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 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.

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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, the competitive effects of bank rescues tend to be limited to distressed institutions and their immediate competitors (Acharya and Yorulmazer (2008); Brown and Dinc (2011)). However, interventions during 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 unviable zombie banks, i.e. banks that have an economic net worth below zero but continue to operate and remain able to repay debt because of their access to government support. In turn, 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 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 our final tests

document how interventions and zombie banks affect deposit and loan rates. Although the literature started examining the effects of interventions on risk-taking on the bank level and distinguishes between the behavior of rescued banks and protected banks' competitors, no effort has been devoted to the effects on competition for the entire industry, despite the relevance for policy and regulation. We therefore perform our 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.

A common feature that connects the four interventions we study 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. The bulk of the theoretical work and empirical evidence offer so far only limited insights into the effect of government interventions on competition on the banking system level. However, several studies on the bank level, and the literature on the interaction between non-financial firms' leverage and product-market dynamics offer some indications.

Focusing on blanket guarantees for individual banks, Kane and Klingebiel (2004), Hakenes and Schnabel (2010), and Acharya and Kulkarni (2013) show that blanket guarantees equip banks with competitive advantages in funding markets. Similarly, Richardson and Troost (2009) argue that liquidity support increases distressed banks' survival odds, and Berger and Bouwman (2013) document the same effect for banks with higher capital ratios. 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 as capital support raises charter values. Moral hazard effects from guarantees are documented by 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. The literature on the nexus between non-financial firms' leverage and product-market dynamics offers conflicting views. Brander and Lewis (1986) predict firms with greater debt may prey on competitors, an argument which suggests that

blanket guarantees would increase competition. In contrast, Chevalier (1995) and Phillips (1995) show that less levered firms are more competitive which suggests that recapitalizations and nationalizations should increase competition.

Given these inconclusive predictions and the lack of evidence, empirical work is necessary to establish the effects of government interventions on banking competition. However, in the absence of natural experiments it is challenging to identify causal effects of interventions with cross-country data. Before employing difference-in-difference estimations 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 key results, unique in the literature, highlight large increases in competition from liquidity support, recapitalizations, and nationalizations. We can rule out that compressed interest income in crises, poor demand, and low monetary policy rates drive our results.

Disentangling reactions to banking crises from the responses to interventions is another challenge. Crises may trigger similar effects than the government interventions for 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 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 witnessed the most intensive crises in terms of rescue costs, and EU countries where rescues have been conditional on pro-competitive bank restructurings. In addition, we run falsification tests based on relaxations of banks' activity restrictions and fake crises which also support our inferences.

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 which reflects already existing moral hazard offsets the impact of these measures. The main results are further nuanced when we examine another characteristic of banking systems: transparency. We show disclosure requirements mitigate the competition-increasing effects.

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 (Kane (1990)). 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 and the number of zombie banks. 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 when zombie banks are most prevalent. The importance of zombie banks becomes 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 zombie banks' 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, but benefit borrowers and reduce loan rates. The role of zombie banks as driver behind the results becomes more obvious when we replicate the tests on subsamples of countries with at least one year of zombie banks because our key coefficients increase in magnitude. 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 (Ongena, Smith, and Michalsen (2003); Claessens and Laeven (2005); Ivashina and Scharfstein (10)). To the extent that interventions, via effects on competition, affect banks' supply of credit as shown in Giannetti and Simonov (2013), the competitive effects will 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]

We acknowledge that countries tend to adopt multiple interventions simultaneously, and some countries also rely on implicit guarantees and other policies that are difficult to quantify. Beyond taking the signalling effects from recapitalizations and nationalizations for the entire banking industry into account, our cross-country setting with analyses performed at the aggregate level provides the additional advantage that the results not only generalize beyond a single country but also allow digging deeper to examine which characteristics of banking systems that vary on the country level moderate or amplify the effects of interventions.

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 that 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 and transparency, 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

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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).

