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

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**Abstract**

On July 26, 2012 Mario Draghi announced to do "whatever it takes" to preserve the Euro and shortly after launched the Outright Monetary Transactions (OMT) Program, which led to a significant reduction in the sovereign yields of periphery countries. Due to their significant holdings of GIIPS sovereign debt, the OMT announcement indirectly recapitalized periphery country banks by increasing the value of their sovereign bond holdings. This paper shows that this backdoor recapitalization of European banks led to an increased supply of loans to private borrowers in Europe. This loan increase is mostly targeted towards low-quality firms and can at least partly be explained by evergreening of banks that benefited from the OMT announcement, but remained weakly capitalized even after the OMT announcement. We show that firms that receive new loans from these banks use the newly available funding to build up cash reserves, but there is no impact on real economic activity like employment or investment. Moreover, the presence of zombie firms depresses employment growth and investment of high quality firms that operate in the same industry.

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# 1 Introduction

In the peak of the European Sovereign Debt Crisis in 2010, the European Central Bank (ECB) began to introduce unconventional monetary policy measures to stabilize the Eurozone and restore trust in the periphery of Europe. Ultimately, these unconventional monetary policy measures were aimed at breaking the vicious circle between bank and sovereign health, which has led to a sharp decline in economic activity in the countries in the periphery of the Eurozone (Acharya, Eisert, Eufinger, and Hirsch (2015)). It was especially the ECB's Outright Monetary Transactions (OMT) program, which the ECB's president Mario Draghi announced during his famous "whatever it takes" speech in the summer of 2012, that helped to restore trust in the viability of the Eurozone.

While, according to the ECB, the primary objective of the OMT program was "safeguarding an appropriate monetary policy transmission and the singleness of the monetary policy", the measure also potentially had an important impact on the stability of banks and their lending behavior. As the OMT program announcement led to a strong decrease in sovereign debt spreads of stressed countries in the periphery of the Eurozone, banks with significant holdings of these sovereign bonds potentially experienced substantial windfall gains due to the increased value of their bond holdings, resulting in a backdoor bank recapitalization.

However, there is still no conclusive evidence as to whether and how the OMT program has impacted the real economy through the bank lending channel. Therefore, in this paper, we analyze whether (i) the ECB's OMT program led to a reduction in bank credit risk by increasing the value of the sovereign debt portfolio of banks, (ii) whether this reduction in bank credit risk entailed an increase in the availability of bank funding for borrowing firms (and which firms benefited most), and (iii) whether this potential increase in loan supply led to real economic effects on the firm level.

This sets the structure for our analysis. Our empirical analysis is hence organized into three parts. We start by analyzing the impact of the OMT program announcement on bank health. The sample used in this paper builds on loan information data obtained from Thomson Reuters LPC's DealScan, which provides extensive coverage of bank-firm relationships throughout Europe, and firm-specific information from Bureau van Dijk's Amadeus database, which we hand-match to DealScan. The sample includes all private firms from all EU countries for which Dealscan provides loan information. In addition, we obtain information on bank and sovereign CDS spreads from Markit, bank equity and sovereign bond information from Datastream, bank level balance sheet data from SNL, and data on the sovereign debt holdings of banks from the EBA stress tests, transparency, and capital exercises. This allows us to determine the extent to which individual banks were affected by the announcement of the OMT program. Our sample period covers the years 2009 until 2013.

We first show that GIIPS banks benefited most from the OMT announcement due to their substantial amount of GIIPS sovereign debt holdings. These banks realized significant windfall gains on their sovereign debt holdings due to the decreasing sovereign yields, implying that the OMT program announcement has indirectly recapitalized especially those banks in Europe that contributed significantly to the severe loan supply disruptions during the sovereign debt crisis. Furthermore, we find that bank credit risk decreased significantly on the dates surrounding the OMT announcement dates, a result that is in line with findings in Acharya, Pierret, and Steffen (2015). We use regression analysis on the bank level to confirm that the reduction in bank credit risk is indeed largely driven by a bank's holding of GIIPS sovereign debt and its resulting windfall gains due to the OMT program.

Second, we document that this reduction in bank credit risk and the resulting improvement in bank health led to an increase in available loans to firms. Building on the methodology of Khwaja and Mian (2008), we find that banks with higher windfall gains on their sovereign debt holdings increased loan supply to the corporate sector by more in the quarters following the OMT announcement than banks with lower windfall gains. To analyze which type of borrowers benefited most from an increased lending volume in the period after the announcement of the OMT program, we divide our sample into low- and high-quality borrower based on the ability of firms to service existing debt. In particular, a low-quality borrower is defined as having a below country median interest coverage ratio, while borrowers are considered to be of high-quality if their interest coverage ratio is above the median. The results of our lending regressions show that especially low-quality borrower benefited from the increased loan volume in the period following the OMT program announcement. In contrast to this result, high-quality borrower did not benefit significantly from the OMT announcement as the loan volume extended to this subset of firms did not increase in response to the OMT announcement.

Building on this result, we show that the increase in loan volume extended to low-quality borrowers is at least partly driven by zombie lending motives of banks that benefited from the OMT announcement, but remained weakly capitalized even after the OMT announcement. Following Caballero, Hoshi, and Kashyap (2008) and Giannetti and Simonov (2013), we show that these banks extended loans to low-quality borrowers at very advantageous interest rates, that is, interest rates that are below the rates paid by the most creditworthy European borrowers (high-quality public borrowers in non-GIIPS EU countries). This can be explained by the fact that mostly undercapitalized banks increased their holdings of periphery sovereign debt during the sovereign debt crisis (Acharya, Eisert, Eufinger, and Hirsch (2015), Acharya and Steffen (2014)). While significant gains on these sovereign debt holdings due to the OMT event increased the liquidity of these banks, some of these banks still remained weakly capitalized at the end of 2012, leading to an incentive to evergreen their distressed loans.

In a final step, we investigate whether the OMT program supported the economic recovery of the Eurozone due to the potential positive impact on firms' polices and real activity induced by the increased loan supply. To analyze how the OMT announcement has impacted corporate policies of firms through the bank lending channel, we closely follow the approach used in Acharya, Eisert, Eufinger, and Hirsch (2015). In particular, we use a diff-in-diff framework to evaluate the performance and policies of borrowing firms in the post OMT period. To measure the impact of the OMT program announcement, we construct for each firm a variable that captures how much each firm indirectly benefited by the post OMT value increase of the sovereign debt holdings of the banks it is associated with. We provide evidence that borrowers with higher indirect OMT windfall gains (indirectly as they benefited through their banks) increased both their cash holdings and leverage by roughly the same amount, suggesting that they use the majority of cash inflow to build up cash reserves. Firms that receive subsidized loans (zombie firms), on the other hand, are not able to increase cash and leverage by the same margin. Moreover, we do not find any changes in real economic activity; neither investment nor employment are significantly affected by a firms' indirect OMT windfall gains. High quality non-zombie firms, however, are suffering from the presence of zombie firms in their industry. Both their investment and employment growth rates are significantly depressed if the fraction of zombie firms in their industry increases.

A possible concern about our empirical methodology is that our results could be driven by the poor macroeconomic environment in GIIPS countries which prevented firms from investing and creating new jobs. We control for the macroeconomic environment in our main specification by including firm as well as interactions between industry, year and country fixed effects to absorb unobserved time-varying shocks to an industry in a given country in a given year. Furthermore, we include foreign bank country-year fixed effects to absorb any unobserved, time-varying heterogeneity that may arise because a firm's dependency on banks from a certain country might be influenced by whether this firm has business in the respective country. Consider as an example a German firm borrowing from a Spanish bank and a German bank. For this firm, we include a Spain-year fixed effect to capture the firm's potential exposure to the macroeconomic downturn in Spain during the European Sovereign Debt Crisis. Moreover, we control for unobserved, time-constant firm heterogeneity and observable time-varying firm characteristics that affect the firms' corporate policies, loan demand, and/or loan supply.

# 2 Outright Monetary Transactions

In mid-2012 the anxiety about excessive national debt led to interest rates on Italian and Spanish government bonds that were considered unsustainable. From mid-2011 to mid-2012, the spreads of Italian and Spanish 10-year government bonds had increased

by 200 basis points and 250 basis points, respectively relative to Germany. As a result, yields on 10-year Italian and Spanish government bonds were more than 4 percentage points higher than yields on German government bonds in July 2012.

This significant increase in bond spreads of countries in the periphery of the Eurozone became a matter of great concern for the ECB as it endangered the monetary union as a whole. In response to the mounting crisis, ECB President Mario Draghi stated on July 26, 2012, during a conference in London: "Within our mandate, the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough." On August 2, 2012, the ECB announced it would undertake outright monetary transactions in secondary, sovereign bond markets. The technical details of these operations were unveiled on September 6, 2012.

To activate the OMT program towards a specific country, that is, buy a theoretically unlimited amount of government bonds with one to three years maturity in secondary markets, four conditions have to be met. First, the country must have received financial support from the European Stability Mechanism (ESM). Second, the government must comply with the reform efforts required by the respective ESM program. Third, the OMT program can only start if the country has regained complete access to private lending markets. Fourth, the country's government bond yields are higher than what can be justified by the fundamental economic data. In case the OMT program would be activated the ECB would reabsorb the liquidity pumped into the system by auctioning off an equal amount of one-week deposits at the ECB. By Summer 2015, the OMT program has still not been actually activated.

There is clear empirical evidence that the OMT announcement significantly lowered sovereign bond spreads. For example, Szczerbowicz et al. (2012) find that the OMT measure lowered covered bond spreads and periphery sovereign yields. Altavilla, Giannone, and Lenza (2014), Krishnamurthy, Nagel, and Vissing-Jorgensen (2014), and Ferrando, Popov, and Udell (2015) reach a similar conclusion by showing that the OMT announcements led to a relative strong decrease for Italian and Spanish government bond yields (roughly 2 pp), while bond yields of the same maturity in Germany and France seem unaffected.

Furthermore, Krishnamurthy, Nagel, and Vissing-Jorgensen (2014) investigate which channels led to the reduction in bond yields. The authors find that for Italy and Spain, a decrease in default and segmentation risks was the main factor in case of OMT, while there might have been a reduction in redenomination risk in the case of Spain and Portugal, but not for Italy. Finally, their paper shows that the announcement of the OMT measure led to large increases in stock prices in both distressed and core countries. Saka, Fuertes, and Kalotychou (2015) finds that the perceived commonality in default risk among peripheral and core Eurozone sovereigns increased after Draghi's "whatever-it-takes" announcement.

By substantially reducing sovereign yields, the OMT program improved the asset side,

capitalization, and ability to access financing for banks with large GIIPS sovereign debt holdings, and thereby the financial stability of these banks. First, the higher demand for GIIPS bonds and, in turn, higher bond prices implied that banks were able to sell government bonds with a profit and bonds in the banks' trading book, which are marked to market, increased in value. Both improved the banks' equity position. For example, Italian-based UBI Banca states in its annual report of 2012:"The effects of the narrowing of the BTP/Bund spread entailed an improvement in the market value of debt instruments with a relative positive net impact on the fair value reserve of Euro 855 million [...]." Consistent with this statement, Krishnamurthy, Nagel, and Vissing-Jorgensen (2014) and Acharya, Pierret, and Steffen (2015) document significantly positive effects on banks' equity prices after the OMT announcement.

Second, due to the lower sovereign bond spreads and the resulting positive effect on the banks' financial stability, investors regained faith in the banking sectors of the stressed countries. This improved the ability of banks from GIIPS countries 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." In line with this anecdotal evidence, Acharya, Pierret, and Steffen (2015) find that, after the ECB announced its OMT program, U.S. money market funds provided more unsecured funding to European banks. Furthermore, since banks regularly use sovereign bonds as collateral, their access to private repo markets and ECB financing improved as well due to higher bond ratings and the resulting lower haircuts.

In sum, the OMT program announcement has indirectly recapitalized financial institutions in Europe, especially in the periphery of Europe, by raising market prices of sovereign bonds that were under severe stress at the time of the announcement. By targeting GIIPS sovereign bonds in particular, predominantly those banks were recapitalized that contributed significantly to the severe loan supply disruptions during the sovereign debt crisis. By making the program (potentially) unlimited, the ECB provided liquidity insurance for otherwise illiquid banks. As a result, banks were able to re-enter capital markets and raise capital from private investors.

While the existing literature provides clear evidence that the OMT program was effective in lowering bond spreads and thereby improving the health of banks with large GIIPS sovereign debt holdings, there is still no conclusive evidence about the impact of the ECB's OMT program on bank lending and the real economy. To our knowledge, our paper and a concurrent paper by Ferrando, Popov, and Udell (2015) are the only papers that investigate the effects of OMT on extension of credit to European borrowers. Using survey data, Ferrando, Popov, and Udell (2015) find that after the announcement

of OMT, less firms report that they are credit rationed and discouraged from applying for loans. In particular, firms with improved outlook and credit history were more likely to benefit from easier credit access. Therefore, our paper is the first to conduct a comprehensive event-study to analyze the effect on OMT on banks' lending behavior and the resulting real effects for borrowing firms. More broadly, our paper contributes to the understanding of the impact of QE measures on the economy (e.g., Agarwal, Chomsisengphet, Mahoney, and Stroebel (2015)). In a related paper Acharya, Imbierowicz, Steffen, and Teichmann (2015) investigate the effectiveness of monetary policy measures (more precisely the ECB's role as lender of last resort) that improve bank liquidity but that do not address concerns about bank health. They conclude that a policy that only targets banks' liquidity, but not bank capitalization is insufficient and does not reach the real sector. In contrast, our paper focuses on an unconventional monetary policy tool that led to a backdoor recapitalization of the banking sector.

# 3 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).

We collect information on syndicated loans to non-financial firms from all GIIPS countries. In addition, to be better able to disentangle the macro and bank lending supply shock, we include firms incorporated in other European (non-GIIPS) countries. Consistent with the literature (e.g., Sufi, 2007), all loans are aggregated to a bank's parent company. Our sample period spans the fiscal years 2009-2013. We augment the data on bank-firm relationships with firm-level accounting data taken from Bureau van Dijk's Amadeus database. This database contains information about 19 million public and private companies from 34 countries, including all EU countries. Since especially non-listed firms were affected by the lending contraction in the periphery due to their lack of alternative funding sources, we restrict our sample to private firms in Europe (see Acharya, Eisert, Eufinger, and Hirsch (2015)). This allow us to evaluate whether firms that were under severe stress during the peak of the sovereign debt crisis benefited from the OMT announcement.

