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Whatever it takes: The Real Effects of Unconventional Monetary Policy

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Non-Technical Summary

At the peak of the European debt crisis in 2012, anxiety about excessive national debt led to interest rates on government bonds issued by countries in the European periphery that were considered unsustainable, endangering the Eurozone as a whole. In response, the President of the European Central Bank (ECB), Mario Draghi, introduced the Outright Monetary Transactions (OMT) program by stating on July 26, 2012 that "[...] the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough." In our paper we analyze the effect of the OMT program announcement on bank lending and the resulting impact on the real economy.

Once activated towards a specific country, the OMT program allows the ECB to buy a theoretically unlimited amount of a country's government bonds in secondary markets. Even though the OMT program has not actually been activated yet, there is clear empirical evidence (e.g. Krishnamurthy et al., 2015) that the pure announcement effect of the OMT program caused a significant lowering of spreads of sovereign bonds issued by distressed European countries. In this regard the OMT program announcement has been a major success in preventing a potential break-up of the euro area.

Apart from its impact on sovereign bond spreads, the OMT program announcement also had significant effects on the European banking sector as a substantial amount of sovereign bonds was held on the balance sheets of domestic banks. Based on a new self-compiled pan-European dataset, which includes borrower-lender linkages as well as information on loan characteristics and borrower balance sheets, we empirically analyze the effect of the OMT program announcement on bank lending and the resulting impact on the real economy.

In our paper, we come to three major results. First, we show that the value increase of sovereign bonds caused by the OMT program announcement helped to restore the stability of the European banking system. The reason is that banks with significant holdings of government bonds issued by stressed European countries (especially Greece, Ireland, Italy, Portugal and Spain (GIIPS)) experienced substantial windfall gains, resulting in a backdoor (indirect) bank recapitalization.

However, while the example shows that an indirect recapitalization measure like the OMT program allows central banks to target the recapitalization of banks that hold troublesome assets, it also reveals that central banks are not able to tailor the amount of the recapitalization to a bank's specific capital needs. Therefore, even though European banks regained some lending capacity due to the recapitalization effect of the OMT announcement, some of these banks still remained weakly capitalized after the announcement.

Second, we document that the resulting improvement in bank health led to an increase in loans available to firms. In particular, the results of our lending regressions indicate that especially low-quality borrowers benefited from the increased loan volume in the period following the OMT program announcement. In contrast, the loan volume extended to high-quality borrowers did not increase.

Following Caballero et al. (2008) and Giannetti and Simonov (2013), we show that undercapitalized banks extended loans to existing low-quality borrowers at interest rates that were below the rates paid by the most creditworthy European borrowers (high-quality public borrowers in non-GIIPS European countries). This result is consistent with the incentives of undercapitalized banks to misallocate credit towards existing impaired borrowers – a strategy that is commonly known as "loan evergreening" or "zombie lending". In particular undercapitalized banks have an incentive to roll over loans from existing borrowers that struggle financially. Due to these zombie loans, the impaired borrowers acquire enough liquidity to be able to meet their payments on outstanding loan commitments. Thereby, banks can avoid having to declare the outstanding loans as non-performing which would lower the banks' net operating income, force them to raise provisioning levels and increase the likelihood that they violate their minimum capital requirements.

Third, we analyze whether the rise in zombie firms after the OMT program announcement had an impact on non-zombie firms operating in the same industries as one can assume that the "loan evergreening" behavior by undercapitalized banks could lead to a crowding-out of credit to more productive and creditworthy firms operating in the same industries as existing zombie firms. Building on the analysis of Caballero et al. (2008), we document that high-quality non-zombie firms indeed suffered from an increased presence of zombie firms in their industries: Both their investment and employment growth rates were significantly lower compared to high-quality non-zombie firms active in industries without a high prevalence of zombie firms. In particular, high-quality non-zombie firms in industries with an average increase in the fraction of zombie firms (i.e., 8.9 %) invested between 11.6 % and 13.3 % less capital and had between 3.6 % to 4.4 % lower employment growth rates compared to a scenario where the fraction of zombies would have stayed at its pre-OMT level.

Our analysis hence highlights the importance of recapitalizing banks adequately to prevent them from engaging in zombie lending. While the launch of the OMT program helped to avert a collapse of the eurozone by stabilizing government bond yields and (partially) restoring financial stability, combining the program with a targeted bank recapitalization program would most likely have induced a much stronger economic recovery.

Whatever it takes: The Real Effects of Unconventional Monetary Policy*

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Abstract

The ECB's Outright Monetary Transactions (OMT) program, launched in summer 2012, indirectly recapitalized periphery country banks through its positive impact on the value of sovereign bonds. However, the regained stability of the European banking sector has not fully transferred into economic growth. We show that zombie lending behavior of banks that still remained undercapitalized after the OMT announcement is an important reason for this development. As a result, there was no positive impact on real economic activity like employment or investment. Instead, firms mainly used the newly acquired funds to build up cash reserves. Finally, we document that creditworthy firms in industries with a high prevalence of zombie firms suffered significantly from the credit misallocation, which slowed down the economic recovery.

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1 Introduction

At the peak of the European debt crisis in 2012, the anxiety about excessive national debt led to interest rates on government bonds issued by countries in the European periphery that were considered unsustainable, which endangered the Eurozone as a whole. In response, the president of the European Central Bank (ECB), Mario Draghi, introduced the Outright Monetary Transactions (OMT) program by stating on July 26, 2012, during a conference in London that "[...] the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough."

Once activated towards a specific country, the OMT program allows the ECB to buy a theoretically unlimited amount of the country's government bonds in secondary markets. Even though the OMT program has still not been actually activated, there is clear empirical evidence that the pure announcement effect of the OMT program has been very successful in terms of lowering spreads of sovereign bonds issued by distressed European countries. Szczerbowicz et al. (2012), Altavilla et al. (2014), Krishnamurthy et al. (2014), and Ferrando et al. (2015) all find that the OMT measure lowered periphery sovereign yields, especially for Italian and Spanish government bond yields (by roughly 2 pp).[1] Moreover, we show that the resulting value increase of these bonds helped to restore the stability of the European banking system as banks with significant holdings of these bonds experienced substantial windfall gains, resulting in a backdoor (indirect) bank recapitalization.

However, when Mario Draghi reflected on the impact of the OMT program on the real economy during a speech in November 2014, he noted that "[...] these positive developments in the financial sphere have not transferred fully into the economic sphere. The economic situation in the euro area remains difficult. The euro area exited recession in the second quarter of 2013, but underlying growth momentum remains weak. Unemployment is only falling very slowly. And confidence in our overall economic prospects is fragile and easily disrupted, feeding into low investment."

There are a lot of unvital signs that Europe's weak economic recovery is a repeat of Japan's "zombie lending" experience in the 1990s, when banks in distress failed to foreclose on unprofitable and highly indebted firms.[2] For example, in 2013, in Portugal, Spain and Italy, 50%, 40% and 30% of debt, respectively, was owed by firms which were not able to cover their interest expenses out of their pre-tax earnings.[3] To the best of our knowledge, our paper is the first to provide systematic evidence that, indeed, the

[1] Furthermore, Krishnamurthy et al. (2014) investigate which channels led to the reduction in bond yields. The authors find that for Italy and Spain, a decrease in default and segmentation risks was the main factor in case of OMT, while there might have been a reduction in redenomination risk in the case of Spain and Portugal, but not for Italy.

[2] See, for example, "Blight of the living dead", *The Economist*, July 13, 2013 and "Companies: The rise of the zombie" by Michael Stothard, *Financial Times*, January 8, 2013.

[3] "Europe's other debt crisis", *The Economist*, October 26, 2013.

slow economic recovery in Europe can at least partially be explained by zombie lending motives of banks that still remained undercapitalized after the OMT announcement. In particular, we find that from the Euro 543 billion in loans extended to the European firms in our sample after the OMT announcement, roughly 8% were extended to low-quality firms at interest rates that were lower than the rates paid by the most creditworthy firms in the economy (i.e., AAA rated public firms). This problem is most pronounced in Italy, where roughly 18% of loans were zombie loans, as well as, Spain and Portugal, where roughly 11% of the loan volume was extended to zombie firms.

While an indirect recapitalization measure like the OMT program allows central banks to target the recapitalization to banks holding troublesome assets, it does not allow them to tailor the amount of the recapitalization to a bank's specific capital needs. Therefore, even though European banks regained some lending capacity due to the recapitalization effect of the OMT announcement, some of these banks still remained weakly-capitalized after the announcement, creating zombie lending incentives for these banks. By continuing to lend to their impaired borrowers, distressed banks can avoid realizing losses on outstanding loans, which would further deter the banks' situation due to increasing regulatory scrutiny and intensified pressure from market forces. Instead, by "evergreening" loans to their impaired borrowers, banks in distress can gamble for resurrection in the hope that their borrowers regain solvency, or, at least, they can delay taking a balance sheet hit. This behavior leads to an inefficient allocation of bank loans, since loan supply is shifted away from creditworthy productive firms towards distressed less productive borrowers, which distorts market competition and causes detrimental effects on employment, investment, and growth in general.[4]

Our sample is based on loan information data obtained from Thomson Reuters LPC's DealScan, which provides extensive coverage of bank-firm relationships throughout Europe. We augment this dataset with firm-specific information from Bureau van Dijk's Amadeus database and bank-specific information from various sources, including the banks' CDS spreads, balance sheet information, and sovereign debt holdings. The sample includes all private firms from all EU countries for which Dealscan provides loan information and covers the years 2009 until 2014. This dataset allows us to trace the impact of the OMT program announcement through the banking sector to the real economy. Accordingly, we organize our empirical analysis into three parts. First, we determine the extent to which individual banks were affected by the announcement of the OMT program. Second, we track the resulting change in their lending behavior and, finally, we evaluate whether the change in loan supply led to real effects for European firms.

Our results show that banks with significant holdings of government bonds issued by stressed European countries (the GIIPS countries, i.e., Greece, Ireland, Italy, Portugal,

[4]See Kane (1989), Peek and Rosengren (2005), Caballero et al. (2008), and Giannetti and Simonov (2013).

and Spain) realized the highest windfall gains after the OMT announcement, which improved their equity capitalization and liquidity. Moreover, we document that the resulting improvement in bank health led to an increase in available loans to firms.[5] Building on the methodology of Khwaja and Mian (2008), we find that, in the quarters following the OMT announcement, banks with higher windfall gains on their sovereign debt holdings increased loan supply to the corporate sector relatively more than banks with lower windfall gains, but only to existing borrowers (intensive margin). Conversely, we do not find any significant relation between a bank's windfall gains and its propensity to issue new loans to borrowers it did not have a prior relation with (extensive margin).

To analyze which type of borrowers benefited most from an increased lending volume in the period after the announcement of the OMT program, we divide our sample into low- and high-quality borrower based on the ability of firms to service existing debt. In particular, a low-quality (high-quality) borrower is defined as having a below (above) country median interest coverage ratio. The results of our lending regressions show that in particular low-quality borrowers benefited from the increased loan volume in the period following the OMT program announcement. In contrast, the loan volume extended to high-quality borrower did not increase. The fact that the banks' loan supply increase in the period following the OMT announcement was primarily targeted towards existing borrowers with a low creditworthiness is a first indication that zombie lending behavior might have prevailed in the European lending market.

Given this evidence, we then specifically test whether these results can indeed be traced back to zombie lending behavior by banks that regained some lending capacity due to the OMT announcement but still remained weakly-capitalized and hence had risk-shifting incentives. Following Caballero et al. (2008) and Giannetti and Simonov (2013), we show that these banks extended loans to existing low-quality borrowers at interest rates that are below the rates paid by the most creditworthy European borrowers (high-quality public borrowers in non-GIIPS European countries). A potential alternative explanation for this finding besides zombie lending due to risk-shifting incentives could be government pressure on specifically weakly-capitalized domestic banks to redirect credit to weak firms at advantageous interest rates to avoid defaults. If government pressure would indeed be the explanation for the banks' zombie lending behavior, we would expect that (i) a prior bank-firm lending relationship is not important for the likelihood of a new zombie loan, (ii) zombie lending is more prevalent for banks with a significant government ownership stake, and (iii) that especially government owned firms received zombie loans. However, we do not find evidence for any of these hypotheses, which suggests that the banks' zombie lending behavior is mainly driven by risk-shifting incentives of weakly-capitalized banks.

[5]This result is consistent with the findings of a concurrent paper by Ferrando et al. (2015), who find in their survey data study that after the announcement of OMT, less firms report that they are credit rationed and discouraged from applying for loans.

A distinguish feature of firms classified as zombies is that they are struggling financially. However, their financial problems could be caused by temporary financial constraints (e.g., due to limited access to bank financing) or fundamental economic problems. In the first case, these firms should have recovered after they regained access to bank financing, while, if their financial problems are due to fundamental economic problems, their performance should have remained poor even after banks increased their loan supply to these firms. Therefore, we track the real outcomes of firms that benefited from the loan supply increase after the OMT announcement and analyze whether there is a difference between the behavior and performance of non-zombie firms and firms classified as zombies. For this analysis, we closely follow the approach used in Acharya et al. (2015a). In particular, we use a difference-in-differences framework to evaluate the performance and policies of borrowing firms in the post-OMT period. To measure the impact of the OMT program announcement, we construct a variable for each firm that captures its indirect benefits from the post-OMT value increase of the sovereign debt holdings of the banks it is associated with. We provide evidence that borrowers with higher indirect OMT windfall gains (i.e., benefits accrued via their banks) increased both their cash holdings and leverage by roughly the same amount, suggesting that they used the majority of cash inflow to build up cash reserves. Firms that received subsidized loans (zombie firms), on the other hand, are not able to increase cash and leverage by the same margin since these firms have to use the funds acquired through new loans, at least partially, to repay some other debts. Moreover, we do not find any changes in real economic activity: neither investment, employment, nor return on assets are significantly affected by a firms' indirect OMT windfall gains.

To consistently estimate the real effects for borrowing firms, we include industry-country-year fixed effects to capture any time-varying shocks to an industry in a given country that may have affected the firms' credit demand, their access to credit, and/or their real outcomes. Moreover, if a firm borrows from a bank incorporated in a GIIPS country (GIIPS bank), we include foreign bank GIIPS country-year fixed effects, that is, a fixed effect for the GIIPS bank's country of incorporation. These fixed effects absorb any unobserved, time-varying heterogeneity that may arise because a firm's dependency on banks from a certain country might be influenced by whether this firm has business in the respective country. Consider as an example a German firm borrowing from a Spanish and a German bank. For this firm, we also include a Spain-year fixed effect to capture the firm's potential exposure to changes in the macroeconomic environment in Spain. Furthermore, we control for unobserved, time-constant firm heterogeneity and observable time-varying firm characteristics that affect the firms' corporate policies, loan demand, and/or loan supply.

In a final step, we analyze whether the rise in zombie firms after the OMT announcement had an impact on non-zombie firms operating in the same industries. There are two

potential channels through which non-zombie firms could be negatively affected. First, banks with zombie lending incentives might shift their loan supply to existing borrowers in distress, thereby crowding-out credit to more productive and creditworthy firms operating in the same industries. Second, zombie lending keeps distressed borrowers artificially alive, which congests the respective markets. The resulting distorting effects on healthy firms competing in the same industries include, for example, depressed product market prices and higher market wages. Building on the analysis of Caballero et al. (2008), we document that high-quality non-zombie firms indeed suffered from an increased presence of zombie firms in their industry: both their investment and employment growth rates were significantly lower compared to high-quality non-zombie firms active in industries without a high prevalence of zombie firms. In particular, high-quality non-zombie firms in industries with an average increase in the fraction of zombie firms (i.e., 8.9%) invest between 11.6% and 13.3% of capital less and had between 3.6% to 4.4% lower employment growth rates compared to a scenario where the fraction of zombies would have stayed at its pre-OMT level. An industry at the 95th percentile experienced an increase of zombie firms of 30%, implying that high-quality non-zombie firms invested between 39% and 44% of capital less and had 12% to 15% lower employment growth rates. These findings highlight that the distorted market competition, induced by the misallocation of loan supply due to zombie lending, hampered real economic growth and thus significantly weakened the potentially positive impact of the OMT program's indirect bank recapitalization effect. Finally, our results indicate that zombie lending seems to have been an issue not only in the syndicated loan market, but across all loan categories (loans to SMEs, etc.). In particular, our analysis shows that for banks we identify as banks that engaged in zombie lending based on our syndicated loan data, the ratio of non-performing loans over gross loans increased significantly over our sample period, while it only increased slightly for banks for which we do not find evidence for zombie lending.

Overall, our analysis provides evidence that central banks can indirectly recapitalize an undercapitalized banking sector by introducing policy measures that affect the prices of assets that banks are holding on their balance sheets. However, it also highlights that central banks need to pay close attention to the magnitude of the resulting windfall gains that banks can realize from such an intervention, and hence the amount of additional equity capital these banks are being provided. If the backdoor (indirect) bank recapitalization fails to adequately recapitalize (some) banks, zombie lending incentives may arise, which can have detrimental effects on employment, investment, and growth in general. Therefore, while the announcement of the OMT program probably averted an even fiercer economic downturn or even a break-up of the Eurozone, our results suggest that combining the OMT program with a targeted bank recapitalization program could have led to superior outcomes in terms of economic growth. Given a well-capitalized European banking system, the increased loan supply would have been targeted mainly at the most productive firms and, without the market distortions due to zombie lending, the regained

stability of the European banking system probably would have been fully transferred into economic growth.

2 Data

We use a novel hand-matched dataset that contains bank-firm relationships in Europe, along with detailed firm and bank-specific information. Information about bank-firm relationships are taken from Thomson Reuters LPC's DealScan, which provides a comprehensive coverage of the European syndicated loan market. In contrast to the U.S., bank financing is the key funding source for firms in our sample since only very few bonds are issued in Europe (Standard&Poor's, 2010). The sample includes private firms from all EU countries for which Dealscan provides significant loan information and our sample period spans the fiscal years 2009-2014. Consistent with the literature (e.g., Sufi, 2007), all loans are aggregated to a bank's parent company.

We augment the data on bank-firm relationships with firm-level accounting data taken from Bureau van Dijk's Amadeus database. This database contains information about 19 million public and private companies from 34 countries, including all EU countries.[6] Since especially non-listed firms were affected by the lending contraction in the periphery due to their lack of alternative funding sources, we restrict our sample to private firms in Europe (see Acharya et al. (2015a)). This allows us to evaluate whether firms that were under severe stress during the peak of the sovereign debt crisis benefited from the OMT announcement.

Finally, we obtain information on bank as well as sovereign CDS spreads from Markit, sovereign bond information from Datastream, bank level balance sheet data from SNL, and data on the sovereign debt holdings of banks from the European Banking Authority (EBA). For banks to be included in the sample, they must act as lead arranger in the syndicated loan market during our sample period. We identify the lead arranger according to definitions provided by Standard & Poor's, which for the European loan market are stated in Standard & Poor's Guide to the European loan market (2010). Therefore, we classify a bank as a lead arranger if its role is either "mandated lead arranger", "mandated arranger", or "bookrunner". Moreover, the banks need to be included in the capital exercise conducted by the EBA in June 2012, which is the closed elicitation of the banks' portfolio structure prior to the OMT announcement in July 2012.

[6]For a description of the process to match DealScan and Amadeus see Acharya et al. (2015a).

3 Bank Capitalization and Liquidity

The OMT announcement significantly lowered spreads of sovereign bonds issued by distressed European countries, thereby increasing their prices. As a result, banks with significant holdings of these bonds experienced substantial windfall gains. First, bonds in the banks' trading book, which are marked-to-market, directly increased in value, thereby improving their equity position. Second, even though the sovereign bonds in the banks' banking book did not directly appreciate in value, as they are not marked-to-market, market participants include a value increase of these bonds in their bank valuation. For example, Italian-based UBI Banca states in its annual report of 2012: "The effects of the narrowing of the BTP/Bund spread entailed an improvement in the market value of debt instruments with a relative positive net impact on the fair value reserve of Euro 855 million [...]." Given UBI Banca's total equity of 8,608 million, this amounts to a gain of 9.9% of total equity. Consistent with this statement, Krishnamurthy et al. (2014) and Acharya et al. (2015b) document significantly positive effects on banks' equity prices after the OMT announcement.

To formally estimate the direct impact of the OMT announcement on the capitalization of European banks, we exploit information on the complete breakdown of their sovereign debt holdings. In particular, by using information on changes in sovereign bond prices, as well as the data on the banks' sovereign debt holdings, we construct a measure (called *OMT windfall gain*) for how much a bank's equity capital increased due to the OMT announcement. To compute the banks' *OMT windfall gain*, we first compile data on the sovereign debt holdings of all sample banks at the closest date available before July 26 (the first OMT announcement date), which is the EBA capital exercise from June 2012. From Datastream, we obtain information on EU sovereign bonds prices, yields, and duration for various maturities.[7]

Second, we calculate the change in bond prices for all maturities around the three OMT announcement dates (July 26, August 2, and September 6) and sum these changes across the three announcement dates.[8] Third, we multiply the respective sovereign debt holdings outstanding before July 26 and the sum of the change in sovereign bond prices for each maturity and country. Finally, the total *OMT windfall gain* of a bank follows from summing the individual gains over all EU sovereign bonds in the bank's portfolio.

[7]As Krishnamurthy et al. (2014), we are not able to use sovereign yields from Greece and Ireland since for these countries information on yields is partially or completely missing. Hence, we are not able to calculate the *OMT windfall gain* for Greek and Irish banks since the majority of sovereign debt holdings of GIIPS banks is domestic. Moreover, note that, while mainly GIIPS sovereign yields were affected by the OMT announcement, the sovereign yields of other countries were also affected (although to a lesser extent). To capture all sovereign debt holdings, our measure of *OMT windfall gain* is based on all EU sovereign debt holdings of a bank.