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 non-residents), (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

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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.

protected. Since runs destabilize payment systems, guarantees can restore confidence. Theory offers clear predictions for the effect of (asymmetric) guarantees. Kane and Klingebiel (2004) state that guarantees constitute credit enhancements which allow supported banks to obtain funds more cheaply. Subsequent work by Hakenes and Schnabel (2010) points out that guarantees not only affect protected banks but also their competitors. Guarantees reduce margins and charter values of the protected banks' competitors which arises from aggressive competition from supported 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 guarantees curbs moral hazard. Work by Brander and Lewis (1995) examines the leverage of non-financial firms which is also relevant as blanket guarantees increase bank debt. They find that highly levered firms behave more aggressively in the market.

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 liquidity support from the Treasury. The premise is that extending loans to troubled banks is less costly than no intervention. Richardson and Troost (2009) show that monetary intervention can be effective because emergency lending raises distressed banks' chance to survive. 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) argue recapitalizations reduce banks' propensity to compete because capital injections increase charter values. Empirical work on capital structure yields conflicting results. On one hand, Chevalier (1995) and Phillips (1995) illustrate that less leverage increases non-financial firms' competitiveness. This result is confirmed by Berger and Bouwman (2013) who show that better capitalized banks have higher market shares. On the other hand, Lyandres (2006) shows that less levered non-financials compete less aggressively.

Nationalizations are takeovers of systemically important financial institutions and extend only to cases where governments take majority ownership stakes. In some crises, nationalizations take place at a large scale and all banks are nationalized. Studies on government ownership 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. The predictions from the literature on non-financial firms discussed for recapitalizations also apply to nationalizations.

All interventions are related via the effects on refinancing costs and moral hazard. Thus, we 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. Consequently, we also document pricing effects for deposits and loans.

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 non-residents/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 display substantial declines in competition, some countries only experience marginal declines or even increases in competition, suggesting the effects of interventions are amplified or mitigated depending on other characteristics that vary on the country level. We explore these issues in Section 4 below.

3.2 Identification strategy

We now 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. 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.[4] 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).[5] 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

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[4]   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.

[5]   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.

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. 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 real 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 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.

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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.

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 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 next 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

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

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]

All coefficients for the interventions enter negatively. While the inclusion of controls increases the efficiency of the estimation and reduces the error variance, their inclusion has little effect on the key coefficients. All subsequent analyses 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 meaningful. 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

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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. Moreover, in some countries, such as Ireland, blanket guarantees exceed GDP, and question the sovereigns' ability to honor 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 any one of these four measures were observed. The idea is to consider any intervention, irrespective of its specific design, signals future bailouts to the industry and shifts conduct towards more competition. These tests indeed 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 ($\chi 2$-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.

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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.

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 % 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 shows 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. Our 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. 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. Loan demand may be weak or banks may be risk averse and shift lending to higher quality borrowers during crises. 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. Next, we 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 crisis as in a few instances the interventions occur one year after the crisis struck. 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

Government interventions may not occur randomly. This constitutes a selection problem and may bias our coefficients. We address this with instrumental variables and use 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.

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

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[9] To offer an additional check whether the effects are driven by shifts in monetary policy, we examine correlations of real 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 real money market rates and Lerner indices but a positive association of real money market rates with net interest margins.

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

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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 cautious 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

Figure 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.

Claessens and Laeven (2004) show that market characteristics such as structure, contestability, and moral hazard affect competition. We illustrate our arguments about the initial conditions as follows. If blanket guarantees boost competition by giving rise to moral hazard if there was no deposit insurance before announcing blanket guarantes, then the effect of such guarantees should be greater in countries without deposit insurance. Foreign banks may also play a role as their presence suggests greater contestability. If foreign banks are well represented prior to nationalizations, the competition-increasing effect may be limited. Likewise, if a banking system is not contestable prior to a crisis reflected in activity and entry restrictions, the competition-enhancing effect of liquidity support will 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 Panel A of 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.

