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Recapitalization, Credit and Liquidity

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1. INTRODUCTION

During the recent financial crisis, governments of mainly developed economies provided substantial support to the distressed financial sector. With the aim of stabilizing the flow of credit, they endowed private banks with public resources that, in each quarter between 2008Q3 and 2009Q4, amounted to 34-54% of pre-crisis equity for the representative sample of banks that we analyse in this paper (Figure 1). Guided only by the experience of Japan and events such as the rescue of Long-Term Capital Management [LTCM] in 1998, the design of these resolutions ('bailouts') varied considerably across banks and countries and relied upon often untested theory. However, whilst the lack of information about effective recapitalizations had been acknowledged in the past, and history strongly suggests that public interventions will remain inevitable, the greater part of current research and the regulatory debate continue to be directed towards crisis prevention.[1]

In contrast, this paper adopts the 'rare event approach' to regulation, i.e. the premise that "*financial crises will occur infrequently, but are inescapable*", and answers the corresponding call for "*clear-cut provisions for bank bailouts*" (Freixas, 2010). In other words, we hold the view that governments will continue to be called upon for emergency

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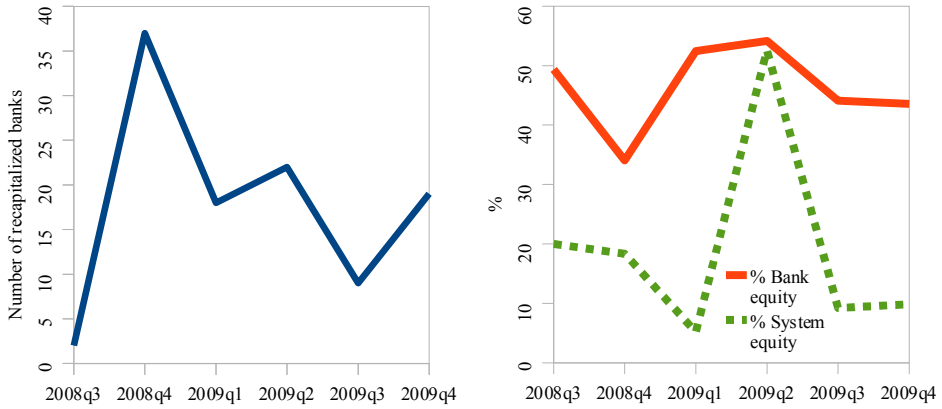
[1]Aghion et al. (1999) note that "[u]*nfortunately most bank regulations (and in particular the BIS regulations) are concerned with the ex ante problem of how to avoid bank failures, and few rules have been devised on how to deal with bank failures when they occur.*" For an extensive summary of recurrent crises, see for example Reinhart & Rogoff (2009).

interventions and to provide guidance on how to employ public resources most effectively in these instances.

Figure 1. Number of recapitalized banks & relative size of 'bailouts' over time



Source: Own data. *Notes*: The data covers 15 countries (listed in Table 1) that had spent at least two percent of their gross domestic product [GDP] on recapitalizations during 2008-10. Spanish recapitalizations that occurred during 2010 are excluded. The chart on the right plots the overall size of the interventions over time, in the first instance relative to recapitalized banks' 2006 equity levels (% System equity) and, second, relative to all banks' 2006 equity levels (% Bank equity). Zeros are excluded.

To this end, our analysis proceeds in two steps: first, we provide an historic account of recent provisions, and examine a panel of data representing recapitalized banks from 15 countries in order to identify the main observable characteristics of bailout recipients during 2008Q3 and 2009Q4.

We find that banks with a higher Tier1 capital ratio (the ratio of preference shares and common equity over total capital) and a larger fraction of liquid assets (government bonds and loans and advances with maturities of less than three months) have a lower probability of being recapitalized; at the same time, both properties are also found to coincide with smaller sized recapitalizations and with lower risk-absorbing properties of the provided capital. Moreover, the data exhibits evidence of the 'too big to fail' [TBTF] paradigm, implying that balance sheet size positively correlates with a higher likelihood of receiving public capital. Interestingly, larger banks seem to also have been provided with higher quality capital.

Finally, we find that recapitalizations of larger banks were more often associated with forced mergers and nationalisations and that, independent of bank size, a shortage of liquid assets is a strong predictor of unconditional recapitalizations.[2] Instead, the main determinant for recapitalizations of smaller banks seemed to have been a shortage of liquid assets.

[2]'Unconditional' recapitalizations throughout the paper are recapitalizations that are not associated with mergers or nationalisations. They may still impose for example behavioural constraints on the management.

Whilst not our foremost concern, it is worth pointing out that these results are also valuable for the design of preemptive regulation: in accordance with the current debate, they suggest it worthy to consider the assignment of a prominent role to capital controls and matters of liquidity; they also indicate that such regulation reduces the risk of a crisis (i.e. the probability of the need to be recapitalized) as well as its conditional costs (i.e. the amount of capital provided, and the risk assumed by the government in the process).[3]

In the second and main phase of the paper, we then examine the link between public capital injections and bank lending. More specifically, we are interested in exploring to what extent recapitalization schemes are successful in maintaining bank lending and how this performance relates to different features of the intervention.

Our analysis suggests that sufficiently large interventions are an effective tool for stabilizing banks' disposition to lend during crises and that common equity, but not lower tiers of capital are associated with improved lending. Furthermore, we fail to confirm the hypothesis that recapitalizations are more effective when provided to locally operating (Cooperative and Savings) banks, and present evidence, which suggests that interbank lending improves in response to aggregate capital provisions; finally, we find the timing of an intervention to be of minor relevance.

Consequently, the paper can potentially serve as an empirical reference for current and future theoretical work, as well as an aid to the orientation of regulatory policies and the design of the aforementioned clear-cut provisions.

To arrive at our conclusions, we have structured the remainder of the paper as follows: Section 2 discusses the existing literature and relates it to our most important results; Section 3 describes our sample, as well as the econometric strategy. Section 4 analyses the determinants of recapitalizations; and Section 5 identifies the most relevant features of an effective bailout. The paper concludes with a summary in Section 6.

2. LITERATURE AND INITIAL RESULTS

In a general context, our paper relates to the literature that explores the relationship between shocks to bank equity and lending. In short, the underlying mechanism in this work is the following: if the value of equity drops, leverage increases, as loan portfolios are slow to adjust (Hancock et al., 1995). Then, since banks typically target a certain leverage ratio (Adrian & Shin, 2010) and/or have to abide by certain regulatory requirements (Haubrich & Wachtel, 1993; Berger & Udell, 1994; Calem & Rob, 1996; Thakor, 1996; Morrison & White, 2005), they are forced to cut back on lending as soon as assets become illiquid.

Applied to the context of resolution policies, this literature would predict that recapitalizations (i.e. positive 'shocks' to bank equity) increase lending, especially when

[3]Liquidity shortages have widely been understood as fundamental determinants of the recent financial crisis. For a concise overview see Brunnermeier (2009).

banks face fire sale prices for their assets, and thus provides the theoretical underpinning for our central hypothesis.

However, while this 'credit channel' has been studied extensively, it is not self-evident that the mechanism offers a satisfactory framework to think about the effect of emergency recapitalizations as the vast majority of the work considers negative (regulatory) shocks during “normal” times.

The investigation as to whether the mechanism is indeed symmetric, and how it interacts with other forces during times of financial turmoil, is the subject of a small, but rapidly growing, body of literature, which explicitly addresses the optimal design of bank bailouts.

Before the review of a number of selected contributions to this body of is undertaken, one recent article from the 'credit channel'-literature deserves a specific mention. Mora & Logan (2012) study the dynamic responses of shocks to capital and the regulatory buffer, and show, among other things, that loans to private non-financial corporations are positively correlated with shocks to capital; while the relationship with loans to households is negative. Since we are analysing a loan composite, their results suggest that our point estimates should be interpreted as lower bounds when it comes to assessing their effect on investment stimulating corporate lending.

The remainder of the section is then attributed to the literature that specifically concerns the design of public recapitalizations.

Theoretical. In general, the success of an intervention primarily depends on two channels: first, at the individual bank level, recapitalizations relax banks' financing constraints (either because they allow banks to lend directly out of provided resources or because they enhance collateral value), and, hence, allow them to increase lending (see the work based on Holmström & Tirole, 1997); second, going back to Diamond & Dybvig (1983), the literature has convincingly argued that government guarantees (deposit insurance as well as – implicit - bailout-guarantees) are useful in preventing credit markets from drying up. Hence, because public capital provisions reduce solvency concerns, they are expected to support lending in the interbank market, and, thus, indirectly affect the supply of liquidity. We will analyse both channels in turn.

In addition, Diamond (2001) and Diamond & Rajan (2005) highlight the importance of providing sufficient amounts of capital, and explain that recapitalizations, which allow banks to write-off non-performing loans but do not permit them to issue new credit, can cause bank lending to decrease. We find evidence in favour of this prediction.

Furthermore, the literature has discussed the effect of providing capital with different risk-absorbing properties: Philippon & Schnabl (2010) recommend stock warrants and preferred stock on the grounds that they leave more risk with the issuer, and are, therefore, better suited to minimize private information rents and, consequently, opportunistic behaviour. Instead, Wilson (2009) and Wilson & Wu (2010) recommend recapitalising banks with common equity since the higher seniority of preference shares

requires governments to pay higher subsidies in order to induce efficient lending; they find, provisions of preferred stock to be least efficient, as they do not contribute to reducing the variability of banks' returns. However, their result relies on the assumption that banks are solvent.

While our results conform to the prediction that common equity interventions are less costly, they also reveal that recapitalizations are closely related to liquidity shortages. Consequently, our data appears to reject both frameworks, and, thus, reinforces the call for a richer theory of bank recapitalization.

More recently, Bhattacharya & Nyborg (2011) study equity injections in a private information model, and derive conditions under which they are equivalent to asset buybacks; they also emphasize that banks' future investment opportunities can affect the impact of these interventions and suggest an augmentation of asset buybacks with call options, in order to maintain the upside of entitling the bailout agency to shares of new investments. We do not address the issue of combined interventions, but the relevance of bank-specific investment opportunities addresses an important point; along with, for example, loan demand, they are exemplary of unobservable bank characteristics that we are unable to control for, and that may distort our point estimates and their interpretation. We will discuss this potential bias along with our results and various robustness checks.

Landier & Ueda (2009) review different options for bank restructuring and conclude that due to the diversity of trade-offs, a case-by-case approach is indispensable. Their conclusion is much in the spirit of the current paper, as our aim is precisely to identify and inform policymakers about the conditionalities of effective bailouts.

