Kicking the can down the road: government interventions in the European banking sector

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Abstract

Building on a novel and comprehensive dataset of all government interventions in the eurozone banking sector, we analyze the implications of government interventions in the European banking sector during the 2007 to 2009 financial crisis for the subsequent sovereign debt crisis. We find that governments with weaker public finances were more reluctant to recapitalize distressed banks during the financial crisis of 2007 to 2009. Insufficient recapitalizations of distressed banks had significant negative consequences for financial stability and real sector lending as weak banks remained vulnerable to future shocks, increased their risk-taking and did not write down defaulted loans by evergreening loans to "zombie" borrowers.

Keywords: regulatory forbearance; evergreening; zombie lending; sovereign debt crisis; bank recapitalization; fiscal constraints; political economy

JEL: E44, G21, G28, G32, G34

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1. Introduction

It can be optimal for a government to bail out a distressed bank if its failure poses a systemic risk to the economy. However, financing such an intervention is costly, at least in the short run, as it requires the issuance of additional government debt, funded by future tax proceeds with attendant distortions and uncertainties. In turn, the ability of a government to intervene in the banking sector is intimately linked to the fiscal capacity of the sovereign as it determines the amount of debt it can raise for bailouts (Acharya *et al.*, 2014). In particular, when a government itself faces a severe debt overhang, raising additional funds for bank bailouts becomes increasingly costly as new debt can only be issued at the expense of the sovereign's creditworthiness.[1]

Facing such fiscal constraints, regulatory forbearance and postponing costly capital injections become increasingly attractive for the sovereign—implemented by issuing rolling guarantees, by injecting just enough capital to ward off immediate insolvency, or by allowing banks to hide sustained losses. The government trades off its short-term debt sustainability against financial stability. A recapitalization resolves the bank's distress but reduces the sovereign's creditworthiness; regulatory forbearance, in contrast, is costless in the short-term, but risks even more detrimental disruptions to financial intermediation and public finances in the future as the banking sector's debt overhang remains unresolved and its vulnerability to further shocks is elevated. Consequently, governments may choose regulatory forbearance over recapitalizations if the sovereign debt overhang is severe and there is at least some probability that the distressed banks will recover without further government support. This strategy of a fiscally constrained government

[1] This is in part due to the Laffer curve property of tax revenues, as the extent of additional tax revenues through tax increases is limited by the underinvestment problem in the taxed non-financial sector. When the sovereign debt level becomes sufficiently high, there are no possible further tax proceeds that could be pledged for the additional debt, making the dilution of existing sovereign debt holders and the sacrifice of creditworthiness the only option for the sovereign (Acharya *et al.* (2014)).

is akin to "gambling for resurrection", with the sovereign placing a bet on the banking sector's survival.

In this paper, we investigate the implications of regulatory forbearance in the context of the European financial crisis that started in 2007 and the sovereign debt crisis that followed from 2010. The sovereign debt crisis, in particular, was characterized by an accelerating deterioration of the balance sheets of both banks and sovereigns, with banks' and sovereigns' insolvency mutually reinforcing one another in a "diabolic loop" (Mody and Sandri, 2012; Acharya *et al.*, 2014; Cooper and Nikolov, 2017; Farhi and Tirole, forthcoming). Acharya and Steffen (2015), for example, show that undercapitalized European banks engaged in carry-trade behavior by investing in risky sovereign debt, which eventually inflicted large losses on these banks. Banks with significant exposure to sovereign credit risk also reduced credit supply and tightened lending conditions (Popov and van Horen, 2015; Bofondi *et al.*, 2017) with adverse implications for investment, job creation and sales growth (Acharya *et al.*, 2018a).

Our primary objective is to understand whether regulatory forbearance in the European banking sector during the financial crisis of 2007 to 2009 sowed the seeds for the subsequent amplification of banking-sector distress during the European sovereign debt crisis. More specifically, we ask whether the deterioration of bank balance sheets and the behavior of undercapitalized banks during the sovereign debt crisis were a consequence of delayed or insufficient recapitalizations of severely distressed banks in the preceding financial crisis. To the best of our knowledge, this is the first paper asking this question.

Our analysis builds on a novel, hand-collected dataset of all aid measures granted to eurozone banks during the 2007 to 2012 period. The European financial crisis provides the perfect laboratory to investigate the consequences of regulatory forbearance. Fiscal capacities of governments to support failing banks varied widely across the eurozone. The early 2000s had been

characterized by the surge of foreign capital flows into the eurozone peripheral countries (i.e., Greece, Ireland, Italy, Portugal and Spain (GIIPS)), fueling private and/or public credit booms, as illustrated by the increasing dispersion of current account balances in Table 1.[2]

Our preferred measure of sovereign fiscal constraints is the current account balance, i.e., the current account surplus/deficit. If a country is not borrowing from abroad (and c.p. has a current account surplus), it is not at risk of becoming constrained as it can engage in financial depression to secure its funding, e.g. through an increase in domestic taxes. However, if a country is borrowing from abroad on a net basis, it is subject to market discipline and possible reversal of capital flows ("sudden stops") when foreign investors become unwilling to roll over their funds. Sudden stops have detrimental effects on future tax income through output contractions, increases in unemployment and asset price declines (Freund and Warnock, 2007). In other words, fiscal constraints become binding when a country is borrowing from abroad.

Indeed, in the eurozone periphery, the reversal of capital flows resulted in significant private sector capital outflows and a halt in construction activity. For some peripheral countries, the pool of potential buyers of sovereign debt was also reduced, as was the case for Greece, Ireland and Portugal, which had financed a considerable part of their public debt through foreign funds (Lane (2012); Chen *et al.* (2013)).

[Table 1 about here]

Almost all eurozone banking sectors exhibited serious distress during the financial crisis due to direct exposure to the U.S. financial crisis or the bursting of domestic housing bubbles. In the absence of an orderly bank resolution mechanism, almost all of these distressed banks received some kind of support measure (such as recapitalizations, liquidity support, or troubled asset relief

[2] See, e.g., Lane (2012), for a review on the relation between pre-crisis macroeconomic and financial imbalances and the European sovereign debt crisis.

measures), instead of being dissolved. Crucially, the timing, type and scope of government interventions was entirely determined by the domestic government's fiscal capacity as the European Monetary Union (EMU) had not been accompanied by a banking union or a fiscal union and the "no bailout clause" in the European Treaties prohibits bailouts of European Union (EU) sovereigns (Article 125 TFEU). Indeed, Figure 1 shows that interventions exhibit considerable cross-sectional variation during the financial crisis: the ratio of recapitalizations to liquidity support is considerably lower in countries with a high current account deficit (e.g., GIIPS) than in those with a low current account deficit (non-GIIPS). This suggests that regulatory forbearance due to limited fiscal capacity may have played an important role during the financial crisis.

[Figure 1 about here]

Regulatory forbearance can contribute to banks' vulnerability through different channels. Delaying necessary government interventions leaves the banking sector vulnerable to future shocks as distressed banks have low capital buffers to meet additional losses. In addition, the unresolved debt overhang may cause distressed banks to underinvest (Myers, 1977; Philippon and Schnabl, 2013) or become riskier because banks—akin to their forbearing governments—start to gamble for resurrection and increase their risk-taking (Jensen and Meckling, 1976; Diamond, 2001). To avoid insolvency, banks may also postpone writing off legacy assets and evergreen bad loans, crowding out lending to healthy borrowers (Peek and Rosengren, 2005; Giannetti and Simonov, 2013; Acharya *et al.*, 2018b; Blattner *et al.*, 2018).

Our first main result is that governments with weaker public finances delayed recapitalizations of distressed banks during the 2007 to 2009 period. Analyzing the delay until the first intervention for a distressed bank, we show that banks located in countries with lower fiscal capacity were at least as likely to receive government support as banks located in countries with

stronger public finances.[3] However, consistent with the hypothesis that capital injections are costly, fiscally constrained governments delayed capital injections and waited significantly longer than fiscally stronger countries to recapitalize distressed banks. The effect is economically significant. The hazard rate for a recapitalization—the rate for a recapitalization conditional upon no recapitalization up to that point—decreases by about 30 percent when the sovereign's current account deficit increases by 1 percentage point. Also, for banks that eventually obtained government support, the recapitalization amount relative to total assets was significantly lower in countries with lower fiscal capacity. We include a vector of bank characteristics such as the exposure to short-term debt and argue that the government's decision to provide liquidity guarantees is not a response to liquidity withdrawals of short-term investors from some banks. In fact, governments are more likely to inject capital into banks that have high short-term debt exposure, e.g., to stabilize funding flows with a larger capital buffer.

Our second main result is that insufficient government support during the 2007 to 2009 period made banks more vulnerable to subsequent shocks. We measure the sufficiency of government support as the extent to which government interventions were successful in stabilizing bank health relative to pre-crisis levels. More specifically, we identify changes in bank health between 2007 and 2009 as changes in a bank's hazard rate to require a recapitalization during that time period. In order to capture a bank's propensity to require a recapitalization that is orthogonal to the domestic government's bailout capacity, we remove macro-level factors that capture the fiscal capacity of the domestic sovereign from the hazard rate. We find that banks that were insufficiently stabilized during the 2007 to 2009 period experienced a significant drop in their equity-to-asset ratio in the post-2009 period. They also had lower Tier 1 ratios, higher loan loss

[3] Duration analysis is widely used to analyze bank failures and/or government interventions in the banking sector (see, e.g. Lane *et al.* (1986); Whalen (1991), Brown and Dinç (2005, 2011)). In particular, it has been shown to be superior to single-period models for forecasting the occurrence of events such as bankruptcy (Shambaugh *et al.* (2012)).

provisions and non-performing loans, and lower return on assets relative to stronger banks. Furthermore, insufficiently stabilized banks were more likely to require additional recapitalizations.

We then investigate the drivers of the poor performance of insufficiently stabilized banks vis-à-vis other banks in the post-2009 period. Our third main result is that the deterioration of the health of banks with insufficient government support during the 2007 to 2009 period is consistent with the behavior of banks that results from distorted incentives arising from a debt overhang problem. We do not document a causal effect of bank capital on lending in this section but show that banks that are left severely undercapitalized during the 2007 to 2009 period make poor lending decisions in this period.[4] Specifically, we show that banks that obtain government support generally decrease their lending activity in the syndicated loan market over the 2007 to 2009 period; however, insufficiently stabilized banks are less likely to reduce their lending. We find that this result is driven by weak banks that issue loans to high-risk borrowers and do not cut lending to zombie firms so as to avoid the recognition of loan losses and the erosion of bank capital.

Overall, our results shed new light on the emergence of the sovereign-bank doom loop. Adding to the view that large bailouts threaten sovereign creditworthiness and may thereby trigger a negative feedback loop between sovereigns and banks (Acharya *et al.*, 2014), we show that *insufficient* bailouts can have the same—and even worse—effects. Because bailouts reduce governments' creditworthiness, constrained eurozone governments delayed capital interventions, trading off long-term financial stability against short-term debt sustainability. However, as weak banks are not dissolved, weak governments are simply "kicking the can down the road": they are taking the risk of (i) additional disruptions to the future provision of financial services, and (ii)

[4] Other papers that have documented the causal effect of (the lack of) bank capital on lending in different settings include e.g. Acharya *et al.* (2018a, b).

having to provide even larger recapitalizations in the future, should banking-sector health deteriorate even further. Thus, governments tie their future intimately to the survival of the—ex ante insufficiently—stabilized financial sector.

The remainder of the paper is organized as follows. Section 2 discusses the related literature. Section 3 introduces the dataset, focusing especially on the novel, hand-collected dataset comprising all government interventions benefiting eurozone banks over the 2007 to 2012 period. Section 4 presents empirical evidence on regulatory forbearance in the European banking sector during the financial crisis from 2007 to 2009. Section 5 examines the long-term implications of insufficient government interventions on indicators for bank health from 2010 onwards. Section 6 provides empirical evidence on the implications of insufficient aid to weak banks on these banks' incentives. Section 7 concludes.

2. Related literature

Our paper contributes to different strands of literature. First, it relates to the long literature on regulatory forbearance that dates back to at least the 1980s and the discussion of "zombie thrifts" in the U.S. by Edward Kane and other authors, showing that regulatory forbearance is not a new phenomenon but one that has played out over decades (see, e.g., Kane, 1989, and references therein). More recent research in this area focuses on the drivers of regulatory forbearance, e.g. why governments do not intervene in the banking sector, even though it would be optimal from a general welfare perspective. Governments postpone the resolution of distressed banks if there are many weak banks in the banking sector (Acharya and Yorulmazer, 2007a, 2007b; Kroszner and Strahan, 1996; Hoshi and Kashyap, 2001; Brown and Dinç, 2011) or for political economy reasons, such as timing in electoral cycles (Brown and Dinç, 2005; Imai, 2009; Bian *et al.*, 2017). Our paper highlights fiscal capacity as an additional driver behind regulatory forbearance. We show that

governments are more likely to postpone recapitalizations if they are fiscally constrained. Moreover, and in addition to most of the previous literature, we also investigate the implications of regulatory forbearance. Gropp *et al.* (2018) show that regulatory forbearance in the U.S.—due to the Federal Deposit Insurance Corporation's (FDIC) decision not to let banks fail—affects growth and employment in some regions; we show that a sovereign's debt overhang can significantly impede a banking sector's recovery after a financial crisis, as fiscal constraints limit the government's capacity to provide bailouts focusing on financial stability, loan supply and bank incentives in the Euro area.

More broadly, our paper adds to the growing literature investigating the cost-benefit trade-offs involved in government interventions in the banking sector. The main benefit is that bailouts help alleviate negative externalities from failing or severely undercapitalized banks, such as reduced lending to viable borrowers (Diamond, 2001). Costs mainly comprise large fiscal outlays (Acharya *et al.*, 2014) and moral hazard arising from bailout expectations (Majlath and Mester, 1994; Dam and Koetter, 2012; Fischer *et al.*, 2014).[5] Several papers analyze this trade-off during the recent financial crisis, focusing predominantly on the Capital Purchase Program (CPP) in the United States (Veronesi and Zingales, 2010; Bayazitova and Shivdasani, 2012; Li, 2013; Duchin and Sosyura, 2014; Berger *et al.*, forthcoming; Black and Hazelwood, 2016). Evidence from the U.S. suggests that recapitalizations stabilized lending, but also increased lending to riskier borrowers. In contrast, we investigate government interventions during the European financial and sovereign debt crisis.[6] Homar and van Wijnbergen (2017) show that timely bank recapitalizations reduce the duration of recessions using an international sample of banking crises. We provide new

[5] While most theoretical and empirical papers highlight the negative incentives arising from government interventions associated with decreased investor monitoring, some authors highlight that bailouts may also lower moral hazard as government guarantees increase the charter value of banks (Keeley (1990); Cordella and Yeyati (2003)).

[6] Homar (2016) investigates the benefits of bank recapitalizations for publicly traded banks, highlighting that recapitalizations need to be large enough, but does not investigate the costs of interventions.

evidence that government interventions need to be large enough to overcome banks' debt overhang to allow banks to recognize legacy assets and restart lending, a theme reminiscent of the work of Diamond, 2001, Giannetti and Simonov, 2013 and Brei *et al.*, 2013.

