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Abstract

We study whether government subsidies can stimulate bank funding of marginal investment projects and the associated effect on financial stability. We do so by exploiting granular project-level information for the largest regional economic development programme in Germany since 1997: the Improvement of Regional Economic Structures programme (GRW). By combining the universe of subsidised firms to virtually all German local banks over the period 1998-2019, we test whether this large-scale transfer programme destabilised regional credit markets. Because GRW subsidies to firms are destabilised at the EU level, we can use it as an exogenous shock to identify bank responses. On average, firm subsidies do not affect bank lending, but reduce banks' distance to default. Average effects conflate important bank-level heterogeneity though. Conditional on various bank traits, we show that well capitalised banks with more industry experience expand lending when being exposed to subsidised firms without exhibiting more risky financial profiles. Our results thus indicate that stable banks can act as an important facilitator of regional economic development policies. Against the backdrop of pervasive transfer payments to mitigate Covid-19 losses and in light of far-reaching transformation policies required to green the economy, our study bears important implications as to whether and which banks to incorporate into the design of transfer programmes.

Keywords: bank stability, financial intermediation, government subsidies

JEL classification: G21, G28, H25

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1 Introduction

Government subsidies to firms are canonical tools of economic policy in the presence of market frictions that prevent the optimal allocation of production resources in terms of investment and employment choices based on free market equilibrium alone (Criscuolo et al., 2019). Financial constraints faced by firms feature prominently as one of such market frictions that prevail during structural transformations of economic systems and sudden economic shocks alike. For example, reforms towards an ecologically more sustainable economic system often encounter classical underinvestment problems into "clean" innovative technologies with highly uncertain cash-flow projections. More recently, the depression of economic activity due to the Covid-19 pandemic highlighted the eminent danger of liquidity freezes in times of increased uncertainty, which may result in credit crunches and the subsequent amplification of recessionary tendencies. Accordingly, national governments in the European Union (EU) provided an unparalleled volume of direct financial support to firms to prevent liquidity freezes and resulting credit crunches (ESRB, 2021).

Whereas the (in)ability of subsidies to mitigate financial frictions to foster investment and employment has been studied intensively (Brachert et al., 2019; Cerqua and Pellegrini, 2014; Criscuolo et al., 2019; Ehrlich and Seidel, 2018), evidence about possible effects of this economic policy on the financial system is scarce. This gap is surprising given that such subsidies can undermine firms' incentives to exert their best effort when employing resources, and compromise the incentives in the financial system to conduct its canonical screening and monitoring tasks. Thus, we aim to shed light on the effects of government subsidies to firms on bank lending and risk-taking.

To this end, we mobilize a novel combination of comprehensive corporate subsidy data and bank relationships of German firms to shed light on the implication of firm subsidies for credit markets and financial stability. Loan guarantees ease liquidity provision from banks to non-financial firms. Governments thereby delegate the screening of borrowers to banks and do not face immediate payments. Alternatively, in the case of public loans or government subsidies, payments are directly made to firms. Banks can still be involved in channeling such funds from governments to non-financial firms by taking on some screening task. Such policies can mitigate a credit crunch and keep viable firms alive in the shorter run, but might also distort allocative efficiency and financial stability in the longer-run. Whereas the role of *guarantees* for bank behavior has been studied

extensively (Allen et al., 2015; Gropp et al., 2013; Dam and Koetter, 2012; Gropp et al., 2011), the consequences of *direct subsidies* provided by the government to firms that are intermediated via banks remain unclear.

