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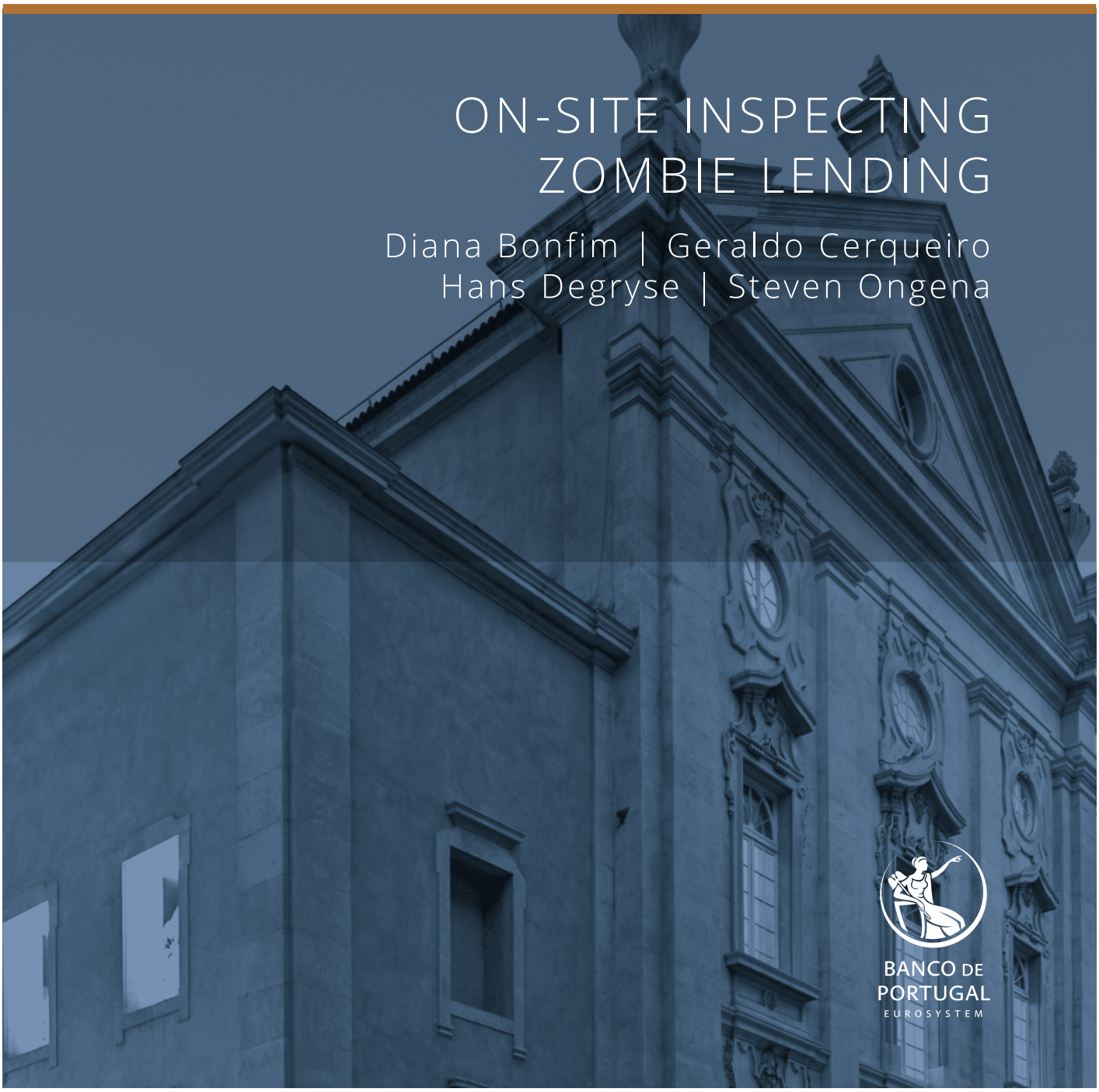

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Abstract
Banks may have incentives to continue lending to "zombie" firms in order to avoid or delay the recognition of credit losses. In spite of growing regulatory pressure, there is evidence that "zombie lending" remains widespread, even in developed countries. We exploit information on a unique series of authoritative on-site inspections of bank credit portfolios in Portugal to investigate how such inspections affect banks' future lending decisions. We find that following an inspection a bank becomes up to 9 percentage points less likely to refinance a firm with negative equity, implying a halving of the unconditional refinancing probability. Hence, banks structurally change their lending decisions following on-site inspections, suggesting that – even in the age of reg-tech – supervisory "reg-leg" can remain a potent tool to tackle zombie lending.

JEL: G21, G32

Keywords: zombie lending, bank supervision.

1. Introduction

Banking crises are associated with prolonged declines in financial intermediation and economic activity. Laeven and Valencia (2018) for example document that more than half of the banking crises in high-income countries lasted five years or more and generated a median cumulative output loss of 35% of GDP. An important driver is that banks continue lending to non-viable firms ("zombie firms") in the hope to recover previously granted loans. Such behavior is particularly strong in low interest rate environments (Banerjee and Hoffman, 2018). Banks may do so in order to avoid or delay the recognition of credit losses. An open question is whether and how the enforcement of regulation remedies the problem of banks' zombie-lending. In this paper, we aim to answer this question by studying "unconventional supervision" stemming from two special on-site inspection programs that reflect a coordinated effort of bank supervisors.

The importance of zombie lending and its implications for the economy have been discussed by policy makers and academics alike. Caballero et al. (2008) define zombie lending or evergreening as "continuing to lend to otherwise insolvent firms". Zombie lending affects the allocation of credit. Through its impact on product market competition, it can have important effects on economic growth (Peek and Rosengren, 2005; Caballero et al., 2008; Schivardi et al., 2017; Adalet McGowan et al., 2018).[1] Regulators and supervisors have been struggling to deal with evergreening by banks. Giannetti and Simonov (2013) for example show that bank bailouts with sufficiently large recapitalizations may mitigate evergreening. Tighter regulation could be another approach. Recent evidence documents that in spite of the stricter regulatory environment, this type of pervasive bank behavior became widespread in Europe following the global financial crisis (see for example Acharya et al., 2019). We ask the question whether bank supervisors on-site inspection programs may offer part of the solution.

In this paper we show that stricter supervision of banks ex post turns out to be an effective tool in mitigating zombie lending. The "unconventional supervision" we study captures a combined effort of the Troika (IMF, ECB and European Commission), the banks' usual supervisor (Banco de Portugal), and the hired external auditors. In particular, we exploit actual on-site bank inspections of the credit portfolios of the largest Portuguese banks to investigate how such inspections affect banks' behavior towards the refinancing of zombie firms. The main goal of the inspection program was to validate the quality of assets that the banks provide as inputs for their risk assessment. These assessments implied an unprecedented level of intrusion, since the inspectors analyzed a large number of individual credit

1. The Financial Times writes in its February 23, 2018 edition: "On average, across the US, Japan, Australia and western Europe, the proportion of firms that are zombies has risen five-fold since 1987, from 2 to 10 percent". See https://www.ft.com/content/40c44992-17c3-11e8-9376-4a6390addb44. Banerjee and Hofmann (2018) study the importance of publicly listed zombie firms in 14 countries. They show that their presence has ratcheted up since the late 1980s.

files of the selected banks and had the freedom to collect additional information from the borrowers themselves.[2] The timing and the intrusiveness of the inspection program came largely as a surprise to the banking sector.

We combine this quasi-experimental setting with a comprehensive configuration of three matched economy-wide datasets that are maintained by Bank of Portugal. First, we obtain from the Credit Register all loans (above 50 euros) granted to Portuguese firms. Second, we obtain financial information for all Portuguese firms. After merging these two datasets we are able to characterize in detail all firms with bank loans in Portugal. Third, we further merge the resulting dataset with supervisory bank-level information that covers all banks operating in Portugal.

We study two special inspection programs to investigate to which extent unconventional bank supervision can mitigate zombie lending by banks.[3] The first, which took place in the middle of 2012, focused on the construction and real estate sectors. The second took place in the middle of 2013 and comprised all sectors. We analyze the effect of those inspections on a bank's willingness to refinance a zombie firm using triple-difference regressions and after controlling for firm-by-year, bank-by-year, and firm-by-bank fixed effects. Our identification thus comes from comparing the triple difference in lending: (i) to the same firm by an inspected versus a non-inspected bank, (ii) by the same bank to zombie versus non-zombie firms, and (iii) for the same firm-bank pair before versus after the inspections.

We find that an inspected bank is between 4 to 9 percentage points less likely to refinance a zombie firm after the inspection (relative to a non-inspected bank, to a non-zombie firm, and to the pre-inspection period). The estimated effects are economically important as they represent between 25% and 50% of the unconditional probability that a zombie firm is refinanced. One potential concern about our empirical strategy is that the inspected banks are larger than the non-inspected banks (and thus potentially different in other relevant dimensions). We assuage such concerns in three ways. First, we show that, prior to the inspections, the inspected and non-inspected banks were refinancing zombie firms at similar rates (that is, pre-trends are parallel across the two groups). Second, the first on-site inspection focused on two industries only, allowing for an additional within-bank comparison. Third, we show that our results become actually stronger if we restrict our sample to the smallest inspected banks and the largest non-inspected, making the two groups of banks more comparable in terms of size.

