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Bank risk taking and liquidity creation following regulatory interventions and capital support

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Abstract

During times of bank distress, authorities often engage in regulatory interventions and provide capital support to reduce bank risk taking. An unintended effect of such actions may be a reduction in bank liquidity creation, with possible adverse consequences for the economy as a whole. This paper tests hypotheses regarding the effects of regulatory interventions and capital support on bank risk taking and liquidity creation using a unique dataset over the period 1999-2009. We find that both types of actions are generally associated with statistically significant reductions in risk taking and liquidity creation in the short run and long run. While the effects of regulatory interventions are also economically significant, the effects of capital support are only economically significant in the long run. Thus, both types of actions have important intended and unintended consequences with implications for policymakers.

Keywords: risk taking, liquidity creation, bank distress, regulatory interventions, capital support
JEL Classification: G21, G28

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Introduction

During times of bank distress, authorities often intervene in banks and may also provide capital support in order to reduce bank risk taking (e.g., Dahl and Spivey (1995); Bhattacharya, Boot, and Thakor (1998); Oshinsky and Olin (2005); Giannetti and Simonov (2010); Hoshi and Kashyap (2010)).[1] However, a potential unintended consequence of these actions may be that banks create less liquidity by, for example, making fewer loans, issuing fewer loan commitments, or shifting into liquid assets. This may not be desirable given that liquidity creation is one of banks' raisons d'être (e.g., Bryant (1980); Diamond and Dybvig, (1983); Boot, Greenbaum, and Thakor (1993); Holmstrom and Tirole (1998); Kashyap, Rajan, and Stein (2002)),[2] and reduced liquidity creation may have negative consequences for the macroeconomy (Bernanke (1983); Gibson (1995); Ongena, Smith, and Michalsen (2003); Dell'Ariccia, Detragiache, and Rajan (2008); Khwaja and Mian (2008); Chava and Purnanandam (2011)). Understanding whether regulatory interventions and capital support succeed in inducing banks to reduce their risk taking, and what the consequences are for bank liquidity creation is critical for academics, regulatory authorities, and policymakers (e.g., Webb (2000); Acharya, Bharath, and Srinivasan (2007); Bank of England (2008); Acharya, Shin, and Yorulmazer (2009)). Nonetheless, the effects of both types of actions are not well understood.

The key question we ask in this paper therefore is: What are the effects of regulatory interventions and capital support on bank risk taking and liquidity creation? Addressing this question informs the current debate about the efficacy of different ways of intervening and dealing with distressed banks and helps fill a gap in the literature that lacks empirical evidence on whether regulatory interventions and capital support are beneficial.

While regulatory interventions and capital support take place in many countries, data on such actions are typically impossible to obtain and previous studies are therefore usually confined to analyzing the effects of laws and regulations on bank soundness (e.g., Barth, Caprio, and Levine (2004); Demirgüç-Kunt, Detragiache, and Tressel (2008)). We use a unique dataset from the Deutsche Bundesbank (the German central bank) which covers the entire universe of German

[1] Other benefits include avoiding gridlock in the payments system, restoring financial market confidence, and enhancing systemic stability. These latter factors benefit the real economy and it is not uncommon that governments justify such interventions and capital support measures on the grounds that "Saving Wall Street is a considered necessary step to help Main Street" as Giannetti and Simonov (2010, p. 1) put it.

[2] Another key role of banks is to transform risk (e.g., Diamond (1984); Ramakrishnan and Thakor (1984); Boyd and Prescott (1986)).

banks for the period 1999-2009. The specific advantage of our dataset is that it contains a complete set of information on all the interventions and all the capital support provided. Over this time period, regulatory authorities intervened in 17% of all banks, and provided capital support (averaging 18% of their Tier 1 capital) to 14% of all banks. Thus, a sizeable proportion of banks received interventions and capital support, allowing for meaningful analyses.

To address how the different actions affect banks' risk taking and liquidity creation, we formulate hypotheses and test them using ordered logit models in which we regress the changes in risk taking and liquidity creation on a regulatory intervention dummy, the amount of capital support received (if any), and a set of control variables. We focus on substantial changes in risk taking and liquidity creation, defined as changes of at least 3%.

By way of preview, we find that regulatory interventions and capital support are generally associated with statistically significant reductions in both risk taking and liquidity creation in the short run and long run. While the effects of regulatory interventions are also economically significant, the effects of capital support are only economically significant in the long run.

We perform a number of additional analyses in which we run regressions separately for: different bank pillars (i.e., private, public, and cooperative banks); small banks (total assets below the median of € 329 million) and large banks (total assets above the median); poorly- and better-capitalized banks (split at the median bank's balance sheet equity capital ratio of 8.73%); and crisis years (2001 and 2007-2009) and non-crisis years (1999-2000 and 2002-2006).

To assess robustness of our results, we perform several sensitivity analyses. First, we use alternative cutoffs to define what constitutes a substantial change in risk taking and liquidity creation. Second, we run regressions for subsamples of merged and non-merged banks. Third, we use alternative measures of risk taking and liquidity creation. Fourth, to deal with a potential endogeneity issue (bank distress may result in both regulatory interventions and capital support on the one hand, and reductions in risk taking and liquidity creation on the other hand), we use lagged regulatory interventions and lagged capital support in our main regressions. Recognizing that this may not be sufficient, we also run instrumental variable regressions. In all cases, we obtain results that are similar to the main findings.

We emphasize that although we use German data, our results are likely representative for a broad number of countries, including the U.S., Japan, and various European countries. To see

that, it is important to note that Germany has many small- and medium-sized banks that provide financial services in local areas (Puri, Rocholl, and Steffen (2011)). That also holds for the U.S., where the vast majority of all banks are considered to be community banks that are the primary providers of credit for small- and medium-sized businesses. These community banks are locally owned and operated like savings and cooperative banks in Germany. Japan and various European countries including Austria, Switzerland, Italy, France, and Spain, also have similar financial institutions, regulations, and economic environments as Germany. In addition, all those countries exhibit similarities in terms of dealing with distressed banks. Regulatory interventions of various forms, and capital support measures have been repeatedly observed in the U.S., Japan, and in many European economies (e.g., Oshinsky and Olin (2005); Berrospide and Edge (2010); Giannetti and Simonov (2010); Hoshi and Kashyap (2010); Stolz and Wedow (2010)).

Our paper is related to the studies about prompt corrective action and regulator's closure policies (e.g., Boot and Thakor (1993); Mailath and Mester (1994); Dahl and Spivey (1995); Noe, Rebello, and Wall (1996); Aggarwal and Jacques (2001)), and on the effect of capital support on banks' lending behavior (e.g., Berrospide and Edge (2010); Giannetti and Simonov (2010)). To our knowledge, this paper is the first study that sheds light on how regulatory interventions and capital support affect bank risk taking and liquidity creation. By examining the effects of regulatory interventions and capital support on risk taking, we address an issue of first-order importance. By focusing on the effects of these actions on liquidity creation instead of examining their effects on lending behavior, our research takes a more holistic perspective using a superior concept of bank output that includes all on- and off-balance sheet activities.

We organize the paper as follows: Section I provides a brief overview of the German banking sector and the regulatory interventions and capital support provided during our sample period. Section II develops our hypotheses. Section III describes the regression framework, data, and variables. Section IV reports our main empirical results for the short-run effects of regulatory interventions and capital support on bank risk taking and liquidity creation, and includes additional analyses and robustness checks. In Section V, we examine the long-run effects of regulatory interventions and capital support. Concluding remarks are offered in Section VI.

I. Institutional background, regulatory interventions, and capital support

This section first describes the institutional background of the German banking system. It then discusses the actions taken by the government and bankers associations in response to bank distress, i.e., regulatory interventions and capital support.

A. German banking system

Germany has a bank-based financial system, where retail and corporate customers depend heavily on liquidity provision by financial institutions (Schmidt, Hackethal, and Tyrell (1999)). The German banking sector consists of three pillars: private banks, public sector banks, and credit cooperatives. While all these banks are universal banks, the three pillars differ in terms of ownership structure (Brunner, Decressin, Hardy, and Kudela (2004)). The private bank pillar contains large nationwide banks, regional banks, and branches and subsidiaries of foreign banks. The larger private banks are organized as joint-stock companies whereas their smaller counterparts are partnerships, private limited companies or even sole proprietors. The public sector banks include savings banks and Landesbanks owned by governments at the city-, county-, or state-level. The cooperative banking pillar comprises cooperative banks and central credit cooperatives. These banks are organized as mutuals. Additional details about these different types of institutions – particularly with respect to geographical reach and type of business activities – are provided in Altunbas, Evans, and Molyneux (2001), and Puri et al. (2011).[3]

Each banking pillar has its own bankers associations. In addition to three umbrella organizations in each pillar, there are a number of bankers associations at the state and regional level. Together, they operate a tightly-knit framework of support schemes (Brunner et al. (2004); Puri et al. (2011)). Across the three pillars, these support schemes not only offer deposit insurance coverage that exceeds the statutory required coverage of € 20,000 per depositor per bank, but – important for our paper – they also provide distressed institutions with capital support to avoid disruptions of confidence in the system that would arise from closures.

[3] The large private banks tend to operate national branch office networks, whereas smaller private banks operate in local or regional markets. Savings banks operate in locally delimited areas. They are linked to Landesbanks in three ways. First, Landesbanks are partially owned by savings banks and, second, they provide wholesale services to savings banks. Third, Landesbanks offer services to the savings banks' customers that the local savings banks are not able to provide, e.g., international banking and securities business. Cooperative banks also operate in local banking markets. The central credit cooperatives are owned by the local cooperative banks. The key task of the central cooperatives is similar to the role of Landesbanks for the savings banks.

B. Actions by the government and bankers associations: Regulatory interventions and capital support

Supervision of banks in Germany is the joint responsibility of the Federal Financial Supervisory Authority and the Deutsche Bundesbank. Based on financial statement data, audit reports, and on-site examinations, the Bundesbank collects and processes information about banks' operations and their financial positions. When banks violate the principles of the Banking Act,[4] the Bundesbank forwards this information to the Federal Financial Supervisory Authority, which is ultimately responsible for all disciplinary actions against banks.