[8]For the OMT announcement dates, we follow Krishnamurthy et al. (2014) and analyze the events on July 26, 2012 ("whatever-it-takes" speech); August 2, 2012 (OMT program announcement); and September 6, 2012 (release of technical details).

We report this gain on sovereign debt holdings as a fraction of a bank's total equity throughout, that is, we define the windfall gains of bank b in country j as:

$$OMT\ windfall\ gain_{bj} = \frac{\Delta\, Value\ EU\ Sov.\ Debt_{bj}}{Total\ Equity_{bj}}. \tag{1}$$

Column (1) of Panel A in Table 1 reports the results for the *OMT windfall gain*, split by GIIPS and non-GIIPS banks. In particular, the equity capital of GIIPS banks and non-GIIPS banks increased by 8% and 1% due to the appreciation of their sovereign debt portfolio induced by the OMT announcement, respectively. Hence, while both subsets of banks experienced significant windfall gains, GIIPS banks experienced significantly larger windfall gains as is evidenced by a t-value of 5.69. This difference can be explained by the fact that right before the OMT announcement, the GIIPS sovereign bond holdings as a fraction of total assets is roughly 10 times larger for GIIPS than for non-GIIPS banks (11.8% compared to 1%; as shown by Column (2)) and that GIIPS sovereign yields were most affected by the OMT announcement.[9]

Finally, Column (3) reports results for time-series regressions of CDS spreads on a set of dummy variables for the three OMT announcement dates. We run separate regressions for the subset of GIIPS and non-GIIPS banks and report the mean of the sum over the three event dates. In line with the previous findings, the results show that the OMT announcement had a significant positive effect on the perceived stability of GIIPS banks as the CDS spread of the mean GIIPS bank decreased by -96bp over the three OMT announcement dates, while it only decreased by -23bp for the average non-GIIPS bank. Consistent with this finding, Figure A1, Panel A in the online appendix shows a clear negative relation between a bank's sovereign debt holdings and its CDS return around the OMT announcement. This relation is also present within the subsample of GIIPS banks, as shown by Panel B.[10] In the following we will refer to banks that strongly benefited (above mean *OMT windfall gain*, which consists mainly of GIIPS banks) as *high gain banks* and banks that benefited less (below mean *OMT windfall gain*) from the OMT announcement as *low gain banks*.

Panel B of Table 1 presents the evolution of the banks' book leverage ratio separately for high and low gain banks as well as for U.S. banks. Moreover, we split high gain banks into banks that have an above median leverage ratio after the OMT announcement (still undercapitalized) and those with a below median leverage ratio (well-capitalized). Before the start of the financial and sovereign debt crisis, both well-capitalized and still undercapitalized high gain banks had lower leverage ratios than low gain banks (which

[9]The difference in pre-OMT GIIPS sovereign holdings between GIIPS and non-GIIPS banks can be explained by the home bias of the banks' sovereign bond holdings (e.g., Acharya and Steffen, 2014).

[10]Table A1 in the online appendix reports regression results where we regress the value of the banks' GIIPS sovereign debt holdings (Panel A) and their *OMT windfall gain* (Panel B) on their CDS return. The results suggest that the decrease in the banks' CDS spread can indeed be explained by the appreciation in value of their sovereign debt holdings.

consist predominantly of non-GIIPS banks). However, while the leverage ratio decreased significantly over time for low gain banks, it increased dramatically for high gain banks classified as still undercapitalized (peaking in the year prior to the OMT announcement at 24.51) and slightly for well-capitalized high gain banks over the sovereign debt crisis period. Furthermore, while the leverage ratio of weakly-capitalized high gain banks banks improved after the OMT announcement, they still remain highly levered after the announcement. Well-capitalized high gain banks, on the other hand, are back to their pre-crisis leverage ratio after the OMT announcement. A similar picture emerges when considering the quasi leverage of banks, defined as market value of equity plus the book value of debt divided by the market value of equity (see Panel C of Table 1). Hence, although the OMT announcement increased the banks' equity capitalization through its positive effect on the valuation of the sovereign bond holdings of European banks, some of these banks still remained weakly-capitalized after the announcement.

In addition to the positive impact on the banks' equity capitalization, the OMT announcement also positively affected the banks' liquidity. First, with a backdoor recapitalization measure like the OMT announcement, banks' existing assets appreciate in value which increases the asset side of their balance sheets, resulting in additional equity on the liability side. By restructuring their asset portfolio, banks can then free-up liquidity needed to make new investments.[11]

Second, the OMT announcement also improved the ability of banks with significant holdings of GIIPS sovereign bonds to acquire funding from financial markets. For example, Spain-based BBVA noted in its annual report of 2012: "[...] as a result of new measures adopted by the ECB with the outright monetary transactions (OMT), the long-term funding markets have performed better, enabling top-level financial institutions like BBVA to resort to them on a recurring basis for the issue of both senior debt and covered bonds." Furthermore, since banks regularly use sovereign bonds as collateral, their access to private repo markets and ECB financing improved as well due to higher bond ratings and the resulting lower haircuts.

Finally, the OMT announcement helped banks to free-up liquidity that they had acquired previously, for example, under the longer-term refinancing operations (LTRO) programs, but which they were not able to invest due to their insufficient solvency. In particular, while the LTRO programs provided banks with large amounts of liquidity, we do not see an expansion of credit between the start of LTRO programs (launched in December 2011) and the OMT announcement (see Figure 1). A likely explanation is that banks had to use the liquidity obtained from the LTRO programs to safeguard against the risk of massive deposit withdrawals as, in early 2012, financial markets throughout

[11]In contrast, a direct government bank recapitalization directly increases the banks' liquid funds on the asset side and equity capital on the liability side, giving them immediately spare liquidity available for new investments without having to restructure the asset portfolio first.

Europe were characterized by high uncertainty so that even small negative events had potentially large consequences.[12] For example, British customers withdrew 200 million pounds on the day after the credit rating downgrade of Banco Santander and some analysts estimated that banks would have lost up to 10% of their deposit base if Greece had left the Eurozone in 2012.[13] Only after the OMT announcement, which significantly improved the banks' financial stability, they were able to use the liquidity acquired under the LTRO programs to grant new loans.

To provide evidence on the extent to which banks where subject to a bank run in early 2012, we adopt the method used in Veronesi and Zingales (2010), which utilizes the term structure of CDS rates to estimate the probability of a bank run. The idea is to compare the probability of bankruptcy in year 1 ($P1$) and the conditional probability of bankruptcy in year 2 given no default in year 1 ($P2$). The run index is then calculated as $R = P1 - P2$. A positive R value is an indication that a bank is subject to a run as this means that the probability of default is higher in the short-term (i.e., within one year) than in the long-term (i.e., in year 2 conditional on surviving year 1). Figure 2 plots the evolution of the run index over the period January 2012 to December 2013 for high and low gain banks. For high gain banks the run index is positive at the beginning of 2012 but gradually decreases after the second LTRO allotment date (February 2012). However, the decline in the probability of a bank run is not permanent as the run index increases again until the date of the OMT announcements (the three vertical lines). After the OMT announcement the run index is permanently lower than 0 (even lower than for low gain banks), which indicates that the imminent threat of a bank run is no longer present for high gain banks. Table 2 confirms this result using bank-level regressions. The results show that banks with higher *OMT windfall gains* have a significantly stronger reduction in their run index (calculated as the average six months prior to OMT compared to the average six months after OMT). These results suggest that the issue of high gain banks not extending credit to the real sector in 2011 and early 2012 was a matter of solvency but not liquidity.

We draw two main conclusions from the analysis in this section. First, through its positive effect on the valuation of the sovereign bond holdings of European banks, the OMT announcement increased the banks' equity capitalization and their liquidity. This is especially true for GIIPS banks, which are the banks that had reduced their real sector lending during the European debt crisis the most (see Acharya et al., 2015a). Thereby, the OMT announcement helped to restore the stability of the European banking system. However, an backdoor (indirect) recapitalization measure like the OMT program does not allow central banks to tailor the amount of the recapitalization to a bank's specific

[12]Between 20% to 50% of bank deposits are held overnight and could therefore be withdrawn at very short notice.

[13]See, "Europe Banks Dear a Flight", *The Wall Street Journal*, May 21, 2012 by David Enrich, Sara Schaefer Munoz, and Charles Forelle.

capital needs. Therefore, even though European banks regained some lending capacity due to the recapitalization effect of the OMT announcement, some of these banks still remained weakly-capitalized after the announcement, potentially creating risk-shifting incentives.

4 Bank Lending

We now turn to the question of whether and how the announcement of the OMT program and its recapitalization effect affected the banks' lending behavior in the quarters following the OMT announcement. We employ the same methodology as Acharya et al. (2015a) to control for loan demand and other observed and unobserved changes in borrowing firm characteristics. In particular, we track the evolution of the lending volume from a specific bank to a certain firm cluster, which allows us to control for any observed and unobserved characteristics that are shared by firms in the same cluster and that might influence loan outcomes.

To this end, we form firm clusters based on the following three criteria, which capture important drivers of loan demand, as well as the quality of firms in our sample: (i) the country of incorporation; (ii) the industry; and (iii) the firm rating.[14] The main reason for aggregating firms based on the first two criteria is that firms in a particular industry in a particular country share a lot of firm characteristics and were thus likely affected in a similar way by macroeconomic developments during our sample period. Our motivation behind forming clusters based on credit quality follows from theoretical research in which credit quality is an important source of variation driving a firm's loan demand (e.g., Diamond, 1991).

4.1 Loan Volume

We start our empirical investigation by analyzing the lending volume to private borrowers around the OMT announcement graphically. Figure 1 plots the log of the sum loans provided by high gain banks (above mean *OMT windfall gain*) and low gain banks (below mean *OMT windfall gain*) from the OMT announcement in a given quarter. Note that we measure the change in loan volume relative to the quarter of the OMT announcement, that is, the y-axis is normalized to zero at the time of the announcement in Q3 2012. Figure 1 documents a significant increase in loan supply to private borrowers after Q3 2012 by banks that strongly benefited from the OMT announcement. In contrast, the loan supply by banks that did not significantly benefit from the measure remained roughly at the same level.

[14]Since private borrowers generally do not have a credit rating, we assign ratings estimated from three-year median interest coverage ratio by rating category provided by Standard & Poor's.

Next, we formally investigate whether the indirect equity recapitalization induced by the OMT announcement led to a change in the banks' loan supply to the real sector. In particular, we test whether banks with higher *OMT windfall gains* increased their loan supply to existing borrowers (intensive margin) and/or firms with which no lending relationship existed before the OMT announcement (extensive margin) more than banks with relatively low *OMT windfall gains*. Our preferred specification to estimate the quarterly change in loan volume to existing borrowers (i.e., clusters only consist of firms with a relation to the respective bank) provided by bank b in country j to firm cluster m in quarter t is given by:

$$\begin{aligned} \Delta Volume_{bmjt+1} &= \beta_1 \cdot OMT\ windfall\ gain_{bj} * PostOMT \\ &+ \gamma \cdot X_{bjt} + Firm\ Cluster_m \cdot Quarter\text{-}Year_{t+1} \\ &+ Firm\ Cluster_m \cdot Bank_{bj} + u_{bmjt+1}, \end{aligned} \tag{2}$$

where the firm clusters only consist of firms that had a prior relation (before the OMT announcement) with a bank. Our main variable of interest is *OMT windfall gain* interacted with a dummy variable *PostOMT*, which is equal to one when the quarter falls into the period after the OMT announcement.

For the extensive margin, our dependent variable is an indicator equal to one if the bank issued a new loan to a firm cluster to which no relation existed in the period prior to the OMT announcement. Our respective preferred specification is given by:

$$\begin{aligned} NewLoan_{bmjt+1} &= \beta_1 \cdot OMT\ windfall\ gain_{bj} * PostOMT \\ &+ \gamma \cdot X_{bjt} + Firm\ Cluster_m \cdot Quarter\text{-}Year_{t+1} \\ &+ Firm\ Cluster_m \cdot Bank_{bj} + u_{bmjt+1}, \end{aligned} \tag{3}$$

where the firm clusters consist of firms with no prior relation (before the OMT announcement) with a bank.

We present the results of this empirical analysis in Table 3, where, for brevity, we only report the results for our main variable of interest. The results in Panel A show that banks with higher windfall gains from the OMT announcement significantly increased their supply of bank loans to existing private borrowers (intensive margin) after the OMT announcement. This result holds across all specifications (Columns (1)-(4)), which control for different sets of fixed effects. In Column (1), we include bank and quarter-year fixed effects. Column (2) shows the regression results for the case in which we interact firm-cluster and bank fixed effects, which exploits the variation within the same firm-cluster-bank relationship over time. This controls for any unobserved characteristics that are shared by firms in the same cluster, bank heterogeneity, and for relationships between firms in a given cluster and the respective bank. Finally, in the results reported in

Columns (3) and (4), we add firm-cluster-time fixed effects, which allow us to additionally control for any time observed and unobserved time-varying characteristics that are shared by firms in the same cluster.

To further test the robustness of these results, we follow Peek and Rosengreen (2005) and Giannetti and Simonov (2013) and employ the probability of a loan increase instead of the change in the loan amount as the dependent variable in our regression analysis. Results in Column (5) of Table 3, Panel A confirm that our result is robust to using this alternative measure of lending supply expansion. Finally, Column (6) of Table 3 estimates the regression for the case in which we restrict our sample to GIIPS banks. Recall that, in particular, GIIPS banks hold large GIIPS sovereign debt holdings, which implies that especially these banks benefited from the OMT program announcement. The significant coefficient in Column (6) shows that also within the subsample of GIIPS banks, those banks with higher windfall gains increased lending to existing borrowers more than banks with lower windfall gains.

Conversely, Panel C of Table 3 shows that across all specifications there is no significant relation between a bank's *OMT windfall gain* and its propensity to issue a new loan to a group of borrowers it had no prior relation with. These results suggest that only existing borrowers benefited from the loan supply increase induced by the announcement of the OMT program. As a robustness check, we replace *OMT windfall gain* in regressions from Eqs. (2) and (3) with a bank's *CDS return* on the OMT announcement dates. This allows us to determine the extent to which banks benefited from the OMT announcement with market price reactions and thus the perceived change in bank credit risk in the market. Results are presented in Table A2 in the online appendix. Panel A and C show that all results continue to hold qualitatively and quantitatively using this alternative measure.

4.2 Borrower Quality

To determine whether banks that benefited from the OMT announcement targeted the subsequent increase in loan supply towards a particular type of borrower, we separately analyze the change in lending volume extended to low- and high-quality borrowers. In particular, we identify a low-quality (high-quality) borrower as a firm with a below (above) country median 3-year average interest coverage ratio in the crisis years 2009 to 2011. The general picture that emerges from Panel B in Table 3 is that the loan volume increase (at the intensive margin) in the period after the OMT announcement was primarily extended to low-quality borrowers since only the triple interaction term of OMT windfall gains, post-OMT, and low-quality is significantly positive.

An explanation for this result is that in many cases borrowers with a below country median average interest coverage ratio based on the 2009 to 2011 period are precisely

those borrowers that had close borrowing relationships with high gain banks in the past. Acharya et al. (2015a) show that these banks significantly lowered their lending supply to the real sector during the European debt crisis since they suffered significant losses on their sovereign bond holdings and, in addition, bought more domestic sovereign bonds due to risk-shifting incentives, which crowded out corporate lending. As a result, firms that were very dependent on high gain banks became financially constrained during the crisis, even though they were not less healthy before the outbreak of the European debt crisis (i.e., there was no systematic relation between firm quality and whether a firm borrowed from high gain banks prior to the sovereign debt crisis). Since bank-borrower relationships are sticky (e.g., Chodorow-Reich, 2014), and private firms are less able to utilize alternative funding sources, these borrowers were stuck with their distressed banks. Consequently, they got under stress themselves and, in turn, their interest coverage ratios decreased, as shown by Figure 6, Panel A.

Table 3, Panel D shows that, even if we split the firms according to their quality, there are no significant loan supply effects at the extensive margin. Panels B and D of Table A2 show that these loan volume results for borrowers of different quality continue to hold if we employ the banks' *CDS returns* on the OMT announcement dates instead of their *OMT windfall gains* in regressions (2) and (3).

4.3 Zombie Lending

Given that some banks remained undercapitalized even after the OMT announcement (potentially causing risk-shifting incentives) and only low-quality borrower with pre-existing lending relationships benefited from the increased loan supply, we next explore whether banks' lending behavior can be explained by loan evergreening (zombie lending). In particular, weakly-capitalized banks have an incentive to extend new loans at advantageous interest rates to existing borrowers in distress to avoid having to declare outstanding loans non-performing. Declaring them non-performing would lower the banks' net operating income, require them to raise provisioning levels, and also would tie up even more equity capital due to higher risk weights on impaired assets (see Aiyar et al., 2015 and Jassaud and Kang, 2015). As a result, regulatory scrutiny and pressure from market forces would be more intense, which would further deteriorate the banks' situation. By "evergreening" loans to their impaired borrowers, struggling banks can gamble for resurrection in the hope that their borrowers regain solvency, or, at least, they can delay taking a balance sheet hit. Indeed, many observers have raised the concern that Europe's weak economic growth is a repeat of Japan's experience in the 1990s, when banks in distress failed to foreclose on unprofitable and highly indebted firms.[15]

[15]For example, "Blight of the living dead", *The Economist*, July 13, 2013, "Europe's other debt crisis", *The Economist*, October 26, 2013, and "Companies: The rise of the zombie" by Michael Stothard, *Financial Times*, January 8, 2013.

4.3.1 Identification of Zombie Firms

To detect zombie firms, we follow the approach in Caballero et al. (2008) and Giannetti and Simonov (2013), which is based on whether firms obtained subsidized credit from their banks. In particular, a firm is considered to have received subsidized credit (i.e., a loan at a very advantageous interest rate) if in a given year the actual interest expenses paid by the firm is below the interest expense paid by the most creditworthy firms in the economy. To this end, we use the interest rate paid by public firms incorporated in non-GIIPS countries with a AAA rating (inferred from EBIT interest coverage ratios) as benchmark interest rate. Public, non-GIIPS firms were among the least affected firms by the sovereign debt crisis, since they were less strongly affected by the macroeconomic downturn in the European periphery and were also able to substitute a potential lack of bank financing with other sources of funding. By calculating benchmark interest rates from public firms we further reduce the risk of misclassifying private firms as zombies because Saunders and Steffen (2011) document that public firms pay lower spreads than otherwise similar private firms, suggesting that there is a cost of being a private firm.

We use information from two different sources to calculate interest rate benchmarks. In what follows we use r for interest rates and R for interest expenses. The first approach is based on loan information from Dealscan (denoted with index D). To calculate interest rate benchmarks, we first compute the median interest rate on newly issued loans in a given year paid by public firms incorporated in non-GIIPS countries with AAA rating (inferred from EBIT interest coverage ratios). This approach has the advantage that we know the maturity of the loans and can thus calculate the benchmark interest rate based on two different maturity buckets m. To be even more conservative, we use the minimum of this measure over the last 5 years, that is, we assume that the firm receives new credit when interest rates are most favorable to the firm. This yields two benchmark interest rates (short and long term) r^D_{tm} in year t. Given this interest rate benchmark, we calculate the threshold $R^{D^*}_{ijht}$ below which the interest payment of private firm i in country j and industry h in year t is considered subsidized as

$$R^{D^*}_{ijht} = \sum_m r^D_{tm} \cdot Debt_{ijhtm}, \tag{4}$$

where we split a firm's total debt $Debt_{ijht}$ into short and long term debt.

The second approach to calculate the benchmark interest rate is based on information obtained from Amadeus (denoted with index A). More precisely, Amadeus reports the total interest payments of firm i in country j and industry h in year t, R_{ijht}, as well as its total outstanding debt, $Debt_{ijht}$. Therefore, the average interest rate paid by firm i can be calculated by dividing R_{ijht} by $Debt_{ijht}$. However, with the data from Amadeus, we are not able to distinguish between the interest paid on different maturities. Hence, we divide firms into two groups, based on their reliance on short and long term debt.

The benchmark rate for private firms that rely mostly on short (long) term debt is then derived from a AAA rated public firms with a similar debt maturity structure. In particular, the interest rate benchmark, r^A_{tm}, is calculated using the median interest rate paid by public firms incorporated in non-GIIPS countries with a AAA rating (inferred from EBIT interest coverage ratios) in a given year, split according to their reliance on short versus long-term debt. Given this interest rate benchmark, we calculate the threshold $R^{A^*}_{ijht}$ below which the interest payment of private firm i in country j and industry h in year t is considered subsidized as

$$R^{A^*}_{ijht} = r^A_{tm} \cdot Debt_{ijht}, \tag{5}$$

where we also split the private firms into two groups based on their reliance on short versus long-term debt. Figure 3 plots the evolution of the benchmark interest rates calculated from Dealscan and Amadeus over time and across maturities, as well as the median interest payment of zombie firms.

We then compare the actual interest payments of the low-quality borrowers in our sample with the two hypothetical interest payments to calculate the interest expense gap:

$$x^{n^*}_{ijht} = R_{ijht} - R^{n^*}_{ijht} \tag{6}$$

where $n \in \{D, A\}$. Ideally, we would like to compare the firms' interest expense in Dealscan to the benchmark derived from Dealscan. However, Dealscan contains information only at the time of the origination of the loan, which does not allow us to observe changes over time for a particular loan. Moreover, the spread information is missing for more than 50% of our Dealscan sample of private firms. Therefore, we compare both benchmark interest expenses (from Dealscan and Amadeus) to the firms' interest expense information derived from Amadeus.

Firm i is then classified as zombie if it meets the following three criteria: (i) x^{n*}_{ijht} is negative, (ii) its rating (derived from three year median EBIT interest coverage ratios) is BB or lower, and (iii) the syndicate composition has either remained constant, or banks leaving the syndicate without being replaced by new participants, that is, the same syndicate has already provided a loan to the firm.[16] By imposing the second criterion on zombie firms, we reduce the risk of misclassifying high-quality private borrower as zombies because these firms may pay low interest rates on their debt for reasons unrelated to zombie lending. By requiring zombies to fulfill the last criterion, we ensure that all banks involved have zombie lending incentives, that is, all banks should have a stake in the company from a prior loan and should be negatively affected when the firm defaults on the loan.