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. We test these ideas and create a Transparency index, ranging from 0 to 5 (Barth et al. (2004)). The index consists of a dummy that takes on the value of one if an external audit is required and an accounting index which increases in the quality of bank accounts. The index considers data about whether income statements include accrued or unpaid interest or principal on non-performing loans and whether banks have consolidated accounts. Panel B in Table 6 presents the effects of interventions on competition augmented by interactions with the transparency index. Except for blanket guarantees for Lerner indices, all coefficients enter significantly, and the interactions are positive. The effect of interventions is limited as transparency increases.[11]

[TABLE 6: Extensions: Initial market conditions and the role of transparency]

4.3 Evolution of zombie banks

We now examine what drives the shift towards competition. It is plausible to assume that interventions keep unviable banks in business as a going concern. If so, the Schumpeterian

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[11] To examine theories by Keeley (1990) and Cordella and Yeyati (2003) which assign a role to charter values on banks' incentives to compete, we interact charter values, reflected in the ratio of current deposits to total deposits, and money market and short-term funding with interventions in Supplementary Appendix A.6, Panel C. Neither charter values nor the interaction terms enter significantly. Charter values play no role for the effect of government interventions on competition.

process of creative destruction is suppressed, and insolvent zombie banks originate risky loans with negative net present values but substantial upside potential (Kane (1990)). Limited liability in combination with government support puts them in a no-lose situation. Zombies are incentivized to prey on their rivals' market shares. If these conjectures are true, we should find positive associations between the evolution of zombie banks and government interventions.

We classify zombie banks as those banks that operate with economic net worth below zero. To this end, we compute banks' tangible capital as common equity minus intangible assets, consisting of goodwill, other intangibles, and deferred tax assets (Kroszner and Strahan (1996)). Next, 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 the 5 years following the government interventions. The number of zombies increases immediately after interventions and then starts declining. Further, in the second year after 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 3: Evolution of zombie banks]

There is also econometric support for the role played by zombie banks for the shift in competition. Table 7 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 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 7: 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 stabilizing effects arise from the interventions as they help restore confidence, increase banks' probability of survival, and avoid disruptive bank closures, our focus is on pricing effects. This 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.

5.1 Pricing effects: Loan and deposit rates

Table 8 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.[12]

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[12] 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 (forthcoming)). To rule out that these alternative forces drive our results, Panel A in Table A.7 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.7).

Our analysis of loan rates in Panel B of Table 8 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 real money market rates. Our tests highlight the disparate pricing effects. While interventions help borrowers, they harm depositors. Moreover, the magnitudes of the coefficients in the loan rate equations are greater than in the deposit rate equations. To verify this, we 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 4.3 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 8: Pricing effects: Deposit and loan rates]

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

We now illustrate the net effects for borrowers and depositors. While we cannot offer a welfare analysis because our tests remain inconclusive as the benefits of rescuing banks and restoring confidence are difficult to quantify, our analyses in Table 8 allow some calculations to

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[13] As an alternative way to examine this, Panel C in Table A.7 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.

gauge the *direct* benefits for borrowers arising from aggregate reductions in loan rates and the *direct* negative effect for depositors from the aggregate reductions in deposit rates, expressed in % of GDP. We focus on Malaysia, a country that experienced all four interventions in 1997. Malaysia had a GDP of 100,168mn USD, loans of 95,466mn USD (average loan rate 10.62%), and deposits of 135,070mn USD (average deposit rate 7.77%). Using the point estimates from Table 8, we find that borrowers are better off by 5,126mn USD (5.12% of GDP). However, 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] These results are amplified when we consider that governments use taxes to fund interventions. In addition to the *direct* effects, the costs from the fiscal outlays from the rescue packages incurred by Malaysian taxpayers amount to 16.4% of GDP, suggesting a wealth transfer from taxpayers to the banking industry.[15]

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. Liquidity support, recapitalizations, and nationalizations trigger 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

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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.

[15] Our Supplementary Appendix A.8 presents an overview of these computations for all countries. With the exception of Denmark and Sweden, the gains for bank customers remain below the rescues costs in all other countries. A detailed study by Veronesi and Zingales for the U.S. also reports considerable wealth transfers away from taxpayers.

possibility that unobservables which coincide with the interventions drive our inferences. Nevertheless, several sensitivity tests suggest our findings are robust. Zombie banks play a key role for the increase in competition. Their emergence correlates with liquidity support and recapitalizations, and zombies' market shares increase with the frequency of interventions.