The actions by the Federal Financial Supervisory Authority depend on the severity of the recorded violations. In case of minor violations, it may intensify supervision or issue warnings and conduct hearings of the bank's board of directors. If the violations are more serious, it may take actions such as prohibiting the origination of new loans or dismissing senior executives. Before such serious interventions into the bank's business activities take place, the Federal Financial Supervisory Authority typically gives the bank time to correct the deficiencies by issuing a warning letter. Neither the serious nor the weaker interventions are publicly known, but they are available in our dataset. Our empirical tests focus on the serious interventions by the regulator because such intrusions into their business operations are more likely to significantly affect banks' risk taking and their ability to create liquidity than mere warning letters and intensified supervision.[5]

The government and the bankers associations may also provide capital support to distressed banks to prevent them from failing and to stabilize the financial system. The government did this during the recent financial crisis. It set up a Financial Market Stabilization Fund (SoFFin) which provided capital support mainly to large private banks and to the Landesbanken.[6] The bankers associations provided capital support to their members over our entire sample period from 1999-2009.[7] Our empirical analysis combines the capital support by the government and the bankers associations. However, the results are not driven by this combination.

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4 The Banking Act is the statutory banking supervision guide for banks in Germany.

5 In unreported regressions, we confirm that risk taking and liquidity creation are not significantly affected when weak measures are administered by the Federal Financial Services Supervisory Agency.

6 SoFFin also provided guarantees and purchased securities via open market operations.

7 The insurance schemes of the bankers associations obtain information about bank soundness either indirectly from the auditors or directly from the regulatory authorities. If a member institution is considered unsound, the support scheme often injects capital and informs the regulator. The member banks are obliged to disclose any

Capital restoration measures are publicly known, as they are reported in the banks' financial statements. Bankers associations are normally aware of regulatory interventions at an early stage, and vice versa. There is no predetermined ordering with respect to the timing of when regulatory interventions and capital support take place. Capital support may precede or follow regulatory interventions, and either may occur without the other.

II. Hypothesis development

This section develops our risk-taking and liquidity-creation hypotheses.

A. Risk-taking hypotheses

Our first hypothesis focuses on the fact that the primary concern of regulators is to limit undue risk taking. The reason is that regulatory authorities aim to avoid losses to the deposit insurer, lower resolution costs, incentivize healthy banks to avoid becoming distressed, and reduce the number of failures (e.g., James (1987); Dahl and Spivey (1995)). To achieve this, they are equipped with the power to revoke the bank license in extreme cases, and the threat thereof can trigger portfolio adjustments and affect future asset choices in banks (Mailath and Mester (1994)). While banks may not face the immediate threat of closure, we argue that imposing restrictions on certain activities likely limits a bank's scope for undertaking such activities. We therefore expect risk taking to decline after interventions. Risk taking may also decline due to increased regulatory monitoring after an intervention. We formulate our first hypothesis as follows:

***H1. Regulatory Intervention Risk Reduction Hypothesis*:** *Regulatory interventions are associated with reductions in risk taking.*

Capital support is generally given to enhance the survival odds of ailing institutions. Capital support has two components: an injection of capital and increased post-injection monitoring of the bank.

While it is expected that post-capital-injection monitoring of the bank by a regulator or a bankers association would lead to lower risk, the theoretical literature is divided on whether

information to the bankers association that is necessary to allow for a transparent assessment of the bank's financial position (see Dam and Koetter (2011)).

higher capital by itself reduces bank risk. One set of theories argues that higher bank capital goes hand in hand with lower bank risk taking. Morrison and White (2005) focus on moral hazard. The idea in their paper is that if banks do not have enough equity at stake, they may be tempted to make excessively risky investments. Higher capital reduces such moral hazard incentives and hence should lead to reduced risk taking. Other papers reach a similar conclusion, but by focusing on the strengthened bank monitoring incentives that accompany higher bank capital (Holmstrom and Tirole (1997), Allen, Carletti and Marquez (forthcoming), and Mehran and Thakor (forthcoming)).

Other theories argue that higher bank capital may be accompanied by an increase in bank risk taking. This may occur if banks react to the higher capital by shifting into riskier portfolios and are not prevented from doing so by regulators (e.g., Koehn and Santomero (1980)). Calomiris and Kahn (1991) also show that a capital structure with sufficiently high demand deposits (and by implication lower equity) leads to more effective monitoring of bank managers by informed depositors and hence a smaller likelihood of bad investment decisions. Thus, banks with higher capital, and consequently a lower proportion of the portfolio financed by demandable deposits, may operate with higher credit risk and insolvency risk.[8]

Thus, theoretically the combined effect of higher capital in the bank and greater post-capital-injection monitoring of the bank could go either way, depending on whether the incentive effect of higher capital on the bank dominates the effect of the loss of creditor discipline due to higher capital. We summarize this as the following hypotheses, but note that we can only measure the net effect:

***H2a. Capital Support Risk Reduction Hypothesis*:** *Capital support is associated with reductions in risk taking.*

***H2b. Capital Support Risk Increase Hypothesis*:** *Capital support is associated with increases in risk taking.*

B. Liquidity-creation hypotheses

While Germany, unlike the U.S., does not have a formal framework for prompt corrective action that ties individual regulatory measures to thresholds in terms of bank capitalization, the

[8] See Freixas and Rochet (2008) for an overview on the literature on the market discipline role of bank leverage.

measures taken against distressed institutions in Germany (see Section III C below) resemble several of the actions taken by the authorities in the U.S.[9] For instance, restrictions on asset growth, deposit taking, dismissals of senior executives, and other instructions to restructure business activities are observed in Germany as well as in the U.S. The types of interventions follow the principle that serious manifestations of distress trigger more extensive sanctions by the regulator (e.g., Dahl and Spivey (1995)); Aggarwal and Jacques (2001)). Since any one of those active interventions into the banks' operations are likely to impede the scope and scale of banks' activities, we hypothesize that regulatory interventions have a negative effect on liquidity creation:

***H3. Regulatory Discipline Hypothesis*:** *Regulatory interventions are associated with reductions in liquidity creation.*

On the issue of how bank capital affects liquidity creation, the theoretical literature provides opposing predictions. We turn to these theories to extract hypotheses on how capital support is expected to affect liquidity creation.

Some theories posit that bank capital may impede liquidity creation because it makes the bank's capital structure less fragile. A fragile capital structure encourages the bank to commit to monitoring its borrowers, and hence allows it to extend loans. Additional equity capital makes it harder for the less-fragile bank to commit to monitoring, which in turn hampers the bank's ability to create liquidity (e.g., Diamond and Rajan (2000, 2001)). We refer to these ideas as the 'financial fragility' theory.

Other theories focus on banks' role as risk transformers. They argue that liquidity creation exposes banks to risk (Allen and Santomero (1998); Allen and Gale (2004)), and that higher capital improves banks' ability to absorb risk (e.g., Bhattacharya and Thakor (1993); Repullo (2004); von Thadden (2004); Coval and Thakor (2005)), so higher capital ratios may allow banks to create more liquidity. We refer to these collectively as the 'risk absorption' theories.

The 'financial fragility' theory suggests that liquidity creation decreases after capital support, while the 'risk absorption' theories predict increases in liquidity creation. Both effects may be at

[9] Dahl and Spivey (1995) and Aggarwal and Jacques (2001) provide more detailed overviews of prompt corrective action measures in the U.S.

play, which implies that our tests will pick up the net effect of capital support on liquidity creation. Thus, we formulate the following two hypotheses:

H4a. Capital Support Financial Fragility Hypothesis: *Capital support is associated with reductions in liquidity creation.*

H4b. Capital Support Risk Absorption Hypothesis: *Capital support is associated with increases in liquidity creation.*

Note that all of our hypotheses in essence focus on the supply side of banking services. That is, they focus on the responses of banks to regulatory interventions and capital support. We acknowledge here that there may be some demand effects as well. Capital support is made public through financial statements. To some extent, regulatory interventions may become public knowledge as well.[10] When customers become aware of the banks' distress, they may reduce their demand for loans and other banking services (for details see, e.g., Slovin, Sushka, and Poloncheck (1993); Cornett and Tehranian (1994); Ongena, Smith, and Michalsen (2003); Watanabe (2007)). This may cause bank risk taking and liquidity creation to decline. In this paper, we cannot distinguish between demand and supply side effects because we do not have information on loan applications or other indicators of demand.

III. Regression framework, data, and variables

This section first discusses our regression framework. It then describes the data. Finally, it explains the key independent variables (regulatory interventions and capital support), the key dependent variables (changes in risk taking and liquidity creation), and the control variables. All financial variables are expressed in real € 2000 terms using the GDP deflator.

A. Regression framework

To test our hypotheses, we model changes in risk taking and liquidity creation as functions of regulatory interventions, capital support, and a set of control variables. To ensure that our results are not driven by small changes in risk taking and liquidity creation, we use ordered logit models

[10] An example of a regulatory intervention eventually surfacing in the public domain is the unanticipated turnover of an executive. Such information may affect customers' choices about the banks from which to purchase their financial services.

which distinguish between substantial changes in bank behavior and relatively constant behavior.[11] Specifically, in our risk-taking ordered logit models, the dependent variable takes on the value of 1 if the bank experienced a drop in risk taking (relative to the previous year) of more than 3% (*DECR*). It takes on the value 2 if risk taking remained constant within a narrow band of +/- 3% (*CONST*), and it takes on the value 3 if risk taking increased by more than 3% (*INCR*). In our liquidity-creation ordered logit models, we also use cutoffs of +/- 3%. In a robustness test, we use alternative cutoffs (see Section IV C).

The general formula for an ordered logit model with three categories expresses the probability of observation i of variable *Y* falling into category *j* in year *t* as:

$$P\left(Y_{i,t} > j\right) = \frac{exp(\alpha_j + \beta X_{i,t-1})}{1 + exp(\alpha_j + \beta X_{i,t-1})},\ j = 1,2 \quad (1)$$

and

$$P(Y_{i,t} = 1) = 1 - P(Y_{i,t} > 1) \quad (2)$$

where $X_{i,t-1}$ is the vector of independent variables for observation *i* in year *t-1*, the α's are the intercepts, and the β's are the slope coefficients.

