Whatever It Takes: The Real Effects of Unconventional Monetary Policy*

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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 an increase in government bond yields for countries in the European periphery that was 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 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 (see Altavilla et al., 2014; Krishnamurthy et al., 2014; Szczerbowicz et al., 2015). 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 is still no conclusive evidence why the regained financial stability of the European banking sector did not result in a robust economic recovery. In this paper, we analyze the impact of the OMT program on bank health and bank lending and, ultimately, its effect on the real economy through the bank lending channel.

To the best of our knowledge, our paper is the first to provide systematic evidence that the slow economic recovery in Europe can be at least partially explained by zombie lending of banks that regained some lending capacity post-OMT (lower bank run risk freed up liquidity for lending) but which still remained weakly-capitalized after the OMT announcement. 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.

We find that from all loans extended to the European firms in our sample in the post-OMT period, roughly 8% were zombie loans, i.e., loans to unproductive low-quality firms at very advantageous interest rates, which 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, Spain, and Portugal.

This zombie lending led to an inefficient allocation of bank loans, since loan supply was shifted away from creditworthy productive firms towards less productive, distressed borrowers. This supply shift distorted market competition and caused detrimental effects on employment, investment, and growth. 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.

For our analysis, we obtain bank-firm relationships from Thomson Reuters DealScan, firm-specific information from the Amadeus database, and bank-specific information from various sources, including banks' CDS spreads, balance sheet information, and detailed data about their sovereign debt holdings from the European Banking Authority (EBA). The sample includes all publicly listed and 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 OMT announcement. Second, we track the resulting change in their lending behavior. Third, we evaluate whether the change in loan supply led to financial and real effects for European 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 that this improved their equity capitalization and liquidity. The resulting improvement in bank health led to an increased loan supply. By exploiting multiple bank-firm relationships to control for borrower specific factors (similar to 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. 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 borrowers based on the ability of firms to service existing debt, i.e., their EBIT interest coverage ratio (IC). Our results show that the increase in loan supply was mainly targeted towards low-quality borrowers. Moreover, we only find a significant relationship between a bank's windfall gains and its propensity to extend loans to low-quality borrowers with whom it has a pre-existing lending relationship (intensive margin), and not to new borrowers (extensive margin).

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.[1] 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 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 assets ratio jumps from about 1.2%-1.3% pre-OMT to 2% post-OMT, this measure decreases from 1.2% to 0.25% 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

[1]Take 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.

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 zombie lending occurs only to domestic firms. However, we do not find evidence for any of these hypotheses, which suggests that the banks' zombie lending 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).[2] Our results show that non-zombie firms connected to banks that benefited from the OMT announcement 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

[2]To consistently estimate the real effects, we include industry-country-year fixed effects to capture any time-varying industry shocks in a given country.

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 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 15.5% of zombie firms in our sample had defaulted compared to only 7.5% of non-zombie firms.

Our results also indicate that zombie lending seems to have led to losses for banks engaging in zombie lending based on our syndicated loan data not only in the syndicated loan market, but across all loan categories (loans to SMEs, etc.). In particular, for these banks, 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.

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., 7pp) invest 12.5% of capital less and had 4.5% 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 18pp, imply-

ing that non-zombie firms invested 32% of capital less and had 14.4% 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.

On a broader scale, the OMT announcement is an interesting testing ground to study the effects of an indirect bank recapitalization program or, more generally, the impact of a positive shock on the banks' equity capital and the influence of their post-shock capitalization on their lending behavior and the attendant consequences for the real economy. In particular, European authorities refrained from implementing a large scale targeted recapitalization program and instead relied on the indirect (non-tailored) recapitalization effect of the OMT announcement to revive the European banking system. This led to a large heterogeneity in terms of the size of the positive shock on the banks' equity capital and their ex-post capitalization.[3]

Our results highlight that central banks need to pay close attention to the magnitude of a recapitalization measure. In general, if banks are being provided additional equity this has a positive impact on their loan supply. However, if the measure 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.

Our finding that the recapitalization magnitude and the banks' ex-post capitalization has an important influence on their lending behavior contributes to the understanding of why the evidence provided by the existing literature on the impact on recapitalization programs is extremely mixed and often conflicting.[4] Regarding the effect of the U.S. Troubled Asset Relief Program (TARP) on lending, Li (2013) and Berger et al. (2016b) find that TARP banks expanded their credit supply, Lin et al. (2014) find a decline in

[3]In addition to the OMT program, the ECB injected massive amounts of liquidity into the banking sector through measures like the longer-term refinancing operations (LTRO) programs.

[4]While the empirical evidence on the effect of bank recapitalizations on loan supply is mixed, studies that analyze the impact of capital regulation on loan supply show consistently that higher capital requirements lead to a lending reduction (see Aiyar et al., 2014a; Aiyar et al., 2014b; Aiyar et al., 2016; Gropp et al. (2016); and Peydro et al., 2017).

lending, while Duchin and Sosyura (2014) and Bassett et al. (2017) do not find evidence that TARP affected the loan supply. Black and Hazelwood (2013) find mixed results depending on bank size, i.e., a loan volume decrease for large TARP banks and no significant change for small TARP banks.[5]

Using German data from 1999 to 2009, Berger et al. (2016a) find evidence that capital support leads to a decline in lending and a reduction in risk-taking. For an international sample, Brei et al. (2013) find that bank recapitalization leads to an increase in loan supply, but only if a rescued bank's capitalization exceeds a certain threshold. This finding is also consistent with what Japanese regulators experienced during their fight against the banking crisis in the 1990s and early 2000s, when poorly capitalized banks evergreened loans to insolvent firms (Peek and Rosengren, 2005; Watanabe, 2010; Giannetti and Simonov 2013) which led to a missallocation of loans and a long stagnation (Caballero et al., 2008).[6]

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.[7] 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,

[5]Regarding the effect of TARP on credit risk, Duchin and Sosyura (2014) and Berger et al. (2016b) find that TARP banks granted riskier loans post-bailout, while Li (2013) finds no change in loan quality. Black and Hazelwood (2013) find an increase in credit risk for large TARP banks and a decrease for small TARP banks.

[6]See Kane (1989) for such evidence in the context of the savings and loans debacle in the U.S.

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

sovereign bond information from Datastream, bank level balance sheet data from SNL, and data on the sovereign debt holdings of banks from the European Banking Authority (EBA). For banks to be included in the sample, they must act as lead arranger in the syndicated loan market during our sample period. We identify the lead arranger according to definitions provided by Standard & Poor's, which for the European loan market are stated in Standard & Poor's Guide to the European loan market (2010). Therefore, we classify a bank as a lead arranger if its role is either "mandated lead arranger", "mandated arranger", or "bookrunner". Moreover, the banks need to be included in the capital exercise conducted by the EBA in June 2012, which is the closed elicitation of the banks' portfolio structure prior to the OMT announcement in July 2012. 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.[8]

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

[8]For 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.

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) and Acharya et al. (2015b) document significantly positive effects on banks' equity prices after the OMT announcement.

To formally estimate the impact of the OMT announcement on the banks' capitalization, we use information on their sovereign debt holdings provided by the EBA and the changes in sovereign bond prices to construct a variable called *OMT windfall gain* that measures how much a bank's equity capital increased due to the OMT announcement. In particular, we compile data on the complete breakdown of 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.[9] We then 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.[10] Next, 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), i.e., we define the windfall gains of bank b as:

$$OMT\ windfall\ gain_b = \frac{\Delta\, Value\ EU\ Sov.\ Debt_b}{Total\ Equity_b}. \tag{1}$$

[9]As Krishnamurthy et al. (2014), we are not able to use sovereign yields from Greece and Ireland since for these countries information on yields is partially or completely missing. Hence, we are not able to calculate the *OMT windfall gain* for Greek and Irish banks since the majority of sovereign debt holdings of banks incorporated in GIIPS countries (GIIPS banks) is domestic.

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

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.[11] 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).[12]

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 their CDS spread decreased on average by 96bp over the three OMT announcement dates, while it only decreased on average by 23bp for non-GIIPS banks.[13]

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. 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*.[14]

Next, we investigate whether banks became uniformly well-capitalized as a result of the backdoor recapitalization. Panel B of Table 1 presents the evolution of the banks'

[11]These 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.

[12]The difference in pre-OMT GIIPS sovereign holdings between GIIPS and non-GIIPS banks can be explained by the home bias of the banks' sovereign bond holdings (e.g., Acharya and Steffen, 2015).

[13]Consistent 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.

[14]The 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.

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 are less than 2% above the regulatory capital threshold (i.e., at least 9% Tier 1 capital to risk-weighted assets ratio) in mid 2012, which we call *weakly-capitalized*, and those with a capital buffer of at least 2% above the minimum requirement (*well-capitalized*). Results are robust to using other cutoff points as 1.5% or 2.5%.

Before the start of the financial and sovereign debt crisis (Column *pre-crisis*), both well-capitalized and weakly-capitalized 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 weakly-capitalized (peaking in the year prior to the OMT announcement at 24.29) and increased slightly for well-capitalized high-gain banks over the sovereign debt crisis period (see Column *Crisis/pre-OMT*).

Importantly, while the leverage ratio of weakly-capitalized high-gain banks improved after the OMT announcement, these banks still remained highly leveraged post-OMT. Well-capitalized high-gain banks, on the other hand, are below 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 weakly-capitalized banks) during the crisis, their quasi-leverage ratio post-OMT is seven times higher than the quasi-leverage ratio of U.S. banks. Therefore, although the OMT announcement increased the banks' equity capitalization (and raised most banks above the regulatory minimum of 9%), some banks still remained weakly-capitalized post-OMT as they still had a very high "risk unweighted" leverage ratio and a high market leverage.[15]

In addition to the positive impact on the banks' equity capitalization, the OMT

[15]This can be explained by the fact that banks met this requirement mainly by reducing their risk-weighted assets (not total assets), instead of increasing their equity capital (see Gropp et al., 2016).

announcement also positively affected the banks' liquidity. First, the OMT announcement 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 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

[16]In 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.

[17]Between 20% to 50% of bank deposits are held overnight and could thus be withdrawn at short notice. For example, British customers withdrew 200 million pounds the day after the 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 suggests 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 first two criteria are motivated by the fact that firms in a particular industry and country share many characteristics and were thus affected similarly by macroeconomic developments. Forming clusters based on ratings follows from studies that shows that credit quality is an important driver for 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 after Q3 2012 by banks that strongly benefited from the OMT announcement. In contrast,

[18]Since 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.

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:

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

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

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

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 1-3), which control for different sets of fixed effects. Column (1) shows the regression results for the case in which we include firm-cluster-time fixed effects, which allow us to control for any time observed and unobserved time-varying characteristics that are shared by firms in the same cluster. Moreover, we add bank fixed effects and time varying bank control variables. In Column (2), we additionally 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. The coefficient suggests that a one standard deviation higher *OMT windfall gain* led to a 1.5% increase in loan volume at the intensive margin.

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. Column (3) of Table 3, Panel A confirms that our results are robust to using this alternative measure of lending supply expansion. Finally, Column (4) of Table 3 estimates the regression for the case in which we restrict our sample to GIIPS banks. Recall that GIIPS banks had large GIIPS sovereign debt exposures, which implies that especially these banks benefited from the OMT program announcement. The significant coefficient in Column (4) 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.

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.

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. This reclassification 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 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).

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 Amadeus (denoted with index A). 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

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

[20]As 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.

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, we use two different approaches to derive the relevant benchmark rate for a given firm.

First, the interest rate benchmark, r^A_{tmh}, is calculated using the median interest rate paid by public firms incorporated in the same two digit SIC code industry h in non-GIIPS countries with a AAA rating (inferred from ICs) in a given year t, split according to their reliance on short versus long-term debt (i.e., $m \in \{s, l\}$ with s for short-term and l for long-term). Second, in a more conservative approach, the interest rate benchmark, r^A_{tm}, is calculated using the median interest rate paid by public firms incorporated in non-GIIPS countries with a AAA rating (inferred from ICs) in a given year, split according to their reliance on short versus long-term debt.