Finally, theoretical considerations that address the long-run costs of bank bailouts include mitigating moral hazard through targeted interventions (Fahri & Tirole, 2011) as well as risks associated with strict recapitalization policies and distorted management incentives (Aghion et al., 1999). While we show how targeting correlates with improved lending in the short-run, long-term effects on incentives are, in general, not (yet) quantifiable, and we leave that particular assessment for future research.

Empirical. Empirical work on the relationship between recapitalizations and credit typically dates back to the Great Depression, and covers specific countries (e.g. Japan) and cases (e.g. LTCM); in addition, few papers have emerged in response to the crisis of 2008.

Closely related to this paper, Giannetti & Simonov (2010) study the effect on loans granted to listed Japanese firms between 1998 and 2004. They find that bailed-out banks extend larger loans but do not induce the corresponding firms to create significantly more jobs; they also show that low quality firms experience relatively higher abnormal returns as a result of their lenders' bailouts. In contrast to their analysis, we do not discriminate between borrowers, and focus on the design of the intervention instead. Hence, whilst we implicitly assume that more credit translates into real economic activity, their work, in fact, complements this assumption by showing that this transmission may be slow and imperfect.

Allen et al. (forthcoming) and Montgomery & Shimizutani (2009) also study Japanese data and find that recapitalizations need to be substantial and targeted in order to be effective. The latter also find that providing capital to larger, globally active, banks is more effective. We confirm the relevance of large and targeted interventions in our panel, but find no significant difference in lending when we compare the primarily local to the globally active banks.

While it has been argued that important lessons can be learned from the experience of Japan (e.g. Hoshi & Kashyap, 2010), it is important to bear in mind that the Japanese crisis, unlike recent events, developed out of a weak real economy.[4] As a consequence, Japanese data is more likely to be driven by (often unobservable) loan demand, as opposed to data from the US and European countries that, in the most part, slid into recession only after their banking sectors were under pressure. Hence, for a more general understanding of bank bailouts, it is valuable to explore the novel cross-country dimension of the 2008 crisis and augment the Japanese results with the corresponding insights. This is precisely the intention of the current paper. To our knowledge we are among the first to provide a systematic analysis of the link between public capital provisions and bank lending during the period of 2008-10. Yet, a few other studies do exist and are briefly reviewed here:

Veronesi & Zingales (2010) identify the risk of bankruptcy as the key friction that had been resolved by the US' intervention, and quantify the net benefit ($86-$109 bn.); they focus on the US, but offer a rich analysis that allows them to touch upon distributive issues and to identify winners and losers of the intervention. In contrast, our paper focuses on average effects, but goes into more detail with respect to the design options for public recapitalizations.

Finally, Laeven & Valencia (2011) provide a thorough account of direct fiscal interventions in the financial sector and are able to assess the ultimate impact on firms' growth prospects. In common with the current paper, they exploit the panel dimension of data from the recent episode in question and are, to our knowledge, the only others to overtly study the intensity of recapitalization. However, in contrast to our work, they are not able to disentangle the effects of individual policies and assess the joint impact of guarantees, asset purchases and liquidity support. We attribute this difference to the fact that they consider the effect on firms' activity, whilst we limit our attention to bank lending; such interpretation is consistent with the mitigated firm activity observed by Gianetti & Simonov (2010).

[4]See for example Katz (2009) for a characterization of the differences between the Japanese and the American events.

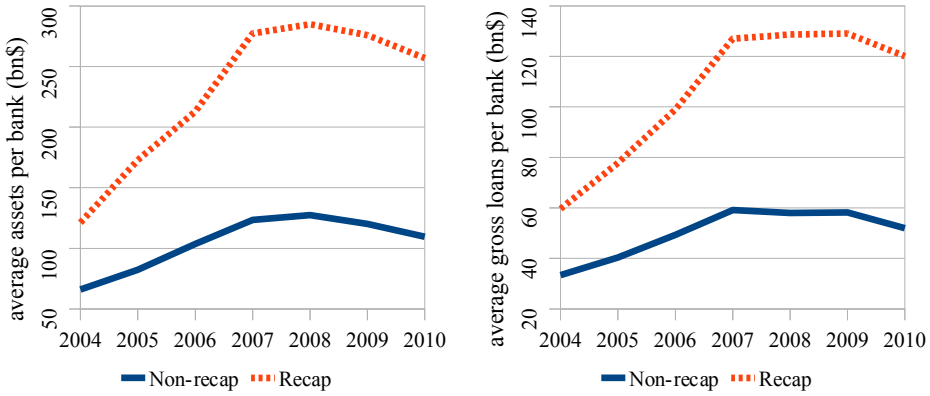
3. DATA

3.1. Sample

We combine balance sheet information from the Bankscope database with the technicalities of government interventions between 2008Q3 and 2009Q4 that are available in the public domain: in addition to information about the dates and sizes of the bailouts, the data also contains details about their ”quality”, i.e. the risk-absorbing properties of the provided capital.[5]

For our reference sample, we have collected data on 94 recapitalizations and 270 bank-year observations. We augment them with data on non-recapitalized banks that report sufficient pre-crisis characteristics to arrive at a total of 392 observations from 15 mostly developed economies; in the end, the sample includes all countries with a minimum of three banks reporting to Bankscope, that, during the period 2008Q3-09Q4, spent at least two per cent of their gross domestic product [GDP] on public recapitalizations. Moreover, to avoid country specific distortion in our analysis, we restrict the sample to the 100 largest banks that have reported consolidated annual balance sheet data and regulatory capital up to, and including, 2010.[6] In our sample this constraint applies only to Japan and the US (see Table 1).

Figure 2. Total assets and lending: non-recapitalized vs. recapitalized banks



Source: Own data. *Notes*: This figure reports average total assets and gross loans for the sub-samples of recapitalized and non-recapitalized banks between 2004 and 2010. Relevant for the analysis in this paper are in particular the observations before (2008) and after (2009 and 2010) the recapitalization. Units are bn US $.

[5]The data is collected primarily from national governments and central banks. More detailed information about the collected sample and a list of sources is available in the Data Appendix.

[6]We consider C1 and C2 consolidated data; for more detailed information we refer the reader to the Bankscope database. For an illustration of potential selection bias resulting from the use of Bankscope data see Bhattacharya (2003).

Finally, we also eliminate cases of bankruptcy from our sample, again to avoid distortions. Since none of the bankrupt institutions received a public capital injection prior to failure, this simplification increases average credit growth in the group of non-recapitalized banks; hence, even if the exclusion were to be a source of bias, it would lead us to underestimate the effect of a public recapitalization. Conservatively interpreted, our point estimates, therefore, constitute lower bounds.

Table 1. Number and characteristics of recapitalizations by country

Country	Number of sample banks	% Recapitalized	% Tier1	/2006 Equity	s.d.	Median	Time	Value weighted time
Austria	25	20.00	100	0.690	0.535	0.395	2009q2	2009q1
Belgium	12	25.00	100	0.507	0.203	0.469	2008q4	2008q4
Denmark	32	65.63	9.52	0.559	0.498	0.309	2009q3	2009q2
France	40	12.50	0	0.067	0.018	0.057	2008q4	2008q4
Germany	23	17.39	100	1.088	0.432	1.214	2009q1	2009q1
Greece	13	61.54	100	0.379	0.194	0.378	2009q2	2009q2
Ireland	14	14.29	100	0.488	0.087	0.488	2009q1	2009q1
Japan	100	4.00	100	0.743	0.513	0.521	2009q2	2009q2
Korea Rep. of	12	41.67	0	0.090	0.078	0.053	2009q1	2009q1
Netherlands	28	3.57	100	0.693	0.000	0.693	2008q3	2008q3
Norway	28	28.57	100	0.433	0.482	0.242	2009q4	2009q4
Spain	52	1.92	100	1.666	0.000	1.666	2009q2	2009q2
Sweden	20	5.00	100	0.039	0.000	0.039	2009q2	2009q2
United Kingdom	49	8.16	100	0.565	0.204	0.484	2009q1	2009q1
USA	100	34.00	100	0.298	0.141	0.278	2008q4	2008q4

Source: Own data, Bankscope. *Notes*: This table reports the distribution of sample banks and recapitalized banks across countries as well as average characteristics of the recapitalizations. %Tier1 is the percentage of recapitalization that involved Tier1 capital. Tier1 capital includes common equity and preference shares. The fourth column reports the average recapitalization scaled by 2006 bank equity. Columns five and six report the corresponding s.d. and the Median. Time is the average timing of recapitalizations rounded to the nearest quarter unweighted and weighted by the amount injected. The sample includes all countries with at least three banks reporting to Bankscope that spent at least two per cent of GDP on recapitalizations in 2008-10. The sample excludes bankruptcies and includes nationalized banks that were also recapitalized.

Reasons for the diversity across recapitalization programs, that is displayed in Table 1, are manifold, and, have not, yet, been widely studied. One recent exception is Nier et al. (forthcoming), who provide a systematic assessment of institutional models, and, report, among other things, that countries in which central banking and financial regulation are organised within the same institution, tend to provide, on average, lower recapitalizations. Their finding is, to some extent, reflected in our sample: Korea and Norway, for example, have their respective financial supervisor integrated in the central bank, while the same is not true, for example, in Spain or the Netherlands.

However, cases like the US, or Greece, who both feature independent financial supervision, provide evidence, that, deeper, structural problems are equally important.

Another reason, why the recapitalization values, for example, for the UK and Spain, are relatively low, is, that they made more frequent use of nationalisations, which we do not count as recapitalizations in our benchmark specification.

3.2. Key Variables

Our two key variables are "recapitalization" and "credit growth"'. The former enters the analysis in two forms: firstly, as a continuous variable equal to the ratio of provided capital over pre-crisis (i.e. 2006) equity levels and, secondly, as a binary dummy variable equal to one if at least one recapitalization occurred between 2008Q3 and 2009Q4. In both cases, let $R_T[i]$ denote recapitalizations received by bank i at time T.

Instead, our main dependent variable is the change in the ratio of loans over assets; we call this ratio *propensity to lend* [PTL] and formally define

$$\Delta PTL_T[i] \equiv (Loans_T[i]/ Assets_T[i]) - (Loans_{T-1}[i]/ Assets_{T-1}[i]) \quad \text{(I)}$$

with $Loans_T[i]$ being the accounting value of total loans held by bank i at date T and $Assets_T[i]$ being the corresponding value of total assets.