Our results show that on-site supervision appears to be effective as it affects banks' lending decisions even after inspectors are gone. From the first inspection we learn that banks only modify their behavior towards zombies in the inspected sectors and do not adjust their lending behavior towards other sectors. A focused

2. The total combined value of loans inspected was €92 thousand million, or 57% of the eligible credit portfolio. The assessments were carried out by more than 300 experts.

3. Zombie lending in Portugal has been documented for example by Blattner et al. (2018), Gouveia and Osterhold (2018), and Azevedo et al. (2018). See also Appendix 1 where we provide our own evidence on zombie lending in Portugal.

inspection thus only leads to modified behavior in the inspected sectors. The second inspection which deals with all sectors reduces zombie lending by the inspected banks across the board.

Although direct bank supervision is a crucial pillar of regulatory oversight, empirical evidence on how it affects (future) bank credit decisions is, to the best of our knowledge, scant.[4] The studies closest to ours are Granja and Leuz (2017) and Haselmann et al. (2019). Granja and Leuz (2017) employ bank-level data to study how the transition under the Dodd-Frank Act of several banks to a different supervisor affects these banks' lending policies and local firm activity. They find that stricter bank supervision leads to an increase in small business loans and higher entry and exit rates. Other recent work focuses on supra(national) supervision. Haselmann et al. (2019) compare the behavior of different bank supervisors around the adoption of the Single Supervisory Mechanism (SSM) under the European Central Bank. Banks under direct supervision of the SSM report higher risk-weights, higher probability of default and lower collateral ratios relative to non-SSM banks lending to the same firm. They further find that this is reflected in SSM banks reducing lending and generates negative impacts on firms' real outcomes. Hence, both papers investigate the impact of changes in regulatory and supervisory authorities and technology (the "reg-tech"), while our paper adds to this literature by studying the impact of actual bank supervisory on-site inspections (the "reg-leg") that aim to assess whether banks' provisioning levels were adequate.

Other related work considers the impacts of bank stress tests on bank lending behavior. The stress tests resulted in additional capital requirements and greater supervisory scrutiny. Pierret and Steri (2019) focus on the US stress tests and show that higher capital requirements are not a substitute for supervisory scrutiny when aiming for prudent lending. Our paper deals with coordinated supervision for a subset of banks in specific sectors. This allows to compare bank lending behavior towards inspected and non-inspected sectors.

The remainder of this paper is organized as follows. Section 2 describes the institutional setting. Section 3 details the data and variables. Section 4 investigates the effect of the two bank inspections – sectoral and general inspection. Section 5 presents a number of robustness tests. Section 6 concludes.

4. Agarwal et al. (2014) find that federal regulators are systematically tougher than state regulators downgrading supervisory ratings almost twice as frequently, and that banks consequently report worse asset quality, higher regulatory capital ratios, and lower return on assets. Delis et al. (2018) find that regulatory interventions in the US promote bank accounting quality, especially during periods of crisis. Gropp et al. (2019b) study banks' incentives to engage in regulatory arbitrage to increase their capital ratios and find that arbitrage is more pronounced in countries where national supervisors have more discretion to engage in regulatory forbearance.

2. Institutional setting

The Portuguese Government signed in May of 2011 a financial assistance program with the International Monetary Fund, the European Commission, and the European Central Bank. At that time several European countries, including Spain and Ireland, were dealing with extensive crises in their banking sectors. For this reason, the national supervisory authority (Bank of Portugal) was called to implement a program of special on-site inspections to assess the health of the banking sector in Portugal.

The inspection program was carried out in the eight largest national banking groups, which altogether represented about 80% of the total assets of the banking system. The selection was imposed by supervisors and based only on bank size. Of course, one may question why supervisors did not inspect all banks at once. However, we note that the inspections were very costly in several dimensions, including the coordination effort between the many parties involved.[5] The inspections we discuss in this paper involved 58 employees of the Bank of Portugal and 289 external auditors, who went through individual credit files that altogether amounted to €92 billion.

The main goal of this program was to assess the credit portfolios and validate the quality of assets that these banking groups provide as inputs for their risk assessment. These inspections marked a profound change in the way supervision is conducted in at least three dimensions. The first is the level of granularity, as the auditors had to analyze selected loans one-by-one. Second, banks had to mobilize resources to host the inspecting teams and satisfy their information requests, facilitating the information flow. Third, the inspections were unexpectedly intrusive in the sense that auditors had the freedom not only to analyze the credit books and talk to loan officers, but also to seek additional information directly from borrowers.

There were three inspection waves. The first was carried out between end-July and end-November of 2011 and targeted loans to households. The second and third inspections targeted corporate loans and are the focus of our analysis. We describe these below.

2.1. Sectoral inspections

The construction and real estate sectors were particularly hit during the Great Recession and the ensuing European sovereign debt crisis (Azevedo et al., 2018). Since the Portuguese banks were considerably exposed to these sectors, Bank of

5. The inspection program was monitored by a committee that included not only experts from Bank of Portugal, but also from the International Monetary Fund, the European Commission, the European Central Bank, and three additional European central banks, i.e., the Bank of Spain, the National Bank of Belgium, and the Bank of France. Two independent external auditing firms were involved in the auditing process: Ernst & Young and PricewaterhouseCoopers.

Portugal carried a special on-site inspection program directed at the construction and real estate sectors. We refer to this inspection as the Sectoral Inspection.[6]

The inspections involved the eight largest banking groups and were carried out between July and November of 2012. The reference period is June 2012, meaning that only loans granted up to this point were eligible for inspection.[7] The inspections focused not only on loans granted to firms operating in the construction and real estate sectors, but also on firms in sectors with close links to the construction sector (mainly suppliers and the tourism sector). For the eight banking groups as a whole, the total exposure eligible amounted to €69 billion, which accounts for around 40% of their corporate lending portfolio. A sample of 2,856 firms (loans) that accounted for a total of €39 billion (or 56% of the eligible portfolio) was audited.

The final report was released on December 3, 2012. The report concluded that the eight banking groups inspected needed to reinforce impairments by €861 million (around 2.2% of the overall amount of exposures assessed). Importantly, the banks were not instructed to target any particular firm. Therefore, any changes in lending behavior we observe are ultimately the decision of the bank.

2.2. General inspections

The same eight banking groups were subject to another inspection in the second and third quarters of 2013. The reference period for this second inspection is April 2013, meaning that only loans granted up to this point were eligible for inspection. The purpose of this inspection was again to assess the adequacy of these banks' provisioning levels.

In contrast to the previous inspection that covered particular sectors, all corporate loans (except mortgages and loans granted to public entities) were eligible. To minimize any potential overlap between the two inspections, we drop from the analysis all firms in the construction and real estate sectors, since these sectors were already covered by the previous inspection.

Another important difference between the two inspections is that while the previous inspection was conducted by independent auditors, this general inspection was conducted by each banking group's external auditor, under guidelines set out by both Bank of Portugal and an independent auditor.

The total exposure covered was €93 billion, including off-balance-sheet exposures such as guarantees conceded and committed credit lines. A sample of 2,206 firms (loans) that accounted for a total of €53 billion (or 57% of the eligible

6. For additional details see: $https://www.bportugal.pt/sites/default/files/anexos/documentos-relacionados/combp20121203_en.pdf$.

7. The European Banking Authority's Capital Exercise was held in November 2011 and could be a potential confounding event taking place in the pre-event window (e.g., Degryse et al., 2019; Gropp et al., 2019a). As we explain below when describing our empirical methodology, our within-bank comparison of loans to different sectors eases such concerns.

portfolio) were audited. The final report was released on Aug 2, 2013. The report concluded that the eight banking groups inspected needed to reinforce impairments by €1.1 billion (around 2.1% of the overall amount of exposures assessed). As before, the banks were not told which individual loans or firms to target.

3. Data and variables

3.1. Data sources

Our analysis uses three comprehensive datasets. First, we obtain from the Central Credit Register nearly all loans granted to non-financial firms in Portugal. This credit register is maintained by Bank of Portugal, which is the regulator and supervisor of the banking system in Portugal. It has nearly full coverage, since the reporting threshold is set at a minimum of 50 euros and since reporting is mandatory for all banks and credit institutions. Every month banks report detailed data on their loan exposures, including off-balance sheet commitments, such as unused credit lines. For each reported exposure there is information on loan amounts, loan types and loan status. This includes information on whether the loan is performing, overdue, in renegotiation or written-off. In 2009 the level of detail in the Credit Register was substantially enhanced, starting to include information also on loan maturity and collateral.

We collapse the credit register data at the quarterly frequency and match these data to both firm-level and bank-level data. At the firm level we have detailed balance-sheet and financial statements, as well as location, employment, and age for all firms operating in Portugal. All Portuguese firms are required to file information on an annual basis. At the bank level, we obtain detailed accounting and prudential information on all banks operating in Portugal.

3.2. Sample period

Our main sample period is from 2011:Q3 to 2014:Q3. For each of the two inspections analyzed, we build a sample with ten quarters: four quarters before the inspection, the two quarters during which the inspection takes place, and four quarters after the inspection. For the Sectoral Inspection, the corresponding timeline is: 2011:Q3 – 2012:Q2 (pre-inspection), 2012:Q3 – 2012:Q4 (inspection), and 2013:Q1 – 2013:Q4 (post-inspection). And for the General Inspection, the timeline is: 2012:Q2 – 2013:Q1 (pre-inspection), 2013:Q2 – 2013:Q3 (inspection), and 2013:Q4 – 2014:Q3.