Given these benchmark, we calculate the thresholds $R^{A^*_h}_{ijht}$ (industry-specific benchmark) and $R^{A^*}_{ijht}$ (unique benchmark across all industries) below which the interest payment of firm i in country j and industry h in year t is considered subsidized as

$$R^{A^*_h}_{ijht} = r^A_{tmh} \cdot Debt_{ijht}, \tag{4}$$

and

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

where we also split the firms into two groups based on their reliance on short- versus long-term debt. Panel A of Figure 3 plots the evolution of the average of the two benchmark interest rates calculated from Amadeus (industry-specific vs. unique benchmark) over time, as well as the median interest payment of zombie firms based on the different benchmarks.

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

$$x_{ijht}^{A_h^*} = R_{ijht} - R_{ijht}^{A_h^*}, \tag{6}$$

and

$$x_{ijht}^{A^*} = R_{ijht} - R_{ijht}^{A^*}. \tag{7}$$

In an alternative approach, we calculate the benchmark interest rate 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 $m \in \{s, l\}$. 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

$$R_{ijht}^{D^*} = \sum_m r_{tm}^D \cdot Debt_{ijhtm}, \tag{8}$$

where we split a firm's total debt $Debt_{ijht}$ into short ($m = s$) and long-term ($m = l$) debt. Unfortunately, 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 in DealScan is missing for more than 50% of the non-benchmark firms in our sample. Therefore, we compare both benchmark interest expenses (from DealScan and Amadeus) to the firms' interest expense information derived from Amadeus.

Note that we are not able to derive an industry-specific benchmark from DealScan, as we are not able to find a loan to a AAA rated company for every period and every two digit SIC code industry.[21] All results are qualitatively and quantitatively similar using this alternative benchmark. To preserve space and given that results are quantitatively and qualitatively similar for this alternative benchmark, we will only present results for the Amadeus benchmark.

In our baseline classification, firm i is classified as zombie if it meets the following three criteria: (i) x_{ijht}^{A*} 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, i.e., 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 quality (i.e., high-IC) 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.

Besides using the industry-specific benchmark interest rate to classify firms as zombie (labeled Z01) and our baseline classification with the unique instead of the industry-specific benchmark (Z02), we employ various additional zombie definitions which are summarized in Table 4.

First, we drop all criteria except criteria (i), i.e., we classify a firm as zombie only based on its interest rate being below the benchmark and do not impose restrictions on the quality of the firm (other than excluding firms that are used to derive the benchmark from the possible zombie candidates) or the syndicate composition (Z03).

Moreover, instead of these crisp zombie definitions, which classify a firm as a 100% zombie if x_{ijht}^{A*} is negative, and as a 100% non-zombie else, we follow Caballero et al. (2008)

[21]Since 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).

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

and create fuzzy zombie measures. Under these definitions, a firm can be a zombie "to a certain degree". To define the degree of zombiness of a firm we use a membership function of the following form

$$z(x, d_1, d_2) = \begin{cases} 1 & \text{if } x < d_1 \\ \frac{d_2 - x}{d_2 - d_1} & \text{if } d_1 \leq x \leq d_2 \\ 0 & \text{if } x > d2 \end{cases} \tag{9}$$

For each of the three zombie definitions (Z01 - Z03), we use two different cutoff points for the interest rate gap: (-25bp; +75bp) for Z04 to Z06, and (0bp; +50bp) for Z07 to Z09. Hence, under the first cutoff point, any firm with an interest rate of 25bp or more below the threshold is classified as 100% zombie. Conversely, a firm which pays at least 75bp more than the benchmark interest rate is a 100% non-zombie. Firms with interest payments in a range of -25bp to +75bp around the benchmark interest rates are partial zombies. A firm with exceeding the benchmark rate by 25bp would thus be a 50% zombie. In what follows we will solely report results for the zombie definitions Z01 - Z03 as the results for the remaining definitions are qualitatively and quantitatively similar.

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

[23] "Feltrinelli, contratti di solidarieta per 1.370 dipendenti del gruppo", *La Repubblica*, May 3, 2013.

for the crisp zombie definitions (Z01 -Z03, Panel A) and three fuzzy zombie definitions (Z04 - Z06, Panel B), 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. Moreover, it shows the increase is much more pronounced when using an industry-specific benchmark rather than an overall benchmark across all industries. Conversely, the evolution of the asset weighted zombie fraction is very similar, independent of whether we apply the additional restriction that a zombie firm must have a low IC or not. This suggests that misclassification when focusing only on the interest rate as criterion for a zombie firm seems to be rather low.

Importantly, as shown in Panel B of Figure 3, firms that became a zombie for the first time after the OMT announcement, and thus firms that contributed to the significant increase in the fraction of zombie firms, paid significantly higher interest rates (around 1-4pp above the threshold) before the OMT announcement. Hence, these firms did not always receive subsidized loans, mitigating concerns that some time-invariant fundamentals of these firms allow them to pay very low interest rates on their debt in general.

Table 5 presents a breakdown of the number of zombie firms by country for the crisp zombie classifications Z01 - Z03. Indeed, our baseline zombie definition Z02 seems to be the most conservative one, as it identifies the fewest firms as zombies. Moreover, the table documents that the zombie problem is particularly severe in the periphery of Europe, with Spain and Italy having around 18% to 20% of zombie firms, while Germany, France, and the UK only have between 7% and 12% of zombie firms. While omitting the quality criterion in the zombie definition (Z03) only leads to a moderate increase in the number of zombie firms in a given country, employing an industry-specific benchmark makes the number of firms classified as zombies significantly larger.[24]

Furthermore, Table 5, Panels B-D compare the characteristics of zombie firms to non-zombie firms for each of the three crisp zombie definitions. On average, zombie firms have

[24]The zombie prevalence by country in our sample is also in line with anecdotal evidence from the financial press which stated that "the zombie problem is chiefly focused in the peripheries of Europe rather than the core." See "Companies: The rise of the zombie" by Michael Stothard, Financial Times, January 8, 2013.

a significantly higher leverage, and lower net worth and profitability (EBITDA/Assets) ratios. More importantly, zombie firms only have an IC ratio of 0.2 to 0.4 (depending on the definition) as opposed to roughly 1.8 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.

Interestingly, Panel E of Table 5 shows that, relative to the most conservative zombie definition (Z02), firms that are additionally classified as zombies according to Z01 (i.e., with an industry-specific benchmark) are significantly better (although still worse than the average low-quality non-zombie firm) than firms classified as zombie using a single benchmark for all firms.[25]

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 5, Panel B to D). 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.[26] 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 weakly-capitalized banks depending on whether they were within 2% of the regulatory capital threshold *after* the OMT announcement.

[25]Due to the low number of firms that are classified as zombie under Z03 but under Z02, a meaningful statistical analysis of their similarity cannot be conducted.

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

We start by investigating graphically how banks changed their lending behavior towards zombie firms post-OMT. As can be seen from Figure 5, Panels A and B, banks that regained some lending capacity due to their windfall gains from the OMT announcement (high-gain banks) but which still remained weakly-capitalized 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. This holds true irrespective of which criteria we use to classify firms as zombies. Panels C and D of Figure 5 shows that this significant increase in zombie loans as a fraction of total assets is mainly driven by weakly-capitalized banks located in GIIPS countries.

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

$$\begin{aligned}
\Delta Volume_{bmt+1} &= \beta_1 \cdot OMT\ windfall\ gain_b \cdot PostOMT_t \\
&+ \beta_2 \cdot OMT\ windfall\ gain_b \cdot PostOMT_t \cdot Weakly\text{-}Cap_b \\
&+ \beta_3 \cdot OMT\ windfall\ gain_b \cdot PostOMT_t \cdot Zombie_{mt} \\
&+ \beta_4 \cdot OMT\ windfall\ gain_b \cdot PostOMT_t \cdot Zombie_{mt} \cdot Weakly\text{-}Cap_b \\
&+ \gamma \cdot X_{bt} + Firm\ Cluster_m \cdot Quarter\text{-}Year_{t+1} \\
&+ Firm\ Cluster_m \cdot Bank_b + u_{bmt+1}. \qquad (10)
\end{aligned}$$

Note that we also control for all other pairwise and triple interaction terms if they are not absorbed by the fixed effects, but omit them in Eq. (10) 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. In our baseline specification, a bank is classified as weakly-capitalized if it

exceeds the regulatory capital ratio of 9% by at most 2%.

The results are presented in Table 6. 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 (2) a one standard deviation higher *OMT windfall gain* for well-capitalized banks implies an increase in loan supply by 2.6%. Banks that still remained weakly-capitalized, 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 6, Column (2), a one standard deviation higher *OMT windfall gain* for undercapitalized banks implies a 1.2% increase in loan supply to zombie firms. Given the additional interaction of banks' capital gains and their capitalization with an indicator for whether the cluster consists of zombie firms, in Column (3) we can add bank-time fixed effects to absorb any time varying bank characteristics that could drive our results. These fixed effects absorb all interactions terms without the zombie indicator. Our key result, that ex-post well capitalized banks significantly reduce lending to zombie firms, whereas still weakly-capitalzed banks significantly increase their loan volume to zombie firms continues to hold. We find similar results when we replace the change in loan volume with a dummy for whether the loan amount to a cluster actually increased (Column 4) or when we restrict the analysis to GIIPS banks (Column 5).

As a robustness check, we use two other measures of bank capitalization. First, instead of classifying banks into two categories (well- and weakly-capitalized), we employ a continuous measure of the capital buffer banks have above the regulatory threshold. To maintain the same sign of coefficients as in the previous table, we invert the capital buffer, such that a higher value means the bank is *closer* to the regulatory threshold. Results presented in Table A2 are qualititatively and quantitatively similar for all zombie definitions. More precisely, a bank at the 90th percentile of the capital buffer distribution (i.e., a bank with little slack to the regulatory constraint) increased its zombie lending volume by 1.6%.

Second, the EBA required banks to have a higher Tier 1 capital ratio as a buffer

for risky sovereign debt holdings. After adjusting for the riskiness of the sovereign debt holdings in the calculation of risk-weighted assets (which under the Basel regulation carry zero risk weights, i.e., are not included in the calculation of risk-weighted assets), banks still had to satisfy the 9% regulatory capital ratio. As a further robusntess check, we classify a bank as weakly-capitalized if it is within 2% of this adjusted regulatory threshold. Results continue to hold (see Table A3).

4.4 Moral Suasion

A potentially alternative explanation for our findings 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 engaged in zombie lending, whereas well-capitalized banks significantly reduced 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, weakly-capitalized 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 7 (Panel A) provides the results. Across all specifications, we find that only banks that still remained undercapitalized after the OMT announcement engaged 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 *domestic* low-IC ratio firms. To test this hypothesis we rerun our main regression limiting the analysis to the (small) subsample of non-GIIPS firms that receive funding from GIIPS banks. Acharya et al. (2015a) document that these bank relationships emerged primarily through pre-crisis bank M&A transactions, e.g., a German bank is taken over by an Italian bank and the German firm borrowing from the German bank before the M&A transaction is now borrowing from the Italian bank (the most prominent example is Unicredit taking over HypoVereinsbank). Given the stickiness of lending relationships in the syndicated loan market (Chodorow-Reich, 2014), these firms were not able to switch banks. Panel B of Table 7 shows that we obtain similar results when focusing on this subsample of firms and banks.

