1.82)	
Recapitalizations × Transparency			0.042*				0.023*	
			(1.79)				(1.80)	
Nationalizations				-0.188**				-0.152***
				(-2.07)				(-3.13)
Nationalizations × Transparency				0.044**				0.030***
				(2.15)				(3.43)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1142	1142	1142	1142	1142	1142	1142	1142
R-squared	0.319	0.320	0.322	0.321	0.723	0.725	0.724	0.725
Number of interventions	9	26	25	21	9	26	25	21
Subpanel: Bank charter values								
Charter value	0.003	0.008	0.006	0.004	0.034	0.027	0.030	0.030
	(0.12)	(0.28)	(0.20)	(0.12)	(1.60)	(1.28)	(1.41)	(1.40)
Blanket guarantee	-0.001				-0.030			
	(-0.02)				(-1.32)			
Blanket guarantee × Charter value	-0.051				-0.012			
	(-0.48)				(-0.33)			
Liquidity support		-0.007				-0.042**		
		(-0.25)				(-2.03)		
Liquidity support × Charter value		-0.067				0.042		
		(-1.05)				(1.27)		
Recapitalizations			-0.019				-0.036**	
			(-0.65)				(-2.03)	
Recapitalizations × Charter value			-0.052				0.011	
			(-0.82)				(0.33)	
Nationalizations				0.018				-0.045**
				(0.65)				(-2.18)
Nationalizations × Charter value				-0.035				0.018
				(-0.55)				(0.58)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1600	1600	1600	1600	1600	1600	1600	1600
R-squared	0.252	0.254	0.255	0.252	0.663	0.665	0.666	0.666
Number of interventions	10	32	30	24	10	32	30	24

Table 8
Extensions: Zombie banks

We present difference-in-difference regressions of the effect of blanket guarantees, liquidity support, significant recapitalizations, and nationalizations on the presence of zombie banks, measured by the number of zombie banks (relative to the number of banks in the banking system), by the loan market share of zombie banks, and by the deposit market share of zombie banks. We define zombie banks as banks with negative tangible capital ratios. Tangible capital equals common equity minus intangible assets. Intangible assets comprise good will, other intangibles, and deferred tax assets. We include the vector of control variables defined in the notes to Table 3. Panel A shows results for the full sample, and Panel B restricts the sample to crisis countries where the effects should be more pronounced. Panel C provides an overview about the number of government interventions per country and the corresponding number of zombie banks and these zombie banks' market share for the full sample, and Panel D shows the change in competition measures per quartile and the corresponding proportion of zombie banks, and the zombie banks' market shares in loan and deposit markets, respectively. Robust t-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Country, year, and income category dummies included. Standard errors are clustered on the country level.

Panel A: Full sample	Number of zombie banks/Total number of banks				Loan market share of zombie banks				Deposit market share of zombie banks			
Blanket guarantee	0.017				-0.007				-0.006			
	(0.80)				(-0.25)				(-0.20)			
Liquidity support		0.016*				0.026				0.021		
		(1.76)				(1.37)				(1.30)		
Recapitalizations			0.016*				0.025				0.020	
			(1.71)				(1.28)				(1.16)	
Nationalizations				0.012				0.012				0.011
				(1.19)				(0.65)				(0.62)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1528	1528	1528	1528	1528	1528	1528	1528	1528	1528	1528	1528
R-squared	0.228	0.230	0.230	0.228	0.245	0.247	0.247	0.245	0.248	0.250	0.250	0.248
Number of interventions	9	30	28	23	9	30	28	23	9	30	28	23

Panel B: Crisis countries only	Number of zombie banks/Total number of banks				Loan market share of zombie banks				Deposit market share of zombie banks			
Blanket guarantee	0.008				-0.003				0.000			
	(0.48)				(-0.12)				(0.00)			
Liquidity support		0.021**				0.037*				0.035**		
		(2.26)				(1.89)				(2.21)		
Recapitalizations			0.020**				0.033*				0.028*	
			(2.12)				(1.80)				(1.98)	
Nationalizations				0.009				0.006				0.008
				(0.99)				(0.43)				(0.63)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	479	479	479	479	479	479	479	479	479	479	479	479
R-squared	0.557	0.575	0.572	0.560	0.399	0.406	0.405	0.399	0.407	0.414	0.412	0.408
Number of interventions	9	30	28	23	9	30	28	23	9	30	28	23

Panel C: Number of interventions	Number of zombie banks/Total number of banks	Loan market share of zombie banks	Deposit market share of zombie banks
1	0.009	0.020	0.021
2	0.042	0.089	0.067
3	0.042	0.104	0.096
4	0.090	0.164	0.166

Panel D: Change in competition by quartile							
Breakdown by competition measure		Lerner index	Net interest margin	Lerner index	Net interest margin	Lerner index	Net interest margin
ΔLerner index	ΔNet interest margin	Number of zombie banks/Total number of banks		Loan market share of zombie banks		Deposit market share of zombie banks	
25th -0.133	-0.045	0.124	0.102	0.129	0.166	0.121	0.153
50th -0.026	-0.002	0.078	0.081	0.164	0.087	0.155	0.083
75th 0.007	0.001	0.063	0.083	0.076	0.095	0.080	0.096

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Table 9
Pricing effects: Deposit and loan rates

The table presents difference-in-difference regressions of the effect of blanket guarantees, liquidity support, significant recapitalizations, and nationalizations on average deposit rates in Panel A, and on average loan rates in Panel B. Panel C and D replicate these tests but omit years where zombie banks are present, and Panel E and F constrain the sample to countries where zombie banks are present at least during one year. In all regressions, we include the control variables (not shown) discussed in the notes to Table 3. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Country, year, and income category dummies included. Standard errors are clustered on the country level.