3.3. Variables

We provide variable definitions in Table 1. Zombie lending (or evergreening) means that a bank is actively refinancing an unviable firm. To capture this behavior, we

focus on new loans being granted to existing borrowers. We define $NewLoan$ as an indicator of whether the bank increases its exposure relative to an existing borrower, including lines of credit. We focus on existing borrowers because zombie lending consists of repeated lending to firms that are essentially insolvent, in which the bank attempts to postpone losses or eventually hope for a possible recovery of the firm.

A zombie firm is essentially an unviable firm. We therefore define $ZombieFirm$ as one with negative equity in the previous year. This means that the firm has accumulated so many losses that liabilities became larger than assets. The economic rationale behind our definition is that this is a firm that is technically insolvent. It is thus quite risky for a lender to refinance such highly levered firms. Although one may argue that banks can price in this risk, charging a high loan rate would raise financing costs and thus make these firms even more financially distressed. The available empirical evidence suggests that the opposite actually happens: Banks grant loans at soft terms to zombie firms (Caballero et al., 2008; Acharya et al., 2019). Below we discuss our definition of zombie firm in more detail and provide some validation tests.

As mentioned in Section 2, the inspection programs applied only to the eight largest banks in Portugal. The variable $Inspectedbank$ indicates whether the bank was subject or not to the inspections.

We compute two relationship measures: the duration of relationship (in years) and an indicator of whether the firm has a main bank (i.e., a bank that concentrates at least 75% of the firm's loans).

Finally, we collect some firm characteristics: an indicator of whether the firm is Micro (the smallest category, with number of employees below 10 and annual balance sheet total below €2 million), the number of employees, the firm's leverage ratio, the firm's profitability (measured by its ROA), and an indicator for whether the firm is in default with any bank.

3.4. Summary statistics

Table 2 presents the summary statistics of the data. Our data offer three sources of variation: across firms, across banks, and across time (year-quarters). The sample period is from 2011:Q3 to 2014:Q3 and comprises the two inspection events. In Appendix Table A1 we provide separate descriptive statistics for the two inspections.

The unconditional probability that a bank refinances an existing borrower in a given quarter is 18.4%. The fraction of firms in our sample with negative equity, which we label zombie firms, is almost 15%. More than 62% of the loans in our sample were granted by one of the eight banks that were subject to the inspections. These three variables are the key ingredients of our regressions.

Concerning our relationship characteristics, average relationship duration is 6 years. Only 15.4% of the firms have a main lender (i.e., at least 75% of their loans were granted by one bank). As explained below, we note that in our estimation sample we only use firms that borrow from multiple banks.

The remaining firm characteristics show that firms are on average very small, highly leveraged, and unprofitable. Moreover, 18.6% of the borrowers are in current default. Such high default rates are explained by the economic recession during this period.

3.5. Univariate tests

In Table 3 we present difference-of-means comparisons between zombie and non-zombie firms (Panel A) and between inspected and non-inspected banks (Panel B). Panel A shows that the two types of firms have nearly identical loan refinancing rates at around 18%. We also see that the group of banks that were subject to the inspections have a lower fraction of zombie borrowers, a result that is confirmed in Panel B. Since these statistics are calculated for the entire sample period, which includes the two inspections, this difference may already indicate a reduction in lending by the inspected banks to such borrowers. Relationship characteristics also differ significantly across zombie and non-zombie firms. Most notably, zombie firms are more likely to have a main bank that concentrates at least 75% of the credit to this firm. Finally, zombie firms are substantially smaller and, as expected, they are more leveraged and less profitable than the non-zombie firms.

Panel B compares inspected and non-inspected banks. Recall that the eight largest banking groups were selected for the inspections. The differences we observe between the two types of banks likely reflect differences in bank size. In particular, inspected banks lend to larger borrowers, with whom they maintain longer lending relationships and are more likely to be the main lenders.

3.6. Zombie versus non-zombie firms

The zombie firms are observationally riskier than the non-zombie firms. However, this static comparison does not account for potential growth opportunities, which might be especially important for the small firms that populate most of our sample. To further validate our definition of a zombie firm, we compare the ex post performance of the two types of firms using annual data for the period 2005 to 2010. We restrict our analysis to the pre-inspections period to avoid any possible contagion of the inspections.

We present some suggestive evidence in Figure 1. For each sample year we tag firms either as zombies or non-zombies (based on whether they have negative equity or not). Then we compute the average difference in default rates (top graph) and exit rates (bottom graph) between zombies and non-zombies for several horizons: one, two, three, and four years. The figure shows for example that in one year a zombie firm is 15 percentage points more likely to default and 13 percentage points more likely to exit than a non-zombie. The differences in default and exit

rates between zombie and non-zombie firms decrease with the horizon (because of a survival effect), but remain economically relevant.[8]

4. Empirical methodology

We want to measure the causal impact of the inspections on a bank's propensity to refinance a zombie firm. We estimate separate regressions for each of the two inspections using eight quarters of data: the four quarters before the inspection and the four quarters after the inspection. We omit the two quarters during which the inspections are taking place in order to identify clear before and after changes. We estimate triple differences regressions, which in its most saturated specification is:

$$Newloans_{fbt} = \alpha_{ft} + \alpha_{bt} + \alpha_{bf} + \beta(Inspected_b * Zombie_f * Post_t) + \varepsilon_{fbt} \quad (1)$$

where New_loan_{fbt} equals one whenever there is strictly positive loan growth from quarter t to $t+1$ within a firm-bank pair, zero otherwise. $Zombie_f$ indicates whether firm f is considered to be zombie or not. $Inspected_b$ indicates whether bank b is subject to inspections or not. The coefficient of interest β measures how the propensity of an inspected bank (relative to a non-inspected bank) to refinance a zombie firm (relative to a non-zombie firm) changes after the inspection (relative to the pre-inspection period). α_{ft}, α_{bt} and α_{bf} capture firm-time, bank-time, and bank-firm fixed effects, respectively. ε_{fbt} is the error term.

The two-way fixed effects account for time-varying unobserved heterogeneity both across firms (such as changes in credit demand, as in Khwaja and Mian, 2008) and across banks (such as changes in credit supply), and control for potential biases due to firm-bank matching. Our identification thus comes from comparing the change in lending: (i) for the same firm from an inspected bank relative to a non-inspected bank, (ii) by the same bank to zombie firms relative to non-zombie firms, and (iii) for the same firm-bank pair before and after the inspections.

At the same time, the high number of fixed effects may reduce the external validity of our results. In fact, equation (1) uses variation only from firms that borrow from at least two banks, and in which one of them is inspected and the other is not. For this reason, we also present results from less restrictive regression models with fewer fixed effects.

One final point that merits discussion is the counterfactual. Since the inspected banks are substantially larger than the non-inspected banks, one could argue that they are also likely to differ in other relevant dimensions, such as their lending

8. In the Appendix Figure A1 we analyze two additional variables: sales growth and employment. There we show that zombie firms have lower future sales growth (-4 to -5 percentage points) and less employees (-10 to -15 employees) than the non-zombie firms.

policies. We examine the validity of our empirical design in two main ways. First, we test for the plausibility of the parallel trends assumption by investigating the period-by-period adjustment of our dependent variable during the inspection windows.[9] Second, we re-estimate equation (1) using only the four smallest banks that are inspected and compare them to the 4 largest banks that are not inspected. This sample restriction should improve our estimate of the counterfactual, as it helps balance the inspected and non-inspected banks in terms of size (and presumably other relevant unobservable characteristics). Although the possible presence of selection bias prevents us from estimating an average treatment effect (ATE), we use this subsample to understand the direction of the bias.

5. Results

5.1. Evidence from sectoral inspections

The first set of inspections we analyze focused only on the construction and real estate sectors. We can therefore assess how a given bank changes its lending behavior to zombie firms as opposed to non-zombie firms in the inspected sectors. We can then repeat the analysis for the same bank using other (non-inspected) sectors. As discussed below, this within-bank comparison is useful to help clarify the mechanisms driving a potential change in bank lending behavior following the inspections.

Our estimation window is as follows. The inspections started in July 2012 and the final results were released in December 2012. We drop from our analysis this inspection period (i.e., 2012:Q3 and 2012:Q4) and focus on the four "pre-inspection" quarters (2011:Q3 to 2012:Q2) and the four "post-inspection" quarters (2013:Q1-2013:Q4).

We present the results in Table 4. The estimation sample contains all firms in the construction and real estate sectors with outstanding loans from at least two banks. The coefficient of interest is the triple interaction term, which measures how the propensity of an inspected bank (relative to a non-inspected bank) to refinance a zombie firm (relative to a non-zombie firm) changes after the inspection (relative to the pre-inspection period).

We estimate four specifications. Model (1) is a standard three-way fixed effects model that accounts for time, firm, and bank fixed effects. Model (2) adds firm-time fixed effects that force the model to compare relative lending by inspected and non-inspected banks to the same firm. Model (3) adds bank-time fixed effects that force the model to compare relative lending by the same bank to zombie and non-zombie firms. Model (4) is our Equation (1) which further includes firm-bank

9. We do so by replacing the variable $Post_t$ in the triplet $Inspected_b * Zombie_f * Post_t$ by a sequence of dummies (and interactions) spanning all periods used in the estimation window.

fixed effects that forces comparison along a lending relationship. Models (1) to (3) allow to estimate (some of the) double interaction terms. In Model (4) these double interaction terms are completely absorbed by the fixed effects.

