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Whatever it takes: The real effects of unconventional monetary policy

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Viral V. Acharya - Tim Eisert - Christian Eufinger - Christian Hirsch

Whatever it takes: The Real Effects of Unconventional Monetary Policy

SAFE Working Paper No. 152

SAFE | Sustainable Architecture for Finance in Europe

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Non-Technical Summary

At the peak of the European debt crisis in 2012, the anxiety about excessive sovereign debt led to government bond yields for countries in the European periphery that were considered unsustainable and thereby 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 successful in terms of lowering spreads of sovereign bonds issued by distressed European countries. Altavilla et al. (2014), Krishnamurthy et al. (2014), and Szczerbowicz 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). 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 several signs that Europe’s weak economic recovery may be a repeat of Japan’s “zombie lending” experience in the 1990s, when distressed banks were not sufficiently recapitalized but their funding conditions were eased by the Bank of Japan. As a result, these banks did not foreclose on impaired borrowers so as not to record losses against thin slivers of bank capital. 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. In these same countries, about 13%, 11%, and 19% of total bank loans, respectively, were non-performing (Shekhar et al., 2015). To the best of our knowledge, our paper is the first to provide systematic evidence that, indeed, the 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 543 billion Euro in loans extended to the European firms in our sample post-OMT, roughly 8% were extended to unproductive low-quality firms at interest rates that were even 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 loans to zombie firms, and in Spain and Portugal, where roughly 11% of the loan volume was extended to zombie firms.

Similar to the crisis episode in Japan during the 1990s, the zombie lending problem in Europe can be traced back to the insufficient capitalization of parts of the European banking sector. While the ECB injected massive amounts of liquidity into the banking sector through measures like the longer-term refinancing operations (LTRO) programs, European authorities refrained from implementing a large scale targeted recapitalization program to systematically revive the European banking system. Instead, European authorities mainly relied on the indirect recapitalization effect of the OMT announcement to stabilize the European banking sector. However, 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.

As a result, while European banks regained some lending capacity post-OMT (lower bank run risk freed up liquidity for lending), 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 avoided realizing losses on outstanding loans, which would have further deteriorated 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 were able to delay taking a balance sheet hit and to gamble for resurrection in the hope that these zombie firms would regain solvency. This behavior led to an inefficient allocation of bank loans, since loan supply is shifted away from creditworthy productive firms towards less productive, distressed borrowers, which distorted market competition and caused detrimental effects on employment, investment, and growth.

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

Viral V. Acharya,[†] Tim Eisert,[‡] Christian Eufinger,[§] and Christian Hirsch[¶]

Abstract

Launched in Summer 2012, the European Central Bank (ECB)'s Outright Monetary Transactions (OMT) program indirectly recapitalized European banks through its positive impact on periphery sovereign bonds. However, the stability reestablished in the banking sector did not fully translate into economic growth. We document zombie lending by banks that remained undercapitalized even post-OMT. In turn, firms receiving loans used these funds not to undertake real economic activity such as employment and investment but to build up cash reserves. Creditworthy firms in industries with a high zombie firm prevalence suffered significantly from this credit misallocation, which further 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 sovereign debt led to government bond yields for countries in the European periphery that were considered unsustainable and thereby 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 successful in terms of lowering spreads of sovereign bonds issued by distressed European countries and avoiding a potential break-up of the Eurozone. Altavilla et al. (2014), Krishnamurthy et al. (2014), and Szczerbowicz et al. (2015) all find that the OMT measure lowered periphery sovereign yields, especially for Italian and Spanish government bond yields (by roughly 2 percentage points (pp)).¹ 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

¹Furthermore, 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.

fragile and easily disrupted, feeding into low investment.”

There are several signs that Europe’s weak economic recovery may be a repeat of Japan’s “zombie lending” experience in the 1990s, when distressed banks were not sufficiently recapitalized but their funding conditions were eased by the Bank of Japan.² As a result, these banks did not foreclose on impaired borrowers so as not to record losses against thin slivers of bank capital. 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 In these same countries, about 13%, 11%, and 19% of total bank loans, respectively, were non-performing (Shekhar et al., 2015). To the best of our knowledge, our paper is the first to provide systematic evidence that, indeed, the slow economic recovery in Europe can be partially explained by zombie lending motives of banks that still remained undercapitalized after the OMT announcement. In particular, we find that from the 543 billion Euro in loans extended to the European firms in our sample in the post-OMT period, roughly 8% were extended to unproductive low-quality firms at interest rates that were even 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 loans to zombie firms, and in Spain and Portugal, where roughly 11% of the loan volume was extended to zombie firms.

Similar to the crisis episode in Japan during the 1990s, the zombie lending problem in Europe can be traced back to the insufficient capitalization of parts of the European banking sector. While the ECB injected massive amounts of liquidity into the banking sector through measures like the longer-term refinancing operations (LTRO) programs, European authorities refrained from implementing a large scale targeted recapitalization program to systematically revive the European banking system. Instead, European authorities mainly relied on the indirect recapitalization effect of the OMT announcement to stabilize the European banking sector. However, while an indirect recapitalization

²See, 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.

³See “Europe’s other debt crisis”, *The Economist*, October 26, 2013.

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.

As a result, while European banks regained some lending capacity post-OMT (lower bank run risk freed up liquidity for lending), 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 avoided realizing losses on outstanding loans, which would have further deteriorated 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 were able to delay taking a balance sheet hit and to gamble for resurrection in the hope that these borrowers would regain solvency. This behavior led to an inefficient allocation of bank loans, since loan supply was shifted away from creditworthy productive firms towards less productive, distressed borrowers, which distorted market competition and caused detrimental effects on employment, investment, and growth.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. Finally, we evaluate whether the change in loan supply led to financial and real effects for European

⁴See Kane (1989), Peek and Rosengreen (2005), Caballero et al. (2008), and Giannetti and Simonov (2013) for such evidence in the context of the savings and loans debacle in the U.S. (Kane, 1989) and the banking crisis in the early 1990s in Japan (others).

firms and subsequent effects for the bank performance in terms of future losses.

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, and Spain) realized the highest windfall gains post-OMT and this improved their equity capitalization and liquidity. The resulting improvement in bank health led to an increase in available loans to firms. Building on the methodology of Khwaja and Mian (2008), we find that, post-OMT, banks with higher windfall gains on their sovereign debt holdings increased their loan supply to the corporate sector relatively more than banks with lower windfall gains. However, we only find a significant relationship between a bank's windfall gains and its propensity to extend loans to borrowers with whom it has a pre-existing lending relationship (intensive margin), and not to new borrowers (extensive margin).

While this macro-evidence on bank lending may suggest a healthy restoration of bank credit supply following the OMT announcement, the micro-evidence about *which* firms received the credit paints a different picture. To analyze which type of borrowers benefited most from an increased lending volume post-OMT, we divide our sample into low- and high-quality borrower based on the ability of firms to service existing debt (i.e., their EBIT interest coverage ratio (IC)). The results of our lending regressions show that mainly low-quality borrowers benefited from the increase in loan volume post-OMT. In contrast, the loan volume extended to high-quality borrowers did not increase. The finding that primarily weaker firms with pre-existing lending relationships benefited from the increased loan supply is consistent with both the firm balance sheet channel (i.e., positive shock on credit quality of borrower pool, see Bernanke and Gertler, 1995) and the zombie lending channel (i.e., subsidized lending of undercapitalized banks, see Caballero et al., 2008).

Hence, to explore which channel drives the banks' lending behavior, we follow the approach in Caballero et al. (2008) and Giannetti and Simonov (2013) and detect zombie firms by determining whether distressed firms obtained subsidized credit from their banks (i.e., loans at interest rates *below* the rates paid by AAA rated public borrowers from non-GIIPS European countries). Looking at the aggregate level and the evolution of the asset-weighted fraction of zombie firms in our sample, we see a substantial increase from

0.04 pre-OMT to nearly 0.12 post-OMT (see Figure 4). This first evidence suggests that zombie lending indeed became a significant issue post-OMT.

Looking at the micro level, we find that banks that regained some lending capacity post-OMT but still remained weakly-capitalized primarily extended loans to low-quality borrowers with whom they had a pre-existing lending relationship at subsidized interest rates.⁵ Lending to existing low-quality borrowers at rates below the rates paid by the most creditworthy firms in the economy is a strong indication for zombie lending behavior. For well-capitalized banks we find the exact opposite behavior. These banks increased the loan supply to corporate borrowers post-OMT, but significantly decreased their zombie lending activity.

As a result, while weakly-capitalized and well-capitalized banks show a similar pre-OMT trend in terms of their zombie loans as a fraction of their total loans, this measure diverges significantly post-OMT for the two groups of banks (see Figure 5). While for weakly-capitalized banks the zombie loans/total loans ratio jumps from about 12%-13% pre-OMT to 18% post-OMT, this measure decreases from 9% to 6% for well-capitalized banks. Finally, comparing the firms we identify as zombie firms to other low-quality firms not classified as zombie firms along observable solvency and liquidity dimensions shows that even within the group of low-quality firms, zombie firms are significantly worse than non-zombie firms.

A potential alternative explanation for these results 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) zombie lending is more prevalent for banks with a significant government ownership stake; and, (ii) 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

⁵Take as an example a loan to Feltrinelli, a private Italian publishing company that came under severe stress during the sovereign crisis. Despite its problems, the firm received a new loan from UniCredit and Intesa Sanpaolo (both previous lenders to Feltrinelli) post-OMT at interest rates well below the rate that high-quality public borrowers paid at the time, even though its IC ratio was only -1.1.

behavior was most likely driven by risk-shifting incentives of weakly-capitalized banks.

To further explore whether the zombie lending channel or the firm balance sheet channel explains this lending behavior, we track firms' financial and real outcomes pre- and post-OMT. If the zombie firms' weak performance pre-OMT was due to fundamental economic problems, their performance should have remained poor (evidence of the zombie lending channel), whereas if poor performance was caused by financial constraints, these firms should have recovered after they regained access to bank financing post-OMT (firm balance sheet channel).

For this analysis, we closely follow the approach in Acharya et al. (2015a).⁶ Our results show that non-zombie firms connected to banks that benefited from the post-OMT value increase of their sovereign debt holdings increased both their cash holdings and borrowing by roughly the same amount. This finding suggests that these firms used the majority of the cash inflow to build up cash reserves. Consistent with this result, we do not find any changes in real economic activity for these firms: neither investment, employment, nor return on assets are significantly affected by a firm's indirect OMT windfall gains (i.e., the benefits accrued via its banks). Zombie firms, on the other hand, were 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 also do not find any changes in real economic activity for zombie firms, suggesting that they were indeed suffering fundamental economic problems and not only temporary financial constraints.

To explore the long-run effects of zombie lending, we investigate whether zombie firms have a higher propensity to default than non-zombie firms. On the one hand, zombie firms are worse ex ante. On the other hand, the evergreening lending incentive of weakly-capitalized banks is precisely to keep zombie firms alive to avoid writing off loans. When comparing default rates between zombie and non-zombie firms, we find that both groups

⁶To consistently estimate the real effects, we include industry-country-year fixed effects to capture any time-varying industry shocks in a given country. Moreover, if a firm borrows from a bank incorporated in a GIIPS country, we include foreign bank GIIPS country-year fixed effects to 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 this country.

of firms have similar default rates in the two years after the OMT announcement (i.e., 2013 and 2014). However, from 2015 onwards, we find a sharp increase in the default rates of zombie firms. By 2016, around 15% of zombie firms in our sample had defaulted compared to only 5% of non-zombie firms.

Our results also indicate that zombie lending seems to have led to losses for lending banks not only in the syndicated loan market, but across all loan categories (loans to SMEs, etc.). In particular, our analysis shows that for banks engaging in zombie lending based on our syndicated loan data, the ratio of non-performing loans over gross loans increased significantly over our sample period relative to banks for which we do not find evidence for zombie lending.

In a final step, we analyze whether the rise in zombie firms post-OMT had an impact on non-zombie firms operating in the same industries. This could occur via two mechanisms. 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 with distorting effects on healthy firms competing in the same industries, such as depressed product market prices and higher market wages. Indeed, we find that the productivity in industries that faced a larger increase in the fraction of zombie firms, decreased in the post-OMT period, whereas industries with a lower increase in the fraction in zombie firms had positive productivity growth.

Building on the analysis of Caballero et al. (2008), we document that 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 non-zombie firms active in industries without a high prevalence of zombie firms. In particular, non-zombie firms in industries with an average increase in the fraction of zombie firms (i.e., 8.2pp) invest 11.5% of capital less and had 4.1pp 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 27pp,

implying that non-zombie firms invested 38% of capital less and had 13.5pp 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 significantly weakened the potentially positive impact of the OMT program's indirect bank recapitalization effect.

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, 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, in turn, can have detrimental effects on employment, investment, and growth in general.

Therefore, when authorities implement unconventional monetary policies and provide substantial amounts of liquidity to the banking system in the hope that it will transmit this liquidity to productive aspects of the real sector, authorities have to make sure that the banking sector is well-capitalized for this transmission to successfully take place. Hence, our results suggest that, while the announcement of the OMT program achieved the key goal of avoiding a break-up of the Eurozone and thus probably averted an even fiercer economic downturn, combining the OMT program with a targeted bank recapitalization program could have led to superior outcomes in terms of economic growth.

More broadly, our paper contributes to the understanding of the impact of unconventional monetary policy measures on the economy, especially in the European setting.⁷ Acharya et al. (2015b) investigate the effectiveness of the ECB's competitive liquidity tender at the beginning of the 2007-08 financial crisis and find a differential transmission of central bank liquidity of low versus high risk banks, and an impaired transmission to corporate borrowers of high risk banks. Carpinelli and Crosignani (2015) investigate the

⁷For evidence on the impact of unconventional policy measures introduced in the U.S. see Agarwal et al. (2015), Rodnyansky and Darmouni (2016), Chakraborty et al. (2016), and Di Maggio et al. (2016).

impact of LTRO liquidity injections on the behavior of Italian banks. They document that LTRO helped to prevent a stronger decline in bank lending activity (i.e., the loan supply decrease would have been stronger in Italy without the LTRO Program). Using country level data on LTRO uptakes and a sample of publicly listed firms in Europe, Daetz et al. (2016) find that debt holdings of public firms in countries with a larger share of LTRO uptakes as a fraction of GDP increased in the aftermath of LTRO. Ferrando et al. (2017) use survey data to show that SMEs reported to be less credit constrained in the post-OMT period.

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). Our sample period spans the fiscal years 2009-2014.⁸ Consistent with the literature (e.g., Sufi, 2007), all loans are aggregated to a bank’s parent company.

We obtain information on bank CDS 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

⁸All our results continue to hold if we drop 2014 from the sample. Results are available upon request.

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. According to the EBA, the sample of banks included in the stress tests cover about 65% of bank assets in Europe.

Finally, we augment the data on bank-firm relationships and bank-level characteristics 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.⁹ Since non-listed firms were especially 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.

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 included 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 855 million.” Given UBI Banca’s total equity of 9,837 million in December 2011, this amounts to a gain of 8.6% of total equity. Consistent with this statement, Krishnamurthy et al. (2014)

⁹For a description of the process to match DealScan and Amadeus see Acharya et al. (2015a). The intersection of Dealscan and Amadeus is also employed by Heider et al. (2016) to investigate the role of negative interest rates on bank lending.

and Acharya et al. (2015c) 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 from the EBA's capital exercises. In particular, by using information on changes in sovereign bond prices, as well as the data on 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.¹⁰

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.¹¹ 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 bond holdings in the bank's portfolio. We report this gain on sovereign debt holdings as a fraction of a bank's total equity (measured at the end of fiscal year 2011), that is, we define the windfall gains of bank b as:

$$OMT\ windfall\ gain_b = \frac{\Delta Value\ EU\ Sov.\ Debt_b}{Total\ Equity_b}. \quad (1)$$

¹⁰As 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 banks incorporated in GIIPS countries (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.

¹¹For 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).

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%, respectively, due to the appreciation of their sovereign debt portfolio induced by the OMT announcement.¹² Hence, while both subsets of banks experienced windfall gains, GIIPS banks experienced significantly larger windfall gains since their GIIPS sovereign bond holdings (which were most affected by the OMT announcement) as a fraction of total assets was roughly 10 times larger than in the case of non-GIIPS banks (11.8% compared to 1%; as shown in Column 2).¹³ Considering again the example of UBI Banca, we estimate an *OMT windfall gain* of 8.46% for this bank, which compares very well to their reported gain due to the OMT announcement of 8.6% of total equity (see Table A10; please note that tables and figures with the prefix A are in the online appendix).

Finally, Column (3) reports results for time-series regressions of CDS spreads of each bank on a set of dummy variables for the three OMT announcement dates. We report the mean of the sum of the coefficients over the three event dates separately for the subset of GIIPS and non-GIIPS banks. 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 for GIIPS banks decreased on average by 96bp over the three OMT announcement dates, while it only decreased on average by 23bp for non-GIIPS banks.¹⁴

Taken together, this evidence shows that the OMT announcement led to a backdoor recapitalization of European banks (especially GIIPS banks) and as a result reduced the banks' credit risk. But it is still an open question whether banks became uniformly well-capitalized as a result of the backdoor recapitalization.