We also contribute to the broader literature on sovereign debt capacity going back to Bulow and Rogoff (1989a), Bulow and Rogoff (1989b) and Eaton and Gersovitz (1981). Recently, an increasing body of literature has emphasized that governments use their domestic financial sectors as commitment devices to expand their debt capacity since a sovereign default would have detrimental effects on the domestic financial sector, e.g., through the loss in value of government guarantees and/or the sector's exposure to domestic sovereign debt (Broner *et al.*, 2008; Acharya and Rajan, 2013). Crosignani (2017), among others, highlights that governments may deliberately keep their banking sector undercapitalized to induce banks to buy domestic sovereign debt. Our results suggest that governments may sacrifice financial stability to ensure debt sustainability: governments may not fully recapitalize their banking sector because the costs from losing their creditworthiness might be higher than the possible benefits of a bailout.

Finally, our paper relates to the literature on the role of bank capital, particularly during financial crises. Berger and Bouwman (2013) document the importance of capital for banks, particularly medium and large banks, during crises. Several studies document that higher capital was associated with lower probability of failure during the 1990 credit crunch (Cole and Gunther, 1995; Estrella *et al.*, 2000; Wheelock and Wilson, 2000) and during the 2008–2009 financial crisis (e.g., Cole and White, 2012; Berger *et al.*, 2016). Beltratti and Stulz (2012) find that bank capital is key to understand bank performance during the subprime crisis and Fahlenbrach *et al.* (2012) show that poorly capitalized banks during the Russian debt crisis also performed poorly during the subprime mortgage crisis. We show that banks that were left undercapitalized during the subprime

crisis were more likely to receive government support, become insolvent and they performed worse during the sovereign debt crisis.

3. Data

3.1. Government interventions

3.1.1. Sample construction

This paper builds on a novel, hand-collected dataset comprising all government interventions for eurozone banks over the 2007 to 2012 period. Our primary data source is the State aid Register of the European Commission (EC), which contains detailed information on government interventions in the European banking sector. The Treaty on the Functioning of the European Union (TFEU) generally prohibits government support to individual companies but government support can be admissible in exceptional cases, such as to "remedy a serious disturbance in the economy of a Member State" (TFEU Article 107(3.b)). Any such exception must be reviewed and approved by the EC on a case-by-case basis and is documented in the State aid Register.

While the State aid Register collects government interventions in the entire EU, we restrict our sample to eurozone banks. We thereby ensure that all banks in our sample could principally access the extensive standard and non-standard monetary policy measures implemented by the European Central Bank (ECB) since 2007. By excluding non-eurozone banks from the sample we avoid confounding the effects of extraordinary monetary policy measures with those of government interventions. In particular, a number of ECB measures were akin to liquidity support.[7] We also exclude Cypriot banks from our sample given the extraordinary dependence of the Cypriot banking sector on foreign funding sources.

[7] These include, for example, the supplementary long-term refinancing operations.

We start building our database by manually extracting information from all State aid cases listed in European Commission (2017) for the 2007 to 2012 period.[8] Government support can be approved for one of two cases: (i) as an ad hoc support measure to an individual bank, or (ii) as a sector-wide scheme making available a maximal amount for a certain aid measure and being accessible to eligible banks. Table A1 in the Appendix provides an example excerpt from this list for the case of Austria. Table A2 in the Appendix provides an excerpt from a State aid case for the recapitalization of the Austrian bank Hypo Tirol.

For reasons of confidentiality, not all details of government support measures are made available in the State aid Register. Also, decisions on sector-wide schemes do not contain information on individual beneficiaries. Therefore, when necessary, we augment the data with information from banks' press releases, information from banks' regular reporting activities, regulators' and central banks' reports and newspaper articles. For every State aid case number, we further cross-check whether approved intervention measures were indeed implemented.

Similar to Laeven and Valencia (2008), we classify government support into four categories: (1) recapitalizations, (2) guarantees, (3) other liquidity support and (4) troubled asset relief.[9] Recapitalizations comprise all measures involving government-funded capital increases and conversions of existing capital or hybrid instruments into higher-order capital instruments.[10] Guarantees comprise all government guarantees on non-deposit liabilities, including both existing and newly issued liabilities. Other liquidity support comprises all interventions other than guarantees that are targeted at stabilizing a bank's liquidity.[11] Finally, troubled asset relief are

[8] http://ec.europa.eu/competition/state_aid/register

[9] We exclude all policies that were not put into use during the financial crisis, such as deposit freezes. We also exclude sector-wide policies such as changes in sector-wide deposit guarantees, which simultaneously benefited all banks in a country.

[10] Banks can be recapitalized using cash, ordinary shares, other Core Tier 1 capital instruments, preferred shares, silent participations, hybrid capital instruments, commitment letters and rights issues.

[11] Our definition of liquidity support differs from the one employed in Laeven and Valencia (2008), where liquidity support indicates liquidity support from the central bank.

government interventions targeted at removing impaired or defaulted assets from a bank's balance sheets by means of asset sales or guarantees.

For most cases, government interventions can be unambiguously assigned to one of the above aid categories. For some cases, however, the measure provided by the state authority does not coincide with the measure received by the bank. In case N 214/2008 in Table A2 of the Appendix, for example, Hypo Tirol bank raises €100 million. in Core Tier 1 capital (*Partizipationskapital*) from private investors with the issuance guaranteed by the Austrian state of Tirol. In such ambiguous cases, we base our classification on the measure ultimately benefiting the supported bank—in this case a recapitalization in the amount of €100 million.

For each type of intervention, our database collects a wide range of characteristics including the identity of the beneficiary, the intervention amount, the specific design of the measure, its remuneration and possible conditions for the beneficiary. We also collect the announcement date (when available), the implementation date, the approval date by the EC and whether the intervention was granted as part of a sector-wide intervention scheme. This study uses a subset of characteristics, which are introduced subsequently. Table A3 of the Appendix provides a detailed overview of all information available in our dataset, which can be made available upon request.

3.1.2. Summary statistics

Governments had considerable leeway in choosing the type and scope of intervention during the financial crisis as the EC was generally very permissive towards support measures: until the end of 2009, the EC approved 66 out of 67 temporary sector-wide aid schemes without objections and did not raise objections against 75 out of 81 individual aid cases. Only from 2010 onwards, were standards for government support in the eurozone considerably tightened, most notably as a result of stricter State aid rules and restrictions in context of the "Economic Adjustment Programmes" for Ireland, Greece and Portugal.

Table 2 provides summary statistics on intervention measures and and banks' balance sheet characteristics.[12] We split the sample into the 2007 to 2009 (financial crisis) period and the 2010 to 2012 (sovereign debt crisis) period. We also split the sample into GIIPS versus non-GIIPS countries, since GIIPS countries were vulnerable to sudden stops due to large current account deficits and were therefore more fiscally constrained in supporting the domestic banking sector during the financial crisis.

[Table 2 about here]

The summary statistics provide first evidence that—while having a similar propensity to provide liquidity support—fiscally constrained governments were less likely to recapitalize distressed banks during the financial crisis. Of all banks in our sample, 8 percent (92 banks) obtained government support during the financial crisis to December 2009. 62 of these banks—who received a total of 204 government interventions—were from GIIPS countries.[13] While this suggests considerable distress of the banking sectors in these countries, the number of recapitalizations is low: only 17 of these banks were recapitalized.

In contrast, the number of non-GIIPS banks that received government support is lower (30 banks), but almost all of these banks obtained at least one recapitalization (24 banks). Non-GIIPS banks were also more likely to obtain follow-up recapitalizations (42 measures per 24 banks), while GIIPS banks mainly received only one recapitalization (20 measures per 17 banks). Similarly, only two troubled asset relief measures were implemented for two GIIPS banks until 2009, whereas in non-GIIPS countries, 18 troubled asset relief measures were implemented for ten banks.[14]

[12] For each variable, the corresponding Bankscope ID is provided in Table A4 of the Appendix.
[13] The largest share of interventions was granted to Spanish banks (38 banks).
[14] Naturally, the descriptive evidence does consider the bank-level distress that makes a government intervention necessary. We explicitly control for bank-level determinants of government interventions in our empirical analysis in Section 3.

The descriptive evidence furthermore suggests that government interventions during the 2007 to 2009 period may have been insufficient for stabilizing the European banking sector in the long run, especially in the periphery. During the sovereign debt crisis, a total of 117 banks obtained first or follow-up support. The majority of these banks (103 banks) were located in GIIPS countries. 29 GIIPS banks obtained at least one recapitalization and 16 GIIPS banks obtained troubled asset relief measures. In the subsequent analysis, we subsume "guarantees" and "other liquidity support" under the measure "liquidity support".

3.2. Bank-level and macro-level data

3.2.1. Sample construction

We obtain bank-level financial data for the 2007 to 2012 period from the Bureau van Dijk (BvD) Bankscope database. Consistent with the literature (e.g., Sufi, 2007), all information is aggregated to the ultimate parent level using shareholder information from Bankscope and various other sources. The sample of banks is constructed as follows. We remove all banks that receive a government intervention but cannot be matched with Bankscope. We also drop banks whose ultimate parent is not incorporated in a eurozone country as the propensity of a bailout for these banks likely depends on the parent's home country. The dataset is further constrained to large banks and those of domestic importance—those whose failure creates a threat of financial contagion or has a large negative impact on the domestic economy. That is, we keep banks with a market share larger than 1 percent (measured in bank size/size of the national banking sector), with size of at least 10 percent of GDP, balance sheets larger than €1 billion, or banks that are among the 5 largest banks in the country.

We also exclude banks with very high Tier 1 ratios (> 30 percent) or equity-to-assets ratios (> 20 percent).[15] These steps reduce the overall number of banks in the sample from 4,704 to 1,206. The number of banks that receive a government intervention, however, drops only from 177 to 149. Hence, we are confident that we account for the majority of banks with government interventions, while limiting the sample to a reasonable control group. Finally, we augment our data with country-level variables including nominal GDP, current account balances and budget balances from Eurostat.

3.2.2. Summary statistics

Cross-sectional summary statistics for bank-level variables are shown in Panel A of Table 3 for the baseline year 2007. Banks show considerable variation in their overall condition prior to the financial crisis. For example, the equity-to-assets ratio (*Equity/TA*) has a cross-sectional mean of 6.51 percent with a standard deviation of 2.75 percent. There is considerable variation also in other variables, such as loan loss provisions (*LLP/Loans*) and non-performing loans (*NPL/Loans*). Cross-sectional summary statistics for macro-level variables in 2007 are shown in Panel B of Table 3. The variation in current account balances is striking: it ranges from a current account deficit of -14.0 percent to a current account surplus of 9.9 percent.

[Table 3 about here]

3.3. Loan-level and firm-level data

We obtain loan-level data from the Thomson Reuters LPC DealScan database, which provides detailed information on European syndicated loans and comprises information on lenders as well as loan contract terms. We collect information on all loan issuances by eurozone banks to non-

[15] We explicitly decide to drop these banks. If we winsorized our dataset, we would also remove the banks with the very worst capital levels, which are the focus of this study.

financial firms incorporated in European countries. For banks to be included in the sample, we follow the previous literature (e.g., Ivashina, 2009; Heider *et al.*, 2017) and require that banks must serve as lead arranger in the syndicate. Following Ivashina (2009), a bank is classified as lead arranger if it has any one of the following lender roles in DealScan: administrative agent, bookrunner, lead arranger, lead bank, lead manager, agent or arranger.[16] If the loan allocation between syndicate members is unknown, we divide the loan facility equally among syndicate members. Also following the previous literature (e.g., Acharya *et al.*, 2018a; Gropp *et al.*, forthcoming), we transform the data and calculate the annual outstanding exposure of bank *b* in country *c* to firm *j,* using the maturity information on each loan at the end of each year.

We hand-match DealScan lenders to Bankscope at the ultimate parent level and remove all lenders that cannot be matched to the Bankscope-intervention dataset. To obtain detailed information on the borrowers, we also match DealScan borrowers in our sample to firms in the Amadeus database. The final loan-level sample comprises 228 banks that arrange loans to 13,791 non-financial firms, of which 2,279 can be matched to Amadeus.[17]

4. Do weak governments delay interventions?

Governments may postpone recapitalizations by issuing rolling guarantees, by injecting just enough capital to avoid immediate insolvency, or by allowing banks to hide sustained losses. This section investigates the determinants behind governments' decisions not to resolve a bank's debt overhang immediately, but to practice regulatory forbearance.

[16] The subsequent results are robust to extending the sample of lead arrangers to match the definition in Heider *et al.* (2017). In this case, lead banks comprise all banks that provide 100% of a given loan or act as lead bank, lead manager, (mandated) lead arranger, joint arranger, co-lead arranger, co-arranger, coordinating arranger, mandated arranger, (administrative) agent, or bookrunner.

[17] Possible differences in the number of lead arrangers in this paper in comparison to other papers on syndicated lending in the European banking sector (e,g., Heider *et al.* (2017)) may be due to the match of lenders to the Bankscope database rather than to the smaller SNL Financials database.

We split our analysis into two parts. In univariate tests, we first analyze to what extent bank-level characteristics can help explain the choice of type and scope of government interventions during the financial crisis. We then use Cox regression models to more formally investigate the role of a country's fiscal capacity and the overall capitalization of the banking sector as to the timing, type and amount of an intervention.

4.1. Univariate tests

We first conduct univariate tests to analyze whether pre-crisis bank-level characteristics can help explain the cross-sectional variation in type and scope of government interventions during the 2007 to 2009 period. In Table 4, we limit the sample to banks with at least one government intervention prior to the end of 2009 and split this subsample into three groups: (i) banks with a high (i.e., above-median) recapitalization-to-total-assets ratio between 2007 and 2009 (*high RC/TA*), (ii) banks with a low (i.e., below-median) recapitalization-to-total-assets ratio between 2007 and 2009 (*low RC/TA*) and (iii) banks that only received liquidity support between 2007 and 2009 (*LIQ only*).[18]

In the absence of a common eurozone standard we closely follow previous studies for the U.S. banking sector and analyze banks' pre-crisis health using CAMELS ratings (Li, 2013; Gropp *et al.*, 2017). The U.S. federal regulator uses CAMELS ratings to analyze the overall condition of a given bank, assessing Capital adequacy, Asset quality, Management, Earnings, Liquidity, and Sensitivity to market risk. We approximate Capital adequacy using equity-to-assets ratios (*Equity/TA*) and Tier 1 ratios (*Tier 1 Ratio*). Asset quality is approximated by loan loss provisions (*LLP/Loans*) and non-performing loans (*NPL/Loans)*. Management is defined using the natural logarithm of the age of the bank (*Log Age*). Earnings is quantified by return on average assets (*ROAA*). Liquidity is represented by short-term funding dependence (*ST funding/TA*), and finally, Sensitivity to market risk is defined using the loans-to-deposits ratio (*Loans/Deposits*).

[18] Banks with recapitalizations may have received liquidity support as well.

Additionally, we add size as a proxy for systemic importance (*Total Assets/GDP*) as well as distance to default (*Log z-score*[19]), risk-weighted assets (*RWA/TA*) and security holdings (*Securities/TA*).

For each subgroup, columns (1) to (3) of Table 4 report mean values of bank-level characteristics at the end of 2007. The last two columns report the difference in means and the parametric t-statistic of the difference in means relative to the *high RC/TA* category.

[Table 4 about here]

The results from our univariate tests highlight two facts. First, banks that receive recapitalizations are different from banks with liquidity support only. Banks that receive liquidity support are, for example, smaller and more reliant on short-term funding than banks with a high amount of recapitalization. They ex ante also have a somewhat higher equity-to-assets ratio (but not a higher Tier 1 ratio). Second, if a bank is recapitalized, the amount per total assets received is unrelated to pre-crisis characteristics. This result provides preliminary evidence that factors other than bank characteristics may influence a government's decision to provide a recapitalization—for instance, a government's fiscal capacity.