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 weakly-capitalized 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 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:

$$\textit{Indirect OMT windfall gain}_{ijht} = \frac{\sum_{l \in L_{ijht}} \textit{Average OMT windfall gain}_{lijh} \cdot \textit{Loan Amount}_{lijht}}{\textit{Total Loan Amount}_{ijht}}, \quad (11)$$

where L_{ijht} are all of the firm's loans outstanding at time t.[27]

We use five different measures for the financial and corporate policies of firms. In 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 (Δlog *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,

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

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. 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:

$$\begin{aligned} y_{ijht+1} &= \beta_1 \cdot \textit{Indirect OMT windfall gain}_{ijh} \cdot \textit{PostOMT}_t \\ &+ \gamma \cdot X_{ijht} + \textit{Firm}_{ijh} + \textit{Industry}_h \cdot \textit{Country}_j \cdot \textit{Year}_{t+1} + u_{ijht+1} \end{aligned} \tag{12}$$

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.[28] 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.

Results for the full sample are presented in Table 8, Panel A. The unit of observation is a firm-year. For ease of exposition, we only report the results for our key variable of

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

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 1.6pp. This result is further confirmed by the fact that we do not find any significant effects for the real variables. Neither employment nor investment or ROA (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.

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 8, 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 8, 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, Table 9 documents that zombie firms do not use the entirety of their new bank loans to build up cash reserves. 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

0.2-0.4, 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.[29] 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 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 10. 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

[29] As noted by the Financial Times, this raises the concern "[...] that these companies - which spend so much of their cash servicing interest payments that they are unable to invest in new equipment or future growth areas - could be at least partly to blame for the weak recovery in Europe, hogging resources that could go to more productive areas". See "Companies: The rise of the zombie" by Michael Stothard, Financial Times, January 8, 2013.

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. The right three panels of Figure 9 present cumulative default rates separately for zombie and non-zombie firms, while the left three panels 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 10 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).

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 *Log Sales-2/3*Empl.-1/3*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 A4. 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:

$$\begin{aligned} y_{ijht+1} &= \beta_1 \cdot \textit{Non-Zombie}_{ijht} + \beta_2 \cdot \textit{Non-Zombie}_{ijht} \cdot \textit{Fraction Zombies}_{jht} \\ &+ \gamma \cdot X_{ijht} + \textit{Firm}_{ijh} + \textit{Industry}_h \cdot \textit{Country}_j \cdot \textit{Year}_{t+1} + u_{ijht+1}, \end{aligned} \tag{13}$$

where $\textit{Fraction Zombies}_{jht}$ 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.[30]

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).[31]

Results for this regression analysis are presented in Table 11, 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.

[30]We 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.

[31]Note, 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.

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.

In our most conservative definition of zombie firms (Z02) the fraction of zombie firms increased by 7pp post-OMT. Considering the estimates in Column (2) of Table 11, this implies that non-zombie firms invest around 12.5% 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 18pp, implying that non-zombie firms invested around 32% of capital less due to the increase in the prevalence of zombie firms. When looking at employment growth (Column 3), we find that firms that experienced an increase of 7pp in the fraction of zombie firms in their industry had around 5.5% lower employment growth rates. Considering again the 95th percentile, we find that non-zombie firms in this industry had 14.4% lower employment growth rates.

Panels B and C of Table 11 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 13.6pp. As Panel B shows, given an average investment to capital rate of 9.48% in this sector, the rise in the fraction of zombie firms implies an investment loss of 24.4% or the equivalent of 2.6 years of investment. Similarly striking numbers can be found in the trade 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 10.8% in the construction industry and a loss of 7.8% in the trade 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 13 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 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".[32]

[32] "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

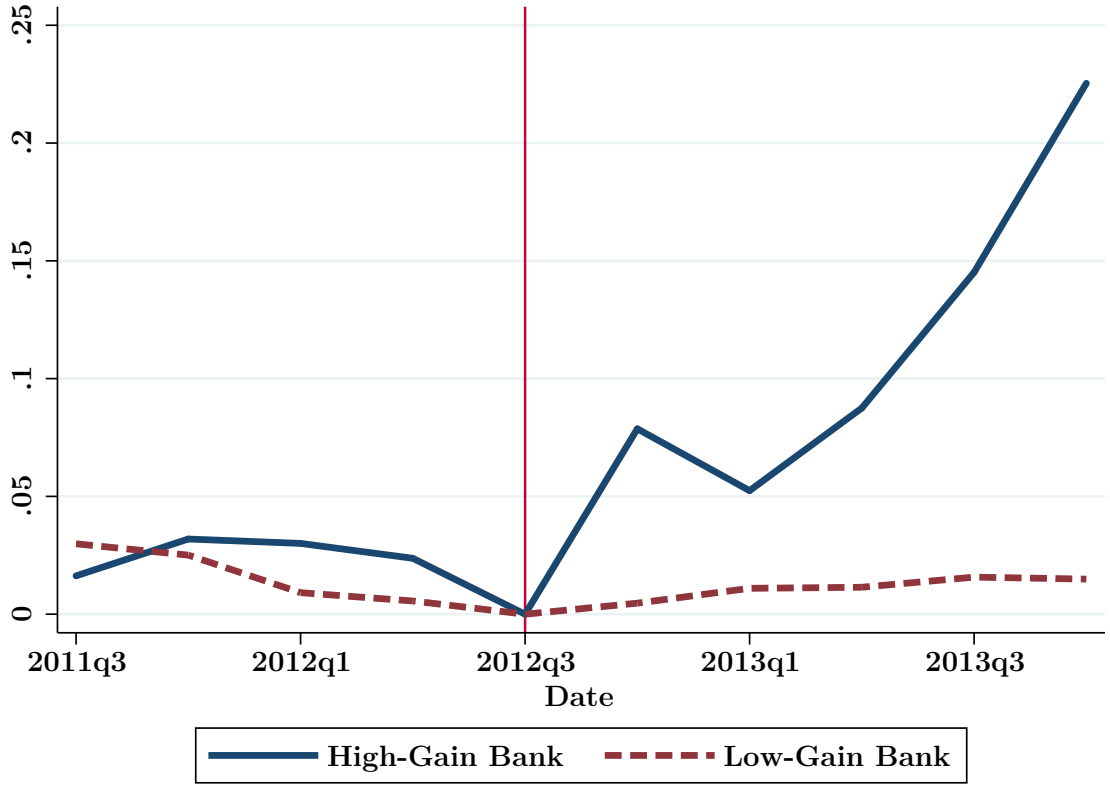


Figure 1 shows the log-ratio of total loans in a given quarter relative to the quarter of the OMT announcement, i.e., the y-axis is normalized to 0 at the time of the OMT announcement, controlling for firm-cluster fixed effects. For each quarter, we aggregate all loans to private firms borrowing from 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

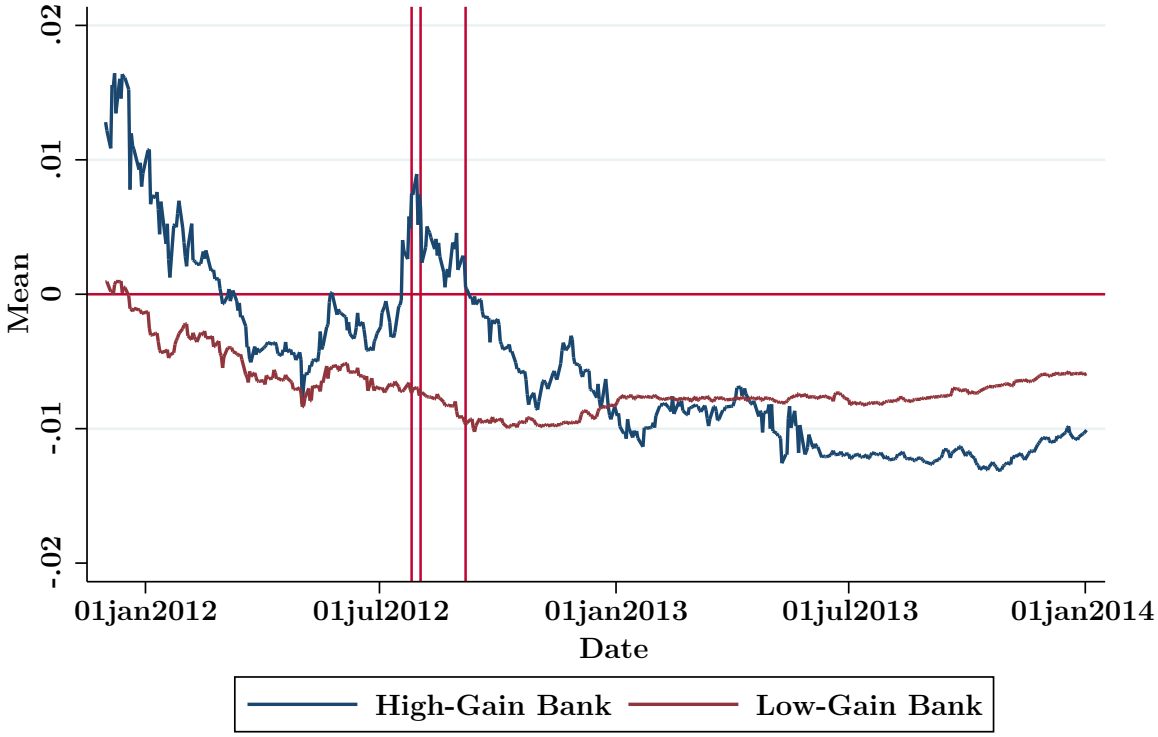
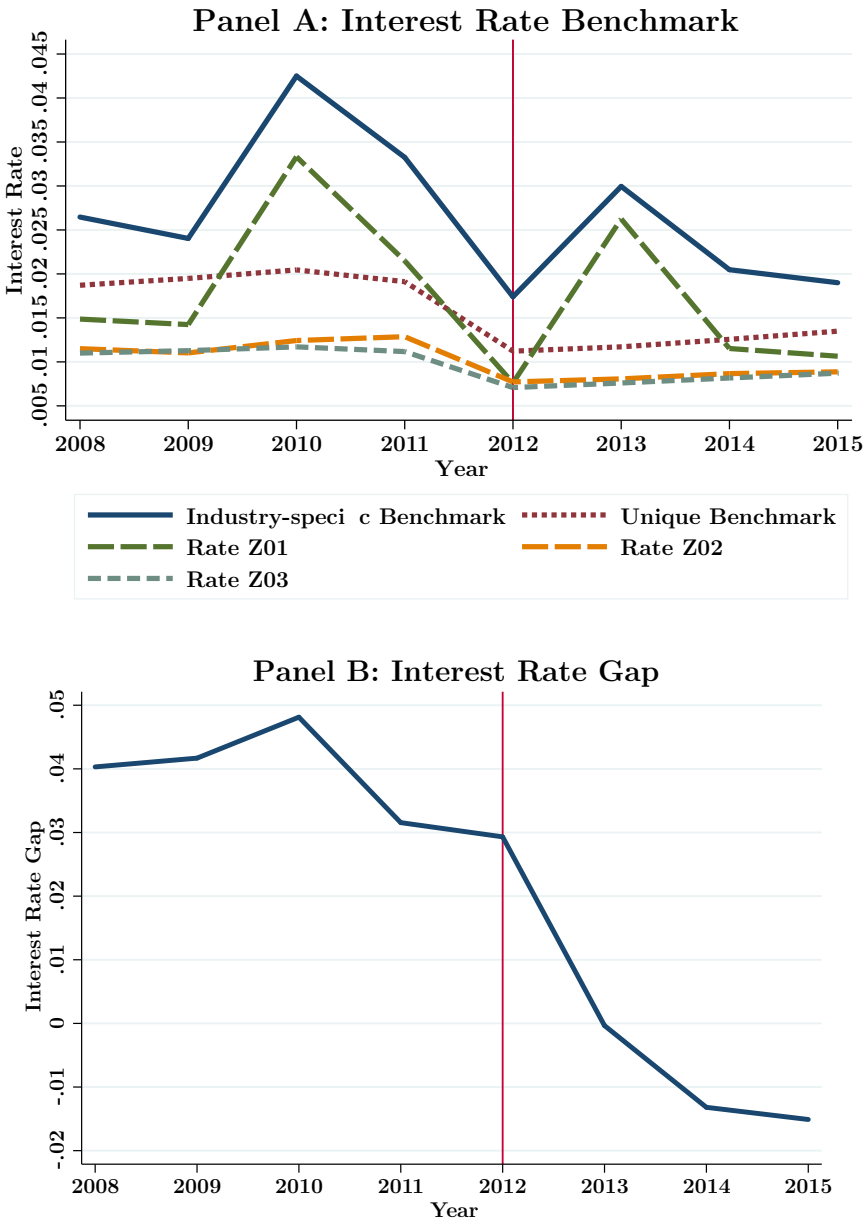