Finally, we obtain information on bank as well as sovereign CDS spreads from Markit, bank equity and sovereign bond information from Datastream, bank level balance sheet data from SNL, and data on the sovereign debt holdings of banks from the EBA stress tests, transparency, and capital exercises. 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 bank needs to be included in EBA stress tests and must have data about the sovereign bond holdings available prior to the OMT announcement (June 2012).

# 4 Results

## 4.1 Bank Health

We begin our empirical analysis by investigating the effect of the OMT announcement on the financial health of large European banks. We conduct an event study using CDS spreads that we compile from Markit. For the OMT announcement dates, we follow Krishnamurthy, Nagel, and Vissing-Jorgensen (2014) and analyze the events on July 26, 2012 ("whatever-it-takes" speech); August 2, 2012 (announcement of the OMT program; and September 6, 2012 (announcement of technical details).

In 2012, financial markets throughout Europe were characterized by tensions and high uncertainty. We account for these market conditions in our analysis by, first, using a 1-day event window in our event study.[1] By employing a narrow window around the OMT announcement dates, we are able to separate the effect of the OMT announcement from other events that may potentially influence financial bank health. Second, we follow the time-series event study approach of Krishnamurthy and Vissing-Jorgensen (2011), which compares the event announcement period (OMT in our case) to other periods of the same length without an event. The advantage of this approach is that it does account for the possibility that other events may arrive during the OMT announcement periods. In doing so the estimated standard errors are more conservative than standard errors from a more traditional cross sectional event study.

Results are presented in Table 1. Column (1) reports results for time-series regressions of CDS spreads on a set of dummy variables for the three OMT announcement dates. We run separate regressions for each subset of banks and report the mean of the sum over the three event dates. The CDS spread of the mean GIIPS bank decreased by -96bp over the three OMT announcement dates, while it decreased by -23bp for the average non-GIIPS bank.

To gauge the statistical significance, we conduct F-tests of the joint significance of the dummy variables in our time-series regressions. The F-test is reported in parenthesis

[1]Results from a 2- or 3-day event window are qualitatively and quantitatively similar.

below the mean. In the case of GIIPS banks the F-test is -3.4 and for non-GIIPS banks it is -9.2, which indicates that the CDS spreads on days with OMT announcements are jointly significantly different from zero for both subsets of banks. To gauge the difference in the magnitude of the announcement effects for the two subsets, we use a $t$-test for the difference in means. The test shows that the default risk of GIIPS banks decreased by a larger margin than the default risk of non-GIIPS banks.

We draw two main conclusions from the results presented in Table 1. First, the OMT announcement led to an improvement of bank financial health for all European banks, that is, for GIIPS and non-GIIPS banks, as evidenced by a substantial decrease in CDS spreads. Second, the effect of the OMT announcement for GIIPS banks is about four times larger than the effect for non-GIIPS banks.

To analyze the large difference in the magnitude of the CDS return between non-GIIPS and GIIPS banks, we exploit information on EU sovereign debt holdings of banks directly. In particular, we use changes in sovereign bond prices, as well as information on sovereign debt holdings, to estimate the impact of the OMT program announcement on the value of the banks' sovereign debt holdings. Since a large fraction of these holdings are held in the banks' trading books, and are hence marked to market, an increase in their value translates into an equity capital gain for the banks. We call this variable the *OMT windfall gain*. Note that, while mainly GIIPS sovereign yields were affected by the OMT announcement, the sovereign yields of other countries were also affected (although to a lesser extent). To capture all sovereign debt holdings, our measure of *OMT windfall gain* is based on all EU sovereign debt holdings of a bank.

To compute the *OMT windfall gain*, we first compile data on the sovereign debt holdings of all sample banks at the closest date before July 26 (the first OMT announcement date) from the EBA webpage.[2] From Datastream, we obtain information on EU sovereign bonds prices, yields, and duration for various maturities. Second, we calculate the change in bond prices for all maturities around the three OMT announcement dates (July 26, August 2, and September 6) and sum these changes across the three announcement dates.[3] Third, we multiply the respective sovereign debt holdings outstanding before July 26 and the sum of change in sovereign bond prices for each maturity and country with valid bond price information in Datastream. Finally, the windfall gain follows from summing over all EU sovereign bonds in the banks portfolio. We report this gain on sovereign debt holdings as a fraction of a bank's total equity throughout, that is, we define the windfall

[2]Sovereign debt holdings are from June 2012.

[3]As a robustness check, we compute the change in bond prices by using the duration of a bond and the change in yield, where the change in yield is either computed from Datastream yields or taken from Krishnamurthy, Nagel, and Vissing-Jorgensen (2014). Results do not change.

gains of bank $b$ in country $j$ as:

$$OMT\ windfall\ gain_{bj} = \frac{\Delta Value\ EU\ Sov.\ Debt_{bj}}{Total\ Equity_{bj}}. \quad (1)$$

Note that, similar to Krishnamurthy, Nagel, and Vissing-Jorgensen (2014), we are only able to use sovereign yields from three out of the five GIIPS countries (Spain, Italy, and Portugal), since for Greece and Ireland information on yields is partially or completely missing. Since the majority of sovereign debt holdings of GIIPS banks is domestic, we are not able to calculate the *OMT windfall gain* for Greek and Irish banks in our sample, since we cannot derive the gain in value of their sovereign debt holdings.

Table 1, Column (2) reports the results for the *OMT windfall gain*, split by GIIPS and non-GIIPS banks. Both subsets of banks experienced significant windfall gains from the appreciation of value of their sovereign debt portfolio through the announcement of the OMT program. However, when testing the difference between the two subgroups, perhaps not surprisingly, GIIPS banks experienced significantly larger windfall gains compared to non-GIIPS banks as is evidenced by a $t$-value of 5.69. This significant difference is due to the fact that banks' sovereign banks holdings are biased towards their own domestic sovereign (e.g., Acharya and Steffen (2014)) and that GIIPS sovereign yields were most affected by the OMT announcement.

Column (3) of Table 1 shows that the value of GIIPS sovereign bond holdings reported to the EBA right before the announcement of the OMT program as a fraction of total assets is roughly 10 times larger for GIIPS banks than for non-GIIPS banks (11.8% compared to 1%). Therefore, as mainly GIIPS sovereign debt appreciated in value in response to the OMT measure, GIIPS banks benefited much more from the OMT program than non-GIIPS banks. Consistent with this explanation, Figure 1 shows a clear negative relation between a bank's sovereign debt holdings and its CDS return around the OMT announcement. This relation is also present within the subsample of GIIPS banks, as shown by Figure 2.

Next, we provide detailed evidence on how much of the change in CDS spreads around the OMT announcements can be explained by banks' sovereign debt holdings and their resulting windfall gains. In particular, we regress the value of the GIIPS sovereign debt holdings of banks and the *OMT windfall gain* on a bank's CDS return. We compute the change in CDS spread for each bank by summing CDS spread changes over the three OMT announcement dates.

Results are presented in Table 2. Panel A reports results for the value of the GIIPS sovereign debt holdings of banks. In all specifications, this variable has a significantly negative effect on a bank's CDS return, suggesting that banks indeed benefited through the increase in the value of their sovereign debt holdings (which is in line with the finding of Acharya, Pierret, and Steffen (2015)). Panel B of Table 2 documents a similar pattern

for the *OMT windfall gain* variable.

To summarize, we find evidence which is consistent with the OMT announcement increasing the financial health of large banks in Europe. The effect is larger for those banks that had reduced their lending volume to the real sector during the sovereign debt crisis. We show that an important channel of the mechanism works through GIIPS sovereign debt holdings of banks.

## 4.2 Bank Lending

We now turn to an investigation of whether the increased health of periphery country banks with high GIIPS sovereign debt holdings, resulting from (i) the increase in equity capital and (ii) the regained access to outside funding, led to an increase in loan supply in the quarters following the OMT announcement. We employ the same methodology as Acharya, Eisert, Eufinger, and Hirsch (2015) to control for loan demand and other observed and unobserved changes in borrowing firm characteristics. In particular, we track the evolution of the lending volume from a specific bank to a certain firm cluster, which allows us to control for any observed and unobserved characteristics that are shared by firms in the same cluster and that might influence loan outcomes.

To this end, we form firm clusters based on the following three criteria, which capture important drivers of loan demand, as well as the quality of firms in our sample: (1) the country of incorporation; (2) the industry; and (3) the firm rating. The main reason for aggregating firms based on the first two criteria is that firms in a particular industry in a particular country probably share a lot of firm characteristics and were thus likely affected in a similar way by macroeconomic developments during our sample period. Our motivation behind forming clusters based on credit quality follows from theoretical research in which credit quality is an important source of variation driving a firm's loan demand (e.g., Diamond (1991)).

Since we focus on private borrowers, firms in our sample generally do not have a credit rating. To aggregate firms into clusters, we assign ratings estimated from interest coverage ratio medians for firms by rating category provided by Standard & Poor's. This approach exploits the fact that our measure of credit quality which is based on accounting information is monotone across credit categories. We follow Standard & Poor's and assign ratings on the basis of the three-year median interest coverage ratio of each firm.

We start our empirical investigation by analyzing the supply of bank loans to private borrowers around the OMT announcement graphically. Figure 3 plots the log of the sum of all revolver and term loans provided by banks that strongly benefited (above median *OMT windfall gain*) and banks that benefited less (below median *OMT windfall gain*) from the OMT announcement in a given quarter. Note that we measure the change in loan volume relative to the quarter of the OMT announcement, that is, the y-axis is

normalized to zero at the time of the announcement in Q3 2012. Figure 3 documents a significant increase in loan supply by banks that strongly benefited from the OMT announcement to private borrowers after Q3 2012. In contrast, we do not see a similar increase in loan supply by banks that did not significantly benefit from the measure. Furthermore, the figure shows that, pre-OMT announcement, the bank loan supply by banks with a low *OMT windfall gain* is higher than that by banks with a high *OMT windfall gain*, a result confirmed by previous studies (e.g., Acharya, Eisert, Eufinger, and Hirsch (2015)).

Our preferred specification to estimate the quarterly change in loan volume provided by bank $b$ in country $j$ to firm cluster $m$ in quarter $t$ is given by:

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

where *OMT windfall gain* is as defined in Eq. (1).

We present the results of our empirical analysis in Table 3. As before, we use a bank's windfall gain on its sovereign debt portfolio from the OMT announcement to proxy how much the bank benefited from the OMT program. Therefore, our main variable of interest is *OMT windfall gain* interacted with a dummy variable *PostOMT*, which is equal to one when the quarter falls into the period after the OMT announcement. The results show that banks with higher windfall gains from the OMT announcement significantly increased their supply of bank loans to private borrowers after the OMT announcement across all specifications, which control for different sets of fixed effects. When we include bank and quarter-year fixed effects in our regression, the coefficient on the interaction between *OMT windfall gain* and *PostOMT* is positive and significant, as shown in Column (1).

This result continues to hold if we interact firm-cluster and bank fixed effects. By doing this, we exploit the variation within the same firm-cluster-bank relationship over time. This controls for any unobserved characteristics that are shared by firms in the same cluster, bank heterogeneity, and for relationships between firms in a given cluster and the respective bank. The results of this specification are presented in Column (2). The interaction between *OMT windfall gain* and *PostOMT* remains positive and significant. Finally, in the results reported in Columns (3) and (4), we add firm-cluster-time fixed effects, which allow us to additionally control for any time observed and unobserved time-varying characteristics that are shared by firms in the same cluster.

To further test the robustness of these results, we follow Peek and Rosengreen (2005) and Giannetti and Simonov (2013) and employ the probability of a loan increase instead of the change in the loan amount as the dependent variable in our regression analysis. Results in Column (5) of Table 3 confirm that our result is invariant to using this alter-

native measure of lending supply expansion. Finally, Column (6) of Table 3 estimates the regression when we restrict our sample to GIIPS banks. Recall that, in particular, GIIPS banks hold large GIIPS sovereign debt holdings, which implies that especially these banks benefited from the OMT program announcement. The significant coefficient in Column (6) shows that also within the subsample of GIIPS banks, those banks with higher windfall gains increased lending to private borrowers more than GIIPS banks with lower windfall gains.

We now turn to analyzing which type of borrowers benefited most from an increased lending volume in the period after the announcement of the OMT program. We identify a low-quality (high-quality) borrower as a borrower with a below (above) country median 3-year interest coverage ratio. We use two different time periods to determine the three year median quality of firms: 2009 to 2011 (i.e., the crisis years) and 2006 to 2008 (i.e., the years prior to the sovereign debt crisis. Results are presented in Table 4. We report results for the classification of firms based on 2009 to 2011 (2006 to 2008) in Panel A (B).

The general picture that emerges from Table 4 is that the increase in loan volume in the period after the OMT announcement is entirely driven by low-quality borrowers. Using the crisis years 2009 to 2011 to classify borrowers as high- and low-quality firms, the results presented in Table 4, Panel A confirm that only the triple interaction term of OMT windfall gains, post OMT, and low quality is significantly positive.[4] Conversely, if we use the pre-sovereign debt crisis years (2006 to 2008) to determine the quality of borrowing firms, we do not find any differential impact of firm quality, that is, banks with higher windfall gains provide more loans to borrowing firms, irrespective of their quality.

An explanation for this result is that in many cases borrowers with a below country median interest coverage ratio based on the 2009 to 2011 period are precisely those borrowers that had close borrowing relationships with GIIPS banks in the past. Acharya, Eisert, Eufinger, and Hirsch (2015) show that, while not being less healthy before the outbreak of the European sovereign debt crisis (i.e., there was no systematic relation between firm quality and whether a firm borrowed from GIIPS banks prior to the sovereign debt crisis), firms that were very dependent on GIIPS banks became financially constrained during the sovereign debt crisis. This is due to the fact that GIIPS banks were weakly capitalized and decreased lending to the private sector. Since bank-borrower relationships are sticky (Chodorow-Reich (2014) and Acharya, Eisert, Eufinger, and Hirsch (2015)), and private firms are less able to utilize alternative funding sources, these borrowers were stuck with weakly-capitalized banks. This implies that they got under stress themselves and as a result their interest coverage ratios decreased (Figure 5).

In a final step, we explore whether banks' lending behavior can be explained by loan

[4]Figure 4 shows graphically that within the group of high windfall gain banks, more loans are issued to low quality borrowers (where borrower quality is again determined based on the crisis period of 2009 to 2011).

evergreening (zombie lending). Indeed, anecdotal evidence suggests that concerns over their balance sheet prevented banks from restructuring their loan portfolio which would result in realizing large losses.[5] An economist from a major bank said in this context: "In Spain, Ireland, Portugal and Greece, banks have been reluctant to pull the plug on companies as it would have forced them to crystallise heavy losses."