[16]Given that (i) and (ii) are satisfied, (iii) holds in 95% of the cases.

Figure 4 plots the asset-weighted fraction of zombie firms in our sample over time for the zombie definition based on the Amadeus and the Dealscan benchmark interest rates, respectively. The figure clearly shows that in the post-OMT period, the fraction of firms that received loans with an interest rate below the zombie lending benchmark increased significantly. Table 4, Panel A and B present a breakdown of the number of zombie firms by country for the zombie classification based on the interest rate benchmarks derived from Amadeus and Dealscan, respectively. The table documents that the zombie problem is particularly severe in the periphery of Europe, with Spain and Italy having around 16.3% to 20.3% of zombie firms, while Germany, France, and the UK, on the other hand, only have between 3.4% and 10% of zombie firms. Importantly, the zombie breakdown by country, and thus the firms that we classify as zombies is very stable across the two zombie definitions which are based on alternative benchmark interest rates. The zombie prevalence by country in our sample is also in line with anecdotal evidence from the financial press which stated that "the zombie problem is chiefly focused in the peripheries of Europe rather than the core".[17]

One potential concern is that only weak banks leave the syndicate. If this is true, then we would potentially misclassify zombie firms because a negative $x^{n^*}_{ijht}$ could also be explained by relationship lending of strong banks. In this argument, banks provide subsidized credit (criterion (i)) to weak firms (criterion (ii)) because they have better information about the future health of the borrower due to a long standing relationship. To test whether the remaining banks have zombie lending or relationship lending incentives, we compare the quality of banks remaining in the syndicate to banks that leave the syndicate. If the banks leaving the syndicate are of lower (higher) quality compared to the banks remaining in the syndicate, we would interpret this as evidence consistent with zombie (relationship) lending. The results of the comparison are provided in Panel C and Panel D of Table 4. The results show for both alternative zombie classifications that the banks leaving the syndicate have a higher equity ratio and are therefore of higher quality which is consistent with healthier banks not wanting to participate in zombie lending activities.

Table 4, Panel E and Panel F present further summary statistics on syndicates that engaged and syndicates that did not engage in zombie lending activities. The variables *Loan exposure to equity* and *Loan exposure to total loans* measure the banks' exposure to a specific firm as a fraction of the banks' equity and as a fraction of the total outstanding loans of the respective bank in a given year, respectively. The results are consistent with the conjecture that zombie lending to a particular firm is more attractive for a bank the greater its exposure towards this firm is. For example, the average *Loan exposure to total loans* is roughly 2% for bank loans to zombie firms, while it is less than 1.5 % for bank loans to non-zombie firms. We obtain similar results if we normalize the banks' loan

[17] "Companies: The rise of the zombie" by Michael Stothard, Financial Times, January 8, 2013.

exposure by their total equity.

The results further suggest that the prevalence of undercapitalized banks in a particular syndicate affects whether this syndicate is prone to engage in zombie lending behavior. For the zombie definition based on the Amadeus benchmark we find that syndicates that extended a loan to a zombie firm were on average comprised of over 50% still undercapitalized banks, whereas the mean non-zombie firm syndicate only consists of about 9% still undercapitalized banks. This results reinforces the notion that undercapitalized banks have strong zombie lending incentives because these banks would be significantly negatively affected when a distressed borrower would default on its loan.

Table 4, Panel G and H present the results for the comparison of zombie firms to other non-zombie low-quality firms. On average, zombie firms have a significantly higher leverage and lower net worth and EBITDA/Assets ratios. More importantly, zombie firms only have an interest coverage ratio of 0.29 or 0.40 (depending on the benchmark) as opposed to 1.12 for other low-quality firms, suggesting that they are unable to meet their current interest payments from the earnings generated. These results show that even within the group of low-quality firms, zombie firms are significantly worse than non-zombie firms.

A potential concern for our analysis could be that also other loan characteristics of zombie firms, besides the cost of borrowing, are significantly different. Even though we derive the benchmark interest rates separately for short- and long-term loans, it could still be that within these two maturity brackets, loans to zombie firms are, for example, of significantly shorter maturity. This could justify a reduction in the cost of borrowing. However, when comparing the characteristics of loans to zombie firms and other low-quality non-zombie firms we do not find any significant differences. More precisely, these loans are of similar size, and have similar maturity. Moreover, there is also no significant difference in the loan type (term loan versus revolver) extended to these firms that could lead to differences in the loan pricing.[18] Hence, the lower borrowing cost do not seem to be driven by differences in other loan characteristics.

4.3.2 Bank lending to Zombie Firms

We now analyze whether banks that regained some lending capacity due to the OMT announcement, but remained weakly-capitalized, engaged in zombie lending behavior in the period after the OMT announcement. For this analysis, we split banks into well-capitalized and still undercapitalized banks depending on whether their leverage ratio after the OMT announcement is below or above the median leverage.

We start by investigating graphically how banks changed their lending behavior towards zombie firms after the OMT announcement. As can be seen from Figure 5, Panel

[18]Unfortunately, we cannot observe covenants for our loan contracts.

A, after the OMT announcement, banks that regained some lending capacity due to their windfall gains from the OMT announcement (high gain banks) but which still remained undercapitalized show a very strong increase in their zombie loan volume relative to their total loan volume. Conversely, well-capitalized high gain banks significantly decrease their zombie loan volume in their loan book after the OMT announcement. Panel B, of Figure 5 shows that this significant increase in zombie loans as a fraction of total loans is mainly driven by still undercapitalized banks located in GIIPS countries. To investigate whether this lending pattern differs across the periphery countries, we further split GIIPS banks into two subgroups: Italian vs. Spanish/Portuguese banks.[19] Figure 5, Panels C and D show that, while both Italian and Spanish/Portuguese banks that remain undercapitalized show an increase in the fraction of zombie loan volume, the increase is much more pronounced in Italy than in Spain and Portugal.

Next, we formally test whether banks that regained some lending capacity due to the OMT announcement, but still remained undercapitalized, engaged in zombie lending behavior. In particular, to estimate the annual change in loan volume provided by bank b in country j to firm cluster m in year t, we employ the following panel regression:

$$\begin{aligned}
\Delta Volume_{bmjt+1} &= \beta_1 \cdot OMT\ windfall\ gain_{bj} * PostOMT \\
&+ \beta_2 \cdot OMT\ windfall\ gain_{bj} * PostOMT * Still\ Undercap_{bj} \\
&+ \beta_3 \cdot OMT\ windfall\ gain_{bj} * PostOMT * Zombie_{mt} \\
&+ \beta_4 \cdot OMT\ windfall\ gain_{bj} * PostOMT * Zombie_{mt} * Still\ Undercap_{bj} \\
&+ \gamma \cdot X_{bjt} + Firm\ Cluster_m \cdot Quarter\text{-}Year_{t+1} \\
&+ Firm\ Cluster_m \cdot Bank_{bj} + u_{bmjt+1}. \qquad (7)
\end{aligned}$$

Note that we also control for all other pairwise and triple interaction terms, but omit them in Eq. (7) for brevity. Moreover, in addition to the criteria used to form firm clusters in Section 4, for this analysis we add the criterion whether firms are classified as zombie or not: Hence, in this section, we form firm clusters based on the following four criteria: (i) the firm's country of incorporation; (ii) the industry; (iii) the firm rating; and (iv) whether the firm is classified as a zombie. Note that classifying firm clusters according to these criteria leads to a larger number of firm clusters than in the previous analysis.

The results for the zombie lending test are presented in Table 5.[20] Several findings are noteworthy. First, high *OMT windfall gain* banks that are well-capitalized increase the loan supply to corporate borrowers in the post-OMT announcement period, but

[19]Note that due the fact that only two Spanish banks still remain undercapitalized after the OMT announcement, we cannot investigate their lending behavior separately and thus have to combine them for this analysis with Portuguese banks to achieve enough cross-sectional variation.

[20]For the zombie lending analysis, we only report results at the intensive margin, since one of the criteria for classifying a firm as zombie is that it had a prior relation to all banks involved in the loan.

significantly decrease their zombie lending activity. Based on the specification in Column (4) of Panel A a one standard deviation higher *OMT windfall gain* implies an increase in loan supply by 2.5%. Banks that still remain undercapitalized, however, show no significant increase in their loan supply to private borrowers in Europe. These banks only increase the loan supply to zombie firms. Based on the coefficients reported in Table 5, Column (4), a one standard deviation higher *OMT windfall gain* implies a 1.1% increase in loan supply to zombie firms. We find similar results when we replace the change in loan volume with a dummy for whether the loan amount to a cluster actually increased (Column (5)) or when we restrict the analysis to GIIPS banks (Column (6)).[21]

Finally, we investigate whether we find the same lending pattern in both subsamples of GIIPS banks (i.e., Spanish/Portuguese and Italian banks), that is, well-capitalized banks increase their loan volume to non-zombie firms and cut lending to zombie firms, while still undercapitalized banks increase lending to zombie firms, but do not increase lending to non-zombie firms. Results for Spain and Portugal are presented in Column (7), whereas results for Italy are presented in Column (8). In line with the suggestive evidence of Figure 5, we find the increase in the zombie lending volume to be more significant (both statistically and economically) in Italy than in Spain and Portugal.

4.4 Alternative Explanations

In this section, we analyze alternative explanations for the findings in Sections 4.1 and 4.3.

4.4.1 EBA Capital Exercise

In Fall 2011, the EBA conducted a capital exercise that required a subset of European banks to increase their core tier 1 capital ratio to 9% by the end of June 2012 (i.e., one month prior to the OMT announcement in July 2012). One distinct feature of this capital exercise was that it included a surcharge for the banks' sovereign bond holdings. Therefore, our *OMT windfall gain* variable could be correlated with this regulatory recapitalization requirement as both are related to the holdings of sovereign bonds. Hence, regarding the results from Section 4.1, a possible concern is that the banks' increased loan supply could be driven by regulatory pressure to increase their capital ratios, as opposed to the equity windfall gains due to the positive effect of the OMT announcement on the value of the banks' sovereign debt holdings.

To rule out this alternative explanation, we compile data on the actual amount of new equity capital raised by banks prior to the regulatory deadline in June 2012 from

[21]Table A4 further shows the robustness of these results for the case where we use *CDS Returns* instead of *OMT windfall gain*.

the EBA webpage. Table A3 in the online appendix presents regression results where we rerun the regressions from Table 3, Panel B and additionally include the amount of new equity capital raised during the capital exercise period (denoted as *Equity Increase EBA*) as a further explanatory variable. Two observations are noteworthy. First, the *Equity Increase EBA* comes out insignificant and thus has no explanatory power for the increase in loan supply. Second, the economic as well as statistical significance of our *OMT windfall gains* variable in the regression remains largely unchanged after including the *Equity Increase EBA* variable as an additional explanatory variable.

A likely explanation for why the mandatory capital ratio increase until June 2012 required by the EBA did not significantly contribute to the increase in loan supply is that banks met this requirement mainly by reducing their risk-weighted assets, as opposed to an increase in their equity capital (see Gropp et al., 2016). Taken together, we interpret these findings as evidence that it was the windfall gains due to the OMT announcement and not the EBA capital exercise that triggered an extension of credit supply to the real economy.

4.4.2 Moral Suasion

Potentially, at the peak of the European debt crisis, governments might have formally or informally pressured domestic banks to redirect credit to weak firms at advantageous interest rates to avoid defaults and a resulting increase in unemployment. If governments indeed exerted pressure and, in addition, their ability and/or willingness to do so was correlated with the banks' capitalization, moral suasion could potentially drive our results (i.e., only undercapitalized banks engage in zombie lending, whereas well-capitalized banks significantly cut their exposure to zombie firms).

A potential link between the banks' capitalization and the degree to which they are prone to government moral suasion might be that, compared to well-capitalized banks, undercapitalized banks potentially have a higher likelihood of needing government assistance in the future and are hence more dependent on the government's goodwill. If this was indeed the case, governments might have targeted especially undercapitalized banks. We employ three different approaches to address this concern.

First, if the governments' concern about an increase in firm bankruptcies and their resulting pressure on banks is the reason for the increased loan supply of still undercapitalized banks to zombie firms, we would expect that a prior bank-firm lending relationship is not important for the likelihood of a new zombie loan. Hence, if government moral suasion was the reason for the increase in subsidized credit to low-quality borrowers, zombie lending should also occur at the extensive margin (i.e., to new borrowers), and not only at the intensive margin (i.e., to existing borrowers). However, only very few firms that meet the first two criteria to be classified as zombie firm (i.e., receiving subsidized credit

and being of low-quality) had no prior relation to a loan syndicate that ex-post extended a zombie loan. As a result, we are not able to rerun the regression from Eq. (7) for the extensive margin. We interpret this as an indication that government pressure is not the reason behind the zombie lending incentives of still undercapitalized banks.

Second, if governments indeed pressured weakly-capitalized banks to engage in zombie lending, we would expect that they were better able to persuade banks in which they had a significant ownership stake. Therefore, if government moral suasion was indeed an important driver for the banks' zombie lending behavior, zombie lending should have been more prevalent for government-owned banks. To investigate this hypothesis, we collect data on the government ownership of all banks in our sample. We then conduct a horse race between undercapitalized and government owned banks. Table 7 provides the respective results. Across all specifications, we find that only banks that still remain undercapitalized after the OMT announcement engage in zombie lending, whereas we find no evidence of zombie lending for government-owned banks. In sum, we interpret these finding as consistent with the notion that the incentives to extend credit to low-quality borrowers indeed stems from the banks' incentives to roll-over loans to low-quality borrowers to avoid realizing losses from writing off these loans.

Finally, if governments exerted pressure on domestic banks to increase their loan supply, we would expect that governments would have pressured banks to extend new loans at advantageous interest rates especially to low-quality firms that are (at least partially) government-owned. To investigate this possibility, we collect ownership information on all firms in our sample from Amadeus. When comparing the fraction of government ownership across zombie and non-zombie firms, we find that zombie firms do not have a higher fraction of government ownership (see Table 4, Panel G and H). To ensure that our results are not driven by lending to government-owned firms in our sample, we rerun our lending regressions and exclude firms that have positive government ownership. Table 6 presents the results for this test, which all remain quantitatively and qualitatively the same.

5 Real and Financial outcomes

Zombie firms are characterized by the fact that, at least temporarily, they are struggling financially. However, it remains unclear whether these financial problems are caused by financial constraints, for example, originating from a lack of access to bank financing, or whether these financial problems are due to fundamental economic problems. If the financial problems are just caused by financial constraints, firms classified as zombies should have recovered after they regained access to bank financing. However, if these problems are of fundamental nature, we would expect that the performance of these firms remained poor even after banks increased their loan supply to these firms.

Therefore, we next track the real outcomes of firms that benefited from the loan supply increase after the OMT announcement and analyze whether there is a difference between the behavior and performance of non-zombie firms and firms classified as zombie firms. To analyze the real and financial outcomes of borrowing firms, we closely follow the approach in Acharya et al. (2015a) and divide the financial information reported in Amadeus into the period before the OMT program announcement (i.e., fiscal years 2009 to 2011) and the period after the OMT announcement (i.e., fiscal years 2012 to 2014). The indicator variable *PostOMT* is now equal to one if the financial information reported in Amadeus falls in the post-OMT period.

To determine how much firms benefited from the OMT announcement through their banking relationships, we construct a variable that measures how much firms gained indirectly from the OMT announcement through the sovereign debt holdings of their banks. We denote this variable as *Indirect OMT windfall gain*. To construct the variable, in a first step, we use the *OMT windfall gain* of each individual bank, as defined in Eq. (1), and compute the average *OMT windfall gain* of all banks that act as lead arranger in a given syndicate, which we denote *Average OMT windfall gain*. Second, we calculate the indirect gains of a firm realized through the *OMT windfall gains* of the banks it has lending relationships with by weighting the *Average OMT windfall gain* of each of the firm's loan syndicates with the loan volume the firm gets from the respective syndicate as a fraction of the firm's total outstanding loan amount. This yields the following measure for firm i in country j in industry h at time t:

$$\textit{Indirect OMT windfall gain}_{ijht} = \frac{\sum_{l \in L_{ijht}} \textit{Average OMT windfall gain}_{lijh} \cdot \textit{Loan Amount}_{lijht}}{\textit{Total Loan Amount}_{ijht}}, \quad (8)$$

where L_{ijht} are all of the firm's loans outstanding at time t.[22]

Table 8 presents descriptive statistics for our sample firms in the pre-OMT period of 2009-2011, split into firms with high and low indirect gains on sovereign debt through their banks. In particular, firms with a higher dependence on banks that benefited from the OMT announcement are larger and have a higher fraction of tangible assets. However, note that, while in the pre-crisis period of 2006-2008 firms in the two groups were comparable along all other observable dimensionsAcharya et al. (2015a), in the pre-OMT period of 2009-2011 firms with a higher dependence on banks that benefited from OMT (i.e., banks that were cutting lending significantly more during the peak of the crisis), have a lower interest coverage ratio, net worth and EBITDA/Assets ratio. This indicates that the quality of these firms deteriorated over the crisis period due to the fact that these firms could not access bank financing in this period, as shown by Acharya

[22]We measure the dependence on banks that benefited from the OMT announcement as the average dependence on these banks over the 2009-2011 period. Results are qualitatively similar when using the 2006-2008 average.

et al. (2015a).

We use five different proxies for the financial and corporate policies of firms. In particular, we use changes in cash holdings ($(cash_{t+1} - cash_t)/total\ assets_t$) or leverage ($(total\ liabilities_{t+1} - total\ liabilities_t)/total\ assets_t$) to proxy for the change in financial policies of firms. To analyze non-financial firm policies, we consider employment growth (Δlog *Employment*), investment ($CAPX\,/\,Tangible\ Assets$), and the return on asset (ROA).

We begin by exploring the effect of the sovereign debt crisis on several firm outcomes graphically.[23] In Figures 6 and 7, we plot the time series of the cash holdings, leverage, employment growth rates, investment levels, and ROA, respectively, for firms with a high and low *Indirect OMT windfall gains*. The figures show that, while the trend before the start of the European debt crisis was similar across all firms, firms with a high dependence on banks that benefited from the OMT announcement (which are mostly GIIPS banks) incurred larger negative real effects during the crisis. Moreover, the figures shows that after the OMT announcement firms with high *Indirect OMT windfall gains* show a significant increase in leverage and cash holdings, whereas firms with low *Indirect OMT windfall gains* did not change their cash and leverage policies significantly. It is interesting to note that for firms with high *Indirect OMT windfall gains*, cash and leverage increased by roughly the same amount, suggesting that these firms used the cash inflow from new loans primarily to build up cash reserves roughly to the same levels they had before the start of the European debt crisis. Finally, none of the two firm groups shows a significant change in their investment level, employment growth rate, or return on assets after the OMT announcement. This first evidence indicates that the additional loan supply acquired by firms with lending relationships to banks that strongly benefited from the OMT announcement was not used for productive purposes and instead translated into liquidity reserves.

To formally investigate whether borrowing firms with significant business relationships to banks that benefited from the OMT announcement altered their corporate policies, we employ the following specification for firm i in country j, and industry h in year t:

$$\begin{aligned} y_{ijht+1} &= \beta_1 \cdot Indirect\ OMT\ windfall\ gains_{ijh} \cdot PostOMT_t \\ &+ \gamma \cdot X_{ijht} + Firm_{ijh} + Industry_h \cdot Country_j \cdot Year_{t+1} + u_{ijht+1} \\ &+ ForeignGIIPSBankCountry_{k \neq j} \cdot Year_{t+1}. \end{aligned} \tag{9}$$

Our baseline regression includes firm and year fixed effects, as well as firm-level control variables to capture other determinants of firms' corporate policies. These include firm size, leverage, net worth, the fraction of tangible assets, the interest coverage ratio, and

[23]Note that we control for observable firm characteristics such as industry, country, and size in the figures.

the ratio of EBITDA to total assets. Additionally, we include interactions between industry, year, and country fixed effects to capture any unobserved time-varying shocks to an industry in a given country in a given year that may impact credit demand of borrowing firms as well as their real outcomes. Moreover, because we observe a number of cross boarder firm-bank relationships in our sample (e.g., a German firm borrowing from a Spanish bank), we also include foreign bank GIIPS country-year fixed effects, which absorb any unobserved, time-varying heterogeneity that may arise because a firm's dependency on banks from a certain country might be influenced by whether this firm has business in the respective country. For example, for a German firm borrowing from a Spanish and a German bank, we also include a Spain-year fixed effect to capture the firm's potential exposure to changes in the macroeconomic environment in Spain.

Results for the full sample are presented in Table 9, Panel A. The unit of observation is a firm-year. For ease of exposure, we only report the results for our key variable of interest, the interaction of *Indirect OMT windfall gains* with the *PostOMT* dummy. The results in Table 9 show distinct patterns for the behavior of financial and real variables after the OMT program announcement. For the financial variables, we find a significant increase in both cash and leverage. Note that the difference of the coefficients for the change in cash and change in leverage regressions is small and statistically insignificant (see Column 3). This result suggests that both leverage and cash holdings increased by a similar amount, implying that firms used the liquidity inflow primarily to increase their cash reserves. More precisely, a one standard deviation increase in *Indirect OMT windfall gains* implies an increase in cash and leverage of around 1.9pp. This result is further confirmed by the fact that we do not find any significant effects for the real variables. Neither employment nor investment or ROA change significantly for firms with high *Indirect OMT windfall gains* in the period after the OMT announcement. Hence, the primary objective of firms seems to be to regain financial stability, i.e., to increase their cash reserves and reach the pre-crisis cash level again. As a robustness, Table A5 presents less restrictive specifications considering firm fixed effects combined with either industry-country-year, country-year, or year fixed effects. All results remain qualitatively and quantitatively similar.