Table 4 shows that the estimated coefficient for the triple interaction is negative and statistically significant across all specifications, indicating that inspected banks became less likely to refinance zombie firms after the inspections. The estimated coefficient is economically relevant as it indicates a 4.4 percentage points drop in their refinancing propensity. This corresponds to 25% of the unconditional likelihood of a zombie firm being refinanced during our sample period (which equals 18%).

The estimated coefficients for the remaining double interaction terms are also interesting. The positive estimate in Model (1) for the variable $Zombie * Post$ suggests that the non-inspected banks may have picked up some (about half) of the zombie borrowers that were cut loose by the inspected banks. The negative estimates in Models (2) and (3) for the variable $Inspected * Zombie$ show that, before the inspections, inspected banks were less likely than the non-inspected banks to refinance zombie firms. This indicates that our empirical setting may underestimate the disciplining effect of the inspections. Finally, the insignificant estimates obtained in Models (1) and (2) for $Inspected * Post$ suggest that inspected banks did not change their lending behavior vis-à-vis healthy firms in the construction and real estate sectors.

The results in Table 4 indicate that unconventional supervision through more intrusive bank supervision helps mitigate zombie lending. Our next question is why. We propose two possible mechanisms. The first is that banks are less likely to refinance zombie firms simply because the benefit of doing so was taken away by supervisors. Evergreening arises in the first place because banks want to avoid recognizing losses on their bad borrowers. However, the main outcome of the inspections was precisely to make banks build additional provisions against these loans. As it becomes costly for a bank to keep zombie firms in its portfolio, the bank has less incentives to refinance them. The second mechanism is that the inspections are disciplining banks. That is, banks may be reducing zombie lending in order to reduce the likelihood of future inspections and thus to avoid the costs associated with such inspections. Banks then would reduce zombie lending also in the non-inspected sectors.[10]

In an attempt to distinguish between these two mechanisms, we repeat the analysis of Table 4 using uninspected sectors. If inspected banks reduce zombie lending because these loans are costlier to withhold, we should see no significant change in their propensity to refinance zombie firms in uninspected sectors. In

10. The on-site inspections were costly for banks in several dimensions. First, they were unexpectedly intrusive in the sense that auditors had the freedom not only to analyze the credit books, but also talk to borrowers, possibly eroding reputational capital of the banks. Second, banks had to mobilize resources to host the inspecting teams and satisfy their requests. Third, the ex post costs imposed by supervisors in terms of loan provisioning were not only high but also concentrated.

other words, taking a "small bath" through the inspected sectors might mitigate zombie lending in the inspected sectors only. In contrast, if banks worry about the possibility of future inspections and the actions associated with them, then we should also see a significant drop in their propensity to refinance zombie firms in uninspected sectors. In the latter case, a "big bath" as implemented by the general inspection would not be required as banks would already "modify their behavior towards zombie firms in uninspected sectors".

We select two sectors with limited direct links to the construction and real estate sectors. The accommodation and food services sectors are appropriate candidates as these have similar characteristics as the real estate and accommodation sector in terms of being non-tradeable sectors, similar loading to the macro-economy, and equally downstream. Since these sectors were not object of inspection, we use them to perform a within-bank comparison that allows to discriminate between the two possible explanations. The results reported in Table 5 show that the estimates for the variable of interest are always insignificant and economically small. This demonstrates that the reduction in zombie lending was indeed driven by the inspections, and the "small bath" inspection does not induce banks to modify their lending towards zombie firms in unrelated sectors in a different way than other non-inspected banks do.

5.2. Identification tests

5.2.1. Parallel trends assumption. One potential concern about our previous results is that before the inspections the inspected banks might be already reducing their exposure to zombie firms in the construction and real estate sectors more aggressively than the non-inspected banks, which would be a direct violation of the parallel trends assumption. To assess the plausibility of this concern, we investigate the dynamic behavior of our dependent variable over our sample window.

In Figure 2 we plot the series of coefficients and corresponding 95% confidence intervals from estimating regressions analogous to Model (4) of Table 5 (top figure) and Table 4 (bottom figure), in which we replace $Post$ by a sequence of time dummies spanning our entire estimation period. The omitted period is 2012:Q2 and the shadowed region indicates the period during which the inspections were taking place.

The timing evidence corroborates a causal interpretation of our results. The top plot shows no evidence of pre-trends, meaning that inspected and non-inspected were changing their exposure to zombie firms roughly at the same rate before the inspectors arrived. After the inspection we see that inspected banks become less likely to refinance zombie firms relative to non-inspected banks. The speed of adjustment is also interesting. Although the final report was released only in December, the inspected banks started reducing their exposure to zombie firms shortly after the inspectors left. This suggests that inspected banks knew that they were overestimating the quality of their credit portfolios, and precautionarily

decided to start cleaning their balance sheets in advance to spread such costs over a longer period.

The bottom plot displays only insignificant coefficients both prior to and after the inspection, for the uninspected sectors.

5.2.2. Inspected versus non-inspected banks. A lingering concern one might have is that the inspected banks are larger – and thus necessarily different – from the non-inspected banks. In order to improve our counterfactual estimate, we select the four smallest banks that are inspected and compare them to the 4 largest banks that are not inspected. This procedure brings us one step closer towards balancing our inspected and non-inspected banks in terms of size (and presumably other relevant unobservable characteristics).

In Table 6 we repeat the analysis we did in Table 4 using this smaller sample of banks. Consistent with our previous results, we obtain negative and statistically significant estimates for our triple interaction variable. Importantly, the estimated coefficients are substantially larger. For example, the point estimate in Model (4) indicates that an inspected bank becomes 9.2 percentage points less likely to refinance a zombie firm after the inspection. This figure economically relevant, since it equals 50% of the unconditional likelihood of a zombie firm being refinanced during our sample period.

The results in Table 6 show that potential differences between inspected and non-inspected banks cannot explain our previous results. In fact, they indicate that using the full sample of banks leads to underestimation of the effects of the inspections. This downward bias is consistent with our earlier finding (in Table 4) that inspected banks were less likely than the non-inspected banks to refinance zombie firms beforehand. Table 6 confirms that using the subsample of banks improves our estimate of the counterfactual. In particular, the insignificant estimates we obtain in Models (2) and (3) for the variable $Inspected * Zombie$ show that the subsample of inspected banks is no longer less likely to refinance zombie firms than the non-inspected banks.

5.3. Evidence from general inspections

We now assess how banks change their lending behavior following a second wave of inspections. Although the set of banks inspected is the same, there are several important differences between this wave of inspections and the previous one. First, this inspection covered corporate loans from all sectors (except mortgages and loans granted to public entities), which is important from an external validity viewpoint. Second, this second inspection was less intrusive in the sense that it was carried out by the banks' habitual auditors (instead of independent auditors appointed by the supervisory team). This feature enables us to see whether the effectiveness of the supervision is affected by the mode it is conducted. The lower intrusiveness might be reflected in lower changes in inspected bank's behavior.

Our empirical model is again Equation (1). The estimation window for this general inspection is as follows. The inspection period was during the second and third quarters of 2013, which we omit from the estimation sample. Consistent with our analysis of the first inspection, we take one year before the inspections started and one year after they ended. Therefore, the pre-inspection period is from 2012:Q2 to 2013:Q1, while the post-inspection period is 2013:Q4 to 2014:Q3. We include all private sectors except construction and real estate in order to avoid overlap with the previous inspection.

We present the regression results in Table 7. All variables and specifications are similar to Table 4. The estimated coefficient for the triple interaction is negative across all specifications shown and statistically significant. Interestingly, the estimated magnitude is marginally lower to those we obtained in the previous inspection. According to the point estimate in Model (4), inspected banks became 3.7 percentage points less likely to refinance zombie firms after this second inspection.

The spillovers of the inspections to other banks and firms are now different from those seen in the first inspection. While in Table 4 we saw that non-inspected banks might have taken up some of the zombie lending discarded by the inspected banks, in this general inspection we see that non-inspected banks did not behave differently from the inspected ones towards zombie firms (the variable $Zombie * Post$ in Model (1) is not statistically significant). The perception of a more intrusive and permanent supervisory action might have changed even the behavior of the banks that were not so closely under the radar of the supervisors. The behavior of the inspected banks towards healthier firms also changes. While after the sectoral inspections the inspected banks did not change their lending to healthier construction firms, in this general inspection we find that the estimates for $Inspected * Post$ become positive. This means that the inspections lead to a reallocation of credit from zombie to healthy firms. The difference might be explained by the fact that even healthy construction firms were under pressure during this period, thus making lending to these companies unattractive when compared to other asset allocation decisions.

As before, we wonder to which extent differences between the inspected and non-inspected banks could explain these results. After all, the inspected banks are not only larger, but they have already been (partially) inspected before and forced to recognize additional provisions on their past loans. In Table 8 we repeat the analysis of Table 7 using a more homogenous sample banks, which includes the four smallest inspected banks with the four largest non-inspected.

The results are globally similar to those we obtained with the full sample. However, there are two minor differences that are worth noting. First, the coefficient on the triple interaction increases in magnitude. For example, in Model (4) the rate at which zombie firms are refinanced drops from -3.7 to -4.8 percentage points. The later value seems to provide a more accurate estimate of the treatment effect of the inspections on zombie lending. In fact, the estimates we obtain in Models (2) and (3) for the variable $Inspected * Zombie$ are virtually equal to zero, suggesting

that the four inspected banks exhibit identical lending behavior to the non-inspected banks prior to this second wave of inspections.[11]

6. Conclusion

There is evidence that "zombie lending" remains a widespread practice by banks in developed countries and that in spite of growing regulatory pressure. In this paper we exploit a series of large-scale authoritative on-site inspections made on the credit portfolios of several Portuguese banks to investigate how these inspections affect banks' future lending decisions. We find that following this unconventional supervision an inspected bank becomes 4 to 9 percentage points less likely to refinance a firm with negative equity. Our results do not seem driven by differences between inspected and non-inspected banks. Our estimates may actually underestimate the disciplining role of supervision if the non-inspected banks also get scared and change their lending behavior.