To detect zombie firms, we follow the approach in Caballero, Hoshi, and Kashyap (2008) and Giannetti and Simonov (2013), which is based on whether firms obtain subsidized credit from their banks. A firm is considered to receive subsidized credit (i.e., a loan at a very advantageous interest rate) if in a given year the actual interest expenses paid by the firm is below the interest expense paid by the most creditworthy firms in the economy. To this end, we use the interest rate paid by public firms incorporated in non-GIIPS countries with a AAA rating (inferred from EBIT interest coverage ratios) as benchmark interest rate to derive the interest rate expense benchmark. In what follows we use $r$ for interest rates and $R$ for interest expenses.

We argue that this is a reasonable choice for an advantageous interest expense benchmark because these firms are the most creditworthy firms in our sample. Public, non-GIIPS firms were among the least affected firms by the sovereign debt crisis, since they were less strongly affected by the macroeconomic downturn in the periphery and were also able to substitute a potential lack of bank financing with other sources of funding. By calculating benchmark interest rates from public firms we further reduce the risk of misclassifying private firms as zombies because Saunders and Steffen (2011) document that public firms pay lower spreads than otherwise similar private firms, suggesting that there is a cost of being a private firm.

We use information from two different sources to calculate interest rate benchmarks. The first approach is directly based on loan information from Dealscan (in what follows denoted with the 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 a AAA rating (inferred from EBIT interest coverage ratios). This approach has the advantage that we know the maturity of the loans and can thus calculate the benchmark interest rate based on two different maturity buckets $m$. To be even more conservative, we use the minimum of this measure over the last 5 years, that is, we assume that the firm receives new credit when interest rates are most favorable to the firm. This yields two benchmark interest rates (short and long term) $r^D_{tm}$. Given this interest rate benchmark, we calculate the minimum required interest payment of private firm $i$ in country $j$ and industry $h$ in year $t$, $R^{D^*}_{ijht}$, as $\sum_m r^D_{tm} \cdot Debt_{ijhtm}$, (where we split a firm's total debt $Debt_{ijht}$ into short and long term maturity).

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

The second approach to calculate the benchmark interest rate is based on information obtained from Amadeus (in what follows denoted with the index $A$). More precisely, Amadeus reports the total interest payments of firm $i$ in country $j$ and industry $h$ in year $t$, $R_{ijht}$, as well as total outstanding debt, $Debt_{ijht}$. Therefore, the average interest rate paid by firm $i$ can be calculated by dividing $R_{ijht}$ by $Debt_{ijht}$. However, with the data from Amadeus, we are not able to distinguish between the interest paid on different maturities. Hence, we divide firms into two groups, based on their reliance on short and long term debt. The benchmark rate for private firms that rely mostly on short (long) term debt is then derived from AAA rated public firms with a similar short (long) term debt structure. In particular, the interest rate benchmark, $r^A_{tm}$, is calculated using the median interest rate paid by public firms incorporated in non-GIIPS countries with a AAA rating (inferred from EBIT interest coverage ratios) in a given year, split according to their reliance on short versus long-term debt. Given this interest rate benchmark, we calculate the minimum required interest payment of private firm $i$ in country $j$ and industry $h$ in year $t$, $R^{A^*}_{ijht}$, as $r^A_{tm} \cdot Debt_{ijht}$, where we also split the private firms into two groups based on their reliance on short versus long-term debt. Figure 6 plots the evolution of the benchmark interest rates calculated from Dealscan (dashed line) and Amadeus (solid line) over time and across maturities.

We then compare the actual interest payments of our low quality private firms with the two hypothetical interest payments to calculate the interest expense gap:

$$x^{n^*}_{ijht} = R_{ijht} - R^{n^*}_{ijht} \tag{3}$$

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

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

only weak banks leave the syndicate. If this is true, then we would potentially misclassify zombie firms because a negative $x_{ijht}^{n^*}$ could also be explained by relationship lending of strong banks. In this argument, banks provide subsidized credit (criterion (i)) to weak firms (criterion (ii)) because they have better information about the future health of the borrower due to a long standing relationship. To test whether the remaining banks have zombie lending or relationship lending incentives, we compare the quality of banks remaining in the syndicate to banks that leave the syndicate. If the banks leaving the syndicate are of lower (higher) quality compared to the banks remaining in the syndicate, we would interpret this as evidence consistent with zombie (relationship) lending. The results of the comparison are provided in Panel A (for the zombie definition based on interest rate benchmarks derived from Amadeus) and Panel B (for the zombie definition based on interest rate benchmarks derived from Dealscan) of Table 6. The results indeed show for both alternative zombie classifications that the banks leaving the syndicate have a higher equity ratio and are therefore of higher quality which is consistent with healthier banks not wanting to participate in zombie lending activities.

Figure 7 plots the asset-weighted fraction of zombie firms in our sample over time for the zombie definition based on the Amadeus or the Dealscan benchmark interest rates, respectively. The figure clearly shows that in the post OMT period, the fraction of firms that received loans with an interest rate below the lower bound increased significantly. Table 6 presents a breakdown of the number of zombie firms by country. The table documents that the zombie problem is particularly severe in the periphery of Europe, with Spain and Italy having around 16.8% - 19.8% of zombie firms. Germany, France and the UK on the other hand only have between 3.4% and 10% of zombie firms. Importantly, the zombie breakdown by country, and thus the firms that we classify as zombies is very stable across the two zombie definitions which are based on alternative benchmark interest rates. The country breakdown is also line with anecdoctal evidence from the financial press which stated that "the zombie problem is chiefly focused in the peripheries of Europe rather than the core".[6] Table 7 compares zombie firms to other below median quality firms. Zombie firms have significantly lower net worth and EBITDA/Assets ratio as well as higher leverage. More importantly, zombie firms only have an interest coverage ratio of 0.29-0.39 (as opposed to 1.12 for other low quality firms), suggesting that they are unable to cover their current interest payments from the earnings generated. Taken together, these results show that within in the group of low quality firms, zombie firms are significantly worse than non-zombie firms.

To formally test whether some high gain banks engaged in zombie lending, even after the backdoor recapitalization induced by OMT, we follow the literature on bank recapitalization to identify banks that might have particularly strong zombie lending incentives. Diamond and Rajan (2000) argue that a key pitfall of bank recapitalization is the failure

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

to recapitalize banks adequately, that is banks might still be undercapitalized after a recapitalization. If the amount of the recapitalization is inadequate to fully restore banks health it can incentivize banks to extent new loans to insolvent firms that would need to be restructured. Giannetti and Simonov (2013) confirm this mechanism empirically for Japan. Indeed, there is some evidence that at least some banks are not adequately capitalized after the OMT announcement because equity capital is too low to absorb losses that would entail from a sustained period of stress (Haldane (2012); Acharya and Steffen (2013)). In the following we want to shed light on whether this mechanism was also present in the period after the OMT announcement.

Identifying undercapitalized banks is complicated, as the aforementioned zombie lending incentive arises because banks do not want to incur losses due loan write-offs. Moreover, low solvency banks report regulatory capital ratios that exceed their book equity by using regulatory adjustments to inflate regulatory capital ratios (Lubberink (2015)). As such it is not feasible to use regulatory capital ratios because they may mask the severity of the problem (Acharya, Engle, and Pierret (2014)). To this end, we follow the recent literature on the optimal capital structure of banks. Gropp and Heider (2010) show that banks target an optimal capital structure. Using this inside we estimate the target leverage ratio of each bank in our sample as the average equity ratio (total equity/total assets) for the banks in the pre financial crisis period between 2004 and 2006. We argue that this is the target capital structure that each banks wants to revert to in normal times. Then we compare the equity ratio of a bank after the OMT announcement (December 2012) to its own pre financial crisis average. A bank is classified as undercapitalized after the OMT announcement if its equity capital ratio in December 2012 is below the 2004-2006 average. Since the target capital structure for each bank is estimated during normal times, we argue that this procedure yields conservative estimates for undercapitalized banks.

The results for the zombie lending test are presented in Table 8. In addition to the criteria used to form firm clusters in Section 4.2, in this part of the analysis we add the criterion whether firms are classified as zombie or not, implying that we have more firm clusters than in the previous analysis. Several results are noteworthy. First, high OMT windfall gain banks that are well capitalized ex post increase the loan supply to corporate borrowers. Based on the specification in Column (4) a one standard deviation higher OMT windfall gains, implies an increase in loan supply by 2.5%. Banks that remain undercapitalized, however, show no significant increase in their loan supply to private borrowers in Europe. These banks only increase the loan supply to zombie firms. Here, a one standard deviation higher OMT windfall gain implies a 1.1% increase in loan supply to zombie firms. We again find similar results when we replace the change in loan volume with a dummy for whether the loan amount to a cluster actually increased. This implies that high OMT windfall gain banks that remain undercapitalized have a

higher propensity to increase the loan amount towards clusters consisting exclusively of zombie firms. Hence, these banks continued to lend to zombie firms to not incur losses on their loan portfolio. Column (6) again shows that these results continue to hold when restricting the analysis to GIIPS banks. Results are again very stable across the two zombie definitions.

Thus, while the OMT program has led to a significant recapitalization of the European banking sector, it seems to be the case that the capital gains for some banks were indeed too small to allow them to write off loans from very poorly performing firms. To prevent incurring the losses from non-performing loans, these banks continued to lend to zombie firms.

## 4.3 Real and Financial outcomes

Given the evidence from the previous section that banks with higher windfall gains from the OMT announcement significantly increased their lending volume to the real sector, we now investigate how firms use this cash inflow from new loans. To analyze the real and financial outcomes of borrowing firms, we closely follow the approach in Acharya, Eisert, Eufinger, and Hirsch (2015). In particular, we now divide the financial information reported in Amadeus into the period before the OMT program announcement (i.e., fiscal years 2009 to 2011) and the period after the OMT program announcement (i.e., fiscal years 2012 and 2013). We construct a new indicator variable, *PostOMT*, which is now equal to one if the financial information reported in Amadeus falls in the respective period.

To determine how much firms benefited from the OMT announcement through their banking relationships, we construct a variable that measures how much firms gained indirectly from the OMT announcement through the sovereign debt holdings of their banks. We denote this variable as *Indirect OMT windfall gain*. To construct the variable, in a first step, we use the *OMT windfall gain* of each individual bank, as defined in Eq. (1), to compute the *Average OMT windfall gain* for all the banks that act as lead arranger in a given syndicate. Second, we calculate the indirect gains of a firm from the OMT program due to the windfall gains of the banks it has lending relationships with by using the fraction of syndicated loans a bank gets from a particular syndicate as weights. This yields the following measure for firm $i$ in country $j$ in industry $h$ at time $t$:

$$\textit{Indirect OMT windfall gains}_{ijht} = \frac{\sum_{l \in L_{ijht}} \textit{Average OMT windfall gain}_{lijh} \cdot \textit{Loan Amount}_{lijht}}{\textit{Total Loan Amount}_{ijht}}, \quad (4)$$

where $L_{ijht}$ are all of the firm's loans outstanding at time $t$. We measure the dependence on banks that benefited from the OMT announcement as the average dependence on

these banks over the 2009-2011 period.[7]

Table 5 presents descriptive statistics for our sample firms in the pre-OMT period of 2009-2011, split into firms with high and low indirect gains on sovereign debt through their banks. Consistent with (Acharya, Eisert, Eufinger, and Hirsch (2015)), firms with a higher dependence on banks that benefited from the OMT announcement are larger and have a higher fraction of tangible assets. However, note that, while in the pre-crisis period of 2006-2008 firms in the two groups were comparable along all other observable dimensions, in the pre-OMT period of 2009-2011 firms with a higher dependence on banks that benefited from OMT (i.e., banks that were cutting lending significantly more during the peak of the crisis), have a lower interest coverage ratio, net worth and EBITDA/Assets ratio. This indicates that the quality of these firms deteriorated over the crisis period due to the fact that these firms could not access bank financing in this period.

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

We begin by exploring the effect of the sovereign debt crisis on several firm outcomes graphically.[8] In Figures 8–11, we plot the time series of the cash holdings, leverage, employment growth rates, and investment levels, respectively, for firms with a high and low dependence on banks that strongly benefited from the OMT announcement, which is defined in Eq. (4). Note, that the x-axis in the graphs is divided into three segments. The first vertical line divides the pre and post sovereign debt crisis period. This partition is similiar to the one used in Acharya, Eisert, Eufinger, and Hirsch (2015). We add a second vertical line that separates the pre and post OMT period. The graphs reconfirm the findings in (Acharya, Eisert, Eufinger, and Hirsch (2015)) that firms with a high and low dependence on banks that benefited from OMT (which are mostly GIIPS banks) were on similar trends prior to the beginning of the sovereign debt crisis.

Furthermore, the graphs clearly reveal that firms with lending relationships to banks that benefited from the OMT announcement show a significant increase in leverage and cash holdings, but no change in their investment level or employment growth rates. Moreover, cash and leverage increased by roughly the same share, suggesting that borrowing firms used the cash inflow from new loans primarily to build up cash reserves.

To formally investigate whether borrowing firms with significant business relationships to banks that benefited from the OMT announcement altered their corporate policies,

[7]Results are qualitatively similar when using the 2006-2008 average.

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

we employ the following specification for firm $i$ in country $j$, and industry $h$ in year $t$:

$$\begin{aligned} y_{ijht+1} &= \beta_1 \cdot \textit{Indirect OMT windfall gains}_{ijh} \cdot \textit{PostOMT}_t \\ &+ \gamma \cdot X_{ijht} + \textit{Firm}_{ijh} + \textit{Industry}_h \cdot \textit{Country}_j \cdot \textit{Year}_{t+1} \\ &+ \textit{ForeignBankCountry}_{k \neq j} \cdot \textit{Year}_{t+1} + u_{ijht+1}. \end{aligned} \tag{5}$$

Our baseline regression includes firm and year fixed effects, as well as firm-level control variables to capture other determinants of firms' corporate policies. These include firm size, leverage, net worth, the fraction of tangible assets, the interest coverage ratio, and the ratio of EBITDA to total assets. Additionally, we include interactions between industry, year, and country fixed effects to capture any unobserved time-varying shocks to an industry in a given country in a given year that may impact credit demand of borrowing firms as well as their real outcomes.