In our model, $Y_{i,t}$ is the change in risk taking or liquidity creation (see Section III D) which falls in one of three categories (it decreases (*DECR*), stays relatively constant (*CONST*), or increases (*INCR*)); $X_{i,t-1}$ is the vector of regulatory interventions and capital injections (see Section III C), and control variables (see Section III E), all lagged by one period. Thus, in our model, the equations are:

$$P(Y_{i,t} = DECR) = 1 - \frac{exp(\alpha_1 + \beta X_{i,t-1})}{1 + exp(\alpha_1 + \beta X_{i,t-1})} \quad (3)$$

$$P(Y_{i,t} = CONST) = \frac{exp(\alpha_1 + \beta X_{i,t-1})}{1 + exp(\alpha_1 + \beta X_{i,t-1})} - \frac{exp(\alpha_2 + \beta X_{i,t-1})}{1 + exp(\alpha_2 + \beta X_{i,t-1})} \quad (4)$$

$$P(Y_{i,t} = INCR) = \frac{exp(\alpha_2 + \beta X_{i,t-1})}{1 + exp(\alpha_2 + \beta X_{i,t-1})} \quad (5)$$

The β's on regulatory interventions or capital support are the coefficients of primary interest. In the tables, we will report odds ratios which are the exponentiated β's, unless stated otherwise.

[11] An ordinary least squares approach could be dominated by small changes.

In the risk-taking (liquidity-creation) regressions, an odds ratio of 1 (β is 0) for regulatory interventions or capital support indicates that the probability of observing an increase or a decrease in risk taking (liquidity creation) following the action is equally likely. If the odds ratio is above 1 (β is positive), this implies that the intervention or support results in a higher probability of an increase in risk taking (liquidity creation). Similarly, if the odds ratio is below 1 (β is negative), this implies that the intervention or support results in a lower probability of an increase in risk taking (liquidity creation) (see Section IV).[12]

B. Data

We obtain annual data for all the banks that operate in Germany between 1999 and 2009 from the Bundesbank. We exclude banks if they have i) no loans outstanding, ii) zero deposits, iii) unused commitments that exceed 4 times total assets, iv) balance sheet items with negative values, or v) total assets below € 25 million. Our dataset has 17,662 bank-year observations for 2,735 banks, of which 234 are private banks, 591 belong to the public banking sector, and 1,910 institutions are in the cooperative pillar. In most analyses, we include banking pillar dummies. In some analyses, we instead split the sample into large versus small banks (above and below median assets).

During the sample period, the banking sector experienced a consolidation wave. Consequently, we identify merged institutions, and create a new institution after the merger to avoid spikes in risk taking and liquidity creation that are attributable to the merger.[13] This causes

[12] Note that the ordered logit model makes a 'parallel odds' assumption that the slope coefficients β are constant. In the context of our study, this means that interventions and support are assumed to have equiproportionate effects on the probabilities of either increases or decreases in risk taking and liquidity creation. For example, if the effect of regulatory interventions is twice the effect of capital support in reducing risk taking (relative to an increase or constant risk taking), then it will also have twice the effect in reducing or constant risk taking (relative to an increase). Wald tests (not reported) show that that the 'parallel odds' assumption cannot be statistically rejected, implying that our use of ordered logit models is valid.

[13] We consider several possible ways to treat mergers: (1) excluding merged banks, (2) merging banks 'backwards' into one institution over the entire time period, and (3) creating a new institution after the merger. The first option leads to loss of information as a number of mergers took place during the sample period. Furthermore, a bias would be created as a large fraction of the mergers are classified as 'distressed mergers,' i.e., dropping these banks would also mean dropping a large share of the most troubled institutions. The second option would be based upon the assumption that banks do not change their behavior after consolidation, i.e., they behave as one entity prior to the merger and do not change their behavior following the merger. We choose the third option, and create a new institution after two banks merge. For a detailed description of possible merger treatment procedures, see Merkl and Stolz (2006).

the number of banks in our sample to increase as we have three independently-treated banks: the two pre-merger banks and the post-merger bank.[14]

C. Key independent variables: Regulatory interventions and capital support

We use a dummy variable ***Regulatory interventions*** to capture serious disciplinary actions by the regulator against banks. The variable takes on the value one if one or more of the following measures was imposed in that year:

(1) Restructuring orders
(2) Restrictions or prohibitions of lending activities
(3) Restrictions or prohibitions of deposit taking
(4) Restrictions or prohibitions of deposit withdrawals
(5) Restrictions or prohibitions of profit distributions
(6) Dismissal of senior executives[15]

We have information on the size of capital injections, and construct a variable ***Capital Support*** measured as capital injection/Tier 1 capital. We scale by Tier 1 capital to measure the relative importance of the support to the bank. We use Tier 1 capital rather than total regulatory capital in the denominator as the latter includes subordinated debt, loan loss reserves, and other less relevant components.

Table I contains summary statistics on regulatory interventions and capital support for the full sample and for the sample broken down by bank type (private/public sector/cooperative banks) and bank size (large/small banks). In addition, the table also shows a breakdown of banks that only recorded regulatory interventions, only received capital support, and received both.

In total, we record 452 regulatory interventions. Due to data confidentiality, we cannot disclose details of the different types of interventions. Regulatory authorities intervened in 17% of all banks. Most of these interventions were in cooperative banks (22%). The dataset contains 371 cases of capital support, 14% of all banks received capital support. Most of this support is

[14] As we show below in Section IV C, results are similar for merged and non-merged banks.
[15] We include measures against senior executives because these individuals determine the key funding and investment decisions of a bank, which have important effects on both risk taking and liquidity creation. The corporate finance literature argues that changing the figurehead is frequently associated with changes in corporate policies (e.g., Weisbach (1988)). Re-running our regressions based on a regulatory intervention dummy that excludes the dismissals of senior executives does not materially change our inferences.

observed in cooperative banks (17%). The average support is 18% of Tier 1 capital. In the sample, 71 banks were subject to both regulatory interventions and capital support.

[Table I *Summary statistics for regulatory interventions and capital support*]

D. Dependent variables: Changes in risk taking and liquidity creation

The dependent variables are the changes in risk taking and liquidity creation. For ease of exposition, however, we discuss these variables below in levels.

Our measure of risk is the Basel I risk-weighted assets divided by total assets (RWA / TA), which has been used in prior research (see, e.g., Logan (2001), Berger and Bouwman (2011)). This measure covers credit risk both on and off the balance sheet. We record a drop in risk (Y = *DECR*) if RWA / TA decreases by more than 3%, an increase in risk (Y = *INCR*) if RWA / TA increases by more than 3%, and constant risk (Y = *CONST*) otherwise.

Our liquidity creation measure takes into account all on- and off-balance sheet activities. We calculate the amount of liquidity created by each bank using a slight variation on Berger and Bouwman's (2009) preferred measure and convert it into real € 2000 terms. The reasons for the change and the three-step procedure used to construct this measure are explained in detail in the Appendix. We record a drop in liquidity creation (Y = *DECR*) if liquidity creation decreases by more than 3%, an increase in liquidity creation (Y = *INCR*) if liquidity creation increases by more than 3%, and constant liquidity creation (Y = *CONST*) otherwise.

E. Control variables

All of the control variables (except for dummy variables) are measured in changes. For ease of exposition, we discuss these variables below in levels. We also indicate how we expect them to correlate with risk taking and liquidity creation.

Total assets (natural log) is included to account for bank size. We expect size to be positively correlated with risk taking because large banks have a greater capacity to absorb risk, and because in some cases, the largest institutions may be considered to be too-important-to-fail. Size is also expected to be positively correlated with liquidity creation (see Berger and Bouwman (2009)). ***Return on equity*** controls for profitability. Profitable banks may be less keen to take on risks (Laeven and Levine (2009)). The effect of profitability on liquidity creation is not clear ex ante. We control for ***loan portfolio concentration*** using a Herfindahl-Hirschman index of

lending activities across 8 industry sectors.[16] While banks with more concentrated loan portfolios are riskier (all else equal), they may choose assets with higher or lower risk weights. The expected effect of loan portfolio concentration on liquidity creation is also ambiguous. The number of ***Bank branches*** is included because more branches offer more opportunities to make loans as well as potentially better monitoring of these loans. The effect on risk taking is ambiguous because of the greater lending but potentially lower risk per loan. More branches offer more business opportunities for providing loans and deposits to customers and may therefore result in greater liquidity creation. To account for the economic environment, we include the ***Interest rate spread***, measured as the difference between 10-year and 1-year government bonds. When the interest rate spread is wide, banks have an incentive to provide more loans, which may lead to increased risk taking and higher liquidity creation. Finally, we also include the dummy variables ***Public bank*** and ***Cooperative bank*** that provide information on bank types. We omit the dummy for ***Private banks*** to avoid perfect collinearity.

Table II contains summary statistics for the dependent variables and the control variables. While the regressions are run in changes, we report levels and changes for all the variables. *Panel A* presents the statistics for the full sample, and *Panels B* and *C* show a detailed breakdown for the banks that experienced regulatory interventions and received capital support, respectively.

[Table II *Summary statistics for dependent variables and control variables*]

IV. How do risk taking and liquidity creation respond to regulatory interventions and capital support?

This section tests our hypotheses on how regulatory interventions and capital support affect bank risk taking and liquidity creation. We first present the main results. We then show the results for subsamples by banking pillar, size, capitalization, and subperiods. Next, we perform robustness checks in which we use alternative cutoffs, run regressions for subsamples of merged and non-merged banks, use alternative measures of risk taking and liquidity creation, and employ ordered probit (instead of ordered logit) models. Finally, we discuss the robustness of our inferences to using instrumental variable regressions.

[16] The 8 industry sectors are i) agriculture, forestry and fishing; ii) utilities and mining; iii) construction; iv) manufacturing; v) trade; vi) transportation; vii) financial services; and viii) other services.

A. Main results: The effects of regulatory interventions and capital support on bank risk taking and liquidity creation

Table III shows the main results. *Panels A* and *B* use changes in risk (ΔRWA / TA) and changes in liquidity creation (Δ LC) as the dependent variables, respectively.