Our results indicate that banks change their lending decisions only in the inspected sectors, and not in uninspected sectors. Inspecting banks across all sectors seems therefore necessary to modify banks' behavior across the board. "Reg-leg" (in addition to reg-tech) may be needed to successfully tackle zombie lending.

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11. We also plot in Appendix Figure A2 the dynamic adjustment of our dependent variable during this general inspection (similar to Figure 2).

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8. Appendix

In this Appendix, we provide evidence that zombie lending occurs in Portugal. We take two steps. First, we discuss who provides a hand to zombie firms. Second, we quantify the magnitude of evergreening over an extended sample period.

8.1. Who provides a hand to zombie firms?

We start by asking in Appendix Table A2 which bank and relationship characteristics make a lender more likely to refinance a zombie firm. The dependent variable is a dummy that indicates whether the bank granted a new loan (including a line of credit) to an existing borrower in a given period (year-quarter) ($NewLoan_{fbt}$). We define a zombie firm ($Zombie_{ft}$) as one with negative equity in the previous period. In this analysis we restrict our attention to the sample of zombie firms that have loans outstanding from at least two lenders. This allows us to control for firm*year fixed effects and thus to explore cross-sectional differences across lenders to the same zombie firm in a given year. We additionally require that the zombie firm obtains a new loan from at least one of the current lenders. Our empirical specification becomes:

$$Newloan_{fbt} = \beta BankChar_{bt} + \gamma Relat_{fbt} + \alpha_{ft} + \varepsilon_{fbt} \quad (2)$$

where $BankChar_{bt}$ captures the bank characteristics ($BankROA$, $CreditOverdue$ and $Log(Assets)$) and $Relat_{fbt}$ the firm-bank relationship characteristics ($DurationoftheRelationship$, $MainBank$, and $InDefaultWithCurrentBank$). The results show that the lender with weaker profitability is the one more likely to step in and refinance a zombie borrower. The estimated coefficient for the variable $BankROA$ is economically relevant, since a one standard deviation decrease in this variable increases the predicted probability of refinancing a zombie firm by almost 1 percentage point, which accounts for 5.5% of the average fraction of zombie firms that are refinanced. This finding corroborates previous evidence on evergreening practices and supports the notion that banks have incentives to evergreen loans to zombie borrowers especially if they are themselves under financial pressure (Storz et al., 2017). A high fraction of non-performing loans reduces the willingness to refinance zombie firms, but the estimated effect is economically small. We also find that larger banks are more likely to refinance zombie firms.

Relationships characteristics also play an important role in explaining which bank is more likely to refinance a zombie borrower. In particular, a bank is more likely to refinance when it has a longer relationship with the firm and when it concentrates a high fraction of the firm's borrowing. This shows the tenuous link between the bright side of relationship lending and the dark side of evergreening (e.g., Beck et al., 2018; Bolton et al., 2016). A bank is also more likely to refinance a zombie firm when it defaulted on its past obligations. Taken together, these

results are not surprising because under these conditions the bank is able to better internalize the potential benefits of refinancing a zombie firm.

8.2. Full sample results

We next quantify the incidence of evergreening practices using a dataset covering the period 2005:Q1-2015:Q4. We display our baseline results in Appendix Table A3. Each observation is a firm-bank pair in a given year-quarter. Our most saturated empirical model becomes

$$Newloan_{fbt} = \beta(WeakBank_{bt} * Zombie_{ft}) + \alpha_{ft} + \alpha_{bt} + \varepsilon_{fbt} \quad (3)$$

The dependent variable $NewLoan_{fbt}$ equals one when the lender grants a new loan to an existing borrower, including a new line of credit, and zero otherwise. A zombie firm is one with negative equity in the previous period. The explanatory variable of interest is the interaction $WeakBank_{bt} * Zombie_{ft}$. We use this interaction to test the premise that a bank is more likely to refinance a firm in poor shape when the bank is also in poor shape. Banks will have incentives to postpone the recognition of losses especially if they are themselves under financial and regulatory pressure. We consider that banks may have more incentives for making riskier lending decisions when they have low profitability (with $LowROA$ identifying banks that are in the bottom quartile of each year's ROA distribution).[12] To facilitate the interpretation of regression coefficients, our variable Weak bank equals one if the bank's ROA is in the bottom quartile of the current period's distribution, and zero otherwise. We control in all regressions for the firm-bank relationship characteristics (see Table 1). Robust t-statistics that account for potential heteroscedasticity are reported in brackets.

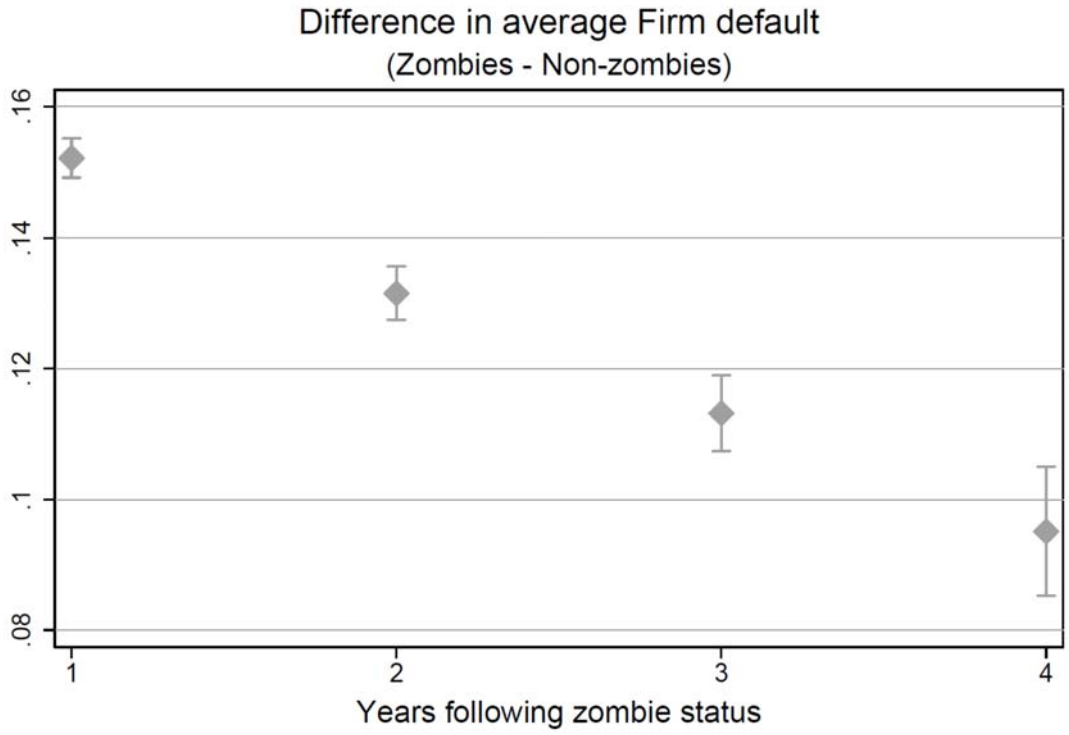
Models (1) to (4) include different sets of fixed effects. Model (1) starts with year-quarter fixed effects. All coefficients shown in this model are thus obtained from cross-sectional differences among firms and among banks in a given year-quarter. The interaction term of $WeakBank * ZombieFirm$ is positive and significant, offering a first glimpse of the practice of evergreening. Model (2) adds firm and bank fixed effects. Although the estimated interaction term remains positive and significant, we note that this specification alters the interpretation of the other coefficients. The first ($WeakBank$) tells us that a bank becomes less likely to refinance healthy borrowers when its profitability plunges into the bottom quartile. The second ($ZombieFirm$) tells us that zombie firms are substantially less likely to be refinanced by more profitable banks.

12. A more standard way to identify weaker banks would be to consider those with lower capital ratios (e.g., Peek and Rosengren, 2005, and Albertazzi and Marchetti, 2010). However, given that there were several events during the period that lead to sizeable fluctuations in banks' capital ratios (including private and public capital injections and several changes to capital requirements), we chose to focus on ROA.

Models (3) and (4) further improve identification by forcing comparison within the same bank and firm-year-quarter (3), and bank-year-quarter and firm-year-quarter (4). In Model (4) we are able to identify only the interaction term, since the other variables are absorbed by the high-dimensional fixed effects. In both models, the coefficient of $WeakBank_{bt} * Zombie_{ft}$ remains positive and statistically significant. Based on Model (4), a zombie firm that teams up with a weak bank is 1.2 percentage points more likely to obtain additional credit than from other banks (and relative to healthy firms). This effect is economically relevant as it represents almost 8% of the average fraction of borrowers that are refinanced in a given year-quarter. Our results hold when we: (1) Exclude lines of credit; (2) replace our binary dependent variable $NewLoan$ by its continuous counterpart, $LoanGrowth$; (3) define a zombie firm when it has negative equity for at least two years (instead of one); and (4) employ low interest coverage as an alternative proxy for zombie firm, as for example in Acharya et al. (2019).