We observe a number of cross boarder firm-bank relationships in our sample. For example, a German firm borrowing from a Spanish bank. To capture possible effects that the German firm's exposure to the potentially changing macroeconomic environment in Spain after the OMT announcement that might be correlated with its dependence on a Spanish bank (e.g., because the German firm has a subsidiary in Spain), we include foreign bank country times year fixed effects. For the example of the German firm with a Spanish subsidiary, besides the industry-country-year fixed effect, we additionally include a Spain-year fixed for this firm.

Results are presented in Table 9. The unit of observation is a firm-year. For ease of exposure, we only report the results for our key variable of interest, the interaction of *Indirect OMT windfall gains* with the *PostOMT* dummy. The results in Table 9 show distinct patterns for the behavior of financial and real variables after the OMT program announcement. For the financial variables, we find a significant increase in both cash and leverage. Note that the difference of the coefficients for the change in cash and change in leverage regressions is small and statistically insignificant (see Column (3)). This again suggests that both leverage and cash holdings increased by a similar amount, implying that firms used the liquidity inflow primarily to increase their cash reserves. More precisely, a one standard deviation increase in *Indirect OMT windfall gains* implies an increase in cash and leverage of around 1.9pp. This result is further confirmed by the fact that we do not find any significant effects for the real variables. Neither employment nor investment change significantly for firms with high *Indirect OMT windfall gains* in the period after the OMT announcement. One potential explanation for the results presented in Table 9 is that at the time of its announcement, it was unclear whether the OMT program would permanently improve the liquidity situation of banks. Therefore, firms may have prepared for a possible contraction in credit by hoarding more cash on their balance sheet.

Table 4 reports that primarily low-quality firms benefited from the expansion in loan volume induced by the increase in value of the sovereign debt holdings in the period following the OMT program announcement. Next, we provide evidence on the relation between real effects and the *Indirect OMT windfall gains* of these firms. Table 10 presents the results for our baseline regressions for the four different corporate policies of firms (i.e., change in cash, change in debt, employment growth, and investment). Table 10, Panel A reports results where we again classify firms based on their average interest coverage ration during the sovereign debt crisis (2009 to 2011) and Panel B presents results where we classify firms based on their average interest coverage ration before the sovereign debt crisis (2006 to 2008). The general picture that emerges from the table is that the financial effects reported in Table 9 for our entire sample of firms is driven mostly by the low interest coverage subset of firms if we use the sovereign debt crisis period to classify firms (2009 to 2011) while neither high- nor low-quality firms show a significant relation between *Indirect OMT windfall gains* of their banks and real economic activity like employment and investment. Dividing firms based on their quality in the pre-sovereign debt crisis period (2006 to 2008) does not yield significant results for the triple interaction term of indirect OMT windfall gains, post OMT, and low interest coverage ratio, again implying that results are not driven by firms that were of worse quality prior to the crisis, but by firms whose quality deteriorated because they were cut off from bank financing during the sovereign debt crisis.

In contrast, Panels C and D of Table 9 documents that zombie firms do not use the entire funds from their new bank loans to build up cash reserves. For these firms, leverage increases significantly more than cash holdings. A potential explanation could be that firms need the proceeds to service interest rate payments on their loans. This is backed by the observation, that zombie firms only have an interest coverage ratio of 0.29-0.39, implying that they are unable to service interest payments from earnings. Also for these firms there are no significant effects on either employment or investment. These firms thus show the typical behavior of zombie firms (Giannetti and Simonov (2013)).

## 4.4 Zombie Distortions

In a final step, we investigate whether the rising fraction of zombie firms has negative effects on healthy (non-zombie) firms in the same industry. The basic regression we will run in this section follows Caballero, Hoshi, and Kashyap (2008) and is given by:

$$\begin{aligned} y_{ijht+1} &= \beta_1 \cdot \textit{Non-Zombie}_{ijht} + \beta_2 \cdot \textit{Non-Zombie}_{ijht} \cdot \textit{Fraction Zombies}_{jht} \\ &+ \beta_3 \cdot \textit{Non-Zombie}_{ijht} \cdot \textit{Fraction Zombies}_{jht} \cdot \textit{High IC Firm}_{ijht} \\ &+ \gamma \cdot X_{ijht} + \textit{Firm}_{ijh} + \textit{Industry}_h \cdot \textit{Country}_j \cdot \textit{Year}_{t+1} + u_{ijht+1}. \end{aligned} \tag{6}$$

We will focus our analysis on real outcomes at the firm level, that is, the dependent variables are employment growth and investment. The fraction of zombies is measured at the industry-country-year level.[9] Our coefficients of interest are $\beta_2$ and $\beta_3$, that is, whether non-zombie firms, and especially high quality non-zombie firms, invest less or have lower employment growth due to the presence 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 the industry in a given a country and year is a proxy for the overall (un)attractiveness of operating in the industry (for that year). Note, however, that even without industry-country-year fixed effects, non-zombie firms would have to be more affected by a industry-specific macroeconomic downturn than zombie firms in order to get a significant effect of being a non-zombie on investment or employment.

Results for this specification are presented in Table 11. The table shows that low quality non-zombie firms that operate in industries with a high zombie fraction do not invest less or have lower employment growth rates ($\beta_2$ is insignificant throughout all specifications). High quality non-zombie firms, however, invest significantly less if they operate in industries with many zombie firms ($\beta_3$ is significantly negative), and also have significantly lower employment growth rates. This is consistent with our previous results, which show that mostly low quality borrowers benefited from the loan supply increase. While also non-zombie low quality firms received additional loans, these firms mostly used the proceeds to build up cash reserves. If regaining financial stability was indeed their primary objective, it seems plausible that these firms would not have used the loan proceeds to invest or hire people if there were less zombies in their industry. High quality firms, however, which did not benefit from the loan supply increase, suffer from the presence of zombie firms in their industry. For these firms, investment levels are significantly depressed if they operate in industries with a significant fraction of zombie firms. On average, the fraction of zombie firms increased by 8.9% after OMT. Considering the estimates in Columns (2) and (4), this implies that high quality non-zombie firms invest between 11.6% and 12.5% of capital less compared to a scenario where the fraction of zombies had stayed at its pre-OMT level. An industry at the 95th percentile saw an increase of zombie firms of 30%, implying that high quality non-zombie firms invested between 39% and 42% of capital less due to the increase in the fraction of zombie firms. When looking at employment growth, we find that firms that saw an increase of 8.9% in the fraction of zombie firms in their industry had 3.6% lower employment growth rates. Considering again the 90th percentile, we find that high quality non-zombie firms in this industry had 12% lower employment growth rates.

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

# 5 Conclusion

In this paper, we show that the announcement of the OMT program has significantly improved the health of banks in the periphery of Europe. By substantially reducing the yields on periphery sovereign debt, GIIPS banks could realize significant windfall gains on their large sovereign debt holdings. These gains significantly reduced bank risk and allowed banks to access market based financing again. The increase in bank health translated into an increased loan supply to the corporate sector, especially to low-quality borrowers. We show that this increase in loan supply to low quality borrowers is at least partly driven by zombie lending motives of high gain banks that remain weakly capitalized after the OMT announcement. The analysis thus highlights the importance of recapitalizing banks adequately to prevent them from engaging in zombie lending. Non-zombie firms that regain access to bank based financing use the cash inflow from new bank loans to build up cash reserves. Zombie firms, on the other hand, are not able to use the inflow from new bank loans to build up cash reserves one for one. Neither group of firms show a significant increase in real activity, that is, an increase in employment or investment.

# References


Acharya, V. V., T. Eisert, C. Eufinger, and C. W. Hirsch (2015): "Real effects of the sovereign debt crisis in Europe: Evidence from syndicated loans," CEPR Discussion Paper No. DP10108.

Acharya, V. V., R. F. Engle, and D. Pierret (2014): "Testing Macroprudential Stress Tests: The Risk of Regulatory Risk Weights," Journal of Monetary Economics, 65, 36–53.

Acharya, V. V., B. Imbierowicz, S. Steffen, and D. Teichmann (2015): "Does the Lack of Financial Stability Impair the Transmission of Monetary Policy?," Working Paper.

Acharya, V. V., D. Pierret, and S. Steffen (2015): "Do Central Bank Interventions Limit the Market Discipline from Short-Term Debt?," Working Paper.

Acharya, V. V., and S. Steffen (2013): "Falling Short of Expectations? Stress-Testing the European Banking System," Working Paper.

——— (2014): "The Greatest Carry Trade Ever? Understanding Eurozone Bank Risks," Journal of Financial Economics, 115(2), 215–236.

Agarwal, S., S. Chomsisengphet, N. Mahoney, and J. Stroebel (2015): "Do Banks Pass Through Credit Expansions to Consumers Who Want To Borrow?," Working Paper.

Altavilla, C., D. Giannone, and M. Lenza (2014): "The Financial and Macroeconomic effects of OMT Announcements," ECB Working Paper.

Caballero, R. J., T. Hoshi, and A. K. Kashyap (2008): "Zombie Lending and Depressed Restructuring in Japan," The American Economic Review, pp. 1943–1977.

Chodorow-Reich, G. (2014): "The Employment Effects of Credit Market Disruptions: Firm-level Evidence from the 2008-09 Financial Crisis," Quarterly Journal of Economics, 129, 1–59.

Diamond, D., and R. Rajan (2000): "A Theory of Bank Capital," Journal of Finance, 55(6), 2431–2465.

Diamond, D. W. (1991): "Monitoring and reputation: The choice between bank loans and directly placed debt," Journal of Political Economy, 99(4), 689–721.

Ferrando, A., A. A. Popov, and G. F. Udell (2015): "Sovereign Stress, Unconventional Monetary Policy, and SME Access to Fina nce," Working Paper.

Giannetti, M., and A. Simonov (2013): "On the Real Effects of Bank Bailouts: Micro Evidence from Japan," American Economic Journal: Macroeconomics, 5(1), 135–67.

Gropp, R., and F. Heider (2010): "The Determinants of Bank Capital Structure," Review of Finance, 14, 587–622.

Haldane, A. (2012): "The Dog and the Frisbee," Bank of England Speech.

Khwaja, A. I., and A. Mian (2008): "Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market," American Economic Review, 98(4), 1413–1442.

Krishnamurthy, A., S. Nagel, and A. Vissing-Jorgensen (2014): "ECB policies involving government bond purchases: Impact and channels," Working Paper.

Krishnamurthy, A., and A. Vissing-Jorgensen (2011): "The Effects of Quantitative Easing on Interest Rates: Channels and Implications for Policy," Brookings Papers on Economics Activity.

Lubberink, M. J. P. (2015): "A Primer on Regulatory Bank Capital Adjustments," .

Peek, J., and E. S. Rosengreen (2005): "Unnatural Selection: Perverse Incentives and the Allocation of Credit in Japan," American Economic Review, 95(4), 1144–1166.

Saka, O., A.-M. Fuertes, and E. Kalotychou (2015): "ECB policy and Eurozone fragility: Was De Grauwe right?," Journal of International Money and Finance, 54, 168–185.

Saunders, A., and S. Steffen (2011): "The costs of being private: Evidence from the loan market," Review of Financial Studies, 24(12), 4091–4122.

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

Sufi, A. (2007): "Information asymmetry and financing arrangements: Evidence from syndicated loans," Journal of Finance, 62(2), 629–668.

Szczerbowicz, U., et al. (2012): "The ECB unconventional monetary policies: have they lowered market borrowing costs for banks and governments?," Working Paper.

# Appendix

Figure 1

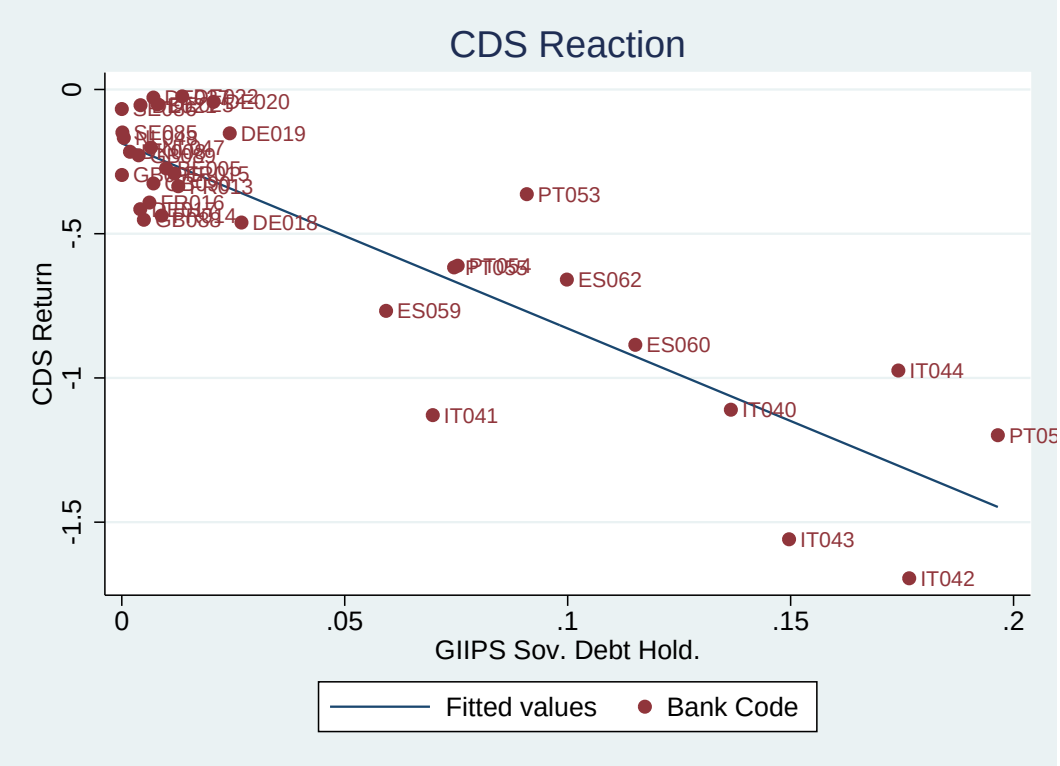


Figure 1 plots the relation between banks' CDS return on the OMT announcement dates and their GIIPS sovereign debt holdings for GIIPS and non-GIIPS banks. Banks included in the analysis must have information about their sovereign debt portfolio prior to the OMT announcement (June 2012) and must be active in the syndicated loan market during the sample period. GIIPS Banks include banks incorporated in Italy, Portugal, and Spain. Non-GIIPS banks consist of banks in all other European countries that are included in the European Banking Authority's stress tests and capital exercises.

