"Keep clear at all times!" Does loose monetary policy block the market exit of unproductive plants?*

Manfred Antoni (IAB)†
Michael Koetter (Deutsche Bundesbank, IWH, OvG University Magdeburg)‡
Steffen Müller (IWH, OvG University Magdeburg)§
Talina Sondershaus (IWH)¶

Abstract

We test if unconventional monetary policy hampers Schumpeterian destruction in the real economy. To this end we combine unique administrative plant exit information with detailed monetary policy data on asset purchases under the Securities Market Program (SMP). The purchases affected quasi-randomly around 1/6 of all German banks and we trace the firms and plants affected by this expansionary shock to gauge if plant closures became significantly less likely for plants connected to treated banks. Our results indicate robust evidence that only unproductive plants that are tied to weak banks that received an unexpected positive monetary policy shock are less likely to be closed. This result therefore suggests that asset purchase by the ECB reduce efficient churn in the real economy, which is crucial for the reallocation of production factors and aggregate productivity growth.

JEL classification: E58, G21, G28, G33
Keywords: Plant exit, factor reallocation, asset purchase programs

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*We thank Reint Gropp, Reiner Haselmann, Jan Krahnen, and Felix Noth for their valuable comments and suggestions. We further thank seminar participants at the IWH DPE seminar series as well as the Goethe-IWH Finance Winterschool in Riezlern for their helpful feedback. All errors are own.

†E-mail: Manfred.Antoni@iab.de

‡Corresponding author. Halle Institute for Economic Research (IWH), Kleine Märkerstraße 8, G-06108 Halle (Saale). Phone: +49 345 7753 727. E-mail: michael.koetter@iwh-halle.de

§E-mail: steffen.mueller@iwh-halle.de

¶E-mail: talina.sondershaus@iwh-halle.de

1 Motivation

The reallocation of production factors from unproductive to more productive firms is crucial to maximize aggregate total factor productivity (TFP) growth (Hsieh and Klenow, 2009). Such reallocation implies that more productive firms become larger (e.g. Bartelsman et al. 2013) and, consequentially, that unproductive firms shrink and are ultimately more likely to exit the market. But how much of a cleansing effect is left after a decade of ultraloose monetary policy since the Great Financial Crisis of 2007/2008? We test empirically if and how a heterogeneously transmitted unconventional monetary policy shock mutes the factor reallocation mechanism that works in conventional times through forcing the exit of unproductive plants. Recent dynamic theory models highlight the role of micro-founded frictions – both in labor (e.g. Jovanovic, 2014) and financial markets (see e.g. Moll, 2014) – that endogenously prevent TFP growth either through the distortion of market entry or via the misallocation of capital across incumbent firms (see also Bueara et al., 2011; Restucia and Rogerson, 2017). Our paper plugs the void left in the empirical literature as to the effect of financial frictions on plant exits. Specifically, our empirical work closely complements the theoretical advances by Osotimehin and Pappadá (2017), who model the relationship between (voluntary and forced) firm exits, financial constraints, and aggregate productivity. They predict that the presence of credit constraints modifies the cleansing such that some high productivity firms are forced to leave the market whereas other unproductive firms remain because exit choices depend also on the expected net worth of firms.

The main contribution of this paper is to devise a clean empirical test of whether (exogenously) increased bank lending capacity distorts factor reallocation by exploiting the combination of granular data regarding both plant exits and (unconventional) monetary policy alike. On the real side of the economy we observe a unique sample from the universe of all plant closures in Germany based on the Establishment History Panel between 2007 and 2013 (Hethey and Schmieder, 2010). On the financial side of the economy, we observe the purchase schedule of the European Central Bank (ECB) during the Securities Market Program (SMP) at the security level, which has been previously analyzed regarding financial markets and macroeconomic effects in Eser and Schwaab (2016) and Gibson et al. (2016). We combine these data with the security holdings of all German banks obtained from the national central bank as in Koetter et al. (2017). Thereby, we identify those financial intermediaries that were exposed to this unexpected regime change of the ECB to purchase Eurozone periphery debt in secondary markets between May 2010 and September 2012. By linking these banks to their corporate customers, we thus trace the transmission of the first European asset purchase program all the way from the ECB via national (central) banking systems to corporate bank customers and, ultimately, their plants. To the best of our knowledge, we are the first to study such a granular chain from the financial to the real sector of a large, developed economy with regards to the implications of loose UMP on the cleansing effects reflected by forced attrition of unproductive plants.

Based on a non-parametric survival analysis of plants connected to banks with and without access to the SMP policy chock, we find robust evidence for both matched and unmatched bank-firm-plant samples for significantly delayed exit rates of treated plants. These differences in survival functions are only significant, however, when comparing plants operated by unproductive firms that are tied to weakly capitalized banks with and without access to the SMP. For the entire sample of banks and firms, no such significant difference emerge. This result is thus in line with evidence provided by Jiménez et al. (2014) that an exuberantly loose monetary stance in Spain causally induced weak banks to extend credit inefficiently to unproductive firms. Our study complements their finding of increasing credit inefficiently by showing an undue reduction in necessary churn. We employ next a difference-in-difference framework saturated for a rich set of fixed effects to demonstrate that these effects are unlikely driven by confounding policy events affecting either banks or firms. Quantitatively, the marginal effect of having access to the SMP shock by a weak bank on unproductive plant exit probabilities amounts to a reduction by 4.6 percentage points. This magnitude is large in light of average churn rates on the order of 2.6 percentage points during the sample period. We also document that the differential SMP effect for bad banks causes both employment and wages to increase significantly with unproductive firms. Thus, an unintended consequence of the asset purchase program to support stressed members of the Eurozone is to block the exit of and to spur the misallocation of (labor) resources towards the least productive plants in this non-stressed economy of the Eurozone.

Whereas exits are generally rarely studied, the flip side of industry dynamics has been the subject of an ample literature. In finance, for example, exist indeed a large body of research that investigates the role of credit market and other financial frictions on the entry of young firms and resulting industry dynamics. Cetorelli and Strahan (2006) show that lackluster banking market competition deters new entrants in U.S. markets. And Kerr and Nanda (2010) show indeed that branch deregulation in the U.S. – which increased competitive pressure – causally increased entry rates of firms without necessarily increasing the size of these contestants. They conclude that the elimination of financial frictions in the form of banking market competition affects real economic activity in particular via the birth of new firms. However, Kerr and Nanda (2010) and also other studies focus primarily on the provision of financial funds to incumbent firms or the entry of new contestants, but neglect the effect of changes to financial frictions on the exit of unproductive units – which is key for a re-allocation of production factors. One of the few studies that also considers churn – that is the exit of unproductive corporations – is Kerr and Nanda (2009). They report that in the aftermath of U.S. banking market deregulation not only market entry, but also exit rates increased.

Regarding empirical evidence for Europe, the lack of homogenous administrative data paired with relatively low public listing frequency of European firms poses a severe hurdle to the availability of comparable data on market exits. An exception are Bertrand et al. (2007), who demonstrate that the deregulation of French banking markets also reduced the bailout of unproductive corporates by the financial sector and that industries with a larger exposure to more competitive banking markets exhibit faster factor reallocation. This important insight on less frequent bailouts of unproductive firms via their bank does not observe direct exits, but infers inefficient lending from below-equilibrium lending conditions (see also Caballero et al., 2008, on the phenomenon of "zombie" firms). We, in turn, observe exits. And in contrast to inferring churn based on financial data at the level of the firm, we also directly observe the exit of productive units of physical activity: plants.

Empirical evidence on the plant level regarding aggregate productivity effects of financial frictions is generally still scarce, yet apparently crucial to the comprehension of aggregate phenomena. For example, Hsieh and Klenow (2014) estimate from plant-level data that aggregate manufacturing productivity in Mexico and India lags that of the U.S. by a quarter due to insufficient investment in process efficiency and product quality. Whereas they remain agnostic as towards the sources of this under-investment, a natural candidate are financial frictions.

The effect of such frictions on aggregate productivity through distortions at the plant level are, however, virtually absent from the literature. Midrigan and Xu (2014) exploit establishment data from South Korean, Colombia, and China to differentiate between entry distortions versus capital misallocation among existing plants due to financial frictions. However, they neither speak to the heterogenous policy effects nor to the role of delaying the attrition of unproductive plants, which is focus of our paper.

A study closely related to our work is Gopinath et al. (2017). They demonstrate that the dispersion of capital returns across Spanish (and further

Southern European) manufacturing firms increased between 1999 and 2012. Declining real interest rates due to European financial integration during this time caused the misallocation of abundantly inflowing capital that was directed towards too unproductive firms, ultimately reducing TFP. As such, their study shares the spirit of ours to analyze the effects of excessive provision of financial funds. But whereas their paper provides important evidence on the intensive margin of misallocation, we can complement this evidence with insights on the extensive margin of misallocation, i.e. the delay-of-exit effect due to the loose supply of financial funds. And whereas they model financial frictions to depend on firm size, we can actually directly observe the exposure of plants to loose monetary policy shocks through their banking relationship. A further contribution is our ability to observe small and medium sized enterprises as, within this group of firms, market exit is more likely in general Fackler et al. (2013) and driven by competitive reallocation forces in particular (e.g. Dosi et al. (2015)).

2 Data

2.1 Monetary policy and bank data

The impact of the SMP program on German plants provides a good testing ground for analyzing the impact of larges scale asset purchase programs (LSAPs) on firms. The SMP was set up in order to stabilize the Eurozone after the outbreak of the European Sovereign Debt crisis. As a response to soaring risk premiums in May 2010, the ECB decided to buy sovereign bonds of Greece, Ireland and Portugal. It extended the purchases to Italian and Spanish bonds in August 2011. In total, the program lasted until September 2012 and entailed a notional volume of EUR 218 billion.

Whereas the size of the SMP is small compared to contemporary LSAP, the ECB was very reluctant to intervene into securities markets in contrast to the US Federal Reserve until then. As such, the SMP was unexpected by market participants and marked a regime shift of the ECB. The SMP was designed to reduce risk premia for sovereign bonds of crises countries. It was not a response either to a crisis in Germany or as a response to troubled German banks. Therefore, it represents an arguably exogenous shock that allows to assess whether LSAPs had unintended consequences on firms located in Germany.