Scaling by time-varying asset values allows us to identify changes of PTL *out of available resources*, as opposed to differences in lending that may result from non-systematic shocks to the size of the balance sheet. Put differently, because asset price movements are typically hard to predict during times of turmoil, we believe that, from an ex ante perspective, it matters more to the policymaker to provide for those institutions that are more likely to expand their loan portfolio in the strongest manner, conditional upon asset value. ΔPTL identifies precisely these institutions.

As a robustness check, we also provide estimates for the effect of recapitalizations on changes in absolute credit growth, scaled by initial asset value, and, find our estimates to remain unchanged.

Nonetheless, we acknowledge that during a recession, policymakers are also concerned with ensuring the provision of *total* credit, and, thus, with providing capital to those banks that are most likely to increase lending in absolute terms. Consequently, we report our benchmark results also using the absolute change in lending (scaled only by $Assets_{T-1}[i]$ as a dependent variable).

To conclude, Table 2 and Table 3 provide summary statistics on our dependent variable and our measure of recapitalization, as well as on the set of pre-crisis variables that we use as controls. In addition, we typically also include country fixed effects and bank type dummies (i.e. dummy variables equal to one if a bank is an investment bank, a commercial bank, etc.).

Table 2. Summary statistics

	Mean	Std	Min	Max	Median	Mean Non-Recapitalized banks (1)	Mean Recapitalized banks (2)	Std Recapitalized banks	Test (1) = (2) p-value
Recapitalization (/2006 Equity)									
Own Recap.	0.096	0.253	0.000	1.666	0.000	0.000	0.424	0.363	
Others Recap.	1.267	3.227	0.005	10.362	0.199	1.592	0.156	0.082	
Dependent variables									
Δ(Loans/Assets)	-0.005	0.049	-0.190	0.137	-0.003	-0.005	-0.007	0.049	0.518
Δ(Interb.Loans/Assets)	-0.004	0.046	-0.161	0.194	-0.001	-0.005	0.000	0.035	0.146
Δ(Loans)/Assets(t-1)	0.013	0.083	-0.209	0.276	-0.209	0.015	0.008	0.092	0.268
2006 bank characteristics									
Tier1	11.719	8.808	5.200	70.800	9.100	12.133	10.105	9.656	0.036
Ln(total assets)	0.168	0.020	0.126	0.214	0.169	0.168	0.170	0.018	0.337
Liquidity	0.156	0.167	0.005	0.794	0.087	0.159	0.143	0.175	0.382
Loans/deposits	5.563	28.954	0.082	250.164	1.082	6.306	2.524	31.736	0.231
Provisions	0.002	0.004	-0.002	0.040	0.001	0.002	0.001	0.004	0.272
Non-performing loans	0.020	0.021	0.000	0.137	0.011	0.020	0.018	0.021	0.441
Return on assets	0.894	0.793	-1.100	4.310	-1.100	0.860	1.098	0.588	0.000
Long term funding	18.241	20.407	0.000	91.589	0.000	17.991	19.650	18.960	0.517
Non-deposit funding	24.662	25.056	0.000	99.491	0.000	24.815	23.753	18.926	0.218
Overhead costs	1.966	1.947	0.094	14.533	0.093	1.944	2.096	1.129	0.277

Source: Own data, Bankscope. *Notes*: "Own recapitalization" is the aggregate amount of capital received by a specific bank; "Others recapitalization" the aggregate amount of capital received by other banks in the system. Loans include all household and corporate loans. Interbank loans are loans and advances to other banks. Foreclosures are foreclosed real estate loans. Tier1 is the risk-weighted capital ratio. Liquidity includes liquid assets (including government bonds) and loans and advances with maturities of less than three months. Deposits are aggregate (savings and demand) customer deposits. Provisions are loan loss provisions scaled by total assets. The value of non-performing loans is scaled by total gross loans. Long term funding is in percentage of total funding and non-deposit funding is in percentage of total short-term funding. All explanatory variables are winsorized at the 1% and 99% level.

Table 3. Correlation matrix

	Recap. dummy	Own Recap.	Others Recap.	ΔLoans/ Assets	ΔInterbank loans/Assets	Ln(total assets)
Recap. dummy	1.0000					
Own Recap.	0.7044*	1.0000				
Others Recap.	-0.1779*	-0.1261*	1.0000			
ΔLoans/Assets	-0.0098	0.0239	-0.0496	1.0000		
ΔInterb.Loans/Assets	0.0536	0.0262	-0.0209	0.0719*	1.0000	
Ln(total assets)	0.0458	0.0655*	0.0471	0.0065	-0.0030	1.0000

Source: Own data, Bankscope. *Notes*: This panel reports Pearson correlations among selected variables. (*) denotes statistical significance at the 5 % level and above.

3.3. Econometric Models

Determinants of recapitalization. In Section 4 we identify determinants of recapitalization, estimating standard Logit, Tobit and Ordered Probit models. The dependent variables are variations of *R[i]*: for the Logit model it is a binary variable that takes the value of one if a recapitalization was received during 2008Q3-09Q4, and zero otherwise; for the Tobit model, it is equal to the accumulated value of received capital provisions; for the Ordered Logit model, it takes higher values for capital with better risk-absorbing properties. More precisely: zero for no capital injection, one for subordinated debt, two for preference shares and three for common equity. In addition to the appropriate distributional assumptions (cumulative distribution function [cdf], *G()*), the regressors are: country dummies $z_{country}$, bank specific regressors scaled by total assets $x_r[i]$, and a set of controls, including bank type dummies and the natural logarithm of total assets $x_c[i]$ (as a measure of bank size). We also include country fixed effects to capture the effect of cross-country differences in institutional structure.

Consequently, with vector x equal to $[z_{country}, x_r[i], x_c[i]]$ and a vector of coefficients β, we arrive at the following specification for the Logit model:

$$Pr(R[i]=1|x) = G(x'\beta) \tag{II}$$

The Tobit and the Ordered Logit model are specified accordingly.

Effect on credit growth. In Section 5, we, instead, estimate changes in credit growth as functions of recapitalization measures.

Ultimately, our interest is in identifying the causal effects of public capital injections upon banks' loan provisions. However, since the data does not permit us to control for fixed effects at the individual bank level, we can not entirely eliminate the possibility that our results are influenced by, for example, bank specific demand effects; plausible sources of such influences could encompass regional and sectoral concentrations, or the, aforementioned future investment opportunities.

Hence, our results should generally be interpreted as correlations that, only under specific assumptions, illustrate a causal impact. We will discuss these assumptions along with the presentation of our empirical models and results.

In order to exploit the continuous nature of our recapitalization variable, we will estimate a difference-in-difference [DD] model as our benchmark. For robustness and to explore the binary version of the recapitalization variable, we also provide estimates using propensity score matching [PSM].

For all bank specific observations i, we define 2008 as the pre-treatment period, and 2009 and 2010 as the post-treatment years; our interest is, then, in estimating determinants of the change in ΔPTL between 2008 [08] and 2009-10 [09/10], and the corresponding benchmark model is given by

$$\Delta PTL_\tau[i] = z'\gamma + R_\tau[i]*\mathbf{1}_{09/10}*x_{int}'\beta_{int,09/10} + u_\tau[i] \quad \text{(III)}$$

where z is a vector containing country fixed effects ($x_{country}$), bank specific controls ($x_c[i]$), a time dummy equal to one for T=2009/10 and zero otherwise ($\mathbf{1}_{09/10}$), and the recapitalization variable ($R_\tau[i]$). Furthermore, the regressions typically include interaction variables (x_{int}); $u_\tau[i]$ is white noise.

The important DD-effect is then captured by the vector $\beta_{int,09/10}$ and tests for the joint effect of $\beta_{int,09/10}$ and the coefficient on x_{int}, β_{int} are typically provided. Under the 'common' or 'parallel trend assumption', i.e. the assumption that conditional upon the control variables and equally sized interventions, banks would have experienced an identical change of ΔPTL; $\beta_{int,09/10}$ marks the causal impact of an intervention. A typical test of this assumption would be to compare lending behaviour during an alternative period; however, due to the unique nature of the recent crisis, we consider this test unserviceable for our purposes. Instead, we rely on country and time dummies to control for macroeconomic demand effects.

Generally, we consider the assumption of a parallel trend, in particular during the crisis, a plausible one since we only estimate our model for the subsample of recapitalized banks. However, the fact that we do not control for bank-specific demand effects remains a caveat that we acknowledge for all of the numerous variations of the model that we estimate.

For additional robustness, we also run regressions using PSM and the Nearest Neighbour Method [NNM] to match single units with replacements and provide estimated treatment effects.[7] Put simply, for each bank that received a recapitalization, we select the bank from the sample of non-recapitalized banks that it most resembles according to observable characteristics. We estimate propensity scores using a Probit specification with bank liquidity, capital, and asset quality as regressors (see Table 5 for the set of regressors). The effect of capital injections is then equal to the average difference of post-intervention lending between these matched pairs.

4. RESULTS: DETERMINANTS OF RECAPITALIZATIONS

Table 5 provides our initial results. It identifies the pre-crisis characteristics of banks that are associated with high probabilities of receiving public capital, and, conditional upon them receiving support, related to more extensive interventions. Table A.1 in the Appendix augments the analysis by exploring how the same characteristics relate to the provision of capital with better risk-absorbing qualities.

Throughout, pre-crisis variables are in 2006 values; in columns (1) and (3), the dummy variable is equal to one if a bank received at least one capital injection between 2008Q3 and 2009Q4, and zero otherwise. In columns (2) and (4), recapitalization includes the aggregate amount that was received during this period. For Table A.1, higher values of

[7] See Dehejia & Wahba (2002) for an assessment of the NNM with replacement.

the dependent variable are associated with better risk-absorbing properties (see Section 3 for more detail). Since some banks do not report all variables at all dates, the sample contains 392 bank-year observations; omitting US banks, the sample is reduced to 298. Throughout the analysis, the sample size is adjusted according to the number of reporting banks. While this is not always explicitly discussed in the text, the number of observations is reported separately for every column.

In addition to the determinants of public bailouts we also report ratios of "prediction accuracy", and define a prediction to be correct if the predicted probability of being recapitalized exceeds the sample probability, provided the bank has in fact been recapitalized. The value 80.519 in column (1) then implies that our model correctly predicts 80.519% of the banks that have actually been recapitalized. Additionally, in the sample that omits US banks (column 3), accuracy is comparably high.

Across all specifications, the evidence shows that higher Tier1 capital ratios correspond to lower probabilities of being recapitalized, and, conditional upon the reception of public support, to lower risk-absorbing qualities and lower levels of injected capital. Table 4 provides a reading of predicted probabilities of being recapitalized at various magnitudes of the explanatory variables, suggesting economic, as well as, statistical significance.