4.2. Cox regressions

Theory suggests that regulatory forbearance and postponing costly capital interventions is an attractive alternative for fiscally constrained governments as new debt can only be issued at the expense of the sovereign's creditworthiness (Acharya *et al.*, 2014). Based on this theory, we ask two questions. First, are fiscally constrained governments as likely as unconstrained countries to support distressed banks, when we do not take into account the type of support (recapitalization, liquidity support)? Second, are they equally likely to provide recapitalizations?

[19] The bank-level z-score proxies for the distance to default (Laeven and Levine (2009)) and is calculated as $(ROAA + Equity/TA)/\sigma(ROAA)$, where $\sigma(ROAA)$ is the three-year backward looking volatility of ROAA.

We study determinants of government interventions in the 2007 to 2009 period, using an exponential hazard model similar to Brown and Dinç (2005).[20] The hazard rate $h_{AID,i}(t)$, $AID \in \{any, recap\}$, is the instantaneous probability that bank *i* receives government support *AID* at time *t*, conditional on not having obtained *AID* prior to *t*. h_{any} denotes the hazard rate for obtaining any type of intervention, and h_{recap} is the hazard rate for being recapitalized. We follow banks from the date Lehman filed for insolvency (15 September 2008) until one of two exit events takes place: (i) the bank receives a (first) intervention $AID \in \{any, recap\}$ or (ii) the end of the sample period, 31 December 2009, is reached. In the Cox regression framework, the hazard rate takes the exponential form

$$h_{AID,i}(t) = h_{AID,0}(t) \cdot \exp\left(\beta_0' X_{i,t-1} + \beta_1' b_{c,t-1} + \beta_2' m_{c,t-1}\right),$$

where $h_{AID,0}(t)$ is the baseline hazard; $X_{i,t-1}$ is a vector of bank-specific characteristics; $b_{c,t-1}$ are banking-sector-specific characteristics and $m_{c,t-1}$ are macroeconomic variables. The analysis is conducted based on daily intervention data but is robust to monthly aggregation. Standard errors are clustered at the country-level, allowing government interventions to be correlated within a country.

Our preferred measure of sovereign fiscal constraints is the current account balance, i.e., the current account surplus/deficit (*CA Balance)*. If a country is not borrowing from abroad (and c.p. has a current account surplus), it is not at risk of becoming constrained as it can engage in financial depression to secure its funding, e.g. through an increase in domestic taxes. However, if a country is borrowing from abroad on a net basis, it is subject to market discipline and possible sudden stops when foreign investors become unwilling to roll over their funds. Sudden stops have detrimental effects on future tax income through output contractions, increases in unemployment

[20] Shambaugh *et al.* (2012) highlight that hazard models are superior to single-period models in forecasting bankruptcy. We include simple logit regressions as robustness checks.

and asset price declines (Freund and Warnock, 2007). In other words, fiscal constraints become binding when a country is borrowing from abroad.

As a banking-sector-specific variable, we include the average book equity-to-assets ratio (*Avg. Equity Ratio*). Brown and Dinç (2011) show that governments are less likely to intervene if the banking sector as a whole is undercapitalized (too-many-to-fail effect). Finally, we also use the budget deficit/surplus (*Budget Balance*), which captures the overall extent of annual sovereign net debt uptake.

We include bank-level characteristics to control for banks' different propensities to becoming distressed and to requiring different types of interventions. Building on the univariate evidence, bank-level characteristics comprise size (*Total Assets/GDP*), equity-to-assets ratio (*Equity/TA*), wholesale funding dependence (*ST funding/TA*) and profitability (*ROAA*). We hypothesize that larger banks with lower capital ratios are more likely to obtain support. Short-term funding dependence, in addition, renders banks vulnerable towards interbank funding freezes. We have no prior hypothesis for the relation between return on assets and the probability of distress, because a high ROAA may be an indicator for a sound business model as well as high pre-crisis risk-taking.

[Table 5 about here]

Table 5 reports the main results for Cox regressions on bank-level and country-level characteristics. Bank financial health is measured using a bank's book equity-to-assets ratio (Panel A) or Tier 1 ratio (Panel B). Columns (1) and (2) contain hazard rate analyses for all types of government support (h_{any}), and columns (3) and (4) for recapitalizations (h_{recap}).

We start our analysis and include only bank characteristics in columns (1) and (3) of Panel A of Table 5. Consistent with our hypothesis, large banks with low equity-to-assets ratios and high short-term funding dependence are more likely to obtain some form of government support prior

to 2009: in column (1), the coefficient estimate on *Total Assets/GDP* and *ST funding/TA* is positive and significant and the coefficient estimate on *Equity/TA* is negative and significant. Pre-crisis profitability in terms of *ROAA* is unrelated to the likelihood of obtaining support. Column (3) repeats the exercise for the likelihood of being recapitalized. Being larger and of worse financial health plays an even more important role in a government's decision to recapitalize a bank. The coefficients on *Total Assets/GDP* and *Equity/TA* increase in absolute terms and remain significant. A higher *ROAA* and a high short-term funding dependence also imply a higher likelihood of being recapitalized.

We next expand the model with our measure for fiscal capacity, *CA Balance*, as well as *Avg. Equity Ratio* and *Budget Balance* in columns (2) and (4). For interventions in general, i.e. irrespective of type, *CA Balance* has a negative coefficient that is statistically significant at the 1 percent level (column (2) of Table 5), while the coefficient estimates on *Budget Balance* and *Avg. Equity Ratio* are insignificant. This suggests that governments of countries with the possibility of a sudden stop are more likely to extend government support to the domestic banking sector. At the same time, however, they are *less* likely to grant recapitalizations: in column (4), the coefficient on *CA Balance* is significant and positive, indicating that governments in countries with high external finance dependence are less likely to provide recapitalizations to their banking sector. Additionally, the positive and significant coefficient on *Avg. Equity Ratio* in column (4) echoes the results from Brown and Dinç (2011) that governments are more likely to delay an intervention when the banking sector as a whole is weakly capitalized.[21]

[21] Note that the coefficient estimate on Budget Balance in column (4) is negative. This result, which seems surprising at first, suggests that governments with higher budget deficits were more likely to implement recapitalizations, despite expected difficulties to raise additional debt for funding the capital infusions. Note, however, that peripheral countries with credit booms (i.e. Spain and Ireland) in fact disposed of budget surpluses leading up to the financial crisis, which may explain this result.

Overall, the results for all types of government interventions (column (2)), and recapitalizations in particular (column (4)), show that banks located in countries with lower fiscal capacity are at least as likely to obtain some kind of intervention measure as banks located in countries with stronger public finances. However, consistent with the idea that capital injections are costly, governments with lower fiscal capacity delay capital injections and wait significantly longer than fiscally stronger countries to recapitalize distressed banks.

The results are robust to a number of robustness checks. Panel B provides the results for the hazard analysis when bank capital is measured using Tier 1 ratios instead of equity-to-assets ratios. Note that the sample size is considerably smaller as information on Tier 1 ratios is only available for a subset of banks. Nonetheless, the results are similar to those reported in Panel A and highlight that countries with higher current account deficits and lower banking-sector health are less likely to recapitalize their banking sector (column (4)).

For robustness, we also add additional CAMELS proxies, including non-performing loan ratios, age, and loans-to-deposit ratios. The coefficient estimates on both bank-level characteristics and macro-level variables are unchanged, while the R^2 increases only slightly. We also substitute ROAA with the z-score—the results remain quantitatively and qualitatively unchanged. The analysis is also robust to setting the starting point of the financial crisis to 9 August 2007, when the withdrawal of BNP Paribas from three hedge funds marked the beginning of a liquidity crisis. Logit regressions produce virtually identical results as Cox regressions. These results are not reported for brevity.

[Table 6 about here]

We next investigate intervention decisions separately for non-GIIPS and GIIPS countries. We augment our regression specification from Table 5 and include interaction terms of bank characteristics with an indicator variable that equals 1 for banks located in GIIPS countries, and 0

otherwise. The GIIPS indicator proxies for the difference in fiscal capacity of European governments and allows the influence of bank characteristics on bailout probabilities to vary across regions. The results are shown in Table 6. The importance of bank characteristics is comparable to the results in Table 5. That is, bank characteristics do not affect bailout decisions in GIIPS and non-GIIPS countries differently.

4.3. Size of intervention

The results from the univariate tests in Section 0 suggest that the size of a bank's recapitalization is relatively independent from bank characteristics. Thus, we next investigate whether fiscally constrained governments are, in addition to postponing recapitalizations, also more likely to restrict recapitalization amounts. Table 7 shows the results from Tobit regressions of the aggregate aid amounts prior to December 2009 on the same macro- and bank-level variables as above. The regressions are limited to banks in distress, i.e., banks that receive at least some type of intervention before the end of 2009. As dependent variables we use *log(1 + Net Recap Amount/TA)* and *log(1 + Liquidity Amount/TA)*.[22]

[Table 7 about here]

The positive and significant coefficient on *CA Balance* in column (1) suggests that more-fiscally-constrained governments grant smaller recapitalization amounts. In contrast, the liquidity amount is independent of the current account deficit (column (2)). The pre-crisis budget deficit, in contrast, has a positive impact on the recapitalization amount and a negative impact on the liquidity amount. Furthermore, the average equity-to-assets ratio of the banking sector has a negative impact on the recapitalization amount. The results remain unchanged if we use Tier 1 ratios instead of equity-to-assets ratios (columns (3) and (4)). Interestingly, leverage (*Equity/TA*) does not predict recapitalization amounts, but it does predict the amount of liquidity support a bank obtains: banks

[22] We also exclude the analysis of troubled asset relief measures, as intervention amounts are difficult to quantify.

that are not as well capitalized receive *larger* liquidity support consistent with regulatory forbearance.

Overall, our results suggest that fiscal constraints, as well as undercapitalized banking sectors, cause governments to postpone interventions in the banking sector and to provide only limited, if any, recapitalization to distressed banks.

5. Long-term implications of forbearance

Delaying government interventions leaves distressed banks vulnerable to further deterioration in health, as necessary recapitalizations are postponed entirely or limited to a bare minimum. On the one hand, insufficiently stabilized banks have low capital buffers to withstand future shocks, on the other hand the debt overhang gives rise to moral hazard, including risk-shifting (Jensen and Meckling, 1976; Diamond, 2001) and zombie-lending (Peek and Rosengren, 2005; Giannetti and Simonov, 2013; Blattner *et al.*, 2018).

To investigate the effects of delayed government support in the European financial crisis, in a first step we analyze the performance of insufficiently stabilized banks from 2010 onwards. To that end, we first develop a measure that captures to what extent government support during the financial crisis was (in)sufficient for stabilizing a distressed bank. We then relate this measure to changes in bank balance sheet characteristics, bank profitability and the likelihood to obtain additional government support after 2009.

5.1. Measuring insufficient stabilization

A main challenge for our analysis is to identify whether a bank was "sufficiently stabilized" during the 2007 to 2009 period. A straightforward approach could be to analyze whether government interventions were adequate to stabilize the bank's equity-to-assets ratio, using the change of the equity-to-assets ratio from 2007 to 2009 as the respective measure. However, the equity-to-assets

ratio only partially captures a bank's vulnerability to future shocks as the adequacy of a bank's capitalization also depends on its business model and risk-taking. In particular, the Cox regressions in Section 0 show that a range of bank characteristics predict whether a bank requires a recapitalization or not.

Consequently, we take a broader approach and analyze whether government interventions were sufficient to stabilize a bank's *hazard rate*. Crucially, we measure changes to the bank-specific hazard rate that are related to bank-level characteristics, while excluding all macro-level factors. That is, we capture a bank's propensity to require a recapitalization, but remove the government's capacity to provide it. More specifically, we use the coefficient estimates from the Cox regressions (Section 0), bank-level characteristics and eurozone-averaged macro variables to calculate (macro-adjusted) hazard rates for the years 2007 and 2009, respectively.[23] By using eurozone-averaged, instead of country-level, macro variables, we effectively remove the domestic government's capacity for recapitalizations from the hazard rate.[24] Our measure for the sufficiency of government support is then defined as the level change in the log (macro-adjusted) hazard rate over the 2007 to 2009 period. For brevity, we refer to the "log macro-adjusted hazard rate" as the "bank-specific hazard rate". An increase in the bank-specific hazard rate over the 2007 to 2009 period indicates that a bank has become more likely to require a recapitalization and thus become less stable.

Table 8 shows the 20 eurozone banks with government support during the 2007 to 2009 period that exhibited the largest deterioration in the bank-specific hazard rate. The majority of banks in the table are located in GIIPS countries with a high current account deficit, which provided

[23] We exclude the baseline hazard from our calculations. The baseline hazard is the time-varying baseline risk for recapitalizations in the eurozone but is constant in the cross section.
[24] In unreported robustness checks, we also remove the macroeconomic variables from the hazard rate calculations entirely. The subsequent results remain unchanged.

fewer recapitalizations to their domestic banking sectors. The table provides further preliminary evidence that banks that were insufficiently stabilized prior to the end of 2009 were not prepared to meet future shocks. Except for two banks, all banks in the table required additional support post-2009 and/or did not survive until 2012 (the end of our sample period).

[Table 8 about here]

5.2. Insufficient support and bank vulnerability

5.2.1. Methodology

We start our analysis by graphically analyzing the effect of insufficient government support on indicators for bank solvency, lending, asset quality and profitability. Figure 2 plots a time series evolution of mean bank characteristics over the 2007 to 2012 period—separately for banks without government support ("No aid 2007-09"), banks with insufficient government support ("Aid 2007-09, less stable") and banks which were stabilized ("Aid 2007-09, more stable"). A bank is identified as insufficiently stabilized ("Aid 2007-09, less stable") if the change in the bank-specific hazard rate is above the median change in the bank-specific hazard rates of banks with government support. Equivalently, banks are considered to be stabilized ("Aid 2007-09, more stable") if the change in the bank-specific hazard rate is below the median change. We do not distinguish between the type and amount of government support as banks with different problems may require different aid measures to be stabilized. Instead, we use the change of the hazard rate to assess whether government support was sufficient to stabilize the bank. For simplicity, we call a bank that received (did not receive) some form of government support during the 2007 to 2009 period an "aid" ("non-aid") bank.

[Figure 2 about here]

Figure 2 shows that banks which were insufficiently stabilized during the 2007 to 2009 period deteriorate further from 2010 onwards. Most prominently, their equity-to-assets ratio drops

by roughly 1.5 percentage points over the 2009 to 2012 period, while the equity-to-assets ratios of banks without government interventions increase by around 1 percentage point. More stable aid banks also increase their equity-to-assets ratio, albeit to a lesser extent. Over the same period, less stable aid banks also exhibit a smaller increase in their Tier 1 ratios, a considerably stronger increase in loan loss provisions and non-performing loans, and a stark drop in the ROAA in 2011 and 2012.

Banks that receive government support generally decrease their loan portfolios, while banks without government support somewhat increase their loan portfolios. Quite strikingly, the net interest margin of less stable banks drops considerably from 2009 to 2012, while it remains relatively consistent for all other banks. This provides initial evidence that insufficiently stabilized banks might engage in some form of zombie-lending to avoid write-downs by rolling over loans to actually defaulted borrowers at very low interest rates.