We identify German banks that are affected by the SMP shock as in Koetter et al. (2017) by matching the ISIN codes of the purchase schedule of the ECB to individual security holdings reported by all German banks to the central bank. Thereby, we identify those banks that hold eligible SMP assets. Exposures to SMP securities increase excess reserves and associated credit generating capacity either through an unloading channel if assets are sold to the ECB or through a valuation channel if they are retained but revalued at higher market prices (Eser and Schwaab, 2016).

To limit concerns about further confounding policies, we focus on regional savings and cooperative banks. These local banks held sovereign debt at the time primarily as a store of liquidity given its regulatory treatment as a risk-free asset. At the same time, sovereign debt holdings from the EU periphery, which were subject of the SMP, were pervasive. According to (Buch et al., 2016) two out of three banks, including very small ones, had such EU periphery exposures. Large German banks, in turn, engaged much more actively in (proprietary) securities trading and have also been subject to various alternative confounding policy events, such as changes to the collateral framework, long-term refinancing operations, or even foreign policy measures that affected them via their cross-border activities (Buch et al., 2018). Excluding these large financial institutions mitigates the possibility that banks in our sample loaded up purposefully on Southern European bonds in anticipation of some form of rescue plan from the ECB or the EU. To control later for observable differences in bank traits, we add financial accounts data from the Bankscope database and conduct a matching exercise to generate a matched sample with and without SMP exposure.

2.2 Firm and plant data

To identify the effect of the SMP on the real economy through plant exits, we need to link banks in a next step to non-financial corporates. To this end, we rely on Bureau van Dijk's Amadeus database, which contains financial information at the firm level. Amadeus encompasses financial data for 6,332,435 firm-year observations in our sample period from 2007 until 2013. We obtain the link between banks and firms from BvD's Dafne database, where missing firm-bank links in early years are extrapolated using 2010 as a base year.

To isolate the effect of the expansionary monetary policy shock represented by the SMP, we confine the sample to single-bank firms. Thereby, we ensure that the sample comprises mainly SMEs – with a mean (median) number of employees of 11 (4) – which cannot substitute their non-treated bank with a link to a treated bank. We only assess the impact on single plant firms, which further ensures that we only look at SMEs with a tight link between firms and banks. Also, as the treatment is at the firm level that is connected to a bank, there is no variance in treatment within firms.

Neither Amadeus nor Dafne contain information on the production plants of these firms though. In fact, only very few studies shed light on the production sites of such SME, which in turn account for a large share of GDP in many developed economies though. Therefore, we merge our firms with the Establishment History Panel (BHP, Betriebshistorikpanel) provided by the Institute for Employment Research (IAB, Institut für Arbeitsmarkt und Berufsforschung Nürnberg), which aggregates worker level social security notifications at the plant level. This dataset provides us with information on the constitution of the workforce of plants and the employee's wages. We follow Hethey and Schmieder (2010) and use worker flows to identify plant exits reliably.

– Table 1 around here –

Table 1 summarizes the variables from these three building blocks at the plant-year level: plant level exits and observable traits; financial data of the firms associated with these plants; and bank traits based on financial indicators. Table A.3 in the Appendix provides the definition and source of each variable. In addition, we show summary statistics of financial weakness indicators for both banks and firms, which we return to in later sections.

In total, the merged dataset contains 2,560,878 plant-year observations. As explained, we restrict these data to regional savings and cooperatives and single bank-single plant firms in the interest of isolating the SMP effect better from possible confounding credit supply and demand effects of large banks and multi-bank firms, respectively. In addition, we condition on firm existence since 2006 and exclude firms from forestry, agriculture, and finance. After this culling, the sample comprises 593,357 German plant-year observations corresponding to approximately 85,000 plants per year between 2007 and 2013.

The median plant, and thus firm, in our dataset has four employees and is therefore very small. This feature reflects the fact that our firms are mainly SME, which depend more heavily on financial frictions compared to e.g. large listed multinationals. Note that in Germany 47% (66%) of plants have less than 5 (10) employees Cin full-time equivalents and the vast majority of all firms are single-plant firms (Koch and Krenz (2010)). Hence, our sample of small firms mimics the population quite well.

We define a bank as treated if it held an SMP asset in all three years during which the SMP was in operation, i.e. 2010-2012. According to this definition, 10.3% of all observations are treated. Table 2 provides a comparison of all variables' levels in the upper panel. The lower panel compares the changes of these variables both across treatment periods and occurrence.

– Table 2 around here –

Consider first the top panel. The average exit rates in the pre-treatment sample period is identical for firms with and without access to the SMP via their bank and equals 1.4%. These average plant exit rates increase in lock-step for both SMP and non-SMP firms during the treatment period and equal 2.9%. As such, any potential effect of unconventional monetary policy to block the exit of firms tied to banks with additional credit-bearing capacity is not obviously visible from this non-parametric, unconditional comparison as is also confirmed by the unconditional difference-in-difference test in the rightmost column of Table 2.

Regarding the comparison of plant characteristics, consider the summary statistics for pre- and post-SMP periods as well as treated and non-treated groups in the top panel Table 2. T-tests on levels in the pre period already hint at differences between treated and non-treated firms. Table 2 shows that treated plants are on average with 1 employee slightly larger than non-treated plants; they have a slightly lower share of marginal workers (0.284 versus 0.294), and are slightly younger. Economically the differences are very small, however, t-tests show that the differences are statistically significant.

Regarding the level of observable firm traits, we find that in terms of asset size, treated firms are slightly smaller; they have a lower long term debt ratio, and exhibit cash ratios which are on average by 0.005 percentage points higher. Again, differences are economically very small, however are statistically significant. To adress differences on plant and firm level data, we will pursue a matching procedure (see below).

Also, t-tests show differences in bank characteristics. Table A.1 shows these differences on the actual bank level. In the pre period, treated and non-treated banks do not differ in terms of exit rates of their firms (*PD of firms*). But, treated banks show lower equity ratios, lower profitability measured according to the return on assets, and are slightly larger in terms of asset size.

T-tests on changes in pre and post periods (see Table 2) show that mean changes in plant and firm variables do not differ in the pre period, and hence parallel trend assumptions are fulfilled for the difference-in-difference model. However, bank level variables still differ, which will also be addressed in the maching procedure.

3 Headline results

To compare exit probabilities of treated and non-treated firms in the period after the SMP started, we apply two different methods. First, we use non-parametric duration analysis to model the attrition due to plant exits and test if the survival functions of increasingly tighter matched groups of treated and untreated firms are significantly different. However, in this approach we cannot control for unobserved heterogeneity across firms. Therefore, we also estimate a difference-in-difference model, which is saturated with an extensive set of fixed effects.

3.1 Survival and duration

To assess wether single-plant firms connected to SMP banks are less likely to exit the market, we first conduct a non-parametric survival analysis. Specifically, we compare Kaplan-Meier (KM) survival functions between treated and non-treated plants. Against the backdrop of the comparison of plant, firm, and bank data in Table 2, which showed that especially bank traits differ significantly between SMP and non-SMP banks, we conduct a one-to-one nearest-neighbor propensity-score matching (PSM) prior to comparing KM-survival functions (Caliendo and Kopeinig (2008)) in two stages.

– Table 4 around here –

First, we match SMP banks with non-SMP banks in the pre period on bank characteristics such as equity ratio, cost-to-income ratio, return on assets, liquidity ratio and bank size. Table 4 shows that all differences in means are statistically insignificant after the matching procedure. Reassuringly, the p-value of the likelihood-ratio test in column III indicates that after matching the probability of being treated can not be explained by the bank level variables. The mean bias and the median bias are with 5.5% and 2.8% fairly small and also Ruben's B (the absolute standardized difference of the means of the linear index of the propensity score in the treated and nontreated group) and Rubens's R (the ratio of treated to non-treated variances of the propensity score index) indicate successful matching.

– Table 5 around here –

In the second step, we match on firm and plant level data (see Table 5). After matching, the differences in means turn statistically insignificant. The last column shows the ratio of the variance of the treatment over the variance of the control group, which equals one in an optimal state. We can reduce the differences between the variances in almost all variables and remove the critical difference in the number of full time equivalents. Again, the lower part of the table provides summary results on the matching procedure and, as in Table 5, demonstrate succesful matching. Summary statistics on all variables for the matched sample are provided in Table A.2 in the appendix.

– Figure 1 around here –

Figure 1 shows Kaplan Maier (KM) Survival functions of treated versus non-treated observations of the matched sample. As we are interested in heterogenous effects of the treatment, we divide our sample into four subgroups. We distinguish between strong and weak banks, as well as productive and unproductive firms based on observable characteristics in the pre crisis year 2007. Weak banks are those with an equity ratio in the lower 25% percentile of the distribution in 2007. Likewise, weak or unproductive firms are those with a turnover per employee below the 25% percentile in the distribution. The lower right panel shows the most interesting pairing between weak firms and weak banks, which according to e.g. Caballero et al. (2008) obstructed the restructuring of Japanese firms, which prolonged the crisis. The Kaplan Meier Survival curves of treated and non-treated are significantly different in this group. Single-plant firms are thus in line with the intuition that overly loose credit conditions provided by low-capitalized banks to unproductive firms entails the deferral of plant closures. This is in strong contrast to unproductive firms that are connected to strong banks: The lower left panel shows that these firms show in fact lower survival rates after being treated.

However, log rank tests will show that this relationship is not statistically significant.

– Table 6 around here –

Table 6 presents log-rank tests on the differences of the KM survival functions of all four subgroups as can be seen in Figure 1. The first four columns show results for the non-matched sample. The tests show that in the samples of productive firms connected to strong and weak banks (columns I and II respectively), as well as in the sample of unproductive firms connected to strong banks (column III), we do not find a statistically significant effect of the treatment. It is especially the connection between unproductive firms and weak banks that leads to lower exit rates among treated firms. This can be seen in column IV: The number of exits observed are statistically significantly lower than expected by the log rank test if both, treated and non-treated firms, had the same survival functions. Columns V-VIII show test results for differences of survival estimates as illustrated in Figure 1. When we employ a tight matching on observable bank, firm and plant variables, the results stay robust.

In sum, non-parametric survival functions give strong indications that plants with an exposure to expansionary monetary policy in the form of the SMP faced a lower likelihood of exit. This evidence, however, might still suffer from potential contamination of a plethora of unobservable effects. Therefore, we turn next to a difference-in-difference regression framework.