Table 4. Predicted probabilities of being recapitalized

	20th percentile	50th percentile	75 percentile
Capital	0.26	0.23	0.19
Liquidity	0.26	0.24	0.18
log(assets)	0.16	0.19	0.23

Notes: Logit model. Predicted probabilities of being recapitalized for various values of the explanatory variables.

These observations are not only relevant from an historical perspective, but also contribute to the debate on preemptive regulation, by suggesting that banks should be required to hold significantly higher levels of Tier1 capital. Moreover, they indicate that this would not only serve to reduce the likelihood of a bank requiring a bailout, but also by limiting the capital and risk transfer from and to the government, and, additionally, to reduce the conditional cost of such an intervention.

The results also suggest that it is important to address the issue of maturity mismatch in order to reduce the probability and the cost of recapitalizations: for example, increasing the fraction of liquid over total assets from 0.5% (sample minimum) to 8.7% (sample median) reduces the value of the received recapitalization by 0.5 s.d.'s; instead, increasing the Tier1 capital ratio from its sample minimum (5.2) to the corresponding sample median (9.1), is associated with a reduction of one s.d.; in joint consideration with the fact that many banks appeared to be in compliance with regulatory capital

requirements before the crisis (Demirgüç-Kunt et al., 2010a) the analysis, therefore, urges practitioners and regulators alike to pay close attention to the risks related to asset (il)liquidity.

Moreover, we also find evidence in support of the emphasis, that is currently put on the regulation of TBTF institutions: an increased in bank size corresponding to the difference between the 20th and the 50th percentile increases the probability of being recapitalized almost by 10%.

Furthermore, Table 5 and Table A.1 identify total balance sheet size as an important predictor of recapitalizations, and as a significant determinant of the amount, as well as the risk-absorbing quality, of injected capital. Our results, therefore, provide empirical evidence for the common conjecture that large financial institutions are more likely to be provided for by the government; in addition, they indicate that the conditional costs and the risk transfer are higher when governments are forced to bail out these institutions.

For robustness considerations we eliminate US banks from the sample in columns (3) and (4) of Table 5 and column (2) of Table A.1, respectively. Since we have shown in Table 1 that a significant fraction of the recapitalizations was administered in the US, we conduct this additional check to rule out that the determinants of recapitalizations and their characteristics are driven by political peculiarities in the US. Our results lead us to conclude that this view is not supported by the data.

In addition, we also examine whether the identified characteristics contain different explanatory powers for differing resolution policies. More specifically, we analyse whether they relate differently to interventions that entail either a (forced) merger or a nationalisation. The corresponding data includes 46 forced mergers and 16 nationalisations, in addition to the 94 provisions that were previously analysed. In our initial sample, we included these 62 banks in the comparison group; instead, in Table 6, the comparison group contains only banks that were not resolved.

The results we provide in Table 6 suggest, interestingly, that unconditional recapitalizations were mostly allocated to banks with low pre-crisis levels of liquid assets and Tier1 capital; moreover, while low levels of Tier1 capital are similarly strong predictors of nationalisations and mergers, it also seems to be the case that larger banks were more frequently forced into either mergers or nationalisation.

Table 5: Determinants of recapitalization probability and size (marginal effects reported)

	Probit P(V>0/.)	Tobit E(V/.)	Probit P(V>0/.)	Tobit E(V/.)
	(1)	(2)	(3)	(4)
	Full sample		Exclude US banks	
Tier1 Capital	-0.144***	-0.090***	-0.155*	-0.110**
	[0.051]	[0.028]	[0.088]	[0.052]
Liquidity	-4.716***	-2.801***	-4.743**	-2.945***
	[1.629]	[0.873]	[1.876]	[1.082]
Loan/Deposits	-0.015	-0.014	-0.013	-0.012
	[0.018]	[0.025]	[0.016]	[0.022]
Provisions	-35.641	-13.778	-49.867	-19.304
	[112.833]	[45.033]	[164.031]	[56.754]
Non-performing loans	8.901	6.680	15.365	10.676
	[11.944]	[6.532]	[14.394]	[7.832]
Ln(total assets)	28.413**	15.173***	42.429***	23.756***
	[11.601]	[5.717]	[14.943]	[7.777]
Investment banks	1.040	0.564	1.377	0.757
	[1.197]	[0.678]	[1.140]	[0.687]
Cooperative banks	0.410	0.233	0.328	0.254
	[0.870]	[0.478]	[0.892]	[0.525]
Real estate banks	-1.767	-0.996*	-1.315	-0.779
	[1.075]	[0.579]	[1.137]	[0.650]
Savings banks	-0.202	0.013	0.404	0.438
	[0.689]	[0.398]	[0.829]	[0.494]
Constant	-2.721	-1.272	-7.409**	-4.048**
	[2.185]	[1.146]	[3.112]	[1.684]
% Recapitalized	19.643		14.765	
% Recapitalized correct	80.519		79.545	
% Non-Recapitalized correct	75.633		76.471	
Country FE	x	x	x	x
Number of banks	392	392	298	298
Pseudo R-squared	0.28	0.22	0.29	0.23

Notes: Robust standard errors in parentheses (***), (**), (*) denote statistical significance at the 1%, 5%, and 10% level, respectively. This table reports estimates of the effect of 2006 bank characteristics on recapitalizations. In columns (1) & (3) the dependent variable takes value one if the bank was recapitalized. In columns (2) & (4) the dependent variable is the amount of capital injected scaled by 2006 equity levels. The specification includes indicators of financial strength, bank specialization dummies, and country fixed effects as regressors. Tier1 is the Tier1 risk-weighted capital ratio. Liquidity includes liquid assets such as government bonds, loans and advances with maturities of less than three months. Deposits are aggregate (savings and demand) customer deposits. Provisions are loan loss provisions over total assets. The value of non-performing loans is scaled by total gross loans. The table reports marginal effects. For the Tobit model, it reports the marginal effect for the unconditional expected value of the dependent variable.

Finally, we also include a number of additional variables that are indicative of mismanagement, and that could, therefore, potentially serve as predictors of bank failure and recapitalization. These variables include profitability ('Return on assets'), the riskiness of the funding structure ('Long-term funding' and 'Non-deposit funding') as well as operational efficiency ('Overhead costs'); and the associated results are presented in Table A.2. As it turns out, we reject the relevance of all of these variables at the 5% significance level and interpret our findings as favourable for our benchmark specification.

In conclusion, our findings are supportive of the view that ensuring liquidity during times of systemic distress (either by requiring banks to hold more liquid assets or by installing institutional emergency facilities) is useful for reducing public costs. Furthermore, our findings are favourable towards discussions that aim at restricting the emergence of institutions that are 'too big', as these banks appear to be more likely, not only to fail, but also to require politically difficult emergency restructuring.

Table 6: Different forms of bank resolution

	Recapitalized	Merged	Nationalised
Tier1 Capital	-0.189***	-0.418**	-0.514*
	[0.0578]	[0.191]	[0.306]
Liquidity	-6.868***	-1.046	-1.710
	[2.579]	[2.258]	[3.746]
Loan/Deposits	-0.132	-0.058	0.001
	[0.141]	[0.146]	[0.0328]
Provisions	-27.070	-35.050	156.200
	[80.20]	[207.3]	[258.6]
Non-performing loans	12.240	-10.530	-0.780
	[13.72]	[40.56]	[28.32]
Ln(total assets)	12.720	47.23**	90.00***
	[13.65]	[22.09]	[32.80]
Investment banks	3.330**	-15.210	-15.550
	[1.590]	[6,788]	[8,666]
Cooperative banks	0.331	0.964	-15.410
	[1.170]	[1.416]	[3,566]
Real estate banks	1.539	1.544	-15.180
	[1.177]	[1.169]	[2,046]
Savings banks	-0.181	3.573***	0.625
	[0.779]	[0.848]	[1.581]
Country FE	x	x	x

Notes: Robust standard errors in parentheses (***), (**), (*) denote statistical significance at the 1%, 5%, and 10% level, respectively. This table reports multinomial Logit estimates, differentiating between different forms of bank resolution: recapitalization, forced merger, and nationalisation. Bankruptcies are excluded because there were too few in our sample. The control group includes only healthy banks, i.e. banks that were not resolved. The regression is run on 396 observations, the Pseudo-Rsquared is 0.46.

Before proceeding to analyse the question of how recapitalizations affect the provision of credit in detail, it is worth pointing out that Section 4 should be thought of as an extended description of the sample; it serves to shape the thinking about the results in the subsequent section by establishing a number of stylized facts:

Banks that received most of the public funds were - on average - large, held low levels of Tier1 capital, and were more likely to be liquidity constrained. Liquidity constrained banks were more likely to receive capital injections, and larger banks were more frequently forced into mergers or nationalisation. Whilst an initial attempt has been made at interpreting these facts, it is acknowledged that a fully-fledged investigation of the underlying sources of distress requires more work. We leave this analysis for future research (see for example Demirgüç-Kunt et al., 2010b).

5. RESULTS: RECAPITALIZATION AND LENDING

Given that the crisis of 2007-09 took, not only, many academics, but certainly, most practitioners, by surprise, and the subsequent interventions were designed subject to tight time and information constraints, it is advisable to ask whether the interventions were, in fact, successful in achieving their intended results and to analyse if, and how, these results could have been improved. Exemplary for the vast majority of recapitalization schemes, the terms and conditions of the US Treasury's Capital Assistance Program [CAP] serve to summarize the most common of these intentions, when they require that participants:[8]

1. *will be subject to the executive compensation requirements in line with the Emergency Economic Stabilization Act of 2008*, […].
2. *must submit a plan for how they intend to use this capital to preserve and strengthen their lending capacity* […]
3. *will be required to submit to Treasury monthly reports on their lending broken out by category*
4. *will* […] *be subject to restrictions on paying quarterly common stock dividends, repurchasing shares, and pursuing cash acquisitions*.

That is, in addition to enforcing behavioural conditions (1) and transparency (3), recapitalization schemes were, in particular, intended to improve lending capacities (2), and to control the allocation of revenues amongst creditors (4). (1) and (3) are tools to achieve compliance with (2) and (4), and whilst the question of allocating the burden of the crisis among creditors is an interesting one, our focus has been on studying the success of governments in promoting lending through direct recapitalizations.[9]

In what follows, we analyse the importance of these channels during the crisis of 2008-10.