Recall that Panel B of Table 3shows that primarily low-quality firms benefited from the expansion in loan volume induced by the increase in value of the sovereign debt holdings in the period following the OMT program announcement. Next, we provide evidence on the relation between real effects and the *Indirect OMT windfall gains* of these firms. Panel B of Table 9 presents the results for our baseline regressions for the five different corporate policies of firms (i.e., change in cash, change in debt, employment growth, investment, and return on assets), split based on the firms' quality. Again, we classify firms based on their average interest coverage ratio during the sovereign debt crisis (2009 to 2011). The general picture that emerges from the table is that the financial

effects (i.e., increase in cash holdings) are driven by the low interest coverage subgroup of firms, while neither high- nor low-quality firms show a significant relation between *Indirect OMT windfall gains* of their banks and real economic activity like employment and investment.

In contrast, Panels C and D of Table 9 documents that zombie firms do not use the entire funds from their new bank loans to build up cash reserves. For these firms, leverage increases significantly more than cash holdings. A potential explanation could be that firms need the proceeds from newly received loans to service interest rate payments on their existing loans. Consistent with this explanation is the fact that zombie firms only have an interest coverage ratio of 0.29-0.40, implying that they are unable to service interest payments from earnings alone. As noted by the Financial Times, this raises the concern "[...] that these companies - which spend so much of their cash servicing interest payments that they are unable to invest in new equipment or future growth areas - could be at least partly to blame for the weak recovery in Europe, hogging resources that could go to more productive areas".[24] This concern is also consistent with the finding that for these firms there are no significant effects of an increased loan supply on either employment or investment.[25] Moreover, the quote suggests that the presence of zombie firms might lead to market distortions and negative spillover effects for healthy firms, which are cut off from bank lending as loans go to zombie firms instead. Hence, in the next section we will investigate whether the presence of zombie firms leads to distortions for healthy firms operating in the same industry as the zombie firms.

6 Zombie Distortions

In a final step, we investigate whether the rising fraction of zombie firms had negative effects on healthy (non-zombie) firms competing in the same industries. There are two potential channels through which non-zombie firms that operate in the same industries as zombie firms could be negatively affected by the prevalence of zombies. First, banks with incentives to evergreen outstanding loans might shift their loan supply to existing borrowers that struggle to service their debt. This might lead to a reduction in loan supply and/or higher interest rates for productive creditworthy firms operating in the same industries, which makes these firms potentially more financially constrained than firms in industries without such loan supply distortions. Second, the prevalence of zombie firms might lead to distorted market competition, which also negatively affects non-zombie firms competing in the same industries. The normal competitive outcome would

[24]Financial Times: Companies: The Rise of the Zombie, January 8th, 2013

[25]All results are depicted graphically in Figures 8 and 9, where we plot the time series of the asset-weighted cash holdings, leverage, employment growth rates, investment levels, and ROA respectively, for high quality firms, low quality non-zombie firms, as well as zombie firms, respectively. Note, that we only consider firms with a high dependence on banks that benefited from the OMT announcement.

be that impaired firms shed workers and lose market share. However, subsidized loans extended by banks that remained undercapitalized even after the OMT announcement kept distressed borrowers artificially alive, which congests the respective markets. The resulting distorting effects on healthy firms competing in the same industries include, for example, depressing product market prices and raising market wages by hanging on to the workers whose productivity at the current firms declined. Due to these two channels, we expect that a high prevalence of congesting zombie firms in a particular industry resulted in larger distortions for healthy firms and thus a less vigorous recovery in this industry compared to industries with a low fraction of zombie firms (see also Caballero et al., 2008).

To determine the detrimental effects of a high zombie prevalence in a particular industry for healthy firms in the same industry, we follow Caballero et al. (2008) and estimate the following panel regression:

$$\begin{aligned} y_{ijht+1} &= \beta_1 \cdot \textit{Non-Zombie}_{ijht} + \beta_2 \cdot \textit{Non-Zombie}_{ijht} \cdot \textit{Fraction Zombies}_{jht} \\ &+ \beta_3 \cdot \textit{Non-Zombie}_{ijht} \cdot \textit{Fraction Zombies}_{jht} \cdot \textit{High IC Firm}_{ijht} \\ &+ \gamma \cdot X_{ijht} + \textit{Firm}_{ijh} + \textit{Industry}_h \cdot \textit{Country}_j \cdot \textit{Year}_{t+1} + u_{ijht+1}, \end{aligned} \tag{10}$$

where $\textit{Fraction Zombies}_{jht}$ measures the fraction of zombies in industry h in country j at time t and the dependent variables are the interest rate paid, employment growth, investment, and productivity.[26]

In industries with a high prevalence of zombies firms it is very likely that many banks that act as capital supplier to this industry shifted their loan supply towards zombie firms, which implies a decrease in the loan supply to healthy, more productive firms. Hence, we expect that non-zombie firms active in this industry have to pay higher interest rates to still be able to access bank financing. Moreover, due to the resulting financial constraints and the distorted market competition, firms competing in industries with a high prevalence of zombie firms should have a lower employment growth and lower investments compared to firms in industries with only a few zombie firms. Finally, high-quality non-zombie firms operating in high fraction zombie industries should have had a higher average productivity. As argued by Caballero et al. (2008), due to the competition distortions, these firms had to cut back their business more strongly in terms of the number of conducted projects and investments. Since firms primarily reduce their investments in projects with a low productivity, the average productivity of their projects should have increased.

Therefore, our coefficients of interest are β_2 and β_3, that is, whether non-zombie firms,

[26]We use the universe of very large Amadeus firms to calculate the industry fraction of zombie firms. This implies that we have to drop the criterion regarding the syndicate composition for our zombie definition.

and especially high-quality non-zombie firms, pay higher interest rates, invest less, have lower employment growth, or a higher average productivity due to a high prevalence of zombie firms in their industry. In our preferred specification, we include again firm, and industry-country-year fixed effects. The latter alleviate concerns that the fraction of zombie firms in an industry in a given country and year is correlated with the overall performance of the industry (for that year). Note, however, that even without industry-country-year fixed effects, non-zombie firms would have to be more affected by a industry-specific macroeconomic downturn than zombie firms in order to get a significant effect of being a non-zombie on interest rates, investment, employment, or productivity.

Results for this regression analysis are presented in Table 10. The results show that low-quality non-zombie firms that operate in industries with a high zombie fraction do not pay higher interest rates, invest less, or have lower employment growth rates (β_2 is insignificant throughout all specifications). High-quality non-zombie firms, however, pay higher interest rates, invest significantly less, and also have significantly lower employment growth rates if they operate in industries with many zombie firms (β_3 is significant throughout all specifications) compared to firms in industries with a low prevalence of zombie firms. This is consistent with our predictions and with our previous results, which show that mostly low-quality borrowers benefited from the loan supply increase. While also non-zombie low-quality firms received additional loans, these firms mostly used the proceeds to build up cash reserves. If regaining financial stability was indeed their primary objective, it seems plausible that these firms would not have used the loan proceeds to invest or hire people if there were less zombies in their industry. High-quality firms, however, which did not benefit from the loan supply increase (instead they even had to pay higher interest rates), suffer from the presence of zombie firms in their industry. For these firms, investment levels are significantly depressed if they operate in industries with a significant fraction of zombie firms. On average, the fraction of zombie firms increased by 8.9% after OMT. Considering the estimates in Column (3), this implies that high-quality non-zombie firms invest between 11.6% and 13.3% of capital less compared to a scenario where the fraction of zombies would have stayed at its pre-OMT level. An industry at the 95th percentile experienced an increase of zombie firms of 30%, implying that high-quality non-zombie firms invested between 39% and 44% of capital less due to the increase in the prevalence of zombie firms. When looking at employment growth (Column 2), we find that firms that experienced an increase of 8.9% in the fraction of zombie firms in their industry had between 3.6% to 4.4% lower employment growth rates. Considering again the 95th percentile, we find that high-quality non-zombie firms in this industry had 12% to 15% lower employment growth rates.

Finally, to ensure that the negative real effects for healthy firms that are active in industries with a high zombie firm prevalence was indeed caused by distorted market competition, we analyze whether these negative effects were more intense for healthy

firms in competitive industries. In particular, an increase in the prevalence of zombie firms should not strongly affect non-zombie firms in a non-competitive industry, because these firms are generally not very affected by the behavior and activities of other firms in the same industry. In competitive industries, however, the performance of healthy firms should be significantly affected by whether impaired firms downsized their business or whether zombie lending kept these firms afloat and thereby prevented an adjustment process. Table 11 presents the results for this test. First, the results show that, due to a loan supply shift to zombie firms, all high-quality non-zombie firms had to pay higher interest rates if the prevalence of zombie firms in their industry was particularly high, irrespective of whether the industry is competitive or not. However, only high-quality non-zombie firms that operate in competitive industries with many zombie firms suffered real effects (i.e, lower investments and employment growth), while high-quality non-zombie firms in non-competitive industries were not significantly negatively affected by the presence of zombie firms in their industries. Again low-quality non-zombie firms are not negatively affected by the presence of zombie firms in their industries, irrespective of whether the industry is competitive or not. These results confirm that indeed high-quality firms suffer real effects caused by distortions of competitive forces that are due to zombie lending to their industries.

In a final step, we determine the long-run effects for the banks in our sample that engaged in zombie lending behavior. For this analysis, we track the evolution of non-performing loans for high gain banks, where we split the banks according to whether or not they extended loans classified as zombie loans. The respective results are presented in Figure 10. The figure shows that for banks that we identify as banks that extended zombie loans the ratio of non-performing loans over gross loans shows a significant increase in our sample period, while it only increased slightly for banks for which we do not find evidence for zombie lending. This graphical analysis is confirmed by the results presented in Table 12. We use the change in a bank's non-performing loans to gross loans ratio from before to after 2013 (i.e., we take the average of this ratio in the two periods). All specifications show that banks with a high fraction of zombie loans have significantly higher non-performing loans. These results indicate that banks we identify as banks that extended zombie loans based on our syndicated loan data seem to have engaged in zombie lending behavior (perhaps even worse) also in other loan categories (e.g., loans to SMEs).

7 Conclusion

In this paper, we show that the announcement of the OMT program has significantly improved the health of banks in the periphery of the Eurozone. By substantially reducing the yields on periphery sovereign debt, banks holding these assets realized significant windfall gains, which improved their capitalization and allowed them to access market

based financing again. The improvement in bank health translated into an increased loan supply to the corporate sector.

However, these loans were mainly extended to low-quality borrowers with whom the respective banks already had a pre-existing lending relationship. We show that this lending pattern was mainly caused by zombie lending motives of banks that regained some lending capacity due to the OMT announcement but still remained weakly-capitalized even after the OMT announcement. In particular, still undercapitalized banks have an incentive to evergreen loans to their struggling borrowers to avoid having to declare outstanding loans non-performing, even if these investments have a negative net present value. We find that non-zombie firms that regained access to bank based financing after the OMT announcement used the whole cash inflow from new bank loans to build up cash reserves. Zombie firms that received new loans, on the other hand, only used a fraction of the cash inflow to build up cash reserves. The remaining proceeds they most likely had to spend on interest payments on outstanding loans due to their low profitability. Finally, neither zombie nor non-zombie firms showed a significant increase in real activity, that is, an increase in employment or investment.

Moreover, we find that, due to the credit misallocation and the resulting market distortions, high-quality non-zombie firms, that is, creditworthy firms that did not benefit from the increase in bank loan supply, are negatively affected if they operate in industries with a high prevalence of zombie firms. Both their employment growth and their investments are lower compared to creditworthy productive firms that operate in industries that do not suffer from a zombie firm problem.

More broadly, our paper shows that central banks can indirectly recapitalize their banking sector by influencing the prices of assets that banks hold in their portfolio. By increasing the value of these assets banks can realize significant windfall gains, which improves their equity positions. However, authorities need to pay close attention to the magnitude of these gains. If the gains are too low to adequately recapitalize (some) banks, zombie lending incentives might arise. This can lead to significant distortions in industries with a high zombie prevalence, as high-quality firms operating in these industries suffer from significantly depressed employment growth rates and investment.

The analysis thus highlights the importance of a well-capitalized banking sector for an effective transmission of unconventional monetary policy measures to the real economy. Therefore, while the launch of the OMT program helped to avert a collapse of the Eurozone by stabilizing government bond yields and (partially) restoring financial stability, combining the program with a targeted bank recapitalization program would most likely have induced a much stronger economic recovery. Instead, low bank capitalization and uncertainty about the health of banks' balance sheets remain significant issues in the Eurozone. Hence, as noted by the Financial Times, "the growing fear is that the continent could be following the path of Japan, where low interest rates, looser government

policy and the failure of the big banks to foreclose on unprofitable and highly indebted companies is thought to have contributed to two decades of weak growth.".[27]

[27]Financial Times: Companies: The Rise of the Zombie, January 8th, 2013

References

Acharya, Viral V, Tim Eisert, Christian Eufinger, and Christian W Hirsch, 2015a, Real effects of the sovereign debt crisis in europe: Evidence from syndicated loans, CEPR Discussion Paper No. DP10108 .

Acharya, Viral V., Diane Pierret, and Sascha Steffen, 2015b, Lender of last resort versus buyer of last resort - evidence from the european sovereign debt crisis, Working Paper .

Acharya, Viral V, and Sascha Steffen, 2014, The greatest carry trade ever? understanding eurozone bank risks, Journal of Financial Economics 115, 215–236.

Aiyar, S., A. Banerji, B. Barkbu, W. Bergthaler, P. Berkmen, J. Bluedorn, J. Garrido, A. Jobst, J. John, K. Kang, T. Kinda, H. Lin, Y. Liu, D. Monaghan, M. Moretti, S. Saksonovs, H. Schoelermann, and T. Wu, 2015, Imf: Euro area policies, Selected Issues, July 10, 2015 .

Altavilla, Carlo, Domenico Giannone, and Michele Lenza, 2014, The financial and macroeconomic effects of omt announcements, ECB Working Paper .

Caballero, Ricardo J, Takeo Hoshi, and Anil K Kashyap, 2008, Zombie lending and depressed restructuring in japan, The American Economic Review 1943–1977.

Chodorow-Reich, Gabriel, 2014, The employment effects of credit market disruptions: Firm-level evidence from the 2008-09 financial crisis, Quarterly Journal of Economics 129, 1–59.

Diamond, Douglas W, 1991, Monitoring and reputation: The choice between bank loans and directly placed debt, Journal of Political Economy 99, 689–721.

Ferrando, Annalisa, Alexander A Popov, and Gregory F Udell, 2015, Sovereign stress, unconventional monetary policy, and sme access to fina nce, Working Paper .

Giannetti, Mariassunta, and Andrei Simonov, 2013, On the real effects of bank bailouts: Micro evidence from japan, American Economic Journal: Macroeconomics 5, 135–67.

Gropp, Reint, Thomas Mosk, Steven Ongena, and Carlo Wix, 2016, Bank response to higher capital requirements: Evidence from a natural experiment, Working Paper .

Jassaud, Nadège, and Mr Kenneth Kang, 2015, A Strategy for Developing a Market for Nonperforming Loans in Italy, number 15-24 (International Monetary Fund).

Kane, Edward J, 1989, The S & L insurance mess: how did it happen? (The Urban Insitute).

Khwaja, Asim Ijaz, and Atif Mian, 2008, Tracing the impact of bank liquidity shocks: Evidence from an emerging market, American Economic Review 98, 1413–1442.

Krishnamurthy, Arvind, Stefan Nagel, and Annette Vissing-Jorgensen, 2014, Ecb policies involving government bond purchases: Impact and channels, Working Paper .

Peek, Joe, and Eric. S. Rosengreen, 2005, Unnatural selection: Perverse incentives and the allocation of credit in japan, American Economic Review 95, 1144–1166.

Peek, Joe, and Eric S. Rosengren, 2005, Unnatural selection: Perverse incentives and the misallocation of credit in japan, American Economic Review 95, 1144–1166.

Saunders, Anthony, and Sascha Steffen, 2011, The costs of being private: Evidence from the loan market, Review of Financial Studies 24, 4091–4122.

Standard&Poor's, 2010, A Guide To The European Loan Market (New York, NY: The McGraw-Hill Companies, Inc).

Sufi, Amir, 2007, Information asymmetry and financing arrangements: Evidence from syndicated loans, Journal of Finance 62, 629–668.

Szczerbowicz, Urszula, et al., 2012, The ecb unconventional monetary policies: have they lowered market borrowing costs for banks and governments?, Working Paper .

Veronesi, Pietro, and Luigi Zingales, 2010, Paulson's gift, Journal of Financial Economics 97, 339–368.

Appendix

Figure 1: Evolution of Loan Volume

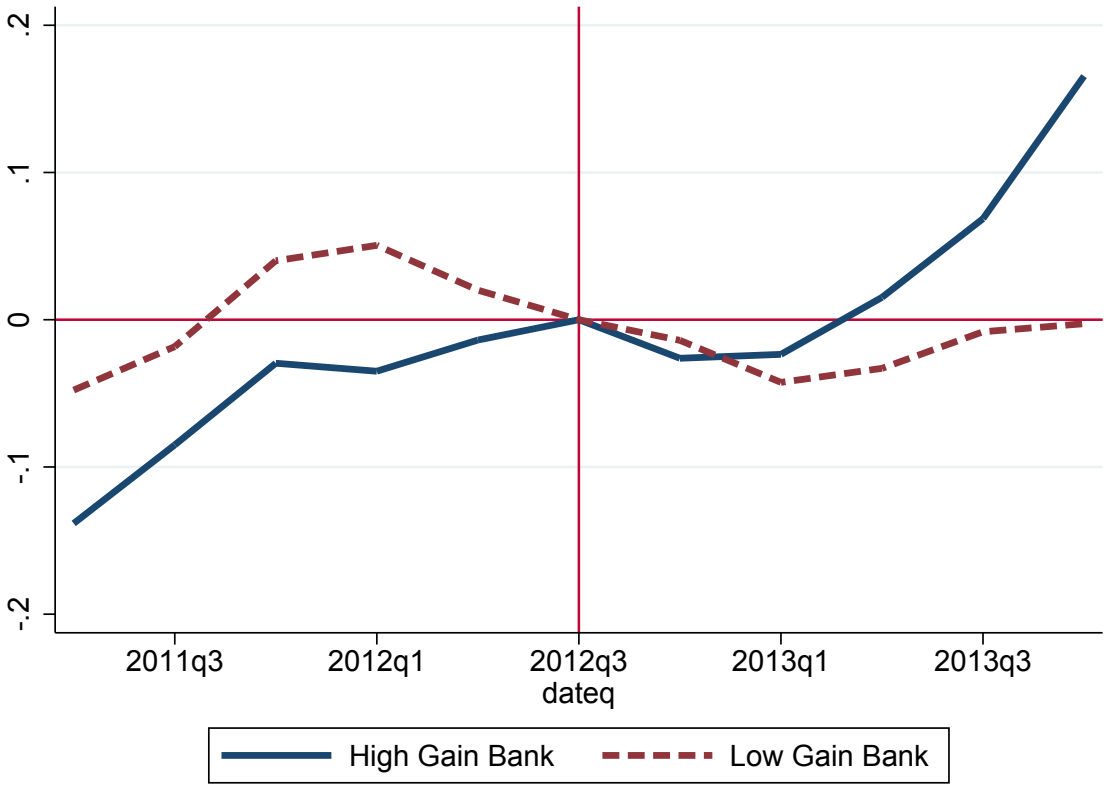


Figure 1 shows the log-ratio of total loans in a given quarter relative to the quarter of the OMT announcement, i.e., the y-axis is normalized to 0 at the time of the OMT announcement. For each quarter, we aggregate all loans to private firms borrowing from banks that are covered by the EBA's June 2012 capital exercises. We restrict the sample to private firms with loan Information in Dealscan and financial information in Amadeus.

Figure 2: Evolution of the Run Index

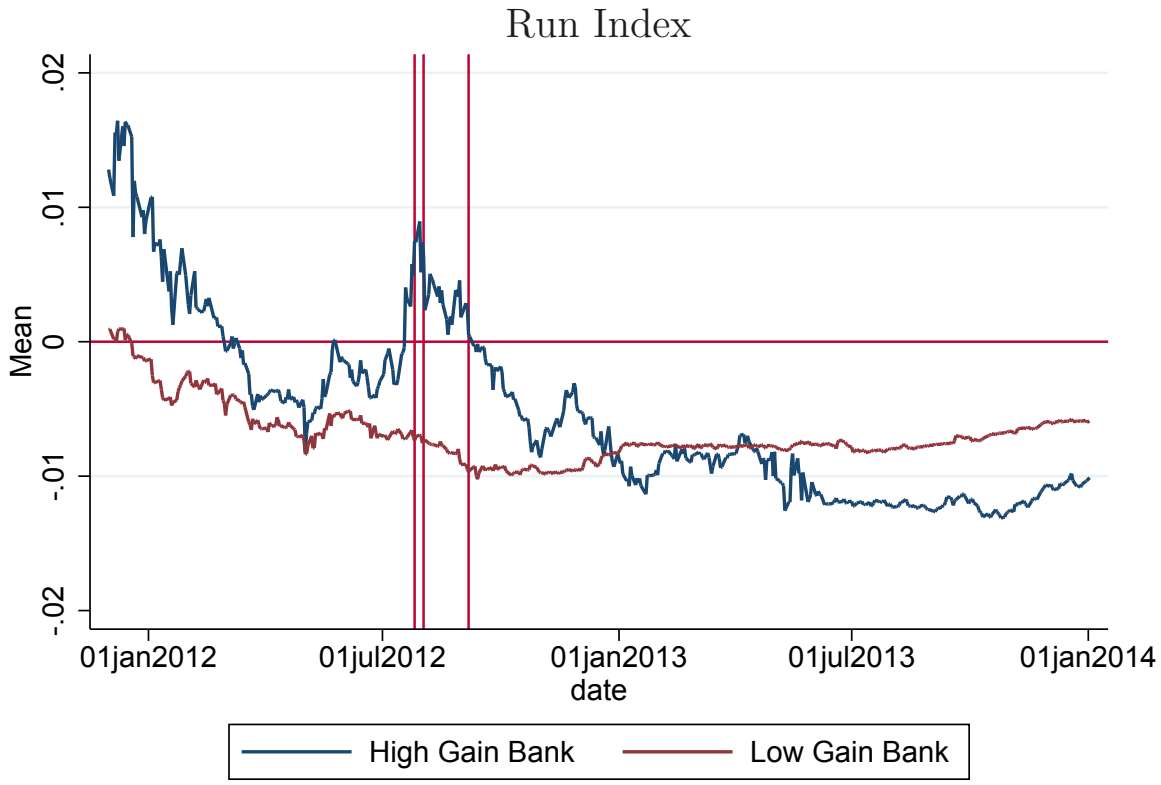


Figure 2 shows the evolution in the run index for high and low gain banks as calculated following the method in Veronesi and Zingales (2010). The run index is a proxy for the likelihood that a bank faces a bank run. The vertical lines indicate the OMT announcement dates (July 26, August 2, September 6, 2012).