3.2 Differential exit effects of the SMP

To quantify the effect of a link between a SMP bank and a firm that closed its plant after the launch of the asset purchase program, we specify the following regression model:

$$Y_{it} = \alpha_i + \alpha_{rt} + \alpha_{kt} + \gamma SMP_i \times Post_t + \delta_x X_{it-1} + \delta_b B_{it-1} + \epsilon_{it} \quad (1)$$

The dependent variable Y_{it} is a binary variable, which equals one in the year t when plant i exits the market. To control for unobservable firm heterogeneity, we specify firm fixed effects α_i. Another concern are region- or industry-specific demand shocks, which may give rise to systematically different plant exit rates that we would falsely attribute to the SMP exposure. Therefore, we include region-time fixed effects α_{rt} as well as industry-time fixed effects α_{kt}.

Consistent with our non-parametric survival analysis, we augment the specification of the main variable of interest in Equation (1) – the interaction between SMP and the post-treatment period – with an additional interaction with weak banks and weak firms. This quadruple difference-in-difference term gauges the effect of a weak bank being exposed to the expansionary policy shock represented by the SMP on churn rates of plants of unproductive firms relative to the pre-SMP period.

Specifically, the binary variable SMP_i equals one if plant i is linked to a bank that held SMP eligible assets in all three treatment years. $Post_t$ equals one in the post period 2010-2013. The interaction of interest is then an indicator whether the bank was considered to be weak and whether the firm was considered to be unproductive in 2007. We estimate the model for the whole sample with lagged firm level X_{it-1} and bank level B_{it-1} controls. Table 7 presents the according results.

– Insert Table 7 around here –

In column (I), the sample comprises all single-plant firms with a single bank relationship. To separate the SMP effect experienced by weak banks and transmitted to weak firms, we specify all the according interactions as shown in the upper panel of the table. Furthermore, we control for the observable traits indicated in Table 1 at the plant, firm, and bank level. The sample moments in the bottom panel indicate that in this most comprehensive sample the unconditional exit rate is 2.2%. The individual interaction terms are all not statistically discernible from zero. Also the total marginal effect of an SMP shock experienced by weak banks that are connected to weak firms shown in the very last panel in Table 7 is insignificant.

As an alternative, Column (II) shows the results when we estimate the model with the matched sample described in Section 3.1 instead of specifying observables as control variables. Here, the total marginal effect of the SMP shock to weak banks and weak firms is statistically significant at the 1%-level and negative. The magnitude of 4.6 percentage points is large relative to mean churn rates of 2.2% and illustrated in Figure 2. This result thus indicates in line with the KM survival functions that unconventional monetary policy to support the EU periphery during the sovereign debt crisis had no overall effect on attrition in Germany. As such, the unintended consequences were confined. However, our results show that any undesirable effects – like roadblocking market exit of weak players – is fueled through the transmission of expansionary policies via the weakest links in the financial system.

– Insert Figure 2 around here –

Columns (V) through(VIII) provide further robustness checks as to the reliability of our firm weakness indicators. As a first alternative, we declare a firm weak if it belonged to the lowest 25% percentile in terms of wages per employee. Second, we categorize weak firms to belong to the lowest 10% percentile in terms of risk adjusted return on assets. For both alternatives we find corroborating evidence that the total marginal effect of the SMP for weak firms and weak banks reduces exit rates after the launch of the asset purchase program by the ECB considerably and significantly.

– Insert Figure 3 around here –

– Insert Figure 4 around here –

To ensure comparability across different estimation methods, we reestimate equation one for all four subgroups separately. Table 8 reports the results. Column I shows no differential effect within the groups of strong firms connected to strong banks or weak banks, respectively (column II). We find similarly no effect in the group of weak firms connected to strong banks (column III). Our finding of significantly higher survival rates in the log rank test within the critical connection between weak firms and weak banks is confirmed in column IV - again, we find that an exposure to SMP assets leads to lower exit rates in the post period of unproductive firms that have a link to weak banks.

– Insert Table 8 around here –

We us a very restricted sample including only single plant relationships as we argue that the treatment varies only across firms and not across plants. However, to ensure that our results are not merely due to this specific subsample of small firms, we include as a robustness check multi-plant firms as well. Table 9 provides evidence that our results hold also when firms that encompass more than one plant are included.

– Insert Table 9 around here –

It is further of interest how decisive the intensity of exposure to SMP assets is with regard to the effect on the banks' corporate customers. The intensive margin can only be evluated in our differences-in-differences setting. Table 10 reports the results. We find very similar results to our binary treatment measures: The more intense the treatment by the ECB, measured according to the average exposure of a bank's balance sheet to SMP assets over all three treatment years, conditional on the fact that the bank was treated in all three years, is reflected in lower exit rates for unproductive firms that are connected to treated weak banks. The relationship is always negative, and statistically significant again in the sample where we identify weak firms according to their ranking in their turnover per employee ratios in 2007, and which is matched on bank, firm and plant observables. We find similar results for alternative productivity measures such as wages and risk adjusted return on assets, whereby we find statistically significant realtionships between treatment and exit rates only in the former distinction.

– Insert Table 10 around here –

Our result provide important evidence on the so-far elusive relationship between loose monetary policy shocks and churn of productive units in a developed economy. But how do alternative indicators of potential misallocation in the vein of Hsieh and Klenow (2009) respond to unconventional monetary policy shocks as represented by the SMP? To this end, we specify alternative dependent variables in Table 11 that gauge more directly potential misallocation in labor markets by weak firms that are exposed to the SMP shock via a connection to a weak bank.

– Insert Table 11 around here –

Columns (I) through (III) of Table 11 specify to this end the log of total full-time equivalents employed in a plant in the full sample, a sample that is matched on bank observables, a sample of matched banks and firms. Across all specifications we find that weak banks that hold eligible SMP securities induce weak firms in the bottom quartile of the labor productivity distribution to increase their staff between 8-20%. Clearly, such a reallocation of labor to the least productive firms is likely to entail productivity losses that add to the postponement of exit.

Related, we specify for the same three sample the log of the wage bill as the dependent variable in columns (IV) through (VI). The results point to a similarly alarming inference, namely an increase of wages between 11-19% by these unproductive firms if they are exposed through their financial intermediary to an expansionary policy shock.

4 Conclusion

In this paper, we test whether unconventional monetary policy in the form of asset purchase programs obstructs Schumpeterian cleansing in the real economy. By directly observing both plant exits and the detailed origins of monetary policy shocks, this paper fills an important gap in the literature investigating the effects of factor market frictions on the re-allocation of production factors and ensuing productivity growth. Specifically, we gauge the direct implications of ultraloose monetary policy on the delay and prevention of unproductive plant exits.

To this end, we rely on a unique combination of granular data of plant exits sampled from the universe of all production sites in Germany with equally granular data on financial firms and monetary policy between 2007 and 2013. These exits and associated employment and productivity data are combined with financial information at the firm level from public sources, which also contains the identity of each firms' bank relationship. Via this latter link, we then connect the micro-level information on churn in the real economy to bank-level information. We observe financial indicators of banks from public sources, which allows us to classify weak and non-weak banks. Finally, we observe the identity and volume of sovereign bonds from five stressed Eurozone economies that the European Central Bank (ECB) purchased for the first time in secondary markets under the securities markets program (SMP) between May 2010 and September 2012. Based on detailed portfolio holdings data of the universe of German banks, we can therefore identify those banks that are subject to this surprise expansionary policy shock, which was arguably exogenous especially to local German banks tied to small and medium enterprises (SME) and their production plants in Germany.

Within this quasi-experimental setting, we first conduct non-parametric Kaplan-Meier survival analyses regarding the exit patterns of plants that are exposed to the SMP shock versus those that are not. For increasingly tightly matched samples based on plant, firm, and bank traits we consistently find no significant difference in survival functions for the entire sample of all firms and banks. As such, the unintended side effects of this first, large scale asset purchase program were not as disastrous across the board of all corporations in this large, non-stressed economy as occasionally suggested by heated media debates and supreme court filings by German politicians and economists.

An important qualification emerges from our analyses with regards to the SMP effects on plant exits of weak firms that are connected to weak banks though. First, we classify weak firms as those in the bottom quartile of the labor productivity distribution at the onset of our sample period. Likewise, banks are classified as those with capitalization in the lowest quartile of the distribution. For these combinations of weak firms and banks, we find consistently that plant exits of weak firms that are connected to weak banks are delayed. This result therefore corroborates earlier evidence on the misallocation of credit to so-called zombie firms when monetary policy is overly loose or when governance and market discipline exert too little pressure on banks to enforce weak firm restructuring.

Also after controlling for unobservables in a difference-in-difference setting, we find ample indication that the SMP induced in particular weak firms that were tied to weak banks to exit less. In addition, we show that these firms allocate more labor to their plants and exhibit higher wage payments. Thereby, we confirm earlier studies on the misallocation of resources due to financial frictions in the intensive margin, i.e. factors misallocation across incumbent firms.

In sum, ultra-loose monetary policy reflected by asset purchase programs appears to have the unintended consequence to block the exit from markets by unproductive units. Figuratively speaking: whether the cost of parking in the wrong spot versus those associated with circling the block for ages and ending up in an even worse place – i.e. not having assisted the European periphery members during the sovereign debt crisis – is clearly out of the scope of this partial equilibrium exercise. What we do show beyond doubt is, however, that misallocation of resources at the extensive margin due to expansionary unconventional monetary policy exists and should be taken into account in estimating the cost of any supporting pan-European policy action.

References

Bertrand, M., A. Schoar, and D. Thesmar (2007). Banking deregulation and industry struckture: Evidence from the French banking reforms of 1985. *Journal of Finance 62*(2), 579–628.

Buch, C., C. T. Koch, and M. Koetter (2018). Crises, rescues, and policy transmission through international banks. *International Journal of Central Banking*, forthcoming.

Buch, C. M., M. Koetter, and J. Ohls (2016). Banks and sovereign risk: A granular view. *Journal of Financial Stability 25*, 1–15.

Bueara, F. J., J. P. Kaboski, and Y. Shin (2011). Finance and development: A tale of two sectors. *American Economic Review 101*(5), 1964–2002.

Caballero, R. J. and M. L. Hammour (1994). The Cleansing Effect of Recessions. *The American Economic Review 84*, 1350–1368.