¹²These magnitudes are similar to the ones determined by Crosignani et al. (2015), who find that the combined gains for banks from LTRO and OMT on their government bond portfolios was roughly 3 billion Euro, equivalent to 7.2% of total book equity. A list of our sample banks and their respective *OMT windfall gain* can be found in Table A10.

¹³The 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, 2015).

¹⁴Consistent with this finding, Figure A1, Panel A shows a clear negative relation between a bank's GIIPS 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 of Figure A1.

In the following, we will refer to banks that strongly benefited from the OMT announcement (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*) as *low-gain banks*.¹⁵ Panel B of Table 1 presents the evolution of the banks' book leverage ratio separately for high- and low-gain banks and, as a benchmark, also for U.S. banks. Moreover, we split high-gain banks into banks that have an above median leverage ratio post-OMT (*still undercapitalized*) and those with a below median leverage ratio (*well-capitalized*). Before the start of the financial and sovereign debt crisis (Column *pre-crisis*), both well-capitalized and still undercapitalized high-gain banks had lower leverage ratios than low-gain banks (which 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 increased slightly for well-capitalized high-gain banks over the sovereign debt crisis period (see Column *Crisis/pre-OMT*).

Furthermore, while the leverage ratio of still undercapitalized high-gain banks improved post-OMT, these banks still remained highly leveraged after the OMT announcement. Well-capitalized high-gain banks, on the other hand, are back to their pre-crisis leverage ratio after the OMT announcement (see Column *post-OMT*). An even more striking picture emerges when considering the quasi-leverage ratio 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). Due to the significant decrease of the market-to-book ratio of European banks (especially still undercapitalized banks) during the crisis, their quasi-leverage ratio post-OMT is almost six times higher than the quasi-leverage ratio of U.S. banks. Hence, although the OMT announcement increased the banks' equity capitalization, 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, the OMT announcement

¹⁵The median *OMT windfall gain* in our sample is 0.9, % while the mean is 2.9 %. Splitting banks at the mean *OMT windfall gain* ensures that the banks experienced a significant gain on their sovereign debt holdings.

restored 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.”

Second, the OMT announcement helped banks to free up liquidity that they had acquired previously, e.g., under the LTRO programs, but which they had not been 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).¹⁶ 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 Europe were characterized by high uncertainty so that even small negative events had potentially large consequences.¹⁷ Only after the OMT announcement, which significantly improved the banks’ financial stability, they were able to use the liquidity acquired under the ECB’s liquidity operations (e.g., the LTRO programs) to grant new loans.

To provide evidence on the extent to which banks were subject to a bank run (and thus liquidity constrained) around the OMT announcement, 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

¹⁶In line with our results, Carpinelli and Crosignani (2015) find that, while LTRO helped to limit the contraction in loan supply, the loan supply nevertheless decreased post-LTRO.

¹⁷Between 20% to 50% of bank deposits are held overnight and could therefore be withdrawn at very short notice. For example, British customers withdrew 200 million pounds on the day after the credit rating downgrade of Banco Santander in May 2012 and some analysts estimated that banks would have lost up to 10% of their deposit base if Greece had left the Eurozone in 2012. See, “Europe Banks Fear a Flight”, *The Wall Street Journal*, May 21, 2012 by David Enrich, Sara Schaefer Munoz, and Charles Forelle.

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 for these banks 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 for high-gain banks (even lower than for low-gain banks), which indicates that the imminent threat of a bank run is no longer present for these banks.

Table 2 confirms this result using cross-sectional (across banks) regressions of the change in the run index on *OMT windfall gain*. The results show that banks with a higher *OMT windfall gain* have a significantly stronger decrease in their run index (calculated as the average six months pre-OMT relative to the average six months post-OMT).

Taken together, through its positive effect on the valuation of the periphery sovereign bond holdings, the OMT announcement increased European banks' equity capitalization and liquidity, especially for GIIPS banks which had reduced their real-sector lending during the European sovereign debt crisis the most (see Acharya et al., 2015a). The improved financial stability thus allowed banks to use existing and newly (from financial markets) acquired liquidity to grant new loans. Importantly, however, a 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 capital needs. Therefore, even though European banks regained some lending capacity post-OMT, some of these banks remained rather weakly-capitalized after the announcement, potentially creating risk-shifting incentives and a reluctance to take further loan losses.

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' subsequent lending. We employ the same methodology as Acharya et al. (2015a) (i.e., a modified Khwaja and Mian (2008) bank lending channel regression) 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 of different banks (which benefited to a different degree from the OMT announcement) to a certain firm "cluster". This allows us to control for any observed and unobserved characteristics shared by firms in the same cluster that might influence loan outcomes.

We form firm clusters based on three criteria, which capture important drivers of loan demand and firm quality: (i) the country of incorporation; (ii) the industry; and (iii) the firm rating.¹⁸ The main reason for aggregating firms based on the first two criteria is that firms in a particular industry in a particular country share many firm characteristics and are thus likely affected in a similar way by macroeconomic developments. 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 graphically analyzing the lending volume to private borrowers around the OMT announcement. Figure 1 plots the log of the total quantity of loans provided by high-gain banks and low-gain banks 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

¹⁸Since private borrowers generally do not have a credit rating, we assign ratings estimated from three-year median IC ratio by rating category provided by Standard & Poor's.

after Q3 2012 by banks that strongly benefited from the OMT announcement. In contrast, the loan supply provided by low-gain banks remained at roughly the same level.

Next, we formally investigate whether banks with a higher *OMT windfall gain* increased their loan supply to existing borrowers (intensive margin) and/or to firms with which no lending relationship existed before the OMT announcement (extensive margin) more than banks with a relatively low *OMT windfall gain*. Our preferred specification to estimate the quarterly change in loan volume to existing borrowers provided by bank b to firm cluster m in quarter t is given by:

$$\begin{aligned}\Delta Volume_{bmt+1} &= \beta_1 \cdot OMT\ windfall\ gain_b * PostOMT_t \\ &+ \gamma \cdot X_{bt} + Firm\ Cluster_m \cdot Quarter-Year_{t+1} \\ &+ Firm\ Cluster_m \cdot Bank_b + u_{bmt+1},\end{aligned}\tag{2}$$

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 post-OMT period.

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 pre-OMT. Our preferred specification for the extensive margin is

$$\begin{aligned}NewLoan_{bmt+1} &= \beta_1 \cdot OMT\ windfall\ gain_b * PostOMT_t \\ &+ \gamma \cdot X_{bt} + Firm\ Cluster_m \cdot Quarter-Year_{t+1} \\ &+ Firm\ Cluster_m \cdot Bank_b + u_{bmt+1},\end{aligned}\tag{3}$$

where the firm clusters consist of firms with no prior relation (pre-OMT) 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 *OMT windfall gain*. The results in Panel A show that banks with higher windfall gains from the OMT announcement

significantly increased their loan supply to existing private borrowers (intensive margin) post-OMT. 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 common to firms in the same cluster, bank heterogeneity, and for relationships between firms in a given cluster and the respective bank. Finally, 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.

Next, Panel B 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 firms with which it had no prior relation. These results suggest that only existing borrowers benefited from the loan supply increase induced by the OMT announcement.

Finally, 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 based on market price reactions and thus the perceived change in bank credit risk in the market.

In addition to the recapitalization effect of the OMT announcement, the banks' *CDS return* also capture the more general positive impact of the OMT announcement on the economies in GIIPS countries. Results are presented in Table A6. Panel A and B 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-quality and high-quality borrowers. In particular, we identify low-quality (high-quality) borrowers as firms with a below (above) country median 3-year IC ratio in the crisis years 2009 to 2011 and refer to them in the following as low-IC ratio (high-IC ratio) firms. The general picture that emerges from Panel C in Table 3 is that the loan volume increase (at the intensive margin) post-OMT was primarily driven by lending to low-IC ratio borrowers since only the triple interaction term of *OMT windfall gain*, post-OMT, and low-IC is significantly positive.

Table 3, Panel D shows that, even if we split the firms according to their IC ratio, there are no significant loan supply effects at the extensive margin. Panels C and D of Table A6 show that these loan volume results for borrowers with different IC ratios continue to hold if we employ the banks' *CDS return* on the OMT announcement dates instead of their *OMT windfall gain* in regressions (2) and (3).

Weaker firms with pre-existing lending relationships benefiting from the increased loan supply is consistent with both the firm balance-sheet channel (Bernanke and Gertler, 1995) and the zombie lending channel (Caballero et al., 2008). According to the firm balance-sheet channel, the positive macro shock due to the OMT announcement increased the credit quality of the pool of the banks' existing borrowers by improving the outlook of their investment opportunities, net worth, and collateral. In turn, extending new loans to these borrowers was again a positive NPV investment for the respective lenders.

In contrast, according to the zombie lending channel, banks that remained weakly-capitalized even post-OMT had an incentive to extend new (negative NPV) loans at advantageous interest rates to existing borrowers in distress to avoid having to declare outstanding loans non-performing. Declaring them non-performing would have lowered the banks' net operating income, required them to raise provisioning levels, and also would have tied up even more equity capital due to higher risk weights on impaired assets (see Aiyar et al., 2015 and Jassaud and Kang, 2015). In turn, regulatory scrutiny and pressure from market forces would have been more intense, which would have further deteriorated the banks' situation. By "evergreening" loans to their impaired borrowers, struggling banks were able to delay taking a balance sheet hit and to gamble for resurrection in the hope that their borrowers regain solvency. 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.¹⁹

4.3 Zombie Lending

To explore whether banks' lending behavior can be explained by the firm balance sheet channel or the zombie lending channel, we follow the approach in Caballero et al. (2008) and Giannetti and Simonov (2013) and detect zombie firms by determining whether distressed 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 an AAA rating (inferred from ICs) as benchmark interest rate.²⁰ Public, non-GIIPS firms were among

¹⁹For 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.

²⁰As there are significant differences in the pricing of syndicated loans between U.S. and European loans (U.S. firms pay significantly higher spreads; see Berg et al., 2016), we have to rely on creditworthy European firms and cannot use U.S. firms to calculate the benchmark interest rate.

the firms that were least affected by the sovereign debt crisis, since they were less exposed to the macroeconomic downturn in the European periphery and were able to substitute a potential lack of bank financing with other funding sources (Acharya et al., 2015a). 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 an AAA rating (inferred from ICs). 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 $m \in \{s, l\}$, with s for short-term and l for long-term. 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_{tm}^D in year t . Given this interest rate benchmark, we calculate the threshold R_{ijht}^{D*} below which the interest payment of firm i in country j and industry h in year t is considered subsidized as

$$R_{ijht}^{D*} = \sum_m r_{tm}^D \cdot Debt_{ijht}^m, \quad (4)$$

where we split a firm's total debt $Debt_{ijht}$ into short ($m = s$) and long-term ($m = l$) 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, in the Amadeus data, 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 (Amadeus provides information about a firm's amount of short- and long-term debt). The benchmark rate for private firms that rely mostly on short (long) term debt is derived from an AAA rated public firms with a similar debt maturity structure. In particular, the interest rate benchmark, r_{tm}^A , is calculated using the median interest rate paid by public firms incorporated in non-GIIPS countries with an AAA rating (inferred from ICs) in a given year, split according to their reliance on short versus long-term debt. Given this benchmark, we calculate the threshold R_{ijht}^{A*} below which the interest payment of firm i in country j and industry h in year t is considered subsidized as

$$R_{ijht}^{A*} = r_{tm}^A \cdot Debt_{ijht}, \quad (5)$$

where we also split the 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-IC ratio borrowers in our sample with the two hypothetical interest payments to calculate the interest expense gap:

$$x_{ijht}^{n*} = R_{ijht} - R_{ijht}^{n*} \quad (6)$$

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.²¹

Firm i is classified as zombie if it meets the following three criteria: (i) x_{ijht}^{n*} is negative, (ii) its rating (derived from three year median ICs) is BB or lower, and (iii) the syndicate composition has either remained constant, or banks that left the syndicate were not replaced by new participants, that is, the same syndicate has already provided a loan to the firm.²² By imposing the second criterion on zombie firms, we reduce the risk of misclassifying high-IC ratio borrowers 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.

A typical example for a firm classified as zombie is Feltrinelli, a private Italian publishing company. *La Repubblica* wrote in 2013: “Feltrinelli announces solidarity contracts for 1,370 employees, for a period of one year. [...] this will allow Feltrinelli to save up to 216,000 working hours. 2012 was a particularly difficult year [...] The company has recorded a contraction of net sales by 11% over the last two years. And 2013 is going to be just as critical.” Despite these problems, the firm received a new loan from UniCredit and Intesa Sanpaolo (both previous lenders to Feltrinelli) post-OMT when its interest coverage ratio was only -1.1. The interest rate on Feltrinelli’s debt in 2015 was only 1.3% and the corresponding benchmark rate of high-quality public borrowers was 1.4%, while pre-OMT it was 4.7% when the benchmark rate was 2.0%.²³

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

²¹Since information on other elements of loan pricing (e.g., fees) are very scarcely populated among our sample of private European borrowers, we are not able to use the total cost of borrowing as defined in Berg et al. (2015).

²²Given that (i) and (ii) are satisfied, (iii) holds in 95% of the cases.

²³“Feltrinelli, contratti di solidarietà per 1.370 dipendenti del gruppo”, *La Repubblica*, May 3, 2013.

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 9.8% 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.²⁴

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_{ijht}^{n*} could also be explained by relationship lending by strong banks: 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 in a syndicate 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 higher (lower) quality compared to the banks remaining in the syndicate, this evidence is 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, which is consistent with healthier banks not wanting to participate in zombie lending activities by weaker banks that are averse to taking losses on their distressed borrowers.

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

²⁴The 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.” (See “Companies: The rise of the zombie” by Michael Stothard, Financial Times, January 8, 2013.)

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 exposure by their total equity.

These panels 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.

Furthermore, Table 4, Panel G and H compare the characteristics of zombie firms to other non-zombie low-IC ratio firms. On average, zombie firms have a significantly higher leverage, and lower net worth and profitability (EBITDA/Assets) ratios. More importantly, zombie firms only have an IC ratio of 0.3 or 0.4 (depending on the benchmark) as opposed to roughly 1.1 for other low-IC ratio 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-IC ratio firms, zombie firms are significantly worse than non-zombie firms on observable solvency and liquidity ratios.

A potential concern could be that 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-IC ratio non-zombie firms we do not find any significant differences (see Table 4, Panel G and H). 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.²⁵ Hence, the lower borrowing cost for zombie firms do not seem to be driven by differences in other loan characteristics.

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

We start by investigating graphically how banks changed their lending behavior towards zombie firms post-OMT. As can be seen from Figure 5, Panel A, 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 assets post-OMT. Conversely, well-capitalized high-gain banks significantly decrease their zombie loan volume post-OMT. Panel B of Figure 5 shows that this significant increase in zombie loans as a fraction of total assets 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.²⁶ Figure 5, Panels C and D show that, while both Italian and Spanish/Portuguese banks that remained undercapitalized show an increase in the fraction of zombie loan volume, the increase was much more pronounced in Italy than in Spain and Portugal.

To formally test for this difference in post-OMT zombie lending behavior as a function of bank capitalization, we estimate the quarterly change in loan volume provided by bank

²⁵Unfortunately, we cannot observe covenants for our loan contracts.

²⁶As only two Spanish banks remained undercapitalized post-OMT, we cannot investigate their lending behavior separately and thus have to analyze Spanish and Portuguese banks together to achieve enough cross-sectional variation.

b to firm cluster m in quarter t by employing the following panel regression:

$$\begin{aligned}
\Delta Volume_{bmt+1} = & \beta_1 \cdot OMT \text{ windfall gain}_b * PostOMT_t \\
& + \beta_2 \cdot OMT \text{ windfall gain}_b * PostOMT_t * Still \text{ Undercap}_b \\
& + \beta_3 \cdot OMT \text{ windfall gain}_b * PostOMT_t * Zombie_{mt} \\
& + \beta_4 \cdot OMT \text{ windfall gain}_b * PostOMT_t * Zombie_{mt} * Still \text{ Undercap}_b \\
& + \gamma \cdot X_{bt} + Firm \text{ Cluster}_m \cdot Quarter\text{-}Year_{t+1} \\
& + Firm \text{ Cluster}_m \cdot Bank_b + u_{bmt+1}.
\end{aligned} \tag{7}$$

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, we add the criterion whether firms are classified as zombie or not for this analysis. Hence, we now 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 this classification leads to a larger number of firm clusters than in the previous analysis.