Figure 3: Benchmark Interest Rates

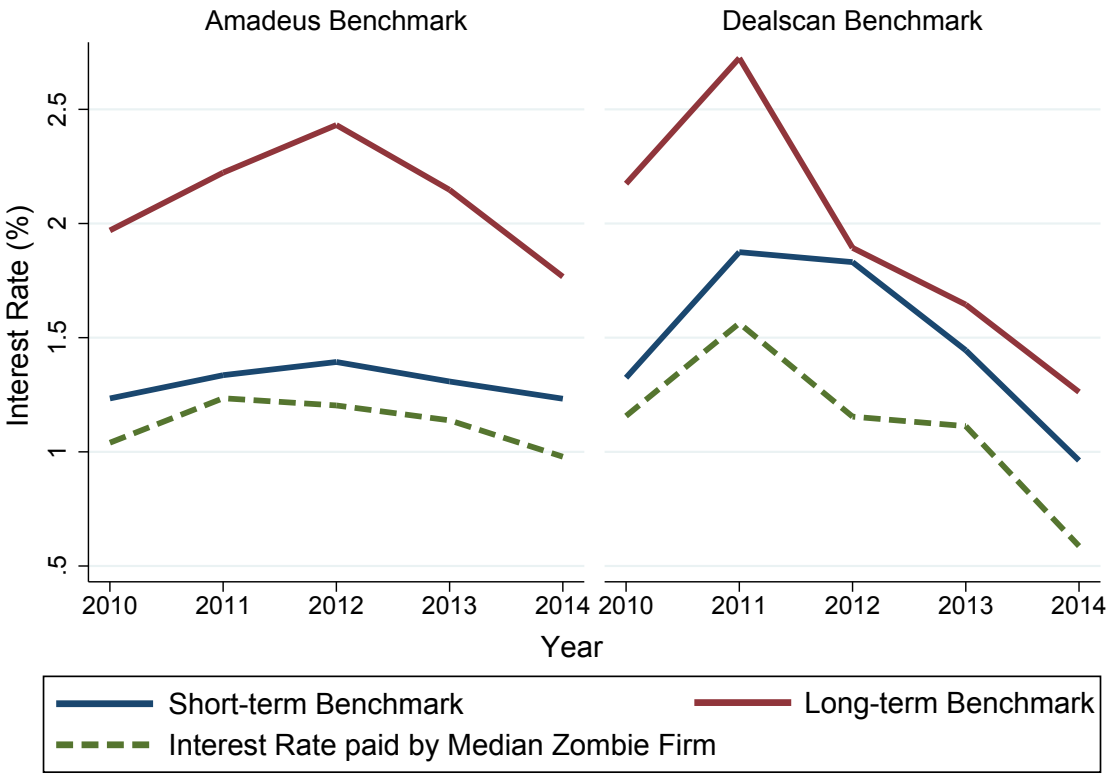


Figure 3 shows the evolution of benchmark interest rates for the two alternative zombie classifications which use information from either Amadeus or Dealscan to calculate benchmark interest rates. The benchmark is derived separately for short-and long-term maturities. We classify a firm as zombie if it meets the following three criteria: (i) the firm receives subsidized credit, (ii) its rating (derived from three year median EBIT interest coverage ratios) is BB or lower, and (iii) the syndicate composition has either remained constant, or banks leaving the syndicate without being replaced by new participants, that is, the same syndicate has already provided a loan to the firm. We restrict the sample to private firms with loan Information in Dealscan and financial information in Amadeus.

Figure 4: Evolution of asset-weighted Fraction of Zombie Firms

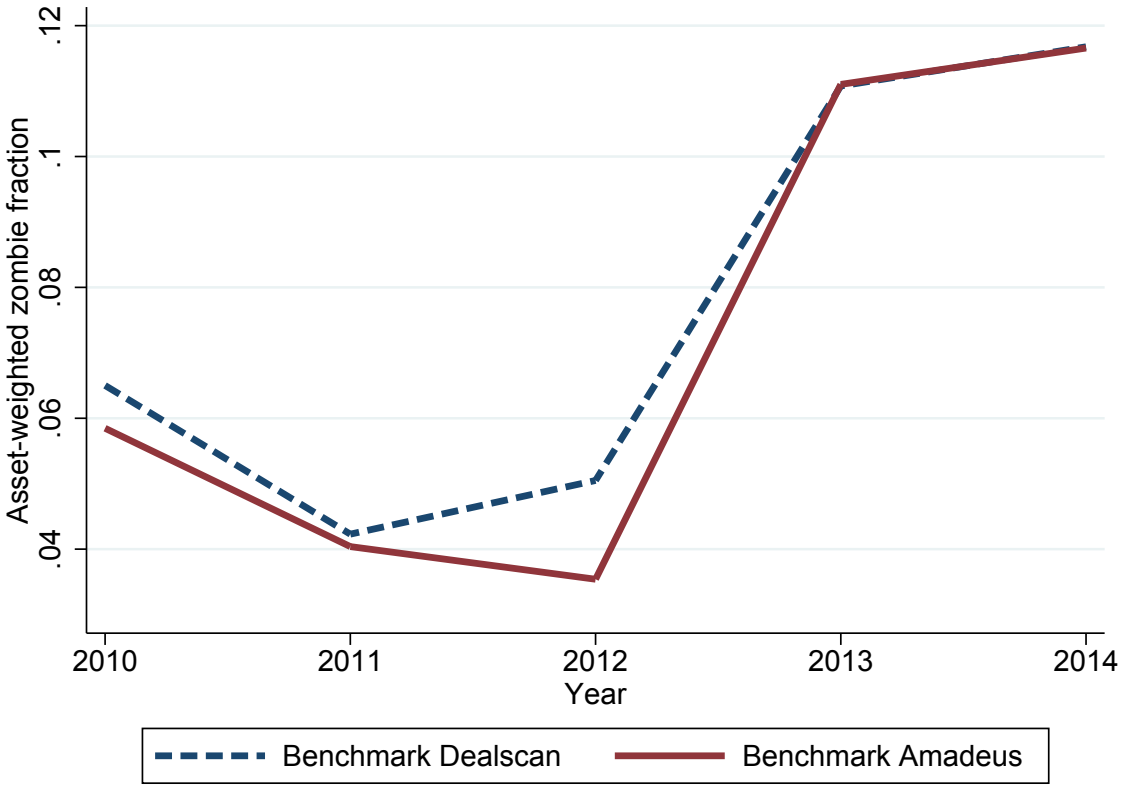
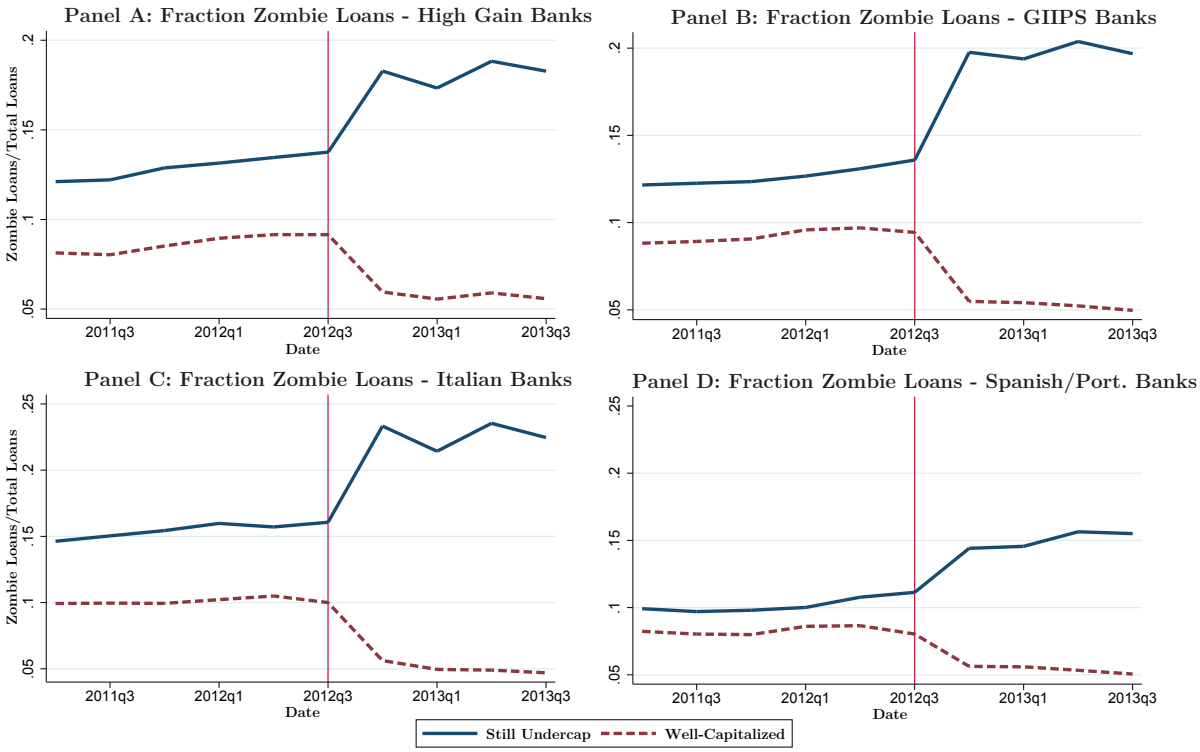


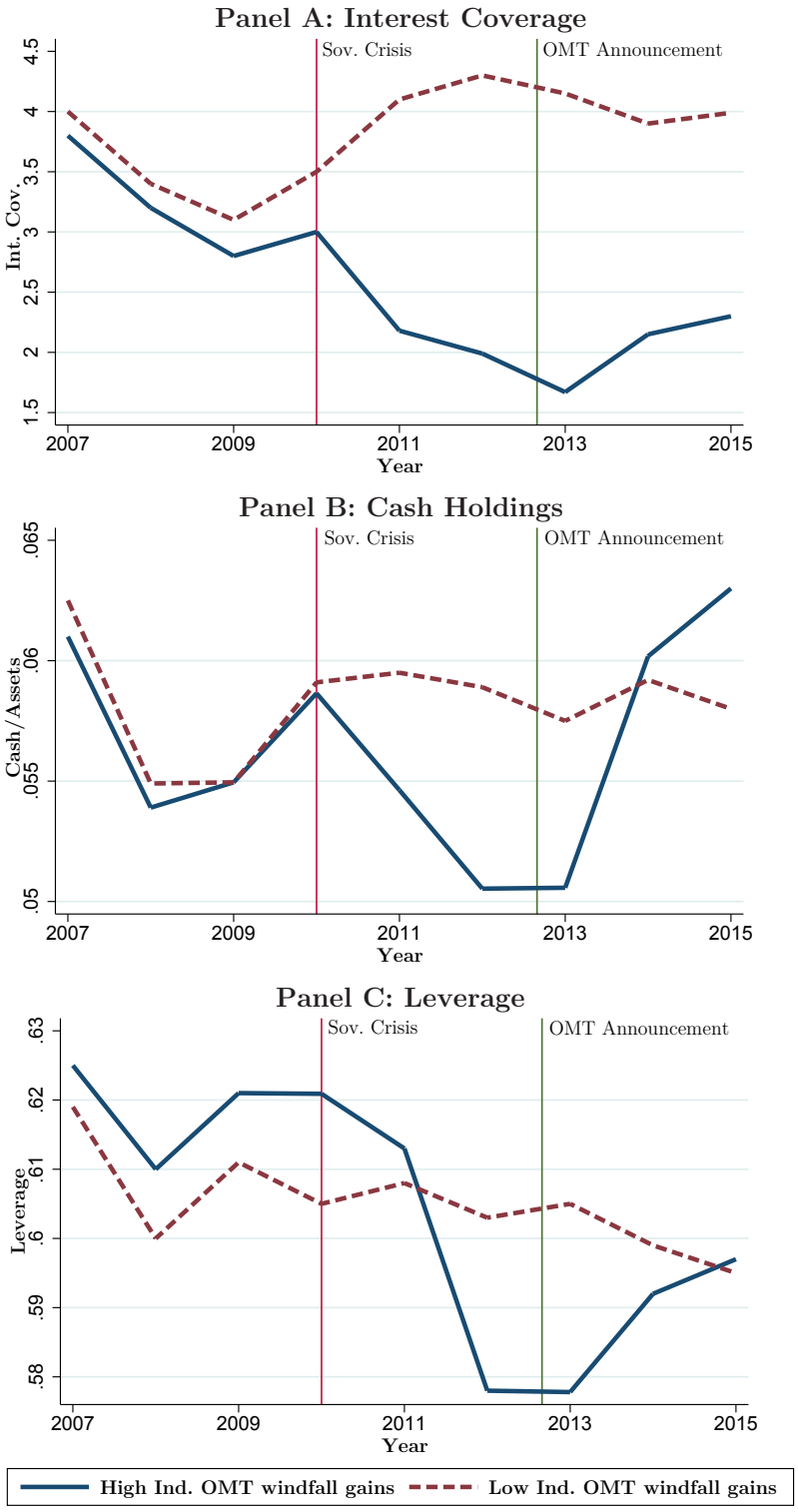
Figure 4 shows the evolution of the asset-weighted fraction of zombies in our sample for the two alternative zombie classifications which use information from either Amadeus or Dealscan to calculate benchmark interest rates. We classify a firm as zombie if it meets the following three criteria: (i) the firm receives subsidized credit, (ii) its rating (derived from three year median EBIT interest coverage ratios) is BB or lower, and (iii) the syndicate composition has either remained constant, or banks leaving the syndicate without being replaced by new participants, that is, the same syndicate has already provided a loan to the firm. We restrict the sample to private firms with loan Information in Dealscan and financial information in Amadeus.

Figure 5: Fraction Zombie Loans



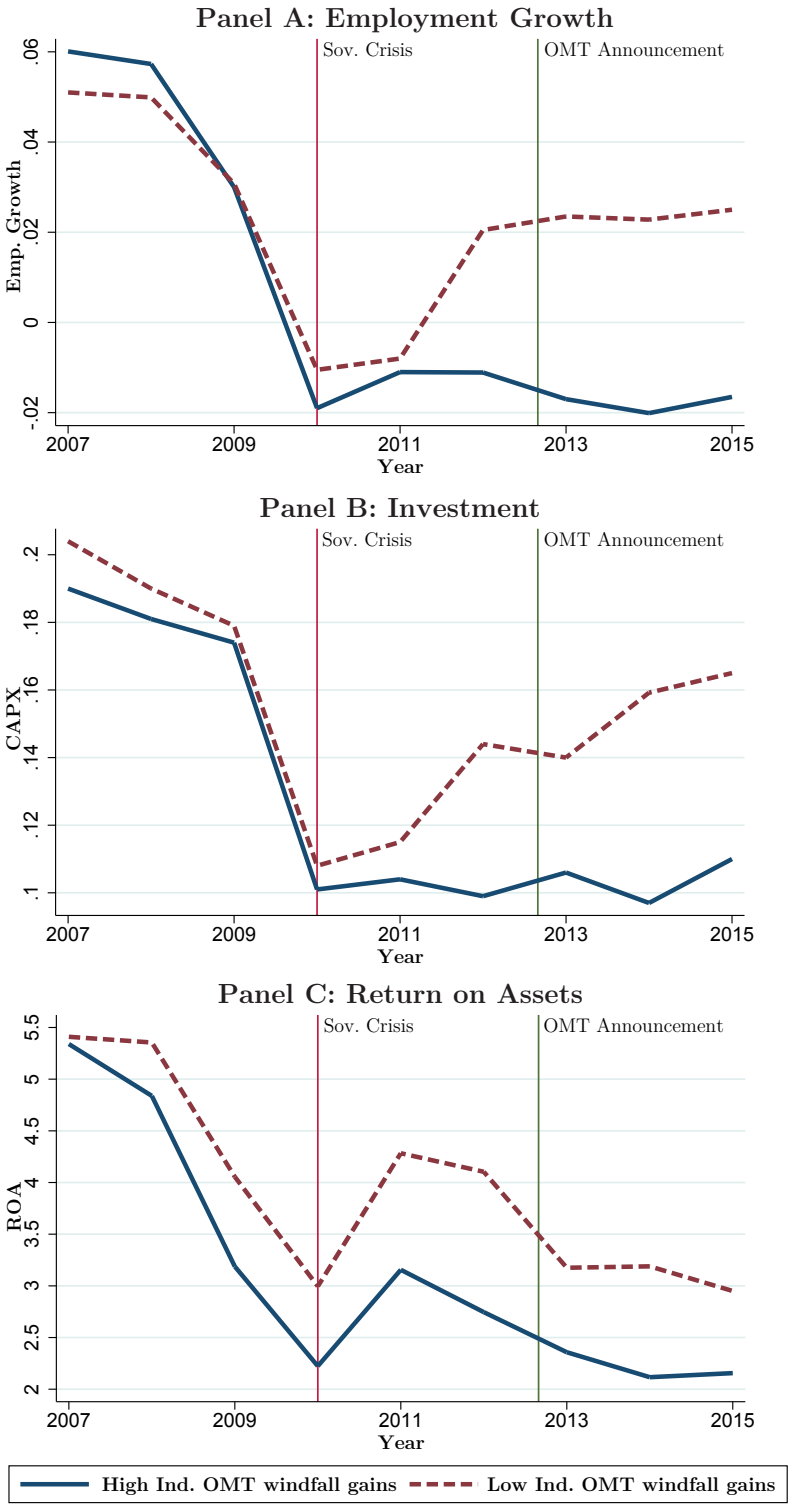
Panel A shows the fraction of the loan volume issued to zombies divided by the total loan volume for high gain banks. Panel B shows the fraction of the loan volume issued to zombies divided by the total loan volume for banks from Italy, Portugal, or Spain. Panel C shows the same for banks from Italy only and Panel D for banks from Spain and Portugal only. The blue solid line shows the evolution for high gain banks that are still undercapitalized after the OMT announcement, whereas the red dashed line shows the evolution for high gain banks that are well-capitalized after the OMT announcement. We restrict the sample to private firms with loan Information in Dealscan and financial information in Amadeus.

Figure 6: Financial Effects



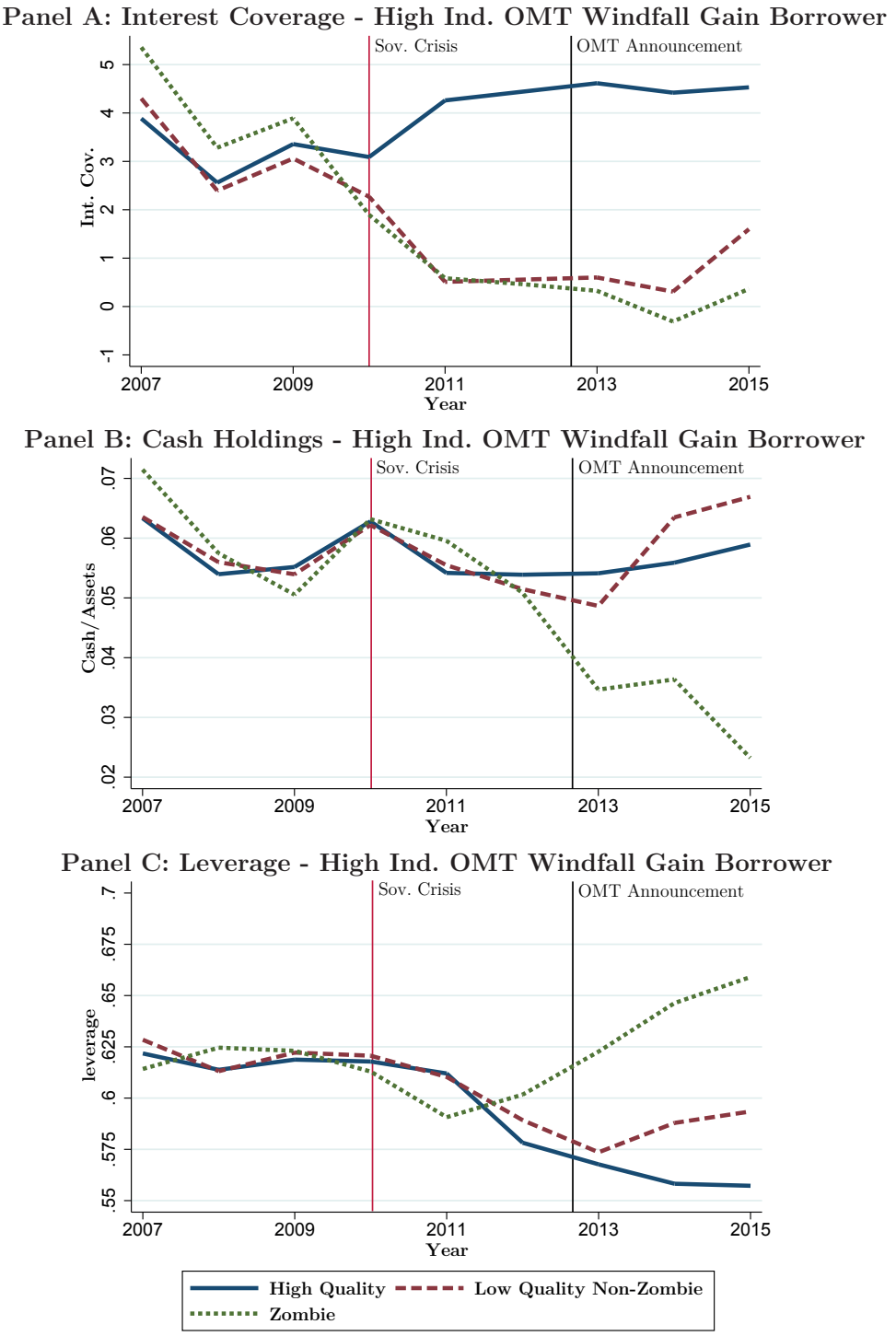
Panel A shows the evolution of interest coverage ratio, Panel B the evolution of cash holdings as a fraction of total assets, and Panel C the evolution of leverage as a fraction of total assets for firms with high (blue solid line) and low (red dashed line) dependence on high gain banks in the pre-OMT and post-OMT period. We consider all loans in DealScan to firms located in EU countries with an active syndicated loan market. The red line marks the beginning of the sovereign debt crisis in 2010, whereas the green line marks the OMT announcement period in the third quarter of 2012. We restrict the sample to private firms with loan Information in Dealscan and financial information in Amadeus.