Next, we more formally investigate whether insufficient government support during the financial crisis is associated with deteriorating bank characteristics from 2010 onwards. We estimate the following cross-sectional regressions

$$\Delta y_{i,2009-12} = \alpha + \beta_1 \cdot Aid_{i,2007-09} + \beta_2 \cdot Aid_{i,2007-09} \cdot \Delta\, hazard_{i,2007-09} + \gamma \cdot X_{i,2007} + FE_{GIIPS,i} + u_i. \quad (1)$$

The dependent variable $\Delta y_{i,2009-12}$ is the level change in characteristic *y* of bank *i* over the 2009 to 2012 period. The variable $Aid_{2007-09}$ is an indicator that takes value 1 if bank *i* received some type of government intervention (recapitalization, liquidity support or troubled asset relief) over the 2007 to 2009 period and 0 otherwise. The variable $\Delta hazard_{2007-09}$ is the change in the bank-specific hazard rate over the 2007 to 2009 period, standardized around its cross-sectional mean. $X_{i,2007}$ are bank-level control variables including *Total Assets/GDP*, *Equity/TA*, *ST funding/TA* and *ROAA*. Standard errors are robust against heteroskedasticity.

There are two main identification concerns in estimating the effect of insufficient government support. First, banks that obtain government support are typically different from banks that do not receive an intervention. In particular, banks with government support are typically severely distressed when requiring an intervention. Second, aid banks that deteriorate more during the financial crisis may already, from an ex ante perspective, be significantly less stable than aid banks that deteriorate less during that period. A different degree of distress may explain why banks perform differently from 2010 onwards. Including pre-crisis bank-level controls, $X_{i,2007}$ allows us to reduce concerns about a selection bias in our results. Building on the results from Section 0, we include those bank characteristics that have been shown to predict a bank's distress and the receipt of government support. Estimating the equation in changes, we absorb any unobserved bank-level heterogeneity in the level of the outcome variable. We include a fixed effect for banks being located in GIIPS countries, $FE_{GIIPS,i}$, to mitigate concerns that any effect is due to banks in GIIPS countries performing fundamentally differently in the sovereign debt crisis than banks in non-GIIPS countries.[25]

The coefficient estimate β_1 on $Aid_{2007-09}$ captures the baseline effect of government support in the 2007 to 2009 period on the evolution of characteristic y post-2009. By interacting $Aid_{2007-09}$ with the change in the bank-specific hazard rate, $\Delta hazard_{2007-09}$, we test whether banks with insufficient government support during the 2007 to 2009 period deteriorated more in the 2009 to 2012 period than stabilized aid banks. A positive coefficient estimate β_2 indicates that an increase in the bank-specific hazard rate, i.e. a deterioration in the bank's health, is associated

[25] While it might be preferable to include country fixed effects rather than GIIPS fixed effects to exploit only within-country differences, the small number of banks for some countries significantly reduces the power of the regressions once we include country-specific fixed effects.

with an increase in the dependent variable y over the 2009 to 2012 period.[26] As $\Delta hazard_{2007-09}$ is standardized around its mean, the effect needs to be interpreted relative to the mean.

5.2.2. Results

The results for the cross-sectional regressions are presented in Panel A of Table 9 and corroborate the graphical evidence. Coefficient estimates on *Constant* highlight that the health of eurozone banks generally improves over the 2009 to 2012 period: banks increase their equity-to-assets and Tier 1 ratios, their loan portfolios and also their ROAA, while loan loss provisions and risk-weighted assets decrease. On average, banks do not exhibit an increase in non-performing loans.

The coefficient estimate β_1 also shows that banks with government support during the 2007 to 2009 period increase their equity-to-assets ratio considerably less than non-rescued banks, but still exhibit, on average, a gain of 1.03 percentage points over the 2009 to 2012 period. Other bank characteristics develop very similarly for both types of banks. One exception is their loan portfolios: while banks without government support significantly increase their loan portfolios by 11 percentage points, banks that obtained some type of support cut their lending by 3 percentage points. A likely reason for the reduction in lending is the consolidation of bank balance sheets. Overall, the increase in the equity-to-assets ratios and the similar evolution of bank characteristics post-2009 suggest that at the mean, government interventions were successful in stabilizing distressed banks.

[Table 9 about here]

In contrast, the negative coefficient estimate on the interaction term $Aid_{2007-09} \times \Delta\, hazard$ emphasizes that insufficiently stabilized banks deteriorated further during the sovereign

[26] All results remain qualitatively the same if we interact the intervention indicator with an indicator that takes value 1 for banks with an above-median change in the hazard rate and 0 otherwise. Using a continuous measure is, however, preferable as it allows the capture of cross-sectional variation in the success of government interventions. Put differently, we allow the effect of government intervention to vary continuously with the degree of stabilization.

debt crisis. Importantly, insufficiently stabilized banks exhibit a significant worsening of their equity-to-assets ratio post-2009: a one-standard-deviation increase in the bank-specific hazard rate is associated with a 4.85-percentage-point-lower increase in the equity-to-assets ratio compared to no-aid banks (the sum of -1.75 percentage points and -3.75 percentage points) and thus with an overall drop of 2.07 percentage points in the equity-to-assets ratio over the 2009 to 2012 period. Aid banks with an above-mean increase in the bank-specific hazard rate experience a significantly lower increase in the Tier 1 ratio, an increase in loan loss provisions and non-performing loans, as well as a drop in profitability. Consistent with the graphical evidence, insufficiently stabilized banks also experience a significant decrease in their net interest margin. In addition, they tend to reduce their loan portfolios less, but the coefficient estimate is insignificant.

Naturally, the regressions in Panel A are constrained to banks that survive at least until 2012. A different measure for the sufficiency of government support is whether a bank survives until 2012 and/or requires a recapitalization post-2009. We run logit regressions similar to specification (1), where the dependent variable is an indicator variable that takes value 1 if the bank survives at least until the end of 2012 or obtains a recapitalization post-2009 and 0 otherwise, respectively. We present the results for the logit regressions in Panel B of Table 9. The results show that banks with government support in the 2007 to 2009 period are less likely to survive than banks without support and are more likely to require a recapitalization post-2009. The coefficient estimate on the interaction term suggests that the likelihood of a recapitalization increases if the interventions obtained during the 2007 to 2009 period were insufficient to stabilize the bank.

Next, we show that the results are not driven by banks located in GIIPS countries. To compare the implications of insufficient government support between GIIPS and non-GIIPS countries, we interact *Constant,* $Aid_{2007-09}$ and $Aid_{2007-09} \times \Delta hazard_{2007-09}$ with the indicators *GIIPS* and *non-GIIPS*. The *GIIPS* indicator equals 1 when the bank is located in a GIIPS

country, and 0 otherwise, and the non-GIIPS indicator has the inverse logic. The results are shown in Table A5 of the Appendix (Panels A and B). Almost all results from the baseline regression also hold separately in GIIPS and non-GIIPS countries: banks that are insufficiently stabilized during the 2007 to 2009 period have a significantly lower increase in the equity-to-assets ratio over the 2009 to 2012 period, a stronger increase in loan loss provisions and, to a certain extent, non-performing loans, and have a higher drop in the ROAA. Overall, the results highlight that the health of banks that received insufficient government support during the 2007 to 2009 period substantially deteriorated in both GIIPS and non-GIIPS countries during the 2010 to 2012 period.[27]

6. Incentive effects for lending decisions

To better understand why insufficiently stabilized banks deteriorate further from 2010 onwards, we next investigate the relationship between insufficient stabilization and banks' incentives. Our analysis focuses on banks' lending decisions, as lending is the primary business of eurozone banks: Table 3 shows that loan portfolios, on average, make up 61 percent of banks' balance sheets in 2007. Given this importance, distorted incentives for loan decisions can have a sizable effect on bank stability, especially if banks shift their loan allocations towards riskier borrowers or lend to zombie borrowers. In particular, they may contribute to the deterioration of insufficiently stabilized banks from 2010 onwards.

6.1. Loan volume

Our main question is how (in)sufficient government support relates to banks' lending decisions during the financial crisis. In particular, we ask if insufficiently stabilized banks are more reluctant

[27] For robustness checks, we repeat the regressions using changes in the equity-to-assets ratio instead of changes in the bank-specific hazard rate as the measure for the adequacy of government interventions. The alternative specification yields similar results, which are excluded for brevity.

to cut down lending to risky and possibly defaulted borrowers in order to hide sustained losses and gamble for resurrection.

We start our loan analysis by studying the effect of government interventions on overall loan supply. Our main dependent variable is $\Delta Loan_{2007-10,i,c,j}$, which captures the change in outstanding loan exposure of bank *i* in country *c* to firm *j* from the pre-crisis year 2007 to the year just after the financial crisis, 2010. Similar to Peydró *et al.* (2017), we define the change in outstanding loan exposure following the definition of Davis and Haltiwanger (1992) as

$$\Delta Loan_{2007-10,i,c,j} = \frac{Loan_{2010,i,c,j} - Loan_{2007,i,c,j}}{0.5 \cdot Loan_{2010,i,c,j} + 0.5 \cdot Loan_{2007,i,c,j}}.$$

Using this definition has two main advantages. First, we avoid the regression results being driven by outliers as $\Delta Loan_{2007-10}$ lies on the closed interval [-2,2]. Second, the measure facilitates the treatment of zeroes, where either no bank–firm relationship exists in 2007 but emerges over the 2008 to 2010 period (i.e. $Loan_{2007,i,c,j}$ equals 0, but $Loan_{2010,i,c,j}$ does not), or the bank–firm relationship is terminated between 2007 and 2010 (i.e. $Loan_{2010,i,c,j}$ equals 0, but $Loan_{2007,i,c,j}$ does not).

We estimate the following cross-sectional regression specification

$$\Delta Loan_{2007-10,i,c,j} = \beta_1 \cdot Aid_{i,2007-09} + \beta_2 \cdot Aid_{i,2007-09} \cdot \Delta hazard_{i,2007-09} + \gamma \cdot X_{i,2007} + \eta_j + \eta_c + u_{ijc}, (2)$$

where all variables are defined as before and bank-level characteristics in 2007 control for selection into treatment. Following Khwaja and Mian (2008), we exploit the fact that some firms borrow from more than one bank and use a within-firm estimator to disentangle loan supply from loan demand. Specifically, firm fixed effects η_j control for observable and unobservable firm characteristics that may affect firm-level demand. Firm fixed effects are identified by multiple bank–firm relationships, where firms borrow from at least two distinct borrowers. We also include

country-level fixed effects to control for country-level shifts in credit supply. Standard errors are clustered at the bank level.

Our main coefficient of interest is β_3, which allows us to investigate how insufficient government support during the period 2007 to 2009 affects banks' decisions to continue lending to the real economy. The coefficient estimate on $Aid_{2007-09}$ again captures the baseline effect of government support during the period 2007 to 2009.

We present the results for the baseline specification in column (1) of Table 10. The large negative coefficient estimate on $Aid_{2007-09}$ shows that banks with government support significantly reduce their loan supply. The result corroborates the result from the balance sheet regression in Section 5.2, which produces the same result for banks' aggregate loan portfolios when we did not control for demand effects. Importantly, however, the positive coefficient estimate on $Aid_{i,2007-09} \times \Delta\, hazard_{i,2007-09}$ suggests that insufficiently stabilized banks reduce their loan supply less than better stabilized banks. An increase in the bank-specific hazard rate by one standard deviation decreases the coefficient estimate on $\Delta Loan_{2007-10,i,c,j}$ by roughly 13 percent.

[Table 10 about here]

As a robustness check, we also employ other dependent variables to measure changes in loan supply (columns (2) and (3)). First, we use the first difference in log loan exposure of bank *i* in country *c* to firm *j*, $\Delta Log\ Loan = \log\big(1 + Loan_{2010,icj}\big) - \log\,(1 + Loan_{2007,icj})$, borrowing the specification from Peydró *et al.*, 2017). Second, we follow Peek and Rosengren (2005) and Giannetti and Simonov (2013) and employ, as dependent variable, the indicator $Loan\ Incr_{icj}$ that takes value 1 if bank *i* increases its loan exposure to firm *j* from 2007 to 2010, and 0 otherwise.

The results confirm the robustness of the result in column (1): aid banks generally reduce their loan supply from 2007 to 2010, but they are less likely to do so if they were insufficiently stabilized. For example, the results in column (2) show that lending of aid banks decreases by 33

percent, but an increase in the bank-specific hazard rate by one standard deviation reduces this effect by 4 percent.

We also measure changes in loan supply at the extensive margin. First, to capture the propensity to maintain lending to a relationship borrower, we use, as dependent variable, the indicator variable $Relationship_{icj}$ that takes value 1 if bank i has positive exposure to firm j in both years 2007 and 2010, and 0 otherwise. Bank–firm relationships with no lending exposure in 2007 are excluded from these regressions. Second, to capture a bank's willingness to engage in a new lending relationship, we use as dependent variable the indicator $NewLoan_{icj}$ that takes value 1 if bank i has a positive (new) exposure to firm j in 2010 and 0 otherwise.

The results of the extensive margin regressions are presented in Table 10, columns (4) and (5). The insignificant coefficient estimates in column (4) show that there is no significant relation between government support in the 2007 to 2009 period and the propensity to maintain lending to an existing borrower. The result suggests that the reduction in loan supply for aid banks occurs due to a reduction in loan volume rather than by severing the link to existing borrowers.

At the same time, the results in column (5) show that in addition to reducing loan volumes to existing borrowers, banks with government support were significantly less likely to issue new loans to firms without a prior relationship. Again, the coefficient estimate on the interaction terms shows that propensity for new lending declines less for those banks that were stabilized less. In other words, banks with insufficient government support were more reluctant than better stabilized banks to cut back lending to existing *and new* borrowers.

6.2. Borrower risk

Do insufficiently stabilized banks increase risk-taking and extend lending to lower-quality borrowers?

Similar to Acharya *et al.* (2018b), we identify borrowers to be more (less) risky if the two-year mean interest coverage ratio in the pre-crisis years (2006 to 2007) is below (above) the median two-year mean interest coverage ratio.[28] We include borrower risk in the interaction terms to investigate lending decisions with respect to borrower quality,

$$\Delta Loan_{2007-10,i,c,j} = \beta_1 \cdot Aid_{i,2007-09} + \beta_2 \cdot Aid_{i,2007-09} \cdot \Delta hazard_{i,2007-09}$$
$$+ \beta_3 \cdot Aid_{i,2007-09} \cdot IC\ Low_j$$
$$+ \beta_4 \cdot Aid_{i,2007-09} \cdot \Delta hazard_{i,2007-09} \cdot IC\ Low_j$$
$$+ \gamma \cdot X_{i,2007} + \eta_j + \eta_c + u_{ijc},$$

where all variables are defined as before and $IC\ Low_j$ takes value 1 if firm j has a below-median coverage ratio, and 0 otherwise.

[Table 11 about here]

The results are shown in Table 11. For reasons of brevity, we only report the coefficient on the interaction terms. The results suggest that the higher loan supply by less stabilized banks is driven by lending to low-quality firms. The coefficient estimate on the triple interaction term $Aid_{i,2007-09} \times \Delta hazard \times IC\ low$ is positive and highly significant across all specifications. At the same time, the coefficient estimate on the double interaction term $Aid_{i,2007-09} \times \Delta hazard$ is mainly insignificant across specifications. Taken together, the results suggest that banks that were stabilized less during the 2007 to 2009 period did not generally provide more loans than better stabilized banks. However, they *were* more likely to sustain relationship lending with and extend new lending to low-quality borrowers.

The higher loan supply from insufficiently stabilized banks to lower-quality borrowers is consistent with both a (i) risk-shifting channel and a (ii) zombie-lending channel. Under the risk-

[28] We would prefer to use a three-year median interest coverage ratio as in Acharya *et al.* (2018b), but unfortunately, firm-level information from Amadeus is only available from 2006.

shifting channel, insufficiently stabilized banks extend loans to existing or new borrowers that are risky, but not necessarily distressed. This is the classic gambling-for-resurrection story, where high leverage facilitates risk-taking due to limited liability (Jensen and Meckling, 1976). Under the zombie-lending channel, insufficiently stabilized banks continue to lend to distressed borrowers with negative net present value (NPV) projects at advantageous rates to avoid declaring loans to be non-performing. As such, the zombie-lending channel is different from the risk-shifting channel: under the risk-shifting channel, borrowers are high-risk, but not necessarily distressed and need not be offered advantageous loan terms.