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

In sum, 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 interventions shape 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 resolution mechanisms are 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
Real 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
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
Contiguous country with crisis	929	0.053	0	1	.22597	Laeven and Valencia (2010, 2013); CEPII http://www.cepii.fr/anglaisgraph/bdd/distances.htm
AFS securities/Total securities	929	0.604	0	1	0.564	BankScope, author's calculations
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 real money market rates (ln) as a proxy for monetary policy. Country and year 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 regressions excluding and including control variables, and the final column in each panel uses a dummy variable that takes on the value of one if any one 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 real 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 and year 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	0.159		0.042		0.036		0.027		0.032	0.032
		(1.24)		(1.19)		(1.12)		(1.27)	(1.20)		(0.61)		(0.52)		(0.38)		(0.44)	(0.47)
Inflation		0.008		0.009		0.009		0.010	0.009		0.064		0.064		0.064		0.064	0.065
		(0.22)		(0.24)		(0.24)		(0.26)	(0.26)		(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)	(-0.27)		(-1.18)		(-1.13)		(-1.14)		(-1.19)	(-1.15)
Concentration (HHI)		-0.032		-0.032		-0.031		-0.032	-0.032		-0.016		-0.017		-0.016		-0.015	-0.016
		(-1.46)		(-1.47)		(-1.42)		(-1.44)	(-1.27)		(-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)	(-2.31)		(-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)	(0.20)		(0.12)		(-0.16)		(-0.12)		(-0.18)	(-0.16)
Bank-based financial system		0.108**		0.104*		0.106*		0.108**	0.106*		0.022		0.019		0.020		0.017	0.019
		(2.00)		(1.90)		(1.92)		(2.00)	(1.92)		(0.70)		(0.61)		(0.65)		(0.54)	(0.61)
Financial development indicator		0.014		0.014		0.015		0.014	0.014		0.002		0.002		0.002		0.002	0.002
		(0.40)		(0.42)		(0.43)		(0.39)	(0.40)		(0.06)		(0.07)		(0.08)		(0.07)	(0.05)
Loan impairment charges/Gross loans		0.136		0.139		0.137		0.130	0.136		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	0.003		-0.009		-0.007		-0.007		-0.004	-0.006
		(0.11)		(0.15)		(0.16)		(-0.11)	(0.13)		(-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)	(-1.43)		(1.59)		(1.39)		(1.37)		(1.39)	(1.35)
Real 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)	(0.07)		(1.65)		(1.51)		(1.47)		(1.52)	(1.43)
Blanket guarantee	-0.031	-0.026								-0.012	-0.013							
	(-1.44)	(-1.09)								(-0.62)	(-0.52)							
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									-0.033**									-0.032**
									(-2.17)									(-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	0.242	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, triggered by 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. Country and year dummies are included. 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. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. 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				n/a			-0.012			
				(-1.42)							(-0.41)			
Liquidity support	-0.043**				-0.032*			-0.040				-0.028*		
	(-2.25)				(-1.94)			(-1.30)				(-1.76)		
Recapitalizations		-0.075***				-0.039**			-0.053				-0.034**	
		(-4.33)				(-2.15)			(-1.41)				(-2.10)	
Nationalizations			-0.010				0.000			-0.095**				-0.039**
			(-0.26)				(0.03)			(-2.05)				(-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	30	3	7	30	28	22	11	30	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				-0.011				-0.001				0.003			
	(0.36)				(-0.71)				(-0.15)				(0.34)			
Liquidity support (placebo)		-0.014				-0.010				-0.007				0.005		
		(-0.89)				(-0.59)				(-0.71)				(0.50)		
Recapitalizations (placebo)			0.011				-0.004				0.001				0.000	
			(0.53)				(-0.21)				(0.14)				(0.02)	
Nationalizations (placebo)				-0.001				-0.005				-0.002				0.004
				(-0.05)				(-0.32)				(-0.28)				(0.54)
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	0.289	0.288	0.288	0.241	0.241	0.240	0.240	0.645	0.645	0.645	0.645	0.661	0.661	0.661	0.661
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				-0.040				0.001				-0.013			
	(-0.25)				(-1.37)				(0.06)				(-0.32)			
Liquidity support		-0.020				-0.048**				-0.019				-0.046*		
		(-1.11)				(-2.19)				(-0.98)				(-1.81)		
Recapitalizations			-0.011				-0.045*				-0.026				-0.051**	
			(-0.53)				(-1.93)				(-1.37)				(-2.20)	
Nationalizations				0.006				-0.016				-0.024				-0.061**
				(0.25)				(-0.68)				(-1.14)				(-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	0.222	-0.087	0.186
	(1.24)	(0.84)	(-1.14)	(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 country 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 and year 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				
Population (log)	0.077	-0.716*	-1.126***	-1.044***
	(0.33)	(-1.92)	(-3.05)	(-2.77)
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)
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 and the role of transparency