Panel A: Deposit rates (Full sample)					Panel B: Loan rates (Full sample)			
Blanket guarantee	-0.088				-0.051			
	(-1.65)				(-1.47)			
Liquidity support		-0.048**				-0.049**		
		(-2.31)				(-2.11)		
Recapitalizations			-0.041*				-0.048**	
			(-1.78)				(-2.00)	
Nationalizations				-0.057**				-0.066**
				(-2.29)				(-2.45)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1687	1687	1687	1687	1687	1687	1687	1687
R-squared	0.916	0.916	0.916	0.916	0.916	0.917	0.917	0.917
Number of interventions	11	34	32	26	11	34	32	26
Panel C: Deposit rates (Years with zombie bank presence omitted)					**Panel D: Loan rates (Years with zombie bank presence omitted)**			
Blanket guarantee	-0.053				-0.039			
	(-1.52)				(-1.20)			
Liquidity support		-0.033*				-0.041*		
		(-1.86)				(-1.81)		
Recapitalizations			-0.023				-0.030	
			(-1.26)				(-1.53)	
Nationalizations				-0.040*				-0.044*
				(-1.92)				(-1.67)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1463	1463	1463	1463	1463	1463	1463	1463
R-squared	0.921	0.921	0.921	0.921	0.922	0.922	0.922	0.922
Number of interventions	7	22	21	18	7	22	21	18
Panel E: Deposit rates (Countries with at least one year of zombie banks)					**Panel F: Loan rates (Countries with at least one year of zombie banks)**			
Blanket guarantee	-0.101*				-0.052			
	(-1.68)				(-1.31)			
Liquidity support		-0.053**				-0.055**		
		(-2.20)				(-2.29)		
Recapitalizations			-0.059**				-0.066**	
			(-2.13)				(-2.36)	
Nationalizations				-0.071**				-0.085***
				(-2.08)				(-2.77)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	874	874	874	874	874	874	874	874
R-squared	0.945	0.944	0.945	0.945	0.931	0.932	0.933	0.934
Number of interventions	10	24	22	17	10	24	22	17

Table 10
Effects on borrowers and depositors and fiscal cost of rescue measures

The table provides an overview about countries with banking crises and government interventions, and the effects for borrowers and depositors, expressed in % of GDP. For all effects, we present evaluations at the point estimate using the regression coefficients presented in Table 9 for the full sample. We also show the net effect, computed as the difference between the increase arising from lower interest payments on loans for borrowers and the decrease in interest payments to depositors, expressed in % of GDP using again the regression coefficients from Table 9. For the computation of these effects, we consider the averages of the changes arising from of interest payments made and received by borrowers and depositors, respectively. The table also shows the fiscal cost in % of GDP, and we indicate whether the fiscal costs in % of GDP assets exceed the net effects, evaluated at the point estimate using the regression coefficients in Table 9. Missing values for the variables needed to compute these effects result in a reduced number of countries for which we can report these effects.

	Effect in % of GDP on borrowers	Effect in % of GDP on depositors	Net effect in % of GDP	Fiscal cost in % of GDP	Do fiscal cost in % of GDP exceed net effect?
Argentina (ARG)	0.89	-1.02	-0.13	9.6	Yes
Austria (AUT)	6.98	-7.18	-0.19	4.9	Yes
Belgium (BEL)	8.77	-12.93	-4.16	6	Yes
Bulgaria (BGR)	0.00	-0.01	-0.01	14	Yes
Colombia (COL)	0.15	-0.15	-0.01	6.3	Yes
Croatia (HRV)	2.15	-1.75	0.40	6.9	Yes
Czech Republic* (CZE)	1.28	-2.02	-0.74	6.8	Yes
Denmark (DNK)	15.37	-10.56	4.82	3.1	No
Dominican Republic (DOM)	0.13	-0.18	-0.05	22	Yes
Ecuador (ECU)	0.18	-0.24	-0.06	21.7	Yes
France* (FRA)	11.27	-13.08	-1.81	1	Yes
Germany (DEU)	3.61	-5.55	-1.94	1.8	Yes
Greece* (GRC)	5.96	-6.15	-0.19	27.3	Yes
Hungary* (HUN)	0.20	-0.14	0.06	2.7	Yes
Indonesia (IDN)	1.46	-1.47	-0.01	56.8	Yes
Ireland (IRL)	20.03	-20.43	-0.40	40.7	Yes
Jamaica (JAM)	0.11	-0.19	-0.09	43.9	Yes
Japan (JPN)	5.85	-7.12	-1.26	14	Yes
Latvia (LVA)	4.72	-3.97	0.75	5.6	Yes
Malaysia (MYS)	5.12	-7.91	-2.79	16.4	Yes
Netherlands (NLD)	15.39	-14.63	0.75	12.7	Yes
Portugal* (PRT)	9.75	-18.48	-8.73	0	Yes
Slovenia* (SVN)	3.51	-3.11	0.40	3.6	Yes
Spain* (ESP)	11.43	-9.96	1.46	3.8	Yes
Sweden* (SWE)	7.48	-4.61	2.87	0.7	No
Switzerland* (CHE)	9.41	-13.96	-4.55	1.1	Yes
Thailand (THA)	0.00	-0.00	-0.00	43.8	Yes
Turkey (TUR)	10.26	-40.76	-30.50	32	Yes
United Kingdom (GBR)	25.90	-27.92	-2.02	8.8	Yes
United States (USA)	1.99	-2.13	-0.14	4.5	Yes
Vietnam (VNM)	0.01	-0.01	-0.00	10	Yes