Figure 2

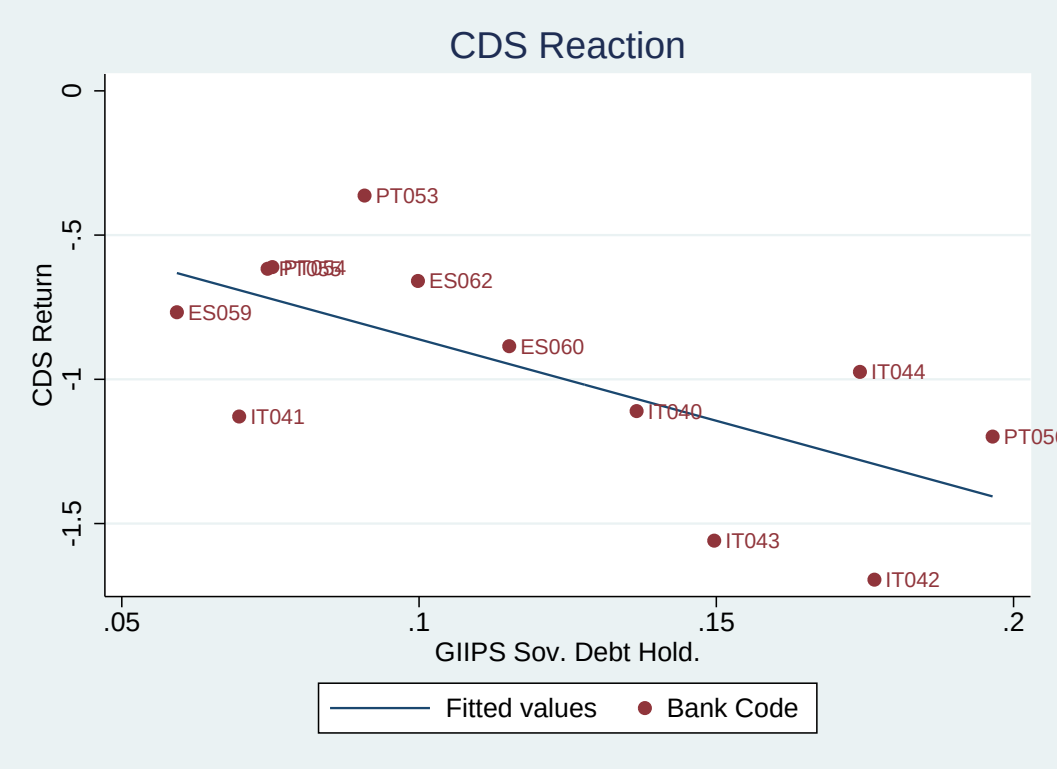


Figure 2 plots the relation between banks' CDS return on the OMT announcement dates and their GIIPS sovereign debt holdings for GIIPS banks only. Banks included in the analysis must have information about their sovereign debt portfolio prior to the OMT announcement (June 2012) and must be active in the syndicated loan market during the sample period. GIIPS Banks include banks incorporated in Italy, Portugal, and Spain.

Figure 3

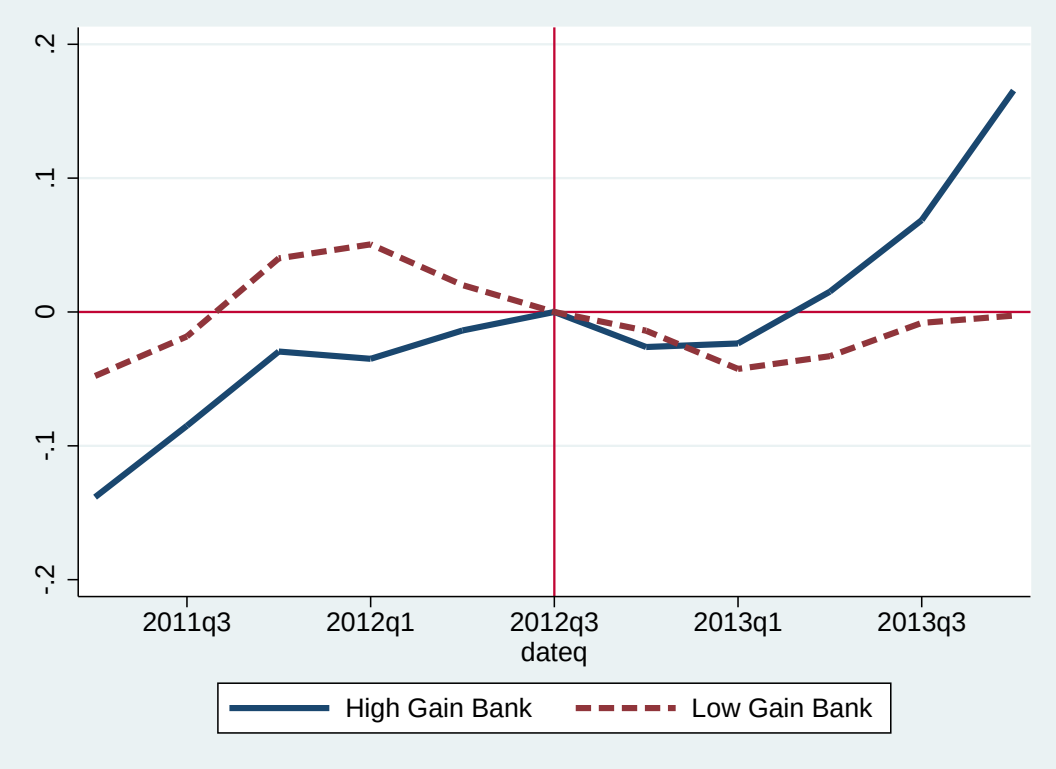


Figure 3 shows the log-ratio of total loans in a given quarter relative to the quarter of the OMT announcement, i.e., the y-axis is normalized to 0 at the time of the OMT announcement. For each quarter we aggregate all loans to private firms borrowing from GIIPS and non-GIIPS banks where GIIPS banks are banks headquartered in Italy, Portugal, or Spain. Non-GIIPS banks consist of banks in all other European countries that are covered by the European Banking Authority's stress tests and capital exercises. We consider all loans in Dealscan and restrict the sample to private firms with financial information available in Amadeus.

Figure 4

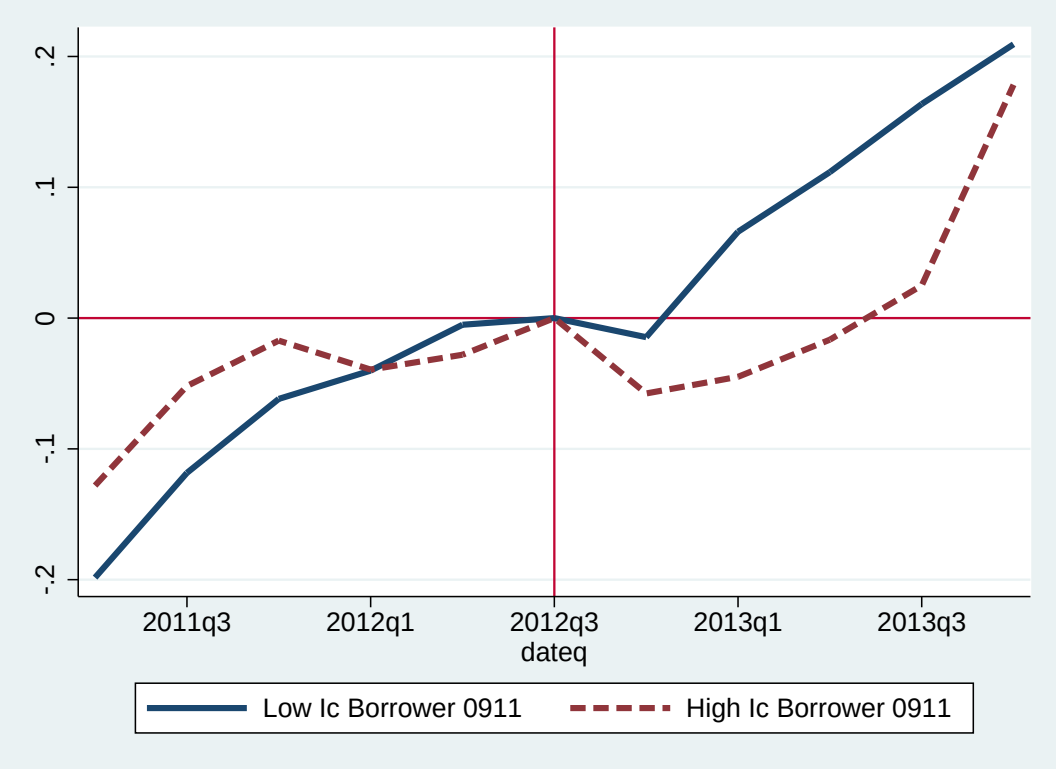


Figure 4 shows the log-ratio of total loans in a given quarter relative to the quarter of the OMT announcement for banks with an above median OMT windfall gain, i.e. the y-axis is normalized to 0 at the time of the OMT announcement, split into firm clusters that have an above and below median quality (based on 2009 to 2011). For each quarter we aggregate loans to private firms borrowing from high OMT windfall gain GIIPS and non-GIIPS banks where GIIPS banks are banks headquartered in Italy, Portugal, or Spain. Non-GIIPS banks consist of banks in all other European countries that are covered by the European Banking Authority's stress tests and capital exercises. We consider all loans in Dealscan and restrict the sample to private firms with financial information available in Amadeus.

Figure 5

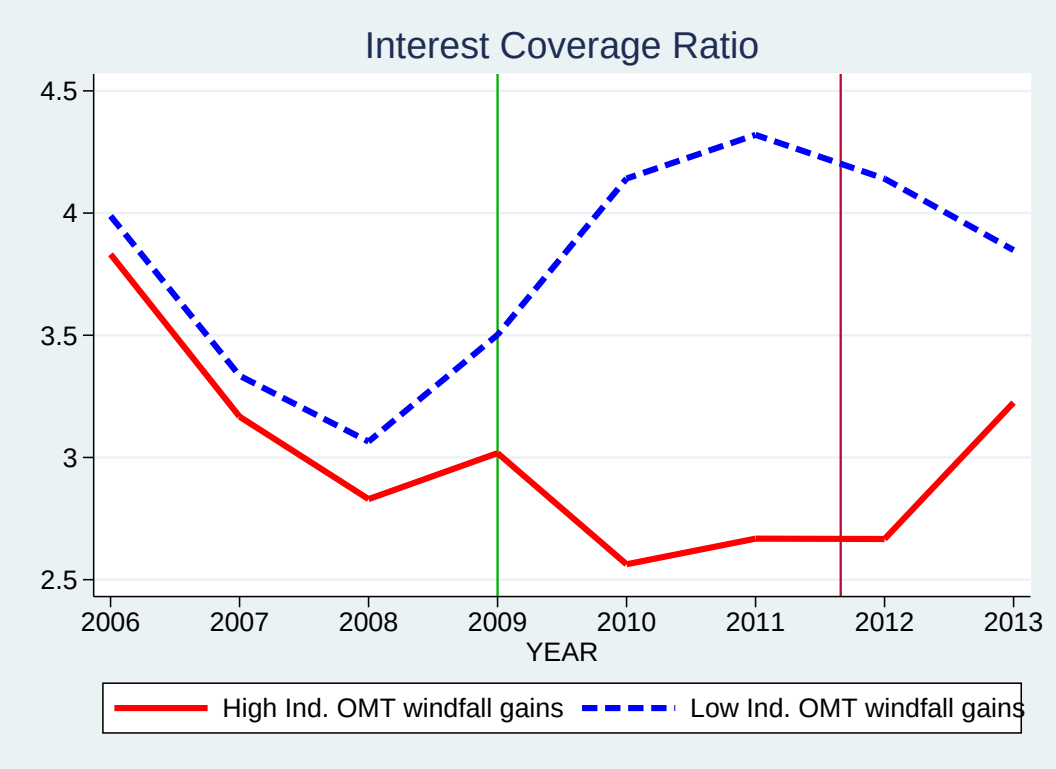


Figure 5 shows the evolution of interest coverage ratio for firms with high (red solid line) and low (blue dashed line) dependence on banks that benefited from the OMT announcement in the pre-OMT and post OMT period. We consider all loans in DealScan to firms located in: Greece, Italy, Ireland, Portugal, Spain (GIIPS countries) and all other EU countries with an active syndicated loan market (non-GIIPS countries). We restrict the sample to private firms with financial information in Amadeus.

Figure 6

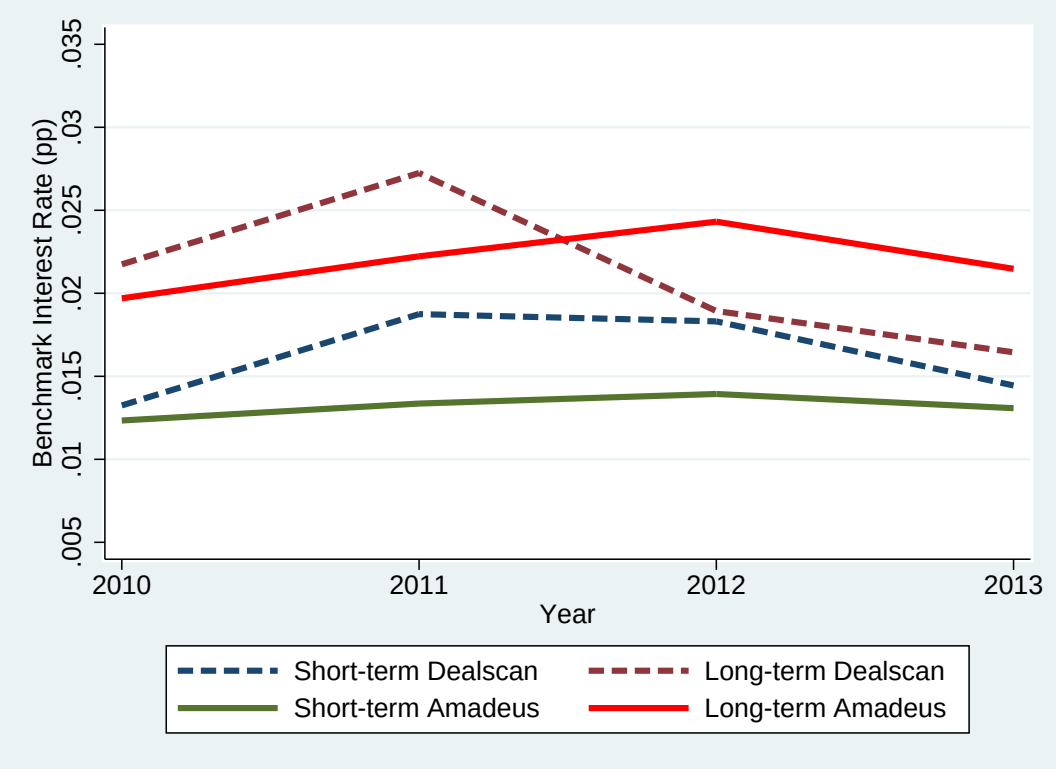


Figure 6 shows the evolution of benchmark interest rates for the two alternative zombie classifications which use information in either Amadeus or Dealscan to calculate benchmark interest rates. We classify a firm as zombie if it meets the following three criteria: (i) the firm receives subsidized credit, (ii) its rating (derived from three year median EBIT interest coverage ratios) is BB or lower, and (iii) the syndicate composition has either remained constant, or banks leaving the syndicate without being replaced by new participants, that is, the same syndicate has already provided a loan to the firm. We consider all loans in DealScan to firms located in: Greece, Italy, Ireland, Portugal, Spain (GIIPS countries) and all other EU countries with an active syndicated loan market (non-GIIPS countries). We restrict the sample to private firms with financial information in Amadeus.