To fill this void, we exploit granular data on government subsidies to firms in the private sector spanning a long time period from 1998 to 2019 to study whether these subsidies affect bank behavior. While government subsidies constitute direct capital grants to firms in our setting, banks play a crucial role in the intermediation process. Thus, we can assess how bank behavior changes in the presence of direct subsidies. Given that the public subsidy acts as firm equity, banks might re-evaluate their lending and risk-taking decisions when being linked to a firm that receives access to subsidies. For identification, we first exploit that – according to the legal framework of the EU – the subsidy program is eventually approved at the EU level whereas we consider bank outcomes at the national level. Second, the concrete funding structure of the subsidy program changes usually every seven years, which introduces uncertainty about program accessibility. Third, the program's main target are non-financial firms instead of the banking system. This reduces concerns about reverse causality and ensures that banks are not directly exposed to the subsidy program but only indirectly via their lending relationships to subsidized firms.

The subsidy data we rely on stems from the program "Improvement of Regional Economic Structures (GRW)"[1], the most important place-based policy scheme in Germany to foster economic development at the regional level.[2] The program draws on investment grants for lagging regions. The budget is jointly provided by the German Federal Government and the Governments of the States (Bundesländer), whereas the operative funding process is administered by the State Governments.[3] The key objective of the GRW program is to reduce regional disparities in terms of employment and income across Germany. The demarcation of eligible regions is made according to a structural weakness score for German regions and a population threshold set by the European Commission (see Sections 2 and 4.2 for more details). If a firm is located in an eligible region, it can apply for subsidies to finance part of an investment project. The database gives us access

[1]In German: Gemeinschaftsaufgabe Verbesserung der regionalen Wirtschaftsstruktur

[2]Effects of the subsidy program for regional development and firm outcomes have been studied by, e.g., Brachert et al. (2018a, 2019); Siegloch et al. (2021). Similar programs in other countries and their effects on firm developments are evaluated by, among others, Bronzini and de Blasio (2006) or Cerqua and Pellegrini (2014) for Italy or Criscuolo et al. (2019) for the UK.

[3]The states can extend their part of the budget with funds from the European Regional Development Fund (ERDF).

to German firms' received subsidies and we can match these firms to firm-level information from Amadeus. Furthermore, we use information obtained from the database Dafne to establish relationship links between banks and non-financial firms (Dwenger et al., 2020; Koetter et al., 2020). The long sample period for which the data are available allows us to evaluate effects not only over the economic cycle but also for phase-in versus phase-out periods of government subsidies.

Our study is based on a sample of regional savings and cooperative banks between 1998 to 2019 and yields three main results. First, on average, firm subsidies do not affect bank lending, but there is some indication that they might reduce banks' distance to default. Second, average effects hide important bank-level heterogeneity. Conditional on various bank traits, we show that large banks, banks with sufficient capital and liquidity buffers, and banks with more sectoral experience expand lending when being exposed to subsidized firms without exhibiting more risky financial profiles. Third, our results indicate that "local champions", that is banks dominating their local markets, increase lending when being linked to subsidized firms (and especially to weak firms) but do not face a significant reduction in stability. Our results thus indicate that stable and locally experienced banks can act as an important facilitator of regional economic development policies.

The paper relates to three main strands of literature. First, a number of studies show that public guarantees provided to banks affect their risk-taking behavior (Allen et al., 2015; Dam and Koetter, 2012; Gropp et al., 2013). Regarding loan guarantees, Wilcox and Yasuda (2019) find that Japanese banks receiving more guaranteed loans became riskier but also issued more non-guaranteed loans. In contrast, Altavilla et al. (2021) show for loan guarantees issued during the Covid-19 pandemic and based on euro-area credit registry data that guarantees ensured credit supply but partially substituted non-guaranteed loans. Carletti et al. (2021) show theoretically that loan guarantees do not necessarily increase financial fragility if depositors are less likely to run and banks keep on monitoring. In contrast to the literature on loan guarantees, we aim at evaluating the role of direct subsidies. Subsidies to firms affect connected banks and their lending and risk-taking decisions indirectly. Our hypothesis is that in case banks are involved in intermediating these funds from the government to non-financial firms, they might adjust their behavior.[4]

A second strand of literature focuses on firm behavior and regional developments following the