Caballero, R. J. and M. L. Hammour (1996). On the Timing and Efficiency of Creative Destruction. *The Quarterly Journal of Economics 111*, 805–852.

Caballero, R. J., T. Hoshi, and A. K. Kashyap (2008). Zombie Lending and Depressed Restructuring in Japan. *The American Economic Review 98*, 1943–1977.

Caliendo, M. and S. Kopeinig (2008). Some practical guidance for the implementation of propensity score matching. *Journal of Economic Surveys 22*, 31 – 72.

Cetorelli, N. and P. Strahan (2006). Finance as a barrier to entry: Bank competition and industry structure in local US markets. *Journal of Finance 61*, 437–461.

Dosi, G. , D. Moschella, E. Pugliese and F. Tamagni(2015). Productivity, market selection, and corporate growth: comparative evidence across US and Europe *Small Business Economics 45*(3), 643–672.

Eser, F. and B. Schwaab (2016). Assessing asset purchases by the ECB's Securities Markets Programme. *Journal of Financial Economics 119*(1), 147–167.

Fackler, D. , C. Schnabel and J. Wagner (2013). Establishment exits in Germany: the role of size and age. *Small Business Economics 41*(3), 683–700.

Gibson, H. D., S. G. Hall, and G. S. Tavlas (2016). The effectiveness of the ECB's asset purchase programs of 2009 to 2012. *Journal of Macroeconomics 47*(45–57).

Gopinath, G., S. Kalemli-Özçan, L. Karabarbounis, and C. Villegas-Sanchez (2017). Capital allocation and productivity in South Europe. *Quarterly Journal of Economics 132*(4), 1915–1967.

Hethey, T. and J. F. Schmieder (2010). Using worker flows in the analysis of establishment turnover: Evidence from German administrative data. *FDZ-Methodenreport 06/2010*, 1–43.

Hsieh, C. and P. Klenow (2009). Misallocation and manufacturing TFP in China and India. *Quarterly Journal of Economics 124*(4), 1403–1448.

Hsieh, C.-T. and P. J. Klenow (2014). The life cycle of plants in India and Mexico. *Quarterly Journal of Economics 129*(3), 1035–1084.

Jiménez, G., S. Ongena, J. Saurina, and J.-L. Peydró (2014). Hazardous times for monetary policy: What do twenty-three million bank loans say about the effects of monetary policy on credit risk? *Econometrica 82*(2), 463–505.

Jovanovic, B. (2014). Misallocation and growth. *American Economic Review 104*(4), 1149–1171.

Kerr, W. R. and R. Nanda (2009). Democratizing entry: Banking deregulations, financing constraints, and entrepreneurship. *Journal of Financial Economics 94*, 124–149.

Kerr, W. and R. Nanda (2010). Banking deregulations, financing constraints, and firm entry size. *Journal of the European Economic Association 8*(2-3), 582–593.

Koch, A. and J. Krenz (2010). The Spatial Concentration of German Industries. An Analysis Based on Micro-Level Data of Firms and Establishment. *mimeo*

Koetter, M., N. Podlich, and M. Wedow (2017). Inside asset purchase programs: The effects of unconventional monetary policy on banking competition. *ECB Working Paper* (2017), 1–50.

Midrigan, V. and D. Y. Xu (2014). Finance and misallocation: Evidence from plant-level data. *American Economic Review 104*(2), 422–458.

Moll, B. (2014). Productivity losses from financial frictions: Can self-financing undo capital misallocation? *American Economic Review 104*(10), 3186–3221.

Osotimehin, S. and Pappadá (2017, June). Credit frictions and the cleansing effect of recessions. *Economic Journal 127*, 1153–1187.

Restucia, D. and R. Rogerson (2017). The causes and costs of misallocation. *The Journal of Economic Perspectives 31*(3), 151–174.

5 Figures

Figure 1: This figure shows the Kaplan Maier Survival functions for a sample of 5,747 plant-year observations, covering the years 2010-2013. The sample is matched on bank, firm and plant characteristics in pre treatment years. We divide the sample into weak and strong banks, as well as weak and strong firms. Firms are considered to be weak if their turnover/employee, i.e. their labour productivity, was in the lower 25 % percentile in 2007. Banks are considered to be weak if their equity ratio was in the lower 25% percentile in 2007. We compare survival rates for treated and untreated observations within each subgroup. The lower right panel shows the results for the most interesting group: weak firms connected to weak banks. The solid line shows the survival rate of treated plants, and the dotted line shows the survival rate of the non-treated plants. Results of the log rank test on the statistically significance of the difference between the two curves can be seen in Table 6, column IV.

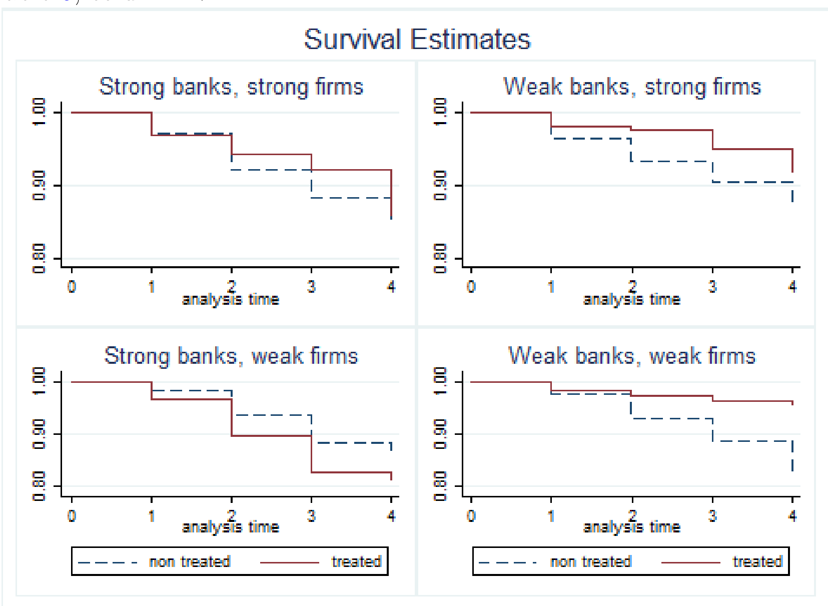


Figure 2: This figure shows the marginal effects of the treatment in the post period for a sample of plant-year observations that are matched on bank, firm and plant characteristics in the pre period 2007-2009. The marginal effects are conditional on whether a firm is weak (solid line) and whether it has a link to a weak (right hand side) or solid bank. Firms are considered to be weak if their turnover/employee, i.e. their labour productivity, was in the lower 25% percentile in 2007. Banks are considered to be weak if their equity ratio was in the lower 25% percentile in 2007. The results correspond to the marginal effects reported in Table 7, Column II.

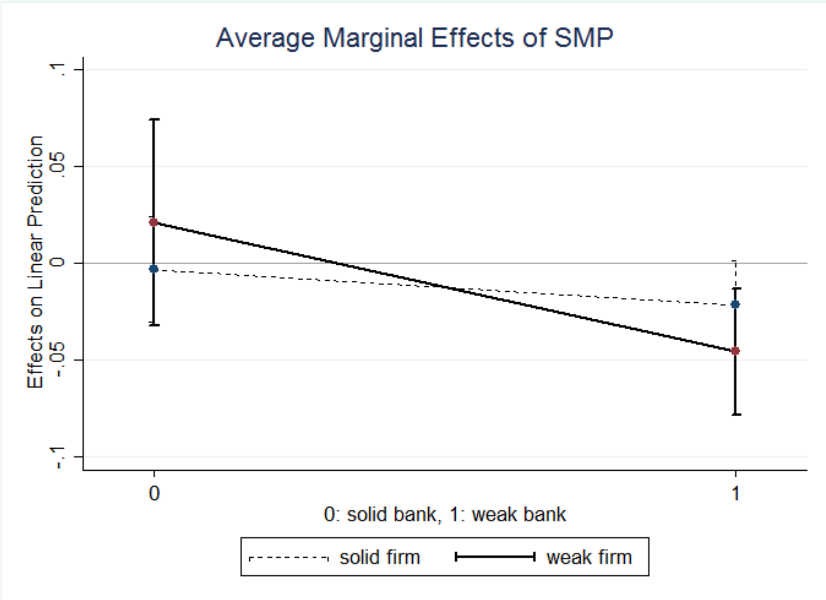


Figure 3: This figure shows the marginal effects of the treatment in the post period for a sample of plant-year observations that are matched on bank, firm and plant characteristics in the pre period 2007-2009. The marginal effects are conditional on whether a firm is weak (solid line) and whether it has a link to a weak (right hand side) or solid bank. Firms are considered to be weak if their marginal product of labour, measures as the wages/employee, was in the lower 25% percentile in 2007. Banks are considered to be weak if their equity ratio was in the lower 25% percentile in 2007. The results correspond to the marginal effects reported in Table 7, Column VI.