Figure 1
The effects of government interventions on Lerner indices and net interest margins

Figure 1 illustrates for countries that announced blanket guarantees, liquidity support, recapitalizations, and nationalizations the change in the competition measure and the corresponding change for countries in the control group over the same period. The panel on the left hand side uses the Lerner index as a competition measure, and the panel on the right hand side uses the net interest margin as a measure of competition. Each subpanel illustrates the effect of the respective government action. Countries with interventions are represented by a triangle, and countries in the control group are depicted by a square. All countries whose ISO codes are printed below the zero line experience contractions in Lerner indices and net interest margins. The diagrams sort the countries on the Y-axis from the greatest contraction in the competition measure on the left to the largest increase in the competition measure on the right hand side.
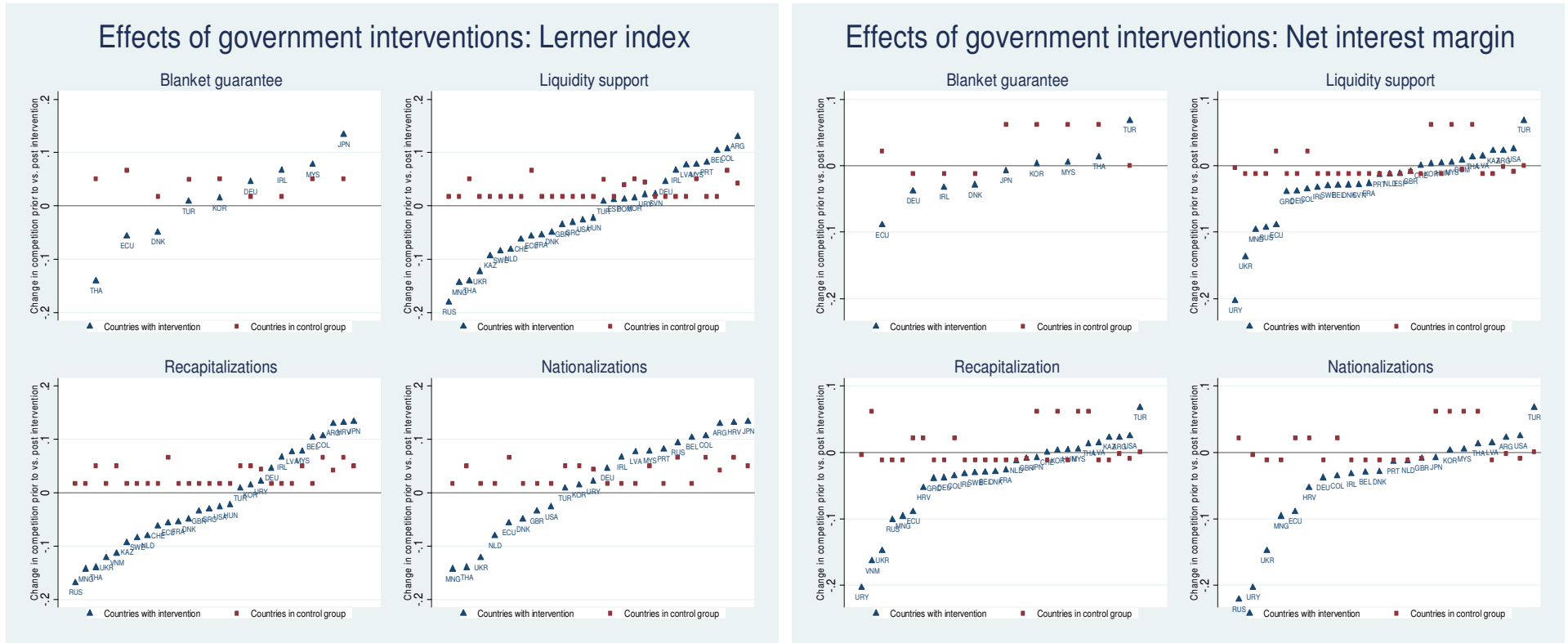
Figure 2

Parallel trends: Behavior of competition measures prior to government interventions

Figure 2 illustrates the behavior of annual changes of Lerner indices and net interest margins in the three years prior to the government interventions (blanket guarantees, liquidity support, recapitalizations, and nationalizations). Each panel illustrates the effect of the respective government action. Countries with interventions are represented by a triangle, and countries in the control group are depicted by a square.