Figure 7: Real Effects



Panel A shows the evolution of employment growth rates, Panel B the evolution of capital expenditures as a fraction of tangible assets, and Panel C the evolution of the return on assets for firms with high (blue solid line) and low (red dashed line) dependence on high gain banks in the pre-OMT and post-OMT period. The red line marks the beginning of the sovereign debt crisis in 2010, whereas the green line marks the OMT announcement period in the third quarter of 2012. We restrict the sample to private firms with loan Information in Dealscan and financial information in Amadeus.

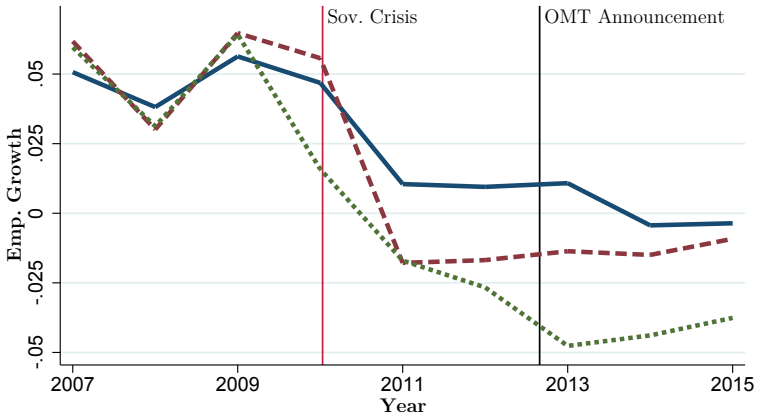
Figure 8



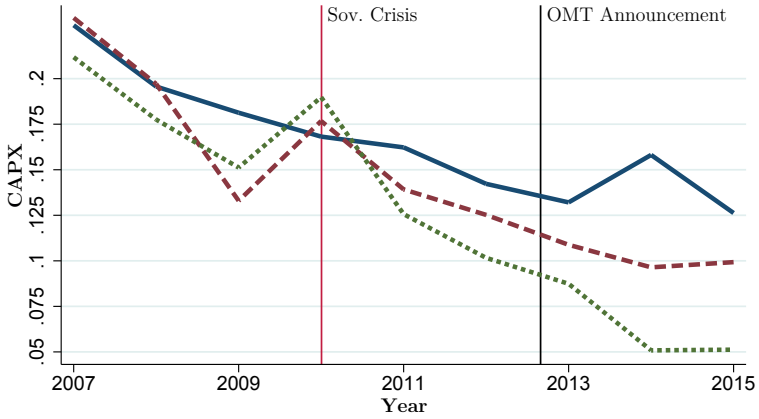
Panel A shows the evolution of the asset-weighted interest coverage ratio, Panel B the evolution of the asset-weighted cash holdings as a fraction of total assets, and Panel C the evolution of the asset-weighted leverage as a fraction of total assets. All three panels are for firms with a high dependence on high gain banks, where we split these borrowers into three groups: high quality firms (blue dashed line), low quality non-zombie firms (red solid line) and low quality zombie firms (green solid line). Firms are classified as low-quality based on their 2009-2011 average EBIT interest coverage ratio. The red line marks the beginning of the sovereign debt crisis in 2010, whereas the green line marks the OMT announcement period in the third quarter of 2012. We restrict the sample to private firms with loan Information in Dealscan and financial information in Amadeus.

Figure 9

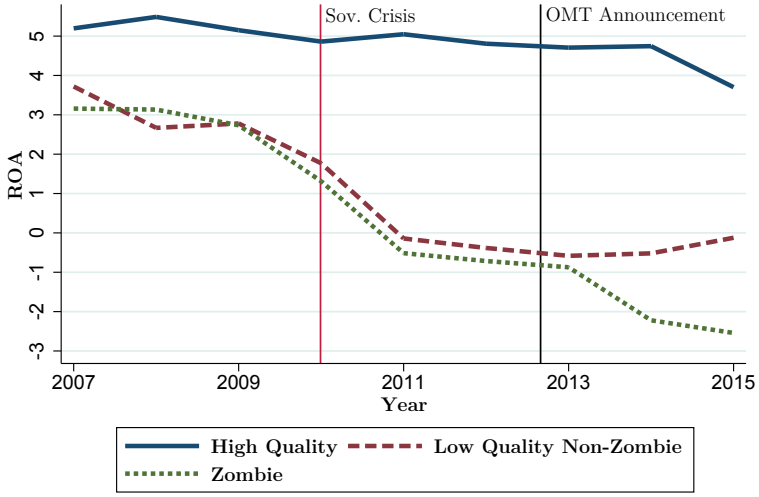
Panel A: Employment Growth - High Ind. OMT Windfall Gain Borrower



Panel B: Investment - High Ind. OMT Windfall Gain Borrower



Panel C: Return on Assets - High Ind. OMT Windfall Gain Borrower



Panel A shows the evolution of the asset-weighted employment growth rates, Panel B the evolution of the asset-weighted capital expenditures as a fraction of tangible assets, and Panel C the evolution of the asset-weighted return on assets. All three panels are for firms with a high dependence on high gain banks, where we split these borrowers into three groups: high quality firms (blue dashed line), low quality non-zombie firms (red solid line) and low quality zombie firms (green solid line). Firms are classified as low-quality based on their 2009-2011 average EBIT interest coverage ratio. The red line marks the beginning of the sovereign debt crisis in 2010, whereas the green line marks the OMT announcement period in the third quarter of 2012. We restrict the sample to private firms with loan Information in Dealscan and financial information in Amadeus.

Figure 10

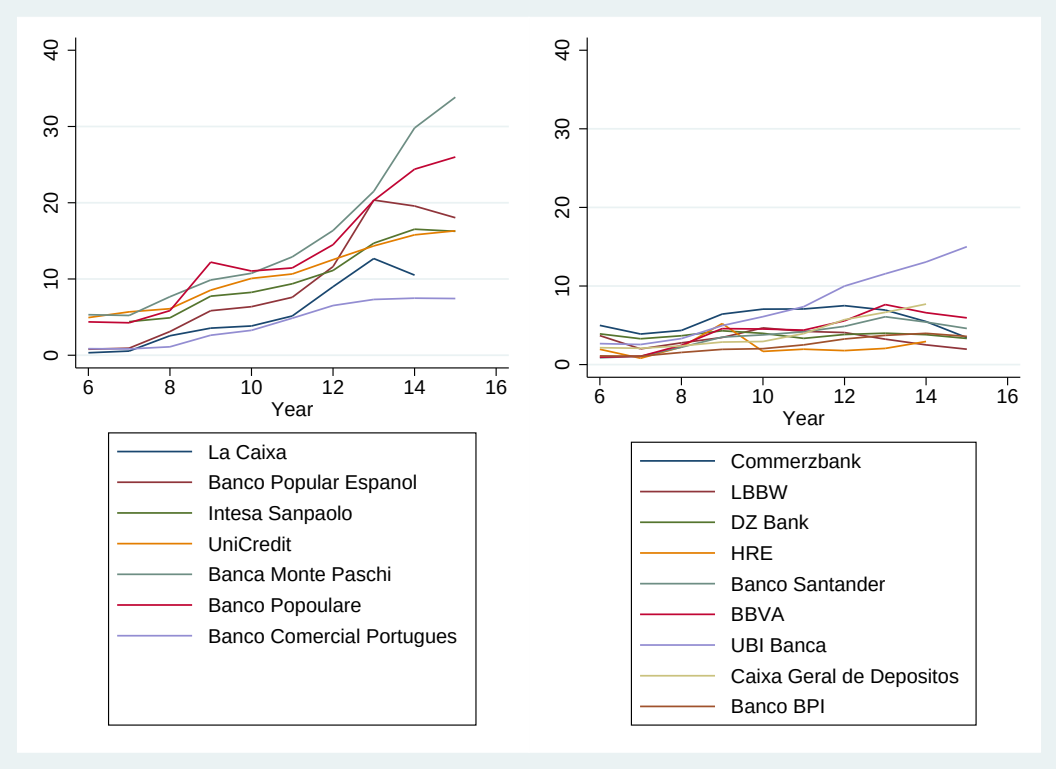


Figure 10 shows the evolution of the fraction of non-performing loans to gross loans for high zombie lending high gain banks (left panel) and low zombie lending high gain banks (right panel).

Table 1: Descriptive Statistics of Banks around OMT

Panel A: Bank Reaction			
	(1)	(2)	(3)
	OMT windfall gain	GIIPS/Assets	CDS return OMT
Non-GIIPS Banks	0.011	0.010	-0.23
			(-9.2)
GIIPS Banks	0.08	0.118	-0.96
			(-3.4)
t-test for difference	5.69	12.7	7.8
Panel B: Total Assets/Total Equity Ratio			
	pre-crisis	crisis/pre-OMT	post-OMT
Still undercapitalized high gain	16.65	24.51	20.37
well-capitalized high gain	12.37	13.57	12.39
low gain	22.19	17.11	16.68
U.S. Banks	12.65	9.25	8.70
Panel C: Quasi-Leverage Ratio			
	pre-crisis	crisis/pre-OMT	post-OMT
Still undercapitalized high gain	12.14	76.34	56.82
well-capitalized high gain	8.74	42.17	36.76
low gain European	14.39	31.81	28.61
U.S. Banks	8.5	10.1	9.9

Panel A of Table 1 presents descriptive statistics about the banks' *OMT windfall gain*, their GIIPS sovereign debt holdings, and the banks' CDS spread reaction to the OMT announcements. Banks included in the analysis are part of the EBA capital exercise prior to the OMT announcement (June 2012) and must be active in the syndicated loan market during the sample period. GIIPS banks include banks incorporated in Italy, Portugal, and Spain. Non-GIIPS banks consist of banks in all other European countries that are covered by EBA's June 2012 capital exercise. CDS return OMT represents the CDS return on the three OMT announcement dates (July 26, August 2, and September 6, 2012). *OMT windfall gain* is the value gain on bank's sovereign debt holdings as a fraction of total equity. GIIPS/Assets is the banks' GIIPS sovereign debt holdings as a fraction of total assets. Panel B presents the book leverage ratio for different groups of banks. Pre-crisis is defined as the average equity/assets ratios for the years 2004-2006. crisis/pre-OMT is defined as the equity/assets ratio in December 2011, whereas post-OMT is defined as the equity/assets ratio in December 2012. A bank is classified as still undercapitalized if its leverage ratio is above the sample median in December 2012 (post-OMT). Panel C reports quasi-leverage defined as market value of equity plus the book value of debt divided by the market value of equity. F-values are reported in parentheses.

Table 2: Run Index

	ΔRun Index	ΔRun Index	ΔRun Index	ΔRun Index
OMT windfall gains	-0.150***	-0.139***	-0.175***	-0.162***
	(-6.58)	(-3.85)	(-3.89)	(-2.51)
GIIPS Bank			0.002	0.002
			(0.65)	(0.44)
Ln(Total Assets)		0.001		0.000
		(0.59)		(0.39)
Tier 1 Ratio		0.000		0.000
		(0.09)		(0.02)
R^2	0.607	0.610	0.613	0.613
N	30	30	30	30

Table 2 presents bank-level regressions. The dependent variable is the change in the run index (average 6 months prior to average 6 months post the OMT announcement) as calculated following the method in Veronesi and Zingales (2010). The run index is a proxy for the likelihood that a bank faces a bank run. t-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 3: Loan Volume Regressions

Panel A: Intensive Margin - All Firms						
	(1)	(2)	(3)	(4)	(5)	(6)
	ΔLoans	ΔLoans	ΔLoans	ΔLoans	Loan Inc.	ΔLoans
OMT windfall gain*PostOMT	0.234***	0.211***	0.216**	0.254**	0.301*	0.284**
	(3.19)	(2.92)	(2.60)	(2.41)	(1.71)	(2.00)
R^2	0.013	0.097	0.598	0.643	0.617	0.775
N	10879	10879	10879	10879	10879	4090
Panel B: Intensive Margin - Quality Split						
OMT windfall gain*PostOMT	0.042	0.062	-0.004	-0.014	-0.030	0.038
	(0.68)	(0.80)	(-0.06)	(-0.18)	(-0.21)	(0.41)
OMT windfall gain*PostOMT*LowIC	0.280***	0.295***	0.212***	0.253***	0.364**	0.296**
	(5.66)	(5.02)	(3.25)	(3.02)	(2.03)	(2.89)
R^2	0.014	0.098	0.598	0.643	0.617	0.775
N	10879	10879	10879	10879	10879	4090
Panel C: Extensive Margin - All Firms						
	New Loan	New Loan	New Loan	New Loan		New Loan
OMT windfall gain*PostOMT	0.018	0.018	-0.044	-0.046		-0.136
	(0.22)	(0.21)	(-0.63)	(-0.63)		(-1.32)
R^2	0.006	0.077	0.667	0.692		0.815
N	25874	25874	25874	25874		7255
Panel D: Extensive Margin - Quality Split						
OMT windfall gain*PostOMT	-0.013	-0.020	-0.015	-0.023		-0.188
	(-0.14)	(-0.20)	(-0.12)	(-0.17)		(-1.40)
OMT windfall gain*PostOMT*LowIC	0.060	0.074	-0.056	-0.045		0.109
	(0.71)	(0.81)	(-0.47)	(-0.36)		(0.99)
R^2	0.006	0.077	0.667	0.692		0.815
N	25874	25874	25874	25874		7255
Bank Level Controls	YES	YES	YES	YES	YES	YES
Bank Fixed Effects	YES	NO	YES	NO	NO	NO
Time Fixed Effects	YES	YES	NO	NO	NO	NO
FirmCluster-Bank Fixed Effects	NO	YES	NO	YES	YES	YES
FirmCluster-Time Fixed Effects	NO	NO	YES	YES	YES	YES

Table 3 presents the results of a modified version of the Khwaja and Mian (2008) bank lending channel regression. The unit of observation is a firm cluster-bank-quarteryear. The dependent variable is the change in log loan volume of a firm cluster-bank relation in a given quarter (Panel A and B) or a dummy variable equal to one if a new loan is issued to a firm cluster with which no prior relation existed (Panel C and D). Columns (1)-(5) consider all banks, whereas Column (6) focuses on banks from Italy, Portugal, and Spain. Firm clusters are formed based on a firm's country of incorporation, industry, and rating. The rating of each firm is estimated from EBIT interest coverage ratio medians (2009-2011) for firms by rating category provided by Standard & Poor's. Firms are split based on the country-specific 3-year median interest coverage ratio. In Panel A and B data are restricted to: (i) the set of firm-bank relations that existed prior to the OMT announcement (i.e., all firms in a cluster must have a relation to a particular bank), and (ii) firm cluster-quarters where firms in a cluster borrow from at least one bank that benefited and one bank that did not benefit from the OMT announcement. In Panels C and D only firms without existing relation at the time of the OMT announcement are included. *PostOMT* is an indicator variable equal to one starting in quarter four of 2012, and zero before. Bank Level controls include the logarithm of total assets, equity/assets, impaired loans/equity, and return on assets. Standard errors are clustered at the bank level. t-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 4: Descriptive Statistics

Panel A: Breakdown of zombie firms by country (Amadeus Benchmark)		
Country	Number of Zombies	Number of private firms in sample
Germany	4	119 (3.4%)
Spain	29	177 (16.3%)
France	10	137 (7.2%)
UK	23	235 (9.8%)
Italy	35	172 (20.3%)
Panel B: Breakdown of zombie firms by country (Dealscan Benchmark)		
Germany	6	119 (5%)
Spain	31	177 (17.5%)
France	13	137 (9.5%)
UK	25	235 (10.6%)
Italy	34	172 (19.8%)

Table 4, Panel A and B present a breakdown of the number of zombie firms by country (fraction of all sample firms in a given country). We present these results for the two alternative zombie classifications which use information in either Amadeus or Dealscan to calculate benchmark interest rates. We classify a firm as zombie if it meets the following three criteria: (i) the firm receives subsidized credit, (ii) its rating (derived from three year median EBIT interest coverage ratios) is BB or lower, and (iii) the syndicate composition has either remained constant, or banks leaving the syndicate without being replaced by new participants, that is, the same syndicate has already provided a loan to the firm.

Table 4: Descriptive Statistics (contd.)

Panel C: Difference in Equity Ratio of Syndicate Banks (Amadeus Benchmark)			
	Remaining Banks	Leaving Banks	Difference (t-statistic)
Equity Ratio	5.13	6.02	-.0.89**
			(-2.25)
Panel D: Difference in Equity Ratio of Syndicate Banks (Dealscan Benchmark)			
Equity Ratio	4.92	5.45	-.53**
			(-2.06)
Panel E: Difference in Syndicates (Amadeus Benchmark)			
	Zombie Firms	Non-Zombie Firms	Difference (t-statistic)
Loan exposure to equity (%)	0.765	0.482	0.283***
			(6.158)
Loan exposure to total loans (%)	2.129	1.428	0.767***
			(3.553)
Still undercap. banks in syndicate (%)	53.48	8.949	44.534***
			(13.236)
Panel F: Difference in Syndicates (Dealscan Benchmark)			
Loan exposure to equity (%)	0.752	0.495	0.256***
			(6.071)
Loan exposure to total loans (%)	2.127	1.425	0.702***
			(3.553)
Still undercap. banks in syndicate (%)	51.999	8.910	43.088 ***
			(13.966)

Panel C and D present the difference in the mean capital ratio (total equity/total assets) of banks leaving zombie syndicates and banks remaining in zombie syndicates while Panel E and F present descriptive statistics for syndicates lending to zombie and non-zombie firms. *Bank loan exposure to equity* is defined as the total sum of outstanding loans of a bank to a firm divided by the bank's equity in a given year. *Bank loan exposure to total loans* is defined as the total sum of outstanding loans of a bank to a firm divided by total outstanding loan amount of this bank in a given year. *Still undercap. banks in syndicate* is defined as the fraction of banks classified as still being undercapitalized after the OMT announcement. We present these results for the two alternative zombie classifications which use information from either Amadeus or Dealscan to calculate benchmark interest rates. We classify a firm as zombie if it meets the following three criteria: (i) the firm receives subsidized credit, (ii) its rating (derived from three year median EBIT interest coverage ratios) is BB or lower, and (iii) the syndicate composition has either remained constant, or banks leaving the syndicate without being replaced by new participants, that is, the same syndicate has already provided a loan to the firm. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 4: Descriptive Statistics (contd.)