Figure 7

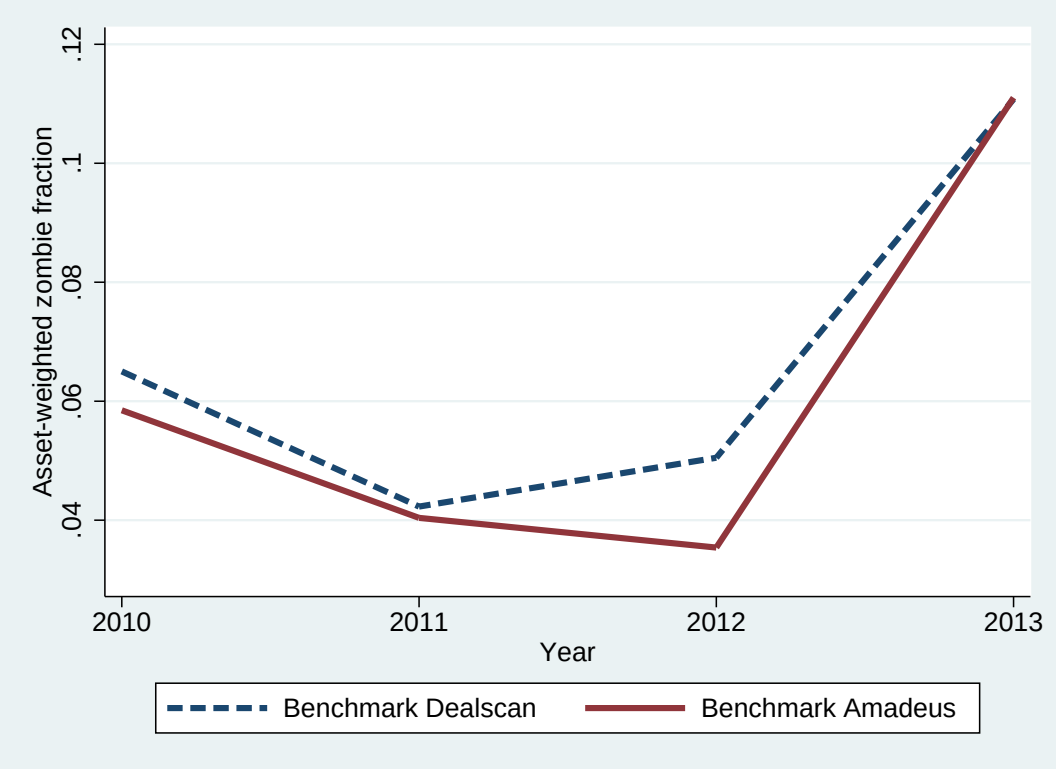


Figure 7 shows the shows the evolution of the asset-weighted fraction of zombies in our sample for the two alternative zombie classifications which use information in either Amadeus or Dealscan to calculate benchmark interest rates. We classify a firm as zombie if it meets the following three criteria: (i) the firm receives subsidized credit, (ii) its rating (derived from three year median EBIT interest coverage ratios) is BB or lower, and (iii) the syndicate composition has either remained constant, or banks leaving the syndicate without being replaced by new participants, that is, the same syndicate has already provided a loan to the firm. We consider all loans in DealScan to firms located in: Greece, Italy, Ireland, Portugal, Spain (GIIPS countries) and all other EU countries with an active syndicated loan market (non-GIIPS countries). We restrict the sample to private firms with financial information in Amadeus.

Figure 8

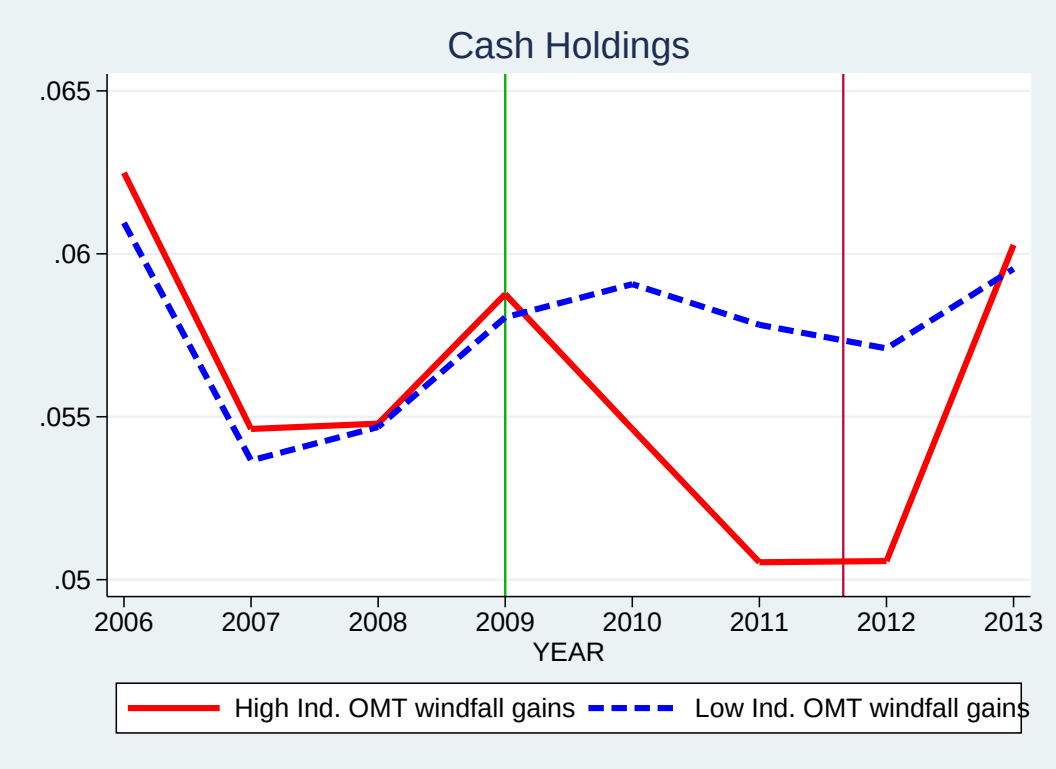


Figure 8 shows the evolution of cash holdings as a fraction of total assets for firms with high (red solid line) and low (blue dashed line) dependence on banks that benefited from the OMT announcement in the pre-OMT and post OMT period. We consider all loans in DealScan to firms located in: Greece, Italy, Ireland, Portugal, Spain (GIIPS countries) and all other EU countries with an active syndicated loan market (non-GIIPS countries). We restrict the sample to private firms with financial information in Amadeus.

Figure 9

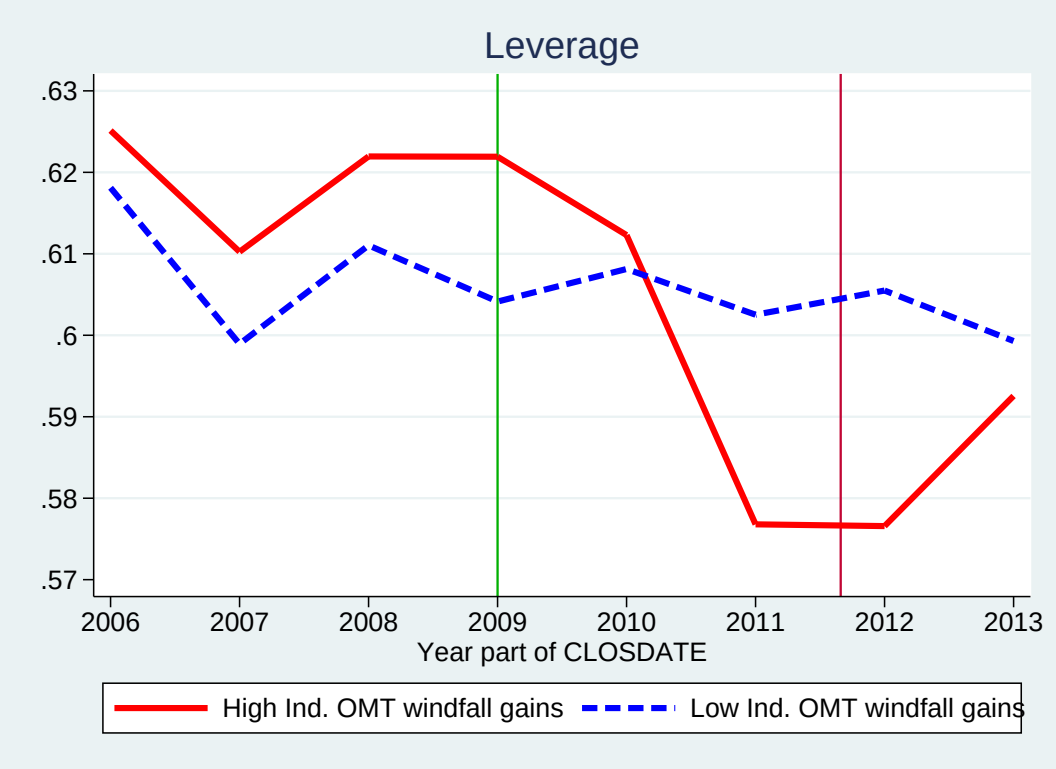


Figure 9 shows the evolution of leverage as a fraction of total assets for firms with high (red solid line) and low (blue dashed line) dependence on banks that benefited from the OMT announcement in the pre-OMT and post OMT period. We consider all loans in DealScan to firms located in: Greece, Italy, Ireland, Portugal, Spain (GIIPS countries) and all other EU countries with an active syndicated loan market (non-GIIPS countries). We restrict the sample to private firms with financial information in Amadeus.

Figure 10

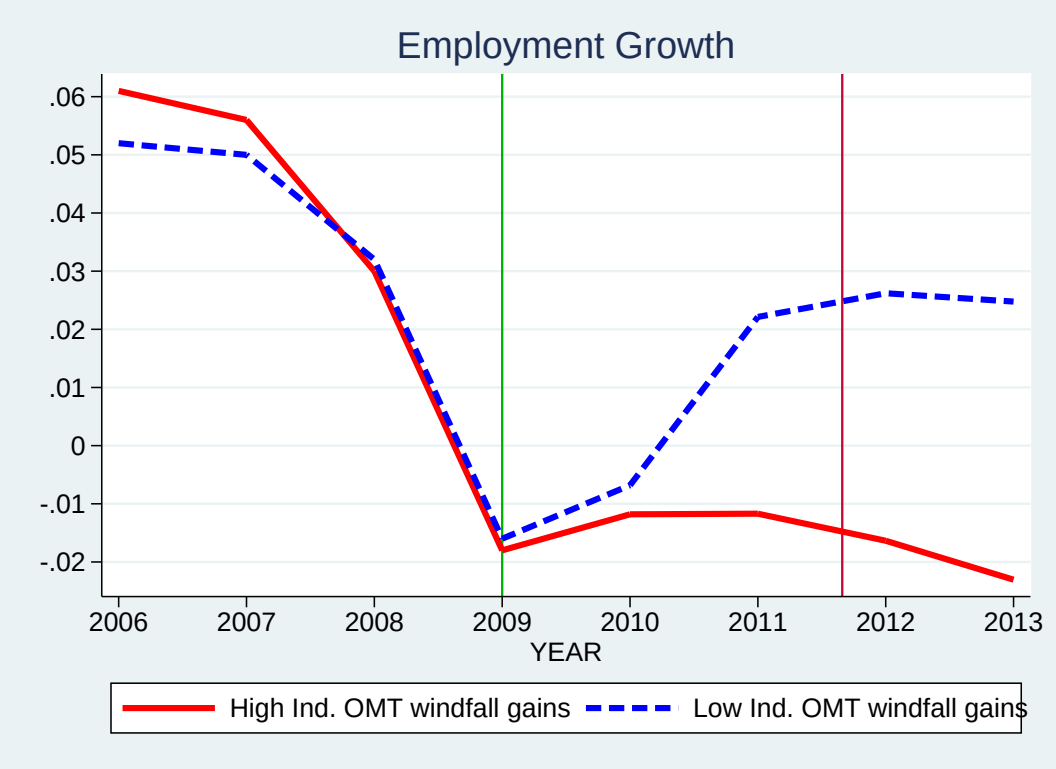


Figure 10 shows the evolution of employment growth rates for firms with high (red solid line) and low (blue dashed line) dependence on banks that benefited from the OMT announcement in the pre-OMT and post OMT period. We consider all loans in DealScan to firms located in: Greece, Italy, Ireland, Portugal, Spain (GIIPS countries) and all other EU countries with an active syndicated loan market (non-GIIPS countries). We restrict the sample to private firms with financial information in Amadeus.