Panel A shows that regulatory interventions are associated with decreases in risk, consistent with the *Regulatory Intervention Risk Reduction Hypothesis (H1).* The odds ratio of 0.7819 is statistically significantly different from one. It implies that an intervention is associated with a 21.81% increase in the likelihood of a drop in risk, which is also economically significant.[17] The odds ratio on capital support, 0.9818, is also statistically significant. However, it is not economically significant. It implies that a mean capital support of 18% of Tier 1 capital (see Table I *Panel A*) is associated with only a 0.33% increase in the likelihood of a drop in risk.[18] This finding suggests that the effects of the *Capital Support Risk Reduction Hypothesis (H2a)* and the *Capital Support Risk Increase Hypothesis (H2b)* are either weak or approximately offset each other, and that capital support is not associated with a substantial change in risk taking, at least not in the short run.

[Table III *Main regression results*]

Panel B reveals that regulatory interventions are associated with decreases in liquidity creation, consistent with the *Regulatory Discipline Hypothesis (H3).* The odds ratio of 0.6398 is statistically significantly different from one and suggests that an intervention is associated with a 36.02% increase in the likelihood of a drop in liquidity creation. This finding is also economically significant, suggesting that sanctions by the regulator have non-negligible effects on the scope and scale of bank activities. The odds ratio on capital support, 0.9839, is again statistically significant, but not economically insignificant. A mean capital support of 18% is associated with only a 0.29% increase in the likelihood of a drop in liquidity creation. This suggests that the effects of the *Capital Support Financial Fragility Hypothesis (H4a)* and the *Capital Support Risk Absorption Hypothesis (H4b)* are weak or approximately net each other out, and that capital support is not associated with a major change in liquidity creation in the short run.

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[17] The percentage change in odds per one-unit change is $(e^{\beta} - 1) * 100$, where e^{β} is the odds ratio and β is the regression coefficient.

[18] The percentage change in odds per mean capital support is $(e^{\beta * \text{mean capital support}} - 1) * 100$, where e^{β} is the odds ratio and β is the regression coefficient.

The control variables in *Panels A* and *B* generally have the expected effects and tend to be statistically significant. Increases in bank size, the number of bank branches, and the interest rate spread are associated with increases in risk taking and liquidity creation. Increases in profitability are associated with a small reduction in risk, and have no effect on liquidity creation. Changes in loan portfolio concentration do not have a significant effect on risk or liquidity creation. Finally, public and cooperative banks are relatively more likely to experience increases in risk taking and liquidity creation than private banks.

B. Results for subsamples by banking pillar, size, capitalization, and subperiods

In this subsection, we examine whether the main results hold for subsamples by banking pillar, size, capitalization, and crisis versus non-crisis subperiods. Table IV contains the results. For brevity, we only report the odds ratios on the main variables of interest, regulatory interventions and capital support. All regressions, however, include the full set of control variables.

[Table IV *Regression results for banks split by banking pillar, size, capitalization, and subperiods*]

First, since our discussion above revealed various differences among banks in the three banking pillars, we investigate whether the main results hold for all three types. As shown in *Panel I-A*, the effect of regulatory interventions on risk taking are only statistically and economically significant for cooperative banks. For these banks, the odds ratio of 0.7470 implies that an intervention is associated with a 25.30% increase in the likelihood of a drop in risk. This finding is not surprising, given that the vast majority of regulatory interventions took place in cooperative banks. The odds ratios on capital support are close to one for all three pillars, showing a lack of economic significance, as in the full sample. Turning to the liquidity creation results in *Panel I-B*, regulatory interventions are found to be statistically and economically significant in reducing liquidity creation in both the public and cooperative banking pillars. Since public and cooperative banks are on average also smaller than private banks, have less flexible business models in terms of scope and scale of activities, and tend to operate in geographically delimited areas, they may find it harder to adapt to regulatory sanctions than their more flexible counterparts from the private banking sector. The effects of capital support are again economically insignificant across the three subsamples.

Next, recognizing that banks of different size classes have different balance sheet compositions (Berger, Miller, Petersen, Rajan, and Stein (2005)), we examine whether regulatory interventions and capital support have different effects for banks of different size classes. We split our sample into small and large banks using the median bank size (€ 329 million) as the cutoff. We find in *Panel II-A* that the effects of regulatory interventions on risk taking appear to occur primarily in small banks, possibly because large banks may have more countervailing power relative to regulators and in some cases may be too-important-to-fail. The effects of regulatory interventions on liquidity creation in *Panel II-B* are statistically and economically significant for both size classes. While there is no statistically significant effect of capital support on liquidity creation for small banks, we again uncover a significant but no economically significant effect of capital support for large banks.

One may expect that regulatory interventions and capital support have stronger effects on risk taking and liquidity creation when banks are poorly capitalized (e.g., Dahl and Spivey (1995); Aggarwal and Jacques (2001)). To examine this idea, we split the sample into poorly- and better-capitalized banks. As cutoffs, we use the median bank's equity capital ratio (8.73%). *Panels III-A* and *III-B* show the results. As expected, the effects of regulatory interventions on bank risk taking and liquidity creation are stronger for the poorly-capitalized institutions. Capital support again results in statistically but not economically significant changes in risk taking and liquidity creation.

Financial crises raise the question of how effectively banks can be disciplined in episodes of extraordinary distress and what the impact is of capital support during such times (Berrospide and Edge (2010); Giannetti and Simonov (2010)). From a policy perspective, it is therefore important to ascertain whether the effects of regulatory interventions and capital support differ for crisis and non-crisis periods. We classify the years 2001 and 2007-2009 in our sample as crisis years, and the remaining years 1999-2000 and 2002-2006 as non-crisis years. The year 2001 is considered a crisis year because the terrorist attacks on September 11 in the U.S. and the bursting of the dot.com bubble both depressed financial markets.[19] The subprime lending crisis that emerged in 2007 gave rise to major difficulties in financial markets with interbank markets seizing up due to banks' reluctance to roll over debt, reflecting concerns about the soundness of other banks and

[19] The high growth segment of the German stock market collapsed. As a result, the Deutsche Börse (the German stock market operator) stopped providing information about high growth stocks on neuermarkt.com at the end of 2001, and subsequently abolished the entire market segment.

their exposure to structured products containing subprime mortgages. During that period, numerous banks such as Industriekreditbank, Bayerische Landesbank, and SachsenLB in Germany and Countrywide and Bear Stearns in the U.S. had to be bailed out or collapsed (e.g., Berger and Bouwman (2010)).

In *Panels IV-A* and *IV-B*, we find that risk taking only responds to regulatory interventions during non-crisis years. This result may be attributable to the too-many-to-fail phenomenon which predicts that closure of a bank by the regulator is rendered unlikely when the number of distressed banks is large, because the closure option is unattractive for the regulator and bailouts are the preferred option (Acharya and Yorulmazer (2008); Brown and Dinc (forthcoming)). Expecting a bailout, banks may not adjust their risk taking. This problem may be amplified by the observation that during crisis periods, ailing banks evergreen their loans to avoid further write-downs (Peek and Rosengren (2005)). In contrast, liquidity creation reacts statistically and economically significantly to regulatory interventions during both subperiods. The effects of capital support measures remain economically ineffectual during both subperiods.

To summarize the findings for the subsamples in Table IV, regulatory interventions result in reduced risk taking in only some of the subsamples – cooperative banks, small banks, poorly-capitalized banks, and banks during non-crisis years. However, these interventions tend to reduce liquidity creation for almost all subsamples (private banks being the lone exception). For most of the subsamples (as for the full sample), capital support generally has a statistically but no economically significant effect on either risk taking or liquidity creation.

C. Robustness tests

In this subsection, we perform several additional robustness checks. First, we use alternative cutoffs for the dependent variables to check whether our results are sensitive to our choice of 3% cutoffs. Second, we perform tests for subsamples that only contain merged and non-merged banks, respectively. Third, we use alternative measures of risk taking and liquidity creation. Finally, we reestimate all our risk taking and liquidity creation regressions using probit analysis to verify our results are insensitive to the choice of modeling technique.

Table V contains most of the results. As before, we only report the odds ratios on the main variables of interest, regulatory interventions and capital support, for brevity. All regressions do, however, include the vector of control variables discussed above.

[Table V *Robustness*]

Our first check examines whether our results are sensitive to the choice of 3% cutoffs. We show robustness tests with alternative cutoffs for the two dependent variables using 1 and 5% changes. We find that for both alternative cutoffs, regulatory interventions reduce risk taking and liquidity creation (statistically and economically significant), and that capital support has economically insignificant effects on both risk taking and liquidity creation (see *Panels A I* and *B I*). Thus, our main regression results are robust to these alternative cutoffs.

Our second check reestimates our regressions for subsamples of merged and non-merged banks, respectively. As shown in *Panels A II* and *B II*, our findings remain qualitatively unchanged, although the significance declines for regulatory interventions from 1% in the main regressions to the 10% level.

Our third check examines whether our results are robust to using alternative measures of risk taking and liquidity creation. Consider risk taking first. *Panel A III* shows the results using an alternative measure of risk taking – the Tier 1 equity capital to risk-weighted assets ratio (Tier 1 / RWA). This is an inverse risk measure in that higher values imply less risk. This variable captures the extent to which the regulatory interventions and capital support affect the banks' regulatory capital ratios. To avoid confusion, we record a 1 if the ratio increased by more than 3% (i.e., risk dropped) and a 3 if the ratio decreased by more than 3% (i.e., risk went up). As shown, our \ results are robust to using this alternative risk measure. Regulatory interventions have a statistically and economically significant effect in lowering risk taking (i.e., in increasing Tier 1 / RWA), and capital support has a statistically but not economically significant effect – both findings are consistent with our main results.

Consider liquidity creation next. A change in liquidity creation may be due to a change in assets, a change in liabilities, a change in off-balance sheet activities, or some combination of these. We decompose our aggregate liquidity creation measure into three components – assets, liabilities, and off-balance sheet activities – to determine which are most affected by regulatory interventions and capital support. *Panel B III* shows that regulatory interventions and capital support reduce asset-based and off-balance sheet-based liquidity creation, but have no measurable effect on liability-based liquidity creation. These effects are also economically significant for regulatory interventions but not for capital support.