[8]Source: http://www.financialstability.gov/roadtostability/capitalassistance.html ; The CAP was launched on February 25, 2009.
[9]See the aforementioned study by Veronesi & Zingales (2010) for an analysis of burden sharing. Wilson (2009) poignantly motivates his concern with public recapitalizations by arguing that "*the government's primary mechanism for improving the troubled bank's lending decision is recapitalizing the bank.*" (p. 4).

5.1. 'Bailout' characteristics

5.1.1. Benchmark and size of the intervention

Column (1), Table 7, provides the benchmark result, whilst first interaction terms are introduced in columns (2)-(4) in order to single out the effects of differently sized recapitalizations.

In the aggregate, we find lower growth of PTL in the period(s) after the intervention, but no significant relationship between recapitalizations and banks' lending behaviour.

However, upon splitting the sample, Table 7 reveals a robust and positive coefficient, linking "High" public capital injections to higher credit growth. In contrast, the point estimates for small and medium sized interventions are insignificant and potentially negative, as predicted, in particular, by Diamond (2001).

"High" recapitalizations are defined to include provisions in the 75th percentile, which, in our sample, corresponds to provisions that range between 49.22% and 166.62% of pre-crisis equity (the mean injection for this subsample is 101.40%, the corresponding s.d. is 49.22%.). Medium sized interventions cover the range between the 75th and the 25th percentile (48.95% - 31.59%) and small interventions are those in the 25th percentile (20.70% - 2.42%).

If the estimated coefficients, indeed, express a causal relationship, a point estimate of 0.027 for "High" capital provisions would imply that receiving a recapitalization in this range would increase the growth of bank's PTL by 0.60 s.d.'s. To assess the economic relevance of this result, it is instructive to notice that it approximately offsets the negative time- or “crisis”-effect (e.g. -0.026 in column 2).

By this measure, "High" recapitalizations appear to have been effective in restoring banks' disposition to lend.

Notwithstanding this observation, it should be emphasised that Table 7 presents results on changes to banks' *willingness* to lend; as pointed out before, we believe that this measure provides viable ex ante guidance for policymakers. Nonetheless, it does not necessarily imply that large capital injections turn out to increase the total provision of credit ex post; especially so, if banks' asset values collapse over the same period. For completeness, we discuss the effects on absolute changes in credit growth further in Section 5.1.3.

Finally, it is clear that the desirability of large capital injections, from a welfare perspective, continues to depend also on the costs of an intervention. However, our evidence seems to be generally inconsistent with theories that predict higher credit growth in response to interventions that account for less than 49.22% of pre-crisis equity, leading us to conclude that recapitalizations in this range are generally, and independent of their costs, not recommendable.

Table 7: Recapitalization size

	(1)	(2)	(3)	(4)
	Bailout size	Bailout dummy	Bailout dummy	Bailout dummy
Recapitalization	-0.005			
	[0.014]			
High		-0.009	-0.007	-0.009
		[0.012]	[0.015]	[0.012]
Medium			0.002	-0.002
			[0.012]	[0.010]
Low				
Recapitalization*Dummy09-10	0.019			
	[0.017]			
	-0.234			
High*Dummy09-10		0.027**	0.026	0.027***
		[0.010]	[0.018]	[0.008]
		(0.037)	(0.126)	(0.029)
Medium*Dummy09-10			-0.001	
			[0.014]	
			(0.936)	
Low*Dummy09-10				0.001
				[0.013]
				(0.887)
Dummy09-10	-0.028***	-0.025***	-0.025**	-0.026***
	[0.009]	[0.006]	[0.011]	[0.008]
Log(Assets/Assets(t-1))	-0.036*	-0.033*	-0.033*	-0.033*
	[0.018]	[0.018]	[0.019]	[0.019]
Country FE	x	x	x	x
Observ.	270	270	270	270
R-squared	0.16	0.17	0.17	0.17

Notes: Robust standard errors in parentheses (***), (**), (*) denote statistical significance at the 1%, 5%, and 10% level, respectively. The dependent variable is the year-to-year change in the loan to assets ratio. Loans include all household and corporate loans. Recapitalization is the amount of capital received, scaled by 2006 equity levels. In columns (2) to (4) we split the sample of recapitalized banks into three groups: (1) High injection (>75th percentile); (2) Medium injection (>25th percentile & <75th percentile); (3) Low injection (<25th percentile). Dummy09-10 is a post recapitalization dummy. All specifications control for bank specialisation and country fixed effects. In brackets we report robust standard errors and in parentheses the p-values for the significance of the total effect.

To conclude, it ought to be pointed out that the reported results concern changes of PTL growth. For robustness, and in order to also identify those recapitalizations that lead to higher absolute credit growth, we proceed to repeat the analysis with an alternative dependent variable in the subsequent section.

5.1.2. Absolute change in credit growth

Table 8: Recapitalization size - absolute change in credit growth

Notes: Robust standard errors in parentheses (***), (**), (*) denote statistical significance at the 1%, 5%, and 10% level, respectively. The dependent variable is Loans(t)/Assets(t-1) - Loans(t-

	(1)	(2)	(3)	(4)
	Bailout dummy	Bailout dummy	Bailout dummy	Bailout dummy
Recapitalization	0.013	-0.008		
	[0.017]	[0.014]		
High			0.001	-0.012
			[0.018]	[0.015]
Medium			0.013	
			[0.014]	
Low				-0.013
				[0.014]
Recapitalization*Dummy0910	0.004			
	[0.020]			
	(0.252)			
High*Dummy0910		0.030*	0.015	0.036**
		[0.017]	[0.021]	[0.018]
		(0.058)	(0.247)	(0.039)
Medium*Dummy0910			-0.021	
			[0.016]	
			(0.461)	
Low*Dummy0910				0.021
				[0.016]
				(0.461)
Dummy0910	-0.019*	-0.023***	-0.009	-0.030***
	[0.010]	[0.008]	[0.013]	[0.009]
Log(Assets/Assets(t-1))	0.461***	0.468***	0.466***	0.466***
	[0.022]	[0.022]	[0.022]	[0.022]
Country FE	x	x	x	x
Observ.	270	270	270	270
R-squared	0.68	0.69	0.69	0.69

1)/Assets(t-1). Loans include all household and corporate loans. Recapitalization is the amount of capital received, scaled by 2006 equity levels. In columns (2) to (4) we split the sample of recapitalized banks into three groups: (1) High injection (>75th percentile); (2) Medium injection (>25th percentile & < 75th percentile), and (3) Low injection (<25th percentile). Dummy0910 is a post recapitalization dummy. The sample includes all countries with at least three recapitalized banks reporting to Bankscope, and that spent at least two per cent of GDP in recapitalizations in 2008-10. The sample excludes bankruptcies, and includes nationalized banks. All specifications control for bank specialisation and country fixed effects. In brackets we report robust standard errors, and in parentheses the p-values for the significance of the total effect.

While, in terms of incentives, and, because asset price movements are hard to predict during crises, it can be of interest for policymakers, to identify those banks, that expand lending most in relative terms, the effect on absolute credit growth is certainly as much of a concern; in particular, during a recession. In Table 8, we provide the corresponding results. The effect in question is, as before, captured by the coefficient on the interaction of a time dummy for the period 2009-10 and "High" provisions. It turns out that,the coefficient on the effect of ”High” provisions remains essentially unchanged.

Consequently, sufficiently large provisions are associated with the strongest improvement in banks' inclination to lend, but, also, with the strongest increase in the

absolute provision of credit during crises. In our view, these findings provide strong evidence in favour of decisive recapitalizations.

5.1.3. Capital choice

When it comes to designing public interventions, policymakers decide not only on the size but, most importantly, on the associated risk transfer, i.e. on the quality of the capital they choose to provide. Motivated by the theoretical work cited in Section 2, we, therefore, proceed to the study of, in particular, the relationship between provisions of common equity and bank lending. In comparison with other forms of Tier1 capital (e.g. preference shares), common equity is typically associated with a more risky lender position, as it does not generally imply a promise of fixed payments; however, the theoretical implications of this feature are unclear and have been predicted to imply both, a reduction of private rents (Philippon & Schnabl, 2010) and lower costs of efficient lending (Wilson, 2009); our results reject both explanations.

We repeat the benchmark analysis (Table 7), but introduce a dummy variable for capital injections that were conducted with common equity, instead of analysing the size of an intervention.[10] The results are presented in Table 9. Independent of whether we use recapitalizations as a continuous variable (column 1), as a binary dummy (columns 2 and 3), or combine the analysis with an additional dummy for Tier1 capital provisions in general, we find that the correlation of common equity injections with changes in loan growth (including common equity) is positive and comparable in magnitude to the relation with "High" capital provisions.[11] Applying a causal interpretation, column (3) furthermore indicates that Tier1 provisions are not generally effective in enhancing loan growth, and that the effect relies entirely on the impulse from common equity provisions.

Generalizing the relationship between common equity and PTL, our analysis also suggests that ex ante regulation, such as the Basel capital requirements, should be even narrower in their definitions of proposed capital ratios.

Clearly, Table 9 introduces the question as to why common equity provisions seem to be so much more effective. The existing theories, as discussed in Section 2, are inconsistent with our evidence since they do not require banks to be liquidity constrained for common equity to be most effective. We conclude that further research is needed, but offer the following conjecture for discussion: since common equity provisions are associated with lower risks for the banks than compared to, for example, preference shares, they signal a stronger commitment by the government to relieve a bailed out intermediary from remaining risks. As a result, the recapitalized bank will be able to refinance itself more easily and, consequently, to lend more and at lower rates.

[10]Ideally we would like to combine both analyses; however, the sample is not sufficiently deep to permit significant results in this case.
[11]The 'Tier1'-dummy variable includes common equity provisions.

Table 9: Recapitalizations with common equity

	(1)	(2)	(3)
	Bailout size	Bailout dummy	Bailout dummy
CE	-0.022	-0.015	-0.019
	[0.019]	[0.020]	[0.020]
Tier1			-0.031
			[0.023]
CE*Dummy09-10	0.038**	0.042***	0.048***
	[0.018]	[0.016]	[0.017]
	(0.341)	(0.131)	(0.104)
Tier1*Dummy09-10			-0.019
			[0.013]
			(0.026)
Dummy09-10	-0.024***	-0.027***	-0.014
	[0.006]	[0.006]	[0.011]
Log(Assets/Assets(t-1))	-0.039**	-0.042**	-0.042**
	[0.018]	[0.018]	[0.018]
Country FE	x	x	x
Observ.	270	270	270
R-squared	0.17	0.18	0.18

Notes: Robust standard errors in parentheses (***), (**), (*) denote statistical significance at the 1%, 5%, and 10% level, respectively. The dependent variable is the year-to-year change in the loan to assets ratio. In column (1), CE is the amount of common equity received, scaled by 2006 equity levels. Dummy0910 is a post recapitalization dummy. In columns (2) and (3), CE is a dummy that takes value one if the bank was recapitalized using common equity, and Tier1 is a dummy that takes value one if the bank received Tier1 capital, including preference shares. All specifications control for bank specialization dummies, and country fixed effects.