Parallel trends between treatment and control groups
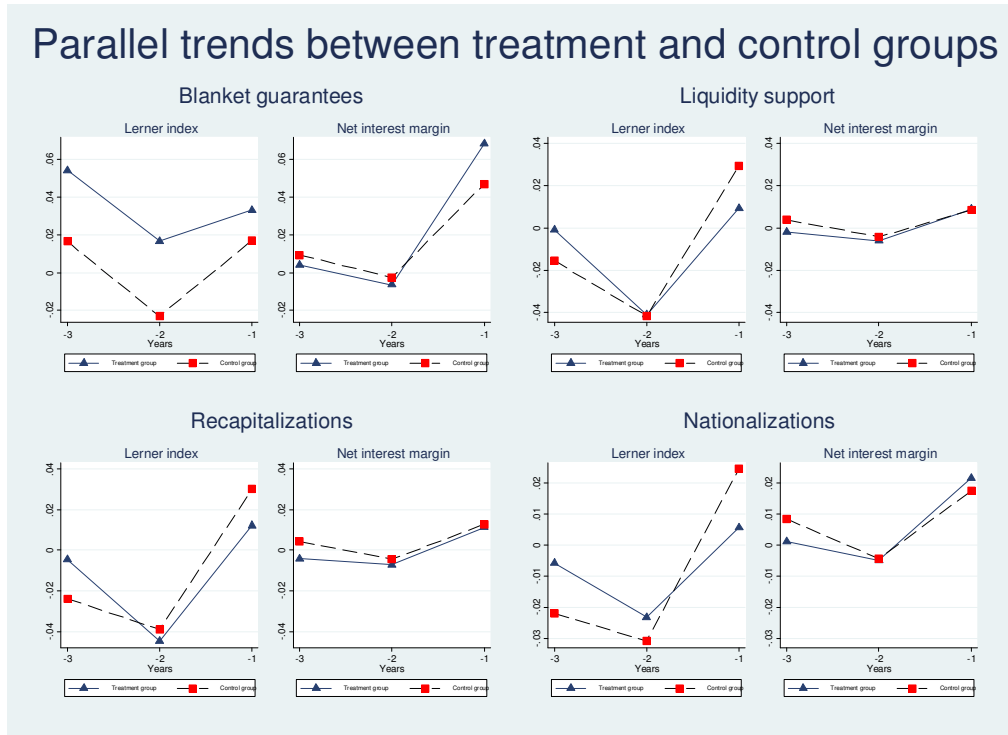
Figure 3

Evolution of zombie banks

Figure 3 illustrates the evolution of zombie banks in countries that announced blanket guarantees, liquidity support, recapitalizations, and nationalizations. We present the information around a time window of -5 and +5 years, centered on the announcement year. Each panel demonstrates the evolution of the average percentage of zombie banks relative to the total number of banks (depicted by a triangle). We also present the market shares in terms of loans, depicted by a square, and in terms of deposits, depicted by a circle, held by zombie banks. Zombie banks are defined as banks with negative tangible capital ratios. Tangible capital equals common equity minus intangible assets. Intangible assets comprise good will, other intangibles, and deferred tax assets.

Evolution of zombie banks
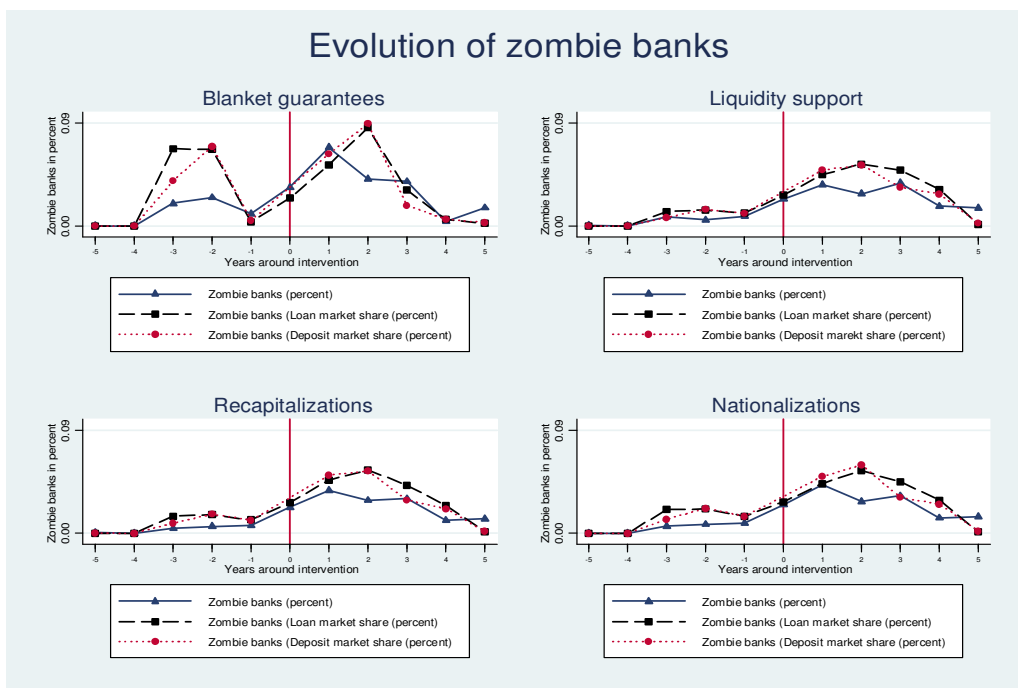
Supplementary Appendix

Depressing depositors and cheering up borrowers: The effects of bank bailouts on banking competition and the evolution of zombie banks

Supplementary Appendix Table A.1
Crises and government interventions

The table provides an overview about countries with banking crises, based on the classification in Laeven and Valencia (2010, 2013) and information from WEO. We also report the government responses to these crises. Countries market with * are borderline crises. In the United States, the † indicates that the crisis started in 2007 but only became systemic in 2008 with deployment of government interventions in 2008.