Finally, we reestimate all regressions reported in Tables III, IV, and V using ordered probit models, and obtain qualitatively similar results (not reported). This suggests that our results are not driven by the modeling technique chosen. We prefer to present our main results using ordered logit models because the odds ratio has a natural interpretation.

D. Instrumental variable regressions

Our results so far show statistically and economically significant associations between regulatory interventions and reductions in risk taking and liquidity creation, but the effect of capital support on these bank behaviors is only statistically significant. However, there is a potential endogeneity concern. Specifically, bank distress may result in both regulatory interventions and capital support on the one hand, and reductions in risk taking and liquidity creation on the other hand. To address this potential endogeneity concern in our main analysis, we used lagged interventions and capital support. Recognizing that this may not be sufficient, we now turn to an instrumental variable (IV) approach.

Since we are not aware of an IV approach using ordered logit models, we instead use IV ordered probit estimators.[20] We estimate two systems of equations: one system for the effects of regulatory interventions and capital support on risk taking, and a separate system for the effects of these actions on liquidity creation. We estimate systems of equations to take into account the correlations between the error terms of the first- and second-stage equations.

Below, we first discuss the instruments and then explain the first- and second-stage regressions. We use several instruments for our two potentially endogenous variables, regulatory interventions and capital support. Some of the instruments are used in both first-stage regressions while others are only used in the capital support equation. We first describe the instruments that are used in both.

Our first instrument exploits variation in the share of ***Capital support at the county level***. This instrument measures capital support in small geographical areas, and captures information about the soundness of regionally-delimited banking markets. Building on the too-many-to-fail effect identified by Acharya and Yorulmazer (2008), we argue that distressed banks are more likely to receive an intervention or be bailed out if other local banks are weak. Thus, regulatory

[20] Since all results presented above hold using ordered logit and ordered probit models (see the last robustness check in Section III C), the use of IV ordered probit should not materially affect our results.

interventions and capital support may be more likely to take place if capital support in that market is prevalent.

We exploit data on the occurrence of special audits, captured by the variable ***Special audit dummy*** as our second instrument. Special audits take place infrequently and mainly assess banks' loan portfolios, and compliance with capital, liquidity and risk management standards. They not only facilitate information production, but also improve supervisory discipline that provides the foundation for regulatory interventions (DeYoung, Flannery, Lang, and Sorescu (2001)), and possibly capital injections. We expect that regulatory interventions and capital support are more likely if banks were subjected to a special audit in the previous year.

In addition, we use the levels of bank risk, captured by the ***Capital adequacy ratio*** (Tier 1 capital / RWA), ***Loan loss provisions/Customer loans***, and ***Risk*** (RWA/TA). Regulatory interventions and capital support take place when bank risk taking is deemed too high. Consequently, the two types of actions are directly related to risk levels. Note, however, that risk levels and our dependent variables that capture changes in risk taking are not directly related.

We now describe the additional instruments that are only used in the capital support first-stage regression.

Since recent research offers suggestive evidence for a politicization of the bank resolution process (Brown and Dinc (2005); Imai (2009)), we exploit variation in local voter behavior to shed light on whether the composition of the local political landscape affects the way bankers associations deal with distressed institutions in their geographic area.[21] Specifically, we include the ***Shares of conservative, liberal, and green party voters per county*** (shares of the social democratic party are excluded to avoid collinearity) as instruments for capital support. We expect a reduced propensity to observe capital support in banks that are located in counties with more conservative, liberal, and green party voters, reflecting their stronger belief in market forces.[22]

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[21] A growing body of literature examines the politicization of the bank resolution process. Brown and Dinc (2005) report evidence that distressed banks are less likely to be bailed out or have their charter revoked prior to elections than after elections in emerging market economies. They conclude that bank resolutions are affected by political considerations. Imai (2009) shows that bank regulators exhibit a propensity of delaying declarations of insolvency in regions that support senior politicians of the ruling party in Japan.

[22] In stark contrast to the U.S., where liberals and conservatives are opposite extremes, in Germany both liberals and conservatives strongly believe in market forces.

Finally, we include ***Bankers Association Dummies*** for membership in regional bankers associations. In total, 32 such dummy variables enter our equation. In doing so, we account for potential differences in the propensities and willingness of these individual associations to provide capital support (Dam and Koetter (2011)).

Our instruments satisfy the criteria of relevance and exogeneity. We argue they are all relevant because they affect the two potentially endogenous variables, but there are no reasons to believe that capital support at the county level, special audits, the levels of risk, voters' shares, or bankers association membership directly affect changes in bank risk taking or liquidity creation.

As mentioned above, we estimate two systems of equations. For ease of exposition, we use the terms "first-stage" and "second-stage" regressions in our discussion below, but emphasize that both are jointly estimated.

We run two first-stage regressions: a probit regression in which the probability of a regulatory intervention is regressed on capital support at the county level, the special audit dummy, the risk measures, and all of the control variables from our main analysis; and an OLS regression in which capital support (Capital injection / Tier 1 capital) is regressed on the instruments and control variables included in the regulatory intervention regression, plus the shares of conservative / liberal / green voters, and bankers association dummies.

In the second stage, we run ordered probit regressions of the change in risk and liquidity creation on the predicted values of the two potentially endogenous variables – regulatory interventions and capital support – and all the control variables.

Table VI presents the instrumental variable regression results. We report coefficients because exponentiated probit coefficients cannot be interpreted as odds ratios as in logit models. The results show that most of the instruments have the predicted effect on regulatory interventions and capital support, although some of them are not significant. F-tests indicate the joint significance of our dummies for the bankers associations. Importantly, we find that – consistent with the results above – regulatory interventions and capital support are statistically significant in reducing risk taking and liquidity creation.

[Table VI *Instrumental variable regressions*]

V. Long-run effects of regulatory interventions and capital support

Our results so far suggest that regulatory interventions are associated with statistically and economically significant reductions in risk taking and declines in liquidity creation, while capital support only has statistically, but generally not economically significant effects. All these analyses focus on the short-run effects, i.e., they examine the impact on risk taking and liquidity creation the year after a regulatory intervention or capital support. In our final analysis, we focus on the long-run effects, where the long run is defined as five years after the regulatory intervention or capital support.

To do so, we examine the long-run impact of regulatory interventions and capital support on risk taking relative to the industry and on banks' liquidity creation market share. We do not use regression analysis because the use of five-year lags of all the regression variables would result in a substantial loss of observations. Instead, we track the evolution of the percentile ranks of the banks that were subject to regulatory interventions and received capital support over a five year period. The use of percentile ranks controls for industry trends in both measures to take out the effects of any long-run secular trends. To illustrate, suppose risk taking and liquidity creation increase by 2% over the five years after a regulatory intervention, while the industry's risk taking and liquidity creation go up by 10%. If we did not control for the industry change, we would incorrectly conclude that the long-run effects of the regulatory interventions were positive on risk taking and liquidity creation. By focusing on risk taking relative to the industry and liquidity creation market shares, we correctly conclude that the long-run effects are negative.

Risk taking is measured as the percentile rank of a bank's RWA / TA relative to that of the entire banking sector. Liquidity creation market share is defined as liquidity created by a bank relative to liquidity created by the entire banking sector. To account for the fact that a bank's liquidity creation market share is negative if it destroys liquidity, we focus on the percentile rank of each bank's market share instead of its market share per se.

The long-run effects are shown in Table VII for the full sample and for banks split by size. The results in *Panel A* suggest that over the five years after regulatory interventions, bank risk taking decreases for all banks and for the subsamples of small and large banks. As shown in *Panel B,* regulatory interventions are associated with long-run declines in liquidity creation

market share for all banks and for the subsamples of small and large banks.[23] Our results indicate that regulatory interventions have a lasting effect on risk taking and liquidity creation – both are lower even five years after the intervention. Thus, the *Regulatory Intervention Risk Reduction Hypothesis* and the *Regulatory Discipline Hypothesis* are supported by the long-run data as well as the short-run data.

[Table VII *Long-run effects*]

Turning to the effects of capital support, the data suggest that five years after such support, both risk taking and liquidity creation are lower for all banks and for the subsamples of small and large banks. While capital support has no economically significant effect on risk taking and liquidity creation in the short run (as shown above), both risk taking and liquidity creation are significantly reduced in the long run. These long-run results support the empirical dominance of the *Capital Support Risk Reduction Hypothesis* over the *Capital Support Risk Increase Hypothesis*, as well as the dominance of the *Capital Support Financial Fragility Hypothesis* over the *Capital Support Risk Absorption Hypothesis.*

VI. Concluding remarks

In this paper, we formulate hypotheses regarding the effects of regulatory interventions and capital support on bank risk taking and liquidity creation, and test these using a unique dataset. Since the reduction of bank risk taking is a primary goal of these actions, and the creation of liquidity by banks is essential for the macroeconomy, these issues are of first-order importance for academics, bank regulators, and policymakers.

We find that regulatory interventions are generally associated with statistically and economically significant reductions in both risk taking and liquidity creation in the short run and long run. The reductions in risk taking are consistent with intentions and support the *Regulatory Intervention Risk Reduction Hypothesis*. The reductions in liquidity creation may be unintentional and support the *Regulatory Discipline Hypothesis*.

[23] The difference in the number of observations is due to the fact that our main risk measure is available for fewer banks than our main liquidity creation measure.

We also find that capital support is associated with statistically significant reductions in both risk taking and liquidity creation in the short run and long run, but the effects are only economically significant in the long run. The risk-taking results suggest that in the short run, the *Capital Support Risk Reduction Hypothesis* and the *Capital Support Risk Increase Hypothesis* are weak or approximately offset each other, while in the long run, the *Capital Support Risk Reduction Hypothesis* empirically dominates. Similarly, the liquidity creation results suggest that in the short run, the *Capital Support Financial Fragility Hypothesis* and the *Capital Support Risk Absorption Hypothesis* are weak or approximately net each other out, while in the long run, the *Capital Support Financial Fragility Hypothesis* empirically dominates.