In summary, the presented evidence shows that conditional upon the decision to provide public support to distressed financial institutions, governments should do so decisively. That is, they should provide sufficient amounts of capital, but they should also commit to actually reducing the banks' risk exposure as much as possible. If they fall short of these requirements, it seems that public interventions fail to provide the desired incentives for improved bank lending.

5.1.4. Timing

Table 10: Comparing the effect of early and late recapitalizations

Notes: Robust standard errors in parentheses (***), (**), (*) denote statistical significance at the 1%, 5%, and 10% level, respectively. The dependent variable is the year-to-year change in the loan to assets ratio. Loans include all household and corporate loans. 'Early' is a dummy that takes the value one if the bank was recapitalized during the first half of the sample period, 'Late' is a dummy that takes the value one if the bank was recapitalized during the second half of the sample period, and zero otherwise. In column (2) 'recapitalization' is the amount of capital received, scaled by

	(1)	(2)	(3)	(4)
		Bailout size	Bailout dummy	
			High	Common Equity
Early	0.024			
	[0.015]			
Early*dummy0910	-0.012			
	[0.013]			
Recapitalization*Early		0.003	-0.004	-0.013
		[0.016]	[0.015]	[0.021]
Recapitalization*Late		-0.019	-0.016	-0.033
		[0.020]	[0.018]	[0.040]
Recapitalization*Early*dummy0910		0.013	0.019	0.039**
		[0.018]	[0.017]	[0.017]
Recapitalization*Late*dummy0910		0.032	0.042*	0.062
		[0.024]	[0.025]	[0.042]
dummy0910	-0.012	-0.028***	-0.025***	-0.027***
	[0.011]	[0.009]	[0.006]	[0.006]
Log(Assets/Assets(t-1))	-0.040**	-0.036**	-0.034*	-0.042**
	[0.018]	[0.018]	[0.018]	[0.018]
Test (A)+(C) = (B)+(D)				
p-value		0.901	0.625	0.917
Country FE	x	x	x	x
Observ.	270	270	270	270
R-squared	0.16	0.16	0.17	0.18

2006 equity levels. In columns (3) it is a dummy that takes value one if the bank received a "High" injection (>75th percentile). In column (4) it is a dummy that takes value 1 if the bank was recapitalized using common equity. The sample includes all countries with at least three recapitalized banks reporting to Bankscope that spent at least 2 per cent of GDP on recapitalizations in 2008-10. The sample excludes bankruptcies and includes nationalized banks. All specifications control for bank specialisation, and country fixed effects. In brackets we report robust standard errors and in parentheses the p-values for the significance of the total effect.

In this section we examine whether recapitalizations that were conducted 'early', i.e. during the first half of our sample period, exhibit a different relation to credit growth than recapitalizations that were provided during the second half (i.e. 'late'). Reasons to suspect different effects are for example the fact that early measures were generally intended to address solvency concerns while later ones were mostly designed to boost economic activity. Similarly, the first recapitalizations were often installed as emergency measures, while the later ones were designed as follow-up programs.

Results are provided in Table 10; specifically, we address the question of whether recapitalizations that were conducted during the first half of the sample period exhibit a systematically different relationship to loan growth than recapitalizations that were provided only later.[12]

[12]For cases where a bank received multiple recapitalizations we consider the date of the first intervention the relevant one.

Our answer, in short, seems to be “no”: whether we use recapitalizations as a dummy variable, a continuous variable (column 2) or as dummies for high (column 3) or common equity (column 4) provisions, the timing of the recapitalization turns out to be irrelevant.

A related concern is one of lagged effects of recapitalization. We have addressed this issue by including the number of quarters since recapitalization to act as a regressor, but find no significant effect.[13]

Ideally we would also like to address the question of whether multiple interventions have an effect that is different to that of single interventions. However, only very few banks received multiple recapitalizations, leaving us with too few observations.

5.1.5. Robustness checks

As has been mentioned repeatedly throughout the paper, a causal interpretation of the presented estimates is only possible to the extent that, conditional on our control variables, regional or bank specific effects do not interfere with the common trend in PTL growth, i.e. under the assumption that all recapitalized banks in our sample would have exhibited parallel changes in PTL growth if it had not been for the public intervention.

Because loan demand, but also future investment opportunities, are likely to be subject to often unobservable influences, and the unique nature of the recent episode does not permit us to provide formal tests of this assumption, we acknowledge that we are constrained with respect to our ability to identify causality.

However, since the causal component of the documented correlations is of particular interest to policymakers, we proceed to provide a number of supportive results.

First, we address the issue of demand effects: in Table A.3 we introduce 'country*year' dummy variables into our benchmark regression to control for countrywide changes in loan demand, and find no significant alteration in our results.

Next, we also provide estimates based on propensity score matching. While remaining dependent on the assumption of no systematic effects at the individual bank level, it contributes to the robustness of our results and their causal interpretation by providing an alternative way of matching observations for comparison. Essentially the analysis allows us to compare recapitalized banks that, based on our observables, had a similar ex ante probability of receiving public capital.

Following Dehejia & Wahba (2002), we estimate propensity scores ('probabilities') using a Probit specification, and the NNM with replacement to select observations for comparison. Figure 3 then provides a graphic illustration of the vicinity of these observations: the fact that both lines essentially overlap, indicates that, according to observables, our matched observations were indeed statistically identical prior to the intervention.

[13]Not reported, available upon request.

Using these comparison groups, we then repeat the analysis from the previous sections and estimate the effect of recapitalization through common equity and of differently sized interventions. In Table 11 we present the corresponding effects prior to (column 1) and after the capital injection (column 2).

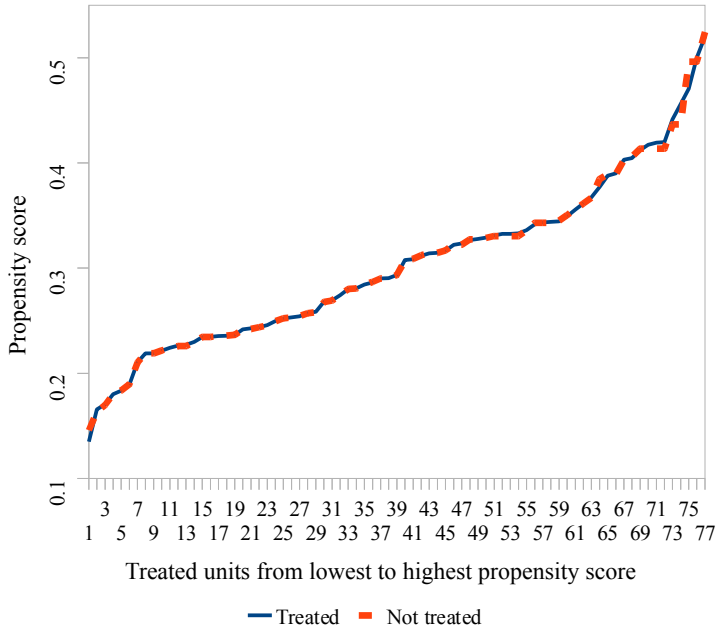
We find no significant difference between the matched samples before the public intervention (in 2008), while we find a significant and sizeable average effect for 2009-10. Essentially, the estimated coefficients confirm our earlier results even though the point estimates are slightly smaller: the estimates for small and medium sized interventions are, again, not significant but negative, and, thus, indicative of the theoretical considerations of Diamond (2001).

In summary, the results in Figure 3 and Table 11 support our earlier conclusions, and provide further evidence in favour of the notion that committed (large and truly risk-absorbing) interventions do have the desired positive and economically relevant effects upon banks' lending behaviour.

Since in our benchmark analysis, we have studied only recapitalized banks over time; a natural question to then ask, is whether the sample selection is, indeed, random, and, thus, whether our estimates suffer from sample selection bias. The issue is, in particular, to determine whether our baseline results apply to the larger sample of banks, that also includes banks that were not recapitalized.

To address this question we perform a two-step Heckman correction, i.e. a formal test that involves including the residual of our Tobit model (see Section 4) as an additional regressor in our benchmark regression. A significant coefficient on this 'Tobit residual' would then be indicative of missing elements in our analysis, and, therefore, imply biased point estimates. However, our results allow us to reject the presence of sample selection bias (see Table A.4).

Figure 3. Propensity score for treated and matched units (NNM)



Notes: Solid line represents the recapitalized banks; dashed line the nearest neighbours.

Table 11: Propensity score matching

	(1) 2008	(2) 2009-10
All Recapitalizations	0.009	-0.005
	(0.007)	(0.006)
CE	0.009	0.022**
	(0.017)	(0.010)
High	0.009	0.020***
	(0.012)	(0.008)
Medium	0.009	-0.006
	(0.010)	(0.007)
Small	0.005	-0.012
	(0.012)	(0.013)

Notes: (**), (***), denote statistical significance at the 5% and 1% level, respectively. See Table 2 for the definition of "High", "Medium" and "Small". Column (1) compares the subsamples prior to treatment; column (2) provides the corresponding comparison during the post-treatment period(s).

5.2. Bank and sectoral characteristics

Having identified the most relevant characteristics of successful recapitalizations, the question of the allocation of the provided funds, is naturally next. In this section we contribute to the answer of this question by examining the data in two additional dimensions: we ask whether the effect of public recapitalizations for locally operating

banks is different from the effect for banks that are primarily involved in national or global financial markets; and we are interested in examining whether recapitalizations were successful in restoring the functionality of the interbank market.

5.2.1. Local vs global

We begin by studying whether the relationship between public recapitalizations and changes in the growth of PTL depends upon bank specialisation, and more specifically, on whether banks' operations are primarily local.

The corresponding hypothesis, namely that local banks respond to capital injections by providing relatively more credit, relies on theoretical and empirical work suggesting that close relationships between banks and firms improve the flow of credit by reducing information asymmetries.[14]

At the same time, it is also at the core of an initiative that the US administration launched in October 2009. Specifically, President Obama motivated the focus on local banks as follows:

> "*[In order to] spur lending to small businesses, it's essential that we make more credit available to the smaller banks and community financial institutions that these businesses depend on. These are the community banks who know their borrowers; who gave them their first loan; who've watched them grow from down the street - not from Wall Street*" (21 October 2009).