Panel G: Difference in Group of Firms (Amadeus Benchmark)

	(1) High Quality	(2) Low Quality No Zombie	(3) Zombie	(4) Difference (2)-(3)
Total Assets (mn)	2290	1880	1530	350
				(1.24)
Tangibility	0.540	0.650	0.582	0.068***
				(4.54)
Int. Cov.	7.623	1.118	0.404	0.714***
				(3.67)
Net Worth	0.257	0.195	0.167	0.028**
				(2.27)
EBITDA/Assets	0.117	0.050	0.036	0.014***
				(5.88)
Leverage	0.581	0.654	0.695	-0.041***
				(-3.00)
Government Ownership (%)	2.84	2.36	2.82	-0.46
				(-0.46)
Loan Amount / Total Assets (%)	28.26	29.11	33.06	-3.95
				(-1.30)
Maturity (Months)	58.78	59.28	59.87	-0.59
				(-0.22)
Term Loan (%)	54.65	59.38	57.63	1.75
				(0.36)

Panel H: Difference in Group of Firms (Dealscan Benchmark)

Total Assets (mn)	2290	1960	1200	760***
				(2.66)
Tangibility	0.540	0.653	0.566	0.087***
				(5.60)
Int. Cov.	7.623	1.110	0.299	0.811***
				(4.05)
Net Worth	0.257	0.195	0.157	0.038***
				(3.11)
EBITDA/Assets	0.117	0.055	0.035	0.02***
				(5.71)
Leverage	0.581	0.651	0.708	-0.057***
				(-4.10)
Government Ownership (%)	2.84	2.33	3.17	-0.84
				(-0.79)
Loan Amount / Total Assets (%)	28.26	28.98	33.94	-4.96
				(-1.57)
Maturity (Months)	58.78	59.64	58.98	0.66
				(0.23)
Term Loan (%)	54.65	59.30	58.73	0.57
				(0.11)

Panel G and H present a test for the difference in means between low-quality non-zombie firms and zombie firms, where firms are defined as low-quality based on their 2009-2011 average EBIT interest coverage ratio. We present these results for the two alternative zombie classifications which use information in either Amadeus or Dealscan to calculate benchmark interest rates. We classify a firm as zombie if it meets the following three criteria: (i) the firm receives subsidized credit, (ii) its rating (derived from three year median EBIT interest coverage ratios) is BB or lower, and (iii) the syndicate composition has either remained constant, or banks leaving the syndicate without being replaced by new participants, that is, the same syndicate has already provided a loan to the firm. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 5: Loan Volume Regressions - Zombie Lending

Panel A: Zombie Amadeus Benchmark								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ΔLoans	ΔLoans	ΔLoans	ΔLoans	Loan Inc.	ΔLoans	ΔLoans	ΔLoans
	All banks	All banks	All banks	All banks	All banks	GIIPS banks	Span. & Port. banks	Italian banks
OMT windfall gain*PostOMT	0.444***	0.450***	0.393***	0.414***	0.569***	0.587**	0.320*	0.552***
	(5.03)	(4.79)	(3.05)	(3.01)	(2.82)	(1.99)	(1.92)	(3.52)
OMT windfall gain*PostOMT*Zombie	-0.526***	-0.573***	-0.468***	-0.543***	-0.585**	-0.697**	-0.513***	-0.635***
	(-3.16)	(-2.74)	(-4.53)	(-2.75)	(-2.04)	(-2.55)	(-3.32)	(-3.76)
OMT windfall gain*PostOMT*Still Undercap	-0.405**	-0.460**	-0.431***	-0.433***	-0.560***	-0.663**	-0.430**	-0.551***
	(-2.13)	(-2.33)	(-2.75)	(-2.83)	(-2.78)	(-2.83)	(-2.10)	(-3.12)
OMT windfall gain*PostOMT*Still Undercap*Zombie	0.722***	0.701***	0.768***	0.756***	0.865**	0.998***	0.746*	1.01***
	(3.17)	(4.50)	(4.12)	(3.58)	(2.42)	(3.66)	(1.79)	(4.05)
R^2	0.011	0.111	0.726	0.759	0.695	0.834	0.832	0.906
N	13600	13600	13600	13600	13600	4280	2878	1402
Panel B: Zombie Dealscan Benchmark								
OMT windfall gain*PostOMT	0.437***	0.448***	0.397***	0.412***	0.689***	0.648**	0.306**	0.511***
	(4.67)	(4.37)	(3.39)	(3.34)	(4.11)	(2.15)	(2.41)	(2.97)
OMT windfall gain*PostOMT*Zombie	-0.493***	-0.522***	-0.480***	-0.544***	-0.784***	-0.733***	-0.491***	-0.685***
	(-2.74)	(-2.73)	(-5.54)	(-3.91)	(-3.40)	(-2.97)	(-4.58)	(-4.24)
OMT windfall gain*PostOMT*Still Undercap	-0.461**	-0.517**	-0.440***	-0.409***	-0.682***	-0.664***	-0.468***	-0.521**
	(-2.38)	(-2.48)	(-3.54)	(-3.59)	(-4.26)	(-3.42)	(-2.79)	(-2.51)
OMT windfall gain*PostOMT*Still Undercap*Zombie	0.758***	0.732***	0.684***	0.707***	1.093***	1.012**	0.750**	1.10***
	(3.47)	(3.57)	(5.70)	(4.43)	(3.95)	(2.64)	(2.47)	(4.04)
R^2	0.010	0.114	0.723	0.756	0.693	0.848	0.843	0.928
N	13600	13600	13600	13600	13600	4280	2878	1402
Bank Level Controls	YES	YES	YES	YES	YES	YES	YES	YES
Bank Fixed Effects	YES	NO	YES	NO	NO	NO	YES	YES
Time Fixed Effects	YES	YES	NO	NO	NO	NO	NO	NO
FirmCluster-Bank Fixed Effects	NO	YES	NO	YES	YES	YES	NO	NO
FirmCluster-Time Fixed Effects	NO	NO	YES	YES	YES	YES	YES	YES

Table 5 presents the results of a modified version of the Khwaja and Mian (2008) bank lending channel regression. The unit of observation is a firm cluster-bank-quarteryear. The dependent variable is the change in log loan volume of a firm cluster-bank relation in a given quarter where firm clusters are formed based on a firm's country of incorporation, industry, rating, and whether the firm is a zombie. Hence clusters consist entirely of zombies or non-zombies. We present these results for the two alternative zombie classifications which use information in either Amadeus or Dealscan to calculate benchmark interest rates. Panel A considers the interest benchmark based on Amadeus whereas Panel B presents results for the benchmark based on Dealscan. *Still Undercap* is a dummy variable that equals one if banks have an above sample median leverage ratio after the OMT announcement. Data are restricted to: (i) the set of firm cluster-bank relations that existed prior to OMT announcement, (ii) firm cluster-quarters where firms in a cluster borrow from at least one bank that benefited and one bank that did not benefit from the OMT announcement. Columns (1)-(5) consider all banks, Column (6) focusses on banks in Italy, Spain and Portugal, whereas Columns (7) and (8) consider only banks from Spain/Portugal and Italy, respectively. *PostOMT* is an indicator variable equal to one starting in quarter four of 2012, and zero before. Standard errors are clustered at the bank level. t-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 6: Loan Volume Regressions - Zombie Lending excluding firms with positive government ownership

Panel A: Zombie Amadeus Benchmark								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Δ Loans	Δ Loans	Δ Loans	Δ Loans	Loan Increase	Δ Loans	Δ Loans	Δ Loans
OMT windfall gain*PostOMT	0.454***	0.478***	0.380**	0.432***	0.585**	0.591*	0.315**	0.580*
	(3.64)	(3.51)	(2.66)	(2.76)	(2.33)	(1.97)	(2.65)	(2.38)
OMT windfall gain*PostOMT*Zombie	-0.518**	-0.542**	-0.490***	-0.490*	-0.612**	-0.673**	-0.549***	-0.662**
	(-2.24)	(-2.60)	(-2.75)	(-2.00)	(-2.31)	(-2.29)	(-5.25)	(-3.42)
OMT windfall gain*PostOMT*Undercap	-0.393*	-0.452*	-0.414**	-0.478**	-0.591***	-0.686**	-0.384*	-0.697*
	(-1.92)	(-1.98)	(-2.45)	(-2.59)	(-3.07)	(-2.55)	(-2.15)	(-2.31)
OMT windfall gain*PostOMT*Undercap*Zombie	0.677**	0.733***	0.752***	0.740***	0.906**	0.865**	0.738	1.066**
	(2.72)	(2.96)	(3.19)	(2.89)	(2.06)	(2.14)	(1.71)	(3.42)
R^2	0.011	0.113	0.730	0.763	0.692	0.855	0.847	0.940
N	13117	13117	13117	13117	13117	4116	2803	1313
Panel B: Zombie Dealscan Benchmark								
OMT windfall gain*PostOMT	0.420***	0.435***	0.397***	0.425***	0.696***	0.682*	0.376	0.529**
	(4.02)	(3.71)	(3.27)	(3.35)	(3.15)	(1.99)	(1.84)	(3.89)
OMT windfall gain*PostOMT*Zombie	-0.516**	-0.560**	-0.475***	-0.553***	-0.843**	-0.704**	-0.507***	-0.683**
	(-2.42)	(-2.37)	(-4.61)	(-3.37)	(-2.14)	(-2.33)	(-4.43)	(-3.67)
OMT windfall gain*PostOMT*Undecap	-0.439	-0.494*	-0.459***	-0.466***	-0.699***	-0.686*	-0.492	-0.570**
	(-1.67)	(-1.72)	(-2.84)	(-2.83)	(-3.62)	(-2.01)	(-1.80)	(-2.91)
OMT windfall gain*PostOMT*Undecap*Zombie	0.763***	0.720***	0.785***	0.758***	1.138**	1.084**	0.812	1.090**
	(3.26)	(3.08)	(5.80)	(4.09)	(2.60)	(2.42)	(1.70)	(3.84)
R^2	0.010	0.113	0.727	0.759	0.690	0.838	0.839	0.936
N	13117	13117	13117	13117	13117	4116	2803	1313
Bank Level Controls	YES	YES	YES	YES	YES	YES	YES	YES
Bank Fixed Effects	YES	NO	YES	NO	NO	NO	YES	YES
Time Fixed Effects	YES	YES	NO	NO	NO	NO	NO	NO
FirmCluster-Bank Fixed Effects	NO	YES	NO	YES	YES	YES	NO	NO
FirmCluster-Time Fixed Effects	NO	NO	YES	YES	YES	YES	YES	YES

Table 6 presents the results of a modified version of the Khwaja and Mian (2008) bank lending channel regression. The unit of observation is a firm cluster-bank-quarteryear. The dependent variable is the change in log loan volume of a firm cluster-bank relation in a given quarter where firm clusters are formed based on a firm's country of incorporation, industry, rating, and whether the firm is a zombie. Hence clusters consist entirely of zombies or non-zombies. We present these results for the two alternative zombie classifications which use information in either Amadeus or Dealscan to calculate benchmark interest rates. Panel A considers the interest benchmark based on Amadeus whereas Panel B presents results for the benchmark based on Dealscan. Data are restricted to: (i) the set of firm cluster-bank relations that existed prior to OMT announcement, (ii) firm cluster-quarters where firms in a cluster borrow from at least one bank that benefited and one bank that did not benefit from the OMT announcement. Columns (1)-(5) consider all banks, Column (6) focusses on banks in Italy, Spain and Portugal. *PostOMT* is an indicator variable equal to one starting in quarter four of 2012, and zero before. Standard errors are clustered at the bank level. t-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 7: Loan Volume Regressions - Horse Race between still undercap. and Government Ownership

Panel A: Zombie Amadeus Benchmark						
	(1)	(2)	(3)	(4)	(5)	(6)
	ΔLoans	ΔLoans	ΔLoans	ΔLoans	Loan Increase	ΔLoans
OMT windfall gain*PostOMT	0.437***	0.481***	0.422***	0.526***	0.768***	0.804*
	(4.58)	(5.11)	(3.58)	(4.24)	(5.01)	(2.00)
OMT windfall gain*PostOMT*Zombie	-0.512***	-0.559***	-0.479***	-0.468	-0.770**	-1.164***
	(-3.16)	(-2.86)	(-3.96)	(-1.65)	(-2.17)	(-5.81)
OMT windfall gain*PostOMT*Undercap	-0.388**	-0.462**	-0.464***	-0.540***	-0.778***	-0.837**
	(-2.24)	(-2.58)	(-3.01)	(-3.58)	(-5.24)	(-2.18)
OMT windfall gain*PostOMT*Undercap*Zombie	0.786***	0.713**	0.731***	0.757**	0.867***	1.152***
	(3.36)	(2.53)	(3.24)	(2.28)	(3.68)	(10.53)
OMT windfall gain*PostOMT*High Gov. Own.	-0.088	-0.058	-0.059	-0.083	-0.068	-0.016
	(-1.31)	(-0.77)	(-1.30)	(-1.29)	(-0.57)	(-0.29)
OMT windfall gain*PostOMT*High Gov. Own.*Zombie	0.072	0.166	0.011	0.040	0.109	0.073
	(0.94)	(1.24)	(0.33)	(0.22)	(1.01)	(0.56)
R^2	0.011	0.111	0.726	0.760	0.695	0.842
N	13600	13600	13600	13600	13600	4280
Panel B: Zombie Dealscan Benchmark						
OMT windfall gain*PostOMT	0.412***	0.435***	0.407***	0.445***	0.750***	0.735*
	(3.89)	(3.96)	(3.45)	(3.70)	(5.41)	(2.02)
OMT windfall gain*PostOMT*Zombie	-0.450**	-0.515***	-0.446***	-0.410***	-0.568***	-1.238***
	(-2.34)	(-2.85)	(-3.89)	(-4.11)	(-2.99)	(-5.47)
OMT windfall gain*PostOMT*Undercap	-0.413**	-0.471**	-0.452***	-0.439***	-0.740***	-0.618*
	(-2.22)	(-2.36)	(-3.39)	(-3.72)	(-6.45)	(-2.06)
OMT windfall gain*PostOMT*Undercap*Zombie	0.704***	0.754***	0.687***	0.692***	1.019***	1.124***
	(3.04)	(3.61)	(4.37)	(4.66)	(3.61)	(4.94)
OMT windfall gain*PostOMT*High Gov. Own.	-0.107	-0.143	-0.035	-0.056	0.049	-0.038
	(-1.49)	(-1.66)	(-0.80)	(-1.25)	(0.59)	(-0.80)
OMT windfall gain*PostOMT*High Gov. Own.*Zombie	0.068	0.133	0.002	0.117	-0.046	0.063
	(1.25)	(1.28)	(0.05)	(1.28)	(-0.60)	(0.98)
R^2	0.010	0.115	0.723	0.756	0.631	0.850
N	13600	13600	13600	13600	13600	4280
Bank Level Controls	YES	YES	YES	YES	YES	YES
Bank Fixed Effects	YES	NO	YES	NO	NO	NO
Time Fixed Effects	YES	YES	NO	NO	NO	NO
FirmCluster-Bank Fixed Effects	NO	YES	NO	YES	YES	YES
FirmCluster-Time Fixed Effects	NO	NO	YES	YES	YES	YES

Table 7 presents the results of a modified version of the Khwaja and Mian (2008) bank lending channel regression. The unit of observation is a firm cluster-bank-quarteryear. The dependent variable is the change in log loan volume of a firm cluster-bank relation in a given quarter where firm clusters are formed based on a firm's country of incorporation, industry, rating, and whether the firm is a zombie. Hence clusters consist entirely of zombies or non-zombies. We present these results for the two alternative zombie classifications which use information in either Amadeus or Dealscan to calculate benchmark interest rates. Panel A considers the interest benchmark based on Amadeus whereas Panel B presents results for the benchmark based on Dealscan. *Still Undercap* is a dummy variable that equals one if banks have an above sample median leverage ratio after the OMT announcement. Data are restricted to: (i) the set of firm cluster-bank relations that existed prior to OMT announcement, (ii) firm cluster-quarters where firms in a cluster borrow from at least one bank that benefited and one bank that did not benefit from the OMT announcement. Columns (1)-(5) consider all banks, Column (6) focusses on banks in Italy, Spain and Portugal, whereas Columns (7) and (8) consider only banks from Spain/Portugal and Italy, respectively. *PostOMT* is an indicator variable equal to one starting in quarter four of 2012, and zero before. Standard errors are clustered at the bank level. t-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 8: Descriptive Statistics (pre-OMT Program Announcement) - All Firms

		Total Assets (mn)	Tangibility	Int. Cov.	Net Worth	EBITDA/Assets
	Mean	2850	0.614	2.60	0.210	0.076
High Indirect OMT windfall gains	Median	486	0.658	1.25	0.190	0.069
	Std. Dev.	7520	0.260	9.25	0.196	0.062
	Mean	1810	0.536	3.82	0.230	0.090
Low Indirect OMT windfall gains	Median	330	0.553	1.41	0.220	0.075
	Std. Dev.	5590	0.290	2.540	0.216	0.077
Diff. (t-Stat)		1040 (3.65)	0.078 (6.30)	-1.22 (-5.47)	-0.02 (-1.77)	-0.014 (-2.87)
Normalized Diff.		0.289	0.149	-0.148	-0.074	-0.120

Table 8 presents descriptive statistics of firm-level control variables split into firms with a high and low dependence on banks that benefited from the OMT announcement in the pre-OMT period.

Table 9: Financial and Real Effects - All Firms

Panel A: All Firms						
	(1)	(2)	(3)	(4)	(5)	(6)
	ΔCash	ΔDebt	ΔDebt-ΔCash	Emp. Growth	CAPX	ROA
Indirect OMT windfall gains*PostOMT	0.376***	0.368***	-0.008	0.070	-0.248	0.051
	(2.82)	(2.87)	(-0.04)	(0.15)	(-0.59)	(0.43)
R^2	0.485	0.576		0.458	0.496	0.460
N	3198	3982		3163	3948	3919
Panel B: Quality Classification 2009-2011						
Indirect OMT windfall gains*PostOMT	0.171	0.267	0.096	0.065	0.023	-0.101
	(1.01)	(1.32)	(0.36)	(0.15)	(0.05)	(-0.67)
Indirect OMT windfall gains*PostOMT*Low IC	0.517**	0.567**	0.05	-0.240	-0.728	0.252
	(2.42)	(2.08)	0.14	(-0.49)	(-1.30)	(1.40)
R^2	0.493	0.612		0.441	0.486	0.459
N	3198	3982		3163	3948	3919
Panel C: Zombie Lending - Amadeus Benchmark						
Indirect OMT windfall gains*PostOMT*Low IC	0.519**	0.557**	0.038	-0.418	-0.618	0.185
	(2.30)	(2.05)	(0.1)	(-0.98)	(-0.93)	(0.82)
Indirect OMT windfall gains*PostOMT*Low IC*Zombie	-0.384**	-0.028	0.356**	0.346	0.044	0.125
	(-2.00)	(-0.19)	(2.15)	(1.36)	(0.11)	(1.12)
R^2	0.514	0.619		0.471	0.500	0.482
N	2856	3431		2773	3361	3405
Panel D: Zombie Lending - Dealscan Benchmark						
Indirect OMT windfall gains*PostOMT*Low IC	0.568**	0.582**	0.014	-0.398	-0.931	0.176
	(2.45)	(2.17)	(0.2)	(-0.57)	(-1.37)	(0.77)
Indirect OMT windfall gains*PostOMT*Low IC*Zombie	-0.385**	-0.107	0.278**	0.534	0.371	0.072
	(-2.27)	(-0.98)	(2.12)	(1.09)	(1.16)	(0.63)
R^2	0.513	0.617		0.466	0.501	0.481
N	2856	3431		2773	3361	3405
Firm Level Controls	YES	YES		YES	YESYES	
Firm Fixed Effects	YES	YES		YES	YES	YES
Industry-Country-Year Fixed Effects	YES	YES		YES	YES	YES
Foreign Bank GIIPS Country-Year Fixed Effects	YES	YES		YES	YES	YES

Table 9 presents firm-level regression results. The dependent variables are the change in cash holdings, change in leverage, employment growth, investments, and ROA, respectively. Panel A includes all firms in the sample. In Panel B, firms are split based on the country-specific 3-year median interest coverage ratio in the sovereign debt crisis years 2009 to 2011 in high and low-quality firms. Panel C considers all firms for which it is possible to classify them as zombies or non-zombies based the interest rate benchmark from Amadeus, while Panel D considers the interest rate benchmark from Dealscan. The sample consists of all private firms in the intersection of DealScan and Amadeus that are located in the following countries: Greece, Italy, Ireland, Portugal, Spain (GIIPS countries) or other EU countries with active syndicated loan markets (non-GIIPS countries). *Indirect OMT windfall gains* measure the firms' indirect gains on sovereign debt holdings through their lenders, that is, for each firm, we measure the exposure it has to the value increase in the sovereign debt holdings of the banks from which it received loans. *PostOMT* is an indicator variable equal to one starting at the end of fiscal year 2012, and zero before. Firm control variables include the logarithm of total assets, leverage, tangibility, interest coverage ratio, EBITDA as a fraction of total assets, and net worth. All firm-level control variables are lagged by one period. Standard errors are adjusted for heteroscedasticity and clustered at the firm-level. t-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 10: Effects on Non-zombie Firms

Panel A: Amadeus Benchmark				
	(1)	(2)	(3)	(4)
	Interest	Emp. Growth	CAPX	Productivity
Industry Frac Zombie*Non-Zombie	-0.001	0.000	0.002	-0.001
	(-1.44)	(1.57)	(1.36)	(-0.39)
Industry Frac Zombie*Non-Zombie*High IC	0.021**	-0.005**	-0.015**	0.011***
	(2.03)	(-2.05)	(-2.43)	(2.87)
R^2	0.523	0.453	0.468	0.441
N	3327	2773	3361	2860
Panel B: Dealscan Benchmark				
Industry Frac Zombie*Non-Zombie	-0.001	0.000	0.002	0.001
	(-0.88)	(1.53)	(1.54)	(1.30)
Industry Frac Zombie*Non-Zombie*High IC	0.019**	-0.004**	-0.013**	0.011**
	(2.13)	(-2.55)	(-2.08)	(2.38)
R^2	0.520	0.456	0.470	0.471
N	3327	2773	3361	2860
Firm Level Controls	YES	YES	YES	YES
Firm Fixed Effects	YES	YES	YES	YES
Industry-Country-Year Fixed Effects	YES	YES	YES	YES

Table 10 presents firm-level regression results. The dependent variables are interest payments, employment growth, investments, and productivity, respectively. Panel A considers the interest rate benchmark derived from Amadeus whereas Panel B considers the benchmark derived from Dealscan. The sample consists of all private firms in the intersection of DealScan and Amadeus that are located in the following countries: Greece, Italy, Ireland, Portugal, Spain (GIIPS countries) or other EU countries with active syndicated loan markets (non-GIIPS countries). *Industry Frac Zombie* measures the asset-weighted fraction of zombie firms in a given industry and country in a given year (measured using the universe of very large Amadeus firms). *Non-zombie* is an indicator variable equal to one for firms that are not classified as zombie firms. High IC is an indicator variable if the firm has an above country median interest coverage ratio. Firm control variables include the logarithm of total assets, leverage, tangibility, interest coverage ratio, EBITDA as a fraction of total assets, and net worth. Standard errors are adjusted for heteroscedasticity and clustered at the firm-level. t-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 11: Effects on Non-Zombie Firms