In terms of policy implications, the results suggest that regulatory interventions and capital support have intended and unintended consequences. Policy makers should be aware that while these policies may be effective in reducing bank risk taking, they may have adverse effects on the macroeconomy through reductions in bank liquidity creation. We conclude by pointing out that our research naturally gives rise to several critically important questions that are beyond the scope of our study. At which point in time should regulators intervene in ailing institutions? What is the optimal level of bank liquidity creation? Do capital support measures distort the competitive landscape in banking? We leave these questions to future research.

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Appendix: Bank liquidity creation

This Appendix explains how we measure liquidity creation and shows how liquidity creation changed over our sample period.

A. Measuring bank liquidity creation

We calculate a bank's € amount of liquidity creation using a slight variation on Berger and Bouwman's (2009) three-step procedure, which is discussed below and illustrated in Table A-1.

In the first step, we classify bank assets, liabilities, and equity as liquid, semi-liquid, or illiquid based on the ease, cost, and time it takes for customers to withdraw liquid funds from the bank, and the ease, cost and time it takes for a bank to dispose of their obligations to meet these liquidity demands. We follow a similar principle for off-balance sheet items.

A key difference between our calculation of liquidity creation and the approach in Berger and Bouwman (2009) exists. They argue that all activities should be classified based on information on both product category and maturity. However, due to data limitations, Berger and Bouwman (2009) have to classify loans according to either category or maturity. The unique database from the Bundesbank, however, enables us to exploit information on both loan category and maturity when classifying these items.[24]

In the second step, we assign weights of either +½, 0, or -½ to all bank activities that are classified in the previous step. The signs of the weights are consistent with liquidity creation theory, which states that liquidity is created when banks transform illiquid assets into liquid liabilities. Liquidity is destroyed when liquid assets are financed by illiquid liabilities or equity. Hence, we allocate positive weights to illiquid assets and liquid liabilities, while negative weights are applied to liquid assets and illiquid liabilities and equity. We use weights of +½ and -½ because liquidity creation is only half determined by the source or use of funds alone. We apply the intermediate weight of 0 to semi-liquid assets and liabilities, based on the assumption that semi-liquid activities fall halfway between liquid and illiquid activities. In terms of off-balance

[24] Another difference is that Berger and Bouwman's (2009) preferred measure includes the gross fair values of off-balance sheet derivatives. Since only notional amounts are available in the Bundesbank database and since derivatives affect liquidity creation only marginally in the U.S., we assume that this holds in Germany as well and exclude derivatives from our measure of liquidity creation. This exclusion should not have a large effect since most banks operate with close to matched books.

sheet items, we follow Berger and Bouwman (2009) and apply positive weights to all illiquid guarantees.

In the third step, we combine the activities as classified and weighted in the first two steps to obtain two liquidity creation measures. 'Mat Cat Fat' represents our classification of activities based on both maturity and category with the inclusion of off-balance sheet activities. 'Mat Cat Nonfat' excludes off-balance sheet activities. The calculation of both measures is illustrated in Table A-1.

B. Bank liquidity creation from 1999 to 2009

We briefly explore how liquidity creation has evolved from 1999 to 2009 and further investigate how it varies across different types of banks (see Figure A-1). Assessing liquidity creation by 'Mat Cat Fat' (our preferred measure) and 'Mat Cat Nonfat' reveals similar trends over time. However, the level of liquidity created by banks doubles when we include off-balance sheet activities, a finding that is similar to the U.S. Since banks create a substantial amount of liquidity off the balance sheet we focus on 'Mat Cat Fat' in the rest of the paper.

[Fig. 1 *Liquidity creation: Mat Cat Nonfat and Mat Cat Fat*]

Based on our preferred measure 'Mat Cat Fat,' we find that liquidity creation increased sharply at the beginning of the period before it peaked in 2001 and began to decline steadily thereafter. Liquidity creation rose again from 2004 onwards whereby it reached the highest level of approximately € 1.5 trillion in 2006. The financial crisis that began in 2007 coincided with a massive plunge in liquidity creation. The level of aggregate liquidity creation at the end of the period is lower than at the beginning of our sample period. Banks created around € 1.014 trillion of liquidity in 1999, compared with € 1.250 trillion in 2009. An examination of the median bank's liquidity creation in Table A-2, however, suggests that the median bank's liquidity creation increased from € 42 million in 1999 to € 102 million in 2009, we obtain a similar picture when we investigate liquidity creation divided by total assets (increases from 21% to over 28%).[25]

[Table A-2 *Liquidity Creation in Germany*]

[25] The increase in liquidity creation for the median bank is due to the fact that banks grew considerably during the sampling period. This growth is, at least partially, due to extensive merger activities in the banking sector.

Table A-1
Classification of bank activities and construction of two liquidity creation measures

Step 1: Classify all bank activities as liquid, semi-liquid, or illiquid based on product category (Cat) and maturity (Mat).

Step 2: Assign weights to the activities classified in Step 1.

ASSETS:

Illiquid assets (weight = ½)		Semi-liquid assets (weight = 0)		Liquid assets (weight = - ½)
Cat	***Mat***	***Cat***	***Mat***	
Loans to credit institutions	> 1 year	Loans to credit institutions	<= 1 year	Cash and due from other institutions
Loans to customers	> 1 year	Loans to customers	<= 1 year	Loans to credit institutions (due daily)
Premises				Exchange listed fixed income securities
Intangible assets				Exchange listed equities and other non fixed income securities
Non exchange listed fixed income securities				Exchange listed participation rights
Non exchange listed equities and other non fixed income securities				Exchange listed investments in unconsolidated subsidiaries
Non exchange listed investments in unconsolidated subsidiaries				
Non exchange listed participation rights				
Subordinated loans to customers				
Subordinated loans to credit institutions				
Other subordinated assets				
Other real estate owned				

LIABILITIES PLUS EQUITY:

Liquid liabilities (weight = ½)	Semi-liquid liabilities (weight = 0)		Illiquid liabilities (weight = - ½)	
	Cat	***Mat***	***Cat***	***Mat***
Liabilities to credit institutions (overnight funds)	Savings deposits	All maturities	Liabilities to credit institutions	>1 year
Other liabilities to customers (transactions deposits)	Time deposits	All maturities	Other tradable liabilities	>1 year
	Liabilities to credit institutions	<= 1 year	Bank's liability on bankers acceptances	
	Other tradable liabilities	<= 1 year	Subordinated debt	
			Equity	

OFF-BALANCE SHEET ACTIVITIES:

Illiquid guarantees (weight = ½)
Commercial and similar letters of credit
Unused irrevocable loan commitments
Unused revocable commitments
Net standby letters of credit
All other off-balance sheet liabilities

Step 3: Combine bank activities as classified in Step 1 and as weighted in Step 2 to construct "Mat Cat Fat" and "Mat Cat Nonfat" liquidity creation measures.

Mat Cat Fat =

+ ½*illiquid assets + ½*liquid assets + ½*illiquid guarantees + 0* semi-liquid assets + 0* semi-liquid liabilities - ½* liquid assets - ½* illiquid liabilities - ½* equity

Mat Cat Nonfat =

+ ½*illiquid assets + ½*liquid assets + 0* semi-liquid assets + 0* semi-liquid liabilities - ½* liquid assets - ½* illiquid liabilities - ½* equity

Table A-2
Liquidity creation in Germany

Panel A presents the levels of liquidity creation in million € for the median bank, and the level of liquidity creation per € of total assets based on the preferred measure of liquidity creation (Mat Cat Fat) at the beginning (1999) and at the end (2009) of our sample period for the full sample and for the subsamples of private, public, and cooperative banks. We also show a breakdown by bank size, whereby we use the median bank size (€ 329 m) as the cutoff. In Panel B, we report the same figures when off-balance sheet items are excluded using the alternative measure of liquidity creation (Mat Cat Nonfat).

		Liquidity creation in 1999			Liquidity creation in 2009		
		Number of banks	Median LC in million €	LC/TA	Number of banks	Median LC in million €	LC/TA
Panel A: Mat Cat Fat	All banks	2,735	42.23	0.21	1,736	102.28	0.28
	Private banks	234	39.14	0.12	170	50.21	0.15
	Public banks	591	190.56	0.21	441	408.10	0.31
	Cooperative banks	1,910	29.65	0.21	1,125	69.78	0.28
	Small banks	1,658	21.18	0.21	767	34.84	0.26
	Large banks	1,077	164.52	0.22	969	274.27	0.30
Panel B: Mat Cat Nonfat	All banks	2,735	33.81	0.18	1,736	84.79	0.24
	Private banks	234	14.98	0.06	170	28.51	0.75
	Public banks	591	152.99	0.18	441	349.61	0.28
	Cooperative banks	1,910	24.72	0.18	1,125	58.74	0.24
	Small banks	1,658	17.93	0.17	767	29.46	0.22
	Large banks	1,077	128.51	0.18	969	230.32	0.26

Figure A-1
Liquidity creation over time

This Figure shows how liquidity creation changed from 1999 – 2009. The left panel presents liquidity creation (measured using the Mat Cat Fat and the Mat Cat Nonfat measures) of all universal banks. The middle panel shows liquidity creation (Mat Cat Fat only) of the three banking pillars: public banks, private banks, and cooperative banks. The right panel presents liquidity creation (Mat Cat Fat only) of small versus large banks (below and above median assets). Liquidity creation is expressed in real € 2000 terms using the GDP deflator.