Panel A: Overview

Country (ISO code)	Crisis		Government interventions			
	Start	End	Blanket guarantee	Liquidity support	Recapitalization	Nationalization
Argentina (ARG)	2001	2003		2001	2001	2001
Austria (AUT)	2008	-		2008	2008	2008
Belgium (BEL)	2008	-		2008	2008	2008
Bulgaria (BGR)	1996	1997		1996	1996	1996
China (CHN)	1998	1998				
Colombia (COL)	1998	2000		1998	1998	1998
Croatia (HRV)	1998	1999			1998	1998
Czech Republic* (CZE)	1996	2000			1996	
Denmark (DNK)	2008	-	2008	2008	2008	2008
Dominican Republic (DOM)	2003	2004		2003		
Ecuador (ECU)	1998	2002	1998	1998	1998	1998
France* (FRA)	2008	-		2008	2008	
Germany (DEU)	2008	-	2008	2008	2008	2008
Greece* (GRC)	2008	-		2008	2008	
Hungary* (HUN)	2008	-		2008	2008	
Iceland (ISL)	2008	-				
Indonesia (IDN)	1997	2001	1997	1997	1997	1997
Ireland (IRL)	2008	-	2008	2008	2008	2008
Jamaica (JAM)	1996	1998	1996	1996	1996	1996
Japan (JPN)	1997	2001	1997		1997	1997
Kazakhstan* (KAZ)	2008	-		2008	2008	
Korea (KOR)	1997	1998	1997	1997	1997	1997
Latvia (LVA)	2008	-		2008	2008	2008
Luxembourg (LUX)	2008	-		2008	2008	2008
Malaysia (MYS)	1997	1999	1997	1997	1997	1997
Mongolia (MNG)	2008	-		2008	2008	2008
Netherlands (NLD)	2008	-		2008	2008	2008
Philippines (PHL)	1997	2001				
Portugal* (PRT)	2008	-		2008		2008
Russian Federation (RUS)	1998	1998		1998		1998
Russian Federation* (RUS)	2008	-		2008	2008	
Slovak Republic (SVK)	1998	2002				
Slovenia* (SVN)	2008	-		2008		
Spain* (ESP)	2008	-		2008		
Sweden* (SWE)	2008	-		2008	2008	
Switzerland* (CHE)	2008	-		2008	2008	
Thailand (THA)	1997	2000	1997	1997	1997	1997
Turkey (TUR)	2000	2001	2000	2000	2000	2000
Ukraine (UKR)	1998	1999		1998		
Ukraine (UKR)	2008	-		2008	2008	2008
United Kingdom (GBR)	2007	-		2007	2007	2007
United States (USA)†	2007	-		2008	2008	2008
Uruguay (URY)	2002	2005		2002	2002	2002
Vietnam (VNM)	1997	1997			2002	

Panel B: Time distribution

	Number of countries with crises	Government interventions			
		Blanket guarantee	Liquidity support	Recapitalization	Nationalization
1996	3	1	2	3	2
1997	9	5	4	6	5
1998	13	1	4	3	4
1999	10	0	0	0	0
2000	9	1	1	1	1
2001	7	0	1	1	1
2002	4	0	1	1	1
2003	3	0	1	0	0
2004	1	0	0	0	0
2005	1	0	0	0	0
2006	0	0	0	0	0
2007	2	0	2	2	2
2008	20	3	18	15	9
2009	21	0	0	0	0
2010	21	0	0	0	0

Panel C: Frequency of interventions

	Number of government interventions			
Government interventions per country	1	2	3	4
% of countries with multiple interventions	13.51	24.95	31.89	29.64

Bank level evidence for the effect of recapitalizations and nationalizations

We report panel data models for the effect of recapitalizations and nationalizations on Lerner indices in Panel A and net interest margins on the bank level in Panel B using manually collected information on recapitalizations and nationalizations. The information on recapitalizations and nationalizations only covers the recent crisis from 2007 onwards. Banks that receive capital injections or are nationalized are matched with observationally similar banks from the same country, the same year, and from the same bank type (commercial, savings, or cooperative bank). Additionally, we impose the criterion that the banks from the control group are similar in terms of size based on being in the same size quartile of the distribution of total assets to compare banks that are equivalent in terms of scope and scale of business activities. If multiple banks serve as a match for a treatment bank, we restrict the number of matches to a maximum of 5 banks in the control group. Our control variables are identical to the control variables used in the regressions on the aggregate (i.e., country) level, except for the dummy for bank-based financial systems and the Financial development indicator which are both dropped due to collinearity. We use GDP growth, inflation, real GDP per capita, an asset-based Herfindahl-Hirschman index, the size of the banking system in terms of total assets (ln), a regulatory quality index, a dummy that takes on the value of one if a country used multiple forms of bailouts (blanket guarantees, liquidity support, recapitalizations, or nationalizations), a dummy variable that takes on the value of one if the country uses assisted mergers to rescue distressed banks, government consumption expenditure in % of GDP, and the money market rate (ln) as a proxy for monetary policy conditions as control variables. On the bank level, we use loan impairment charges/gross loans, and total assets (ln) as further control variables. We also include bank and year fixed effects, and run specifications where we additionally include the interaction term of country fixed effects with year fixed effects. Standard errors are clustered at the bank level. Since different countries revert to different types of bailouts, we use for recapitalizations and nationalizations two different samples. We present the countries that are included in the two different samples at the bottom of the table. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Panel A: Lerner index					Panel B: Net interest margin			
Recapitalization	-0.035**	-0.033*			-0.052**	-0.053**		
	(-2.00)	(-1.82)			(-2.03)	(-1.99)		
Nationalization			-0.084*	-0.104*			0.002	0.001
			(-1.86)	(-1.87)			(0.30)	(0.15)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects × Year fixed effects	No	Yes	No	Yes	No	Yes	No	Yes
Observations	7023	7023	890	890	7023	7023	890	890
R-squared	0.158	0.173	0.172	0.329	0.050	0.050	0.102	0.22
Number of interventions	589	589	26	26	589	589	26	26
Countries included	Austria, Belgium, Germany, France, Greece, Ireland, Luxembourg, Netherlands, United Kingdom, United States		Austria, Belgium, Denmark, Germany, Iceland, Ireland, Kazakhstan, Latvia, Luxembourg, Mongolia, Netherlands, Portugal, Ukraine, United Kingdom		Austria, Belgium, Germany, France, Greece, Ireland, Luxembourg, Netherlands, United Kingdom, United States		Austria, Belgium, Denmark, Germany, Iceland, Ireland, Kazakhstan, Latvia, Luxembourg, Mongolia, Netherlands, Portugal, Ukraine, United Kingdom	