Figure 11

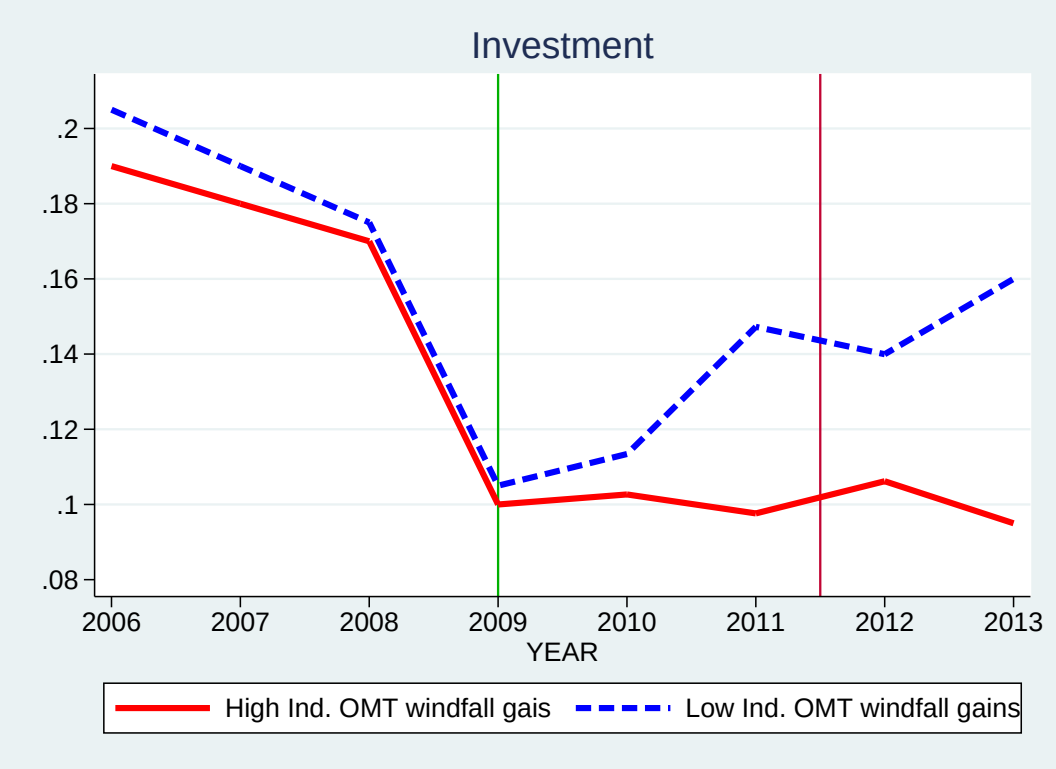


Figure 11 shows the evolution of capital expenditures as a fraction of tangible assets for firms with high (red solid line) and low (blue dashed line) dependence on banks that benefited from the OMT announcement in the pre-OMT and post OMT period. We consider all loans in DealScan to firms located in: Greece, Italy, Ireland, Portugal, Spain (GIIPS countries) and all other EU countries with an active syndicated loan market (non-GIIPS countries). We restrict the sample to private firms with financial information in Amadeus.

Table 1: Bank Reaction to OMT

| | (1) CDS return OMT | (2) OMT windfall gain | (3) GIIPS/Assets |
|---|---|---|---|
| Non-GIIPS Banks | -0.23 | 0.011 | 0.010 |
| | (-9.2) | | |
| GIIPS Banks | -0.96 | 0.08 | 0.118 |
| | (-3.4) | | |
| $t$-test for difference | 7.8 | 5.69 | 12.7 |

Table 1 presents descriptive statistics about banks' CDS spread reaction to the OMT announcements, the *OMT windfall gain*, and the amount of sovereign debt holdings. Banks included in the analysis must have information about their sovereign debt portfolio prior to the OMT announcement (June 2012) and must be active in the syndicated loan market during the sample period. GIIPS Banks include banks incorporated in Italy, Portugal, and Spain. Non-GIIPS banks consist of banks in all other European countries that are covered by the European Banking Authority's stress tests and capital exercises. CDS return OMT represents the CDS return on the three OMT announcement dates (July 26, August 2, and September 6, 2012). *OMT windfall gain* represents the value gain on bank's sovereign debt holdings as a fraction of total equity. GIIPS/Assets represents banks' GIIPS sovereign debt holdings as a fraction of total assets. F-values are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 2: Bank CDS Reaction to OMT Announcement

| Panel A: GIIPS sovereign bond holdings scaled by total assets | | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | CDS Return OMT | CDS Return OMT | CDS Return OMT | CDS Return OMT |
| GIIPS/Assets | -6.414*** | -7.635*** | -7.567*** | -7.715*** |
| | (-10.38) | (-13.05) | (-11.28) | (-10.62) |
| Log Assets | | -0.134*** | -0.133*** | -0.126*** |
| | | (-4.12) | (-4.00) | (-3.51) |
| Tier1 Capital | | | 0.396 | 1.110 |
| | | | (0.22) | (0.50) |
| RWA/Assets | | | | 0.084 |
| | | | | (0.57) |
| $R^2$ | 0.771 | 0.852 | 0.852 | 0.854 |
| $N$ | 34 | 34 | 34 | 34 |
| 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 |
| $N$ | 34 | 34 | 34 | 34 |

Table 2 presents estimates from a linear regression analysis of the determinants banks' CDS returns on the OMT announcement dates. Independent variables are each banks' GIIPS sovereign bond holdings scaled by total assets (GIIPS/Assets) measured before the OMT announcement or the OMT windfall gain which is defined as the gain on the sovereign debt holdings as a fraction of total equity. Control variables include the log of total assets, the ratio of tier 1 capital to risk weighted assets, and the ratio of risk weighted assets to total assets, all measured in the period prior to the OMT announcement. $t$-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 3: Loan Volume Regressions - All Firms

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Δ Loans | Δ Loans | Δ Loans | Δ Loans | Loan Inc. | Δ Loans |
| OMT windfall gain*PostOMT | 0.187*** | 0.211*** | 0.108** | 0.122** | 0.165* | 0.184** |
| | (3.19) | (2.92) | (2.60) | (2.41) | (1.71) | (2.00) |
| Log Assets | -0.015 | -0.010 | -0.000 | 0.009 | 0.027 | 0.075 |
| | (-0.62) | (-0.37) | (-0.01) | (0.34) | (0.47) | (1.44) |
| Equity/Assets | 0.121 | 0.168 | 0.233 | 0.350 | 0.230 | 0.311 |
| | (0.46) | (0.54) | (0.65) | (0.88) | (0.39) | (0.44) |
| Impaired Loans | 0.054** | 0.059** | 0.004 | 0.001 | 0.000 | -0.016 |
| | (2.34) | (2.32) | (0.20) | (0.04) | (0.01) | (-0.46) |
| Return on Avg. Assets | 0.014*** | 0.013** | 0.011* | 0.011* | 0.020** | 0.016 |
| | (2.76) | (2.35) | (1.99) | (1.86) | (2.27) | (1.14) |
| $R^2$ | 0.013 | 0.097 | 0.598 | 0.643 | 0.617 | 0.775 |
| $N$ | 10879 | 10879 | 10879 | 10879 | 10879 | 4090 |
| Bank Fixed Effects | YES | NO | YES | NO | NO | NO |
| Time Fixed Effects | YES | YES | NO | NO | NO | NO |
| FirmCluster-Bank Fixed Effects | NO | YES | NO | YES | YES | YES |
| FirmCluster-Time Fixed Effects | NO | NO | YES | YES | YES | YES |

Table 3 presents the results of a modified version of the Khwaja and Mian (2008) bank lending channel regression. The unit of observation is a firm cluster-bank-quarteryear. The dependent variable is the change in log loan volume of a firm cluster-bank relation in a given quarter where firm clusters are formed based on a firm's country of incorporation, industry, and rating. The rating of each firm is estimated from EBIT interest coverage ratio medians for firms by rating category provided by Standard & Poor's. We assign ratings on the basis of the pre-crisis median interest coverage ratio of each firm. Data is restricted to: (i) the set of firm cluster-bank relations that existed prior to OMT announcement, and (ii) firm cluster-quarters where firms in a cluster borrow from at least one bank that benefited one bank that did not benefit from the OMT announcement. *PostOMT* is an indicator variable equal to one starting in quarter four of 2012, and zero before. 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: Loan Volume Regressions - Firm Quality

| Panel A: Classification 2009-2011 | | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | Δ Loans | Δ Loans | Δ Loans | Δ Loans | Loan Inc. | Δ Loans |
| OMT windfall gain*PostOMT | 0.042 | 0.062 | -0.004 | -0.014 | -0.030 | 0.038 |
| | (0.68) | (0.80) | (-0.06) | (-0.18) | (-0.21) | (0.41) |
| OMT windfall gain*PostOMT*LowIC | 0.280*** | 0.295*** | 0.212*** | 0.253*** | 0.364** | 0.296** |
| | (5.66) | (5.02) | (3.25) | (3.02) | (2.03) | (2.89) |
| Log Assets | -0.019 | -0.013 | -0.002 | 0.006 | 0.023 | 0.071 |
| | (-0.79) | (-0.49) | (-0.09) | (0.25) | (0.41) | (1.38) |
| Equity/Assets | 0.004 | 0.060 | 0.152 | 0.255 | 0.093 | 0.246 |
| | (0.01) | (0.18) | (0.42) | (0.64) | (0.16) | (0.36) |
| Impaired Loans | 0.052** | 0.057** | 0.003 | -0.001 | -0.002 | -0.016 |
| | (2.34) | (2.32) | (0.14) | (-0.03) | (-0.08) | (-0.46) |
| Return on Avg. Assets | 0.014*** | 0.013** | 0.011** | 0.011* | 0.020** | 0.015 |
| | (2.75) | (2.33) | (2.03) | (1.91) | (2.38) | (1.13) |
| $R^2$ | 0.014 | 0.098 | 0.598 | 0.643 | 0.617 | 0.775 |
| $N$ | 10879 | 10879 | 10879 | 10879 | 10879 | 4090 |
| Panel B: Classification 2006-2008 | | | | | | |
| OMT windfall gain*PostOMT | 0.376*** | 0.399*** | 0.237** | 0.224** | 0.309** | 0.360** |
| | (3.34) | (2.99) | (2.72) | (2.25) | (2.68) | (2.32) |
| OMT windfall gain*PostOMT*LowIC | -0.118 | -0.123 | -0.147 | -0.106 | -0.064 | -0.039 |
| | (-1.24) | (-1.11) | (-1.14) | (-0.78) | (-0.32) | (-0.18) |
| Log Assets | -0.011 | -0.018 | 0.022 | 0.032 | 0.056 | 0.069** |
| | (-0.41) | (-0.57) | (0.90) | (1.46) | (1.50) | (2.62) |
| Equity/Assets | 0.371 | 0.434 | 0.349 | 0.475* | 0.738 | 0.705* |
| | (0.84) | (0.89) | (1.32) | (1.69) | (1.48) | (2.04) |
| Impaired Loans | 0.043 | 0.056** | -0.010 | -0.009 | 0.036 | 0.003 |
| | (1.64) | (2.29) | (-0.50) | (-0.45) | (0.83) | (0.09) |
| Return on Avg. Assets | 0.017* | 0.011* | 0.005 | 0.003 | 0.012* | 0.014* |
| | (1.91) | (1.82) | (1.07) | (0.80) | (1.80) | (1.90) |
| $R^2$ | 0.011 | 0.101 | 0.604 | 0.650 | 0.619 | 0.827 |
| $N$ | 10330 | 10330 | 10330 | 10330 | 10330 | 3994 |
| Bank Fixed Effects | YES | NO | YES | NO | NO | NO |
| Time Fixed Effects | YES | YES | NO | NO | NO | NO |
| FirmCluster-Bank Fixed Effects | NO | YES | NO | YES | YES | YES |
| FirmCluster-Time Fixed Effects | NO | NO | YES | YES | YES | YES |

Table 4 presents the results of a modified version of the Khwaja and Mian (2008) bank lending channel regression. The unit of observation is a firm cluster-bank-quarteryear. The dependent variable is the change in log loan volume of a firm cluster-bank relation in a given quarter where firm clusters are formed based on a firm's country of incorporation, industry, and rating. Panel A uses the sovereign debt crisis years 2009 to 2011 to classify firms as high and low quality firms, whereas Panel B uses the pre-sovereign debt crisis years 2006 to 2008. Firms are split based on the country-specific 3-year median interest coverage ratio of the respective period. The rating of each firm is estimated from EBIT interest coverage ratio medians for firms by rating category provided by Standard & Poor's. We assign ratings on the basis of the pre-crisis median interest coverage ratio of each firm. Data are restricted to: (i) the set of firm cluster-bank relations that existed prior to OMT announcement, and (ii) firm cluster-quarters where firms in a cluster borrow from at least one bank that benefited one bank that did not benefit from the OMT announcement. *PostOMT* is an indicator variable equal to one starting in quarter four of 2012, and zero before. 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 5: Descriptive Statistics (pre-OMT Program Announcement) - All Firms

| | | Total Assets (mn) | Tangibility | Int. Cov. | Net Worth | EBITDA/Assets |
|---|---|---|---|---|---|---|
| | Mean | 2850 | 0.614 | 2.70 | 0.210 | 0.076 |
| High Indirect OMT windfall gains | Median | 486 | 0.658 | 1.25 | 0.190 | 0.069 |
| | Std. Dev. | 7520 | 0.260 | 9.25 | 0.196 | 0.062 |
| | Mean | 1810 | 0.536 | 4.98 | 0.230 | 0.090 |
| Low Indirect OMT windfall gains | Median | 330 | 0.553 | 1.41 | 0.220 | 0.075 |
| | Std. Dev. | 5590 | 0.290 | 2.540 | 0.216 | 0.077 |
| Diff. ($t$-Stat) | | 1040 (3.65) | 0.078 (6.30) | -2.28 (-5.83) | -0.02 (-1.77) | -0.014 (-2.87) |
| Normalized Diff. | | 0.289 | 0.149 | -0.148 | -0.074 | -0.120 |

Table 5 presents descriptive statistics of firm-level control variables split into firms with a high and low dependence on banks that benefited from the OMT announcement in the pre-OMT period.