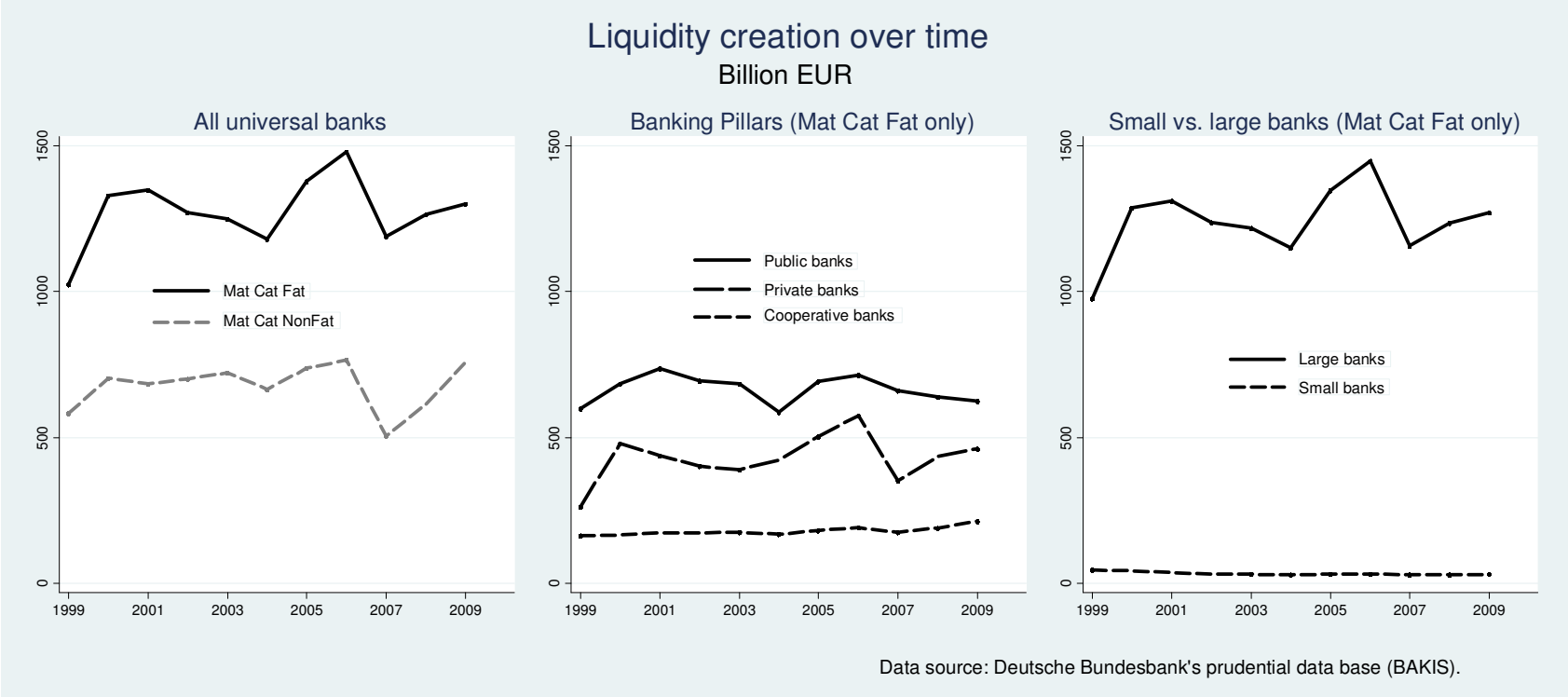

Table I
Summary statistics for regulatory interventions and capital support

This table provides the number and proportion of banks with regulatory interventions and capital support, and includes the mean and standard deviation of capital support for banks that received capital injections. We also show the descriptive statistics for banks that observed both regulatory interventions and capital support. Regulatory interventions is a dummy that takes on the value one if the supervisory authority intervened in a bank and zero otherwise. Interventions include: restructuring orders, restrictions or prohibitions of lending activities, deposit taking, deposit withdrawals, or profit distributions; and dismissal of senior executives. Capital support is the amount of capital injected scaled by Tier 1 equity capital. Panel A provides these statistics for the full sample. Panel B offers a breakdown by banking pillar into private, public, and cooperative banks. Panel C shows a breakdown by bank size into small and large banks (below and above median total assets (€ 329 million, respectively).

		Regulatory interventions		**Capital support (Capital injection/Tier 1 capital)**				**Regulatory interventions and capital support**		
	Number of banks	*Number of banks with interventions*	*Number of banks that only have interventions*	*Number of banks with capital support*	*Number of banks that only have capital support*	*Mean capital support*	*S.D. of capital support*	*Number of banks that had regulatory interventions and capital support*	*Mean capital support*	*S.D. of capital support*
Panel A: Full sample										
All banks	2,735	452	381	371	300	0.18	0.11	71	0.22	0.09
	(Proportion)	*(0.17)*	*(0.14)*	*(0.14)*	*(0.11)*			*(0.03)*		
Panel B: Breakdown by banking pillar										
Private banks	234	16	14	26	24	0.19	0.11	2	0.14	0.19
	(Proportion)	*(0.07)*	*(0.06)*	*(0.11)*	*(0.11)*			*(0.01)*		
Public banks	591	24	22	24	22	0.13	0.11	2	0.27	0.00
	(Proportion)	*(0.04)*	*(0.04)*	*(0.04)*	*(0.04)*			*(0.01)*		
Cooperative banks	1,910	412	345	321	254	0.18	0.11	67	0.22	0.08
	(Proportion)	*(0.22)*	*(0.18)*	*(0.17)*	*(0.13)*			*(0.04)*		
Panel C: Breakdown by size										
Small banks	1,658	256	227	170	141	0.19	0.10	29	0.23	0.08
	(Proportion)	*(0.15)*	*(0.14)*	*(0.10)*	*(0.09)*			*(0.02)*		
Large banks	1,077	196	154	201	159	0.16	0.11	42	0.22	0.09
	(Proportion)	*(0.18)*	*(0.14)*	*(0.19)*	*(0.15)*			*(0.04)*		

Table II
Summary statistics for dependent variables and control variables

While regressions are run in changes, we report means of levels and changes of the variables. Panel A shows summary statistics for the full sample. Panels B and C report these statistics for banks with regulatory interventions and capital support. Risk is measured as risk-weighted assets divided by total assets (RWA/TA). Liquidity creation is calculated using our Mat Cat Fat measure. The controls include total assets (natural log used in regressions); return on equity (net income divided by equity capital); loan portfolio concentration (a Herfindahl-Hirschman index measuring loan portfolio concentration); the number of branch offices; interest rate spread (between a 10-year and a 1-year German government bond); and public and cooperative bank dummies (the private bank dummy is excluded as the base case). Liquidity creation and total assets are measured in real € 2000.

	Panel A: Full sample	**Observations**	**Mean of level**	**Mean of change**
Dependent variables	Risk (RWA/TA)	17,662	0.60	-0.02
	Liquidity creation in million € (Mat Cat Fat)	17,662	602.00	0.22
Control variables	Total assets in million €	17,662	2,400.00	0.02
	Return on equity	17,662	0.11	-0.04
	Loan portfolio concentration	17,662	0.31	0.02
	Bank branches	17,662	19.66	-0.59
	Interest rate spread	17,662	0.01	0.01
	Private bank	17,662	0.08	n/a
	Public bank	17,662	0.26	n/a
	Cooperative bank	17,662	0.66	n/a
	Panel B: Banks with regulatory interventions			
Dependent variables	Risk (RWA/TA)	452	0.63	0.00
	Liquidity creation in million € (Mat Cat Fat)	452	1,130.00	0.19
Control variables	Total assets in million €	452	4,410.00	0.02
	Return on equity	452	0.06	0.06
	Loan portfolio concentration	452	0.29	0.05
	Bank branches	452	16.02	-0.48
	Interest rate spread	452	0.01	0.01
	Private bank	452	0.04	n/a
	Public bank	452	0.05	n/a
	Cooperative bank	452	0.91	n/a
	Panel C: Banks with capital support			
Dependent variables	Risk (RWA/TA)	371	0.61	-0.02
	Liquidity creation in million € (Mat Cat Fat)	371	542.00	0.18
Control variables	Total assets in million €	371	3,480.00	-0.02
	Return on equity	371	0.03	0.03
	Loan portfolio concentration	371	0.31	0.04
	Bank branches	371	17.61	-1.13
	Interest rate spread	371	0.01	0.01
	Private bank	371	0.07	n/a
	Public bank	371	0.06	n/a
	Cooperative bank	371	0.86	n/a

Table III
Main regression results

We estimate ordered logit models for changes in risk and liquidity creation. The dependent variable takes on the value 1 if there was a drop in risk (Panel A) or liquidity creation (Panel B) of at least 3% relative to the previous year, it takes on the value 2 if risk (Panel A) or liquidity creation (Panel B) remained within the interval +/- 3%, and it takes on the value 3 if there was an increase in risk (Panel A) or liquidity creation (Panel B) of more than 3%. All variables are defined in the notes to Table II. The dummy for private banks is omitted to avoid perfect collinearity. All variables enter the regression in changes, unless dummy variables are used. We report odds ratios, and test the null hypothesis that the odds ratios are significantly different from one. Robust z-statistics are presented in brackets. *** p≤0.01, ** p≤0.05, * p≤0.1

	Panel A: Risk (Δ RWA/TA)	**Panel B: Liquidity creation (Δ LC)**
Variable of interest		
Regulatory interventions	0.7819***	0.6398***
	[-2.73]	[-5.02]
Capital support	0.9818***	0.9839***
	[-3.52]	[-3.47]
Control variables		
Δ Log total assets	1.0518***	1.0365***
	[14.99]	[11.98]
Δ Return on equity	0.9885***	1.0015
	[-7.03]	[0.97]
Δ Loan portfolio concentration	0.9954	1.0041
	[-0.68]	[0.66]
Δ Bank branches	1.0226**	1.0357***
	[2.06]	[2.87]
Δ Interest rate spread	2.2491***	1.3606***
	[31.97]	[12.42]
Public bank dummy	1.4290***	1.5082***
	[4.60]	[6.08]
Cooperative bank dummy	1.1508*	1.3452***
	[1.87]	[4.63]
α1	1.4235***	0.9125
	[4.41]	[-1.33]
α2	10.8454***	1.8456***
	[28.55]	[8.90]
Observations	17,662	17,662
Pseudo R-squared	0.039	0.011

Table IV

Subsample results for banks split by banking pillar, size, capitalization, and subperiods