[4]Evidence on earmarked loans in Brazil by Haas Ornelas et al. (2019) suggests that if private banks select suitable receivers of such government loans, this can have allocative effects.

introduction of place-based policies like the one we are analyzing (Brachert et al., 2019; Bronzini and de Blasio, 2006; Brown and Earle, 2017; Cerqua and Pellegrini, 2014; Criscuolo et al., 2019; Ehrlich and Seidel, 2018). Related studies also discuss the role of such policies for firms' financial constraints. For example, Banerjee and Duflo (2014) make use of a targeted lending program in India to evaluate whether firms face a credit constraint. They find that the funds have been used to finance more production instead of substituting other types of credit. For a credit certification program in Portugal, Custodio et al. (2021) find that eligible firms benefit from better credit conditions and invest more, whereas these results are only found for crisis times. We add one possibly missing element to the literature that might be relevant to evaluate implications of such programs for regional stability and development, namely adjustments in bank behavior linked to subsidized firms.

Third, a recent and evolving strand of literature discusses the effects of Covid-19 support measures to banks and non-financial firms. The need for liquidity by non-financial firms has been visible, for example, in the increased credit line drawdowns at the start of the pandemic (Acharya and Steffen, 2020; Li et al., 2020), with smaller firms often facing harder times to access credit (Chodorow-Reich et al., 2021). Such credit constraints can threaten the viability of solvent but illiquid firms. Thus, several measures have been taken to improve liquidity access for banks as the main financial intermediaries in Europe (Altavilla et al., 2020), but also more directly for firms. For example, Core and De Marco (2021) assess the determinants of loan disbursements within the Italian guarantee program. Government guaranteed credit was mainly granted by larger banks closer to their customers, whereas firm characteristics played a minor role. Minoiu et al. (2021) show for the US that lending backstops incentivized banks to provide more credit at favorable conditions, while Koulischer et al. (2021) provide evidence for Europe that public interventions targeted at non-financial firms reduced credit market failures.[5] We complement this literature by evaluating a subsidy program that is not short-lived and thus affects the universe of German banks via their links to subsidized firms over a long time horizon.

The following section provides information on the subsidy program, how banks are involved and which hypotheses regarding bank behavior follow from that setting. Section 3 describes the underlying data, both at the firm and the bank level as well as regional controls. Section 4 explains

[5]Further evidence on US support programs during the pandemic such as the paycheck program is provided by, e.g., Cole (2020), Denes et al. (2021) or Granja et al. (2020) who study the role of banks in intermediating these loans.

the empirical specification and the following Section 5 shows regression results. Section 6 concludes.

2 Firms' access to the subsidy program and hypotheses

In this section, we describe how firms receive access to the subsidy program and derive the hypotheses that might follow from the design of the program as regards bank behavior. We also compare the outlined mechanism to the ones discussed in the related literature.

The subsidy program "Improvement of Regional Economic Structures (GRW)" has existed since 1969 in West Germany, and since 1990, it has been spanning the reunified country constituting the most important program to foster regional development. The main goal of the program is to reduce regional disparities in terms of employment and income by stimulating investment activity and, on average, annual expenditures amount to approximately one billion euros in recent years. When being located in an eligible regions, non-financial firms can apply for subsidies (see Section 4.2 for more information on the determination of regional eligibility). For this study, we have data on subsidized projects of non-financial firms across all German regions for the funding periods from 1997 to 2020.