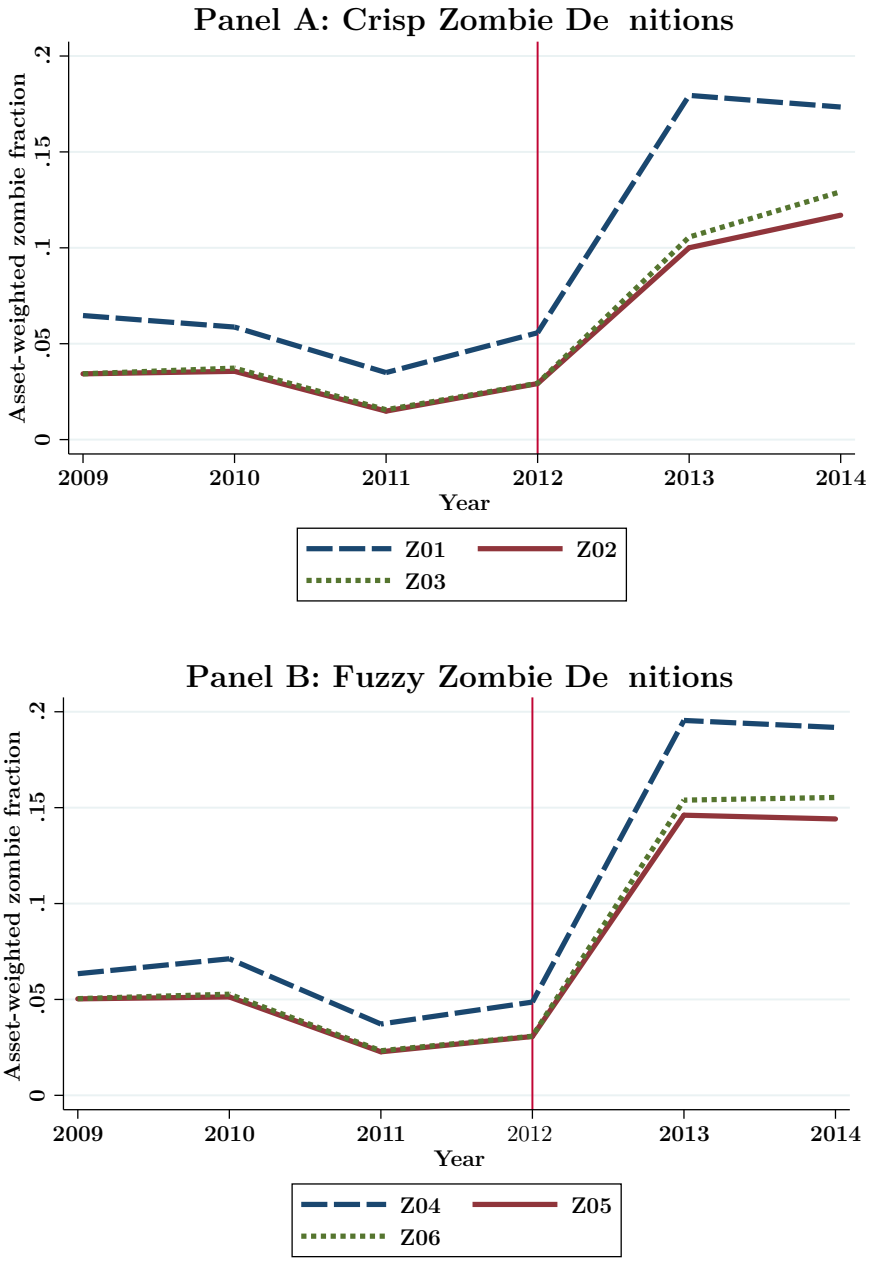
Figure 2 shows the evolution of the run index for high- and low-gain banks calculated following Veronesi and Zingales (2010). The run index is a proxy for the likelihood that a bank faces a bank run. A bank is classified as high-gain (low-gain) bank if its equity capital increase due to the OMT announcement 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



Panel A shows the benchmark interest rates when we use an industry-specific benchmark rate (blue solid line) and a unique benchmark rate across all industries (red dotted line). It also shows the average interest rate paid by firms that are classified according to our three crisp zombie definitions (Z01-Z03). Panel B shows the average interest rate gap for firms that become a zombie for the first time after the OMT announcement in 2012Q3, based on our crisp zombie definitions Z02 and Z03.

Figure 4: Fraction of zombie firms



Panel A shows the asset weighted fraction of zombie firms in our sample for our three crisp zombie definitions (Z01-Z03). Panel B shows the asset weighted fraction of zombie firms in our sample for three fuzzy zombie definitions (Z04-Z06).

Figure 5: Fraction of zombie loans

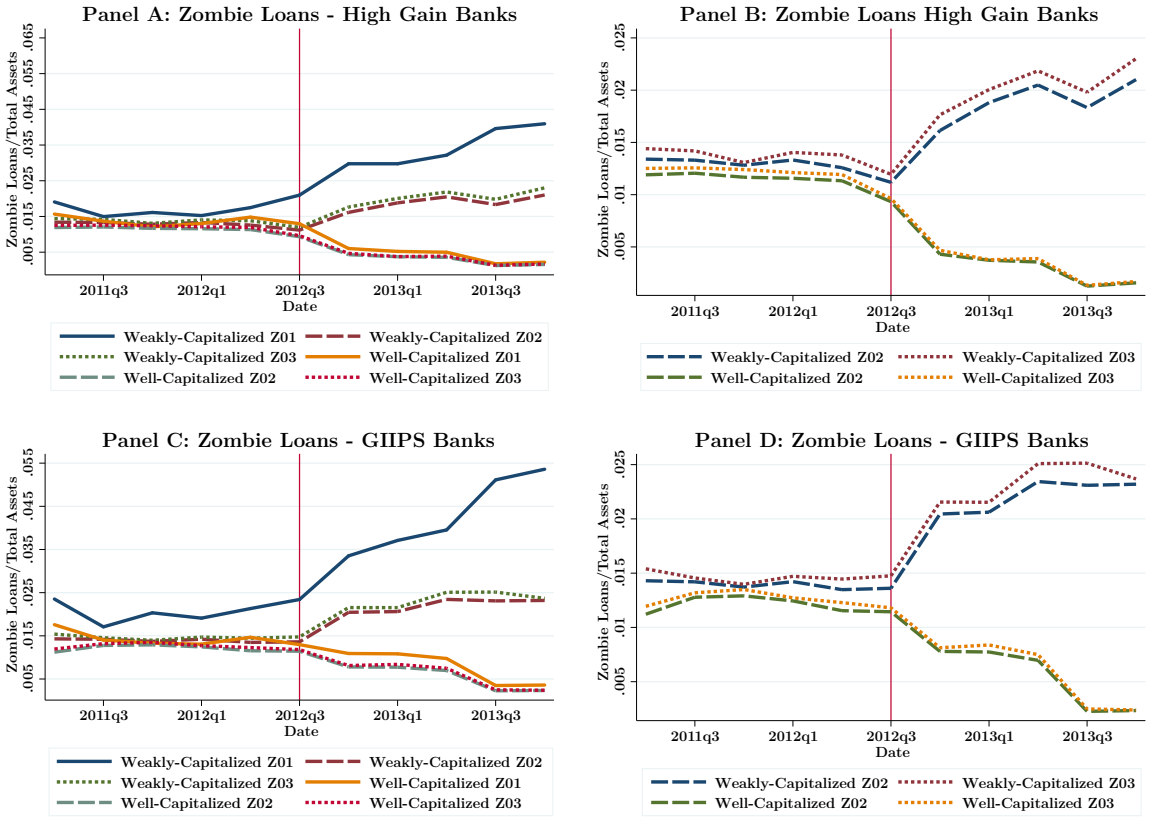


Figure 5 presents the ratio of zombie loans to total assets for the three crisp zombie definitions separately for the subsample of high-gain banks (Panels A and B), and GIIPS banks (Panels C and D).

Figure 6: Financial Effects

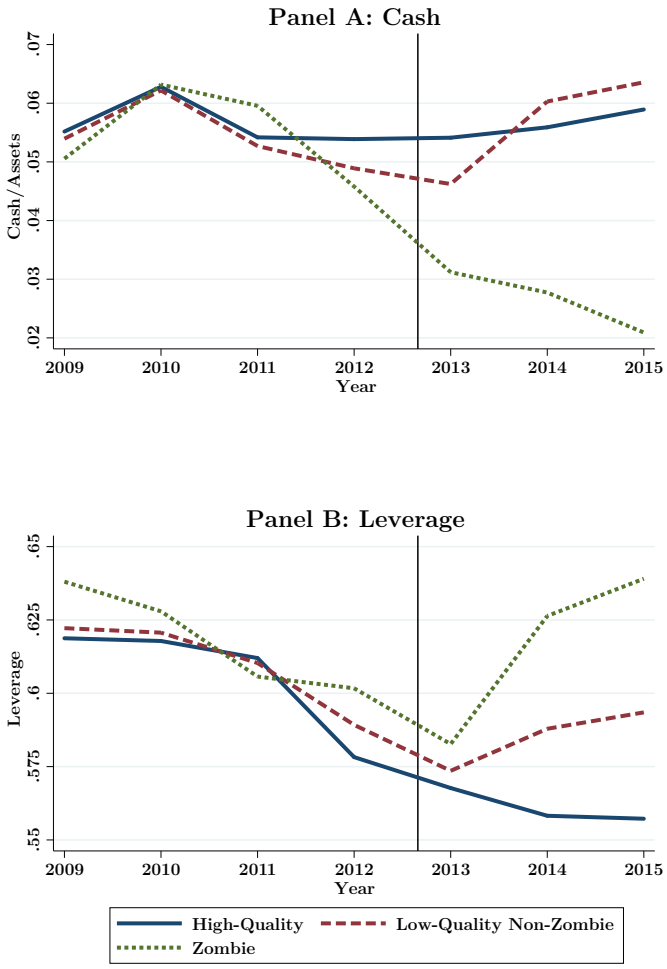


Figure 6, Panel A shows the evolution of the asset-weighted cash holdings as a fraction of total assets and Panel B the evolution of the asset-weighted leverage as a fraction of total assets. Both panels show high *Indirect OMT windfall gain* firms (i.e., firms with an above median *Indirect OMT windfall 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 Table 4. The benchmark interest rates are calculated using information from Amadeus. The vertical line marks the OMT announcement period in the third quarter of 2012.