Panel A examines the role of initial conditions. We present coefficients 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. All other coefficients are suppressed 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. . 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. Panel B tests the effect of transparency. We use a Transparency index which consists of a dummy variable that takes on the value one if a compulsory external audit is required and an accounting index that is increasing in the quality of bank accounts Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Country and year dummies included. Standard errors are clustered on the country level.

Panel A: The role of initial conditions

Subpanel: Lerner index	Market structure	Contestability	Contestability	Contestability	Moral hazard
Government intervention interacted with	Concentration HHI (initial conditions)	Foreign bank ownership (initial conditions)	Activity restrictions index (initial conditions)	Entry restrictions index (initial conditions)	Explicit deposit insurance (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)

Subpanel: 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)

Panel B: The role of transparency

Subpanel: Lerner index					Subpanel: Net interest margin			
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

Table 7
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 and year 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

Table 8
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 and year 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

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.
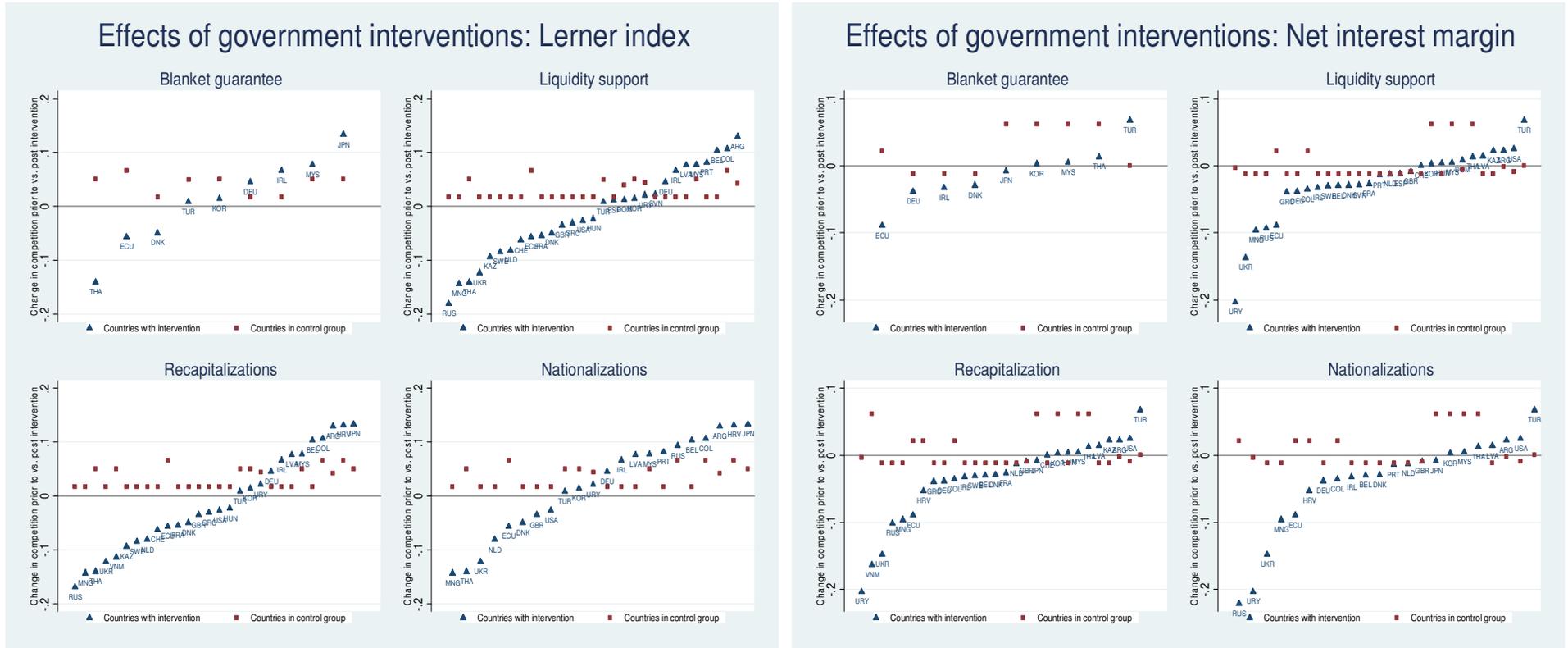
Figure 2