Supplementary Appendix A.3
Computation of the Lerner index

The Lerner index is a widely used measure of banking competition (Koetter, Kolari, and Spierdijk (2012)). The index captures the degree of market power of a bank by calculating the divergence between product prices and marginal costs of production. The mark-up of output prices over marginal cost is illustrated as follows

$$L_{kt} = \frac{p_{kt} - mc_{kt}}{p_{kt}} \tag{A.1}$$

where p_{kt} denotes the output price of bank k at time t (total revenue, interest and non-interest, divided by total assets) and mc_{kt} is the marginal cost obtained by differentiating a translog cost function

$$\ln(C_{kt}) = \alpha_k + \sum_{i=1}^{2} \beta_i \ln(Q_{kt})^i + \sum_{i=1}^{3} \gamma_i \ln(Z_{i,kt}) + \sum_{i=1}^{3} \delta_i \frac{\ln(Q_{kt})\ln(Z_{i,kt})}{2} + \sum_{i=1}^{3}\sum_{j=1}^{3} \delta_{ij} \frac{\ln(Z_{i,kt})\ln(Z_{j,kt})}{2} +$$
$$+ \lambda_1 \tau_t + \lambda_2 \tau_t^2 + \lambda_3 \tau_t \ln(Q_{kt}) + \lambda_4 \tau_t \ln(Z_{1,kt}) + \lambda_5 \tau_t \ln(Z_{2,kt}) + \lambda_6 \tau_t \ln(Z_{3,kt}) + \xi_{kt} \tag{A.2}$$

where C is total operating plus financial costs, Q represents total assets, Z_1 is the ratio of interest expenses to total deposits and money market funding (*proxy* for input price of deposits), Z_2 is the ratio of personal expenses to total assets (*proxy* for input price of labor), and Z_3 is the ratio of other operating and administrative expenses to total assets (*proxy* for input price of equipment/fixed capital). The term μ_k denotes bank-level fixed effects. The cost equation specified above includes trend terms that capture cost-reducing technological changes over time. The estimation of the cost function in (A.2) is undertaken under the restrictions of symmetry and linear homogeneity in the price of inputs. Note that the results do not change if these constraints are lifted. The Lerner index, *L*, takes values between 0 and 1, whereby higher values indicate more market power (and, hence, less competition). Calculation of the Lerner index is based on data for all commercial, savings, and cooperative banks for the years 1996 – 2010. The bank data are

obtained from BankScope. In total, 181,830 bank-year observations for 21,988 banks in 124 countries are used to compute the index.

Summary statistics

The table presents the number of observations, means, and standard deviations for the variables used to calculate the Lerner index. All bank level data are obtained from BankScope.

Variable	Observations	Mean	S.D.	Min	Max
Total assets (ln)	181,830	5.716	2.196	-4.900	19.469
Total costs (ln)	181,830	2.779	2.156	-7.301	16.754
Interest expenses/Total deposits, money markets and short-term funding (ln)	181,830	-3.634	0.800	-11.838	3.399
Personal expenses/Total assets (ln)	181,830	-4.260	0.579	-11.415	-0.452
Operating and administrative expenses/Total assets (ln)	181,830	-4.390	0.693	-11.331	0.372