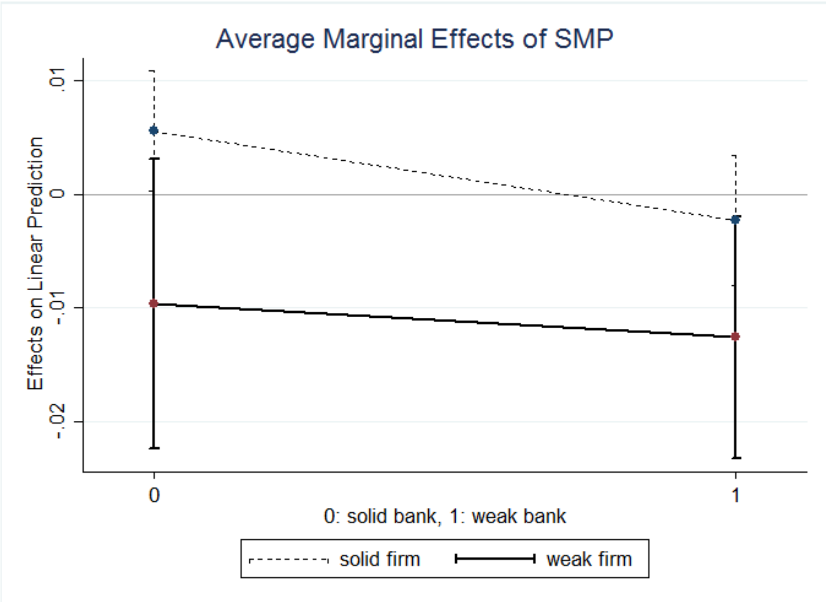
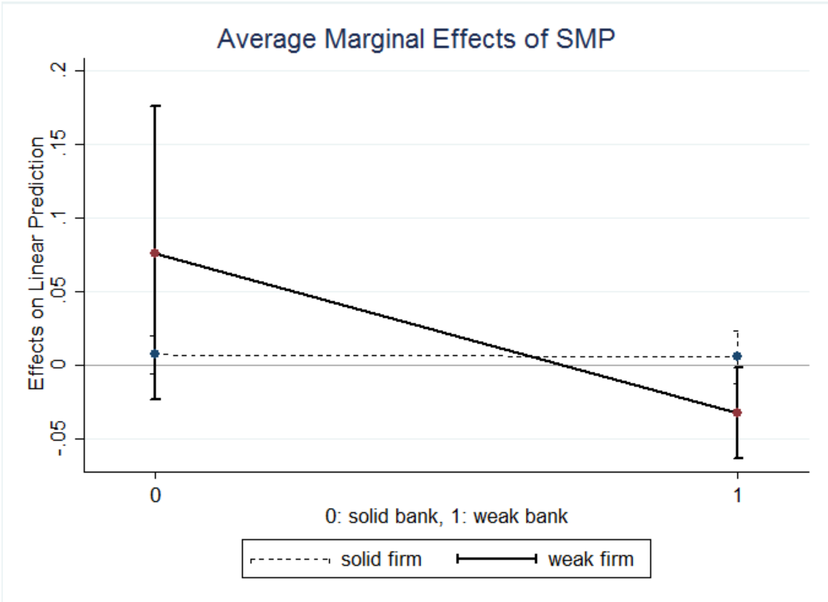


Figure 4: This figure shows the marginal effects of the treatment in the post period for a sample of plant-year observations that are matched on bank, firm and plant characteristics in the pre period 2007-2009. The marginal effects are conditional on whether a firm is weak (solid line) and whether it has a link to a weak (right hand side) or solid bank. Firms are considered to be weak if their risk adjusted return on assets (return on assets divided by the standard deviation in years 2006-2008) was in the lower 10% percentile in 2007. Banks are considered to be weak if their equity ratio was in the lower 25% percentile in 2007. The results correspond to the marginal effects reported in Table 7, Column VIII.



6 Tables

Table 1: Summary Statistics

Final sample, years 2007-2013. All variables are reported at the plant level. Continuous variables are winsorized at the top and bottom 1% percentile. Post, SMP, bank and firm weakness indicators are binary variables, which are defined as the following: Post equals one in years 2010-2013. SMP equals one if bank held an SMP asset in all three treatment years 2010, 2011 and 2012. Bank weakness indicator equals one if the bank's equity ratio ranked at the bottom quarter of the sample distribution in 2007. Weakness_turn (weakness_earn) equals one if firm's turnover/employee (wages/employee) ranked at the bottom quarter of the sample distribution in 2007. Weakness_return equals one if firm's [ROA/SD(ROA)] (2006-2008) ranked at the bottom decile in 2007.

	N	mean	p50	sd	min	max
Plant level						
Exits	593,357	0.023	0.000	0.150	0.000	1.000
Number fte	593,357	11.103	4.000	41.817	0.000	9911.000
Number fte, log	550,745	1.608	1.609	1.219	-0.693	9.201
Total wages, log	520,311	6.002	5.981	1.301	-2.896	13.730
Share of marginal workers	593,357	0.284	0.200	0.299	0.000	1.000
Agegroup	593,357	3.317	3.000	1.347	1.000	5.000
Age	593,357	15.768	13.000	10.049	1.000	38.000
Post	593,357	0.564	1.000	0.496	0.000	1.000
Firm level						
Log of assets	461,493	-0.731	-0.792	1.364	-4.503	4.503
Long term debt ratio	459,750	0.311	0.207	0.318	0.000	0.991
Equity ratio (in %)	461,492	33.382	28.931	27.751	0.000	99.841
Cash ratio	448,088	0.187	0.108	0.207	0.000	0.816
Bank level						
Equity ratio (in %)	593,357	6.727	6.488	1.774	2.538	12.331
Cost-to-income ratio (in %)	593,277	68.879	68.490	8.798	44.640	145.120
Return on assets (in %)	593,345	0.204	0.190	0.160	-1.570	0.880
Liquidity ratio (in %)	593,357	12.912	11.576	7.320	2.144	66.974
Log of assets	593,357	7.913	8.008	1.242	5.142	12.470
SMP	593,357	0.103	0.000	0.304	0.000	1.000
Bank Weakness Indicator						
weak_bank	593,357	0.373	0.000	0.484	0.000	1.000
Firm Weakness Indicators						
Weakness_turn	41,683	0.241	0.000	0.428	0.000	1.000
Weakness_earn	458,991	0.234	0.000	0.423	0.000	1.000
Weakness_return	26,237	0.095	0.000	0.293	0.000	1.000

Table 2: Differences in levels and differences in changes

This table reports results of t-tests on levels (upper part) and on mean changes (lower part) within pre and post period between treatment and control group. The last two columns report the diifference-in-difference tests between the means of the two groups over both periods. The sample covers the years 2007-2009 in the pre period and 2010-2013 in the post period. In the lower part, year-to-year changes from 2007-2009 are covered in the pre period, and changes from 2009-2013 are covered in the post period. All variables are reported at the plant level. Continuous variables are winsorized at the top and bottom 1% percentile. Post, SMP, bank and firm weakness indicators are binary variables, which are defined as the follwing: Post equals one in years 2010-2013. SMP equals one if bank held an SMP asset in all three treatment years 2010, 2011 and 2012. Bank weakness indicator equals one if the bank's equity ratio ranked at the bottom quarter of the sample distribution in 2007. Weakness_turn (weakness_earn) equals one if firm's turnover/employee (wages/employee) ranked at the bottom quarter of the sample distribution in 2007. Weakness_return equals one if firm's [ROA/SD(ROA)] (2006-2008) ranked at the bottom decile in 2007. The p-values are as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Pre Period						**Post Period**							
	Non treated		Treated				Non treated		Treated					
	Mean	N	Mean	N	Difference	SE	Mean	N	Mean	N	Difference	SE	DID	SE
Differences in levels														
Plant level														
Exits	0.014	231,742	0.014	26,752	0.000	0.001	0.024	367,627	0.024	42,237	0.000	0.001	0.001	0.001
Number fte	10.478	231,742	11.577	26,752	1.098***	0.270	11.544	367,627	12.914	42,237	1.370***	0.215	0.272	0.345
Total wages, log	5.913	203,588	5.924	23,528	0.011	0.009	6.096	322,505	6.107	37,176	0.012	0.007	0.000	0.011
Share of marginal workers	0.294	231,742	0.284	26,752	-0.01***	0.002	0.275	367,627	0.262	42,237	-0.013***	0.002	-0.003	0.002
Age	13.822	231,742	13.352	26,752	-0.469***	0.064	17.861	367,627	17.326	42,237	-0.536***	0.051	-0.066	0.082
Agegroup	3.013	231,742	2.970	26,752	-0.043***	0.008	3.629	367,627	3.597	42,237	-0.033***	0.007	0.011	0.011
Firm level														
Log of assets	-0.861	190,735	-0.886	22,007	-0.025**	0.010	-0.561	262,663	-0.603	29,980	-0.041***	0.008	-0.016	0.013
Long term debt ratio	0.327	189903	0.319	21,905	-0.008***	0.002	0.311	261,895	0.303	29,880	-0.009***	0.002	-0.001	0.003
Equity ratio (in %)	31.213	190,734	31.145	22,007	-0.068	0.198	35.827	262,663	35.356	29,980	-0.472***	0.169	-0.404	0.260
Cash ratio	0.178	186,080	0.184	21,425	0.005***	0.001	0.196	253,364	0.202	28,845	0.006***	0.001	0.001	0.002

continued next page

Table 3: Differences in levels and differences in changes: continued

	Pre Period						Post Period							
	Non treated		Treated				Non treated		Treated					
	Mean	N	Mean	N	Difference	SE	Mean	N	Mean	N	Difference	SE	DID	SE
Bank level														
Equity ratio (in %)	5.920	231,742	5.069	26,752	-0.851***	0.010	7.758	367,627	6.679	42,237	-1.079***	0.008	-0.228***	0.013
Cost-to-income ratio (in %)	70.584	231,662	74.649	26,752	4.065***	0.055	67.402	367,627	70.996	42,237	3.594***	0.044	-0.471***	0.070
Return on assets (in %)	0.192	231,730	0.039	26,752	-0.153***	0.001	0.228	367,627	0.175	42,237	-0.053***	0.001	0.100***	0.001
Liquidity ratio (in %)	14.565	231,742	15.319	26,752	0.754***	0.046	11.089	367,627	13.230	42,237	2.141***	0.036	1.387***	0.058
Log of assets	7.795	231,742	8.522	26,752	0.727***	0.008	7.884	367,627	8.580	42,237	0.697***	0.006	-0.031***	0.010
Differences in changes														
Plant level														
Exits	0.013	213,816	0.013	24,685	0.000	0.001	0.023	361,214	0.023	41,473	0.000	0.001	0.001	0.001
Number fte	0.300	213,816	0.287	24,685	-0.013	0.097	0.203	361,214	0.208	41,473	0.005	0.075	0.018	0.123
Total wages, log	0.039	186,386	0.040	21,516	0.001	0.002	0.033	313,204	0.031	36,038	-0.002	0.002	-0.003	0.003
Share of marginal workers	-0.004	213,816	-0.004	24,685	0.000	0.001	-0.005	361,214	-0.006	41,473	-0.001	0.001	-0.001	0.001
Agegroup	0.154	213,816	0.163	24,685	0.009***	0.002	0.147	361,214	0.153	41,473	0.006***	0.002	-0.003	0.003
Firm level														
Log of assets	0.041	180,778	0.038	20,856	-0.003	0.002	0.035	255,468	0.028	29,156	-0.006***	0.002	-0.003	0.003
Long term debt ratio	-0.007	179,613	-0.01	20,719	-0.003	0.002	0.011	254,394	0.01	29,014	0.000	0.002	0.003	0.002
Equity ratio (in %)	0.612	180,776	0.529	20,856	-0.083	0.085	1.067	255,468	0.985	29,156	-0.083	0.072	0.001	0.111
Cash ratio	0.002	174,939	0.001	20,151	-0.001	0.001	0.005	244,948	0.005	27,873	0.000	0.001	0.001	0.001
Bank level														
Equity ratio (in %)	0.081	213,461	0.087	24,682	0.006	0.004	0.562	361,204	0.481	41,473	-0.081***	0.003	-0.087***	0.005
Cost-to-income ratio (in %)	0.401	213,318	1.601	24,682	1.201***	0.043	0.067	361,204	-0.187	41,473	-0.254***	0.033	-1.454***	0.055
Return on assets (in %)	-0.016	213,447	-0.046	24,682	-0.030***	0.001	0.003	361,204	0.026	41,473	0.023***	0.001	0.053***	0.001
Liquidity ratio (in %)	-0.503	213,461	0.258	24,682	0.761***	0.028	-0.501	361,204	-0.288	41,473	0.213***	0.021	-0.548***	0.035
Log of assets	0.033	213,461	0.027	24,682	-0.005***	0.000	0.024	361,204	0.013	41,473	-0.012***	0.000	-0.006***	0.001