While there is no specific target group, mostly small and medium-sized non-financial firms in eligible regions can apply for *non-repayable* subsidies of up to 50% of the planned investment costs. Firms can use the funds to invest in machinery to expand existing business, or to finance new establishment sites, while funds are not obtained for R&D investments. To obtain the subsidy, firms necessarily need to fulfill at least one of the two following requirements. First, the investment project needs to be accompanied by an increase in the labor force by 15%. Alternatively, the planned investment expenditures have to exceed the threshold of 50% of the average amount of depreciation over the last three years before the application is filed. Hence, the project needs to be sizable. Another program condition is that the firm needs to generate at least 50% of revenues from inter-regional sales such that mostly manufacturing firms qualify.[6] Regarding the application process, firms need to fill in a form specifying the investment project and handing it in at their State Government. In general, projects have to be pursued within three years. Within our sample,

[6]Subsidized firms are mainly represented by manufacturing firms (60% of all subsidized firms, half of them being high- or medium-high-technology firms), followed by knowledge-intensive services (17%), accommodation (11%) and other (12%) industries.

the average number of subsidized projects per year is 2,282, with an average subsidy of around 350 thousand Euros. Around 56% of firms apply only once for a subsidy.

While the subsidy constitutes a direct grant to non-financial firms administered by the State Government, a bank needs to be involved in the application process. The bank's task is to verify the financing plan of the investment project before the firm can finalize the application. Usually, following talks with experts from the banking industry, firms approach their relationship bank ("Hausbank") to do so. If a non-financial firm asks a bank with which it did not have a relationship before, it is very likely that the bank would neglect to do the verification task due to a lack of knowledge about the customer. In case the investment costs exceed the sum of the firm's available funds, the bank can furthermore be involved by granting a credit. In any case, the subsidy only covers a certain share of investment costs. A possible funding situation of a project partially financed by a subsidy is illustrated in Figure 1.

[Insert Figure 1 here]

In our analysis, to define banks' linkages to subsidized firms and consequent lending and risk-taking adjustments, we thus focus on firms that receive a subsidy but have relatively large investment costs and are likely to be financially constraint.[7] The reason is that only then we expect that firms are likely to interact with the bank in a way that might impact on bank behavior.[8]

If the firm's application for a subsidy is successful, the subsidy reduces the amount of funds a firm would need from the bank to finance a project.[9] Firms' access to direct subsidies can have positive effects on bank lending. This might especially hold true in case banks are now more willing to finance a project at the margin. Also, recent studies have shown that government programs such as loan guarantees can stimulate bank lending instead of generating a crowding out effect (Core and De Marco, 2021; Custodio et al., 2021; Minoiu et al., 2021; Koulischer et al., 2021). We hence test whether banks' exposure to firms accessing public subsidies – whereas we condition on firms that

[7]See Section 4.1 for more information on how we define a firm to be financially constraint.

[8]We do not have credit registry data. Hence, we do not know whether the bank provided a loan as well to the firm in the year it received a subsidy. However, knowing the investment costs, we can plausibly assume that for very small projects, firms do not need additional funds from a bank.

[9]Given the abundance of funds (most State Governments have not depleted the available funds), a rejection of an application is very unlikely once the financing plan has been approved such that we do not suffer from a selection bias in that respect.

have significant project costs which they are unlikely to finance themselves – affects banks' lending volumes:

H0: In the presence of public subsidies, bank lending increases as the subsidy acts like equity for the firm and banks might be willing to finance projects being previously at the margin.

Furthermore, from the perspective of a bank, the subsidy reduces its equity at stake in case of firm default and hence its "skin in the game". Thus, banks might see less need to monitor the customer and conduct screening during the project period. For the case of loan guarantees, Wilcox and Yasuda (2019) put forward a stylized model with non-guaranteed and guaranteed loans on the asset side of banks' balance sheet. They demonstrate that loan risk goes up in the share of guaranteed loans. This results in the following hypothesis as concerns risk-taking:

H1: As a result of less "skin-in-the-game", subsidies to firms in the form of direct grants lower screening / monitoring incentives and increase bank risk-taking.