Figure 7: Real Effects

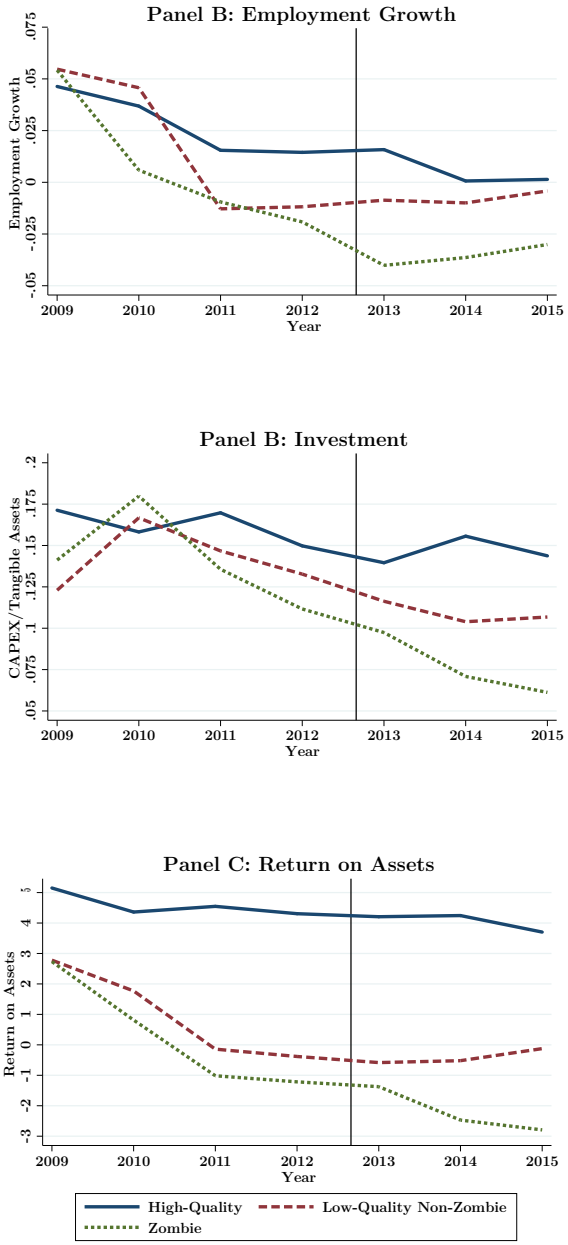


Figure 7, Panel A shows the evolution of the asset-weighted employment growth rates, Panel B the evolution of the asset-weighted capital expenditures as a fraction of tangible assets, and Panel C the evolution of the asset-weighted return on assets. All three panels show high *Indirect OMT windfall gain* 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 Table 4. The benchmark interest rates are calculated using information from Amadeus. The vertical line marks the OMT announcement period in the third quarter of 2012.

Figure 8: Evolution of Non-Performing Loans

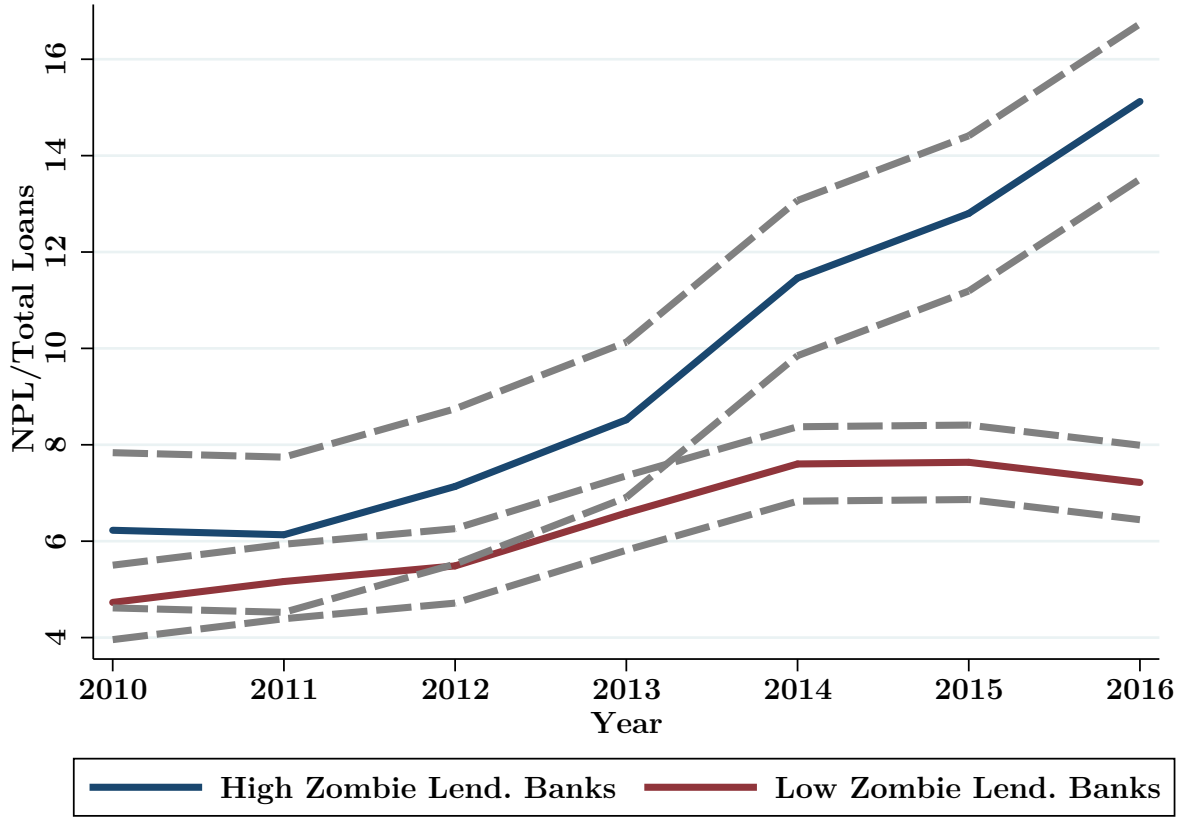


Figure 8, shows the evolution of the asset-weighted fraction of non-performing loans to total loans (in %) for high (low) zombie lending high-gain banks. A bank is classified as high-zombie lending (low zombie lending) bank if it has an above median fraction of zombie loans to total assets. For the definition of a zombie firm see Table 4. The benchmark interest rates are calculated using information from Amadeus. The grey dashed lines show 95% confidence intervals.

Figure 9: Default Rates

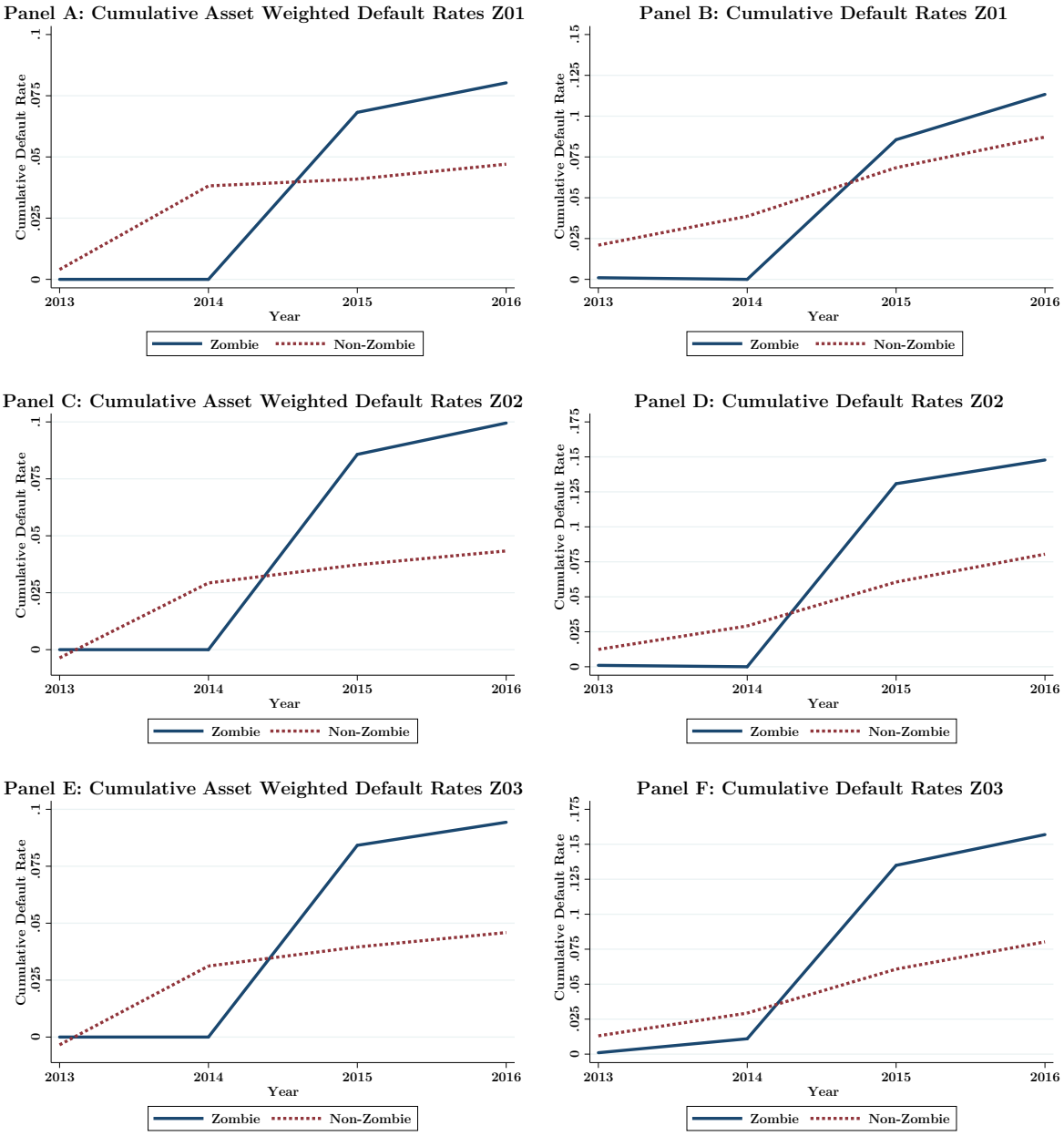


Figure 9 presents asset-weighted cumulative default rates (left panels) and equally weighted default rates (right panels) for each of our three crisp zombie definitions

Figure 10: Industry Productivity

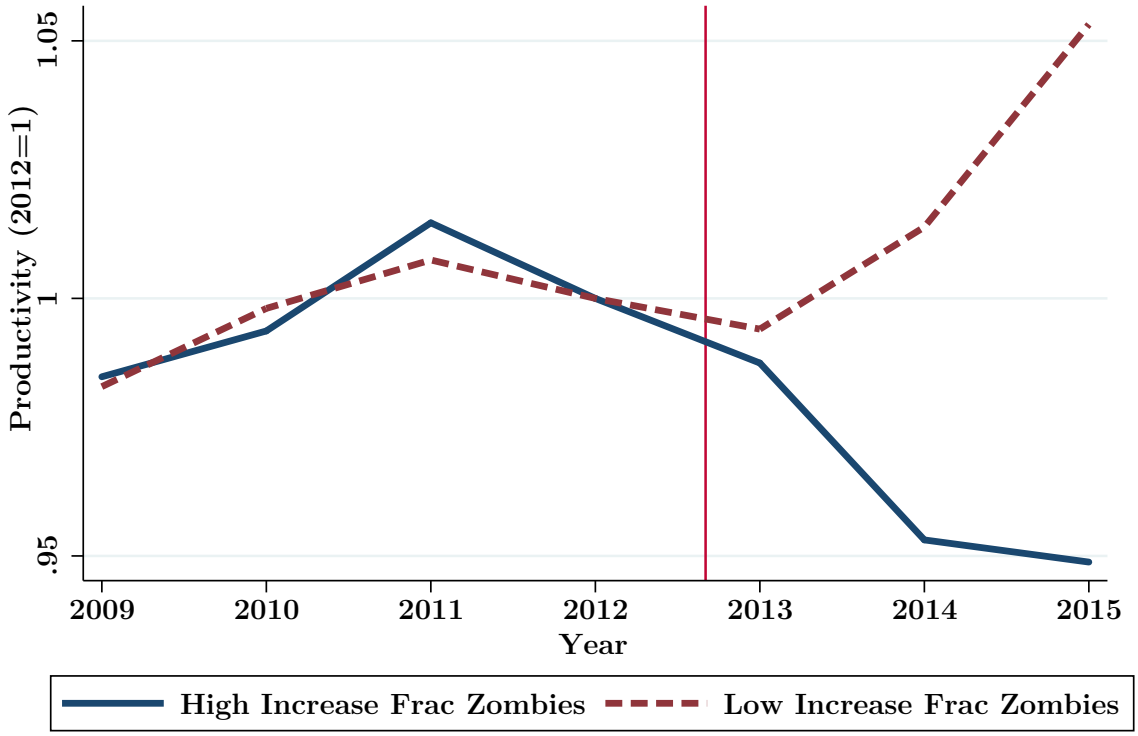


Figure 10 shows the average country-industry-level productivity (measured relative to 2012 where productivity is set equal to one) for industries with a high (blue solid line) and low (red dashed line) increase in the fraction of zombie firms in the post-OMT period. For the definition of a zombie firm see Table 4.