Table 4: Propensity score matching on bank variables

One-to-one nearest neighbor propensity score matching on bank variables in the pre-treatment years 2007-2009. Column V indicates the percentage bias for the unmatched or matched group respectively. Column VI describes the reduction of the bias after the matching procedure, and column VII shows the t-statistic of the t-test of equality of sample means within the unmatched and matched samples. Column VIII shows the corresponding p-value. The last column shows the variance ratio of treated and untreated. The lower part of the table provides summary results on the matching procedure inluding test statistics of the likelihood ratio test (including p_values) on the joint insignificance of covariates in explaining the treatment, mean and median bias, as well as Rubens' B and Rubens' R. Ideally, Rubens' B should be less than 25 and Rubens' R in the range of 0.5 and 2.

Variable	Unmatched Matched		Mean Treated	Control	%bias	%reduct $\|bias\|$	t-test t	$p > \|t\|$	V_e(T)/ V_e(C)
Equity	U		5.900	6.371	-30.8		-4.20	0.000	0.97
	M		5.945	5.943	0.2	99.4	0.02	0.985	0.99
Cost-to-income	U		72.129	71.993	1.4		0.22	0.824	1.99*
	M		71.351	72.723	-13.6	-903.8	-1.54	0.125	1.31*
Roa	U		0.195	0.234	-23.3		-3.57	0.000	1.59*
	M		0.209	0.213	-2.8	87.8	-0.32	0.749	0.77*
Liquidity	U		15.847	15.614	2.8		0.41	0.679	1.22
	M		15.505	16.178	-8.1	-189.2	-0.81	0.417	1.16
Log assets	U		6.684	6.365	24.5		3.93	0.000	1.24
	M		6.575	6.610	-2.6	89.3	-0.28	0.781	1.19

Overall	Ps R2	LR chi2	p > $chi2$	MeanBias	MedBias	B	R	%concern	%bad
U	0.018	26.15	0.000	16.6	23.3	35.00*	1.37	40	0
M	0.009	4.93	0.424	5.5	2.8	22.10	1.10	40	0

Table 5: Propensity score matching on firm and plant variables

One-to-one nearest neighbor propensity score matching on firm and plant variables in the pre-treatment years 2007-2009. Column V indicates the percentage bias for the unmatched or matched group respectively. Column VI describes the reduction of the bias after the matching procedure, and column VII shows the t-statistic of the t-test of equality of sample means within the unmatched and matched samples. Column VIII shows the corresponding p-value. The last column shows the variance ratio of treated and untreated. The lower part of the table provides summary results on the matching procedure inluding test statistics of the likelihood ratio test (including p_values) on the joint insignificance of covariates in explaining the treatment, mean and median bias, as well as Rubens' B and Rubens' R. Ideally, Rubens' B should be less than 25 and Rubens' R in the range of 0.5 and 2.

	Unmatched		Mean			%reduct	t-test		V_e(T)/
Variable	Matched		Treated	Control	%bias	$\|bias\|$	t	$p > \|t\|$	V_e(C)
Log assets	U		-0.878	-0.879	0.1		0.140	0.885	1.08
	M		-0.879	-0.874	-0.3	-194.6	-0.350	0.724	1.07
Agegroup 2	U		0.265	0.263	0.4		0.550	0.584	1.01
	M		0.265	0.262	0.6	-39.2	0.640	0.522	1.02
Agegroup 3	U		0.183	0.169	3.6		4.370	0.000	1.09
	M		0.183	0.188	-1.3	62.6	-1.340	0.181	1.05
Agegroup 4	U		0.156	0.135	6.0		7.500	0.000	1.23
	M		0.156	0.156	0.2	96.2	0.230	0.820	1.01
Agegroup 5	U		0.223	0.256	-7.8		-9.450	0.000	1.15
	M		0.223	0.224	-0.2	97.0	-0.250	0.806	1.00
Long term debt, ratio	U		0.319	0.322	-0.9		-1.160	0.247	0.98
	M		0.319	0.318	0.2	81.5	0.180	0.856	0.98
Equity, ratio	U		30.927	31.313	-1.4		-1.760	0.078	1.00
	M		30.920	30.737	0.7	52.5	0.710	0.479	1.01
Cash, ratio	U		0.183	0.183	0.3		0.350	0.724	1.03
	M		0.183	0.182	0.5	-72.9	0.510	0.608	1.04
Number fte	U		12.978	11.037	5.4		7.170	0.000	1.77*
	M		12.804	12.316	1.3	74.9	1.310	0.190	1.13
Marginal workers, ratio	U		0.278	0.282	-1.5		-1.830	0.068	0.98
	M		0.278	0.278	0.0	99.0	-0.010	0.988	1.00
Overall	Ps R2	LR chi2	$p > chi2$	MeanBias	MedBias	B	R	%concern	%bad
U	0.002	203.730	0.000	2.7	1.5	11.50	1.26	9	0
M	0.000	5.660	0.843	0.5	0.4	2.30	1.06	0	0

Table 6: Results from testing the similarity of survival functions

This table shows results of log rank based tests on the similarity of survival functions of treated and control firms 2010-2013. The H_0 hypothesis of the log rank test claims that both survival functions are equal. The first four columns show results for unmatched sample: In column I, results for sample of strong banks connected to productive firms is shown. Column II reports results for weak banks connected to productive firms. Column III shows results for strong banks connected to unproductive firms, and column IV shows weak banks connected to unproductive firms. Columns V-VIII report similarly for the matched sample. Firms are considered to be unproductive if their turnover/employee, i.e. their labour productivity, ranked at the bottom quarter of the sample distribution in 2007. Banks are considered to be weak if their equity ratio ranked at the bottom quarter of the sample distribution in 2007. The lower part of the table reports the sign of the difference between events observed, i.e. actual exits, and events expected by the log rank test if both groups showed the same survival rate, as well as whether the difference is statistically significant. Further, total number of observations underlying the test as well as total number of events, i.e. exits, are shown. The p-values are as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Matching variables 2007-2009	I	II	III	IV	V	VI	VII	VIII
Bank level								
Equity ratio	-	-	-	-	Yes	Yes	Yes	Yes
Cost-to-income ratio	-	-	-	-	Yes	Yes	Yes	Yes
Return on assets	-	-	-	-	Yes	Yes	Yes	Yes
Liquidity ratio	-	-	-	-	Yes	Yes	Yes	Yes
Log of assets	-	-	-	-	Yes	Yes	Yes	Yes
Firm level								
Age	-	-	-	-	Yes	Yes	Yes	Yes
Log of assets	-	-	-	-	Yes	Yes	Yes	Yes
Long term debt ratio	-	-	-	-	Yes	Yes	Yes	Yes
Equity ratio	-	-	-	-	Yes	Yes	Yes	Yes
Cash ratio	-	-	-	-	Yes	Yes	Yes	Yes
Plant level								
Number employees	-	-	-	-	Yes	Yes	Yes	Yes
Share of part time employees	-	-	-	-	Yes	Yes	Yes	Yes
Difference events observed and events expected of treated	(-)	(-)	(+)	(-)***	(-)	(-)	(+)	(-)***
Total number of observations	12,240	8,765	3,377	3,531	1,869	2,520	446	912
Total number of events	503	291	161	110	73	75	/	27

Table 7: Results from difference-in-difference analysis

This table shows results of a quadruple difference-in-difference analysis at the plant-year level for single plant firms with a single bank link and years 2007-2013. Dependent variable is a binary variable indicating whether firm i in year t exited the market. The pre-period covers the years before the treatment 2007-2009, and the post-period covers the years 2010-2013. A firm is treated if it was connected to a bank that held an SMP asset in all three treatment years 2010, 2011 and 2012. Standard errors are clustered at the firm level. The lower part of the table reports marginal effects conditional on whether the firm had a link to a weak bank and on whether the firm exhibited a low productivity in 2007. Firms are considered to be unproductive if their turnover/employee, i.e. their labour productivity, ranked at the bottom quarter of the sample distribution in 2007 in columns I and II. Banks are considered to be weak if their equity ratio ranked at the bottom quarter of the sample distribution in 2007. In columns III and IV, firms are considered to be weak if their wages/employee ranked in the bottom quartile of the sample distribution in 2007. In column V and VI, firms are considered to be weak if their risk adjusted return on assets (return on assets divided by the standard deviation of return on assets 2006-2008) ranked in the bottom decile of the sample distribution in 2007. The p-values are as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Turnover/Employee		Wages		Return on assets	
	I	II	III	IV	V	VI
Post*SMP	0.005	-0.003	0.003	0.006**	0.001	0.007
	0.010	0.014	0.002	0.003	0.005	0.008
Post*Weak_Firm	0.007	0.000	0.017***	0.030***	0.012*	0.033
	0.006	0.021	0.002	0.005	0.007	0.022
Post*Weak_Bank	-0.002	-0.003	-0.001	0.003	0.001	0.013*
	0.005	0.014	0.001	0.002	0.003	0.008
Post*Weak_Bank*Weak_Firm	-0.006	0.012	0.002	-0.003	-0.008	-0.021
	0.009	0.025	0.002	0.006	0.010	0.028
Post*SMP*Weak_Bank	-0.017	-0.018	-0.006**	-0.008**	0.009	-0.001
	0.012	0.018	0.003	0.004	0.008	0.013
Post*SMP*Weak_Firm	0.005	0.024	-0.005	-0.015**	0.088	0.069
	0.020	0.029	0.005	0.007	0.060	0.061
Post*SMP*Weak_Firm*Weak_Bank	0.000	-0.049	0.001	0.005	-0.113*	-0.108*
	0.023	0.034	0.007	0.009	0.061	0.065
Firm age	Yes	-	Yes	-	Yes	-
Firm controls	Yes	-	Yes	-	Yes	-
Bank Controls	Yes	-	Yes	-	Yes	-
Plant controls	Yes	-	Yes	-	Yes	-
Matched bank	-	Yes	-	Yes	-	Yes
Matched firm	-	Yes	-	Yes	-	Yes
Plant FE	Yes	Yes	Yes	Yes	Yes	Yes
Kreis*Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry*Time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	33,685	10,264	392,550	121,610	25,197	7,708
R2	0.292	0.313	0.271	0.256	0.267	0.285
Mean Exit	0.022	0.024	0.014	0.015	0.007	0.009
SD Exit	0.147	0.154	0.117	0.123	0.083	0.092
Marginal Effects: Weak_Bank*Weak_Firm						
00	0.005	-0.003	0.003	0.006	0.001	0.007
01	0.010	0.021	-0.003	-0.01	0.088	0.076
10	-0.012	-0.022*	-0.004*	-0.002	0.01	0.006
11	**-0.008**	**-0.046*** **	**-0.008***	**-0.013*** **	**-0.016***	**-0.033***