Figure: Long-run effect of government interventions on competition

This figure illustrates the evolution of Lerner indices and net interest margins following blanket guarantees, liquidity support, recapitalizations, and nationalizations over five years in the treatment countries. The dark bars show competition in the year the government intervention was announced, and the light bars illustrate the evolution in the five subsequent years. For counties that experience interventions after 2005, we only observe the mean values of the competition measures in the remaining years of the sample period.
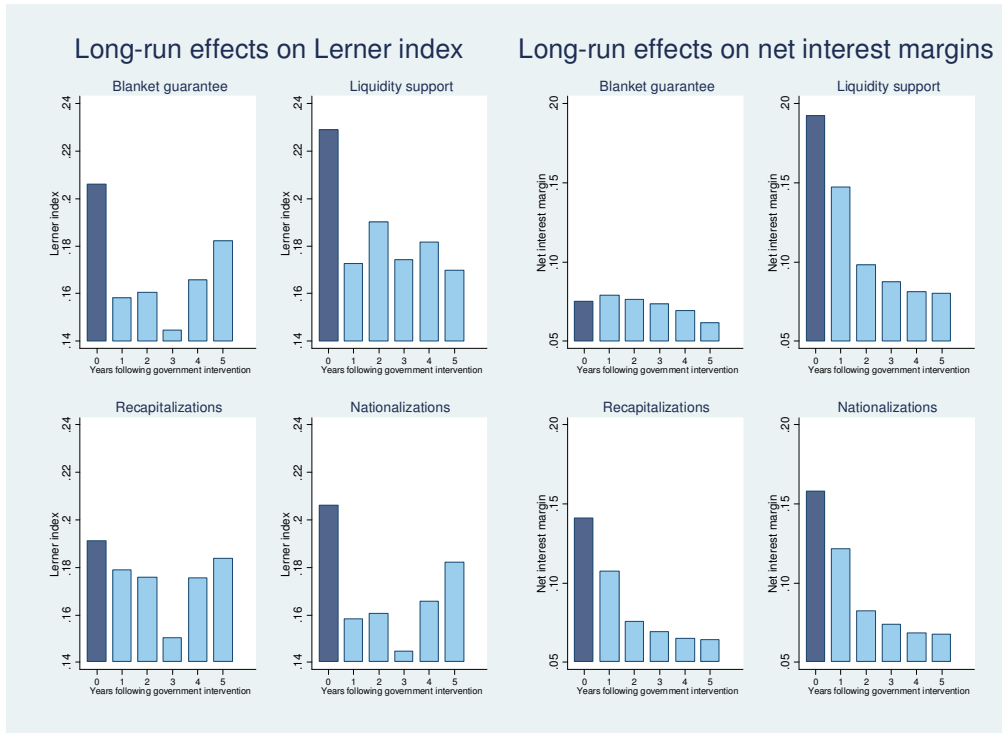
Supplementary Appendix Table A.5
Additional robustness tests

We present additional robustness tests. The first subpanel alternatively clusters the standard errors by year to account for the occurrence of government interventions in different subperiods. The second test in the first subpanel includes an additional control variable which takes on the value of one if a country also set up asset management companies and restructuring agencies which assume distressed bank assets. In the second subpanel we account for the too-big-to-fail and the too-many-to-fail effects. We consider the too-big-to-fail effect by removing countries whose HHI lies above the 95th percentile of the distribution of the concentration variable, and we account for the too-many-to-fail effect by excluding countries whose total capital ratio is below the 5th percentile of the capital ratio. The third subpanel removes high income economies and emerging markets. The fourth subpanel uses regression weights where we use the inverse of the number of interventions as a weight to assign less importance to countries with multiple interventions. The last test additionally includes a dummy variable for the year during the onset of the crisis. All regressions contain control variables not shown). They are explained in the notes to Table 3. We use the Lerner index in Panel A and the net interest margin in Panel B as dependent variable. Robust t-statistics in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Country, year, and income category dummies included. Standard errors clustered on the country level unless stated otherwise.

Panel A: Lerner index — cols 1–8 | **Panel B: Net interest margins** — cols 9–16

Subpanel: Clustering and additional controls

	Clustering of SE by year				Controlling for asset management and restructuring companies				Clustering of SE by year				Controlling for asset management and restructuring companies			
Blanket guarantee	-0.026 (-1.09)				-0.027 (-1.12)				-0.013** (-2.18)				-0.014 (-0.56)			
Liquidity support		-0.033** (-2.36)				-0.033* (-1.95)				-0.027 (-1.54)				-0.027* (-1.78)		
Recapitalizations			-0.040*** (-3.55)				-0.038** (-2.14)				-0.033** (-2.58)				-0.031** (-2.08)	
Nationalizations				-0.002 (-0.16)				-0.002 (-0.08)				-0.038** (-2.50)				-0.038** (-2.07)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687
R-squared	0.241	0.242	0.243	0.240	0.241	0.243	0.244	0.241	0.661	0.664	0.665	0.665	0.664	0.666	0.667	0.668
Number of interventions	11	34	32	26	11	34	32	26	11	34	32	26	11	34	32	26

Subpanel: TBTF and TMTF

	Accounting for the too-big-to-fail effect (TBTF)				Accounting for the too-many-to-fail effect (TMTF)				Accounting for the too-big-to-fail effect (TBTF)				Accounting for the too-many-to-fail effect (TMTF)			
Blanket guarantee	-0.026 (-1.05)				-0.009 (-0.32)				-0.014 (-0.56)				-0.010 (-0.39)			
Liquidity support		-0.036** (-2.09)				-0.029* (-1.69)				-0.028* (-1.84)				-0.027* (-1.76)		
Recapitalizations			-0.041** (-2.24)				-0.035* (-1.87)				-0.034** (-2.20)				-0.034** (-2.13)	
Nationalizations				-0.003 (-0.16)				0.006 (0.30)				-0.039** (-2.12)				-0.039** (-2.05)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610
R-squared	0.234	0.236	0.237	0.233	0.248	0.250	0.250	0.248	0.656	0.658	0.659	0.660	0.672	0.674	0.675	0.676
Number of interventions	11	34	32	26	10	33	31	25	11	34	32	26	10	33	31	25

Subpanel: Subsamples

	High income economies excluded				Emerging market economies excluded				High income economies excluded				Emerging market economies excluded			
Blanket guarantee	-0.080** (-2.11)				-0.017 (-0.50)				-0.041 (-1.14)				-0.040*** (-2.98)			
Liquidity support		-0.049 (-1.52)				-0.043** (-2.13)				-0.047** (-2.00)				-0.032* (-1.86)		
Recapitalizations			-0.061* (-1.91)				-0.045** (-1.99)				-0.048** (-2.42)				-0.046** (-2.56)	
Nationalizations				-0.027 (-0.68)				-0.006 (-0.25)				-0.071*** (-2.67)				-0.046** (-2.33)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1223	1223	1223	1223	1381	1381	1381	1381	1223	1223	1223	1223	1381	1381	1381	1381
R-squared	0.257	0.258	0.259	0.256	0.246	0.249	0.249	0.246	0.672	0.675	0.675	0.678	0.659	0.661	0.664	0.663
Number of interventions	7	21	20	17	6	24	22	17	7	21	20	17	6	24	22	17