The results are presented in Table 5.²⁷ Several findings are noteworthy. First, high *OMT windfall gain* banks that are well-capitalized increase the loan supply to corporate borrowers post-OMT, but significantly decrease their zombie lending activity. Based on the specification in Column (4) a one standard deviation higher *OMT windfall gain* for well-capitalized banks implies an increase in loan supply by 2.5%. Banks that still remained undercapitalized, however, show no significant increase in their overall loan supply. These banks increase the loan supply *only* to zombie firms. Based on the coefficients reported in Table 5, Column (4), a one standard deviation higher *OMT windfall gain* for undercapitalized banks 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

²⁷For 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. In Table 5 we use the Amadeus benchmark rates, while in Table A3 we employ the Dealscan benchmark rates which yields qualitatively and quantitatively virtually identical results.

loan amount to a cluster actually increased (Column 5) or when we restrict the analysis to GIIPS banks (Column 6).²⁸

Finally, to ensure that the documented lending increase indeed led to a cash inflow for our sample firms and was not just driven by the granting of new credit lines that are potentially not drawn, in a robustness check, we rerun the analysis in Eq. (7), restricting the sample to term loans.²⁹ As shown in Table A4, all results remain quantitatively and qualitatively similar when focusing on the subsample of term loans.

4.4 Alternative Explanations

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

4.4.1 EBA Capital Exercise

In Fall 2011, the European Banking Authority (EBA) conducted a capital exercise that required a subset of European banks to increase their core tier 1 capital to risk-weighted assets 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. Hence, it is possible that our *OMT windfall gain* variable is correlated with this regulatory recapitalization requirement as both are related to the holdings of sovereign bonds. Therefore, a possible concern regarding the results in Section 4.1 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 from the OMT announcement.

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 the

²⁸Table A7 further shows the robustness of these results for the case where we use *CDS Return* instead of *OMT windfall gain*. Moreover, in line with the suggestive evidence of Figure 5, we find the post-OMT increase in the zombie lending volume to be more significant (both statistically and economically) in Italy than in Spain and Portugal. These results are available upon request.

²⁹Table 4, Panels G and H show that roughly 60% of the loans in our sample are term loans.

EBA webpage. Table A2 presents regression results where we rerun the regressions from Table 3, Panel C, including 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 the *OMT windfall gain* variable in the regression remains largely unaffected.

A likely explanation for why the mandatory risk-weighted assets based capital ratio increase 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

Another possibility is that, at the peak of the European debt crisis, governments formally or informally pressured domestic banks to redirect credit to weak firms at advantageous interest rates to avoid defaults and an increase in unemployment. If governments indeed exerted pressure and, in addition, their ability and/or willingness to do so was greater for still undercapitalized banks, then moral suasion could potentially drive our results (i.e., only undercapitalized banks engage in zombie lending, whereas well-capitalized banks significantly reduce 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 have a higher likelihood of needing government assistance in the future and are hence more dependent on the government's goodwill. We employ two different approaches to address this concern.

First, 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, i.e., 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 6 (Panel B) provides the results. Across all specifications, we find that only banks that still remained undercapitalized after the OMT announcement engage in zombie lending, whereas we find no evidence of zombie lending for government-owned banks.

Second, if governments exerted pressure on domestic banks to increase their loan supply, we would expect governments to pressure banks to extend new loans at advantageous interest rates especially to low-IC ratio firms that are (at least partially) government-owned. To investigate this possibility, we collect ownership information from Amadeus on all firms in our sample. 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, we rerun our lending regressions excluding firms that have positive government ownership. Table 6 (Panel A) presents these results which are qualitative and quantitatively unchanged.³⁰

Taken together, we interpret these findings as consistent with the notion that the increase in loan supply to low-IC ratio borrowers is indeed caused by the incentive of still undercapitalized banks to roll-over loans to avoid realizing losses.

5 Real and Financial Outcomes

To gather further supporting evidence for the zombie lending channel, we track the firms' financial and real outcomes before and after the OMT announcement. If the zombie

³⁰In Table 6 we use the Amadeus benchmark rates and in Table A5 the Dealscan benchmark rates, which yields qualitatively and quantitatively virtually identical results.

firms' financial problems (i.e., low profitability and thus low IC ratio) were caused by financial constraints, firms classified as zombies should have recovered after they regained access to bank financing (firm balance sheet channel). However, if these problems were of a fundamental nature, we expect that the performance of these firms remained poor even after banks increased the loan supply to these firms (zombie lending channel).

To analyze whether there is a difference between the behavior and performance of zombie and non-zombie firms, we closely follow the approach in Acharya et al. (2015a) and divide the financial information reported in Amadeus into the pre-OMT period (fiscal years 2009 to 2011) and the post-OMT period (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.

As a proxy for the extent to which firms benefited from the OMT announcement through their banking relationships, we construct a variable (*Indirect OMT windfall gain*) that measures firms' indirect gains from OMT via their banks' sovereign debt holdings. To construct the variable, we first 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 from its lending relationships by weighting the *Average OMT windfall gain* of each of the firm's loan syndicates by the fraction of the firm's total outstanding loan amount received from that syndicate. This yields the following measure for firm i in country j in industry h at time t :

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

where L_{ijht} are all of the firm's loans outstanding at time t .³¹

We use five different measures for the financial and corporate policies of firms. In

³¹We 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.

particular, we analyze changes in cash holdings $((cash_{t+1} - cash_t)/total\ assets_t)$ and leverage $((total\ liabilities_{t+1} - total\ liabilities_t)/total\ assets_t)$ to investigate changes in the financial policies of firms. To analyze non-financial firm policies, we consider employment growth $(\Delta \log\ Employment)$, investment $(CAPX/Tangible\ Assets)$, and the return on asset (ROA) .

We begin by exploring the effect of the OMT announcement on several firm outcomes graphically. In Figures 6 and 7, we plot the time series of the cash holdings, leverage, employment growth rates, investment levels, and ROA, respectively, for high *Indirect OMT windfall gain* firms (i.e., firms with an above median *Indirect OMT windfall gain*), further split into high-IC ratio, low-IC ratio non-zombie, and zombie firms. The figures show that low-IC ratio non-zombie firms show a significant increase in leverage and cash holdings (Panels A and B of Figure 6) post-OMT. Zombie firms, however, are not able to increase their cash holdings, despite the increase in leverage resulting from the inflow of new bank credit. Importantly, while the leverage ratio already starts increasing from 2011 to 2012 (a year before the OMT announcement) for zombie firms, Panel C of Figure 6 shows that this increase pre-OMT is primarily driven by a decrease in the assets of zombie firms. Their actual debt only starts growing in the post-OMT period. Panels A-C of Figure 7 show that none of the three groups of firms (high-IC ratio, low-IC ratio non-zombie, zombie) show a significant increase in employment, investment or ROA post-OMT. Moreover, the performance of zombie firms appears to be the worst of all firms.

To formally investigate whether borrowing firms with significant syndicate 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 :

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

Our baseline regression includes firm fixed effects, as well as firm-level control variables - firm size, leverage, net worth, the fraction of tangible assets, the IC ratio, and the ratio of EBITDA to total assets - to capture other determinants of firms' corporate policies.³² 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 border firm-bank relationships in our sample (e.g., a German firm borrowing from a Spanish bank), we also include foreign GIIPS bank country-year fixed effects, which absorb any unobserved, time-varying heterogeneity that may arise because a firm's dependency on banks from a certain GIIPS country might be influenced by whether this firm has business in that 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 7, Panel A. The unit of observation is a firm-year. For ease of exposition, we only report the results for our key variable of interest, the interaction of *Indirect OMT windfall gain* with the *PostOMT* dummy. The results 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 as fraction of total assets and debt as a fraction of total assets (leverage) for the full sample of firms (Columns 1 and 2). The difference of the coefficients for the change in cash and change in debt regressions is small and statistically insignificant (see Column 3). This result suggests that both debt and cash holdings increased by a similar amount, implying that firms used the liquidity inflow from bank credit primarily to increase their cash reserves. More precisely, a one standard deviation increase in *Indirect OMT windfall gain* implies an increase in cash and debt (over total assets) of around 1.9pp. This result is further confirmed by the fact that we do not find any significant

³²All results are qualitatively and quantitatively similar if we rerun these regressions using weighted least squares with firms' total assets as weights.

effects for the real variables. Neither employment nor investment or ROA (Columns 4 - 6) change significantly for firms with a high *Indirect OMT windfall gain* in the post-OMT period. Hence, the primary objective of firms on average seems to be to regain financial stability by increasing their cash reserves to pre-crisis levels.³³

Recall that Panel C of Table 3 shows that primarily low-IC firms benefited from the expansion in loan volume induced by the post-OMT increase in value of the sovereign debt holdings. In Panel B of Table 7, we provide evidence on the relation between financial and real effects and the *Indirect OMT windfall gain* of firms classified based on their median IC 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) of Table 7, Panel A are driven by the low-IC ratio subgroup of firms, while neither high- nor low-IC ratio firms show a significant relation between *Indirect OMT windfall gain* and real economic activity like employment and investment.

Moreover, Panel C of Table 7 documents that zombie firms (based on the Amadeus benchmark) do not use the entirety of their new bank loans to build up cash reserves.³⁴ For these firms, leverage increases significantly more than cash holdings (Columns 1 and 2). A potential explanation is that firms need the proceeds from newly received loans to service interest rate payments on existing loans. Consistent with this explanation is the fact that zombie firms only have an IC ratio of 0.3-0.4, implying that they are unable to service interest payments from earnings alone.

Finally, there are no significant effects of an increased loan supply on employment, investment or ROA (Columns 4-6) for zombie firms.³⁵ Overall, this suggests no gain in economic activity from zombie firms. However, their presence possibly led to greater bank losses in the long-run and also potentially caused market distortions and negative

³³As a robustness, Table A8 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.

³⁴Results for the Dealscan benchmark are virtually identical and available upon request.

³⁵As 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”. See “Companies: The rise of the zombie” by Michael Stothard, Financial Times, January 8, 2013.

spillover effects for healthy firms. We analyze these consequences next.

6 Long-Run Effects and Market Distortions

First, we track the performance of banks that engaged in zombie lending behavior with regard to the amount of non-performing loans in their portfolios and the long-run default propensity of zombie firms compared to other firms. Second, we determine the effect of the increased prevalence of zombie firms on competing non-zombie firms in the same industry.

6.1 Long-Run Effects

To determine the long-run effects for the banks in our sample that engaged in zombie lending behavior, we track the evolution of their non-performing loans to total loans ratio. The results are presented in Figure 8. The figure shows that for banks that we identify as extending zombie loans, the ratio of non-performing loans over total loans shows a significant increase in our sample period, especially after 2014. In contrast, the ratio for banks for which we do not find evidence for zombie lending, shows only a slight increase.

This graphical analysis is confirmed by the results presented in Panel A of Table 8. We calculate the change in a bank's non-performing loans to total loans ratio from before to after 2014 (we take the average of this ratio in the two periods 2012-13 and 2014-15, respectively). We relate this change to whether the bank engaged heavily in zombie lending or not. All specifications show that banks with a high fraction of zombie loans (i.e., above median) have significantly higher non-performing loans. Therefore, as the NPL ratio captures all bank loans, this result suggests that banks we identify as zombie lending banks based on our syndicated loan data have engaged in zombie lending behavior also in other loan categories (e.g., loans to SMEs).

Finally, we track whether the rise in non-performing loans is followed by a subsequent increase in the default propensity of zombie firms. For this analysis, we collect data

on firm defaults from Amadeus and augment this information with an extensive news search on default events for our sample firms. We classify a firm as defaulted if it is either no longer active or if insolvency proceedings have been opened. Figure 9, Panel A presents cumulative default rates separately for zombie and non-zombie firms, while Panel B presents asset-weighted cumulative default rates. Initially, that is, in 2013 and 2014 (the first two years post-OMT), zombie firms had a similar or even smaller propensity to default than non-zombie firms. This result is remarkable as zombie firms are on average of much lower quality than non-zombie firms (see Table 4, Panel G and H). However, the liquidity provided through zombie loans allowed many zombie firms to stay afloat (the intended purpose of extending these subsidized loans in the first place). Starting in 2015, however, we see a sharp increase in the default rate of zombie firms. This increase is consistent with the rise in non-performing loans starting one year earlier in 2014.

To formally test whether the sharp increase in the default rate of zombie firms is also statistically significant, we run panel regressions for the post-OMT period (2012-2016). The dependent variable in these regressions is an indicator variable for whether a firm defaulted in year t . The results in Panel B of Table 8 show that low-IC ratio firms in general have a higher probability to default than high-IC ratio firms. Consistent with the evidence from Figure 9, zombie firms have a lower propensity to default compared to other low-IC ratio firms immediately after the OMT announcement (2012-2014) but a statistically significantly higher default probability during 2015-2016.

6.2 Zombie Distortions

There are two potential channels through which non-zombie firms could be negatively affected by the prevalence of zombies. First, banks with incentives to evergreen outstanding loans shift their loan supply to existing borrowers that struggle to service their debt. This leads to a reduction in loan supply and higher interest rates for productive, creditworthy firms operating in the same industries. Thus, these firms are 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 be that impaired firms reduce employment and lose market share. However, subsidized zombie loans kept distressed borrowers artificially alive, which congests the respective markets. The resulting distorting effects on healthy firms in the same industries include, for example, depressed product market prices and increased market wages by hanging on to the workers whose productivity at the zombie 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). Since these spillover effects should also affect firms with access to alternative funding sources, we include publicly listed firms in the intersection of Dealscan and Amadeus for this analysis. Restricting the analysis to our sample of private firms yields qualitatively and quantitatively similar results.

We start by providing suggestive country-industry-level evidence of the distortions caused by the increased zombie firm prevalence. Similar in spirit to Caballero et al. (2008), we compare the average industry productivity for industries with a large and small increase in the fraction of zombie firms. We follow Caballero et al. (2008) and measure productivity as $\text{Log Sales} - 2/3 * \text{Empl.} - 1/3 * \text{Fixed Assets}$. Figure 10 shows that the productivity in industries that faced a larger increase in the fraction of zombie firms decreased in the post-OMT period, whereas industries with a lower increase in the fraction in zombie firms experienced an increase in industry productivity. This result is confirmed by the cross-sectional regressions at the country-industry level in Table A9. The table shows that industries with a larger increase in the fraction of zombie firms post-OMT had a significantly lower productivity growth (measured as average growth in the industry productivity from the pre-OMT period (2009-2011) to the post-OMT period (2012-2015)). These results suggest that industries where zombie lending is more prevalent suffered from significantly lower productivity growth rates compared to industries with less zombie lending.

To test whether a high presence of zombie firms had negative spillover effects on non-zombie firms operating in the same industry we estimate the following panel regression:

$$y_{ijht+1} = \beta_1 \cdot \text{Non-Zombie}_{ijht} + \beta_2 \cdot \text{Non-Zombie}_{ijht} \cdot \text{Fraction Zombies}_{jht} + \gamma \cdot X_{ijht} + \text{Firm}_{ijh} + \text{Industry}_h \cdot \text{Country}_j \cdot \text{Year}_{t+1} + u_{ijht+1}, \quad (10)$$

where $\text{Fraction Zombies}_{jht}$ measures the fraction of zombies in industry h (SIC2) in country j at time t and the dependent variables are the interest rate paid, employment growth, investment, and productivity.³⁶

Our coefficients of interest is β_2 , that is, whether 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).³⁷

Results for this regression analysis are presented in Table 9, Panel A. The results show non-zombie firms pay higher interest rates ($\beta_2 > 0$), invest less ($\beta_2 < 0$), have lower employment growth rates ($\beta_2 < 0$), and their average productivity increases ($\beta_2 > 0$) if they operate in industries with many zombie firms (β_2 is significant throughout all specifications) compared to firms in industries with a low prevalence of zombie firms. Regarding the average productivity result, as argued by Caballero et al. (2008), non-zombie firms operating in industries with a high fraction of zombie firms cut back their business more strongly in terms of the number of conducted projects and investments due to the competitive distortions. Since firms primarily reduce their investments in projects with a low productivity, the average productivity of their projects increases.

³⁶We use the universe of very large Amadeus firms (incl. publicly listed firms) to calculate the industry fraction of zombie firms. In particular, we no longer restrict attention to firms with syndicated loans when calculating the industry fraction of zombie firms since the competitive general equilibrium effects work in the aggregate through the *full* sample of firms receiving zombie style credit.

³⁷Note, however, that even without industry-country-year fixed effects, non-zombie firms would have to be more affected by an 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.