This table presents results based on ordered logit models for different subsamples. Subpanel I splits banks by banking pillar into private, public, and cooperative banks. Subpanel II splits banks by size into small and large banks, i.e., banks with assets below and above the median, respectively. Subpanel III splits banks by capitalization into poorly- and well-capitalized banks, i.e., banks with capital below and above the median capital adequacy ratio (Tier 1 plus tier 2 capital/Risk-weighted assets), respectively. Subpanel IV splits the sample into non-crisis years (1999-2000 and 2002-2006) and crisis years (2001, 2007-2009). Panels A and B present the risk and liquidity creation results, respectively. The dependent variable takes on the value 1 if there was a drop in risk (Panel A) or liquidity creation (Panel B) of at least 3% relative to the previous year, it takes on the value 2 if risk (Panel A) or liquidity creation (Panel B) remained within the interval +/- 3%, and it takes on the value 3 if there was an increase in risk (Panel A) or liquidity creation (Panel B) of more than 3%. All control variables used in Table III are included but not shown due to space constraints. We report odds ratios and test the null hypothesis that the odds ratios are significantly different from one. Robust z-statistics are presented in brackets. *** *** p≤0.01, ** p≤0.05, * p≤0.1

Subsamples	**I Banking pillar**			**II Size**		**III Capitalization**		**IV Subperiods**	
	Private banks	Public banks	Cooperative banks	Small banks	Large banks	Poorly-capitalized banks	Better-capitalized bank	Non-crisis years	Crisis years
Panel A: Risk (Δ RWA/TA)									
Regulatory interventions	1.0988	1.1169	0.7470***	0.7158***	0.9012	0.7066***	0.9165	0.6716***	0.7997
	[0.15]	[0.28]	[-3.02]	[-2.91]	[-0.71]	[-3.03]	[-0.57]	[-3.57]	[-1.21]
Capital support	0.9811	0.9715*	0.9828***	0.9842**	0.9791***	0.9827***	0.9807**	0.9760***	0.9775**
	[-0.94]	[-1.80]	[-2.98]	[-2.13]	[-2.93]	[-2.58]	[-2.24]	[-3.83]	[-2.07]
Observations	1,415	4,635	11,612	8,839	8,823	8,833	8,829	10,795	6,867
Pseudo R-squared	0.007	0.051	0.049	0.04450	0.03788	0.046	0.033	0.022	0.160
Panel B: Liquidity creation (Δ LC)									
Regulatory interventions	0.6623	0.2942***	0.6599***	0.7519**	0.5000***	0.5774***	0.7417**	0.6132***	0.6794**
	[-0.74]	[-3.00]	[-4.41]	[-2.43]	[-5.02]	[-4.82]	[-1.99]	[-4.60]	[-2.41]
Capital support	1.0052	0.9714	0.9830***	0.9919	0.9761***	0.9727***	1.0073	0.9812***	0.9907
	[0.30]	[-1.59]	[-3.34]	[-1.23]	[-3.58]	[-4.73]	[0.84]	[-3.46]	[-1.03]
Observations	1,415	4,635	11,612	8,839	8,823	8,833	8,829	10,795	6,867
Pseudo R-squared	0.013	0.006	0.016	0.015	0.011	0.017	0.008	0.010	0.014

Table V
Robustness tests

This table presents ordered logit models that test the robustness of our main results. Panel A contains the risk regressions and Panel B shows the results for liquidity creation. All control variables used in Table III are included but not shown due to space constraints. Subpanel I uses alternative cutoffs of 1% and 5% changes in risk and liquidity creation. Subpanel II presents the results for banks that were engaged in merger activities during the sample period versus banks that were not involved in such activities. Subpanel III use alternative dependent variables: an alternative (inverse) risk taking measure defined as Tier 1 equity capital divided by risk-weighted assets, and three alternative liquidity creation measures which decompose total liquidity creation into asset-based, liability-based, and off-balance sheet-based liquidity creation. We report odds ratios and test the null hypothesis that the odds ratios are significantly different from one. Robust z-statistics are presented in brackets. *** *** p≤0.01, ** p≤0.05, * p≤0.1

	I		**II**		**III**		
	Alternative cut-offs		**Alternative subsamples**		**Alternative dependent variables**		
Panel A: Risk (Δ RWA/TA)	*1% change*	*5% change*	*Merged banks only*	*Merged banks excluded*	*Insolvency risk (Δ Tier 1/RWA)*		
Regulatory interventions	0.7952**	0.8484*	0.7640*	0.7875**	0.8285**		
	[-2.37]	[-1.64]	[-1.68]	[-2.18]	[-1.99]		
Capital support	0.9821***	0.9840***	0.9924	0.9723***	0.9867***		
	[-3.61]	[-2.93]	[-1.00]	[-3.80]	[-2.64]		
Observations	17,662	17,662	5,506	12,156	17,662		
Pseudo R-squared	0.030	0.055	0.050	0.034	0.011		
Wald test Chi-squared	n/a	n/a	n/a	n/a	n/a		
Panel B: Liquidity creation (Δ LC)	*1% change*	*5% change*	*Merged banks only*	*Merged banks excluded*	*Δ LC assets*	*Δ LC liabilities*	*Δ LC off-balance sheet*
Regulatory interventions	0.6791***	0.6634***	0.5545***	0.6942***	0.7283***	1.0228	0.6701***
	[-4.06]	[-4.65]	[-3.74]	[-3.37]	[-3.28]	[0.24]	[-4.10]
Capital support	0.9863***	0.9826***	0.9915	0.9789***	0.9896**	1.0006	0.9824***
	[-2.95]	[-3.67]	[-1.23]	[-3.30]	[-2.17]	[0.13]	[-3.95]
Observations	17,662	17,662	5,506	12,156	17,662	17,662	17,607
Pseudo R-squared	0.011	0.011	0.016	0.009	0.013	0.012	0.009
Wald test Chi-squared	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table VI
Instrumental variable regressions

This table presents the results of IV ordered probit models to deal with a potential endogeneity issue: bank distress may result in both regulatory interventions and capital support on the one hand, and reductions in risk taking and liquidity creation on the other hand. We estimate two systems of equations: one system for the effects of regulatory interventions and capital support on risk taking, and a separate system for the effects of these actions on liquidity creation. For ease of exposition, we use the terms "first-stage" and "second-stage" regressions in our discussion, but emphasize that both are jointly estimated. Panels A and B present the risk and liquidity creation results, respectively. Our second-stage dependent variables (Δ RWA/TA and Δ LC) take on take on the value 1 if there was a drop in the dependent variable by at least 3%, they take on the value 2, if the dependent variable remained within a range of +/- 3%, and they take on the value 3 if the dependent variable increased by more than 3%. Each panel also presents results for the estimation of the two first stage regressions. Regulatory intervention first-stage regressions are probit regressions that use the following instruments: Capital support at the county level; a Special audit dummy; and the levels of the Capital adequacy ratio, Loan loss provisions ratio, and Risk. Capital support first-stage regressions are OLS regressions that include all the instruments used in the regulatory intervention regressions plus the Shares of conservative, liberal, and green voters (county level) and dummy variables for membership in regional Bankers Associations. All control variables used in Table III are included but not shown for space constraints. We report coefficients because exponentiated probit coefficients cannot be interpreted as odds ratios as in logit models. To test the joint significance of the Bankers Association dummies, we present F-tests. Robust z-statistics are presented in brackets. *** p<0.01, ** p<0.05, * p<0.1

	Panel A: Risk			**Panel B: Liquidity creation**		
Dependent variable	**Regulatory interventions**	**Capital support**	**(Δ RWA/TA)**	**Regulatory interventions**	**Capital support**	**(Δ LC)**
Estimation method	**Probit**	**OLS**	**Ordered Probit**	**Probit**	**OLS**	**Ordered Probit**
Variables of interest in 2nd stage						
Regulatory interventions (instrumented)			-0.6243**			-0.9271***
			[-2.09]			[-3.84]
Capital support (instrumented)			-0.1802***			-0.1225***
			[-5.92]			[-6.42]
Instruments in 1st stage						
Capital support at the county level	0.0010	0.0215***		0.0009	0.0246***	
	[0.64]	[9.2140]		[0.60]	[13.49]	
Special audit dummy	0.0402	-0.0217		0.0473	0.0406	
	[0.58]	[-0.36]		[0.69]	[0.64]	
Capital adequacy ratio (level)	-0.0623***	-0.0093		-0.0657***	-0.0195***	
	[-6.31]	[-1.34]		[-6.69]	[-2.76]	
Loan loss provisions ratio (level)	0.5567***	0.8985***		0.5856***	0.9851***	
	[12.88]	[15.28]		[13.91]	[19.97]	
Risk (level)	-0.0089***	0.0052*		-0.0117***	-0.0076***	
	[-3.25]	[1.85]		[-5.04]	[-3.45]	
Share of conservative voters (county)		0.0063**			-0.0036	
		[2.06]			[-1.39]	
Share of liberal voters (county)		0.0125			-0.0080	
		[1.54]			[-0.97]	
Share of green voters (county)		0.0202***			0.0141**	
		[3.09]			[2.01]	
Bankers Association dummies	No	Yes		No	Yes	
F-test for joint significance	n/a	83.22***		n/a	76.37***	
Observations	17,039	17,039	17,039	17,039	17,039	17,039
Wald Chi-squared	n/a	n/a	2052.08***	n/a	n/a	568.81***

Table VII
Long-run effects

This table examines the long-run effects of regulatory interventions and capital support on bank risk taking (Panel A) and liquidity creation (Panel B) by comparing the median nationwide percentile rank in risk and liquidity creation market share in years *t* and *t+5* of banks that received regulatory interventions and capital support in year *t*. A bank's liquidity creation market share is calculated by dividing its liquidity creation by the German banking system's liquidity creation in that year. Results are presented for the full sample; and for small and large banks (below and above median assets, respectively). Only banks that received regulatory interventions and/or capital support in year *t* and are still in the sample in year *t+5* are included in this analysis.

	Regulatory interventions			**Capital support**		
	Obs	***t***	***t+5***	**Obs**	***t***	***t+5***
Panel A: Risk taking (nationwide percentile rank)						
All banks	275	56.20	48.10	234	58.40	42.20
Small banks	145	58.50	47.80	101	58.60	42.00
Large banks	130	56.15	48.20	133	58.20	42.30
Panel B: Liquidity creation market share (nationwide percentile rank)						
All banks	275	54.80	46.10	235	58.70	48.30
Small banks	144	33.20	27.30	102	43.60	34.20
Large banks	131	73.00	65.60	133	73.90	64.80