Hence, testing the empirical validity of the link between local orientation and credit growth is not only relevant for the cited literature, but also provides important feedback on recent policies.

Table 12 presents our results; and whilst they are in accord with the literature - to the extent that the willingness to lend of locally operating banks improved after the crisis - they also contradict it by showing that the marginal effect of public capital provision is *not* higher. This result clearly provides a challenge to such US policies and, in part, also to the corresponding literature. Hence, whilst we do not question the relevance of relationship banking in general, we show that its importance for the provision of credit during crises may have been overly emphasized.

In order to arrive at these conclusions, we split the sample into 'local' (i.e. Cooperative and Savings) and 'global' (i.e. Investment and Commercial) banks, and augment the benchmark model accordingly. Column (1) ignores recapitalizations, and merely compares post-crisis willingness to lend of local and global banks. It exhibits a significant 'crisis effect', but also evidence that local banks were more likely to lend only after the crisis; during the earlier period no such difference exists. Column (2) accounts for recapitalizations and, as in the benchmark specification, shows no evidence of a

[14]The vast literature on the link between information asymmetries and bank lending goes back to the 1980s. Contributions include among others Diamond (1984, 1989), Sharpe (1990), Petersen & Rajan (1994), Cole (1998), Ongena (1999), Boot (2000) and Berger & Udell (2002).

significant recapitalization effect. The negative crisis effect and the higher PTL of local banks, however, remain, and the more pronounced point estimates suggest that the coefficients in column (1) were biased towards zero.

Finally, the most relevant model is presented in column (3). Building upon our previous analysis, we define the recapitalization dummy as equal to one only for interventions that were either "High", according to the earlier definition, or conducted through common equity. It has been confirmed that these interventions did positively influence banks' lending behaviour, and also that local banks were more willing to increase lending after the crisis. However, the point estimate for the marginal effect of a public intervention in local banks is negative, economically small and, in fact, not significant (- 0.010 [0.031]).

A natural question to ask in this context is how the subsamples of local and global banks compare in terms of bank size and, maybe more importantly, with respect to the capital provisions that they have received. As is turns out, the 231 'local' banks in our sample are on average 0.1 bn USD larger than the 66 'global' banks, and the difference is marginally significant with a p-value of 0.083. However, the difference between the amounts of received capital is insignificant, implying that our estimates do not substitute for the size-related effects that were discussed earlier.

In summary, while our results confirm that providing capital to local banks increases their willingness to lend, it challenges the idea that these institutions have a comparable advantage when it comes to contributing to economic recovery. Our data suggests, therefore, that the effect on credit in the US would have been the same without the local lender initiative, provided that an identical amount of capital had been allocated to Investment or Commercial banks. Considering, also, that to date, many of the larger banks have already repaid their obligations towards the Treasury, whereas many smaller banks continue to struggle with their interest payments, we believe that our evidence is testimony of the failure of programs that seek to fuel a real recovery by targeting local banks.

Table 12: Effect of recapitalization - local vs global banks

	(1)	(2)	(3)
	Bailout size	Bailout size	Dummy (High & CE)
Recapitalization*Local		0.007	-0.004
		[0.029]	[0.026]
Recapitalization		-0.005	-0.003
		[0.018]	[0.013]
Recapitalization*Local*Dummy09-10		-0.030	-0.010
		[0.035]	[0.031]
Recapitalization*Dummy09-10		0.027	0.033**
		[0.020]	[0.014]
Local*Dummy09-10	0.034**	0.046**	0.038**
	[0.014]	[0.020]	[0.016]
Dummy09-10	-0.028***	-0.038***	-0.037***
	[0.007]	[0.010]	[0.008]
Local	0.008	0.005	0.007
	[0.020]	[0.026]	[0.023]
Log(Assets/Assets(t-1))	-0.044**	-0.043**	-0.045**
	[0.018]	[0.018]	[0.018]
Country FE	x	x	x
Number of observations	270	270	270
R-squared	0.17	0.18	0.20

Notes: Robust standard errors in parentheses (***), (**), (*) denote statistical significance at the 1%, 5%, and 10% level, respectively. The dependent variable is the year-to-year change in the loan to assets ratio. Loans include all household and corporate loans. Recapitalization in columns (1) - (2) is the amount of capital received scaled by 2006 equity levels, in column (3) recapitalization is a dummy that takes the value one if the bank has either received an injection of common equity or if it had received an injection of an amount of capital above the 75th percentile. Local is a dummy variable that takes the value one for cooperative banks, savings banks, and real estate banks. The sample includes all countries with at least three banks reporting to Bankscope that spent at least two per cent of GDP on recapitalizations during 2008-10. The sample excludes bankruptcies and includes nationalized banks that were also recapitalized. All specifications control for bank specialisation and country fixed effects.

5.2.2. Interbank lending

Up to this point, the analysis has focused on observations at the individual bank level. However, the industry acknowledges that much of the financial crisis' severity was owed to its systemic nature, and that financial linkages played an important role with respect to propagation and amplification. Maybe even more importantly, most of the recapitalization programs were designed precisely with the intention of ring-fencing contagion, and preventing the interbank market from freezing, as well as inducing otherwise sound intermediaries to cut back on lending. Consequently, it is worth investigating to what extent recapitalizations affect other banks in the system, and we will, therefore, provide a first pass on estimating systemic effects in this section.

In order to do so, we define an aggregate recapitalization variable for each bank *i* as the sum of the capital that was received by all other banks from the same country ('Others recapitalization'), and include it as a regressor in addition to a dummy variable that is equal to one if a bank received either "High" or common equity provisions, and

zero otherwise ('Own recapitalization'). Since the interbank market arguably played a crucial role in propagating systemic risks, we now also consider changes of PTL growth for loans between banks. For robustness, we also look at absolute changes in lending.

Results for interbank lending are presented in Table 13, while Table A.5 covers retail lending; in both cases, column (1) reports results for the whole sample, i.e. including non-recapitalized banks.

Table 13: Systemic effects - interbank lending

	All banks	Recapitalized banks
	(1)	(2)
Own Recapitalization	0.009	-0.002
	[0.008]	[0.013]
Others Recapitalization	0.002	0.102
	[0.002]	[0.407]
Own Recapitalization*Dummy0910	-0.004	0.013
	[0.010]	[0.014]
Others Recapitalization*Dummy0910	0.001**	-0.010
	[0.001]	[0.061]
Dummy0910	0.007	-0.001
	[0.006]	[0.013]
Log(Assets/Assets(t-1))	-0.019	0.031*
	[0.013]	[0.017]
Test (A) + (C)=0	0.273	0.342
Test (B) + (D)=0	0.163	0.819
Country FE	x	x
Observ.	1154	257
R-squared	0.04	0.06

Notes: Robust standard errors in parentheses (***), (**), (*) denote statistical significance at the 1%, 5%, and 10% level, respectively. "Own recapitalization" is a dummy that takes the value one if the bank received either a high capital injection or capital in the form of common equity. "High"' injections are injections above the 75th percentile. "Others recapitalization" is the aggregate amount of capital received by other banks in the system. The dependent variable is the year-to-year change in the interbank lending activity, scaled by total assets. Interbank lending is the loans and advances to other banks, scaled by total assets. The sample excludes bankruptcies and includes nationalised banks that were also recapitalized. All specifications include bank specialization dummies and country fixed effects. In column (1) the sample includes non-recapitalized banks.

In particular, the results in Table 13 are as expected. Aggregate recapitalizations are associated with improved interbank lending across all banks; instead, the potentially more constrained (recapitalized) banks exhibit no such effect.

In contrast, the fairly sizeable effect on retail lending of distressed institutions (Table A.5) calls for policymakers' attentions. It suggests that weak banks' willingness to lend is lower the more publicly provided capital is in the system. To our knowledge, concerns about this general equilibrium effect have not been voiced during the policy debate and we are also not aware of any theoretical work that examines this externality in greater

detail. Our intuitive explanation for the detrimental effect is that banks are pressured to improve their capital base in order to appease and retain depositors as their competitors become better capitalized. Since receiving a public capital injection signals that these banks are already constrained, they have to reduce the issuance of new loans in order to meet what may be thought of as 'market-imposed capital constraints'.

Taken at face value, our estimates suggest that policymakers who intend to maintain the flow of credit during crises by providing public capital to distressed banks should not only be concerned with designing the interventions appropriately, and tailoring them to the 'right' recipients, but that they should also be aware of the adverse effects they create by raising the capitalization that depositors demand. With respect to the global nature of our sample, the externality also lends further traction to the call for international policy coordination.

Nonetheless, the evidence is good news with respect to the efforts that saw public recapitalizations as a means to restore interbank activity; when assessing their benefits, the indirect impulse on non-recapitalized banks' lending behaviour should, therefore, be borne in mind.

6. CONCLUSION

During the financial crisis of 2007-2009, governments around the world have, individually, and in coordination with each other, invested substantial resources into the stabilization of a financial system that, if allowed to collapse, threatened to amplify a deep economic recession into a second Great Depression. The design of these interventions drew on experiences that either dated back almost 80 years, or were very specific to particular countries (most notably Japan). With the global financial system on its way to recovery, it is now the time to analyse the success of these programs, identify opportunities for improvement and provide policymakers and regulators alike with guidance on how to prevent, and more importantly, how to resolve future distress at minimal cost.

We are among the first to assemble and analyse comprehensive data that allows for the study of, not only, the date of an intervention, but also its size and the nature of the capital provided.[15]

Providing an initial step towards answering the questions of efficient crisis resolution, this paper then studies the effect of public capital injections on year-to-year changes of banks' propensity to lend. It analyses the role of bank and bailout characteristics, with respect to the banks' ability to promote lending, and thereby identifies those features of recapitalizations that enable the efficient use of public capital.

The analysis suggests that public interventions should be conducted via purchases of common equity and cover at least 49.22% (and on average about 100%) of the recapitalized banks' pre-crisis equity. Furthermore, we reject the hypothesis that locally

[15]Laeven & Valencia (2011) is another study that accounts for intervention size.

operating (Cooperative and Savings) banks are more likely to increase their lending activity in response to a public bailout, and provide evidence showing that aggregate recapitalizations improved interbank, but not retail lending among non-recapitalized banks. Finally, our analysis indicates that practitioners should not allocate resources to large fractions of the banking sector in order to avoid inefficient externalities.

Clearly the paper addresses only one of the many options that policymakers have in order to support a fragile financial sector; and while much has been written on proactive regulation, little information is available to guide these ex post interventions.[16] Yet, with the debate evolving towards structured resolution mechanisms, this information becomes essential. As has been pointed out, the data contains more detail than has been processed in this paper, and the effect on credit is only one of many and relevant variables to study. Of interest for future research are certainly also the role of public recapitalizations on profitability, dividend payments, asset prices and interest rate spreads.