On average, the fraction of zombie firms increased by 8.2pp post-OMT. Considering the estimates in Column (3) of Table 9, this implies that non-zombie firms invest around 11.5% 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 27pp, implying that non-zombie firms invested around 38% 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 8.2pp in the fraction of zombie firms in their industry had around 4.1pp lower employment growth rates. Considering again the 95th percentile, we find that non-zombie firms in this industry had 13.5pp lower employment growth rates.³⁸

Panels B and C of Table 9 provide an overview of the evolution of the fraction of zombie firms by sector for GIIPS countries. The average increase in the fraction of zombie firms was largest in the construction sector of periphery countries with an increase of 17pp. As Panel B shows, given an average investment to capital rate of 9.58% in this sector, the rise in the fraction of zombie firms implies an investment loss of 23.8% or the equivalent of 2.5 years of investment. Similarly striking numbers can be found in the service industry where 1.5 investment years are lost. Panel C shows that the increase in the fraction of zombie firms translates into an employment loss of 8.5pp in the construction industry and a loss of 6.8pp in the service industry.

Finally, to verify that these negative real effects for healthy firms were indeed caused by distorted market competition from the prevalence of zombies, we analyze whether these effects were more intense in competitive industries relative to non-competitive industries. In particular, in competitive industries, 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 10 presents the results for this test. First, the results show that, due to a loan supply shift to zombie firms, all 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

³⁸Results using the Dealscan benchmark are virtually identical (results are available upon request).

is competitive or not. However, only non-zombie firms in competitive industries facing high prevalence of zombies suffered real effects (i.e., lower investments and employment growth).

7 Conclusion

In this paper, we show that the announcement of the OMT program 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, and this improved their capitalization, allowing them to regain access to market-based financing. At an aggregate level, 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 post-OMT but still remained weakly-capitalized. These undercapitalized banks had an incentive to evergreen loans to their struggling borrowers to avoid having to declare outstanding loans non-performing.

We find that non-zombie firms that regained access to bank-based financing after the OMT announcement used the cash inflow from new bank loans primarily to build up cash reserves. In contrast, zombie firms that received new loans only used a fraction of the cash inflow to build up cash reserves, likely spending the rest on interest payments on outstanding loans. Finally, neither zombie nor non-zombie firms showed a significant increase in real activity, that is, an increase in employment or investment. Over time, zombie firms experienced greater default rates and undercapitalized banks that we identify as banks that engaged in zombie lending registered a greater increase in non-performing loans.

Finally, we find that, due to the credit misallocation and the resulting market distortions, creditworthy firms that did not benefit from the increase in bank loan supply were negatively affected if they operated in industries with a high prevalence of zombie firms.

Both their employment growth and their investments were lower than that of non-zombie firms operating in industries that did 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 portfolios. By increasing the value of these assets banks can realize significant windfall gains and this 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 as undercapitalized banks have an incentive to evergreen loans to troubled firms using their renewed funding access. This can lead to significant market distortions in industries with a high zombie firm prevalence.

Our analysis thus highlights the importance of a well-capitalized banking sector for an effective transmission of unconventional monetary policy measures (such as the OMT) to the real economy. 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 as evidenced by the increasing malaise in the Italian banking sector three years post-OMT, where 19% of total loans are classified as non-performing. 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".³⁹

³⁹"Companies: The rise of the zombie" by Michael Stothard, Financial Times, January 8, 2013.

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Appendix

Figure 1: EVOLUTION OF LOAN VOLUME

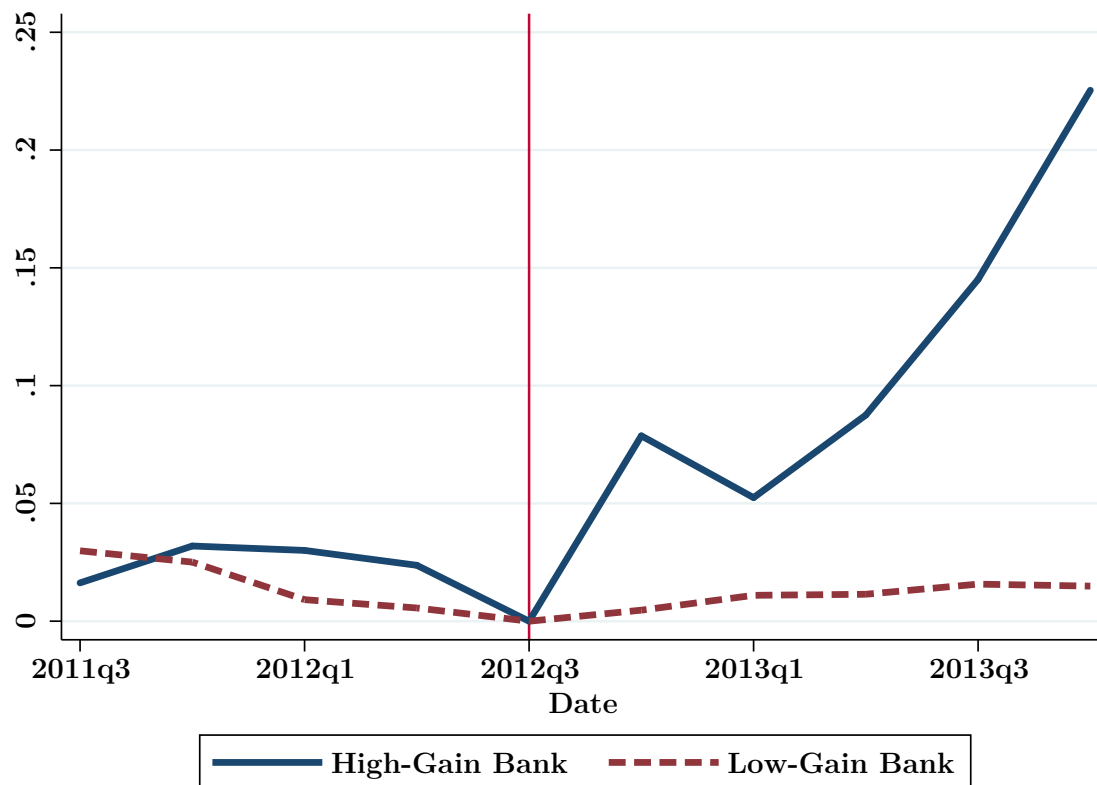


Figure 1 shows the log-ratio of total loans in a given quarter relative to the quarter of the OMT announcement, i.e., the y-axis is normalized to 0 at the time of the OMT announcement, controlling for firm-cluster fixed effects. For each quarter, we aggregate all loans to private firms borrowing from banks that are covered by the EBA's June 2012 capital exercise. A bank is classified as high-gain (low-gain) bank if its equity capital increase due to the OMT announcement is above (below) the sample mean. We restrict the sample to private firms with loan information in Dealscan and financial information in Amadeus.

Figure 2: EVOLUTION OF THE RUN INDEX

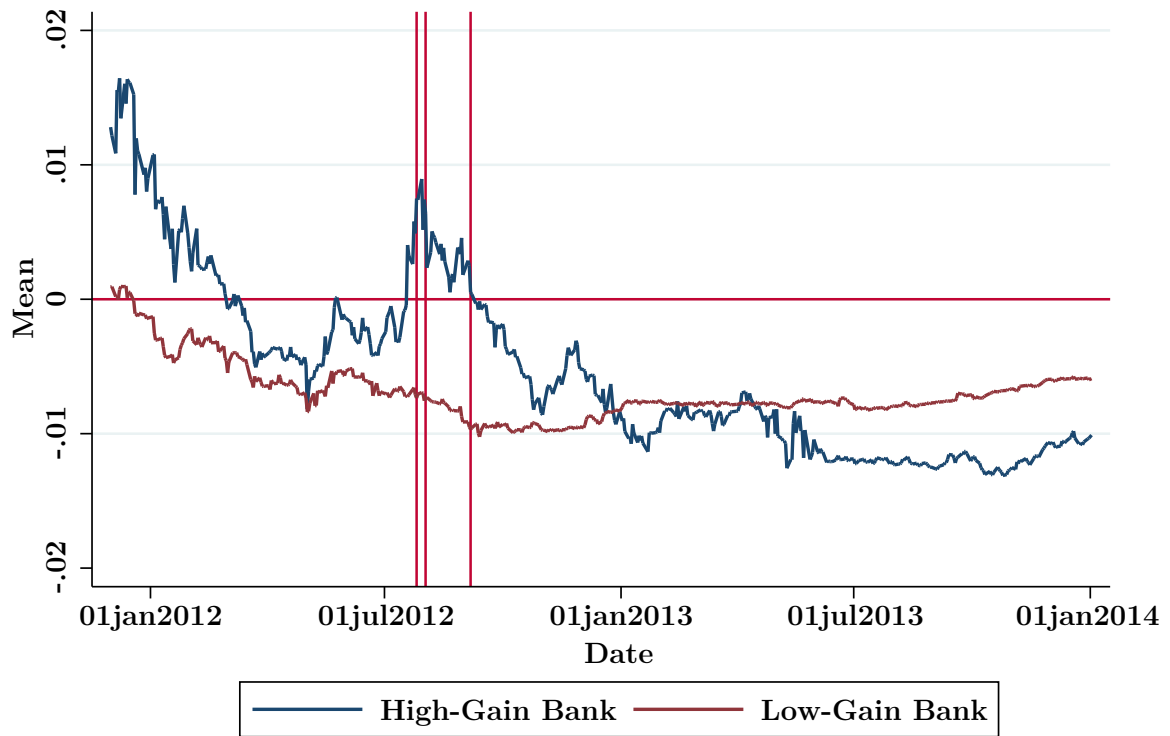


Figure 2 shows the evolution of the run index for high- and low-gain banks calculated following Veronesi and Zingales (2010). The run index is a proxy for the likelihood that a bank faces a bank run. A bank is classified as high-gain (low-gain) bank if its equity capital increase due to the OMT announcement is above (below) the sample mean. The vertical lines indicate the OMT announcement dates (July 26, August 2, September 6, 2012).

Figure 3: BENCHMARK INTEREST RATES

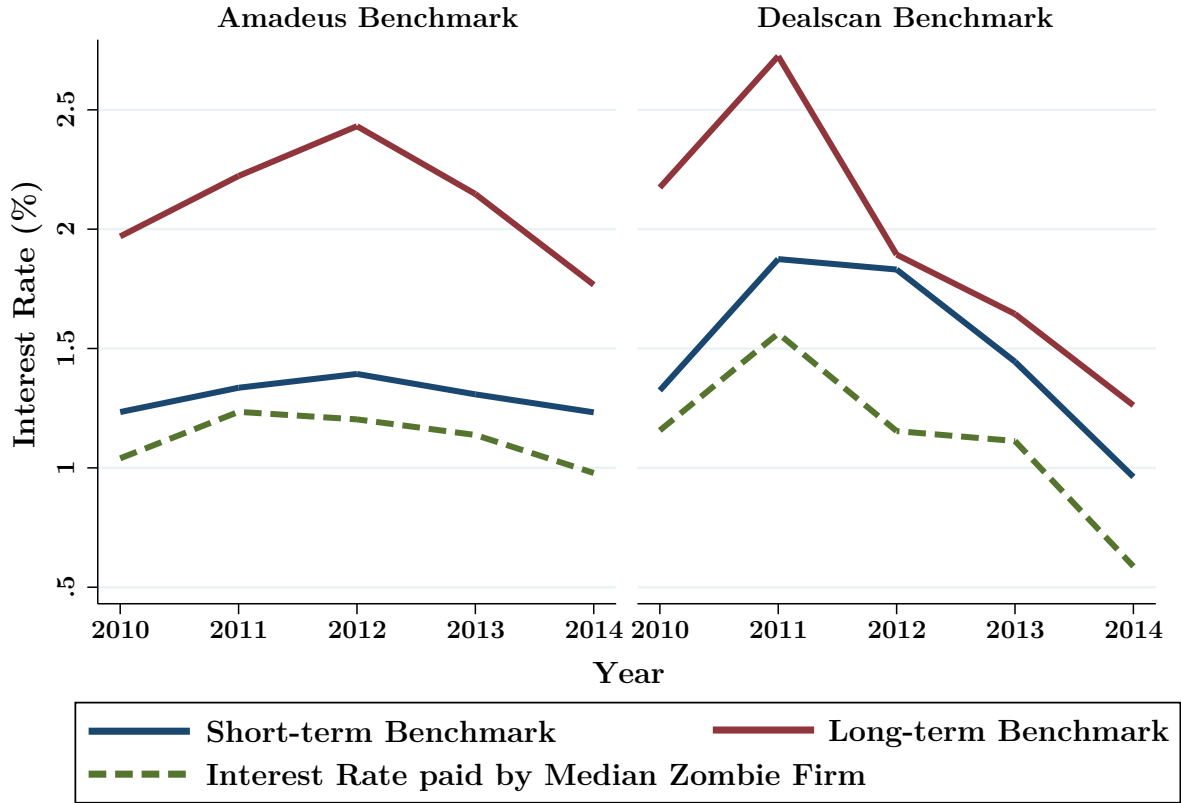


Figure 3 shows the evolution of benchmark interest rates for the two alternative zombie classifications which use information from either Amadeus or Dealscan to calculate benchmark interest rates. The benchmark is derived separately for short-and long-term maturities. We classify a firm as zombie if it meets the following three criteria: (i) the firm received subsidized credit, (ii) its rating (derived from three year median ICs) is BB or lower, and (iii) the syndicate composition has either remained constant, or banks that left the syndicate were not 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

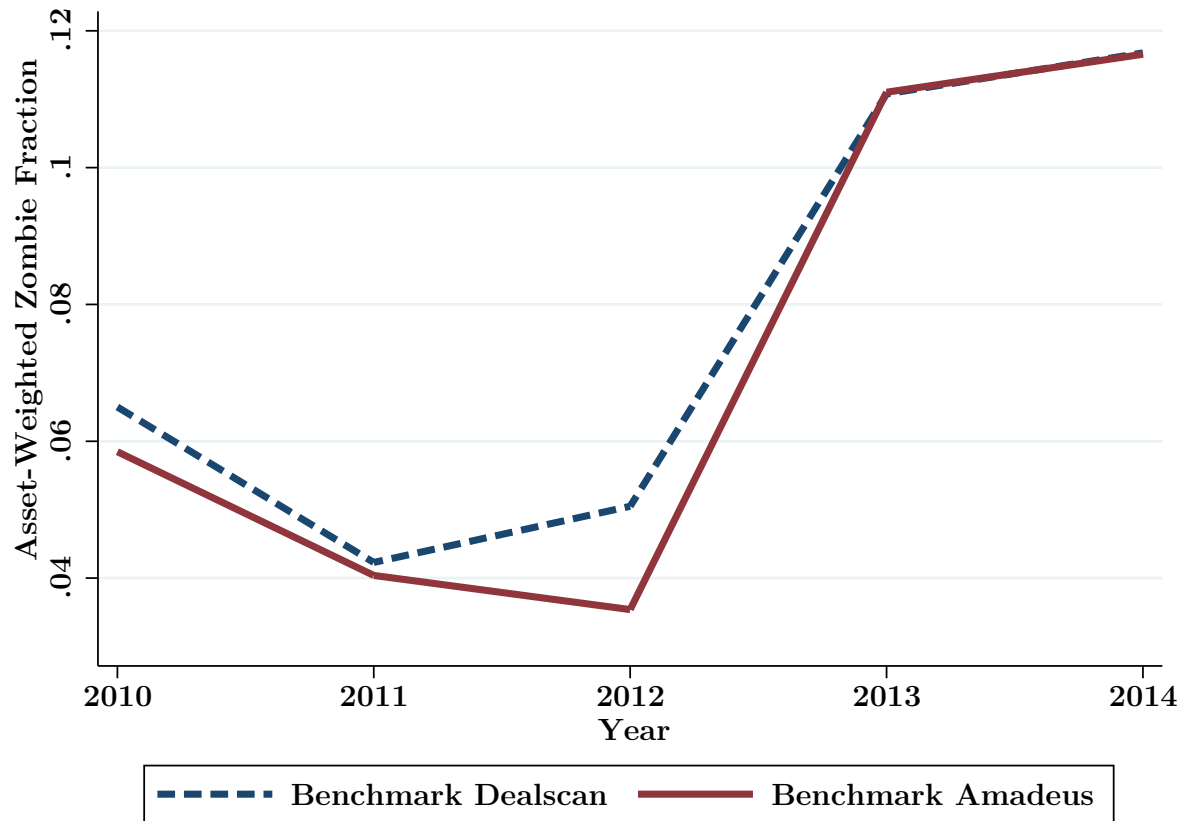


Figure 4 shows the evolution of the asset-weighted fraction of zombie firms in our sample for the two alternative zombie classifications which use information from either Amadeus or Dealscan to calculate benchmark interest rates. For the definition of a zombie firm see Figure 3. We restrict the sample to private firms with loan information in Dealscan and financial information in Amadeus.