Figure 1 – Average default and exit rates of zombies and non-zombies

The sample contains annual data from 2005 to 2010. The figures plot the point estimates (with 95% confidence intervals) of the difference in average default rate (top) and exit rate (bottom) between zombie firms and non-zombie firms, for different horizons (from one to four years).



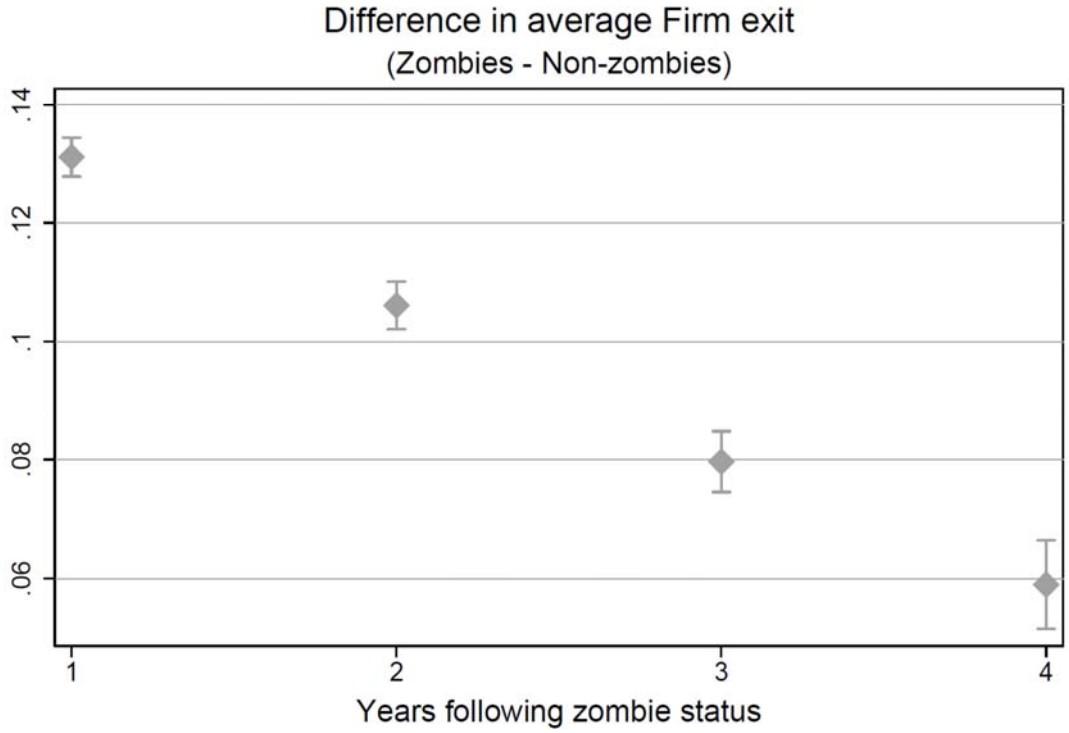
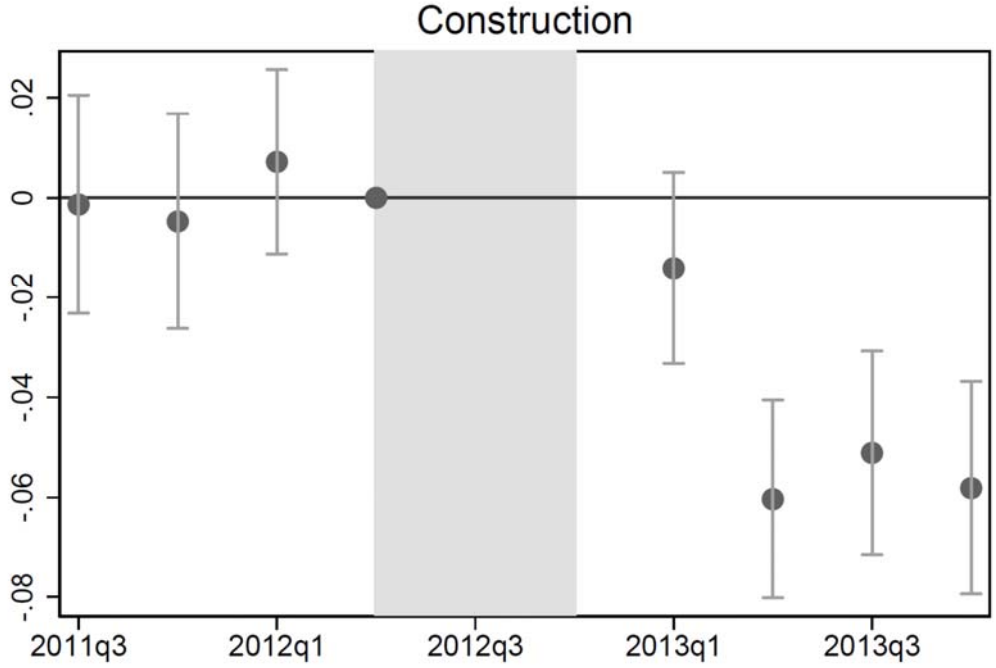


Figure 2 – Zombie lending around the Sectoral Inspection

The figure uses quarterly data for the period 2011:Q3 to 2013:Q4. The shadowed region corresponds to the omitted period (2012:Q2) and to the two inspection quarters (2012:Q3 and 2012:Q4) that are not included in the sample. Each graph plots period-by-period coefficients that we obtain by replacing in equation (1) the variable $Post_t$ in the triple interaction $Inspected_b \times Zombie_f \times Post_t$ by a sequence of period dummies spanning all periods used in the estimation window. The top graph includes firms from the Construction and Real Estate sector, and the bottom graph includes firms from the Accommodation and Food Services sector.



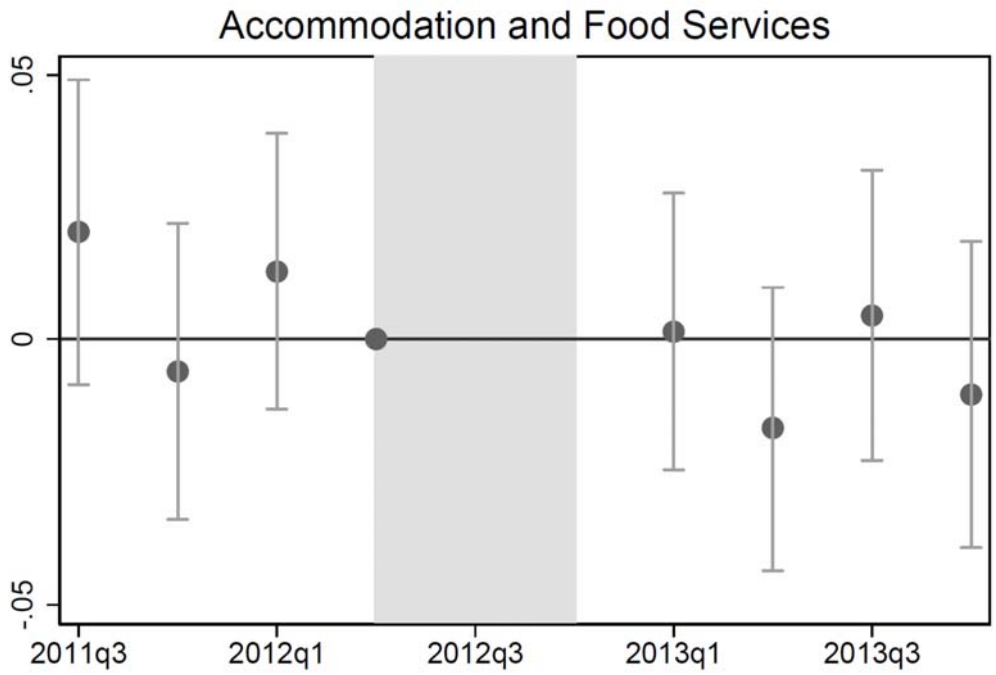


Table 1 – Description of variables
The table defines the main variables used in the paper.

Variable	Definition
Main variables	
New loan	= 1 if the firm obtains a new loan same lender; = 0 otherwise.
Zombie firm	= 1 if the firm had negative equity in t-1; = 0 otherwise.
Inspected bank	= 1 if bank is subject to the mandatory onsite inspections
Relationship characteristics	
Duration	Duration of relationship (in months).
Main bank	= 1 if bank has at least 75% of total loans
Firm characteristics	
Micro firm	= 1 if the firm employs < 10 persons and has annual turnover or assets < EUR 2 million; = 0 otherwise.
Employment	Number of employees
Leverage	= Debt / Assets.
Profitability	= Net income / Assets.
Default	= 1 if firm is in default with any bank

Table 2 – Descriptive statistics

The statistics are based on quarterly data for the period 2011:Q3 to 2014:Q3 and cover the two bank inspections. In the Sectoral Inspection (2011:Q3 to 2014:Q1) we include only the Construction and Real Estate sector. In the General Inspection (2012:Q2 to 2014:Q3) we include all sectors except Construction and Real Estate. The number of observations is 2,525,984.