Panel A: Amadeus Benchmark - Competitive Industries				
	(1)	(2)	(3)	(4)
	Interest	Emp. Growth	CAPX	Productivity
Industry Frac Zombie*Non-Zombie	-0.001	0.000	0.001	-0.000
	(-1.62)	(1.32)	(1.48)	(-0.02)
Industry Frac Zombie*Non-Zombie*High IC	0.021**	-0.004**	-0.014**	0.012***
	(2.34)	(-2.15)	(-2.27)	(2.93)
R^2	0.564	0.467	0.418	0.573
N	1685	1345	1702	1398
Panel B: Amadeus Benchmark - Non-Competitive Industries				
Industry Frac Zombie*Non-Zombie	-0.001	-0.000	-0.000	0.000
	(-1.37)	(-0.25)	(-0.74)	(0.31)
Industry Frac Zombie*Non-Zombie*High IC	0.020**	-0.001	-0.001	0.016
	(2.57)	(-0.85)	(-0.78)	(1.45)
R^2	0.664	0.646	0.681	0.579
N	1642	1428	1659	1462
Panel C: Dealscan Benchmark - Competitive Industries				
Industry Frac Zombie*Non-Zombie	-0.000	0.000	0.001	0.001
	(-0.60)	(1.28)	(0.58)	(1.36)
Industry Frac Zombie*Non-Zombie*High IC	0.020**	-0.004**	-0.015**	0.013**
	(2.04)	(-2.32)	(-2.21)	(2.30)
R^2	0.565	0.477	0.427	0.587
N	1685	1345	1702	1398
Panel D: Dealscan Benchmark - Non-Competitive Industries				
Industry Frac Zombie*Non-Zombie	-0.001	0.000	-0.000	-0.000
	(-1.43)	(0.52)	(-0.20)	(-0.37)
Industry Frac Zombie*Non-Zombie*High IC	0.018**	-0.000	0.001	0.003
	(2.18)	(-0.48)	(0.67)	(1.04)
R^2	0.646	0.644	0.682	0.570
N	1642	1428	1659	1462
Firm Level Controls	YES	YES	YES	YES
Firm Fixed Effects	YES	YES	YES	YES
Industry-Country-Year Fixed Effects	YES	YES	YES	YES

Table 11 presents firm-level regression results. The dependent variables are interest payments, employment growth, investments, and productivity, respectively. Panel A and B consider the interest rate benchmark derived from Amadeus whereas Panel C and D consider the benchmark derived from Dealscan. The sample is further split into competitive (Panel A and C) and non-competitive industries (Panel B and D) based on the the HHI index of an industry. The sample consists of all private firms in the intersection of DealScan and Amadeus that are located in the following countries: Greece, Italy, Ireland, Portugal, Spain (GIIPS countries) or other EU countries with active syndicated loan markets (non-GIIPS countries). *Industry Frac Zombie* measures the asset-weighted fraction of zombie firms in a given industry and country in a given year (measured using the universe of very large Amadeus firms). *Non-zombie* is an indicator variable equal to one for firms that are not classified as zombie firms. High IC is an indicator variable if the firm has an above country median interest coverage ratio. Firm control variables include the logarithm of total assets, leverage, tangibility, interest coverage ratio, EBITDA as a fraction of total assets, and net worth. Standard errors are adjusted for heteroscedasticity and clustered at the firm-level. t-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 12: Non-performing Loans

	(1) ΔNPL	(2) ΔNPL	(3) ΔNPL	(4) ΔNPL
High Zombie Lending Bank	0.090***	0.088***	0.088***	0.081***
	(4.87)	(4.69)	(4.60)	(3.63)
Log(Assets)		-0.004	-0.005	-0.005
		(-1.59)	(-1.73)	(-1.21)
Equity/Assets			-0.001***	-0.001**
			(-3.09)	(-2.45)
RWA/TA				0.049
				(1.41)
R^2	0.511	0.522	0.541	0.564
N	49	49	49	49

Table 12 present bank level regressions. The dependent variable is the change of a bank's non-performing loans to gross loans ratio (average after minus average before 2014). High Zombie Lending Bank is an indicator variable equal to one if a bank has a high fraction of zombie loans, and zero else. Standard errors are adjusted for heteroscedasticity and clustered at the firm-level. t-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

For Online Publication

Online Appendix for

"Whatever it takes: The Real Effects of Unconventional Monetary Policy"

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Tim Eisert
Christian Eufinger
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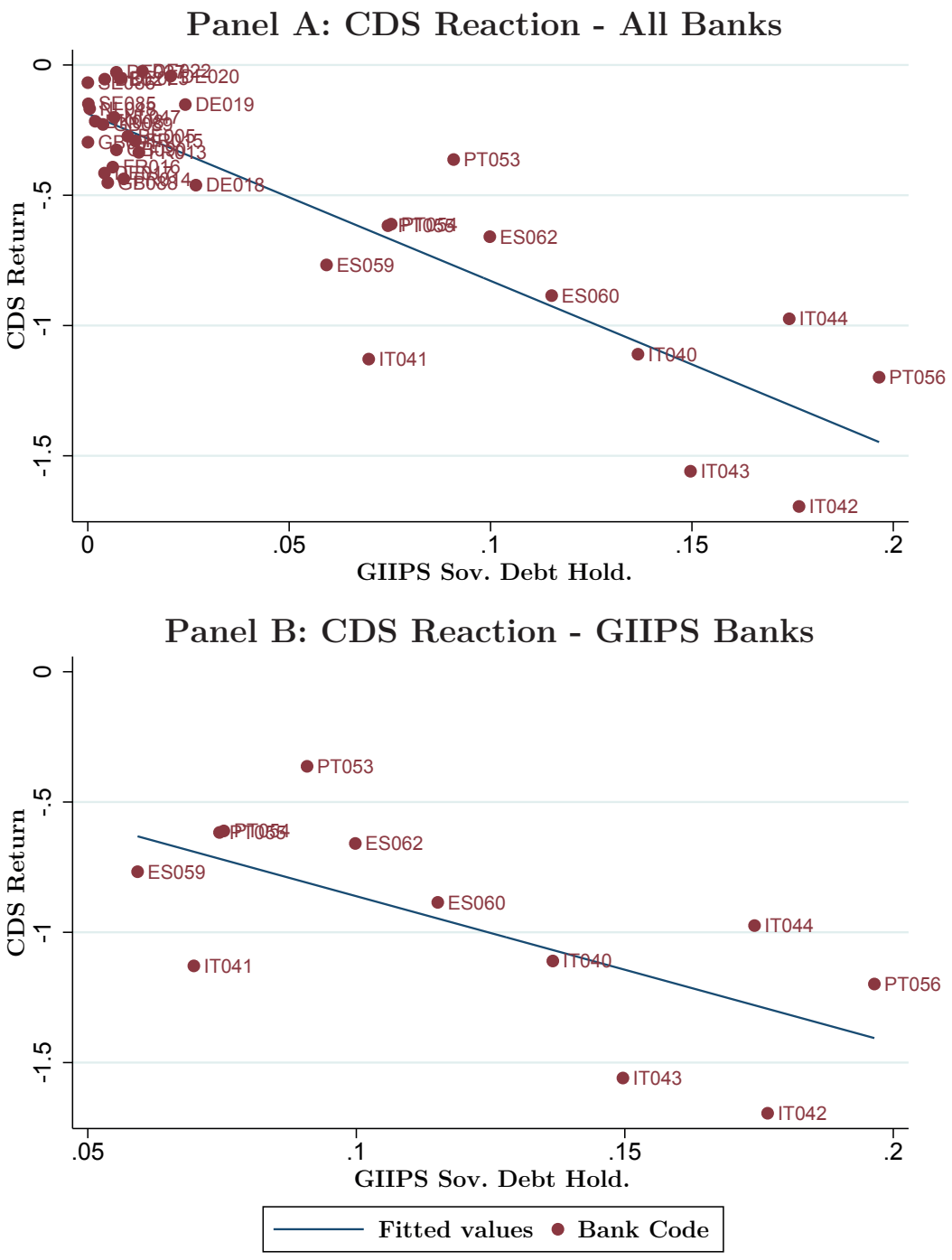
Figure A1



Panel A (Panel B) plots the relation between banks' CDS return on the OMT announcement dates and their GIIPS sovereign debt holdings for GIIPS and non-GIIPS banks (only for GIIPS banks). Banks included in the analysis must have information about their sovereign debt portfolio prior to the OMT announcement (June 2012) and must be active in the syndicated loan market during the sample period. GIIPS Banks include banks incorporated in Italy, Portugal, and Spain. Non-GIIPS banks consist of banks in all other European countries that are included in the EBA's June 2012 capital exercises.

Table A1: Bank CDS Reaction to OMT Announcement

Panel A: GIIPS sovereign bond holdings scaled by total assets				
	(1)	(2)	(3)	(4)
	CDS Return OMT	CDS Return OMT	CDS Return OMT	CDS Return OMT
GIIPS/Assets	-6.414***	-7.635***	-7.567***	-7.715***
	(-10.38)	(-13.05)	(-11.28)	(-10.62)
Log Assets		-0.134***	-0.133***	-0.126***
		(-4.12)	(-4.00)	(-3.51)
Tier1 Capital			0.396	1.110
			(0.22)	(0.50)
RWA/Assets				0.084
				(0.57)
R^2	0.771	0.852	0.852	0.854
N	30	30	30	30
Panel B: OMT windfall gain				
OMT windfall gain	-6.501***	-6.741***	-6.321***	-7.016***
	(-7.06)	(-8.25)	(-7.23)	(-7.94)
Log Assets		-0.076*	-0.074*	-0.119**
		(-1.88)	(-1.85)	(-2.26)
Tier1 Capital			0.028	0.010
			(1.27)	(0.37)
RWA/Assets				0.597
				(0.79)
R^2	0.609	0.621	0.777	0.782
N	30	30	30	30

Table A1 presents estimates from a linear regression analysis of the determinants banks' CDS returns on the OMT announcement dates. Independent variables are each banks' GIIPS sovereign bond holdings scaled by total assets (GIIPS/Assets) measured before the OMT announcement or the OMT windfall gain which is defined as the gain on the sovereign debt holdings as a fraction of total equity. Control variables include the log of total assets, the ratio of tier 1 capital to risk weighted assets, and the ratio of risk weighted assets to total assets, all measured in the period prior to the OMT announcement. t-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table A2: Loan Volume Regressions

Panel A: Intensive Margin - All Firms						
	(1)	(2)	(3)	(4)	(5)	(6)
	ΔLoans	ΔLoans	ΔLoans	ΔLoans	Loan Inc.	ΔLoans
CDS Return*PostOMT	0.046***	0.057***	0.040**	0.041**	0.039**	0.057**
	(4.89)	(4.51)	(2.47)	(2.07)	(2.71)	(2.86)
R^2	0.012	0.100	0.637	0.678	0.632	0.858
N	10023	10023	10023	10023	10023	3700
Panel B: Intensive Margin - Quality Split						
CDS Return*PostOMT	0.008	0.018	-0.011	-0.015	-0.013	0.038
	(0.79)	(1.39)	(-1.06)	(-1.27)	(-0.40)	(0.96)
CDS Return*PostOMT*LowIC	0.063***	0.064***	0.064***	0.070***	0.094**	0.073**
	(5.03)	(3.97)	(3.00)	(3.57)	(2.02)	(1.97)
R^2	0.013	0.102	0.639	0.680	0.632	0.887
N	10023	10023	10023	10023	10023	3700
Panel C: Extensive Margin - All Firms						
	New Loan	New Loan	New Loan	New Loan		New Loan
CDS Return*PostOMT	-0.002	-0.002	-0.042	-0.042		-0.099
	(-0.02)	(-0.02)	(-0.58)	(-0.56)		(-0.87)
R^2	0.006	0.079	0.674	0.700		0.818
N	23174	23174	23174	23174		6725
Panel D: Extensive Margin - Quality Split						
CDS Return*PostOMT	0.053	-0.022	0.000	-0.044		-0.188
	(0.63)	(-0.23)	(0.00)	(-0.33)		(-1.40)
CDS Return*PostOMT*LowIC	-0.103	0.038	-0.080	0.003		0.109
	(-1.32)	(0.39)	(-1.17)	(0.02)		(0.99)
R^2	0.006	0.079	0.674	0.700		0.815
N	23174	23174	23174	23174		6725
Bank Level Controls	YES	YES	YES	YES	YES	YES
Bank Fixed Effects	YES	NO	YES	NO	NO	NO
Time Fixed Effects	YES	YES	NO	NO	NO	NO
FirmCluster-Bank Fixed Effects	NO	YES	NO	YES	YES	YES
FirmCluster-Time Fixed Effects	NO	NO	YES	YES	YES	YES

Table A2 presents the results of a modified version of the Khwaja and Mian (2008) bank lending channel regression. The unit of observation is a firm cluster-bank-quarteryear. The dependent variable is the change in log loan volume of a firm cluster-bank relation in a given quarter (Panel A and B) or a dummy variable equal to one if a new loan is issued to a firm cluster with which no prior relation existed (Panel C and D). Columns (1)-(5) consider all banks, whereas Column (6) focuses on banks from Italy, Portugal, and Spain. Firm clusters are formed based on a firm's country of incorporation, industry, and rating. The rating of each firm is estimated from EBIT interest coverage ratio medians (2009-2011) for firms by rating category provided by Standard & Poor's. Firms are split based on the country-specific 3-year median interest coverage ratio. In Panel A and B data are restricted to: (i) the set of firm firm-bank relations that existed prior to the OMT announcement (i.e., all firms in a cluster must have a relation to a particular bank), and (ii) firm cluster-quarters where firms in a cluster borrow from at least one bank that benefited and one bank that did not benefit from the OMT announcement. In Panels C and D only firms without existing relation at the time of the OMT announcement are included. *PostOMT* is an indicator variable equal to one starting in quarter four of 2012, and zero before. Bank Level controls include the logarithm of total assets, equity/assets, impaired loans/equity, and return on assets. Standard errors are clustered at the bank level. t-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table A3

	(1)	(2)	(3)	(4)	(5)	(6)
	ΔLoans	ΔLoans	ΔLoans	ΔLoans	Loan Increase	ΔLoans
OMT windfall gain*PostOMT	0.037	0.058	0.004	-0.008	-0.039	0.079
	(0.54)	(0.67)	(0.07)	(-0.10)	(-0.26)	(0.82)
OMT windfall gain*PostOMT*LowIC	0.247***	0.265***	0.219***	0.259***	0.372**	0.308**
	(3.65)	(3.50)	(3.27)	(3.09)	(2.13)	(3.09)
Equity Increase EBA*PostEBA	-0.049	-0.044	-0.017	-0.015	-0.043	0.008
	(-1.62)	(-1.26)	(-0.70)	(-0.62)	(-1.08)	(0.30)
Equity Increase EBA*PostEBA*LowIC	0.057	0.053	-0.033	-0.032	0.007	-0.067
	(1.44)	(1.18)	(-0.89)	(-0.85)	(0.12)	(-1.54)
R^2	0.014	0.098	0.598	0.643	0.617	0.775
N	10879	10879	10879	10879	10879	4090

Table A3 presents the results of a modified version of the Khwaja and Mian (2008) bank lending channel regression. The unit of observation is a firm cluster-bank-quarteryear. The dependent variable is the change in log loan volume of a firm cluster-bank relation in a given quarter. Columns (1)-(5) consider all banks, whereas Column (6) focuses on banks from Italy, Portugal, and Spain. Firm clusters are formed based on a firm's country of incorporation, industry, and rating. The rating of each firm is estimated from EBIT interest coverage ratio medians (2009-2011) for firms by rating category provided by Standard & Poor's. Firms are split based on the country-specific 3-year median interest coverage ratio. Data are restricted to: (i) the set of firm-bank relations that existed prior to the OMT announcement (i.e., all firms in a cluster must have a relation to a particular bank), and (ii) firm cluster-quarters where firms in a cluster borrow from at least one bank that benefited and one bank that did not benefit from the OMT announcement. *PostOMT* is an indicator variable equal to one starting in quarter four of 2012, and zero before. Bank Level controls include the logarithm of total assets, equity/assets, impaired loans/equity, and return on assets. Standard errors are clustered at the bank level. t-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table A4: Loan Volume Regressions - Zombie Lending

Panel A: Zombie Amadeus Benchmark						
	(1)	(2)	(3)	(4)	(5)	(6)
	ΔLoans	ΔLoans	ΔLoans	ΔLoans	Loan Inc.	ΔLoans
CDS Return*PostOMT	0.065***	0.066***	0.056**	0.059**	0.083**	0.077*
	(4.57)	(4.07)	(2.45)	(2.31)	(2.53)	(2.18)
CDS Return*PostOMT*Zombie	-0.085***	-0.073**	-0.071***	-0.091*	-0.088***	-0.091**
	(-2.94)	(-2.32)	(-3.13)	(-1.83)	(-2.94)	(-2.51)
CDS Return*PostOMT*Still Undercap	-0.069***	-0.074***	-0.067***	-0.072***	-0.089***	-0.080**
	(-4.91)	(-4.95)	(-3.36)	(-3.22)	(-3.14)	(-2.77)
CDS Return*PostOMT*Still Undercap*Zombie	0.123**	0.122***	0.135***	0.139**	0.140**	0.152**
	(2.34)	(4.87)	(3.78)	(2.19)	(2.65)	(2.69)
R^2	0.012	0.111	0.728	0.761	0.696	0.849
N	12367	12367	12367	12367	12367	3986
Panel B: Zombie Dealscan Benchmark						
CDS Return*PostOMT	0.062***	0.065***	0.056**	0.059**	0.105***	0.085*
	(3.19)	(2.88)	(2.45)	(2.37)	(3.60)	(2.05)
CDS Return*PostOMT*Zombie	-0.075**	-0.074**	-0.100**	-0.070**	-0.122**	-0.089*
	(-2.23)	(-2.11)	(-2.55)	(-2.29)	(-2.30)	(-1.81)
CDS Return*PostOMT*Still Undercap	-0.069***	-0.077***	-0.061***	-0.070***	-0.095***	-0.099***
	(-3.88)	(-4.05)	(-3.17)	(-3.25)	(-3.69)	(-3.28)
CDS Return*PostOMT*Still Undercap*Zombie	0.138***	0.146***	0.134***	0.132***	0.184**	0.169**
	(2.81)	(3.73)	(3.50)	(3.06)	(2.10)	(2.29)
R^2	0.011	0.114	0.723	0.756	0.633	0.860
N	12367	12367	12367	12367	12367	3986
Bank Level Controls	YES	YES	YES	YES	YES	YES
Bank Fixed Effects	YES	NO	YES	NO	NO	NO
Time Fixed Effects	YES	YES	NO	NO	NO	NO
FirmCluster-Bank Fixed Effects	NO	YES	NO	YES	YES	YES
FirmCluster-Time Fixed Effects	NO	NO	YES	YES	YES	YES

Table A4 presents the results of a modified version of the Khwaja and Mian (2008) bank lending channel regression. The unit of observation is a firm cluster-bank-quarteryear. The dependent variable is the change in log loan volume of a firm cluster-bank relation in a given quarter where firm clusters are formed based on a firm's country of incorporation, industry, rating, and whether the firm is a zombie. Hence clusters consist entirely of zombies or non-zombies. We present these results for the two alternative zombie classifications which use information in either Amadeus or Dealscan to calculate benchmark interest rates. Panel A considers the interest benchmark based on Amadeus whereas Panel B presents results for the benchmark based on Dealscan. Data are restricted to: (i) the set of firm cluster-bank relations that existed prior to OMT announcement, (ii) firm cluster-quarters where firms in a cluster borrow from at least one bank that benefited and one bank that did not benefit from the OMT announcement. Columns (1)-(5) consider all banks, Column (6) focusses on banks in Italy, Spain and Portugal. *PostOMT* is an indicator variable equal to one starting in quarter four of 2012, and zero before. Standard errors are clustered at the bank level. t-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table A5: Financial and Real Effects - All Firms

Panel A: Industry-Country-Year Fixed Effects						
	(1)	(2)	(3)	(4)	(5)	(6)
	ΔCash	ΔDebt	ΔDebt-ΔCash	Emp. Growth	CAPX	ROA
Indirect OMT windfall gains*PostOMT	0.352***	0.331***	0.021	-0.112	-0.454	0.087
	(3.01)	(2.69)	(0.13)	(-0.26)	(-1.31)	(0.84)
R^2	0.472	0.575		0.508	0.620	0.777
N	3198	3982		3163	3948	3919
Panel B: Country Year Fixed Effects						
Indirect OMT windfall gains*PostOMT	0.390***	0.381**	0.009	0.130	-0.468	0.163
	(4.05)	(2.23)	(0.05)	(0.32)	(-1.45)	(1.56)
R^2	0.161	0.316		0.098	0.216	0.254
N	3198	3982		3163	3948	3919
Panel C: Year Fixed Effects						
Indirect OMT windfall gains*PostOMT	0.418**	0.401***	0.017	0.190	-0.268	0.164
	(2.03)	(2.94)	(0.07)	(0.69)	(-0.79)	(1.57)
R^2	0.131	0.284		0.076	0.168	0.212
N	3198	3982		3163	3948	3919
Firm Level Controls	YES	YES		YES	YES	YES
Firm Fixed Effects	YES	YES		YES	YES	YES

Table A5 presents firm-level regression results. The dependent variables are the change in cash holdings, change in leverage, employment growth, investments, and ROA, respectively. Panel A includes firm and industry-country-year fixed effects. Panel B controls for firm and country-year fixed effects. Panel C controls for firm and year fixed effects. The sample consists of all private firms in the intersection of DealScan and Amadeus that are located in the following countries: Greece, Italy, Ireland, Portugal, Spain (GIIPS countries) or other EU countries with active syndicated loan markets (non-GIIPS countries). *Indirect OMT windfall gains* measure the firms' indirect gains on sovereign debt holdings through their lenders, that is, for each firm, we measure the exposure it has to the value increase in the sovereign debt holdings of the banks from which it received loans. *PostOMT* is an indicator variable equal to one starting at the end of fiscal year 2012, and zero before. Firm control variables include the logarithm of total assets, leverage, tangibility, interest coverage ratio, EBITDA as a fraction of total assets, and net worth. All firm-level control variables are lagged by one period. Standard errors are adjusted for heteroscedasticity and clustered at the firm-level. t-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

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