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.
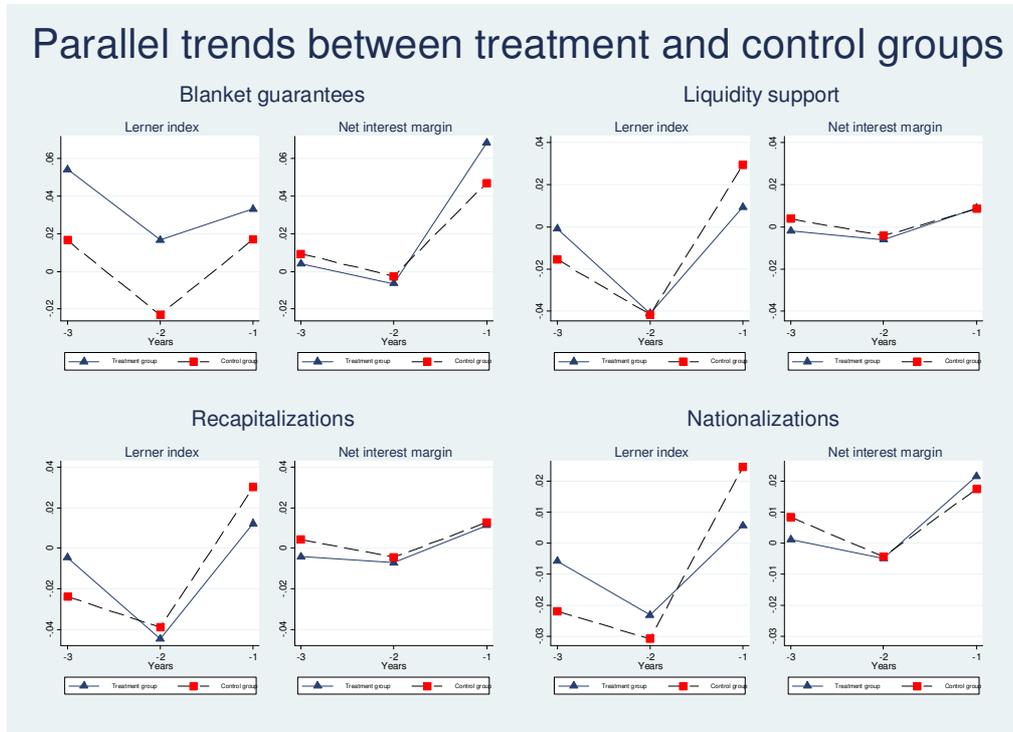
Figure 3