6.3. Zombie-lending

To distinguish between the risk-taking and zombie-lending channel, we next investigate whether insufficiently stabilized banks were more likely to sustain lending to zombie firms, i.e. to extend loans to distressed firms at subsidized terms.

We identify a firm to be a zombie firm if its rating is BB or lower and it pays interest on its loans that is below the benchmark interest of loans to very safe, publicly traded firms. To identify if a firm pays below-benchmark interest rates, we follow the conservative approach of Acharya *et al.* (2018b): we use information from Amadeus to derive a proxy for average interest payments by firm *j*. Amadeus reports total interest paid and total outstanding debt of firm *j* in industry *s* in year *t*. We calculate the average interest paid, r_j, by firm *j* by dividing the total interest payment by the total outstanding debt in 2010. Firms have a high (low) reliance on short-term debt if the ratio of short-term debt to long-term debt is above (below) the median.

We calculate the benchmark interest *R* as the median interest rate paid by publicly traded firms in 2010 that were incorporated in non-GIIPS countries and had an AAA or AA rating. This is done separately for firms with low and high reliance on short-term debt (as a proxy for the maturity structure of debt). A firm pays below-benchmark interest rates if the average interest paid

on its debt r_j is below the benchmark R, with firms split according to their reliance on short-term debt.

To test for the different propensity to extend lending to zombie firms, we again estimate cross-sectional regressions, this time including interaction terms for zombie firms,

$$\Delta Loan_{2007-10,i,c,j} = \beta_1 \cdot Aid_{i,2007-09} + \beta_2 \cdot Aid_{i,2007-09} \cdot \Delta hazard_{i,2007-09} + \beta_3 \cdot Aid_{i,2007-09} \cdot zombie_j + \beta_4 \cdot Aid_{i,2007-09} \cdot \Delta hazard_{i,2007-09} \cdot zombie_j + \gamma \cdot X_{i,2007} + \eta_j + \eta_c + u_{ijc}.$$

We present the results in Table 12. Banks with government support in the 2007 to 2009 period are, on average, no more likely to extend loans to zombie firms, neither to relationship borrowers nor as new lending. The coefficient estimate on $Aid_{i,2007-09} \cdot zombie_j$ is insignificant across all specifications for loan supply. However, at the same time, the coefficient estimate on $Aid_{i,2007-09} \cdot \Delta hazard_{i,2007-09} \cdot zombie_j$ is positive and significant in columns (1), (3) and (4), but insignificant in columns (2) and (5). In particular, the results suggest that insufficiently stabilized banks do indeed continue lending to existing zombie borrowers but are not more likely to extend new lending to zombie borrowers. This is not surprising, as new lending to an already severely distressed firm bears only little upside and is therefore not an attractive investment strategy, even for a highly overleveraged bank.

[Table 12 about here]

Taken together, we find the evidence to be consistent with both a risk-shifting channel and a zombie-lending channel being at work. The risk-shifting channel is at work because insufficiently stabilized banks are more likely to extend lending to risky borrowers. This holds both for relationship *and new* borrowers, suggesting that banks seek higher levels of risk-taking in general.

The zombie-lending channel is at work because insufficiently stabilized banks are more likely to *maintain* lending to zombie relationship borrowers at advantageous terms.

7. Conclusion

Our analysis of government interventions in the banking sector during the European financial and sovereign debt crisis that began in 2007 suggests that regulatory forbearance in the European financial sector is closely related to pre-crisis macroeconomic imbalances, strong interlinkages between governments and banks, as well as weak, decentralized institutions and regulation. In particular, despite the increasingly cross-border nature of the European banking sector, bailouts of distressed banks were closely tied to the fiscal capacity of the domestic sovereign that was also responsible for its supervision. In the absence of an insolvency regime for banks, governments with lower fiscal capacity were practicing regulatory forbearance instead of implementing fully-fledged recapitalizations. Such forbearance left distressed banking sectors vulnerable to future economic shocks, which materialized post 2009 and led to evergreening of poor-quality borrowers by insufficiently stabilized banks.

Consequently, our analysis informs the debate about the future design of the European banking sector and the desirable institutional framework. In particular, our results highlight the importance of reducing the dependence between the health of eurozone banks and the immediate sovereigns both in terms of decision-making processes for bank support and also at the fiscal level so as to minimize the possibility for regulatory forbearance in the future. The more that supervision and resolution of banks becomes shielded from the discretionary decision-making of governments, the lower will be the opportunity for governments to resort to regulatory forbearance. By centralizing the supervision of banks with the ECB under the Single Supervisory Mechanism (SSM) and by establishing the Single Resolution Mechanism (SRM) as a common, standardized

resolution scheme, the eurozone has moved an important step towards resolving these interlinkages. However, as long as the national fiscal capacity determines the size of the public backstop in the banking sector, the threat of a doom loop remains. Thus, the second necessary ingredient for reducing regulatory forbearance is a common European fiscal backstop for bailouts in the financial sector. To minimize moral hazard at the sovereign level, such fiscal backstops could be accompanied by strong rules for public finances and macroeconomic imbalances.

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Figures

Figure 1: Government Interventions by Category (in %)

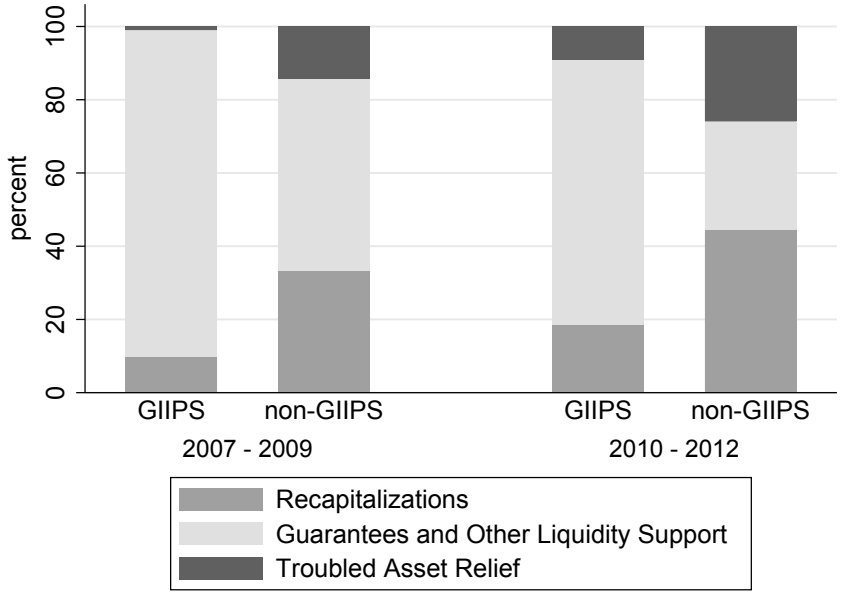
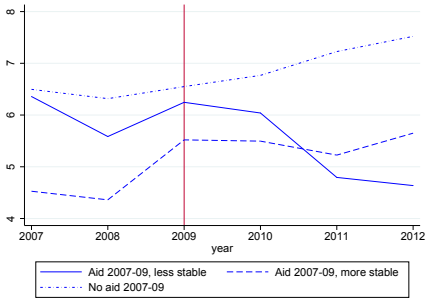
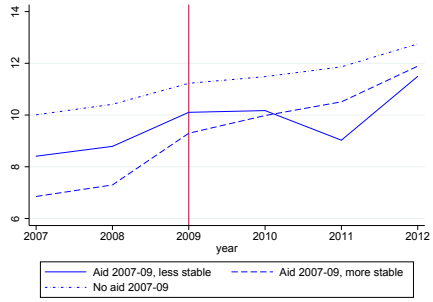


Figure 2: Balance Sheet Characteristics

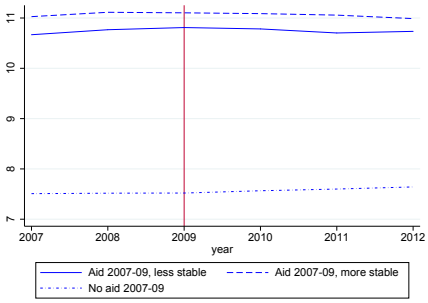
(a) Equity/TA



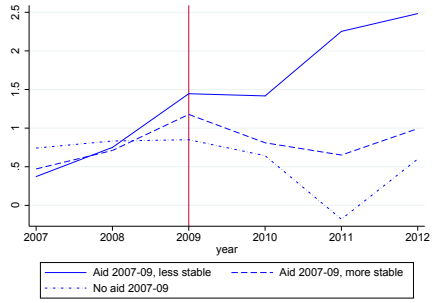
(b) Tier 1 Ratio



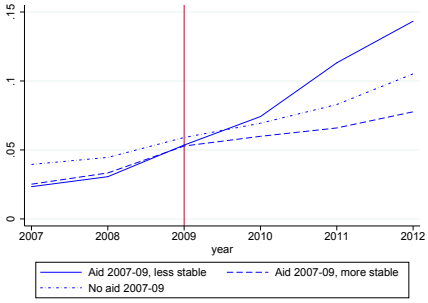
(c) Log Loans



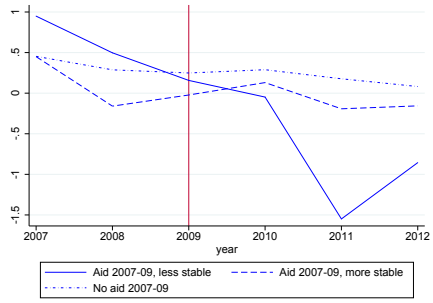
(d) LLP/Loans



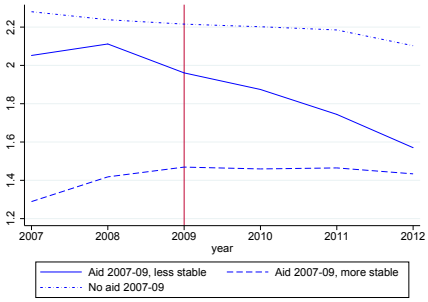
(e) NPL/Loans



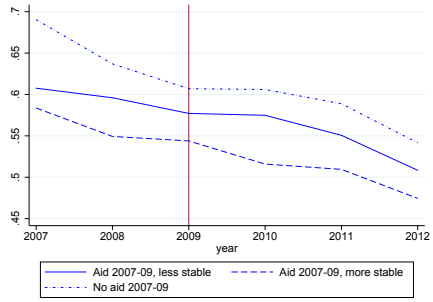
(f) ROAA



(g) Net Int. Margin



(h) RWA/TA



Tables

Table 1: **Current Account Balances**
The table shows current account balances (in percent of GDP) of eurozone countries, averaged over different time periods.

	1993–1997	1998–2002	2003–2007
Austria	-2.1	-0.7	2.6
Belgium	5.2	4.9	2.4
Finland	2.6	6.8	4.3
France	1.3	3.1	0.7
Germany	-1.0	-0.5	4.6
Greece	-2.1	-4.9	-10.3
Ireland	2.8	0.4	-3.0
Italy	2.1	0.7	-0.9
Luxembourg	11.1	9.9	9.8
Malta	-4.3	-2.0	-5.6
Netherlands	5.0	2.6	6.4
Portugal	-2.5	-9.2	-9.2
Slovakia	-3.3	-6.5	-6.0
Slovenia	1.0	-1.1	-2.3
Spain	-1.2	-3.5	-7.1

Table 2: **Characteristics of Government Interventions**
The table provides characteristics of government interventions in the eurozone over the 2007 to 2012 period. Characteristics are shown for different types of interventions: Recapitalization, Guarantees, Other Liquidity Support and Troubled Asset Relief. Panel A provides information on interventions in GIIPS countries and Panel B for interventions in non-GIIPS countries. *# Banks: Sample* denotes the number of banks with Bankscope information, *# Banks with Interventions* the number of banks with government support and *# Interventions* the overall number of interventions. For each intervention type, *# Banks* denotes the number of banks that receive this intervention type and *# Interventions* the overall number of distinct measures of this intervention type. Table **??** in the Appendix provides detailed definitions of the intervention characteristics.

Panel A: GIIPS Countries

	2007 - 2009						2010 - 2012					
VARIABLES	N	Mean	Median	SD	Min	Max	N	Mean	Median	SD	Min	Max
# Banks: Sample	350						391					
# Banks with Interventions	62						101					
# Interventions	204						354					
Recapitalization												
# Banks	17						26					
# Interventions	20						66					
Gross Amount (mn. EUR)	20	1,194	808	1,258	50	4,000	66	2,163	1,133	2,595	35	13,559
Gross Amount/TA (%)	19	2.9	1.8	4.0	0.2	18.0	43	4.1	2.3	5.8	0.0	28.0
Guarantees												
# Banks	52						96					
# Interventions	174						249					
Amount (bn. EUR)	174	40.0	20.0	56.2	3.6	333.1	249	90.1	30.1	194.0	1.5	980.0
Amount/TA (%)	169	126	119	24	95	264	219	173	134	123	95	1,003
Other Liquidity Support												
# Banks	2						4					
# Interventions	8						7					
Amount (mn. EUR)	8	733	275	903	15	2,200	7	1,279	1,000	993	150	3,000
Amount/TA (%)	8	9.9	3.0	13.0	0.2	30.0	5	9.3	13.0	5.7	2.1	14.0
Troubled Asset Relief												
# Banks	2						13					
# Interventions	2						32					

Panel B: Non-GIIPS Countries

	2007 - 2009						2010 - 2012					
VARIABLES	N	Mean	Median	SD	Min	Max	N	Mean	Median	SD	Min	Max
# Banks: Sample	799						783					
# Banks with Interventions	30						11					
# Interventions	126						26					
Recapitalization												
# Banks	24						4					
# Interventions	42						12					
Gross Amount (mn. EUR)	42	2,455	1,700	2,284	54	10,000	12	577	360	600	61	2,080
Gross Amount/TA (%)	38	0.8	0.8	0.6	0.0	2.3	12	0.72	0.34	0.84	0.00	2.20
Guarantees												
# Banks	18						5					
# Interventions	55						7					
Amount (bn. EUR)	55	374.1	408.6	327.2	4.1	1,022.2	7	318.8	418.8	281.8	16.6	645.2
Amount/TA (%)	52	144	114	60	83	259	7	154	114	72	104	259
Other Liquidity Support												
# Banks	10											
# Interventions	11						1					
Amount (mn. EUR)	11	11,056	11,071	11,671	729	40,000	1	1,100	1,100	.	1,100	1,100
Amount/TA (%)	10	2.3	1.8	1.8	0.3	5.2	1	1.4	1.4	.	1.4	1.4
Troubled Asset Relief												
# Banks	10						5					
# Interventions	18						7					

Table 3: **Variable Definitions and Summary Statistics**
The table shows variable definitions and summary statistics for bank-level (Panel A) and macro-level variables (Panel B). All variables are as of end-2007.