Figure 5: FRACTION OF ZOMBIE LOANS

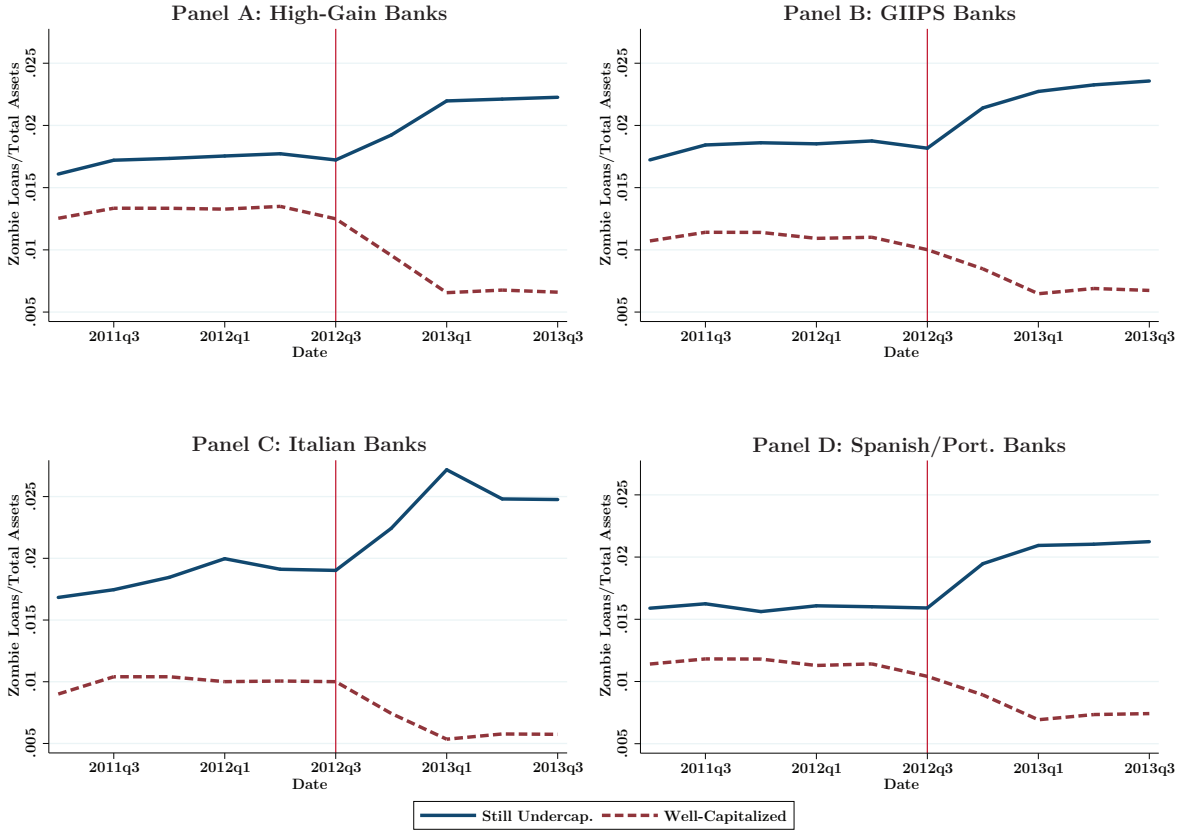
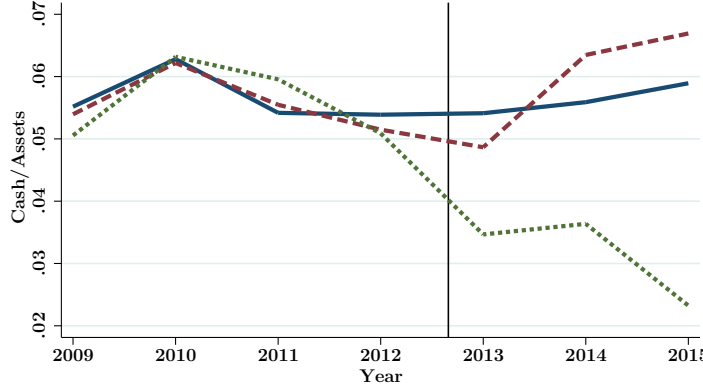


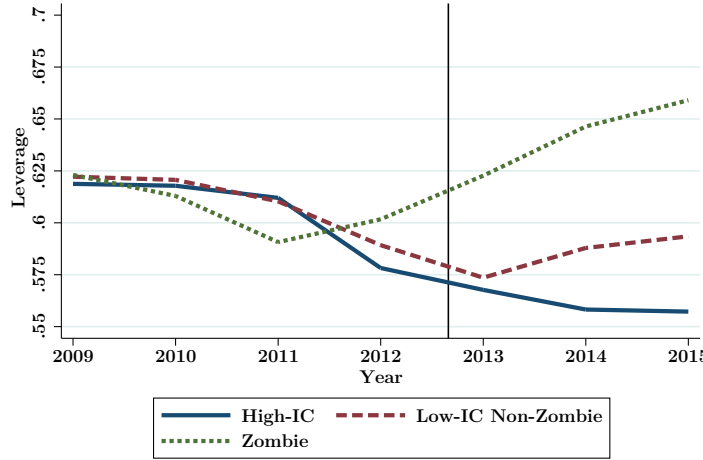
Figure 5, Panel A shows the fraction of the loan volume issued to zombie firms divided by the total assets for high-gain banks. Panel B shows the same for banks from Italy, Portugal, or Spain, Panel C for banks from Italy only, and Panel D for banks from Spain and Portugal only. In each panel, the blue solid line shows the evolution for banks that are still undercapitalized after the OMT announcement, whereas the red dashed line shows the evolution for banks that are well-capitalized after the OMT announcement. A bank is classified as high-gain (low-gain) bank if its equity capital increase due to the OMT announcement is above (below) the sample mean. A bank is classified as still undercapitalized (well-capitalized) if its leverage ratio is above (below) the sample median in December 2012 (post-OMT). For the definition of a zombie firm see Figure 3. The benchmark interest rates are calculated using information from Amadeus. The vertical 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 6: FINANCIAL EFFECTS

Panel A: Cash Holdings - High Ind. OMT Windfall Gain Borrower



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



Panel C: Leverage - Decomposition for Zombie Firms

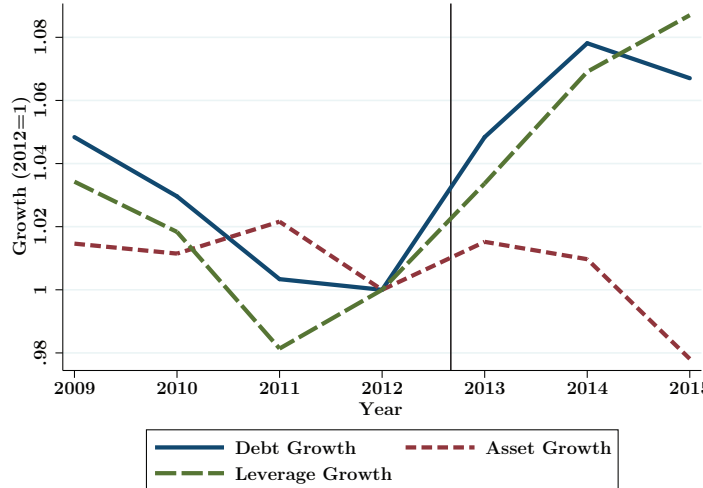
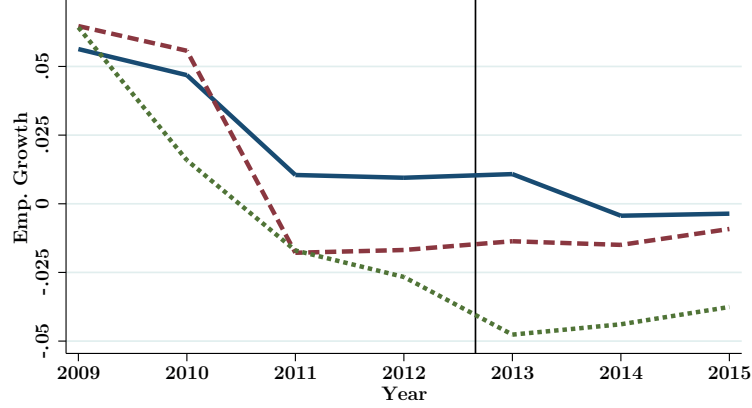


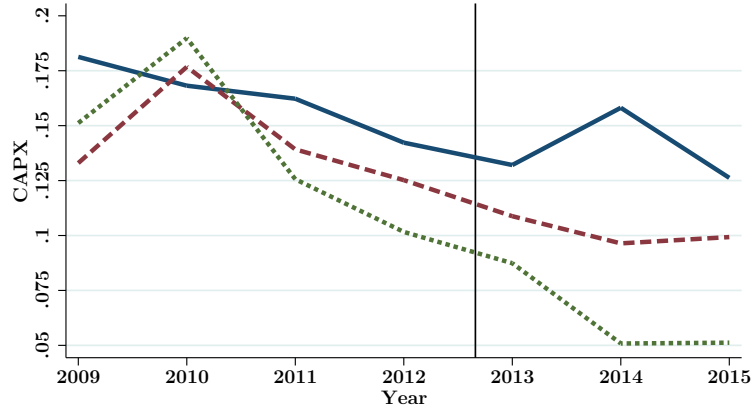
Figure 6, Panel A shows the evolution of the asset-weighted cash holdings as a fraction of total assets and Panel B the evolution of the asset-weighted leverage as a fraction of total assets. Both panels show high *Indirect OMT windfall gain* firms (i.e., firms with an above median *Indirect OMT windfall gain*), where we split these borrowers into three groups: High-IC ratio firms (blue solid line), low-IC ratio non-zombie firms (red dashed line) and low-IC ratio zombie firms (green dashed line). A firm is classified as high-IC (low-IC) ratio firm if its 2009-2011 median IC ratio is above (below) the country-specific 2009-2011 median IC ratio. For the definition of a zombie firm see Figure 3. The benchmark interest rates are calculated using information from Amadeus. The vertical 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: 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

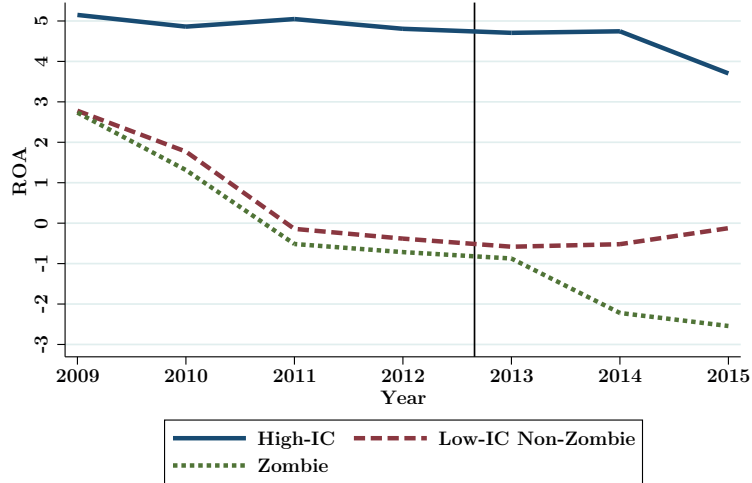


Figure 7, Panel A shows the evolution of the asset-weighted employment growth rates, Panel B the evolution of the asset-weighted capital expenditures as a fraction of tangible assets, and Panel C the evolution of the asset-weighted return on assets. All three panels show high *Indirect OMT windfall gain* firms (i.e., firms with an above median *Indirect OMT windfall gain*), where we split these borrowers into three groups: High-IC ratio firms (blue solid line), low-IC ratio non-zombie firms (red dashed line) and low-IC ratio zombie firms (green dashed line). A firm is classified as high-IC (low-IC) ratio firm if its 2009-2011 median IC ratio is above (below) the country-specific 2009-2011 median IC ratio. For the definition of a zombie firm see Figure 3. The benchmark interest rates are calculated using information from Amadeus. The vertical 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: EVOLUTION OF NON-PERFORMING LOANS

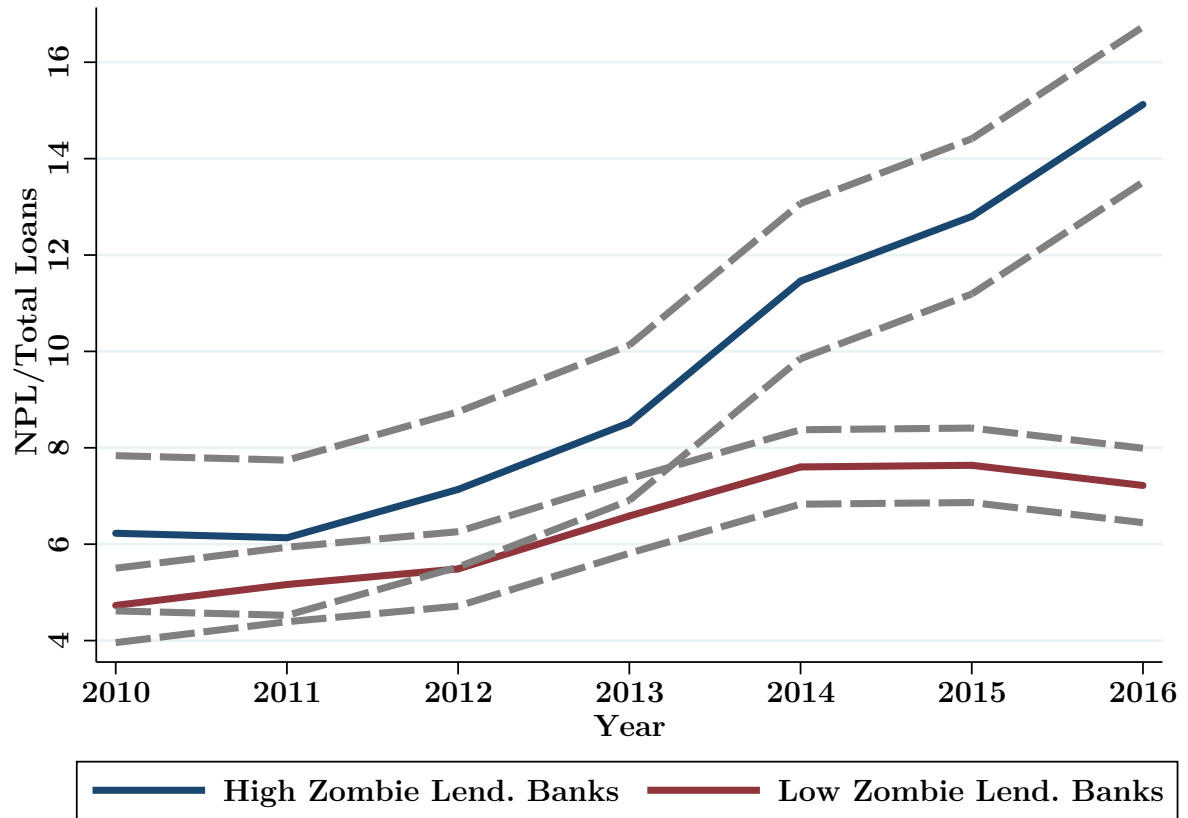
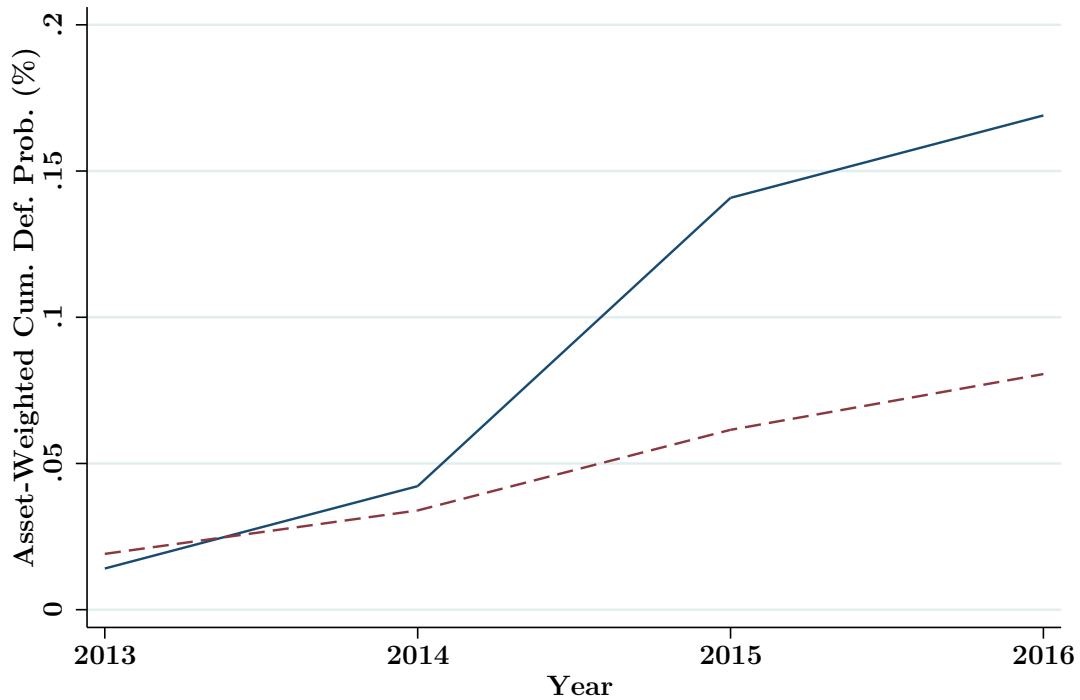


Figure 8, shows the evolution of the asset-weighted fraction of non-performing loans to total loans (in %) for high (low) zombie lending high-gain banks. A bank is classified as high-zombie lending (low zombie lending) bank if it has an above median fraction of zombie loans to total assets. For the definition of a zombie firm see Figure 3. The benchmark interest rates are calculated using information from Amadeus. The grey dashed lines show 95% confidence intervals.