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 for the announcement year (year 0) and the 5 years following 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.
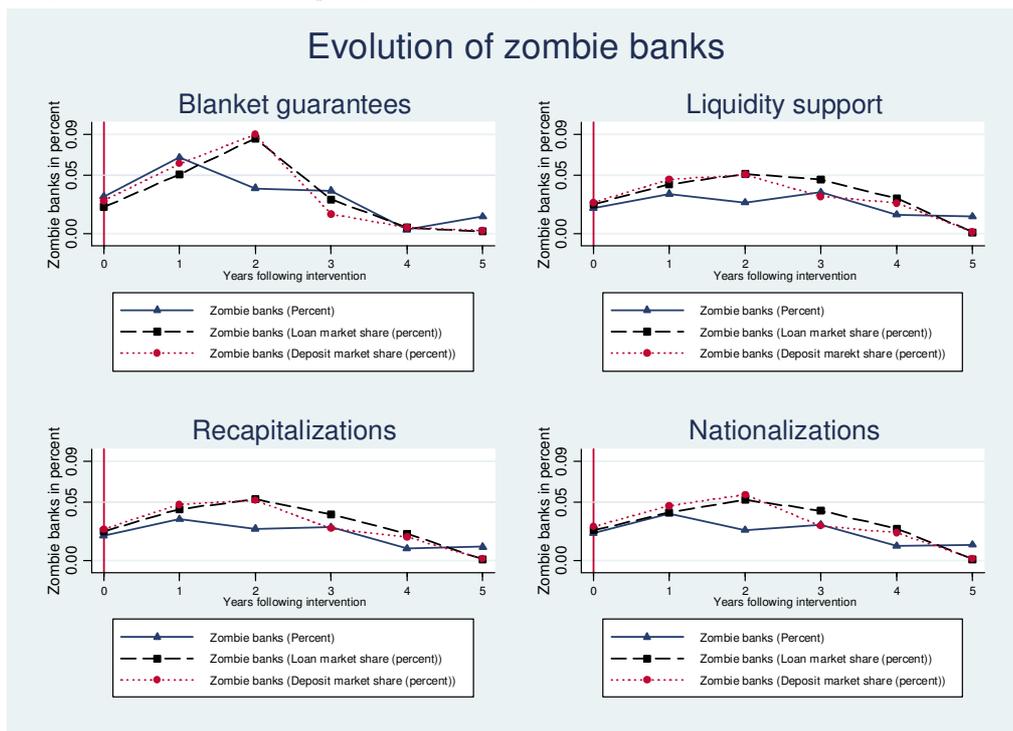
Supplementary Appendix

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

- not for publication -

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

		Government interventions			
	Number of countries with crises	*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

Supplementary Appendix Table A.2
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 real 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	

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

Supplementary Appendix A.4
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.
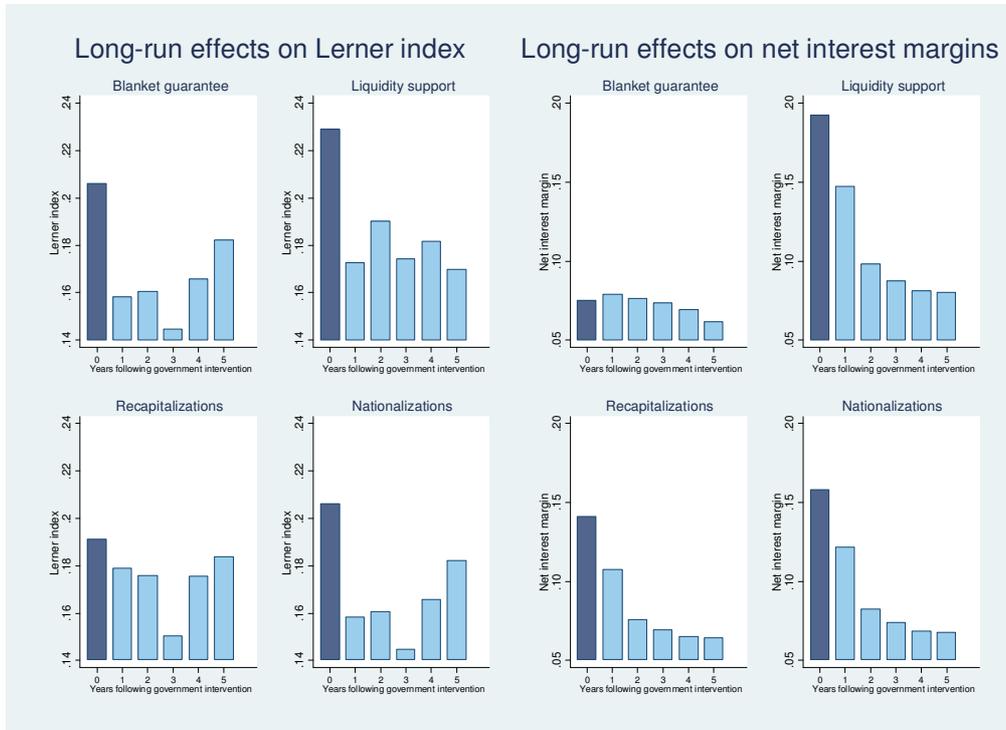
Supplementary Appendix Table A.5
Additional robustness tests