Panel A: Bank-level variables

VARIABLES	Definition	N	Mean	Median	SD	Min	Max
Total Assets/GDP	Total assets to nominal GDP (%)	830	3.46	0.13	13.33	0.04	128.72
Log Loans	Log gross loans	826	7.83	7.38	1.52	5.53	13.23
Loans/TA	Gross loans to total assets	826	60.91	62.64	18.63	3.16	95.39
Net Int. Margin	Net interest margin (% of total assets)	825	2.19	2.25	0.82	0.13	4.03
Equity/TA	Total equity to total assets (%)	830	6.51	6.03	2.75	0.01	19.76
Tier 1 Ratio	Tier 1 regulatory capital ratio (%)	280	9.42	8.45	3.32	4.51	24.13
LLP/Loans	Loan loss provisions to gross loans (%)	806	0.71	0.54	1.38	-1.29	34.14
NPL/Loans	Non-performing loans to gross loans (%)	262	3.53	2.72	4.35	0.18	42.58
Log Age	Log time since incorporation	319	3.97	4.41	1.15	0.69	7.50
ROAA	Return on average assets (%)	827	0.51	0.29	0.63	-1.40	7.41
ST funding/TA	Short-term funding to total assets (%)[1]	811	0.97	0.00	3.80	-0.10	47.89
Loans/Deposits	Loans to deposits (%)	799	117.84	99.88	74.72	22.36	598.73
Log z-score	Log z-score (Laeven and Levine, 2009)	721	4.72	4.62	1.27	0.74	7.36
RWA/TA	Risk-weighted assets to total assets (%)	259	67.40	72.70	20.48	10.42	95.37
Securities/TA	Securities to total assets (%)	826	20.83	18.73	14.25	0.05	99.74

Panel B: Macro-level variables

VARIABLES	Definition	N	Mean	Median	SD	Min	Max
CA Balance	Current account balance (% of nominal GDP)	13	-0.95	-0.33	7.35	-14.00	9.92
Budget Balance	Budget balance (% of nominal GDP)	13	-0.23	0.10	3.04	-6.70	5.10
Avg. Equity Ratio	Banking sector average of 'Equity/TA'	13	6.88	6.83	1.38	4.11	9.07
Avg. Tier 1 Ratio	Banking sector average of 'Tier 1 Ratio'	12	9.35	9.28	1.87	6.41	12.10

[1]Short-term funding is calculated as Bankscope Global Item 'Deposits & Short Term Funding' less Bankscope Universal Item 'Total Deposits'.

Table 4: **T-test: Bank Characteristics by Type of Intervention**
The table shows differences in bank characteristics by the type of intervention during the 2007 to 2009 period. Banks with government support during the 2007 to 2009 period are separated into three groups: banks with a high recapitalization amount per total assets (*high RC/TA*), banks with a low recapitalization amount per total assets (*low RC/TA*), and banks that only obtain liquidity support (*LIQ only*). The recapitalization amount per total assets is high (low) if the aggregate recapitalization amount per total assets obtained in the 2007 to 2009 period is above (below) the median recapitalization amount per total assets in the 2007 to 2009 period. Columns (1)–(3) report mean values for each characteristic by intervention group. The last two columns report the difference in means and the parametric t-statistic of the difference in means relative to the high RC/TA category. Bank characteristics are as of end-2007.

Bank Characteristics	(1) **high RC/TA**	(2) **low RC/TA**	(3) **LIQ only**	**Difference** (2)–(1)	**Difference** (3)–(1)
Total Assets/GDP	28.75	40.40	5.74	-11.65	23.01***
				(0.36)	(0.00)
Equity/TA	5.45	4.70	6.48	0.76	-1.02*
				(0.41)	(0.10)
Tier 1 Ratio	8.30	7.57	7.79	0.73	0.51
				(0.25)	(0.43)
LLP/Loans	0.33	0.45	0.49	-0.11	-0.16**
				(0.53)	(0.04)
NPL/Loans	3.20	3.33	3.31	-0.13	-0.11
				(0.87)	(0.86)
Log Age	3.82	3.48	4.02	0.35	-0.20
				(0.50)	(0.55)
ROAA	0.81	0.45	0.75	0.36**	0.06
				(0.05)	(0.56)
ST funding/TA	3.73	4.18	8.18	-0.45	-4.45*
				(0.80)	(0.09)
Loans/Deposits	200.13	155.59	158.26	44.54	41.87
				(0.22)	(0.16)
Log z-score	3.58	3.69	4.71	-0.11	-1.13***
				(0.75)	(0.00)
RWA/TA	60.21	51.25	71.22	8.96	-11.01**
				(0.14)	(0.03)
Securities/TA	23.71	28.42	14.25	-4.71	9.46***
				(0.27)	(0.00)

Table 5: **Baseline Cox Regression for Government Interventions**
The table presents the results of Cox regressions for government interventions between September 15, 2008 and December 31, 2009. Banks exit the sample if they receive a government intervention of any type (*any*) or a recapitalization (*recap*). Hazard rates h_{AID}, $AID \in \{any, recap\}$ take the exponential form

$$h_{AID,i}(t) = h_{AID,0}(t) \cdot \exp(\beta_0 \times X_{i,t-1} + \beta_1 \times b_{c,t-1} + \beta_2 \times m_{c,t-1}).$$

Bank-level variables $X_{i,t-1}$ comprise total assets to domestic GDP (*Total Assets/GDP*), the equity-to-assets ratio (*Equity/TA*), the regulatory Tier 1 ratio (*Tier 1 Ratio*), the short-term funding ratio (*ST funding/TA*) and return on average assets (*ROAA*). Banking sector variables $b_{c,t-1}$ comprise the average equity ratio in the domestic banking sector (*Average Equity Ratio*) and the average Tier 1 ratio in the domestic banking sector (*Average Tier 1 Ratio*). Macroeconomic variables $m_{c,t-1}$ comprise the current account balance to GDP (*CA Balance*) and the budget balance to GDP (*Budget Balance*) in the country of incorporation. Tie-breaking follows the Efron-Rule. Standard errors are robust and adjusted for clustering at the country-level. The table reports coefficient estimates. Parentheses contain p-values. *, **, *** denote statistical significance at the 10%, 5%, and 1%-levels, respectively.

Panel A: Baseline Specification

	(1)	(2)	(3)	(4)
VARIABLES	any	any	recap	recap
Total Assets/GDP	0.03***	0.03**	0.05***	0.06***
	(0.00)	(0.02)	(0.00)	(0.00)
Equity/TA	-0.25***	-0.33***	-0.49**	-0.53**
	(0.00)	(0.00)	(0.03)	(0.03)
ST funding/TA	0.10***	0.05***	0.07**	0.09***
	(0.00)	(0.00)	(0.04)	(0.00)
ROAA	0.37	-0.00	-0.82***	-0.62**
	(0.27)	(0.99)	(0.00)	(0.01)
CA Balance		-0.15***		0.39***
		(0.00)		(0.00)
Budget Balance		-0.09		-1.04***
		(0.27)		(0.00)
Avg. Equity Ratio		-0.14		0.77***
		(0.56)		(0.00)
Observations	45,631	45,631	22,276	22,276
N fail	83	83	36	36
Pseudo-R2	0.14	0.23	0.31	0.42

Panel B: Tier 1 Ratio

	(5)	(6)	(7)	(8)
VARIABLES	any	any	recap	recap
Total Assets/GDP	0.03***	0.03***	0.05***	0.05***
	(0.00)	(0.00)	(0.00)	(0.00)
Tier 1 Ratio	-0.26**	-0.24***	-0.39***	-0.83***
	(0.01)	(0.00)	(0.00)	(0.00)
ST funding/TA	0.09***	0.09***	0.04	0.10***
	(0.00)	(0.00)	(0.40)	(0.00)
ROAA	-0.21	-0.21*	-0.77***	-0.42*
	(0.16)	(0.09)	(0.00)	(0.08)
CA Balance		0.03		0.54***
		(0.41)		(0.00)
Budget Balance		-0.21**		-1.32***
		(0.05)		(0.00)
Avg. Tier 1 Ratio		-0.11		0.88***
		(0.58)		(0.00)
Observations	17,384	17,384	8,564	8,564
N fail	57	57	32	32
Pseudo-R2	0.17	0.20	0.25	0.41

Table 6: **Cox Regression for Government Interventions: GIIPS vs. non-GIIPS**
The table presents the results of Cox regressions for government interventions between September 15, 2008 and December 31, 2009. Banks exit the sample if they receive a government intervention of any type (*any*) or a recapitalization (*recap*). Hazard rates $h_{AID},\ AID \in \{any, recap\}$ take the exponential form

$$h_{AID,i}(t) = h_{AID,0}(t) \cdot \exp(\beta_0 \times X_{i,t-1} + \widetilde{\beta}_0 \times X_{i,t-1} \times GIIPS + \beta_1 \times b_{c,t-1} + \beta_2 \times m_{c,t-1}).$$

Bank-level characteristics $X_{i,t-1}$ comprise total assets to domestic GDP (*Total Assets/GDP*), the equity-to-assets ratio (*Equity/TA*), the regulatory Tier 1 ratio (*Tier 1 Ratio*), the short-term funding ratio (*ST funding/TA*) and return on average assets (*ROAA*). Banking sector variables $b_{c,t-1}$ comprise the average equity ratio in the domestic banking sector (*Average Equity Ratio*) and the average Tier 1 ratio in the domestic banking sector (*Average Tier 1 Ratio*). Macroeconomic variables $m_{c,t-1}$ comprise the current account balance to GDP (*CA Balance*) and the budget balance to GDP (*Budget Balance*) in the country of incorporation. *Dummy GIIPS* equals 1 for countries Greece, Ireland, Italy, Portugal and Spain, and 0 otherwise. Tie-breaking follows the Efron-Rule. Standard errors are robust and adjusted for clustering at the country-level. The table reports coefficient estimates. *, **, *** denote statistical significance at the 10%, 5%, and 1%-levels, respectively.

VARIABLES	(1) any baseline	(2) recap baseline	(3) any Tier1	(4) recap Tier1
Total Assets/GDP	0.05***	0.07***	0.04***	0.08***
	(0.00)	(0.00)	(0.00)	(0.00)
Total Assets/GDP × GIIPS	-0.04	-0.04***	-0.02	-0.05***
	(0.12)	(0.00)	(0.40)	(0.00)
Equity/TA	-0.43**	-0.67***		
	(0.02)	(0.00)		
Equity/TA × GIIPS	0.09	0.39**		
	(0.57)	(0.04)		
ST funding/TA	0.10***	0.06	0.07***	0.08***
	(0.00)	(0.17)	(0.00)	(0.00)
ST funding/TA × GIIPS	-0.06*	0.01	0.03	0.02
	(0.10)	(0.86)	(0.26)	(0.43)
ROAA	-0.46	-1.28***	-0.93*	-1.13***
	(0.57)	(0.01)	(0.05)	(0.00)
ROAA × GIIPS	0.75	0.83	0.99*	1.17***
	(0.35)	(0.16)	(0.06)	(0.00)
CA Balance	-0.16***	0.49**	-0.00	0.61***
	(0.00)	(0.01)	(0.95)	(0.00)
Budget Balance	-0.11	-1.14***	-0.21*	-1.42***
	(0.22)	(0.00)	(0.05)	(0.00)
Avg. Equity Ratio	-0.41	0.68***		
	(0.19)	(0.00)		
Tier 1 Ratio			-0.20**	-0.72***
			(0.02)	(0.00)
Tier 1 Ratio × GIIPS			-0.09	0.05
			(0.40)	(0.68)
Avg. Tier 1 Ratio			-0.24	0.80***
			(0.32)	(0.00)
Observations	45,631	22,276	17,384	8,564
N fail	83	36	57	32
Pseudo-R2	0.25	0.42	0.21	0.41

Table 7: **Size of Government Intervention**
The table displays results of Tobit regressions for intervention amounts until December 2009. The Tobit regression specification is given as

$$y_i = \begin{cases} y_i^* & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases}; \qquad \text{where } y_i^* = \beta_0 \times X_{i,2007} + \beta_1 \times b_{c,2007} + \beta_2 \times m_{c,2007} + u_i.$$

The dependent variables are defined as the natural logarithm of aid amounts per total assets, log(1 + Net Recap Amount/TA) (*Recap*) and log(1+Liquidity Amount/TA) (*Liq. Aid*). Bank-level variables $X_{i,2007}$ comprise: total assets to domestic GDP (*Total Assets/GDP*), equity-to-assets ratio (*Equity/TA*), regulatory Tier 1 ratio (*Tier 1 Ratio*), short-term funding ratio (*ST funding/TA*) and return on average assets (*ROAA*), as of end-2007. Banking sector variables $b_{c,2007}$ comprise the average equity ratio in the domestic banking sector (*Average Equity Ratio*) and the average Tier 1 ratio in the domestic banking sector (*Average Tier 1 Ratio*), as of end-2007. Macroeconomic variables $m_{c,2007}$ comprise the current account balance to GDP (*CA Balance*) and the budget balance to GDP (*Budget Balance*) in the country of incorporation, as of end-2007. Standard errors are robust and adjusted for clustering at the country-level. Parentheses contain p-values. *, **, *** denote statistical significance at the 10%, 5%, and 1%-levels, respectively.

	(1)	(2)	(3)	(4)
	Recap	Liq. Aid	Recap	Liq. Aid
VARIABLES	baseline	baseline	Tier1	Tier1
Total Assets/GDP	0.00	0.01	0.00	0.03
	(0.66)	(0.26)	(0.65)	(0.11)
Equity / Tot Assets	-0.02	-0.34**		
	(0.73)	(0.01)		
Tier 1 Ratio			0.03	0.23
			(0.69)	(0.22)
Short-term funding/TA	-0.03**	-0.00	-0.04***	0.03
	(0.01)	(0.99)	(0.01)	(0.60)
ROAA	0.57	1.87*	0.60	1.29
	(0.24)	(0.06)	(0.27)	(0.21)
CA Balance	7.61**	-6.00	7.87**	1.81
	(0.02)	(0.39)	(0.03)	(0.77)
Budget Balance	-0.28***	0.62***	-0.15**	0.67***
	(0.00)	(0.00)	(0.03)	(0.00)
Avg. Equity Ratio	-0.26*	-0.14		
	(0.06)	(0.79)		
Avg. Tier 1 Ratio			0.01	-0.38
			(0.95)	(0.45)
Constant	1.88**	5.67*	-0.14	4.29
	(0.03)	(0.08)	(0.92)	(0.20)
Observations	85	85	61	61
Pseudo-R2	0.354	0.163	0.229	0.138

Table 8: **Largest Increases in the Bank-specific Hazard Rate**
The table ranks the 20 banks with government support in the 2007 to 2009 period that exhibit the largest increase in the bank-specific hazard rate. The table presents the change in log bank-specific hazard rates during the 2007 to 2009 period. Bank-specific hazard rates for the years 2007 and 2009 are calculated using the coefficient estimates from Cox regressions (Section 3.2) and eurozone-averaged macro variables. Column *Aid post 2009* takes value 1 if the bank receives additional government support during the 2010 to 2012 period and 0 otherwise. Column *Survival until 2012* takes value 1 if the bank survives at least until the end of 2012, and 0 otherwise.