Figure 9: CUMULATIVE DEFAULT PROBABILITY

Panel A: Cumulative Default Probability



Panel B: Asset-Weighted Cumulative Default Probability

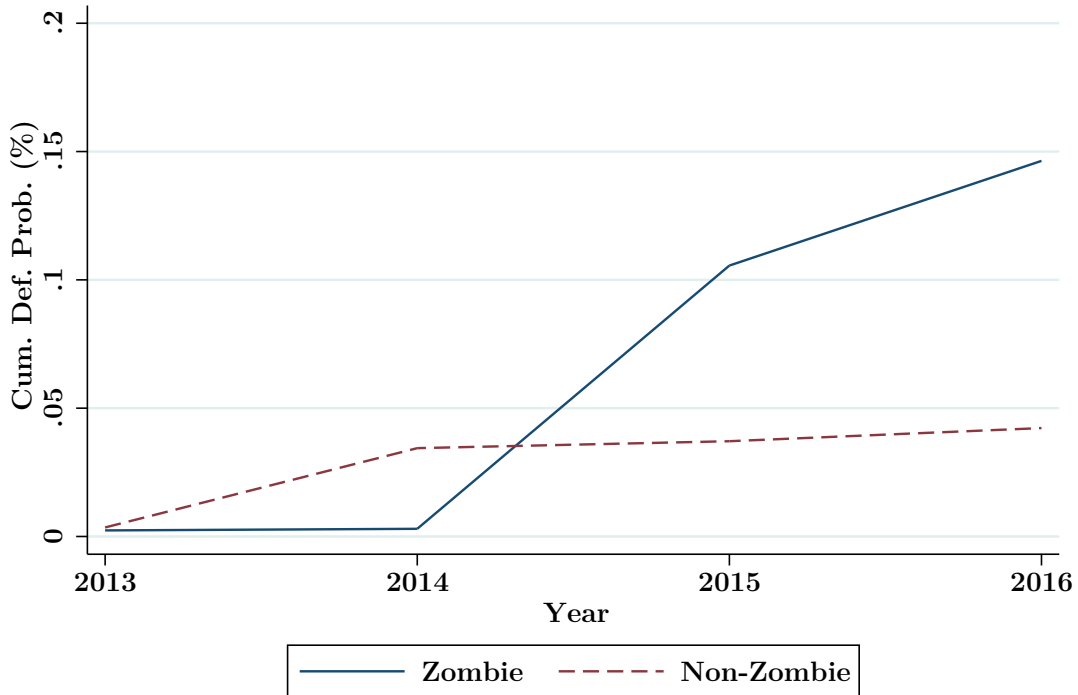


Figure 9, Panel A shows the evolution of the asset-weighted cumulative default rates, while Panel B shows the cumulative default rates for zombie firms (blue solid line) and non-zombie firms (red dashed line). We classify a firm as defaulted if it is either no longer active or if insolvency proceedings have been opened. For the definition of a zombie firm see Figure 3. The benchmark interest rates are calculated using information from Amadeus. We restrict the sample to private firms with loan information in Dealscan and financial information in Amadeus.

Figure 10: INDUSTRY PRODUCTIVITY

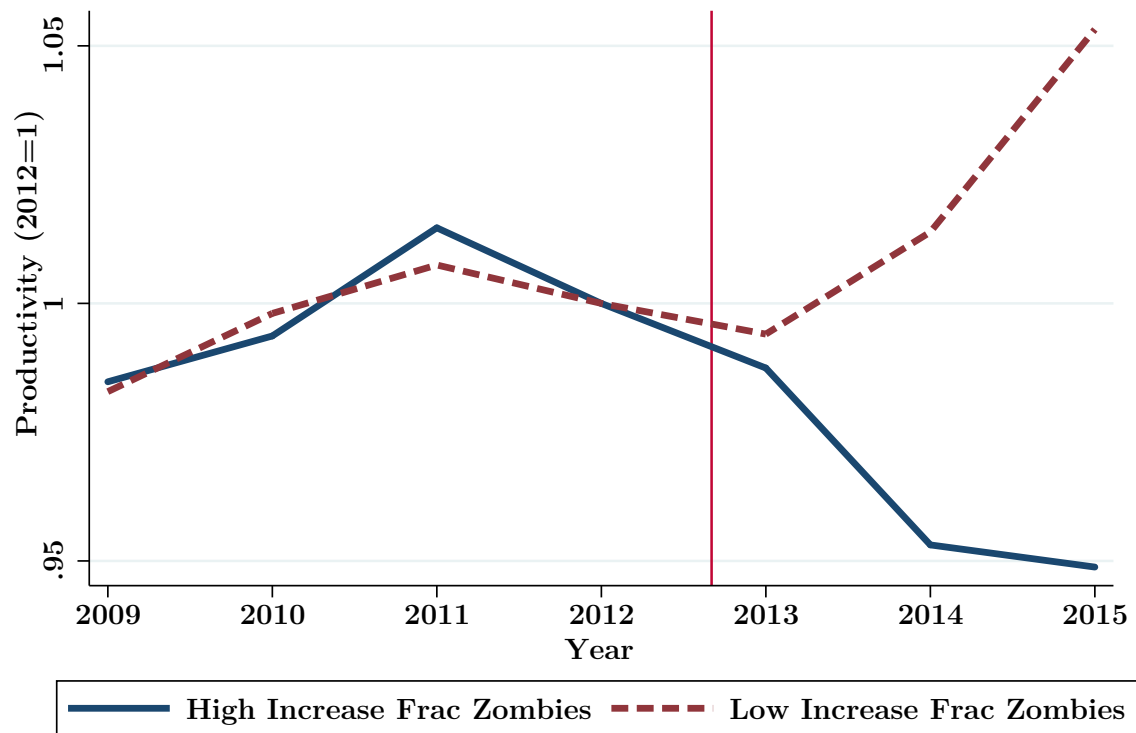


Figure 10 shows the average country-industry-level productivity (measured relative to 2012 where productivity is set equal to one) for industries with a high (blue solid line) and low (red dashed line) increase in the fraction of zombie firms in the post-OMT period. For the definition of a zombie firm see Figure 3.

Table 1: DESCRIPTIVE STATISTICS OF BANKS AROUND OMT

Panel A: Bank Reaction			
	(1)	(2)	(3)
	OMT windfall gain	GIIPS/Assets	CDS Return
Non-GIIPS Banks	0.011	0.010	-0.23 (-9.2)
GIIPS Banks	0.08	0.118	-0.96 (-3.4)
<i>t</i> -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	24.06	20.47
Well-capitalized high-gain	12.37	13.42	12.03
Low-gain	20.75	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	13.30	76.34	56.82
Well-capitalized high-gain	12.13	39.36	33.76
Low-gain	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. *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 the year before the OMT announcement, whereas post-OMT is defined as the equity/assets ratio in the year after the OMT announcement. Panel C presents the quasi-leverage for different groups of banks, defined as market value of equity plus the book value of debt divided by the market value of equity. High-gain (low-gain) bank is a dummy variable equal to one (zero) if a bank's equity capital increase due to the OMT announcement is above (below) the sample mean. A bank is classified as still undercapitalized (well-capitalized) if its leverage ratio is above (below) the sample median in December 2012 (post-OMT). F-values are reported in parentheses.

Table 2: RUN INDEX

	(1)	(2)	(3)	(4)
	$\Delta\text{Run Index}$	$\Delta\text{Run Index}$	$\Delta\text{Run Index}$	$\Delta\text{Run Index}$
OMT windfall gain	-0.150*** (-6.58)	-0.139*** (-3.85)	-0.175*** (-3.89)	-0.162*** (-2.51)
GIIPS Bank			0.002 (0.65)	0.002 (0.44)
Ln(Total Assets)		0.001 (0.59)		0.000 (0.39)
Tier 1 Ratio		0.000 (0.09)		0.000 (0.02)
R^2	0.607	0.610	0.613	0.613
N	30	30	30	30

Table 2 presents bank cross sectional regressions. The dependent variable is the change in the run index (average 6 months prior to average 6 months post the OMT announcement) calculated following Veronesi and Zingales (2010). The run index is a proxy for the likelihood that a bank faces a bank run. *OMT windfall gain* is the value gain on bank's sovereign debt holdings as a fraction of total equity. *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)
	All Banks	All Banks	All Banks	All Banks	All banks	GIIPS Banks
	Δ Loans	Δ Loans	Δ Loans	Δ Loans	Loan Inc.	Δ Loans
OMT windfall gain*PostOMT	0.234*** (3.19)	0.211*** (2.92)	0.216** (2.60)	0.254** (2.41)	0.301* (1.71)	0.284** (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: Extensive Margin - All Firms						
	New Loan	New Loan	New Loan	New Loan		New Loan
OMT windfall gain*PostOMT	0.018 (0.22)	0.018 (0.21)	-0.044 (-0.63)	-0.046 (-0.63)		-0.136 (-1.32)
R^2	0.006	0.077	0.667	0.692		0.815
N	25874	25874	25874	25874		7255
Panel C: Intensive Margin - Quality Split						
	Δ Loans	Δ Loans	Δ Loans	Δ Loans	Loan Inc.	Δ Loans
OMT windfall gain*PostOMT	0.042 (0.68)	0.062 (0.80)	-0.004 (-0.06)	-0.014 (-0.18)	-0.030 (-0.21)	0.038 (0.41)
OMT windfall gain*PostOMT*Low-IC	0.280*** (5.66)	0.295*** (5.02)	0.212*** (3.25)	0.253*** (3.02)	0.364** (2.03)	0.296** (2.89)
R^2	0.014	0.098	0.598	0.643	0.617	0.775
N	10879	10879	10879	10879	10879	4090
Panel D: Extensive Margin - Quality Split						
	New Loan	New Loan	New Loan	New Loan		New Loan
OMT windfall gain*PostOMT	-0.013 (-0.14)	-0.020 (-0.20)	-0.015 (-0.12)	-0.023 (-0.17)		-0.188 (-1.40)
OMT windfall gain*PostOMT*Low-IC	0.060 (0.71)	0.074 (0.81)	-0.056 (-0.47)	-0.045 (-0.36)		0.109 (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 Khwaja and Mian (2008) bank lending channel regression. The unit of observation is a firm cluster-bank-quarteryear. In Panel A and C, the dependent variable is the change in log loan volume of a firm cluster-bank relation in a given quarter. In Panel B and D, the dependent variable is a dummy equal to one if a new loan is issued to a firm cluster with which no prior relation existed. Columns (1)-(5) consider all banks in our sample, 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 IC ratio medians (2009-2011) for firms by rating category provided by Standard & Poor's. In Panel A and C data are restricted to: (i) the set of firm-bank relations that existed pre-OMT, 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 B and D only firms without existing relation at the time of the OMT announcement are included. A firm is classified as high-IC (low-IC) ratio firm if its 2009-2011 median IC ratio is above (below) the country-specific 2009-2011 median IC ratio. *OMT windfall gain* is the value gain on bank's sovereign debt holdings as a fraction of total equity. *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 (3.4%)	119
Spain	29 (16.3%)	177
France	10 (7.2%)	137
UK	23 (9.8%)	235
Italy	35 (20.3%)	172
Panel B: Breakdown of zombie firms by country (Dealscan Benchmark)		
Country	Number of Zombies	Number of private firms in sample
Germany	6 (5%)	119
Spain	31 (17.5%)	177
France	13 (9.5%)	137
UK	25 (10.6%)	235
Italy	34 (19.8%)	172

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). For the definition of a zombie firm see Figure 3. We present these results for the two alternative zombie classifications which use information from either Amadeus or Dealscan to calculate benchmark interest rates. We restrict the sample to private firms with loan information in Dealscan and financial information in Amadeus.

TABLE 4: DESCRIPTIVE STATISTICS (CONTD.)

Panel C: Difference in Equity Ratio of Syndicate Banks (Amadeus Benchmark)			
	(1)	(2)	(3)
	Remaining Banks	Leaving Banks	Difference (<i>t</i> -statistic)
Equity ratio	5.13	6.02	-.089** (-2.25)
Panel D: Difference in Equity Ratio of Syndicate Banks (Dealscan Benchmark)			
	Remaining Banks	Leaving Banks	Difference (<i>t</i> -statistic)
Equity ratio	4.92	5.45	-0.53** (-2.06)
Panel E: Difference in Syndicates (Amadeus Benchmark)			
	Zombie Firms	Non-Zombie Firms	Difference (<i>t</i> -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)			
	Zombie Firms	Non-Zombie Firms	Difference (<i>t</i> -statistic)
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)

Table 4, Panel C and D present the difference in the mean equity 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. *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. *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 post-OMT. For the definition of a zombie firm see Figure 3. We present these results for the two alternative zombie classifications which use information from either Amadeus or Dealscan to calculate benchmark interest rates. 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)	(2)	(3)	(4)
	High-IC Ratio	Low-IC Ratio No Zombie	Zombie	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)				
	High-IC Ratio	Low-IC Ratio No Zombie	Zombie	Difference (2)-(3)
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)

Table 4, Panel G and H present a test for the difference in means between low-IC ratio non-zombie firms and zombie firms. A firm is classified as high-IC (low-IC) ratio firm if its 2009-2011 median IC ratio is above (below) the country-specific 2009-2011 median IC ratio. For the definition of a zombie firm see Figure 3. We present these results for the two alternative zombie classifications which use information from either Amadeus or Dealscan to calculate benchmark interest rates. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 5: LOAN VOLUME REGRESSIONS - ZOMBIE LENDING (AMADEUS BENCHMARK)

	(1)	(2)	(3)	(4)	(5)	(6)
	ΔLoans	ΔLoans	ΔLoans	ΔLoans	Loan Inc.	ΔLoans
	All Banks	All Banks	All Banks	All Banks	All banks	GIIPS Banks
OMT windfall gain*PostOMT	0.444*** (5.03)	0.450*** (4.79)	0.393*** (3.05)	0.414*** (3.01)	0.569*** (2.82)	0.587** (1.99)
OMT windfall gain*PostOMT*Zombie	-0.526*** (-3.16)	-0.573*** (-2.74)	-0.468*** (-4.53)	-0.543*** (-2.75)	-0.585** (-2.04)	-0.697** (-2.55)
OMT windfall gain*PostOMT*Still Undercap	-0.405** (-2.13)	-0.460** (-2.33)	-0.431*** (-2.75)	-0.433*** (-2.83)	-0.560*** (-2.78)	-0.663** (-2.83)
OMT windfall gain*PostOMT*Still Undercap*Zombie	0.722*** (3.17)	0.701*** (4.50)	0.768*** (4.12)	0.756*** (3.58)	0.865** (2.42)	0.998*** (3.66)
R^2	0.011	0.111	0.726	0.759	0.695	0.834
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 5 presents the results of a modified Khwaja and Mian (2008) bank lending channel regression as in Table 3. 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 zombie or non-zombie firms. *OMT windfall gain* is the value gain on bank's sovereign debt holdings as a fraction of total equity. *Still Undercap* is a dummy variable that equals one if banks have an above sample median leverage ratio after the OMT announcement. *PostOMT* is an indicator variable equal to one starting in quarter four of 2012, and zero before. For the definition of a zombie firm see Figure 3. The benchmark interest rates are calculated using information from Amadeus. 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 6: LOAN VOLUME REGRESSIONS - MORAL SUASION (AMADEUS BENCHMARK)