Finally, the paper also provides guidance for future theoretical efforts: For instance, it suggests paying close attention to the theory of Diamond (2001) and to the analysis of the non-linear and adverse incentive effects caused by public capital injections. Moreover, it calls for a more satisfactory explanation of the beneficial role that common equity injections have played and, as pointed out previously, asks for a thorough theoretical examination of the adverse effects of aggregate capital on recapitalized banks' retail lending. More work along these lines is clearly required for future scholarship.

[16] For instance, there is no empirical work that assesses the relative effectiveness of direct recapitalizations of the type examined in this paper as opposed to indirect recapitalizations via the interest rate spread as discussed for example in Leijonhufvud (2011).

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APPENDIX

Table A.1: Determinants of recapitalization quality

	Ordered Logit	
	(1)	(2)
	Full Sample	Exclude US banks
Tier1 Capital	-0.184***	-0.297***
	[0.059]	[0.099]
Liquidity	-4.126**	-4.165**
	[1.634]	[1.931]
Loan/Deposits	-0.015	-0.012
	[0.016]	[0.015]
Provisions	-77.604	-114.021
	[96.703]	[150.861]
Non-performing loans	21.406	29.301*
	[13.618]	[16.869]
Ln(total assets)	26.397**	36.712***
	[10.492]	[13.626]
Investment banks	1.543	1.879
	[1.863]	[1.662]
Cooperative banks	0.219	0.482
	[0.906]	[0.916]
Real estate banks	-1.172	-0.777
	[0.896]	[0.952]
Savings banks	1.174**	1.784***
	[0.497]	[0.607]
Country FE	x	x
Number of banks	392	298
Pseudo R-squared	0.20	0.22

Notes: Robust standard errors in parentheses (***), (**), (*) denote statistical significance at the 1%, 5%, and 10% level, respectively. This table reports estimates of the effect of 2006 bank characteristics on recapitalizations. In columns (1) & (2) the dependent variable takes the value zero if the bank was not recapitalized, the value one if the bank received Tier2 capital (such as subordinated debt), two if the bank received preferred shares, and three if the bank received common equity. The specification includes indicators of financial strength, bank specialization dummies, and country fixed effects. Tier1 is the Tier1 risk-weighted capital ratio. Liquidity includes liquid assets including government bonds, loans and advances with maturities of less than three months. Deposits are aggregate (savings and demand) customer deposits. Provisions are loan loss provisions over total assets. The value of non-performing loans is scaled by total gross loans.

Table A.2: Determinants of recapitalization - additional explanatory variables

	Tobit E(V./)			
	Full sample			
	(1)	(2)	(3)	(4)
Tier1 Capital	-0.057***	-0.059***	-0.056***	-0.064***
	[0.018]	[0.018]	[0.018]	[0.019]
Liquidity	-1.585**	-1.311**	-1.561**	-1.482**
	[0.617]	[0.637]	[0.630]	[0.618]
Loan/Deposits	-0.004	-0.020	-0.003	-0.005
	[0.014]	[0.032]	[0.010]	[0.017]
Provisions	9.834	3.130	5.972	0.647
	[20.882]	[20.973]	[20.651]	[20.241]
Non-performing loans	4.461	4.162	3.885	6.466
	[3.956]	[3.950]	[3.919]	[4.109]
Ln(total assets)	6.315*	4.699	6.914*	5.043
	[3.725]	[3.956]	[3.771]	[3.725]
Investment banks	0.434	0.323	0.498	0.473
	[0.426]	[0.442]	[0.455]	[0.437]
Cooperative banks	0.100	0.146	0.092	0.171
	[0.298]	[0.304]	[0.296]	[0.302]
Real estate banks	-0.522	-0.616*	-0.564*	-0.558*
	[0.337]	[0.337]	[0.338]	[0.331]
Savings banks	0.012	0.022	-0.015	0.064
	[0.231]	[0.241]	[0.235]	[0.230]
Return on assets	0.084			
	[0.093]			
Long term funding		0.008		
		[0.005]		
Non-deposit funding			-0.002	
			[0.004]	
Overhead costs				-0.107*
				[0.061]
Country FE	x	x	x	x
Number of banks	392	383	392	392
Pseudo R-squared	0.24	0.24	0.24	0.25

Notes: Robust standard errors in parentheses (***), (**), (*) denote statistical significance at the 1%, 5%, and 10% level, respectively. See Table 1 for a definition of all explanatory variables. The dependent variable is the size of the recapitalization received by a bank in proportion to 2006 equity levels. Tobit estimates are reported. For further descriptions see also notes to Table 5.

Table A.3: Controlling for changes in loan demand (country*year fixed effects)

	(1)	(2)	(3)	(4)
	Bailout size	Bailout dummy	Bailout dummy	Bailout dummy
Recapitalization	-0.002			
	[0.007]			
High		-0.005	-0.008	-0.004
		[0.009]	[0.012]	[0.009]
Medium			-0.004	
			[0.009]	
Low				0.004
				[0.009]
Recapitalization*Dummy0910	0.015			
	[0.011]			
	(0.203)			
High*Dummy0910		0.022*	0.030**	0.020*
		[0.010]	[0.014]	[0.010]
		(0.030)	(0.023)	(0.033)
Medium*Dummy0910			0.011	
			[0.007]	
			(0.199)	
Low*Dummy0910				-0.011
				[0.007]
				(0.199)
Dummy0910	-0.019	-0.019***	-0.027***	0.028***
	[0.011]	[0.006]	[0.008]	[0.006]
Log(Assets/Assets(t-1))	-0.046	-0.044	-0.043	-0.043
	[0.026]	[0.027]	[0.027]	[0.027]
Country*Year FE	x	x	x	x
Observ.	270	270	270	270
R-squared	0.20	0.20	0.21	0.21

Notes: Robust standard errors in parentheses (***), (**), (*) denote statistical significance at the 1%, 5%, and 10% level, respectively. This table expands the baseline specification with country*year fixed effects to control for (country specific) changes in credit demand. The dependent variable is the year-to-year change in the loan to assets ratio. Loans include all household and corporate loans. Recapitalization is the amount of capital received scaled by 2006 equity levels. In columns (2) to (4) we split the sample of recapitalized banks into three groups: (1) High injection (>75th percentile), (2) Medium injection (>25th percentile & < 75th percentile), (3) Low injection (<25th percentile). Dummy0910 is a post recapitalization dummy. The sample includes all countries with at least three recapitalized banks reporting to Bankscope that spent at least two per cent of GDP on recapitalizations in 2008-10. The sample excludes bankruptcies and includes nationalized banks. All specifications control for bank specialisation and country fixed effects. In brackets we report robust standard errors and in parentheses the p-values for the significance of the total effect.

Table A.4: Controlling for sample selection

	(1)	(2)	(3)	(4)
	Bailout size	Bailout dummy	Bailout dummy	Bailout dummy
Recapitalization	-0.003			
	[0.014]			
High		-0.004	-0.007	-0.010
		[0.009]	[0.015]	[0.010]
Medium			0.003	-0.003
			[0.011]	[0.011]
Low				
Recapitalization*Dummy0910	0.019			
	[0.016]			
	(0.572)			
High*Dummy0910		0.024**	0.027	0.028***
		[0.010]	[0.017]	[0.008]
		(0.136)		(0.157)
Medium*Dummy0910			-0.001	
			[0.014]	
			(0.859)	
Low*Dummy0910				0.001
				[0.014]
				(0.859)
Dummy0910	-0.029*	-0.018**	-0.026	-0.027**
	[0.014]	[0.006]	[0.017]	[0.009]
Log(Assets/Assets(t-1))	-0.036	-0.042	-0.033	-0.033
	[0.031]	[0.028]	[0.032]	[0.032]
Tobit residual	0.002	-0.002	0.002	0.002
	[0.007]	[0.007]	[0.006]	[0.006]
Country FE	x	x	x	x
Observ.	262	262	262	262
R-squared	0.16	0.21	0.17	0.17

Notes: Robust standard errors in parentheses (***), (**), (*) denote statistical significance at the 1%, 5%, and 10% level, respectively. This table reports a specification similar to Table 7, augmented to correct for sample selection, essentially by including the residual from a first-stage Tobit regression, which predicts the amount of capital injected as a function of the pre-crisis bank characteristics (see Table 5). The dependent variable is the year-to-year change in the loan to assets ratio. Loans include all household and corporate loans. Recapitalization is the amount of capital received, scaled by 2006 equity levels. In columns (2) to (4) we split the sample of recapitalized banks into three groups: (1) High injection (>75th percentile); (2) Medium injection (>25th percentile & < 75th percentile); (3) Low injection (<25th percentile). Dummy0910 is a post-recapitalization dummy. The sample includes all countries with at least three recapitalized banks reporting to Bankscope that spent at least two per cent of GDP on recapitalizations in 2008-10. The sample excludes bankruptcies and includes nationalized banks. All specifications control for bank specialisation and country fixed effects. In brackets we report robust standard errors and in parentheses the p-values for the significance of the total effect.

Table A.5: Systemic effects - retail lending

	All banks	Recapitalized banks
	(1)	(2)
Own Recapitalization	0.011	-0.002
	[0.009]	[0.015]
Others Recapitalization	0.003	0.443
	[0.010]	[0.473]
Own Recapitalization*Dummy0910	-0.009	0.021
	[0.011]	[0.016]
Others Recapitalization*Dummy0910	-0.001	-0.257***
	[0.001]	[0.069]
Dummy0910	-0.009***	0.017
	[0.003]	[0.015]
Log(Assets/Assets(t-1))	-0.042***	-0.049***
	[0.008]	[0.018]
Test (A) + (C)=0	0.745	0.134
Test (B) + (D)=0	0.778	0.693
Country FE	x	x
Observ.	1189	270
R-squared	0.08	0.20

Notes: Robust standard errors in parentheses (***), (**), (*) denote statistical significance at the 1%, 5%, and 10% level, respectively. "Own recapitalization" is a dummy that takes value one if the bank received either a high capital injection or capital in the form of common equity. High injections are injections above the 75th percentile. "Others recapitalization" is the aggregate amount of capital received by other banks in the system. The dependent variable in the year-to-year change in the retail loans to assets ratio. Retail loans include all household and corporate loans. The sample excludes bankruptcies and includes nationalised banks that were also recapitalized. All specifications include bank specialization dummies and country fixed effects. In column (1) the sample includes non-recapitalized banks.