	Name	**Country**	**Aid post 2009**	**Survival until 2012**
1.	Irish Nationwide Building Society	IE	1	0
2.	Anglo Irish Bank	IE	1	0
3.	Agricultural Bank Of Greece	GR	1	0
4.	Abanka	SI	1	1
5.	Proton	GR	1	0
6.	Banco Pastor	ES	1	0
7.	Caja Castilla La Mancha	ES	0	0
8.	RCI Banque	FR	0	1
9.	Alpha Bank	GR	1	1
10.	Caixa Terrassa	ES	0	0
11.	Caja De Burgos	ES	1	0
12.	Dexia	BE	1	1
13.	Caixa Tarragona	ES	1	0
14.	Piraeus Bank	GR	1	1
15.	Commerzbank	DE	0	1
16.	Eurobank Ergasias	GR	1	1
17.	Allied Irish Banks	IE	1	1
18.	Caja De Avila	ES	0	0
19.	Caja Inmaculada	ES	0	0
20.	Österreichische Volksbanken	AT	1	1

Table 9: **Adequacy of Government Support and Bank Health (2009–2012)**
The table presents the results of cross-sectional bank-level regressions for changes in bank health. Panel A shows results for ordinary least square regressions,

$$\Delta y_{i,2009-12} = \alpha + \beta_1 \times Aid_{i,2007-09} + \beta_2 \times Aid_{i,2007-09} \times \Delta hazard_{i,2007-09} + \gamma \times X_{i,2007} + FE_{\text{GIIPS},i} + u_i,$$

where changes in bank-level characteristics over the 2009 to 2012 period serve as dependent variables. Panel B contains analogous logistic regressions, where the dependent variables are indicator variables taking value 1 if bank i survives at least until the end of 2012 (*Survival until 2012*) or obtains a recapitalization in the 2010 to 2012 period (*Recap post 2010*), respectively. The variable *Aid 2007-09* is an indicator that takes value 1 if bank i obtained some type of government intervention (recapitalization, liquidity support or troubled asset relief) over the 2007 to 2009 period and 0 otherwise. The variable Δ *hazard* is the change in the log bank-specific hazard rate over the 2007 to 2009 period, standardized around its mean. Bank-level variables $X_{i,2007}$ comprise total assets to domestic GDP (*Total Assets/GDP*), the equity-to-assets ratio (*Equity/TA*), the regulatory Tier 1 ratio (*Tier 1 Ratio*), the short-term funding ratio (*ST funding/TA*) and return on average assets (*ROAA*), as of end-2007. Standard errors are heteroskedasticity-robust.

Panel A: Bank Balance Sheet Characteristics

	Equity/ TA Δ 09-12	Tier 1 Ratio Δ 09-12	Log Loans Δ 09-12	LLP/ Loans Δ 09-12	NPLs/ Loans Δ 09-12	ROAA Δ 09-12	Net Int. Margin Δ 09-12	RWA/ TA Δ 09-12
Aid 2007-09	-1.53***	-0.67**	-0.14**	0.15	2.62*	-0.12	-0.02	-1.46
	(0.01)	(0.01)	(0.01)	(0.71)	(0.07)	(0.72)	(0.84)	(0.37)
Aid 2007-09 × Δ hazard	-3.07**	-1.85	0.18	1.68**	5.71*	-1.34**	-0.21**	0.40
	(0.03)	(0.12)	(0.23)	(0.03)	(0.10)	(0.02)	(0.03)	(0.86)
Total Assets/GDP (2007)	0.01	0.02*	-0.00	0.00	0.00	0.00	-0.00	0.01
	(0.52)	(0.08)	(0.15)	(0.86)	(0.92)	(0.91)	(0.55)	(0.85)
Equity/TA (2007)	-0.07	-0.21***	0.01*	0.06**	0.13	-0.04	-0.01	0.03
	(0.40)	(0.00)	(0.09)	(0.03)	(0.21)	(0.21)	(0.15)	(0.93)
ST funding (2007)	-0.06	-0.07	0.00	0.07*	0.06	-0.06*	-0.01**	-0.06
	(0.29)	(0.19)	(0.88)	(0.09)	(0.50)	(0.07)	(0.03)	(0.64)
ROAA (2007)	-0.23	-0.01	-0.02	0.08	0.70	0.35	0.06*	1.29
	(0.60)	(0.99)	(0.19)	(0.55)	(0.55)	(0.21)	(0.07)	(0.36)
Constant	2.17***	3.39***	0.10***	-1.06***	0.59	0.16*	0.01	-2.04
	(0.00)	(0.00)	(0.00)	(0.00)	(0.63)	(0.10)	(0.86)	(0.17)
Observations	667	268	667	665	195	667	667	218
R-squared	0.38	0.06	0.08	0.24	0.13	0.15	0.10	0.12
GIIPS-FE	YES	YES	YES	YES	YES	YES	YES	YES

Panel B: Survival and Additional Recapitalizations

	Survival until 2012 Δ 09-12	Recap 2010-13 Δ 09-12
Aid 2007-09	-0.39**	0.22*
	(0.01)	(0.07)
Aid 2007-09 × Δ hazard	-0.03	0.16***
	(0.78)	(0.00)
Total Assets/GDP (2007)	0.00*	0.00
	(0.07)	(0.25)
Equity/TA (2007)	-0.00	-0.00
	(0.89)	(0.54)
ST funding (2007)	-0.00	-0.00
	(0.99)	(0.66)
ROAA (2007)	0.02	0.02
	(0.56)	(0.13)
Constant	0.96***	0.01
	(0.00)	(0.75)
Observations	757	757
R-squared	0.22	0.29
GIIPS-FE	YES	YES

Table 10: **Baseline Loan Regression**
The table presents the results of cross-sectional Khwaja and Mian (2008)-type bank lending regressions based on syndicated loan data,

$$\begin{aligned}\Delta y_{2007-10,i,c,j} =& \beta_1 \times Aid_{i,2007-09} + \beta_2 \times Aid_{i,2007-09} \times \Delta hazard_{i,2007-09} \\ &+ \gamma' X_{i,2007} + \eta_j + \eta_c + u_{ijc}.\end{aligned}$$

$y_{2007-10,i,c,j}$ measures the change in loan supply in the 2007 to 2010 period and is defined in the text. The unit of observation is at the bank-firm level. The variable *Aid 2007-09* is an indicator that takes value 1 if bank i obtained some type of government intervention (recapitalization, liquidity support or troubled asset relief) over the 2007 to 2009 period and a value of 0 otherwise. The variable Δ *hazard* is the change in the log bank-specific hazard rate over the 2007 to 2009 period, standardized around its mean. Bank-level control variables $X_{i,2007}$ comprise total assets to domestic GDP (*Total Assets/GDP*), the equity-to-assets ratio (*Equity/TA*), the regulatory Tier 1 ratio (*Tier 1 Ratio*), the short-term funding ratio (*ST funding/TA*) and return on average assets (*ROAA*), as of end-2007. Standard errors are clustered at the bank-level and heteroskedasticity-robust. *, **, *** denote statistical significance at the 10%, 5%, and 1%-levels, respectively.

VARIABLES	(1) Δ Loan	(2) Δ Log Loan	(3) Loan Incr.	(4) Relation	(5) New
Aid 2007-09	-0.15**	-0.33**	-0.04**	-0.01	-0.06*
	(0.02)	(0.01)	(0.04)	(0.56)	(0.06)
Aid 2007-09 × Δ hazard	0.02**	0.04**	0.02***	0.00	0.01*
	(0.01)	(0.02)	(0.00)	(0.67)	(0.06)
Total Assets/GDP (%) (2007)	-0.00	-0.00	-0.00	0.00***	-0.00*
	(0.60)	(0.60)	(0.81)	(0.00)	(0.08)
Equity / Tot Assets (2007)	0.00	0.01	-0.00	-0.00	0.01
	(0.74)	(0.79)	(0.98)	(0.74)	(0.31)
Short-term funding (2007)	0.01**	0.02**	0.00*	0.00*	0.00
	(0.04)	(0.02)	(0.07)	(0.07)	(0.30)
ROAA (2007)	0.04	-0.00	0.02	0.05***	-0.03
	(0.67)	(0.98)	(0.41)	(0.01)	(0.38)
Observations	17,240	17,240	17,240	12,425	17,240
R-squared	0.81	0.80	0.78	0.74	0.80
SE	cluster bank	cluster bank	cluster bank	cluster bank	cluster bank
Firm-FE	YES	YES	YES	YES	YES
Country-FE	YES	YES	YES	YES	YES

Table 11: **Borrower Quality**
The table presents the results of cross-sectional Khwaja and Mian (2008)-type bank lending regressions based on syndicated loan data,

$$\begin{aligned}\Delta y_{2007-10,i,c,j} =& \beta_1 \times Aid_{i,2007-09} + \beta_2 \times Aid_{i,2007-09} \times \Delta hazard_{i,2007-09} \\ &+ \beta_3 \times Aid_{i,2007-09} \times IC\ Low_j + \beta_4 \times Aid_{i,2007-09} \times \Delta hazard_{i,2007-09} \times IC\ Low_j \\ &+ \gamma' X_{i,2007} + \eta_j + \eta_c + u_{ijc}.\end{aligned}$$

$y_{2007-10,i,c,j}$ measures the change in loan supply in the 2007 to 2010 period and is defined in the text. The unit of observation is at the bank-firm level. The variable *Aid 2007-09* is an indicator that takes value 1 if bank i obtained some type of government intervention (recapitalization, liquidity support or troubled asset relief) over the 2007 to 2009 period and a value of 0 otherwise. The variable Δ *hazard* is the change in the log bank-specific hazard rate over the 2007 to 2009 period, standardized around its mean. The variable *IC low* is an indicator that takes value 1 if borrower j's 2-year mean interest coverage ratio in the pre-crisis years (2006 to 2007) is below the median 2-year interest coverage ratio, and 0 otherwise. Bank-level control variables $X_{i,2007}$ comprise total assets to domestic GDP (*Total Assets/GDP*), the equity-to-assets ratio (*Equity/TA*), the regulatory Tier 1 ratio (*Tier 1 Ratio*), the short-term funding ratio (*ST funding/TA*) and return on average assets (*ROAA*), as of end-2007. Standard errors are clustered at the bank-level and heteroskedasticity-robust. *, **, *** denote statistical significance at the 10%, 5%, and 1%-levels, respectively.

	(1)	(2)	(3)	(4)	(5)
	Δ Loan	Δ Log Loan	Loan Incr.	Relation	New
VARIABLES	IC Ratio	IC Ratio	IC Ratio	IC Ratio	IC Ratio
Aid 2007-09	-0.30**	-0.73**	-0.08*	-0.05**	-0.12**
	(0.02)	(0.01)	(0.05)	(0.04)	(0.04)
Aid 2007-09 × Δ hazard	0.00	-0.02	0.02***	-0.00	0.00
	(0.94)	(0.71)	(0.00)	(0.65)	(0.69)
Aid 2007-09 × IC low	0.04	0.22	-0.01	0.01	0.04
	(0.50)	(0.11)	(0.53)	(0.64)	(0.12)
Aid 2007-09 × Δ hazard × IC low	0.05***	0.11***	0.01**	0.01**	0.01**
	(0.00)	(0.00)	(0.02)	(0.03)	(0.02)
Observations	3,818	3,818	3,818	2,771	3,818
R-squared	0.73	0.70	0.73	0.62	0.71
SE	cluster bank	cluster bank	cluster bank	cluster bank	cluster bank
Firm-FE	YES	YES	YES	YES	YES
Country-FE	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES

Table 12: **Zombie Lending**
The table presents the results of cross-sectional Khwaja and Mian (2008)-type bank lending regressions based on syndicated loan data,

$$\begin{aligned}\Delta y_{2007-10,i,c,j} =& \beta_1 \times Aid_{i,2007-09} + \beta_2 \times Aid_{i,2007-09} \times \Delta hazard_{i,2007-09} \\ &+ \beta_3 \times Aid_{i,2007-09} \times zombie_j + \beta_4 \times Aid_{i,2007-09} \times \Delta hazard_{i,2007-09} \times zombie_j \\ &+ \gamma' X_{i,2007} + \eta_j + \eta_c + u_{ijc}.\end{aligned}$$

$y_{2007-10,i,c,j}$ measures the change in loan supply in the 2007 to 2010 period and is defined in the text. The unit of observation is at the bank-firm level. The variable *Aid 2007-09* is an indicator that takes value 1 if bank i obtained some type of government intervention (recapitalization, liquidity support or troubled asset relief) over the 2007 to 2009 period and a value of 0 otherwise. The variable Δ *hazard* is the change in the log bank-specific hazard rate over the 2007 to 2009 period, standardized around its mean. The variable *zombie* is an indicator that takes value 1 if firm j is a zombie firm, and 0 otherwise. Firm j is a zombie firm if its rating is BB or lower and it pays below benchmark interest rates on its loans. Bank-level control variables $X_{i,2007}$ comprise total assets to domestic GDP (*Total Assets/GDP*), the equity-to-assets ratio (*Equity/TA*), the regulatory Tier 1 ratio (*Tier 1 Ratio*), the short-term funding ratio (*ST funding/TA*) and return on average assets (*ROAA*), as of end-2007. Standard errors are clustered at the bank-level and heteroskedasticity-robust. *, **, *** denote statistical significance at the 10%, 5%, and 1%-levels, respectively.

	(1)	(2)	(3)	(4)	(5)
	Δ Loan	Δ Log Loan	Loan Incr.	Relation	New
VARIABLES	zombie	zombie	zombie	zombie	zombie
Aid 2007-09	-0.26**	-0.59**	-0.09***	-0.03	-0.10*
	(0.03)	(0.02)	(0.01)	(0.19)	(0.05)
Aid 2007-09 × Δ hazard	0.02	0.03	0.02**	0.00	0.00
	(0.45)	(0.50)	(0.01)	(0.98)	(0.83)
Aid 2007-09 × zombie	0.00	0.01	0.04	-0.00	-0.00
	(1.00)	(0.94)	(0.28)	(0.86)	(0.91)
Aid 2007-09 × Δ hazard × zombie	0.06***	0.04	0.04***	0.03***	-0.01
	(0.00)	(0.37)	(0.00)	(0.00)	(0.21)
Observations	2,500	2,500	2,500	1,829	2,500
R-squared	0.73	0.70	0.73	0.66	0.72
SE	cluster bank	cluster bank	cluster bank	cluster bank	cluster bank
Firm-FE	YES	YES	YES	YES	YES
Country-FE	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES

Appendix

Table A1: **Overview of State Aid Cases in the EU Financial Sector (Excerpt)**
The table provides an excerpt from the overview of State aid cases in the EU financial sector according to European Commission (2017).

State aid cases - situation as of 31 December

Decisions adopted by the Commission during the period 2008 to 2017[1]. When the Commission applied the Impaired Assets Communication the decision's reference is followed by (*)[2] [3].

Austria

Type of measure / Beneficiary	**Type of Decision**	**Date of adoption**
N557/2008 - Aid scheme for the Austrian financial sector (guarantees, recapitalisation & other)	Decision not to raise objections IP/08/1933	9 December 2008
N352/2009 - Prolongation	EXME/09/0630	30 June 2009
N663/2009 - Second prolongation	EXME/09/1217	17 December 2009
N241/2010 - Extension	IP/10/839	25 June 2010
SA.32018 – Extension	EXME 10/16.12	16 December 2010
N 214/2008 - Recapitalisation of Hypo Tirol	Decision not to raise objections IP/09/928	17 June 2009
N 640/2009 - BAWAG – temporary approval of capital injection and asset guarantee **	Decision not to raise objections IP/09/1989	22 December 2009
N 261/2010 - Restructuring of BAWAG **	Decision not to raise objections IP/10/865	30 June 2010
C 16/2009 and N698/2009 – Emergency aid to Hypo Group Alpe Adria **	Decision not to raise objections IP/09/1998	23 December 2009
SA.32745 - Restructuring of Kommunalkredit **	Decision not to raise objections IP/11/389	31 March 2011
SA.32172 and SA.32554 – Temporary	Decision not to raise	24 May 2011

[1] As a general rule, aid schemes are reviewable six months after approval. Some individual decisions are subject to a review and possible restructuring plan.
[2] If for a particular financial institution the Impaired Assets Communication was applied, this institution appears with the "**" except if the impaired assets measure has been amended.