However, for the firm financing the project partly with a bank loan, a direct grant as the public subsidy constitutes increases its ratio of project generated cash-flow to interest payments. The latter reduces the firm's default probability on the loan. Thus, the bank's expected loss declines, which impacts positively on its "charter value". This mechanism is also put forward by Carletti et al. (2021) for the case of loan guarantees. From the literature, it is known that this mechanism might decline risk-taking incentives of banks and thus we alternatively set up the following hypothesis:

H2: Due to the "charter value" effect, subsidies to firms in the form of direct grants increase screening / monitoring incentives and reduce bank risk-taking.

Obviously, the previously described effects might not be the same across banks with different traits. Thus, we extend the model to evaluate whether, for example, better capitalized banks or banks with more sectoral experience and thus monitoring skills behave differently.

3 Data and descriptives

The main analysis is based on 1,570 banks for the period from 1998 to 2019. We focus on savings banks and cooperative banks in Germany as subsidies are granted to local firms which are likely to

be linked to close by banks. The rationale is that the regionally scattered savings and cooperative banks are more likely to be linked to these small, local firms receiving subsidies. Also, firms are not allowed to apply for funds in regions other than the one in which they are located. Our analysis is based on three main data sources. First, we draw on Bankscope and Orbis Bankfocus to estimate banks' responses following their exposure to subsidized firms. Second, to link banks and firms, we make use of information provided by the database Dafne. Third, we obtain granular firm-level information out of the GRW data, which inform about firms' subsidy amount and investment costs and allow us to compute banks' exposure to subsidized firms. Please see Table 1 for a detailed description of variables and sources.

[Insert Table 1 here]

Bank-level data: To obtain long time series on banks' balance sheets and income statements, we make use of both Bankscope and Orbis Bankfocus. For German banks, we obtained information from Bureau van Dijk about which variables out of the two datasets belong to each other. We switch from one database to the other in 2013 as this gives the broadest coverage and availability of data. To deal with the differences between two datasets, we do the necessary adjustments. First, we harmonize the units of measurement of variables other than ratios by changing them to thousands of Euro. Second, we choose the Euro as the baseline currency.[10] Third, based on bank specialization, we restrict the sample to savings and cooperative banks. For some banks, however, different specialization types are reported across the two datasets such that we manually verified the information content of this variable.[11]

The final data set contains only savings banks and cooperative banks as explained above. If available, we keep unconsolidated data to ensure that we use characteristics of local units in case they are part of a larger group. If unconsolidated data is unavailable, we draw on consolidated data. Based on this sample, we remove implausible observations such as those with negative assets, equity or loan amounts, and ratios that are negative or larger than 100%. Furthermore, we winsorize variables at the 1st and 99th percentiles. Summary statistics are provided in Table 4.

[10] In Bankscope, the baseline currency is US Dollar and we multiply all variables (except ratios) by the year-average exchange rate.

[11] We either did a manual check by searching websites or inferred the type from the bank's name (e.g., if a bank has "Sparkasse" or "Volksbank" in the name, it is classified as a savings or cooperative bank, respectively).

[Insert Table 4 here]

Bank-firm link: To establish a bank-firm link, we use the survey-based Dafne dataset provided by Creditreform. Creditreform considers firms for which balance sheets and annual income statements are available but does not have a size threshold. The database reports a bank-firm link in case firm managers report a bank to be among a firm's main relationship banks ("Hausbanken"). These banks are those at which a firm is most likely to have an account and ask for a loan. We proceed similar to Koetter et al. (2020) but extend the bank-firm links to recent years. Furthermore, given that reported links have partially breaks due to the survey nature of the database and given that bank-firm links tend to be stable over time, we extend the links in a symmetric way to obtain reasonable coverage.[12] On average, each bank has 627 firm links, while larger banks tend to be linked to more firms with a maximum number of bank-firm links of 33,592.

Firm-level data: Firm-level balance sheet and income statement data is taken from Amadeus, whereas information on historical vintages also allows us generating long time series.[13] For our analysis, we keep all firms that maintain a link to a bank in the sample. The firm level information is winsorized at the 1st and 99th percentiles. Similarly to the bank-level data, we remove observations with negative assets and equity, and implausible values of ratios.