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)
t-test for difference	5.69	12.7	7.8

Panel B: Total Assets/Total Equity Ratio			
	Pre-crisis	Crisis/pre-OMT	Post-OMT
Weakly-capitalized high-gain	15.30	24.29	19.63
Well-capitalized high-gain	15.03	16.08	13.92
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
Weakly-capitalized high-gain	22.31	71.05	40.37
Well-capitalized high-gain	19.20	26.15	17.85
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 weakly-capitalized (well-capitalized) if its leverage ratio is less (more) than 2% higher than the regulatory threshold in December 2012 (post-OMT). F-values are reported in parentheses.

Table 2: Run Index

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

Table 2 presents bank 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)
	All Banks	All Banks	All Banks	GIIPS Banks
	ΔLoans	ΔLoans	Loan Inc.	ΔLoans
OMT windfall gain*PostOMT	0.241***	0.253**	0.227**	0.276**
	(2.76)	(2.57)	(2.17)	(2.16)
R^2	0.736	0.774	0.702	0.763
N	15930	15930	15930	6518
Panel B: Extensive Margin - All Firms				
	New Loan	New Loan		New Loan
OMT windfall gain*PostOMT	0.020	0.022		-0.009
	(0.65)	(0.74)		(-0.19)
R^2	0.594	0.627		0.669
N	18291	18291		8655
Panel C: Intensive Margin - Quality Split				
	Δ Loans	Δ Loans	Loan Inc.	Δ Loans
OMT windfall gain*PostOMT	-0.064	-0.045	-0.058	-0.033
	(-1.01)	(-1.04)	(-1.34)	(-1.06)
OMT windfall gain*PostOMT*Low-IC	0.286**	0.251**	0.272*	0.292**
	(2.07)	(2.12)	(1.83)	(2.26)
R^2	0.737	0.778	0.697	0.770
N	15930	15930	15930	6518
Panel D: Extensive Margin - Quality Split				
	New Loan	New Loan		New Loan
OMT windfall gain*PostOMT	0.059	0.053		0.121
	(0.80)	(0.68)		(1.41)
OMT windfall gain*PostOMT*Low-IC	-0.058	-0.053		-0.233
	(-0.56)	(-0.48)		(-1.58)
R^2	0.595	0.627		0.669
N	18291	18291		8655
Bank Level Controls	YES	YES	YES	YES
Bank Fixed Effects	YES	NO	NO	NO
FirmCluster-Bank Fixed Effects	NO	YES	YES	YES
FirmCluster-Time Fixed Effects	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 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. 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. 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: Zombie Definitions

Zombie Definitions				
	Benchmark	Quality Criterion	Crisp/Fuzzy	Interest Rate Cutoffs
Z01	Industry-specific	✓	Crisp	(0bp, 0bp)
Z02	Overall	✓	Crisp	(0bp, 0bp)
Z03	Overall		Crisp	(0bp, 0bp)
Z04	Industry-specific	✓	Fuzzy	(-25bp, +75bp)
Z05	Overalll	✓	Fuzzy	(-25bp, +75bp)
Z06	Overall		Fuzzy	(-25bp, +75bp)
Z07	Industry-specific	✓	Fuzzy	(0bp, +50bp)
Z08	Overall	✓	Fuzzy	(0bp, +50bp)
Z09	Overall		Fuzzy	(0bp, +50bp)

This Table provides an overview over the various zombie definitions used throughout the paper.

Table 5: Descriptive Statistics

Panel A: Breakdown of zombie firms by country (Amadeus Benchmark)				
Country	Number Z01	Number Z02	Number Z03	Number of firms in sample
Germany	20 (12%)	11 (7%)	15 (9%)	167
Spain	58 (29%)	37 (18%)	45 (22%)	201
France	31 (15%)	20 (10%)	25 (12%)	203
UK	62 (22%)	33 (12%)	43 (15%)	286
Italy	60 (30%	40 (20%)	45 (22%))	198

Table 5, Panel A presents 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 Table 4. We present these results for the three alternative zombie classifications which Z01 - Z03.

Table 5: Descriptive Statistics (contd.)

Panel B: Difference in Group of Firms (Industry Specific Benchmark)

	(1)	(2)	(3)	(4)
	High-IC Ratio	Low-IC Ratio No Zombie	Zombie	Difference (2)-(3)
Total Assets (mn)	3130	2850	2100	750 **
				(2.57)
Tangibility	0.556	0.599	0.521	0.078***
				(5.77)
Int. Cov.	6.645	1.845	0.406	1.439***
				(9.12)
Net Worth	0.309	0.222	0.205	0.017*
				(1.66)
EBITDA/Assets	0.134	0.078	0.037	0.041***
				(12.73)
Leverage	0.602	0.709	0.730	-0.021**
				(-2.05)
Loan Amount / Total Assets (%)	21.25	18.83	21.62	-2.79
				(-1.41)
Maturity (Months)	60.03	63.33	60.39	2.94
				(0.96)
Term Loan (%)	53.31	51.73	54.41	-2.68
				(-0.61)

Panel C: Difference in Group of Firms (Unique Benchmark with Quality Criterion)

Total Assets (mn)	3130	2820	2110	710**
				(2.05)
Tangibility	0.556	0.598	0.491	0.107***
				(6.68)
Int. Cov.	6.645	1.790	0.230	1.56***
				(8.28)
Net Worth	0.309	0.223	0.186	0.037***
				(2.91)
EBITDA/Assets	0.134	0.077	0.030	0.047***
				(11.92)
Leverage	0.602	0.709	0.742	-0.033***
				(-2.84)
Loan Amount / Total Assets (%)	21.25	18.80	21.92	-3.12
				(-1.48)
Maturity (Months)	60.03	63.35	61.39	1.96
				(0.58)
Term Loan (%)	53.31	51.76	54.38	-2.62
				(-0.58)

Table 5, Panel B and C 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 Table 4. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 5: Descriptive Statistics (contd.)

Panel D: Difference in Group of Firms (Unique Benchmark without Quality Criterion)

	High-IC Ratio	Low-IC Ratio No Zombie	Zombie	Difference (2)-(3)
Total Assets (mn)	3130	2840	2120	720**
				(2.27)
Tangibility	0.556	0.600	0.495	0.105***
				(7.29)
Int. Cov.	6.645	1.833	0.255	1.58***
				(9.31)
Net Worth	0.309	0.223	0.188	0.035***
				(3.09)
EBITDA/Assets	0.134	0.078	0.030	0.048***
				(14.10)
Leverage	0.602	0.708	0.739	-0.031***
				(-2.83)
Loan Amount / Total Assets (%)	21.25	18.77	.21.49	-2.72
				(-1.41)
Maturity (Months)	60.03	63.28	61.07	1.96
				(0.60)
Term Loan (%)	53.31	51.71	53.38	1.67
				(-0.49)

Panel E: Difference relative to Z02

	Added Z01	Z02	Difference (1)-(2)
Total Assets (mn)	2111	2110	1
			(0.01)
Tangibility	0.583	0.491	0.092***
			(3.15)
Int. Cov.	0.760	0.230	0.53*
			(1.68)
Net Worth	0.242	0.186	0.056***
			(2.64)
EBITDA/Assets	0.050	0.030	0.02***
			(3.85)
Leverage	0.703	0.742	-0.039**
			(-1.97)

Table 5, Panel D presents 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 Table 4. Panel E presents a test for the difference in means between firms that are classified as zombies only under the industry-specific benchmark (Z01) but not under Z02. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 6: Loan Volume Regressions

Panel A: Zombie Definition Z01					
	(1)	(2)	(3)	(4)	(5)
	Δ Loans	Δ Loans	Δ Loans	Loan Inc.	Δ Loans
OMT windfall gain*PostOMT	0.397***	0.429**		0.456**	0.470**
	(2.75)	(2.24)		(2.16)	(2.17)
OMT windfall gain*PostOMT*Z01	-0.469**	-0.496**	-0.535**	-0.584***	-0.572***
	(-2.50)	(-2.45)	(-2.51)	(-2.85)	(-3.09)
OMT windfall gain*PostOMT*Weakly-capitalized	-0.382***	-0.394**		-0.477**	-0.439***
	(-2.77)	(-2.57)		(-2.36)	(-3.33)
OMT windfall gain*PostOMT*Weakly-capitalized*Z01	0.663**	0.679**	0.658**	0.684**	0.765***
	(2.27)	(2.36)	(2.10)	(2.20)	(3.45)
R^2	0.721	0.753	0.759	0.712	0.776
N	18566	18566	18566	18566	8112
Panel B: Zombie Definition Z02					
	Δ Loans	Δ Loans	Δ Loans	Loan Inc.	Δ Loans
OMT windfall gain*PostOMT	0.420**	0.437*		0.476**	0.590*
	(2.30)	(2.01)		(2.10)	(1.97)
OMT windfall gain*PostOMT*Z02	-0.511***	-0.501***	-0.546***	-0.591**	-0.618***
	(-3.17)	(-3.72)	(-3.96)	(-2.21)	(-5.41)
OMT windfall gain*PostOMT*Weakly-capitalized	-0.445**	-0.438**		-0.617**	-0.666**
	(-2.10)	(-2.04)		(-2.36)	(-2.49)
OMT windfall gain*PostOMT*Weakly-capitalized*Z02	0.733***	0.699**	0.661**	0.792***	0.891***
	(3.55)	(2.38)	(2.43)	(3.07)	(3.36)
R^2	0.706	0.740	0.747	0.703	0.767
N	18098	18098	18098	18098	7815
Panel C: Zombie Definition Z03					
	Δ Loans	Δ Loans	Δ Loans	Loan Inc.	Δ Loans
OMT windfall gain*PostOMT	0.443**	0.453**		0.541**	0.530**
	(2.55)	(2.26)		(2.42)	(2.78)
OMT windfall gain*PostOMT*Z03	-0.488***	-0.533***	-0.555***	-0.602**	-0.567***
	(-3.63)	(-6.66)	(-4.28)	(-2.23)	(-3.59)
OMT windfall gain*PostOMT*Weakly-capitalized	-0.450**	-0.420**		-0.646**	-0.627***
	(-2.23)	(-2.25)		(-2.64)	(-3.86)
OMT windfall gain*PostOMT*Weakly-capitalized*Z03	0.714***	0.705***	0.741***	0.751**	0.866**
	(3.28)	(5.37)	(3.43)	(2.05)	(2.18)
R^2	0.711	0.744	0.752	0.705	0.773
N	18162	18162	18162	18162	7953
Bank Level Controls	YES	YES	NO	YES	YES
Bank FE	YES	NO	NO	NO	NO
Bank-Time FE	NO	NO	YES	NO	NO
FirmCluster-Bank FE	NO	YES	YES	YES	YES
FirmCluster-Time FE	YES	YES	YES	YES	YES

Table 6 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. *Weakly-Capitalized* is a dummy variable that equals one if banks is less than 2% above the regulatory threshold 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 Table 4. 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: Loan Volume Regressions - Moral Suasion