Table 8: Results from difference-in-difference analysis for four subgroups separately

This table shows results of a difference-in-difference analysis within four subgroups to make results from the difference-in-difference analysis, as they are reported in Table 7 column II, as comparable as possible to results from survival analysis in Table 6. The sample covers plant-year observations from 2007 until 2013, and includes only single plant firms with a single bank link. Dependent variable is a binary variable indicating whether firm i in year t exited the market. The pre-period covers the years before the treatment 2007-2009, and the post-period covers the years 2010-2013. A firm is treated if it was connected to a bank that held an SMP asset in all three treatment years 2010, 2011 and 2012. The sample is matched on bank, firm and plant characteristics in the pre period 2007-2009. Plant, Region*Time and Industry*Time fixed effects are included. Standard errors are clustered on the firm level. We divide our sample in four subgroups according to bank and firm weakness. Firms are considered to be weak if their turnover/employee, i.e. their labour productivity, ranked at the bottom quarter of the sample distribution in 2007 in columns I and II. Banks are considered to be weak if their equity ratio ranked at the bottom quarter of the sample distribution in 2007. Column I reports results for strong firms connected to strong banks, column II for strong firms connected to weak banks, column III for weak firms connected to strong banks and column IV for weak firms connected to weak banks. The p-values are as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	I	II	III	IV
Post*SMP	-0.014	-0.009	-0.005	-0.045*
	0.018	0.013	0.037	0.025
Firm age	-	-	-	-
Firm controls	-	-	-	-
Bank Controls	-	-	-	-
Plant controls	-	-	-	-
Matched bank	Yes	Yes	Yes	Yes
Matched firm	Yes	Yes	Yes	Yes
Plant FE	Yes	Yes	Yes	Yes
Kreis*Time FE	Yes	Yes	Yes	Yes
Industry*Time FE	Yes	Yes	Yes	Yes
N	3,279	4,418	677	1,454
R2	0.379	0.355	0.604	0.443
Mean Exit	0.028	0.021	0.030	0.021
SD Exit	0.166	0.144	0.169	0.142

Table 9: Results from testing the similarity of survival functions: including multi-plant firms

This table shows results of log rank based tests on the similarity of survival functions of treated and control firms 2010-2013. The sample includes multi-plant firms as well. The H_0 hypothesis of the log rank test claims that both survival functions are equal. The first four columns show results for unmatched sample: In column I, results for sample of strong banks connected to productive firms is shown. Column II reports results for weak banks connected to productive firms. Column III shows results for strong banks connected to unproductive firms, and column IV shows weak banks connected to unproductive firms. Columns V-VIII report similarly for the matched sample. Firms are considered to be unproductive if their turnover/employee, i.e. their labour productivity, ranked at the bottom quarter of the sample distribution in 2007. Banks are considered to be weak if their equity ratio ranked at the bottom quarter of the sample distribution in 2007. The lower part of the table reports the sign of the difference between events observed, i.e. actual exits, and events expected by the log rank test if both groups showed the same survival rate, as well as whether the difference is statistically significant. Further, total number of observations underlying the test as well as total number of events, i.e. exits, are shown. The p-values are as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Matching variables 2007-2009	I	II	III	IV	V	VI	VII	VIII
Bank level								
Equity ratio	-	-	-	-	Yes	Yes	Yes	Yes
Cost-to-income ratio	-	-	-	-	Yes	Yes	Yes	Yes
Return on assets	-	-	-	-	Yes	Yes	Yes	Yes
Liquidity ratio	-	-	-	-	Yes	Yes	Yes	Yes
Log of assets	-	-	-	-	Yes	Yes	Yes	Yes
Firm level								
Age	-	-	-	-	Yes	Yes	Yes	Yes
Log of assets	-	-	-	-	Yes	Yes	Yes	Yes
Long term debt ratio	-	-	-	-	Yes	Yes	Yes	Yes
Equity ratio	-	-	-	-	Yes	Yes	Yes	Yes
Cash ratio	-	-	-	-	Yes	Yes	Yes	Yes
Plant level								
Number employees	-	-	-	-	Yes	Yes	Yes	Yes
Share of part time employees	-	-	-	-	Yes	Yes	Yes	Yes
Difference events observed and events expected of treated	(-)	(-)	(-)	(-)**	(-)	(+)	(+)	(-)*
Total number of observations	15,104	11,254	4,589	6,777	2,847	2,452	968	1,243
Total number of events	589	358	191	202	99	81	29	28

Table 10: Results from difference-in-difference analysis with intensive treatment

This table shows results of a quadruple difference-in-difference analysis at the plant-year level for single plant firms with a single bank link and years 2007-2013. Dependent variable is a binary variable indicating whether firm i in year t exited the market. The pre-period covers the years before the treatment 2007-2009, and the post-period covers the years 2010-2013. The treatment variable SMP_int is defined as the mean exposure of bank i's balance sheet to SMP assets over all three treatment years 2010, 2011 and 2012, conditional on being treated in all three years. Standard errors are clustered at the firm level. The lower part of the table reports marginal effects conditional on whether the firm had a link to a weak bank and on whether the firm exhibited a low productivity in 2007. Firms are considered to be unproductive if their turnover/employee, i.e. their labour productivity, ranked at the bottom quarter of the sample distribution in 2007 in columns I and II. Banks are considered to be weak if their equity ratio ranked at the bottom quarter of the sample distribution in 2007. In columns III and IV, firms are considered to be weak if their wages/employee ranked in the bottom quartile of the sample distribution in 2007. In column V and VI, firms are considered to be weak if their risk adjusted return on assets (return on assets divided by the standard deviation of return on assets 2006-2008) ranked in the bottom decile of the sample distribution in 2007. The p-values are as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Turnover/employee		Wages		Rtas(10%)	
	I	II	III	IV	V	VI
Post*SMP_int	0.007	0.001	0.001	0.003	0.005	0.012
	0.009	0.011	0.002	0.002	0.005	0.009
Post*Weak_Firm	0.007	-0.002	0.017***	0.023***	0.013*	0.038
	0.006	0.019	0.002	0.004	0.007	0.023
Post*Weak_Bank	-0.003	-0.003	-0.001	0.002	0.001	0.014*
	0.005	0.012	0.001	0.002	0.003	0.007
Post*Weak_Bank*Weak_Firm	-0.005	0.013	0.002	0.003	-0.01	-0.028
	0.009	0.022	0.002	0.005	0.01	0.028
Post*SMP_int*Weak_Bank	-0.019	-0.027	-0.006*	-0.007	0.016	0.004
	0.015	0.018	0.004	0.005	0.012	0.016
Post*SMP_int*Weak_Firm	0.006	0.035	0.004	0.002	0.155	0.127
	0.024	0.03	0.005	0.006	0.125	0.126
Post*SMP_int*Weak_Firm*Weak_Bank	-0.014	-0.081**	-0.008	-0.012	-0.194	-0.181
	0.03	0.041	0.008	0.009	0.126	0.129
Firm age	Yes	-	Yes	-	Yes	-
Firm controls	Yes	-	Yes	-	Yes	-
Bank Controls	Yes	-	Yes	-	Yes	-
Plant controls	Yes	-	Yes	-	Yes	-
Matched bank	-	Yes	-	Yes	-	Yes
Matched firm	-	Yes	-	Yes	-	Yes
Plant FE	Yes	Yes	Yes	Yes	Yes	Yes
Kreis*Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry*Time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	33,671	10,250	392,197	121,239	25,183	7,694
R2	0.292	0.313	0.271	0.256	0.267	0.285
Mean Exit	0.022	0.024	0.014	0.015	0.007	0.009
SD Exit	0.147	0.154	0.117	0.123	0.083	0.092
Marginal Effects: Weak_Bank*Weak_Firm						
00	0.007	0.001	0.001	0.003	0.005	0.012
01	0.013	0.036	0.005	0.004	0.161	0.139
10	-0.012	-0.026*	-0.006*	-0.004	0.021*	0.016
11	**-0.020**	**-0.072*****	**-0.010***	**-0.014*****	**-0.018**	**-0.038**