As our analysis is at the bank level, we construct firm controls by averaging respective variables across all firms a bank is linked to.[14] In particular, we control for firm capitalization (ratio of equity to assets), profitability (return to assets), liquidity measured as the difference between current assets and current liabilities relative to total assets and the size of firms. These variables do not only approximate how well the average firm linked to bank i is doing but might also proxy determinants of firms' loan demand.

Furthermore, we obtain information on firms' access to subsidies from the Federal Office for Economic Affairs and Export Control, which is responsible for the monitoring of the overall funding process. For the period from 1998 to 2019, we have information on which firms received a subsidy, the size of the subsidy, as well as the total investment costs of the subsidized project. Due to record

[12]For each bank-firm pair which has a reported relationship length smaller than the median relationship length of the given bank, we symmetrically extend the reported links backward and forward up to the median length. We additionally ensure that the minimum extension of an observed bank-firm link is by three years in both directions.

[13]We thank Alexander Giebler for preparing the data.

[14]We also constructed weighted averages by firm size, which did not change results.

linkages pursued at the Halle Institute for Economic Research[15], we can match the firms in this database to Amadeus identifiers.[16]

Regional controls: To control for regional dynamics, we add time-varying information at the state (Bundesland) level to the data set. This includes state-level GDP growth capturing the stance of the local economy and the annual change in the unemployment rate at the state level, which is an important determinant of regional GRW eligibility. These two variables also constitute a proxy, at a granular level, for local demand side dynamics.

4 Empirical specification

The aim of this study is to shed light on how banks react to a public support program granting subsidies to firms with banks being involved in the application process. In the following, we outline the regression model, describe how we define banks' exposure to the program and discuss the features of the subsidy program that contribute to identification.

4.1 Regression model

We specify the following regression model to analyze the role of banks' subsidy exposures via interlinked firms for bank lending and risk-taking:

$$\begin{aligned} Y_{bt} =& \beta_0 + \beta_1 Subsidy\ Exp\ (0/1)_{bt} + \beta_2 Bank\ Controls_{bt-1} + \beta_3 Avg.\ Firm\ Controls_{bt-1} \\ &+ \alpha_b + \alpha_{st} + \epsilon_{bt}, \end{aligned} \tag{1}$$

where Y_{bt} is either the log of bank b's loan volume or its Z-Score in year t. The Z-Score is defined as follows: $Z\text{-}Score = Ln(\widetilde{Z\text{-}Score}+1)$ where $\widetilde{Z\text{-}Score} = (\frac{Equity}{Assets} + ROA)/SD(ROA)$ such that higher values indicate that the bank is more stable and the distance to default is larger. The sample spans the period from 1998 to 2019 for the universe of German savings and cooperative banks. Standard errors are clustered at the bank level.

[15]For details, please see Brachert et al. (2018b)

[16]Yet not all firms listed in the subsidy database can be found in Amadeus. The reason is that also very small entities like hotels might receive a subsidy, which are not covered by Amadeus.

The coefficient β_1 describes the role of a bank's exposure to financially constrained firms receiving a subsidy for a project with relatively high investment costs. The variable $Subsidy\ Exp\ (0/1)_{bt}$ is derived from the ratio of the number of links to such subsidized firms to the number of a bank's total firm links (including also non-subsidized firms). When calculating this ratio, we take into account the links to subsidized firms throughout the whole period of the project (three years).[17] We then create a dummy variable taking a value of one in case this ratio is larger than zero, and zero otherwise.