[3] If for a particular decision not all the conditions of the IAC 2009 were fulfilled, the decision appears only once with the "*"

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Table A1 (continued): **Overview of State Aid Cases in the EU Financial Sector (Excerpt)**

approval of aid for Hypo Group Alpe Adria [decision replaced – see below]	objections IP/11/636	
SA.32172 and SA.32554 – Replacement decision: Temporary approval of aid for Hypo Group Alpe Adria	Decision not to raise objections	19 July 2011
SA.31883 – Restructuring of Österreichische Volksbanken AG	Decision to open an in-depth procedure IP/11/1522	9 December 2011
SA.31189 – BAWAG Amendment Decision	Decision not to raise objections	19 December 2011
SA.31883 – Restructuring of Österreichische Volksbanken AG	Final decision IP/12/982	19 September 2012
SA.34716 - Recapitalisation of Hypo Tirol	Decision not to raise objections IP/12/1067	4 October 2012
SA.32554 - Temporary approval of an emergency recapitalisation in favour of Hypo Group Alpe Adria	Decision not to raise objections IP/12/1315	5 December 2012
SA.32745 -Run-off plan of Kommunalkredit	Decision not to raise objections EXME/13/19.07	19 July 2013
SA.32554 - Liquidation of Hypo Group Alpe Adria	Final decision IP/13/811	3 September 2013
SA. 31883 (2015/N) – Restructuring of Österreichische Volksbanken AG (OVAG): authorisation for the amended restucturing plan	MEX/15/5303	2 July 2015
SA. 32745 (2017/N) – Sale of parts of Kommunalkredit Austria AG		17 March 2017

Belgium

Belgium/Luxembourg

NN45-49-50/2008 – Guarantee on liabilities of Dexia	Decision not to raise objections IP/08/1745	19 November 2008
Prolongation	IP/09/1662	30 October 2009

Belgium/France/Luxembourg

4

Table A2: **State aid N 214/2008 - Recapitalization of Hypo Tirol (Excerpt)**
The table provides an excerpt from State aid case N 214/2008 on the recapitalization of the Austrian bank Hypo Tirol.

EUROPEAN COMMISSION

Brussels, 17.6.2009
C (2009) 4691 final corr.

In the published version of this decision, some information has been omitted, pursuant to articles 24 and 25 of Council Regulation (EC) No 659/1999 of 22 March 1999 laying down detailed rules for the application of Article 93 of the EC Treaty, concerning non-disclosure of information covered by professional secrecy. The omissions are shown thus […].

PUBLIC VERSION

WORKING LANGUAGE

This document is made available for information purposes only.

Subject: **State aid N 214/2009 – Austria**
Aid measures provided to Hypo Tirol Bank AG

Sir,

1. PROCEDURE

(1) Austria informed the Commission of the measure covered by this decision by letter dated 25 February 2009, registered with the Commission on 7 April 2009. Complementary information, necessary for the Commission's assessment of the compatibility of the aid, was submitted by Austria, dated 12 May 2009, 18 May 2009, 20 May 2009, 28 May 2009, 8 June 2009 and 10 June 2009.

2. BACKGROUND AND BENEFICIARY

(2) Hypo Tirol Bank Aktiengesellschaft (in the following "Hypo Tirol") is a credit-institution in the form of a joint stock company. The Austrian federal state (Land) Tirol is, indirectly via the Landes-Hypothekenbank Tirol Anteilsverwaltung, sole owner of the bank.

(3) Hypo Tirol is active in universal banking, insurance broking, in private banking and in the leasing business. Hypo Tirol is active in Tirol, in Italy (focussing on the region of Südtirol), and, as a niche bank, in Zurich, Munich and Vienna.

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Table A2 (continued): **State aid N 214/2008 - Recapitalization of Hypo Tirol (Excerpt)**

(4) In 2008 Hypo Tirol employed in average 786 employees and its balance sheet amounted to approx. EUR 13 billion, with earnings before tax of approx. EUR 16.6 million. While Hypo Tirol is not amongst Austria's largest banks, it is positioned among the important Austrian banks and is, when measured by balance sheet size, the biggest bank in Western Austria.

(5) Due to the financial crisis Hypo Tirol was confronted with losses and downgrades in its credit business, forcing it to reinforce its capital position. Hypo Tirol incurred losses […]* which affected its financial results in a manner that excluded the possibility of an allocation to reserves. As per 13 December 2008 the tier 1 capital ratio amounted to […] which is low compared to similar banks. In order to ensure a sustainable tier 1 capital ratio of above 7% comparable to its peers and […] whilst at the same time preserving its rating and possibilities for refinancing the aid measure described below was notified.

3. THE FINANCIAL SUPPORT MEASURE

(6) Hypo Tirol issues tier 1 hybrid capital (*Partizipationskapital*) in the amount of up to EUR 100 million, corresponding to 1.6% of the risk-weighted assets (RWA). This capital does not confer voting rights and is not cumulative in its payments to the subscribers.

(7) The capital will be issued via financial instruments and will be subscribed by private investors. The financial instruments have a dividend of 5% payable annually provided the bank shows a profit. As from 16 May 2014 the dividend amounts to EURIBOR (12 months) plus 200 basis points payable annually provided the bank shows a profit.

(8) Land Tirol issues a State guarantee for the principal capital amount subscribed by the investors for a period of ten years, which is called in the case of a bankruptcy of Hypo Tirol.

(9) For this guarantee, Hypo Tirol is paying to Land Tirol a progressively increasing guarantee fee, starting with 3.9% in the first three years, and rising to 6.6% in year number ten (see table).

Year	1-3	4	5	6	7	8	9	10
% Guarantee	3,9	4,2	4,5	4,8	5,1	5,6	6,1	6,6

* Confidential information

Table A2 (continued): **State aid N 214/2008 - Recapitalization of Hypo Tirol (Excerpt)**

(10) For the bank, therefore, the total cost of the capital injection amounts to 8.9% in year one, and rises progressively to 9.5% in year five. Thereafter, the total remuneration is comprised of an increasing guarantee fee and a dividend of 12 months Euribor plus 200 basis points.

(11) The financial instruments do not have a fixed maturity. After ten years, i.e. after the expiry of the guarantee, the private investors have a put option towards the Land Tirol, i.e. they can sell the financial instruments to the Land Tirol. Likewise, Land Tirol has a purchase option. It is envisaged that Tirol makes use of the purchase option and that the capital is subsequently redeemed by the bank. In case this does not happen and if Land Tirol were to remain the owner of the capital, Hypo Tirol commits itself to pay a dividend of Euribor (12 months) plus 860 basis points in year 11. In the 12th year the dividend payable to Land Tirol increases by additional 100 basis points to Euribor (12 months) plus 960 basis points. From year 13 onwards the dividend amounts to Euribor (12 months) plus 1000 basis points.

4. AUSTRIA'S POSITION

(12) Austria considers the bank to be fundamentally sound and has provided evidence to that effect.

(13) Austria explained that it was necessary for Hypo Tirol to reinforce its capital position through a measure that would qualify as tier 1 capital under the applicable solvency regulations.

(14) Austria considers that the measure constitutes state aid within the meaning of Article 87(1) EC. Austria believes that the aid is compatible with the common market under Article 87(3)(b) of the EC Treaty in the context of the current crisis.

(15) Austria considers that the measure is not a recapitalisation stricto sensu, as the aid is restricted to guaranteeing the nominal value of the capital provided by private investors, but accepts the application of the Recapitalisation Communication[1]. The measure is not envisaged under the scope of the Austrian scheme N 557/2008.

(16) Austria has provided a letter from the Austrian Financial Supervisory Authority which considers Hypo Tirol due to its size and strong regional position an important element in the Austrian banking sector.

(17) Austria commits to submit a viability plan for the bank after six months. However, if the bank is no longer fundamentally sound, Austria commits to submit a restructuring plan.

[1] Communication from the Commission – "The recapitalisation of financial institutions in the current financial crisis, limitation of aid to the minimum necessary and safeguards against undue distortions of competition", OJ C 10, 15/01/2009, p. 2

Table A3: **Intervention Characteristics Available in the Interventions Database**
The table provides an overview of the extensive intervention characteristics available in the interventions database. The database comprises intervention characteristics of government interventions for 192 eurozone banks (unconsolidated, before matching to Bankscope) in the 2007 to 2012 period. The study uses a limited subset of these intervention characteristics. All intervention characteristics can be made available upon request.

Panel A: Characteristics of Interventions	
VARIABLES	Description
All interventions	
Announcement Date	Date on which the intervention is publicly announced (limited data availability)
Implementation Date	Date on which the intervention is implemented
EC Decision Date	Date on which the EC decides on the compatibility with the EU Internal Market under TFEU 107(3)
Remuneration	Remuneration of the intervention
Remuneration Adequacy	Indicator taking value 1 if the EC evaluates remuneration to be adequate, and 0 otherwise
Intervention Scheme	Indicator taking value 1 if the intervention is granted within a sector-wide intervention scheme, and 0 otherwise
Recapitalizations	
Capital infusions and conversions of existing capital or hybrid instruments into higher-order capital instruments.	
Recapitalization Type	Type of recapitalization: Core Tier 1 injection, Tier 1 injection, other instruments
Gross Amount	Amount of capital infusion or conversion of existing capital/hybrid instruments
Net Amount	Amount of capital infusion net of conversions of existing capital
Voting Rights	Indicator taking value 1 if capital carries voting rights for governments, and 0 otherwise
CT 1 Capital	Indicator taking value 1 if capital is regulatory Core Tier 1 capital, and 0 otherwise
Redemption Clause	Indicator taking value 1 if redemption of capital is required, and 0 otherwise
Guarantees	
Government guarantees on non-deposit liabilities. Information is provided for the guarantee frame, not for each use.	
Eligible Liabilities	Liabilities for which guarantee can be used: bonds, loans, credit lines, commercial papers, hybrid capital, any new liabilities, litigation costs, interest rate payments, central bank collateral
Amount	Maximally available guarantee amount
One-time Issuance	Indicator taking value 1 if the guarantee is granted for a specific debt issuance, and 0 otherwise
Blanket Guarantee	Indicator taking value 1 if guarantee takes the form of a blanket guarantee, and 0 otherwise
Final Drawing Date	Last date at which a guarantee may be drawn
Maximum Maturity Date	Maximal maturity covered by the guarantee
Other Liquidity Support	
Interventions other than guarantees targeted at resolving liquidity problems	
Type Liquidity Support	Type of liquidity support other than guarantees: provision of direct loan, commercial papers, liquidity lines
Amount	Maximally available guarantee amount
Troubled Asset Relief	
Government interventions relieving bank balance sheets of impaired or defaulted assets by means of asset sales or guarantees.	
Type Troubled Asset Relief	Type of troubled asset relief measure: guarantee on assets remaining with bank; guarantees on assets in context of sale; bridge bank; sale to state agency; safe-for-troubled-asset swap
Book Value Portfolio	Book value of portfolio with troubled asset relief (limited data availability)
Market Value Portfolio	Market value of portfolio with troubled asset relief (limited data availability)
Bank's First Loss	Losses borne by the bank before government support can be used (limited data availability)

Panel B: Characteristics of sector-wide intervention schemes	
VARIABLES	Description
Type Scheme	Type of intervention covered by sector-wide scheme: recapitalization, guarantee, other liquidity support, troubled asset relief
Announcement Date	Date on which sector-wide scheme is announced
Start Date Scheme	Date on which sector-wide scheme became available
End Date Scheme	Date on which sector-wide scheme ended
Amount Scheme	Amount available within the sector-wide scheme

Table A4: **Bankscope IDs**
The table provides the Bankscope IDs corresponding to the banks' balance sheet characteristics employed in this study.

Panel A: Bank-level variables	
VARIABLES	Bankscope ID
Total Assets	2025
Loans/TA	2001 divided by 2025
Net Int. Margin	4018
Equity/TA	18165
Tier 1 Ratio	18150
LLP/Loans	4001
NPLs/Loans	4004
Log Age	No Bankscope ID, construced from Bankscope item "bank history"
ROAA	3024
ST funding/TA	(2003 - 2031)/2025
Loans/Deposits	18245
RWA/TA	30700 divided by 2025
Securities	11210 divided by 2025

Table A5: **Adequacy of Aid and Evolution of Bank Health 2009–2012: GIIPS vs. non-GIIPS**

The table presents the results of cross-sectional bank-level regressions for changes in bank health. Panel A shows results for ordinary least square regressions,

$$\begin{aligned}\Delta y_{i,2009-12} =& \alpha + \beta_1 \times Aid_{i,2007-09} + \beta_2 \times Aid_{i,2007-09} \times \Delta hazard_{i,2007-09} \\ &+ \beta_3 \times Aid_{i,2007-09} \times GIIPS + \beta_4 \times GIIPS \times \Delta hazard_{i,2007-09} \\ &+ \beta_4 \times Aid_{i,2007-09} \times GIIPS \times \Delta hazard_{i,2007-09} + \gamma \times X_{i,2007} + FE_{\text{GIIPS},i} + u_i,\end{aligned}$$

where changes in bank-level characteristics over the 2009 to 2012 period serve as dependent variables. Panel B contains analogous logistic regressions, where the dependent variables are indicator variables taking value 1 if bank i survives at least until the end of 2012 (*Survival until 2012*) or obtains a recapitalization in the 2010 to 2012 period (*Recap post 2010*), respectively. The variable *Aid 2007-09* is an indicator that takes value 1 if bank i obtained some type of government intervention (recapitalization, liquidity support or troubled asset relief) over the 2007 to 2009 period and a value of 0 otherwise. The variable Δ *hazard* is the change in the log macro-adjusted hazard rate over the 2007 to 2009 period, standardized around its mean. *Equity/TA*, *Total Assets/GDP*, *ROAA* and *ST funding/TA* are bank-level control variables, where coefficient estimates are suppressed for brevity. GIIPS is an indicator variable taking value 1 if the bank is located in Greece, Ireland, Italy, Portugal or Spain, and 0 otherwise. Standard errors are robust against heteroskedasticity.

Panel A: Bank Balance Sheet Characteristics

	Equity/ TA Δ 09-12	Tier 1 Ratio Δ 09-12	Log Loans Δ 09-12	LLP/ Loans Δ 09-12	NPLs/ Loans Δ 09-12	ROAA Δ 09-12	Net Int. Margin Δ 09-12	RWA/TA Δ 09-12
Aid 2007-09 × Δ hazard	-0.63**	0.12	-0.02	0.97***	0.04*	-0.66**	-0.00	-0.02
× non-GIIPS	(0.04)	(0.89)	(0.63)	(0.00)	(0.08)	(0.04)	(0.19)	(0.23)
Aid 2007-09 × Δ hazard	-3.34***	-1.93**	0.24***	0.93**	0.03	-0.82***	-0.00*	0.00
× GIIPS	(0.00)	(0.03)	(0.00)	(0.01)	(0.20)	(0.00)	(0.10)	(0.96)
Observations	667	268	667	665	195	667	667	218
R-squared	0.53	0.31	0.29	0.26	0.52	0.19	0.18	0.37
GIIPS-FE	YES	YES	YES	YES	YES	YES	YES	YES

Panel B: Survival and Additional Recapitalizations

	Survival until 2012	Recap post 2009
Aid 2007-09 × Δ hazard	0.14***	0.07**
× non-GIIPS	(0.00)	(0.02)
Aid 2007-09 × Δ hazard	-0.01	0.07***
× GIIPS	(0.84)	(0.00)
Observations	757	757
R-squared	0.89	0.32
GIIPS-FE	YES	YES