Table 11: Results with alternative dependent variables

This table shows results of a quadruple difference-in-difference analysis with alternative dependent variables. The sample covers plant-year observations from 2007 until 2013, and includes only single plant firms with a single bank link. Dependent variables in columns I-III are the log number of full time equivalents. The dependent variable in columns IV-VI are log of total paid wages. The pre-period covers the years before the treatment 2007-2009, and the post-period covers the years 2010-2013. A firm is treated if it was connected to a bank that held an SMP asset in all three treatment years 2010, 2011 and 2012. Standard errors are clustered at the firm level. The lower part of the table reports marginal effects with regard to the effect of the treatment in the post period conditional on whether the firm had a link to a weak bank and on whether the firm exhibited a low productivity in 2007. Firms are considered to be unproductive if their turnover/employee, i.e. their labour productivity, ranked at the bottom quarter of the sample distribution in 2007 in columns I and II. Banks are considered to be weak if their equity ratio ranked at the bottom quarter of the sample distribution in 2007. The p-values are as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Log Number FTE			Log Wages		
	I	II	III	IV	V	VI
Post*SMP	-0.004	-0.01	-0.002	-0.022	-0.036	-0.017
	0.025	0.032	0.039	0.026	0.035	0.041
Post*Weak_Firm	-0.122***	-0.127**	-0.149**	-0.094***	-0.114**	-0.113
	0.021	0.051	0.069	0.021	0.054	0.075
Post*Weak_Bank	-0.033**	-0.051	-0.035	-0.02	-0.043	-0.027
	0.015	0.032	0.038	0.015	0.033	0.04
Post*Weak_Bank*Weak_Firm	0.060**	0.047	0.05	0.047*	0.049	0.029
	0.029	0.063	0.082	0.028	0.063	0.085
Post*SMP*Weak_Bank	0.026	0.051	0.07	0.033	0.061	0.058
	0.039	0.051	0.059	0.04	0.054	0.063
Post*SMP*Weak_Firm	0.063	0.086	0.144*	0.075	0.101	0.141
	0.052	0.071	0.086	0.054	0.074	0.091
Post*SMP*Weak_Firm*Weak_Bank	-0.002	0.001	-0.012	-0.019	-0.011	0.011
	0.072	0.095	0.116	0.075	0.098	0.119
Firm age	Yes	Yes	-	Yes	Yes	-
Firm controls	Yes	Yes	-	Yes	Yes	-
Bank Controls	Yes	-	-	Yes	-	-
Plant controls	Yes	-	-	Yes	-	-
Matched bank	-	Yes	Yes	-	Yes	Yes
Matched firm	-	-	Yes	-	-	Yes
Plant FE	Yes	Yes	Yes	Yes	Yes	Yes
Kreis*Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry*Time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	33,450	11,150	10,167	32,120	10,671	9,705
R2	0.969	0.972	0.969	0.973	0.976	0.973
Mean Log Dependent	2.226	2.262	2.246	6.694	6.748	6.734
SD Log Dependent	1.558	1.592	1.613	1.685	1.744	1.764
Marginal Effects: Weak_Bank*Weak_Firm						
00	-0.004	-0.01	-0.002	-0.022	-0.036	-0.017
01	0.06	0.075	0.142*	0.053	0.064	0.124
10	0.022	0.04	0.068	0.01	0.025	0.041
11	**0.084****	**0.127****	**0.199*****	**0.067**	**0.114***	**0.192****

A Appendix

Table A.1: Differences in levels and differences in changes on bank level

This table reports results of t-tests on levels (upper part) and on mean changes (lower part) of bank level data on the actual bank level within pre and post period between treatment and control group. The last two columns report the difference-in-difference tests between the means of the two groups over both periods. The sample covers the years 2007-2009 in the pre period and 2010-2013 in the post period. In the lower part, year-to-year changes from 2007-2009 are covered in the pre period, and changes from 2009-2013 are covered in the post period. PD of firms is the aggregated number of exits per year divided by the firm links of the bank and thereby describes the probability of default ratio on the bank level. Continuous variables are winsorized at the top and bottom 1% percentile. The p-values are as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Pre Period						**Post Period**							
	Non treated		Treated				Non treated		Treated					
	Mean	N	Mean	N	Difference	SE	Mean	N	Mean	N	Difference	SE	DID	SE
Differences in levels														
PD of firms	0.014	2,693	0.017	208	0.002	0.005	0.035	3,621	0.036	277	0.001	0.004	-0.001	0.007
Equity ratio	6.457	2,693	5.900	208	-0.557***	0.13	7.836	3,621	7.388	277	-0.448***	0.112	0.109	0.172
Cost-to-income ratio	71.976	2,690	72.129	208	0.153	0.61	67.377	3,621	66.886	277	-0.49	0.529	-0.644	0.808
Return on assets	0.239	2,691	0.195	208	-0.044***	0.013	0.291	3,621	0.247	277	-0.044***	0.011	0.000	0.017
Liquidity ratio	15.650	2,693	15.847	208	0.197	0.567	12.483	3,621	13.146	277	0.663	0.492	0.466	0.751
Log of assets	6.346	2,693	6.684	208	0.339***	0.082	6.426	3,621	6.755	277	0.329***	0.071	-0.009	0.108
Differences in changes														
PD of firms	0.006	1557	0.006	117	0.000	0.007	0.010	3,334	0.013	248	0.003	0.005	0.003	0.008
Equity ratio	0.024	1557	0.091	117	0.067	0.061	0.539	3,334	0.577	248	0.038	0.042	-0.029	0.074
Cost-to-income ratio	-1.674	1553	-1.489	117	0.185	0.621	-0.364	3,334	-0.332	248	0.032	0.426	-0.153	0.753
Return on assets	0.010	1555	0.015	117	0.005	0.014	-0.002	3,334	0.004	248	0.006	0.010	0.001	0.018
Liquidity ratio	-1.067	1557	-1.438	117	-0.371	0.422	-0.745	3,334	-0.528	248	0.218	0.290	0.588	0.512
Log of assets	0.034	1557	0.033	117	-0.002	0.006	0.024	3,334	0.022	248	-0.002	0.004	-0.001	0.008

Table A.2: Summary statistics on the matched sample

Matched sample, years 2007-2013. All variables are reported at the plant level. Continuous variables are winsorized at the top and bottom 1% percentile. Post, SMP, bank and firm weakness indicators are binary variables, which are defined as the following: Post equals one in years 2010-2013. SMP equals one if bank held an SMP asset in all three treatment years 2010, 2011 and 2012. Bank weakness indicator equals one if the bank's equity ratio ranked at the bottom quarter of the sample distribution in 2007. Weakness_turn (weakness_earn) equals one if firm's turnover/employee (wages/employee) ranked at the bottom quarter of the sample distribution in 2007. Weakness_return equals one if firm's [ROA/SD(ROA)] (2006-2008) ranked at the bottom decile in 2007.

	N	mean	p50	sd	min	max
Plant level						
Exits	138,439	0.018	0.000	0.134	0.000	1.000
Number fte	138,439	12.797	5.000	36.036	0.000	1155.000
Number fte, log	130,348	1.754	1.792	1.221	-0.693	7.052
Total wages, log	124,315	6.154	6.161	1.301	-2.079	11.983
Share of marginal workers	138,439	0.267	0.182	0.285	0.000	1.000
Age	138,439	15.616	13.000	9.894	1.000	38.000
Agegroup	138,439	3.310	3.000	1.343	1.000	5.000
Post	138,439	0.548	1.000	0.498	0.000	1.000
Firm level						
Log of assets	132,377	-0.750	-0.821	1.373	-4.503	4.503
Long term debt ratio	132,079	0.305	0.199	0.316	0.000	0.991
Equity ratio (in %)	132,377	33.224	29.068	27.449	0.000	99.841
Cash ratio	130,097	0.192	0.113	0.209	0.000	0.816
Bank level						
Equity ratio (in %)	138,439	6.126	5.761	1.663	2.626	12.331
Cost-to-income ratio (in %)	138,398	71.488	71.040	9.106	44.640	109.340
Return on assets (in %)	138,439	0.168	0.160	0.163	-1.240	0.880
Liquidity ratio (in %)	138,439	13.505	12.183	6.956	2.144	59.143
Log of assets	138,439	8.372	8.443	1.321	5.142	10.610
SMP	138,439	0.350	0.000	0.477	0.000	1.000
Bank Weakness Indicator						
weak_bank	138,439	0.568	1.000	0.495	0.000	1.000
Firm Weakness Indicators						
Weakness_turn	10,311	0.234	0.000	0.424	0.000	1.000
Weakness_earn	121,718	0.230	0.000	0.421	0.000	1.000
Weakness_return	7,740	0.097	0.000	0.296	0.000	1.000

Table A.3: Variable descriptions

Variable	Unit	Description
Plant variables. Source: IAB.		
Exits	0/1	Equals 1 in the year a plant exits the market. We make use of the definition of Hethey and Schmieder (2010) on small and atomized deaths.
Number fte	Number	Log number of employees, in full time equivalents.
Total wages, log	EUR	Log of total spending on wages.
Share of marginal workers	Ratio	Number of marginal workers over total numbers of employees.
Age	Number	Age of plant.
Agegroup	1-5	Relative age compared to other plants in the sample. We divide our sample in five agegroups of equal size.
Firm variables, winsorized at lower and upper 1%. Source: Amadeus.		
Log of assets	EUR	Log of total assets in million EUR.
Long term debt ratio	Ratio	Long term debt over total assets.
Equity ratio (in %)	%	Equity over total assets.
Cash ratio	Ratio	Cash over total assets.
Bank variables, winsorized at lower and upper 1%. Source: Bankscope.		
Equity ratio (in %)	%	Equity over total assets.
Cost-to-income ratio (in %)	%	Costs over income.
Return on assets (in %)	%	Return on assets.
Liquidity ratio (in %)	%	Liquid assets over total assets.
Log of assets	EUR	Log of total assets, in million EUR.

Table A.4: Variable descriptions continued

Variable	Unit	Description
Bank Weakness Indicator. Source: Bankscope.		
Weak_bank	0/1	Equals 1 if a bank's equity ratio was in the lower 25% percentile in 2007.
Firm Weakness Indicators		
Weakness_turn	0/1	Equals 1 if a firm's turnover/employee ratio was in the lower 25% percentile in 2007. Sources: turnover: Amadeus, employees: IAB.
Weakness_earn	0/1	Equals 1 if a firm's paid out wage per employee was in the lower 25% percentile in 2007. Source: IAB.
Weakness_return	0/1	Equals 1 if a firm's risk adjusted return on assets (return on assets over standard deviation of return of assets 2006-2008) was in the lower 10% percentile in 2007. Source: Amadeus.
Post	0/1	Equals 0 in 2007-2009. Equals 1 in 2010-2013.
SMP	0/1	Equals 1 if bank held an SMP assets in all three treatment years 2010, 2011 and 2012. Source: Bundesbank and ECB.