Following the discussion in the literature regarding possible proxies for firm financial constraints (see e.g., Almeida et al. (2004); Fagiolo and Luzzi (2006)), we regard a firm as financially constrained if, in a given year, it is in the bottom 50% of the distribution by any two of the following characteristics: size, capitalization, share of cash holdings in assets or turnover growth calculated as the year-to-year growth rate of firm sales. The project is regarded as relatively large for the firm if, in a given year, a firm is in the top 50% of the distribution of the ratio of the subsidized project size (investment costs) to the firm's total assets. We thus expect that banks show significant adjustments in their behavior if they are linked to subsidized firms that are likely to finance the subsidized project with a bank loan as well given that they are either financially constraint and/ or face high investment costs relative to their size.

We control for bank characteristics like size or capitalization by including $Bank\ Controls_{bt-1}$, lagged by one period to reduce simultaneity issues. For example, larger and better capitalized banks might be more likely to maintain a larger loan volume. Similarly, banks with a higher capital or liquidity ratio have larger buffers in the presence of losses or withdrawals such that they retain a higher level of stability. Hence, we control for a bank's capitalization, the management quality by including the cost to income ratio, a bank's profitability measured by the return on assets, the liquidity ratio (liquid assets to total assets), and size (log of total assets). In further tests, we add interactions between selected bank controls and the dummy variable for banks' exposure to subsidized firms. Time-invariant bank traits are controlled for by bank fixed effects α_b.

To proxy loan demand in this set-up, we add controls for firm characteristics, which represent an average across all firms to which a bank maintains a relationship at time t ($Avg.\ Firm\ Controls_{bt-1}$). Further, the inclusion of state-time fixed effects α_{st} captures regional business cycles at the state

[17] In case a subsidized firm reports relationship links to two banks both are considered as treated.

(Bundesland) level controlling also for periods of expansion or recession and thus consequent loan demand dynamics. On the top of that, these fixed effects match dynamics that determine regional eligibility.

4.2 Identification

We exploit the following institutional features for identification and discuss potential threats that might arise in our setting. In particular, we describe the decision making process that determines whether an individual firm can apply for GRW subsidies and comment on subsidy size and different subsidy periods. Finally, we show that there is not significant evidence for weak banks selecting themselves into exposure by being linked to subsidized banks.

Decision making level: First, we exploit that the general rules for state aid across EU Member States are determined at the supranational level, which introduces some exogenous element from the perspective of the individual firm (or bank). Specifically, at the EU level, the share of a country's regions that can benefit from subsidies is determined via their maximum cumulative population share. Additionally, maximum aid intensities a country can apply within its boundaries are set at the EU level. These criteria are linked to the seven year periods of the EU's long-term budget (see the online appendix for more details). Furthermore, the concrete determination of eligible regions within a country is organized in an interactive agreement process between the Member States and the EU. While the Member States have some degrees of freedom to determine eligible regions, this process has to follow a transparent and reasonable procedure. These general EU-level rules also apply to the German GRW program and result in an exogenously driven process that determines which German regions (and how many) can fall into a program such as the GRW and to what extent subsidies can be granted to firms.

At the national level, the German government determines regions' eligibility for the GRW program by a unidimensional score of regional development that aggregates four measures of socio-economic outcomes, namely unemployment respectively underemployment, gross wages and salaries, quality of infrastructure and employment projection. The score is computed prior to the start of the respective EU funding period. The standardized single indicators are then weighted and put into the final score.[18] Scores are calculated on the level of labor market regions (LMR), which are

[18]Before 2007, the score was calculated separately for East and West Germany to cover specific economic conditions,

defined by commuting patterns. The latter aspect also reduces concerns that firms located in more granular regional units know for sure whether their LMR will be eligible.[19] The LMRs are then ranked according to their scores, where the worst performing LMR holds the top position in this list. In the next step, the corresponding cumulative population shares are calculated and all worst ranked regions receive subsidies until the population threshold is hit. Figure 2 illustrates how LMR are defined to be eligible depending on the population threshold and the weakness score.[20]

This process generates cross-regional variation of aid intensities across German municipalities, which are part of different LMR. Maximum aid intensities range from 15 to 50% across subsidy periods (Table 2). Around 5,000 out of 11,264 German municipalities are located in eligible LMR such that firms located in these regions can apply for subsidies. The share of eligible municipalities declines over time from around 48% to 44%. More detailed breakdowns regarding, for example, the total amount of subsidies over the different periods or the number of subsidized firms for the program as such and our estimation sample can be found in Table 3. The general pattern that emerges is that over time both volumes and numbers of subsidized firms have declined, which also spills over to banks' exposure to subsidized firms.