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 and year dummies included. Standard errors clustered on the country level unless stated otherwise.

Panel A: Lerner index | **Panel B: Net interest margins**

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				-0.027				-0.013**				-0.014			
	(-1.09)				(-1.12)				(-2.18)				(-0.56)			
Liquidity support		-0.033**				-0.033*				-0.027				-0.027*		
		(-2.36)				(-1.95)				(-1.54)				(-1.78)		
Recapitalizations			-0.040***				-0.038**				-0.033**				-0.031**	
			(-3.55)				(-2.14)				(-2.58)				(-2.08)	
Nationalizations				-0.002				-0.002				-0.038**				-0.038**
				(-0.16)				(-0.08)				(-2.50)				(-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				-0.009				-0.014				-0.010			
	(-1.05)				(-0.32)				(-0.56)				(-0.39)			
Liquidity support		-0.036**				-0.029*				-0.028*				-0.027*		
		(-2.09)				(-1.69)				(-1.84)				(-1.76)		
Recapitalizations			-0.041**				-0.035*				-0.034**				-0.034**	
			(-2.24)				(-1.87)				(-2.20)				(-2.13)	
Nationalizations				-0.003				0.006				-0.039**				-0.039**
				(-0.16)				(0.30)				(-2.12)				(-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**				-0.017				-0.041				-0.040***			
	(-2.11)				(-0.50)				(-1.14)				(-2.98)			
Liquidity support		-0.049				-0.043**				-0.047**				-0.032*		
		(-1.52)				(-2.13)				(-2.00)				(-1.86)		
Recapitalizations			-0.061*				-0.045**				-0.048**				-0.046**	
			(-1.91)				(-1.99)				(-2.42)				(-2.56)	
Nationalizations				-0.027				-0.006				-0.071***				-0.046**
				(-0.68)				(-0.25)				(-2.67)				(-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				-0.026				-0.023				-0.012			
	(-1.06)				(-1.09)				(-0.93)				(-0.50)			
Liquidity support		-0.031*				-0.034*				-0.026*				-0.029*		
		(-1.93)				(-1.96)				(-1.69)				(-1.87)		
Recapitalizations			-0.044**				-0.040**				-0.038**				-0.033**	
			(-2.34)				(-2.17)				(-2.38)				(-2.16)	
Nationalizations				-0.000				-0.002				-0.045**				-0.038**
				(-0.02)				(-0.08)				(-2.24)				(-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, money market rates, and the role of charter values

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. Panel C focuses on the role of bank charter values. We approximate bank charter values by the ratio of current deposits to total deposits and real money market and short-term funding. The control variables are explained in the notes to Table 3. *** p<0.01, ** p<0.05, * p<0.1. Country and year dummies included in Panel A and Panel C and these regressions cluster standard errors 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 real money market rates (ln)

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

Panel C: The role of bank charter values

Subpanel: Lerner index					Subpanel: Net interest margin			
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

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 and year 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	1410	1410	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

Supplementary Appendix Table A.8
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 8 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 8. 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 8. 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