Subpanel: Weights and accounting for onset of crises

	Weighted regressions				Controlling for onset of crises				Weighted regressions				Controlling for onset of crises			
Blanket guarantee	-0.027 (-1.06)				-0.026 (-1.09)				-0.023 (-0.93)				-0.012 (-0.50)			
Liquidity support		-0.031* (-1.93)				-0.034* (-1.96)				-0.026* (-1.69)				-0.029* (-1.87)		
Recapitalizations			-0.044** (-2.34)				-0.040** (-2.17)				-0.038** (-2.38)				-0.033** (-2.16)	
Nationalizations				-0.000 (-0.02)				-0.002 (-0.08)				-0.045** (-2.24)				-0.038** (-2.07)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687	1687
R-squared	0.247	0.247	0.248	0.247	0.241	0.242	0.243	0.240	0.667	0.668	0.669	0.669	0.662	0.664	0.665	0.666
Number of interventions	11	34	32	26	11	34	32	26	11	34	32	26	11	34	32	26

Additional analyses: Competition measurement, and the role of money market rates

We present additional analyses. In Panel A, we use the Panzar and Rosse (1987) H-Statistic as an alternative competition measure. These regressions are identical to the difference-in-difference tests in Table 3, except for the dependent variable. Unlike the Lerner index and the net interest margin, the H-Statistic increases in competition. The H-Statistic measures the effect of revenue elasticities with respect to factor input prices. These regressions include all the control variables mentioned in Table 3. Panel B shows correlations between competition measures and the money market rate (ln) as a proxy for monetary policy. *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered on the country level.

Panel A: Panzar and Rosse H-Statistic (competition measure) as a dependent variable

Blanket guarantee	0.042*			
	(1.78)			
Liquidity support		0.017		
		(0.90)		
Recapitalizations			0.030*	
			(1.71)	
Nationalizations				0.036**
				(2.00)
Control variables	Yes	Yes	Yes	Yes
Observations	1687	1687	1687	1687
R-squared	0.241	0.243	0.244	0.241
Number of interventions	11	34	32	26

Panel B: Correlations between competition measures and money market rates (ln)

	Lerner index	Net interest margin	Money market rate (ln)
Lerner index	1		
Net interest margin	-0.014	1	
p-value	(0.54)		
Money market rate (ln)	-0.026	0.267	1
p-value	(0.28)	(0.00)	

Supplementary Appendix Table A.8

Deposit volumes, loan and deposit rates, and components of the Lerner index (prices and marginal cost)

The table presents *t*-test for differences in means in deposits and money market funding three years prior to and three years following the announcement of blanket guarantees, liquidity support, recapitalizations, and nationalizations to establish whether inflows of funds differ for these subperiods in Panel A, and Panel B runs the difference-in-difference regressions for deposit and loan rates but we omit countries in which deposit insurance coverage levels have increases between 2007 and 2010. In Panel C, we run the difference-in-difference regressions with the components of the Lerner index, prices and marginal cost. Marginal cost are obtained by differentiating the Translog cost function shown in Supplementary Appendix A.3. The control variables are explained in the notes to Table 3. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Country, year, and income category dummies included. Standard errors clustered on the country level.

Panel A: Deposit volumes	Blanket guarantee			Liquidity support			Recapitalization			Nationalization		
	Before	After	*t*-test	Before	After	*t*-test	Before	After	*t*-test	Before	After	*t*-test
Deposits and money market funding	3,299,749	3,503,309	-0.08	1,681,823	1,915,002	-0.30	2,103,197	2,312,124	-0.24	2,308,503	2,527,478	-0.19

Panel B: Loan and deposit rates	Deposit rates				Loan rates			
	(Countries with increases in deposit insurance coverage limit removed)				*(Countries with increases in deposit insurance coverage limit removed)*			
Blanket guarantee	-0.139*				-0.079			
	(-1.94)				(-1.63)			
Liquidity support		-0.077**				-0.088**		
		(-2.22)				(-2.33)		
Recapitalizations			-0.060*				-0.076**	
			(-1.72)				(-2.11)	
Nationalizations				-0.089**				-0.111***
				(-2.32)				(-2.87)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1410	1410	1,410	1,410	1410	1410	1410	1410
R-squared	0.916	0.916	0.915	0.916	0.914	0.915	0.915	0.916
Number of interventions	8	19	20	17	8	19	20	17

Panel C: Lerner index components	Prices				Marginal cost			
Blanket guarantee	-0.027*				-0.026*			
	(-1.74)				(-1.92)			
Liquidity support		-0.017**				-0.014**		
		(-2.33)				(-2.08)		
Recapitalizations			-0.013				-0.012	
			(-1.44)				(-1.47)	
Nationalizations				-0.019**				-0.019**
				(-2.23)				(-2.53)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1687	1687	1687	1687	1687	1687	1687	1687
R-squared	0.743	0.743	0.742	0.743	0.736	0.736	0.735	0.737
Number of interventions	11	34	32	26	11	34	32	26