	Z01	Z02	Z03
Panel A: Horse Race between Weakly-Capitalized and Government Ownership			
	ΔLoans	ΔLoans	ΔLoans
OMT windfall gain*PostOMT	0.415**	0.543**	0.580**
	(2.45)	(2.20)	(2.30)
OMT windfall gain*PostOMT*Zombie	-0.542**	-0.531**	-0.503***
	(-2.44)	(-2.60)	(-3.59)
OMT windfall gain*PostOMT*Weakly-capitalized	-0.530**	-0.635*	-0.380**
	(-2.51)	(-2.00)	(-2.10)
OMT windfall gain*PostOMT*Weakly-capitalized*Zombie	0.829**	0.807*	0.511**
	(2.04)	(1.85)	(2.48)
OMT windfall gain*PostOMT*High Gov. Own.	0.002	0.001	0.021
	(0.78)	(0.55)	(0.93)
OMT windfall gain*PostOMT*High Gov. Own.*Zombie	-0.001	0.009	0.012
	(-0.13)	(1.41)	(0.73)
R^2	0.728	0.713	0.724
N	18566	18098	18162
Panel B: Non-GIIPS Borrower			
	ΔLoans	ΔLoans	ΔLoans
	GIIPS Banks	GIIPS Banks	GIIPS Banks
OMT windfall gain*PostOMT	0.226**	0.241**	0.245**
	(2.402)	(2.967)	(2.469)
OMT windfall gain*PostOMT*Zombie	-0.414**	-0.440**	-0.533*
	(-2.883)	(-2.427)	(-1.831)
OMT windfall gain*PostOMT*Still Undercap	-0.336**	-0.415*	-0.399**
	(-2.265)	(-2.077)	(-2.441)
OMT windfall gain*PostOMT*Still Undercap*Zombie	0.654*	0.757*	0.826**
	(2.221)	(1.995)	(2.395)
R^2	0.798	0.794	0.792
N	4266	4085	4082
Bank Level Controls	YES	YES	YES
Bank Fixed Effects	YES	NO	YES
FirmCluster-Time Fixed Effects	YES	YES	YES

Table 7 presents the results of a modified Khwaja and Mian (2008) bank lending channel regression as in Table 3. Panel A presents results for a horse race between weakly capitalized and government-owned banks. Panel B restricts the sample to non-GIIPS firms that have a credit relationship with a GIIPS 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. 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 8: Financial and Real Effects - All Firms

Panel A: All Firms						
	(1)	(2)	(3)	(4)	(5)	(6)
	ΔCash	ΔDebt	ΔCash-ΔDebt	Emp. Growth	CAPX	ROA
Indirect OMT windfall gain*PostOMT	0.315**	0.316**	-0.004	0.061	-0.335	0.014
	(2.537)	(2.358)	(-0.013)	(0.618)	(-1.071)	(0.038)
R^2	0.522	0.605		0.804	0.644	0.587
N	5,324	6,595		6,486	6,492	5,544
Panel B: Quality Classification 2009-2011						
	ΔCash	ΔDebt	ΔCash-ΔDebt	Emp. Growth	CAPX	ROA
Indirect OMT windfall gain*PostOMT	0.136	0.108		-0.023	-0.092	0.185
	(0.917)	(0.532)		(-0.173)	(-0.271)	(0.526)
Indirect OMT windfall gain*PostOMT*Low-IC	0.574***	0.579**	0.000	0.087	-0.381	-0.498
	(2.849)	(2.088)	(-0.002)	(0.560)	(-0.827)	(-1.219)
R^2	0.550	0.636		0.806	0.644	0.596
N	5,324	6,599		6,486	6,492	5,544
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

Table 8 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. For the definition of a zombie firm see Table 4. *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. 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: Financial and Real Effects - All Firms

Panel A: All Firms						
	(1)	(2)	(3)	(4)	(5)	(6)
	ΔCash	ΔDebt	ΔCash-ΔDebt	Emp. Growth	CAPX	ROA
Indirect OMT windfall gain*PostOMT*Low-IC	0.514**	0.496**	0.019	0.052	-0.237	-0.288
	(2.101)	(1.996)	(0.054)	(0.546)	(-0.840)	(-1.189)
Indirect OMT windfall gain*PostOMT*Low-IC*Z01	-0.555**	0.560**	-1.115***	-0.046	-0.343	0.038
	(-2.565)	(2.087)	(-3.235)	(-0.309)	(-0.610)	(0.080)
R^2	0.538	0.607		0.772	0.592	0.517
N	5,324	6,599		6,486	6,492	5,544
Indirect OMT windfall gain*PostOMT*Low-IC	0.543**	0.541**	0.003	0.030	-0.194	-0.339
	(2.413)	(2.496)	(0.008)	(0.318)	(-0.705)	(-1.446)
Indirect OMT windfall gain*PostOMT*Low-IC*Z02	-0.548**	0.648***	-1.196***	0.065	0.007	-0.255
	(-2.015)	(2.862)	(-3.379)	(0.565)	(0.013)	(-0.840)
R^2	0.574	0.625		0.772	0.592	0.516
N	5,324	6,599		6,486	6,492	5,544
Indirect OMT windfall gain*PostOMT*Low-IC	0.545**	0.532**	0.013	0.035	-0.194	-0.325
	(2.423)	(2.465)	(0.041)	(0.373)	(-0.707)	(-1.389)
Indirect OMT windfall gain*PostOMT*Low-IC*Z03	-0.512**	0.477*	-0.989***	-0.007	-0.103	-0.480**
	(-2.354)	(1.789)	(-2.874)	(-0.071)	(-0.233)	(-1.973)
R^2	0.574	0.626		0.772	0.592	0.516
N	5,324	6,599		6,486	6,492	5,544
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

Table 9 presents firm-level regression results for the three crisp zombie definitions. The dependent variables are the change in cash holdings, change in leverage, employment growth, investments, and ROA, respectively. For the definition of a zombie firm see Table 4. *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. 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: Long-Run Effects

Panel A: Non-Performing Loans				
	(1)	(2)	(3)	(4)
	ΔNPL	ΔNPL	ΔNPL	ΔNPL
High Zombie Lending Bank	0.079**	0.077**	0.076**	0.041**
	(2.89)	(2.87)	(2.77)	(2.07)
Log(Assets)		-0.002	-0.003	-0.004
		(-0.67)	(-0.85)	(-0.46)
Equity/Assets			-0.000	-0.000
			(-1.36)	(-0.69)
R^2	0.391	0.392	0.401	0.676
N	49	49	49	49
Country Fixed Effects	NO	NO	NO	YES
Panel B: Firm Defaults				
	Default	Default	Default	
Low IC	0.029***	0.029***	0.029***	
	(3.568)	(3.583)	(3.561)	
Low IC*Post	-0.000	0.000	0.001	
	(-0.003)	(0.017)	(0.102)	
Z01	-0.031**			
	(-2.371)			
Z01*Post	0.038**			
	(2.208)			
Z02		-0.054*		
		(-1.879)		
Z02*Post		0.070**		
		(1.998)		
Z03			-0.045**	
			(-2.078)	
Z03*Post			0.056**	
			(2.114)	
R^2	0.194	0.195	0.195	
N	4,993	4,993	4,993	
Industry-Country-Year Fixed Effects	YES	YES	YES	

Table 10, 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 Table 4. The benchmark interest rates are calculated using information from 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 11: Externalities

	(1) Int. Payment	(2) CAPX	(3) Emp Growth	(4) Productivity
Industry Frac Z01*Non-Zombie	0.020***	-0.013**	-0.006***	0.005***
	(2.709)	(-2.233)	(-3.621)	(2.638)
R^2	0.824	0.572	0.504	0.935
N	5,574	5,070	4,280	4,932
Industry Frac Z02*Non-Zombie	0.024***	-0.018**	-0.008***	0.008**
	(2.972)	(-2.025)	(-2.994)	(2.322)
R^2	0.825	0.572	0.504	0.935
N	5,574	5,070	4,280	4,932
Industry Frac Z03*Non-Zombie	0.022**	-0.016**	-0.008***	0.006**
	(2.188)	(-2.186)	(-2.688)	(2.237)
R^2	0.825	0.572	0.504	0.934
N	5,574	5,070	4,280	4,932

Table 11, presents firm-level regression results. The dependent variables are interest payments, employment growth, investments, and productivity, respectively. Benchmark interest rate are 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. 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 12: Effects on Non-Zombie Firms

Panel A: Investment Loss				
Industry	Avg. Investment (% of Capital)	ΔFraction Zombie	Investment Loss (% of Capital)	Investment Years lost
Construction	9.48%	13.59pp	24.4%	2.6
Manufacturing	11.4%	5.50pp	9.9%	0.9
Trade	10.8%	9.79pp	17.6%	1.6
Service	11.1%	9.28pp	16.8%	1.5
Other	10.6%	3.99pp	7.1%	0.7
Panel B: Employment Loss				
Industry	Avg. Emp. Growth	ΔFraction Zombie	Employment Loss	
Construction	-2.1%	13.59pp	10.8pp	
Manufacturing	0.55%	5.50pp	4.4pp	
Trade	0.24%	9.79pp	7.8pp	
Service	-1.0%	9.28pp	7.4pp	
Other	0.5%	3.99pp	3.1pp	

Table 12, Panels A and B 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 Table 4. 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.

Table 13: Effects on Non-Zombie Firms - Competitive Industries

Panel A: Competitive Industries				
	(1)	(2)	(3)	(4)
	Interest	CAPX	Emp. Growth	Productivity
Industry Frac Z01*Non-Zombie	0.025**	-0.017**	-0.007***	0.006***
	(2.388)	(-2.538)	(-3.305)	(2.743)
R^2	0.836	0.589	0.572	0.957
N	2,800	2,511	2,057	2,421
Industry Frac Z02*Non-Zombie	0.032***	-0.021**	-0.009***	0.010**
	(3.431)	(-2.467)	(-2.915)	(2.559)
R^2	0.836	0.589	0.572	0.957
N	2,800	2,511	2,057	2,421
Industry Frac Z03*Non-Zombie	0.028**	-0.018**	-0.009***	0.007**
	(2.145)	(-2.444)	(-2.812)	(2.395)
R^2	0.837	0.589	0.572	0.957
N	2,800	2,511	2,057	2,421
Panel B: Non-Competitive Industries				
Industry Frac Z01*Non-Zombie	0.023***	-0.006	-0.002	0.003
	(2.903)	(-1.012)	(-0.817)	(1.447)
R^2	0.851	0.617	0.656	0.926
N	2,774	2,559	2,233	2,511
Industry Frac Z02*Non-Zombie	0.025*	-0.008	-0.001	0.002
	(1.951)	(-1.154)	(-0.457)	(1.070)
R^2	0.852	0.617	0.656	0.926
N	2,774	2,559	2,233	2,511
Industry Frac Z03*Non-Zombie	0.024**	-0.0007	-0.000	0.003
	(2.206)	(-1.192)	(-0.043)	(1.074)
R^2	0.852	0.617	0.656	0.926
N	2,774	2,559	2,233	2,511
Firm Level Controls	YES	YES	YES	YES
Firm Fixed Effects	YES	YES	YES	YES
Industry-Country-Year Fixed Effects	YES	YES	YES	YES

Table 13 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 Table 4. *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. 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"