Panel A: Excluding Firms with positive Government Ownership						
	(1)	(2)	(3)	(4)	(5)	(6)
	Δ Loans	Δ Loans	Δ Loans	Δ Loans	Loan Inc.	Δ Loans
	All Banks	All Banks	All Banks	All Banks	All Banks	GHIPS Banks
OMT windfall gain*PostOMT	0.454*** (3.64)	0.478*** (3.51)	0.380** (2.66)	0.432*** (2.76)	0.585** (2.33)	0.591* (1.97)
OMT windfall gain*PostOMT*Zombie	-0.518** (-2.24)	-0.542** (-2.60)	-0.490*** (-2.75)	-0.490* (-2.00)	-0.612** (-2.31)	-0.673** (-2.29)
OMT windfall gain*PostOMT*Still Undercap	-0.393* (-1.92)	-0.452* (-1.98)	-0.414** (-2.45)	-0.478** (-2.59)	-0.591*** (-3.07)	-0.686** (-2.55)
OMT windfall gain*PostOMT*Still Undercap*Zombie	0.677** (2.72)	0.733*** (2.96)	0.752*** (3.19)	0.740*** (2.89)	0.906** (2.06)	0.865** (2.14)
R^2	0.011	0.113	0.730	0.763	0.692	0.855
N	13117	13117	13117	13117	13117	4116
Panel B: Horse Race between Still Undercap. and Government Ownership						
	Δ Loans	Δ Loans	Δ Loans	Δ Loans	Loan Inc.	Δ Loans
OMT windfall gain*PostOMT	0.437*** (4.58)	0.481*** (5.11)	0.422*** (3.58)	0.526*** (4.24)	0.768*** (5.01)	0.804* (2.00)
OMT windfall gain*PostOMT*Zombie	-0.512*** (-3.16)	-0.559*** (-2.86)	-0.479*** (-3.96)	-0.468 (-1.65)	-0.770** (-2.17)	-1.164*** (-5.81)
OMT windfall gain*PostOMT*Still Undercap	-0.388** (-2.24)	-0.462** (-2.58)	-0.464*** (-3.01)	-0.540*** (-3.58)	-0.778*** (-5.24)	-0.837** (-2.18)
OMT windfall gain*PostOMT*Still Undercap*Zombie	0.786*** (3.36)	0.713** (2.53)	0.731*** (3.24)	0.757** (2.28)	0.867*** (3.68)	1.152*** (10.53)
OMT windfall gain*PostOMT*High Gov. Own.	-0.088 (-1.31)	-0.058 (-0.77)	-0.059 (-1.30)	-0.083 (-1.29)	-0.068 (-0.57)	-0.016 (-0.29)
OMT windfall gain*PostOMT*High Gov. Own.*Zombie	0.072 (0.94)	0.166 (1.24)	0.011 (0.33)	0.040 (0.22)	0.109 (1.01)	0.073 (0.56)
R^2	0.011	0.111	0.726	0.760	0.695	0.842
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 6 presents the results of a modified Khwaja and Mian (2008) bank lending channel regression as in Table 3. Panel A restricts the sample to non-government owned firms. Panel B presents results for a horse race between still undercapitalized and government-owned banks. 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 zombie or non-zombie firms. *PostOMT* is an indicator variable equal to one starting in quarter four of 2012, and zero before. For the definition of a zombie firm see Figure 3. The benchmark interest rates are calculated using information from Amadeus. 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 7: FINANCIAL AND REAL EFFECTS - ALL FIRMS

Panel A: All Firms						
	(1)	(2)	(3)	(4)	(5)	(6)
	ΔCash	ΔDebt	$\Delta\text{Debt}-\Delta\text{Cash}$	Emp. Growth	CAPX	ROA
Indirect OMT windfall gain*PostOMT	0.376*** (2.82)	0.368*** (2.87)	-0.008 (-0.04)	0.070 (0.15)	-0.248 (-0.59)	0.051 (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						
	ΔCash	ΔDebt	$\Delta\text{Debt}-\Delta\text{Cash}$	Emp. Growth	CAPX	ROA
Indirect OMT windfall gain*PostOMT	0.171 (1.01)	0.267 (1.32)	0.096 (0.36)	0.065 (0.15)	0.023 (0.05)	-0.101 (-0.67)
Indirect OMT windfall gain*PostOMT*Low-IC	0.517** (2.42)	0.567** (2.08)	0.05 (0.14)	-0.240 (-0.49)	-0.728 (-1.30)	0.252 (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						
	ΔCash	ΔDebt	$\Delta\text{Debt}-\Delta\text{Cash}$	Emp. Growth	CAPX	ROA
Indirect OMT windfall gain*PostOMT*Low-IC	0.519** (2.30)	0.557** (2.05)	0.038 (0.1)	-0.418 (-0.98)	-0.618 (-0.93)	0.185 (0.82)
Indirect OMT windfall gain*PostOMT*Low-IC*Zombie	-0.384** (-2.00)	-0.028 (-0.19)	0.356** (2.15)	0.346 (1.36)	0.044 (0.11)	0.125 (1.12)
R^2	0.514	0.619		0.471	0.500	0.482
N	2856	3431		2773	3361	3405
Firm Level Controls	YES	YES		YES	YES	YES
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 7 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, a firm is classified as high-IC (low-IC) ratio firm if its 2009-2011 median IC ratio is above (below) the country-specific 2009-2011 median IC ratio. 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. For the definition of a zombie firm see Figure 3. *Indirect OMT windfall gain* measures 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, IC ratio, EBITDA as a fraction of total assets, and net worth. All firm-level control variables are lagged by one period. We restrict the sample to private firms with loan information in Dealscan and financial information in Amadeus. 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 8: LONG-RUN EFFECTS

Panel A: Non-Performing Loans				
	(1)	(2)	(3)	(4)
	ΔNPL	ΔNPL	ΔNPL	ΔNPL
High Zombie Lending Bank	0.079** (2.89)	0.077** (2.87)	0.076** (2.77)	0.041** (2.07)
Log(Assets)		-0.002 (-0.67)	-0.003 (-0.85)	-0.004 (-0.46)
Equity/Assets			-0.000 (-1.36)	-0.000 (-0.69)
Country Fixed Effects	NO	NO	NO	YES
R^2	0.391	0.392	0.401	0.676
N	49	49	49	49
Panel B: Firm Defaults				
	Default	Default	Default	
Low-IC	0.036*** (3.15)	0.033*** (3.55)	0.038*** (2.66)	
Zombie	-0.037*** (-3.51)	-0.033*** (-2.93)	-0.049** (-2.41)	
Low-IC*Post	0.000 (0.02)	0.006 (0.78)	0.008 (0.74)	
Zombie*Post	0.060** (1.97)	0.051** (1.99)	0.053** (1.97)	
R^2	0.022	0.117	0.254	
N	1915	1915	1915	
Country-Year Fixed Effects	YES	NO	NO	
Industry-Year Fixed Effects	NO	YES	NO	
Industry-Country-Year Fixed Effects	NO	NO	YES	

Table 8, Panel A presents cross-sectional bank regressions. The dependent variable is the change of a bank's non-performing loans to total 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. Panel B presents firm panel regressions for the years 2012-2016 (post-OMT period). We classify a firm as defaulted if it is either no longer active or if insolvency proceedings have been opened. A firm is classified as high-IC (low-IC) ratio firm if its 2009-2011 median IC ratio is above (below) the country-specific 2009-2011 median IC ratio. For the definition of a zombie firm see Figure 3. The benchmark interest rates are calculated using information from Amadeus. We restrict the sample to private firms with loan information in Dealscan and financial information in Amadeus. 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 9: EFFECTS ON NON-ZOMBIE FIRMS

Panel A: Amadeus Benchmark				
	(1)	(2)	(3)	(4)
	Interest	Emp. Growth	CAPX	Productivity
Industry Frac Zombie*Non-Zombie	0.026*** (2.87)	-0.005** (-2.29)	-0.014** (-2.23)	0.010** (2.24)
R^2	0.851	0.512	0.527	0.931
N	5792	5128	5858	5257
Firm Level Controls	YES	YES	YES	YES
Firm Fixed Effects	YES	YES	YES	YES
Industry-Country-Year Fixed Effects	YES	YES	YES	YES
Panel B: Investment Loss				
Industry	Avg. Investment (% of Capital)	Δ Fraction Zombie	Investment Loss (% of Capital)	Investment Years lost
Construction	9.58%	17.00pp	23.8%	2.5
Manufacturing	12.3%	5.40pp	7.6%	0.6
Trade	10.6%	12.29pp	17.2%	1.6
Service	12.5%	13.62pp	19.1%	1.5
Other	8.9%	3.82pp	5.4%	0.6
Panel C: Employment Loss				
Industry	Avg. Emp. Growth	Δ Fraction Zombie	Employment Loss	
Construction	-2.26%	17.00pp	8.5pp	
Manufacturing	0.65%	5.40pp	2.7pp	
Trade	0.44%	12.29pp	6.1pp	
Service	-1.0%	13.62pp	6.8pp	
Other	-2.1%	3.82pp	1.9pp	

Table 9, Panel A presents firm-level regression results. The dependent variables are interest payments, employment growth, investments, and productivity, respectively. Benchmark interest rate is derived from Amadeus. *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. Panels B and C present estimates of the investment and employment losses that result from the increased presence of zombie firms in an industry, respectively. For the definition of a zombie firm see Figure 3. The estimates are derived from a partial equilibrium analysis that compares the outcomes from the de facto fraction of zombie firms to an outcome if the fraction of zombie firms had stayed at its pre-OMT level. We restrict the sample to public and private firms with loan information in Dealscan and financial information in Amadeus. Firm control variables include the logarithm of total assets, leverage, tangibility, IC 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 10: EFFECTS ON NON-ZOMBIE FIRMS - COMPETITIVE INDUSTRIES

Panel A: Amadeus Benchmark - Competitive Industries				
	(1)	(2)	(3)	(4)
	Interest	Emp. Growth	CAPX	Productivity
Industry Frac Zombie*Non-Zombie	0.027**	-0.006**	-0.020**	0.019***
	(2.25)	(-2.45)	(-2.29)	(2.82)
R^2	0.866	0.581	0.576	0.945
N	2834	2428	2848	2511
Panel B: Amadeus Benchmark - Non-Competitive Industries				
Industry Frac Zombie*Non-Zombie	0.021**	-0.001	-0.004	0.003
	(2.03)	(-0.39)	(-1.12)	(0.34)
R^2	0.827	0.685	0.614	0.947
N	2958	2700	3010	2746
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. Both panels consider the interest rate benchmark derived from Amadeus. The sample is further split into competitive (Panel A) and non-competitive industries (Panel B) based on the HHI index of an industry. For the definition of a zombie firm see Figure 3. *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. We restrict the sample to public and private firms with loan information in Dealscan and financial information in Amadeus. Firm control variables include the logarithm of total assets, leverage, tangibility, IC 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: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

For Online Publication

Online Appendix for

“Whatever it takes: The Real Effects of Unconventional Monetary Policy”

Viral V. Acharya

Tim Eisert

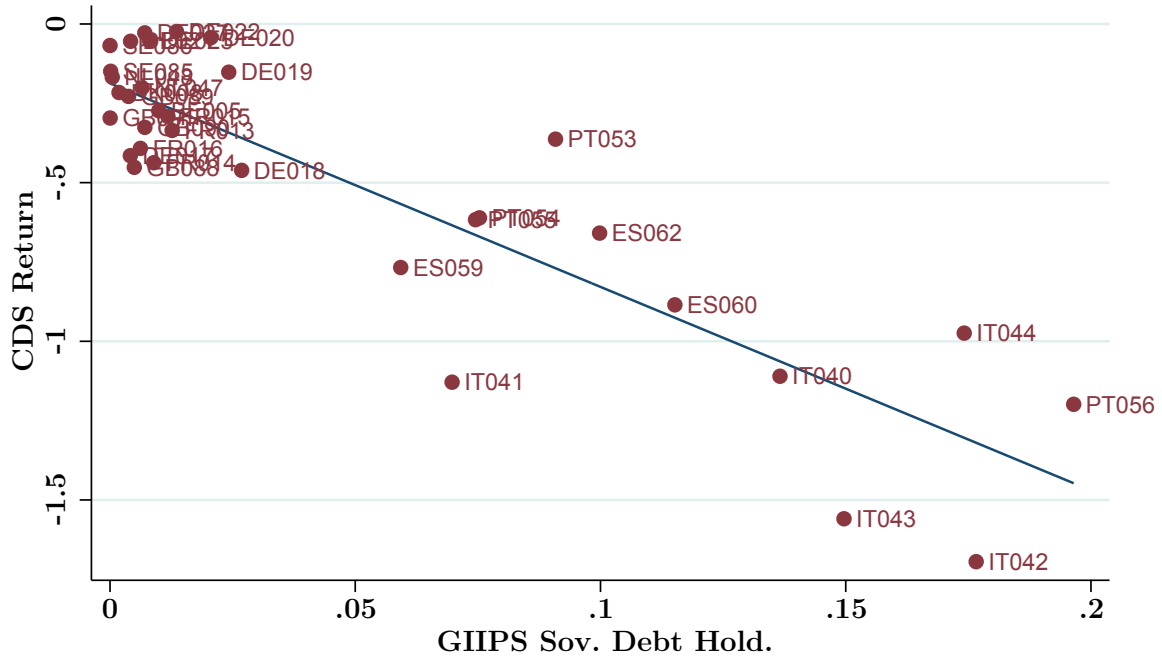
Christian Eufinger

Christian Hirsch

November 2016

Figure A1: CDS REACTION

Panel A: All Banks



Panel B: GIIPS Banks

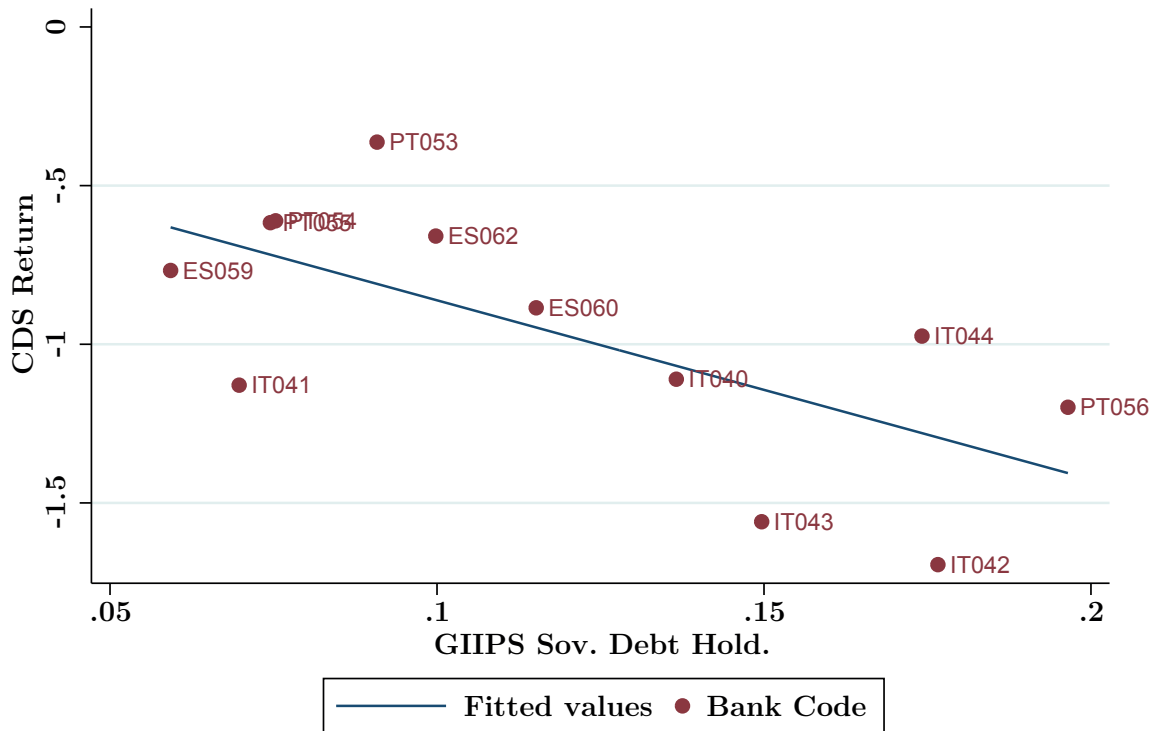


Figure A1, Panel A plots the relation between banks' CDS return on the OMT announcement dates and their GIIPS sovereign debt holdings for GIIPS and non-GIIPS banks. Panel B does the same for GIIPS banks only. GIIPS Banks include banks incorporated in Italy, Portugal, and Spain. Non-GIIPS banks consist of banks in all other European countries. All banks are included in the analysis for which information about their sovereign debt portfolio prior to the OMT announcement (June 2012) is available and which are active in the syndicated loan market during the sample period.