Table 6

| Panel A: Difference in equity ratio of syndicate banks (Amadeus Benchmark) | | |
|---|---|---|
| | Remaining Banks | Leaving Banks |
| Mean | 5.13 | 6.02 |
| SD | 1.04 | 2.23 |
| Difference ($t$-statistic) | -.0.89 (-2.25) | |
| **Panel B: Difference in equity ratio of syndicate banks (Dealscan Benchmark)** | | |
| | Remaining Banks | Leaving Banks |
| Mean | 4.92 | 5.45 |
| SD | .99 | 1.78 |
| Difference ($t$-statistic) | -.53 (-2.06) | |
| **Panel C: Breakdown of zombie firms by country (Amadeus Benchmark)** | | |
| Country | Number of Zombies | Number of private firms in sample |
| Germany | 4 | 119 (3.4%) |
| Spain | 35 | 177 (19.8%) |
| France | 10 | 137 (7.2%) |
| UK | 23 | 235 (9.8%) |
| Italy | 29 | 172 (16.8%) |
| **Panel D: Breakdown of zombie firms by country (Dealscan Benchmark)** | | |
| Country | Number of Zombies | Number of private firms in sample |
| Germany | 6 | 119 (5%) |
| Spain | 33 | 177 (18.6%) |
| France | 13 | 137 (9.5%) |
| UK | 25 | 235 (10.6%) |
| Italy | 34 | 172 (19.8%) |

Table 6, Panel A and B present the difference in mean leverage ratio of banks leaving zombie syndicates and banks remaining in zombie syndicates while Panel C and D present a breakdown of the number of zombie firms by country (fraction of all sample firms in a given country). We present these results for the two alternative zombie classifications which use information in either Amadeus or Dealscan to calculate benchmark interest rates. We classify a firm as zombie if it meets the following three criteria: (i) the firm receives subsidized credit, (ii) its rating (derived from three year median EBIT interest coverage ratios) is BB or lower, and (iii) the syndicate composition has either remained constant, or banks leaving the syndicate without being replaced by new participants, that is, the same syndicate has already provided a loan to the firm.

Table 7: Difference in means between zombie and non-zombie low quality firms

| Panel A: Amadeus Benchmark | | | |
|---|---|---|---|
| | No Zombie | Zombie | Difference |
| Total Assets (mn) | 1910 | 1750 | 160 |
| | | | (0.25) |
| Tangibility | 0.640 | 0.644 | 0. |
| | | | (-0.004) |
| Int. Cov. | 1.127 | 0.290 | 0.837*** |
| | | | (2.86) |
| Net Worth | 0.213 | 0.154 | 0.059** |
| | | | (2.51) |
| EBITDA/Assets | 0.050 | 0.034 | 0.016** |
| | | | (2.53) |
| Leverage | 0.643 | 0.720 | -0.077*** |
| | | | (-2.92) |
| Panel B: Dealscan Benchmark | | | |
| | No Zombie | Zombie | Difference |
| Total Assets (mn) | 1910 | 1860 | 50 |
| | | | (0.08) |
| Tangibility | 0.641 | 0.631 | 0.01 |
| | | | (0.36) |
| Int. Cov. | 1.113 | 0.383 | 0.730*** |
| | | | (2.72) |
| Net Worth | 0.212 | 0.175 | 0.037* |
| | | | (1.70) |
| EBITDA/Assets | 0.051 | 0.034 | 0.017*** |
| | | | (2.82) |
| Leverage | 0.676 | 0.722 | -0.046* |
| | | | (-1.80) |

Table 7 presents a test for the difference in means between low quality zombie and low quality non-zombie firms, where firms are defined as low quality based on their 2009-2011 average EBIT interest coverage ratio. We present these results for the two alternative zombie classifications which use information in either Amadeus or Dealscan to calculate benchmark interest rates. We classify a firm as zombie if it meets the following three criteria: (i) the firm receives subsidized credit, (ii) its rating (derived from three year median EBIT interest coverage ratios) is BB or lower, and (iii) the syndicate composition has either remained constant, or banks leaving the syndicate without being replaced by new participants, that is, the same syndicate has already provided a loan to the firm.

Table 8: Loan Volume Regressions - Zombie Lending

| Panel A: Zombie Amadeus Benchmark | | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | Δ Loans | Δ Loans | Δ Loans | Δ Loans | Loan Inc. | Δ Loans |
| OMT windfall gain*PostOMT | 0.444*** | 0.450*** | 0.393*** | 0.413*** | 0.569*** | 0.587** |
| | (5.03) | (4.79) | (3.05) | (2.99) | (2.82) | (1.99) |
| OMT windfall gain*PostOMT*Undercap | -0.368** | -0.418** | -0.392*** | -0.433*** | -0.560*** | -0.662** |
| | (-2.13) | (-2.33) | (-2.75) | (-2.81) | (-2.78) | (-2.83) |
| OMT windfall gain*PostOMT*Undercap*Zombie | 0.157*** | 0.232*** | 0.171*** | 0.237*** | 0.283** | 0.378*** |
| | (3.17) | (4.50) | (4.12) | (3.50) | (2.42) | (3.66) |
| $R^2$ | 0.011 | 0.111 | 0.726 | 0.759 | 0.695 | 0.834 |
| $N$ | 13600 | 13600 | 13600 | 13600 | 13600 | 5566 |
| Panel B: Zombie Dealscan Benchmark | | | | | | |
| OMT windfall gain*PostOMT | 0.437*** | 0.448*** | 0.397*** | 0.412*** | 0.689*** | 0.648** |
| | (4.67) | (4.37) | (3.39) | (3.34) | (4.11) | (2.15) |
| OMT windfall gain*PostOMT*Undercap | -0.419** | -0.470** | -0.400*** | -0.438*** | -0.730*** | -0.688*** |
| | (-2.38) | (-2.48) | (-3.54) | (-3.59) | (-4.26) | (-3.42) |
| OMT windfall gain*PostOMT*Undercap*Zombie | 0.189*** | 0.235*** | 0.173*** | 0.223*** | 0.322*** | 0.364** |
| | (3.47) | (3.57) | (5.70) | (4.43) | (3.95) | (2.64) |
| $R^2$ | 0.010 | 0.114 | 0.723 | 0.756 | 0.693 | 0.848 |
| $N$ | 13600 | 13600 | 13600 | 13600 | 13600 | 5566 |
| Bank Level Controls | YES | YES | YES | YES | YES | YES |
| Bank Fixed Effects | YES | NO | YES | NO | NO | NO |
| Time Fixed Effects | YES | YES | NO | NO | NO | NO |
| FirmCluster-Bank Fixed Effects | NO | YES | NO | YES | YES | YES |
| FirmCluster-Time Fixed Effects | NO | NO | YES | YES | YES | YES |

Table 8 presents the results of a modified version of the Khwaja and Mian (2008) bank lending channel regression. The unit of observation is a firm cluster-bank-quarteryear. The dependent variable is the change in log loan volume of a firm cluster-bank relation in a given quarter where firm clusters are formed based on a firm's country of incorporation, industry, rating, and whether the firm is a zombie. Hence clusters consist entirely of zombies or non-zombies. We present these results for the two alternative zombie classifications which use information in either Amadeus or Dealscan to calculate benchmark interest rates. Panel A considers the interest benchmark based on Amadeus whereas Panel B presents results for the benchmark based on Dealscan. We classify a firm as zombie if it meets the following three criteria: (i) the firm receives subsidized credit, (ii) its rating (derived from three year median EBIT interest coverage ratios) is BB or lower, and (iii) the syndicate composition has either remained constant, or banks leaving the syndicate without being replaced by new participants, that is, the same syndicate has already provided a loan to the firm. Undercap is a dummy variable that equals one if a bank's equity ratio (equity/assets) is below its pre financial crisis average (2004-2006), and zero else. Data are restricted to: (i) the set of firm cluster-bank relations that existed prior to OMT announcement, (ii) firm cluster-quarters where firms in a cluster borrow from at least one bank that benefited one bank that did not benefit from the OMT announcement, and (iii) loans for which pricing information is available in Dealscan. *PostOMT* is an indicator variable equal to one starting in quarter four of 2012, and zero before. Standard errors are clustered at the bank level. $t$-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 9: Financial and Real Effects- All Firms

| Panel A: | | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| | Δ Cash | Δ Debt | Δ Debt-Δ Cash | Emp. Growth | CAPX |
| Indirect OMT windfall gains*PostOMT | 0.348*** | 0.379*** | 0.031 | 0.104 | -0.117 |
| | (2.64) | (2.89) | (0.16) | (0.24) | (-0.39) |
| $R^2$ | 0.161 | 0.316 | | 0.098 | 0.216 |
| $N$ | 2187 | 2269 | | 1822 | 2265 |
| Firm Level Controls | YES | YES | | YES | YES |
| Firm Fixed Effects | YES | YES | | YES | YES |
| Country-Year Fixed Effects | YES | YES | | YES | YES |
| Panel B: | | | | | |
| Indirect OMT windfall gains*PostOMT | 0.385*** | 0.368** | -0.017 | -0.313 | -0.363 |
| | (2.71) | (2.32) | (-0.08) | (-0.55) | (-0.92) |
| $R^2$ | 0.502 | 0.648 | | 0.489 | 0.546 |
| $N$ | 2187 | 2269 | | 1822 | 2265 |
| Firm Level Controls | YES | YES | | YES | YES |
| Firm Fixed Effects | YES | YES | | YES | YES |
| Industry-Country-Year Fixed Effects | YES | YES | | YES | YES |
| Panel C: | | | | | |
| Indirect OMT windfall gains*PostOMT | 0.394*** | 0.401** | 0.007 | -0.400 | 0.126 |
| | (2.65) | (2.31) | (0.03) | (-0.62) | (0.26) |
| $R^2$ | 0.530 | 0.649 | | 0.515 | 0.570 |
| $N$ | 2187 | 2269 | | 1822 | 2265 |
| Firm Level Controls | YES | YES | | YES | YES |
| Firm Fixed Effects | YES | YES | | YES | YES |
| Industry-Country-Year Fixed Effects | YES | YES | | YES | YES |
| Foreign Bank Country-Year Fixed Effects | YES | YES | | YES | YES |

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

Table 10: Financial and Real Effects - Firm Quality

| Panel A: Quality classification 2009-2011 | | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| | Δ Cash | Δ Debt | Δ Debt-Δ Cash | Emp. Growth | CAPX |
| Indirect OMT windfall gains*PostOMT | 0.163 | 0.231 | 0.068 | -0.582 | 0.087 |
| | (0.92) | (1.02) | (0.23) | (-1.11) | (0.16) |
| Indirect OMT windfall gains*PostOMT*Low IC | 0.538** | 0.548** | 0.01 | 0.737 | -0.756 |
| | (2.36) | (2.01) | (0.03) | (1.21) | (-1.16) |
| $R^2$ | 0.507 | 0.666 | | 0.507 | 0.547 |
| $N$ | 2187 | 2269 | | 1822 | 2265 |
| Panel B: Quality Classification 2006-2008 | | | | | |
| Indirect OMT windfall gains*PostOMT | 0.406** | 0.444** | 0.038 | -0.437 | -0.058 |
| | (2.10) | (2.10) | (0.13) | (-0.64) | (-0.15) |
| Indirect OMT windfall gains*PostOMT*Low IC | 0.214 | 0.113 | -0.101 | 0.322 | -0.595 |
| | (0.96) | (0.47) | (-0.30) | (0.39) | (-1.18) |
| $R^2$ | 0.509 | 0.664 | | 0.490 | 0.568 |
| $N$ | 2187 | 2269 | | 1822 | 2265 |
| Panel C: Zombie Lending - Amadeus Benchmark | | | | | |
| Indirect OMT windfall gains*PostOMT*Low IC | 0.534** | 0.555** | 0.021 | 0.088 | -0.722 |
| | (2.37) | (2.09) | (0.02) | (0.10) | (-0.95) |
| Indirect OMT windfall gains*PostOMT*Low IC*Zombie | -0.317** | -0.104 | 0.213* | 0.083 | -0.068 |
| | (-2.51) | (-0.85) | (1.90) | (0.34) | (-0.26) |
| $R^2$ | 0.544 | 0.680 | | 0.534 | 0.558 |
| $N$ | 1949 | 1973 | | 1628 | 1946 |
| Panel D: Zombie Lending - Dealscan Benchmark | | | | | |
| Indirect OMT windfall gains*PostOMT*Low IC | 0.492** | 0.539** | 0.047 | 0.166 | -1.077 |
| | (2.26) | (2.04) | (0.15) | (0.20) | (-1.42) |
| Indirect OMT windfall gains*PostOMT*Low IC*Zombie | -0.230** | -0.077 | 0.153** | 0.034 | 0.091 |
| | (-2.52) | (-0.84) | (2.01) | (0.17) | (0.42) |
| $R^2$ | 0.541 | 0.676 | | 0.533 | 0.566 |
| $N$ | 1949 | 1973 | | 1628 | 1946 |

Table 10 presents firm-level regression results. Panel A uses the sovereign debt crisis years 2009 to 2011 to classify firms as high and low quality firms, whereas Panel B uses the pre-sovereign debt crisis years 2006 to 2008. Firms are split based on the country-specific 3-year median interest coverage ratio of the respective period. Panel C considers all firms for which it is possible to classify them as zombies or non-zombies based the interest rate benchmark from Amadeus, while Panel D considers the interest rate benchmark from Dealscan. The sample consists of all private firms in the intersection of DealScan and Amadeus that are located in the following countries: Greece, Italy, Ireland, Portugal, Spain (GIIPS countries) or other EU countries with active syndicated loan markets (non-GIIPS countries). *Indirect OMT windfall gains* measure the firms' indirect gains on sovereign debt holdings through their lenders, that is, for each firm, we measure the exposure it has to the value increase in the sovereign debt holdings of the banks from which it received loans. *PostOMT* is an indicator variable equal to one starting at the end of fiscal year 2012, and zero before. Firm control variables include the logarithm of total assets, tangibility, interest coverage ratio, EBITDA as a fraction of total assets, and net worth. All regressions include firm, and industry-country-year fixed effects, as well as all firm-level controls. Standard errors are adjusted for heteroscedasticity and clustered at the firm-level. $t$-statistics are reported in parentheses. Significance levels: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 11: Effects on Non-zombie Firms

| Panel A: Amadeus Benchmark | | |
|---|---|---|
| | (1) | (2) |
| | Emp. Growth | CAPX |
| Industry Frac Zombie*Non-Zombie | 0.000 | 0.001 |
| | (1.14) | (1.41) |
| Industry Frac Zombie*Non-Zombie*High IC | -0.004** | -0.014** |
| | (-2.03) | (-2.20) |
| $R^2$ | 0.529 | 0.581 |
| $N$ | 1628 | 1946 |
| Panel B: Dealscan Benchmark | | |
| Industry Frac Zombie*Non-Zombie | 0.000 | 0.001 |
| | (0.49) | (1.14) |
| Industry Frac Zombie*Non-Zombie*High IC | -0.004** | -0.015** |
| | (-2.17) | (-2.19) |
| $R^2$ | 0.529 | 0.581 |
| $N$ | 1628 | 1946 |
| Firm Level Controls | YES | YES |
| Firm Fixed Effects | YES | YES |
| Industry-Country-Year Fixed Effects | YES | YES |

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