Variable	Mean	Std Dev	P25	Median	P75
Main variables					
New loan	0.184	0.387	0	0	0
Zombie firm	0.146	0.353	0	0	0
Inspected bank	0.622	0.485	0	1	1
Relationship characteristics					
Duration	5.99	4.56	2.17	4.83	9.33
Main bank	0.154	0.361	0	0	0
Firm characteristics					
Micro firm	0.607	0.488	0	1	1
Employment	27	209	3	6	16
Leverage	71.4	32.2	49.6	69.5	87.2
Profitability	-2.36	11	-3.57	0.399	2.65
Default	0.186	0.389	0	0	0

Table 3 – Univariate tests

The statistics are based on quarterly data for the period 2011:Q3 to 2014:Q3 and cover the two bank inspections. In the Sectoral Inspection (2011:Q3 to 2014:Q1) we include only the Construction and Real Estate sector. In the General Inspection (2012:Q2 to 2014:Q3) we include all sectors except Construction and Real Estate. The number of observations is 2,149,917.

PANEL A – Firms: Zombies versus non-zombies

Variable	Zombies	Non-zombies	Difference
Main variables			
New loan	0.179	0.181	0.00278***
Zombie firm	1	0	-1
Inspected bank	0.601	0.645	0.0441***
Relationship characteristics			
Duration	6.03	6.77	0.735***
Main bank	0.212	0.148	-0.0632***
Firm characteristics			
Micro firm	0.826	0.565	-0.262***
Employment	13.3	29.6	16.3***
Leverage	117	63.8	-53***
Profitability	-10.1	-1.07	9.05***
Default	0.448	0.15	-0.298***

PANEL B – Banks: Inspected versus non-inspected

Variable	Inspected	Non-inspected	Difference
Main variables			
New loan	0.221	0.122	-0.0995***
Zombie firm	0.138	0.161	0.0239***
Inspected bank	1	0	-1
Relationship characteristics			
Duration	6.96	4.51	-2.46***
Main bank	0.164	0.136	-0.0276***
Firm characteristics			
Micro firm	0.588	0.639	0.0511***
Employment	29.7	22.6	-7.12***
Leverage	70.7	72.6	1.94***
Profitability	-2.28	-2.49	-0.218***
Default	0.179	0.196	0.0164***

Table 4 – Sectoral Inspection and zombie lending

The regressions use quarterly data for the period 2011:Q3 to 2013:Q4 excluding the two inspection quarters (2012:Q3 and 2012:Q4). The sample includes only firms from the Construction and Real Estate sector, which was covered by the Sectoral Inspection.

Sector analyzed: Construction and Real Estate

Dependent variable:	New loan from existing lender			
	(1)	(2)	(3)	(4)
Inspected × Zombie × Post	-0.051***	-0.028**	-0.030**	-0.044***
	[-5.636]	[-2.342]	[-2.504]	[-3.351]
Inspected × Zombie	0.006	-0.023***	-0.021***	
	[1.092]	[-2.714]	[-2.576]	
Inspected × Post	0.001	-0.002		
	[0.250]	[-0.403]		
Zombie × Post	0.027***			
	[3.910]			
Year-quarter FE	Yes	-	-	-
Firm FE	Yes	-	-	-
Firm×Year-quarter FE	-	Yes	Yes	Yes
Bank FE	Yes	Yes	-	-
Bank×Year-quarter FE	-	-	Yes	Yes
Firm×Bank FE	-	-	-	Yes
Number of observations	220,315	220,315	220,315	220,315
R-squared	0.203	0.437	0.444	0.622

Table 5 – Zombie lending in non-inspected sectors

The regressions use quarterly data for the period 2011:Q3 to 2013:Q4 excluding the two inspection quarters (2012:Q3 and 2012:Q4). The sample includes only firms from the Accommodation and Food Services sector, which was not covered by the Sectoral Inspection.

Sector analyzed: Accommodation and food services

Dependent variable:	New loan from existing lender			
	(1)	(2)	(3)	(4)
Inspected × Zombie × Post	0.001	-0.005	-0.007	-0.008
	[0.054]	[-0.321]	[-0.438]	[-0.462]
Inspected × Zombie	-0.011	-0.011	-0.012	
	[-1.500]	[-1.006]	[-1.045]	
Inspected × Post	0.001	0.012		
	[0.143]	[1.351]		
Zombie × Post	-0.002			
	[-0.218]			
Year-quarter FE	Yes	-	-	-
Firm FE	Yes	-	-	-
Firm×Year-quarter FE	-	Yes	Yes	Yes
Bank FE	Yes	Yes	-	-
Bank×Year-quarter FE	-	-	Yes	Yes
Firm×Bank FE	-	-	-	Yes
Number of observations	70,524	70,524	70,524	70,524
R-squared	0.197	0.453	0.464	0.647

Table 6 – Sectoral Inspection and zombie lending: Subsample of banks
The regressions use quarterly data for the period 2011:Q3 to 2013:Q4 excluding the two inspection quarters (2012:Q3 and 2012:Q4). The sample includes only firms from the Construction and Real Estate sector, which was covered by the Sectoral Inspection. The sample is also restricted to the four smallest inspected banks and the four largest non-inspected banks.

Sector analyzed: Construction and Real Estate

Dependent variable:	New loan from existing lender			
	(1)	(2)	(3)	(4)
Inspected × Zombie × Post	-0.071***	-0.071*	-0.074**	-0.092**
	[-3.955]	[-1.948]	[-2.026]	[-2.362]
Inspected × Zombie	0.045***	0.037	0.041	
	[3.140]	[1.335]	[1.483]	
Inspected × Post	0.009	-0.030**		
	[1.220]	[-2.119]		
Zombie × Post	0.030***			
	[2.831]			
Year-quarter FE	Yes	-	-	-
Firm FE	Yes	-	-	-
Firm×Year-quarter FE	-	Yes	Yes	Yes
Bank FE	Yes	Yes	-	-
Bank×Year-quarter FE	-	-	Yes	Yes
Firm×Bank FE	-	-	-	Yes
Number of observations	58,401	58,401	58,401	58,401
R-squared	0.352	0.541	0.545	0.701

Table 7 – General Inspection and zombie lending
The regressions use quarterly data for the period 2012:Q2 to 2014:Q3 excluding the two inspection quarters (2013:Q2 and 2013:Q3). The sample includes firms from all sectors except Construction and Real Estate.

Sectors analyzed: All sectors except Construction and Real Estate

Dependent variable:	New loan from existing lender			
	(1)	(2)	(3)	(4)
Inspected × Zombie × Post	-0.034***	-0.025***	-0.028***	-0.037***
	[-7.896]	[-4.516]	[-4.979]	[-6.525]
Inspected × Zombie	-0.005*	-0.017***	-0.017***	
	[-1.902]	[-4.627]	[-4.402]	
Inspected × Post	0.027***	0.030***		
	[15.583]	[14.068]		
Zombie × Post	-0.001			
	[-0.322]			
Year-quarter FE	Yes	-	-	-
Firm FE	Yes	-	-	-
Firm×Year-quarter FE	-	Yes	Yes	Yes
Bank FE	Yes	Yes	-	-
Bank×Year-quarter FE	-	-	Yes	Yes
Firm×Bank FE	-	-	-	Yes
Number of observations	985,055	985,055	985,055	985,055
R-squared	0.183	0.423	0.425	0.584

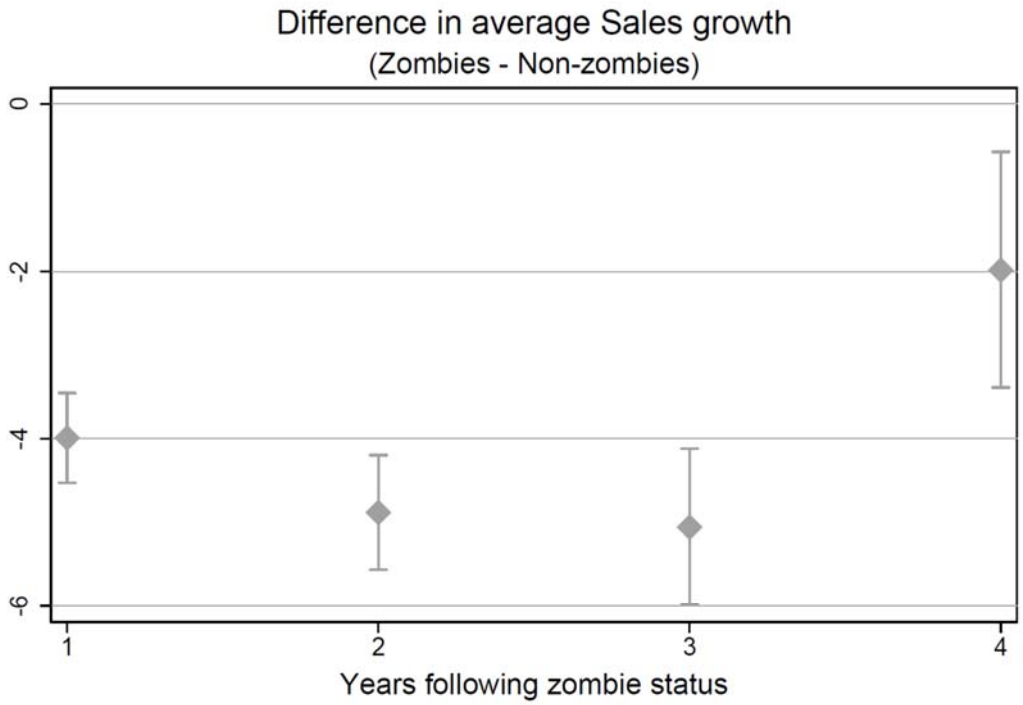
Table 8 – General Inspection and zombie lending: Subsample of banks
The regressions use quarterly data for the period 2012:Q2 to 2014:Q3 excluding the two inspection quarters (2013:Q2 and 2013:Q3). The sample includes firms from all sectors except Construction and Real Estate. The sample is also restricted to the four smallest inspected banks and the four largest non-inspected banks.