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Figure A1: CDS Reaction

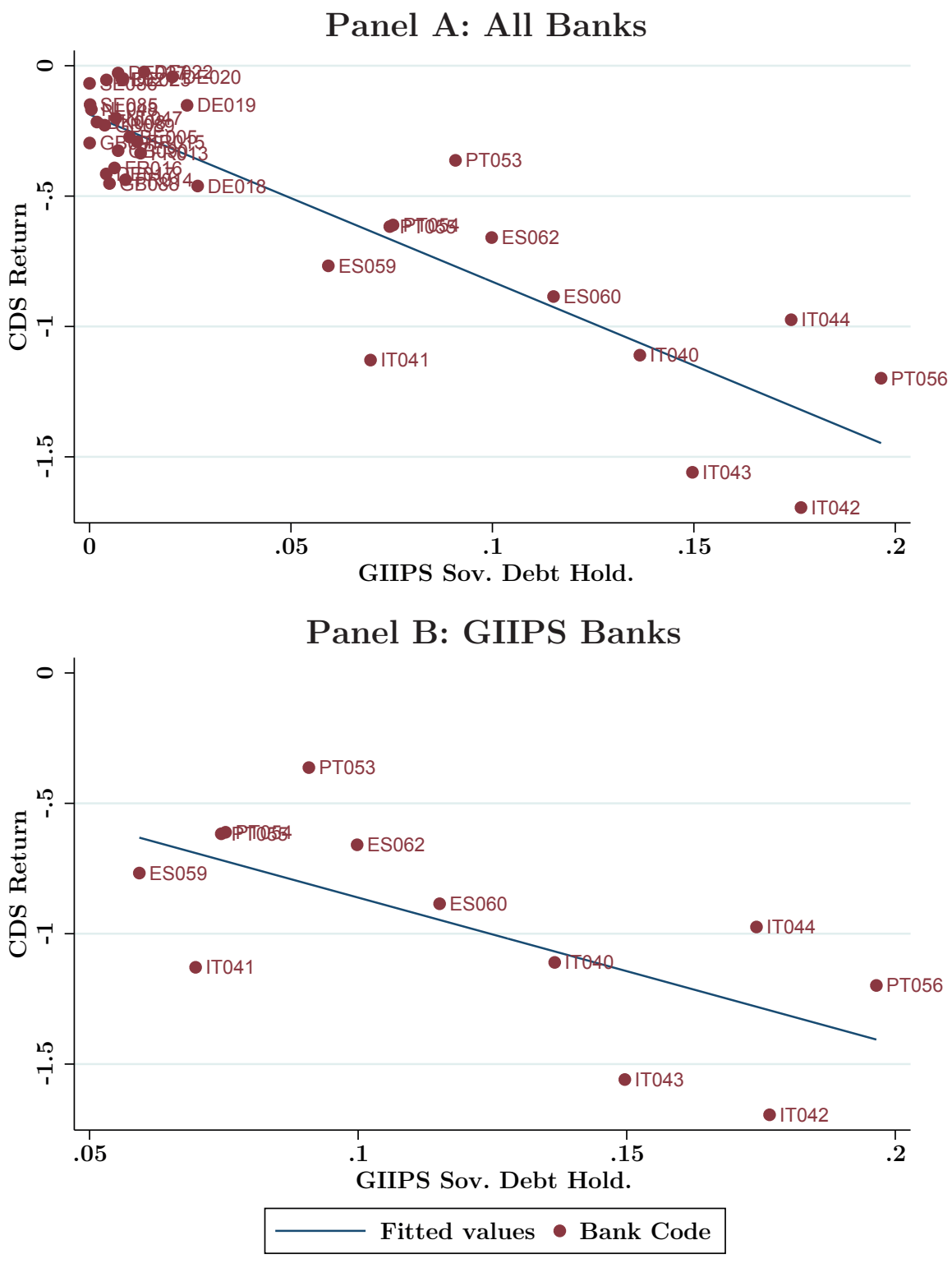

Figure A1, Panel A plots the relation between banks' CDS return on the OMT announcement dates and their GIIPS sovereign debt holdings for GIIPS and non-GIIPS banks. Panel B does the same for GIIPS banks only. GIIPS Banks include banks incorporated in Italy, Portugal, and Spain. Non-GIIPS banks consist 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***	-7.635***	-7.567***	-7.715***
	(-10.38)	(-13.05)	(-11.28)	(-10.62)
Log Assets		-0.134***	-0.133***	-0.126***
		(-4.12)	(-4.00)	(-3.51)
Tier1 Capital			0.396	1.110
			(0.22)	(0.50)
RWA/Assets				0.084
				(0.57)
R^2	0.771	0.852	0.852	0.854
N	30	30	30	30
Panel B: OMT windfall gain				
OMT windfall gain	-6.501***	-6.741***	-6.321***	-7.016***
	(-7.06)	(-8.25)	(-7.23)	(-7.94)
Log Assets		-0.076*	-0.074*	-0.119**
		(-1.88)	(-1.85)	(-2.26)
Tier1 Capital			0.028	0.010
			(1.27)	(0.37)
RWA/Assets				0.597
				(0.79)
R^2	0.609	0.621	0.777	0.782
N	30	30	30	30

Table A1 presents estimates from a linear regression analysis of the determinants banks' CDS returns on the OMT announcement dates. Independent variables are each banks' GIIPS sovereign bond holdings scaled by total assets (GIIPS/Assets) measured before the OMT announcement (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

Panel A: Zombie Definition Z01					
	(1)	(2)	(3)	(4)	(5)
	ΔLoans	ΔLoans	ΔLoans	Loan Inc.	ΔLoans
OMT windfall gain*PostOMT	0.436**	0.411**		0.443***	0.510**
	(2.69)	(2.50)		(3.36)	(2.39)
OMT windfall gain*PostOMT*Z01	-0.487**	-0.481***	-0.485***	-0.580***	-0.590**
	(-2.49)	(-2.86)	(-2.97)	(-3.33)	(-2.33)
OMT windfall gain*PostOMT*Capital buffer	-0.421**	-0.424**		-0.546***	-0.564***
	(-2.55)	(-2.61)		(-4.20)	(-3.98)
OMT windfall gain*PostOMT*Capital buffer*Z01	0.695*	0.704***	0.699***	0.791*	0.856**
	(1.87)	(3.27)	(3.29)	(1.89)	(2.79)
R^2	0.721	0.753	0.759	0.712	0.796
N	18566	18566	18566	18566	8112
Panel B: Zombie Definition Z02					
	ΔLoans	ΔLoans	ΔLoans	Loan Inc.	ΔLoans
OMT windfall gain*PostOMT	0.423**	0.388**		0.485***	0.520**
	(2.58)	(2.40)		(2.91)	(2.19)
OMT windfall gain*PostOMT*Z02	-0.509**	-0.453***	-0.507***	-0.592*	-0.555***
	(-2.70)	(-2.90)	(-3.04)	(-1.87)	(-4.24)
OMT windfall gain*PostOMT*Capital buffer	-0.431**	-0.467***		-0.598***	-0.707**
	(-2.69)	(-2.95)		(-3.31)	(-2.34)
OMT windfall gain*PostOMT*Capital buffer*Z02	0.776***	0.805**	0.747**	0.805***	0.994***
	(2.81)	(2.29)	(2.24)	(2.99)	(3.91)
R^2	0.706	0.740	0.747	0.703	0.768
N	18098	18098	18098	18098	7815
Panel C: Zombie Definition Z03					
	ΔLoans	ΔLoans	ΔLoans	Loan Inc.	ΔLoans
OMT windfall gain*PostOMT	0.430**	0.509**		0.524***	0.579**
	(2.62)	(2.46)		(3.13)	(2.46)
OMT windfall gain*PostOMT*Z03	-0.530***	-0.472***	-0.501***	-0.605***	-0.636***
	(-4.25)	(-6.57)	(-3.54)	(-4.59)	(-3.26)
OMT windfall gain*PostOMT*Capital buffer	-0.476**	-0.486***		-0.611***	-0.670**
	(-2.63)	(-2.87)		(-3.23)	(-2.69)
OMT windfall gain*PostOMT*Capital buffer*Z03	0.826***	0.726***	0.760**	0.817***	0.995***
	(4.45)	(3.48)	(2.19)	(2.81)	(4.01)
R^2	0.711	0.744	0.752	0.706	0.774
N	18162	18162	18162	18162	7953
Bank Level Controls	YES	YES	NO	YES	YES
Bank FE	YES	NO	NO	NO	NO
Bank-Time FE	NO	NO	YES	NO	NO
FirmCluster-Bank FE	NO	YES	YES	YES	YES
FirmCluster-Time FE	YES	YES	YES	YES	YES

Table 6 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 Table 4. 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 A3: Loan Volume Regressions

Panel A: Zombie Definition Z01					
	(1)	(2)	(3)	(4)	(5)
	ΔLoans	ΔLoans	ΔLoans	Loan Inc.	ΔLoans
OMT windfall gain*PostOMT	0.369**	0.352**		0.737**	0.533***
	(2.17)	(2.12)		(2.11)	(4.09)
OMT windfall gain*PostOMT*Z01	-0.497**	-0.507***	-0.520***	-0.587***	-0.579***
	(-2.63)	(-6.56)	(-6.66)	(-3.44)	(-5.64)
OMT windfall gain*PostOMT*Weakly-capitalized	-0.415**	-0.424**		-0.649**	-0.547***
	(-2.08)	(-2.20)		(-2.27)	(-5.09)
OMT windfall gain*PostOMT*Weakly-capitalized*Z01	0.715**	0.743***	0.721***	0.887*	0.831***
	(2.58)	(8.29)	(8.34)	(1.79)	(6.35)
R^2	0.723	0.754	0.760	0.711	0.776
N	18566	18566	18566	18566	8112
Panel B: Zombie Definition Z02					
	ΔLoans	ΔLoans	ΔLoans	Loan Inc.	ΔLoans
OMT windfall gain*PostOMT	0.454**	0.405*		0.683**	0.590*
	(2.22)	(1.89)		(2.07)	(1.98)
OMT windfall gain*PostOMT*Z02	-0.515***	-0.495***	-0.510***	-0.597**	-0.619***
	(-3.25)	(-3.82)	(-4.08)	(-2.31)	(-5.42)
OMT windfall gain*PostOMT*Weakly-capitalized	-0.430*	-0.410*		-0.780**	-0.701**
	(-1.94)	(-1.79)		(-2.29)	(-2.49)
OMT windfall gain*PostOMT*Weakly-capitalized*Z02	0.698***	0.729***	0.691***	0.763**	0.957***
	(3.66)	(2.79)	(2.83)	(2.42)	(3.23)
R^2	0.706	0.740	0.747	0.703	0.767
N	18098	18098	18098	18098	7815
Panel C: Zombie Definition Z03					
	ΔLoans	ΔLoans	ΔLoans	Loan Inc.	ΔLoans
OMT windfall gain*PostOMT	0.442***	0.508**		0.559*	0.580**
	(3.04)	(2.61)		(1.78)	(2.28)
OMT windfall gain*PostOMT*Z03	-0.545***	-0.528***	-0.525***	-0.599***	-0.625***
	(-4.33)	(-6.41)	(-5.46)	(-3.79)	(-3.34)
OMT windfall gain*PostOMT*Weakly-capitalized	-0.438*	-0.409**		-0.703**	-0.591***
	(-1.97)	(-2.09)		(-2.09)	(-2.98)
OMT windfall gain*PostOMT*Weakly-capitalized*Z03	0.734**	0.647***	0.699***	0.799***	0.856**
	(2.67)	(4.28)	(3.07)	(2.98)	(2.34)
R^2	0.715	0.748	0.755	0.706	0.777
N	18162	18162	18162	18162	7953
Bank Level Controls	YES	YES	NO	YES	YES
Bank FE	YES	NO	NO	NO	NO
Bank-Time FE	NO	NO	YES	NO	NO
FirmCluster-Bank FE	NO	YES	YES	YES	YES
FirmCluster-Time FE	YES	YES	YES	YES	YES

Table 6 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 Table 4. 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 A4: Industry Productivity Growth

	(1)	(2)	(3)	(4)	(5)	(6)
	ΔProductivity	ΔProductivity	ΔProductivity	ΔProductivity	ΔProductivity	ΔProductivity
Δ Industry Frac Z01	-0.012**					
	(-2.572)					
Δ Industry Frac Z02		-0.012**				
		(-2.429)				
Δ Industry Frac Z03			-0.013***			
			(-2.995)			
Δ Industry Frac Z04				-0.010*		
				(-1.975)		
Δ Industry Frac Z05					-0.012**	
					(-2.357)	
Δ Industry Frac Z06						-0.011**
						(-2.325)
R^2	0.261	0.256	0.260	0.252	0.259	0.255
N	481	481	481	481	481	481
Country Fixed Effects	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES

Table A4 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: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).