Table A1: BANK CDS REACTION TO OMT ANNOUNCEMENT

Panel A: GIIPS Sovereign Bond Holdings scaled by Total Assets				
	(1)	(2)	(3)	(4)
	CDS Return	CDS Return	CDS Return	CDS Return
GIIPS/Assets	-6.414*** (-10.38)	-7.635*** (-13.05)	-7.567*** (-11.28)	-7.715*** (-10.62)
Log Assets		-0.134*** (-4.12)	-0.133*** (-4.00)	-0.126*** (-3.51)
Tier1 Capital			0.396 (0.22)	1.110 (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*** (-7.06)	-6.741*** (-8.25)	-6.321*** (-7.23)	-7.016*** (-7.94)
Log Assets		-0.076* (-1.88)	-0.074* (-1.85)	-0.119** (-2.26)
Tier1 Capital			0.028 (1.27)	0.010 (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 (Panel A) or the OMT windfall gain which is defined as the gain on the sovereign debt holdings as a fraction of total equity (Panel B). Control variables are 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 - EBA CAPITAL EXERCISE

	(1)	(2)	(3)	(4)	(5)	(6)
	ΔLoans	ΔLoans	ΔLoans	ΔLoans	Loan Inc.	ΔLoans
	All Banks	All Banks	All Banks	All Banks	All Banks	GIIPS Banks
OMT windfall gain*PostOMT	0.037 (0.54)	0.058 (0.67)	0.004 (0.07)	-0.008 (-0.10)	-0.039 (-0.26)	0.079 (0.82)
OMT windfall gain*PostOMT*Low-IC	0.247*** (3.65)	0.265*** (3.50)	0.219*** (3.27)	0.259*** (3.09)	0.372** (2.13)	0.308** (3.09)
Equity Increase EBA*PostEBA	-0.049 (-1.62)	-0.044 (-1.26)	-0.017 (-0.70)	-0.015 (-0.62)	-0.043 (-1.08)	0.008 (0.30)
Equity Increase EBA*PostEBA*Low-IC	0.057 (1.44)	0.053 (1.18)	-0.033 (-0.89)	-0.032 (-0.85)	0.007 (0.12)	-0.067 (-1.54)
R^2	0.014	0.098	0.598	0.643	0.617	0.775
N	10879	10879	10879	10879	10879	4090
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 Khwaja and Mian (2008) bank lending channel regression as in Table 3. A firm is classified as high-IC (low-IC) ratio firm if its 2009-2011 median IC ratio is above (below) the country-specific 2009-2011 median IC ratio. *PostOMT* is an indicator variable equal to one starting in quarter four of 2012, and zero before. *Equity Increase EBA* is defined as the amount of new equity capital raised during the capital exercise period. *PostEBA* is an indicator variable equal to one in the period after the EBA recapitalization, and zero otherwise. 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: LOAN VOLUME REGRESSIONS - ZOMBIE LENDING (DEALSCAN BENCHMARK)

	(1)	(2)	(3)	(4)	(5)	(6)
	ΔLoans	ΔLoans	ΔLoans	ΔLoans	Loan Inc.	ΔLoans
	All Banks	All Banks	All Banks	All Banks	All Banks	GIIPS Banks
OMT windfall gain*PostOMT	0.437*** (4.67)	0.448*** (4.37)	0.397*** (3.39)	0.412*** (3.34)	0.689*** (4.11)	0.648** (2.15)
OMT windfall gain*PostOMT*Zombie	-0.493*** (-2.74)	-0.522*** (-2.73)	-0.480*** (-5.54)	-0.544*** (-3.91)	-0.784*** (-3.40)	-0.733*** (-2.97)
OMT windfall gain*PostOMT*Still Undercap	-0.461** (-2.38)	-0.517** (-2.48)	-0.440*** (-3.54)	-0.409*** (-3.59)	-0.682*** (-4.26)	-0.664*** (-3.42)
OMT windfall gain*PostOMT*Still Undercap*Zombie	0.758*** (3.47)	0.732*** (3.57)	0.684*** (5.70)	0.707*** (4.43)	1.093*** (3.95)	1.012** (2.64)
R^2	0.010	0.114	0.723	0.756	0.693	0.848
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 A3 reproduces the results of Table 5 for the zombie classifications that uses information in Dealscan to calculate benchmark interest rates. 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 (TERM LOANS)

	(1)	(2)	(3)	(4)	(5)	(6)
	ΔLoans	ΔLoans	ΔLoans	ΔLoans	Loan Inc.	ΔLoans
	All Banks	All Banks	All Banks	All Banks	All Banks	GIIPS Banks
Panel A: Amadeus Benchmark						
OMT windfall gain*PostOMT	0.481*** (5.17)	0.466*** (4.79)	0.443*** (3.37)	0.432*** (4.15)	0.624*** (2.93)	0.611** (2.40)
OMT windfall gain*PostOMT*Zombie	-0.591** (-2.08)	-0.659*** (-3.64)	-0.521*** (-4.36)	-0.512*** (-4.16)	-0.706*** (-3.01)	-0.739** (-2.45)
OMT windfall gain*PostOMT*Undecap	-0.434** (-2.67)	-0.413** (-2.30)	-0.392** (-2.39)	-0.393*** (-2.75)	-0.629** (-2.63)	-0.700* (-2.08)
OMT windfall gain*PostOMT*Undecap*Zombie	0.773** (2.71)	0.787*** (3.38)	0.808*** (2.78)	0.836*** (4.98)	0.943*** (3.94)	1.051*** (3.91)
R^2	0.012	0.141	0.706	0.716	0.652	0.760
N	9040	9040	9040	9040	9040	3102
Panel B: Dealscan Benchmark						
OMT windfall gain*PostOMT	0.406*** (3.24)	0.426*** (3.06)	0.393*** (3.98)	0.394*** (4.36)	0.694*** (3.86)	0.629*** (3.26)
OMT windfall gain*PostOMT*Zombie	-0.473* (-1.84)	-0.556*** (-3.75)	-0.478*** (-3.03)	-0.492*** (-3.00)	-0.801* (-1.99)	-0.710*** (-3.11)
OMT windfall gain*PostOMT*Undercap	-0.426*** (-2.94)	-0.451*** (-2.87)	-0.407*** (-2.86)	-0.407*** (-3.39)	-0.745*** (-3.26)	-0.699*** (-3.60)
OMT windfall gain*PostOMT*Undercap*Zombie	0.782** (2.08)	0.783*** (3.74)	0.731** (2.58)	0.762*** (3.04)	1.024** (2.21)	1.027** (2.84)
R^2	0.011	0.144	0.692	0.703	0.644	0.754
N	9040	9040	9040	9040	9040	3102
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 reproduces the results of Table 5 for both zombie classifications (Amadeus and Dealscan) restricting the sample to term loans. 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 A5: LOAN VOLUME REGRESSIONS - MORAL SUASION (DEALSCAN BENCHMARK)

Panel A: Excluding Firms with positive Government Ownership						
	(1)	(2)	(3)	(4)	(5)	(6)
	ΔLoans	ΔLoans	ΔLoans	ΔLoans	Loan Inc.	ΔLoans
	All Banks	All Banks	All Banks	All Banks	All Banks	GIIPS Banks
OMT windfall gain*PostOMT	0.420*** (4.02)	0.435*** (3.71)	0.397*** (3.27)	0.425*** (3.35)	0.696*** (3.15)	0.682** (1.99)
OMT windfall gain*PostOMT*Zombie	-0.516** (-2.42)	-0.560** (-2.37)	-0.475*** (-4.61)	-0.553*** (-3.37)	-0.843** (-2.14)	-0.704** (-2.33)
OMT windfall gain*PostOMT*Still Undercap	-0.439 (-1.67)	-0.494* (-1.72)	-0.459*** (-2.84)	-0.466*** (-2.83)	-0.699*** (-3.62)	-0.686* (-2.01)
OMT windfall gain*PostOMT*Still Undercap*Zombie	0.763*** (3.26)	0.720*** (3.08)	0.785*** (5.80)	0.758*** (4.09)	1.138** (2.60)	1.084** (2.42)
R^2	0.010	0.113	0.727	0.759	0.690	0.838
N	13117	13117	13117	13117	13117	4116
Panel B: Horse Race between Still Undercap. and Government Ownership						
OMT windfall gain*PostOMT	0.412*** (3.89)	0.435*** (3.96)	0.407*** (3.45)	0.445*** (3.70)	0.750*** (5.41)	0.735** (2.02)
OMT windfall gain*PostOMT*Zombie	-0.450** (-2.34)	-0.515*** (-2.85)	-0.446*** (-3.89)	-0.410*** (-4.11)	-0.568*** (-2.99)	-1.238*** (-5.47)
OMT windfall gain*PostOMT*Still Undercap	-0.413** (-2.22)	-0.471** (-2.36)	-0.452*** (-3.39)	-0.439*** (-3.72)	-0.740*** (-6.45)	-0.618* (-2.06)
OMT windfall gain*PostOMT*Still Undercap*Zombie	0.704*** (3.04)	0.754*** (3.61)	0.687*** (4.37)	0.692*** (4.66)	1.019*** (3.61)	1.124*** (4.94)
OMT windfall gain*PostOMT*High Gov. Own.	-0.107 (-1.49)	-0.143 (-1.66)	-0.035 (-0.80)	-0.056 (-1.25)	0.049 (0.59)	-0.038 (-0.80)
OMT windfall gain*PostOMT*High Gov. Own.*Zombie	0.068 (1.25)	0.133 (1.28)	0.002 (0.05)	0.117 (1.28)	-0.046 (-0.60)	0.063 (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 A5 reproduces the results of Table 6 for the zombie classifications that uses information in Dealscan to calculate benchmark interest rates. 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 A6: LOAN VOLUME REGRESSIONS - CDS RETURN

Panel A: Intensive Margin - All Firms						
	(1)	(2)	(3)	(4)	(5)	(6)
	Δ Loans	Δ Loans	Δ Loans	Δ Loans	Loan Inc.	Δ Loans
	All Banks	All Banks	All Banks	All Banks	All Banks	GIIPS Banks
CDS Return*PostOMT	0.046*** (4.89)	0.057*** (4.51)	0.040** (2.47)	0.041** (2.07)	0.039** (2.71)	0.057** (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: Extensive Margin - All Firms						
	New Loan	New Loan	New Loan	New Loan		New Loan
CDS Return*PostOMT	-0.002 (-0.02)	-0.002 (-0.02)	-0.042 (-0.58)	-0.042 (-0.56)		-0.099 (-0.87)
R^2	0.006	0.079	0.674	0.700		0.818
N	23174	23174	23174	23174		6725
Panel C: Intensive Margin - Quality Split						
	Δ Loans	Δ Loans	Δ Loans	Δ Loans	Loan Inc.	Δ Loans
CDS Return*PostOMT	0.008 (0.79)	0.018 (1.39)	-0.011 (-1.06)	-0.015 (-1.27)	-0.013 (-0.40)	0.038 (0.96)
CDS Return*PostOMT*Low-IC	0.063*** (5.03)	0.064*** (3.97)	0.064*** (3.00)	0.070*** (3.57)	0.094** (2.02)	0.073** (1.97)
R^2	0.013	0.102	0.639	0.680	0.632	0.887
N	10023	10023	10023	10023	10023	3700
Panel D: Extensive Margin - Quality Split						
	New Loan	New Loan	New Loan	New Loan		New Loan
CDS Return*PostOMT	0.053 (0.63)	-0.022 (-0.23)	0.000 (0.00)	-0.044 (-0.33)		-0.188 (-1.40)
CDS Return*PostOMT*Low-IC	-0.103 (-1.32)	0.038 (0.39)	-0.080 (-1.17)	0.003 (0.02)		0.109 (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 A6 presents the results of a modified Khwaja and Mian (2008) bank lending channel regression as in Table 3. A firm is classified as high-IC (low-IC) ratio firm if its 2009-2011 median IC ratio is above (below) the country-specific 2009-2011 median IC ratio. *CDS Return* is the CDS return of a bank on the three OMT announcement dates (July 26, August 2, and September 6, 2012). *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 A7: LOAN VOLUME REGRESSIONS - ZOMBIE LENDING

Panel A: Zombie Amadeus Benchmark						
	(1)	(2)	(3)	(4)	(5)	(6)
	ΔLoans	ΔLoans	ΔLoans	ΔLoans	Loan Inc.	ΔLoans
	All banks	All banks	All banks	All banks	All banks	GIIPS banks
CDS Return*PostOMT	0.065*** (4.57)	0.066*** (4.07)	0.056** (2.45)	0.059** (2.31)	0.083** (2.53)	0.077* (2.18)
CDS Return*PostOMT*Zombie	-0.085*** (-2.94)	-0.073** (-2.32)	-0.071*** (-3.13)	-0.091* (-1.83)	-0.088*** (-2.94)	-0.091** (-2.51)
CDS Return*PostOMT*Still Undercap	-0.069*** (-4.91)	-0.074*** (-4.95)	-0.067*** (-3.36)	-0.072*** (-3.22)	-0.089*** (-3.14)	-0.080*** (-2.77)
CDS Return*PostOMT*Still Undercap*Zombie	0.123** (2.34)	0.122*** (4.87)	0.135*** (3.78)	0.139** (2.19)	0.140** (2.65)	0.152** (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*** (3.19)	0.065*** (2.88)	0.056** (2.45)	0.059** (2.37)	0.105*** (3.60)	0.085* (2.05)
CDS Return*PostOMT*Zombie	-0.075** (-2.23)	-0.074** (-2.11)	-0.100** (-2.55)	-0.070** (-2.29)	-0.122** (-2.30)	-0.089* (-1.81)
CDS Return*PostOMT*Still Undercap	-0.069*** (-3.88)	-0.077*** (-4.05)	-0.061*** (-3.17)	-0.070*** (-3.25)	-0.095*** (-3.69)	-0.099*** (-3.28)
CDS Return*PostOMT*Still Undercap*Zombie	0.138*** (2.81)	0.146*** (3.73)	0.134*** (3.50)	0.132*** (3.06)	0.184** (2.10)	0.169** (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 A7 presents the results of a modified Khwaja and Mian (2008) bank lending channel regression as in Table 3. 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 zombie or non-zombie firms. For the definition of a zombie firm see Figure 3. We present these results for the two alternative zombie classifications which use information from either Amadeus or Dealscan to calculate benchmark interest rates. *CDS Return* is the CDS return of a bank on the three OMT announcement dates (July 26, August 2, and September 6, 2012). *PostOMT* is an indicator variable equal to one starting in quarter four of 2012, and zero before. *Still Undercap* is a dummy variable that equals one if banks have an above sample median leverage ratio after the OMT announcement. 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 A8: FINANCIAL AND REAL EFFECTS - ALL FIRMS

Panel A: Industry-Country-Year Fixed Effects						
	(1)	(2)	(3)	(4)	(5)	(6)
	ΔCash	ΔDebt	$\Delta\text{Debt}-\Delta\text{Cash}$	Emp. Growth	CAPX	ROA
Indirect OMT windfall gain*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 gain*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 gain*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 A8 reproduces the results of Table 7, Panel A for different sets of fixed effects. 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. Firm control variables include the logarithm of total assets, leverage, tangibility, IC 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 A9: INDUSTRY PRODUCTIVITY GROWTH

	(1)	(2)	(3)	(4)
	Δ Productivity	Δ Productivity	Δ Productivity	Δ Productivity
Δ Fraction Zombie Firms	-0.011*** (-2.70)	-0.012*** (-2.90)	-0.008** (-2.07)	-0.010** (-2.42)
R^2	0.017	0.071	0.249	0.303
N	545	545	545	545
Country Fixed Effects	NO	YES	NO	YES
Industry Fixed Effects	NO	NO	YES	YES

Table A9 presents results of cross-sectional regressions at the country-industry level. The dependent variable is the change in the average productivity from the pre-OMT period (2009-2011) to the post-OMT period (2012-2015). The explanatory variable is the change in the fraction of zombie firms in an industry from the pre-OMT period (2009-2011) to the post-OMT period (2012-2015). t -statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table A10: BANKS

Bank	OMT windfall gain
ABN AMRO Bank NV	-0.10
BNP Paribas SA	1.47
BPCE	0.99
Banca Monte dei Paschi di Siena SpA	17.73
Banco BPI SA	13.47
Banco Bilbao Vizcaya Argentaria SA	8.89
Banco Comercial Portugues SA	5.27
Banco Espirito Santo SA	3.06
Banco Popolare Societa Cooperativa Scrl	7.65
Banco Santander SA	5.31
Banque et Caisse d'Epargne	2.27
Barclays	0.22
BayernLB	0.36
Caixa Geral de Depositos SA	5.11
Commerzbank AG	3.16
Credit Agricole Corporate Investment Bank SA	0.98
DNB	0.10
DZ Bank AG	3.38
Danske Bank A/S	0.06
DekaBank Deutsche Girozentrale	0.32
Deutsche Bank AG	0.60
Erste Bank AG	0.22
Grupo Banco Popular	9.77
HRE Group	7.52
HSBC Banking Group	0.18
HSH Nordbank AG	1.20
ING Group	0.73
Intesa Sanpaolo SpA	7.22
Jyske Bank	0.20
KBC Group	2.61
La Caixa	7.11
Landesbank Baden-Wuerttemberg	3.67
Landesbank Berlin AG	1.74
Landesbank Hessen-Thuringen GZ	1.55
Lloyds Banking Group Plc	-0.55
NordLB Group	2.09
Nordea Bank AB	0.11
Powszechna Bank S.A.	0.10
Pohjola Bank Plc	0.13
Rabobank	-0.15
Raiffeisen Bank International AG	0.13
Royal Bank of Scotland Plc	0.13
SEB Merchant Banking AB	-0.19
Societe Generale SA	0.67
Svenska Handelsbanken AB	-0.11
Swedbank AB	-0.07
UniCredit	4.23
Unione di Banche Italiane ScpA	8.47
Westdeutsche Genossenschafts-Zentralbank eG	5.27

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