Sectors analyzed: All sectors except Construction and Real Estate

Dependent variable:	New loan from existing lender			
	(1)	(2)	(3)	(4)
Inspected × Zombie × Post	-0.030***	-0.029**	-0.032**	-0.048***
	[-4.045]	[-2.067]	[-2.225]	[-3.398]
Inspected × Zombie	0.014**	-0.000	-0.000	
	[2.462]	[-0.039]	[-0.005]	
Inspected × Post	0.031***	0.031***		
	[10.550]	[5.531]		
Zombie × Post	0.002			
	[0.408]			
Year-quarter FE	Yes	-	-	-
Firm FE	Yes	-	-	-
Firm×Year-quarter FE	-	Yes	Yes	Yes
Bank FE	Yes	Yes	-	-
Bank×Year-quarter FE	-	-	Yes	Yes
Firm×Bank FE	-	-	-	Yes
Number of observations	323,913	323,913	323,913	323,913
R-squared	0.308	0.519	0.521	0.672

APPENDIX FIGURES AND TABLES

Figure A1 – Average sales growth and employment of zombies and non-zombies



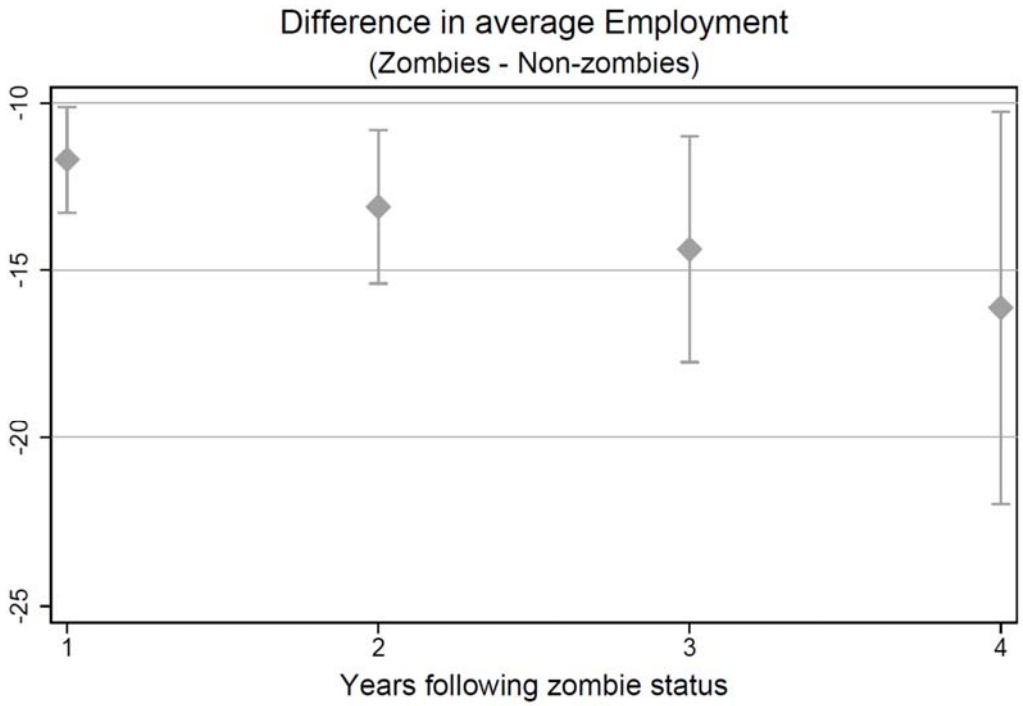


Figure A2 – Zombie lending around the General Inspection

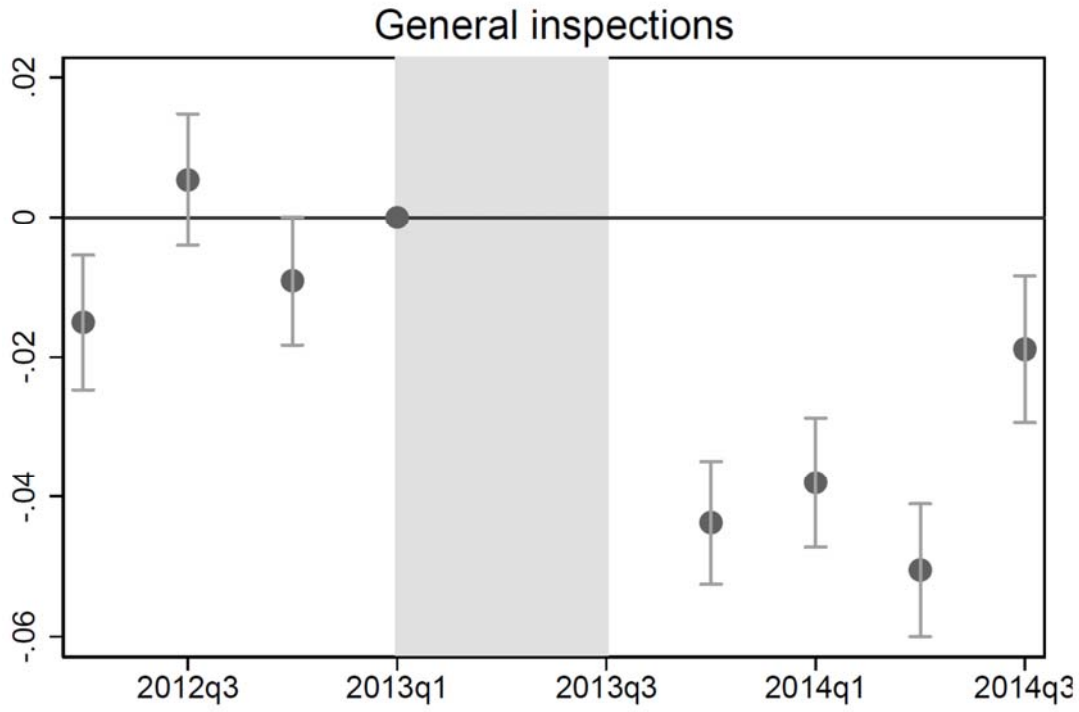


Table A1 – Separate descriptive statistics for the two inspections

PANEL A – Sectoral Inspection
Sample period is from 2011:Q3 to 2013:Q4 and it includes only the Construction and Real Estate sector. The number of observations is 260,492

Variable	Mean	Std Dev	P25	Median	P75
Main variables					
New loan	0.191	0.393	0	0	0
Zombie firm	0.152	0.359	0	0	0
Inspected bank	0.624	0.484	0	1	1
Relationship characteristics					
Duration	5.98	4.27	2.42	5.08	9
Main bank	0.166	0.372	0	0	0
Firm characteristics					
Micro firm	0.651	0.477	0	1	1
Employment	22.8	166	2	5	13
Leverage	72.8	32.1	50.8	71.5	89.8
Profitability	-3.12	10.6	-4.25	0.059	1.54
Default	0.289	0.453	0	0	1

PANEL B – General Inspection
Sample period is from 2012:Q2 to 2014:Q3 and it includes all sectors except Construction and Real Estate. The number of observations is 1,247,492.

Variable	Mean	Std Dev	P25	Median	P75
Main variables					
New loan	0.187	0.39	0	0	0
Zombie firm	0.145	0.352	0	0	0
Inspected bank	0.631	0.483	0	1	1
Relationship characteristics					
Duration	6.15	4.7	2.25	4.92	9.67
Main bank	0.152	0.359	0	0	0
Firm characteristics					
Micro firm	0.595	0.491	0	1	1
Employment	27.9	216	3	6	17
Leverage	70.8	32.3	49	68.8	86.3
Profitability	-2.05	11	-3.1	0.512	2.99
Default	0.167	0.373	0	0	0

Table A2 – Who refinances zombie firms?

Data are at the loan-level for the period 2005-2015. See Table 1 for variable definitions.

Dependent variable:	New loan from existing lender
Bank characteristics	
Bank ROA	-0.010***
	[-11.711]
Credit overdue	-0.004***
	[-19.543]
Log(Bank Assets)	0.030***
	[62.485]
Relationship characteristics	
Duration of relationship	0.000***
	[8.571]
Main bank	0.128***
	[57.440]
In default with current bank	0.188***
	[72.419]
Firm-year-quarter FE	Yes
Number of observations	427,587
R-squared	0.417

Table A3 – Evidence of zombie lending

Data are at the loan-level for the period 2005-2015. See Table 1 for variable definitions.

Dependent variable:	New loan from existing lender			
	(1)	(2)	(3)	(4)
Weak bank × Zombie firm	0.013***	0.010***	0.007***	0.012***
	[8.649]	[6.268]	[3.573]	[6.739]
Weak bank	0.007***	-0.009***	-0.006***	
	[10.934]	[-11.045]	[-6.451]	
Zombie firm	-0.061***	-0.040***		
	[-63.140]	[-26.778]		
Year-quarter FE	Yes	Yes	-	-
Firm FE	-	Yes	-	-
Firm×Year-quarter FE	-	-	Yes	Yes
Bank FE	-	Yes	Yes	-
Bank×Year-quarter FE	-	-	-	Yes
Number of observations	1,878,586	1,878,586	1,878,586	1,878,586
R-squared	0.015	0.182	0.420	0.427

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