[Insert Table 2 here]

[Insert Table 3 here]

The specifics of the decision-making process as described above introduce uncertainty about exact aid levels to firms as argued by the related literature on the role of subsidies for firm and regional developments (Brachert et al., 2018a; Siegloch et al., 2021). As aid intensities depend on pre-determined performance scores not only of one region but also of all other regions within the EU, it is very unlikely that counties, and ultimately the firms or banks located there, can actively affect their treatment status. Hence, while not only the exact probability to fall in a region that has

particularly the dramatic consequences of the transition processes in the aftermath of the German reunification.

[19] Regional firms might know how their municipality is doing but might not look at aggregated data on their LMR. Relative to municipalities, the average LMR is large. For example, in 2019, the last year of our sample, there were 258 LMR and 11,264 municipalities.

[20] Although the demarcation of eligible regions for the GRW program relies on the LMR level, the eligibility status might vary within a certain LMR in some rare cases. The German government argues that the score does not always cover spatial heterogeneity within LMRs adequately (e.g., border areas, remarkable economic disparities within LMRs etc.). Importantly, this procedure has to be in line with the derogation framework set by the EU.

access to such funds is unknown a priori, the treatment intensity may be regarded as unexpected to firms and banks. For our setting, this argument holds the more so as banks are not directly targeted by the program but only indirectly exposed to it depending on the number of interlinked firms that receive subsidies.

Obviously, regions receive access to the subsidy program due to their economic characteristics. Hence, we need to ensure that banks' response is due to their exposure to subsidized firms and not driven by underlying structural characteristics determining the region's eligibility. Thus, we control for state-time fixed effects to capture potential time-varying confounders that also determine eligibility. Further, we check whether treated banks differ compared to untreated banks. Table 5 shows summary statistics by treatment status. Importantly, there seems to be no significant differences when it comes to state-level variables. This finding reduces concerns that, for example, a stronger economic development in regions where banks linked to subsidized firms are located drives bank behavior.[21]

[Insert Table 5 here]

Relevance of subsidy program: Second, we need to ensure that the subsidy program is sizable such that treated banks are likely to be affected much more compared to untreated as a consequence of their exposure to subsidized firms. While aid intensities vary across regions, another level of variation stems from subsidy rates varying across firm size. Larger firms have smaller subsidy rates relative to investment costs. This ensures that even tough smaller firms might be more likely to execute smaller projects, they still receive a relevant amount of funds. Hence, also smaller banks only being linked to smaller firms can be exposed to the program in a significant way. Table 3 reveals that subsidies relative to investment costs describing the realized aid intensity amount to, on average, 27.7%. Furthermore, we define banks' exposure to the subsidy program in such a way that only linkages with firms are considered in case the firm's investment costs are sizable relative to firm size and the firm is likely to be financially constraint.

[Insert Table 3 here]

[21] Table A1 reveals that banks do not differ significantly in case we compare characteristics for all banks and banks located in regions that are more similar regarding their structural weakness score.

Time variation: Third, we make use of the institutional feature that each subsidy period lasts for seven years, after which regional eligibility and aid intensities are adjusted again. This changing pattern introduces another layer of uncertainty. We have data on three complete subsidy periods: 2000-2006, 2007-2014[22], and 2015-2020.[23] In addition, it provides a unique opportunity to analyze effects of phase outs. The reason is that in more recent years, after a significant time span of stable aid intensities, some counties saw a significant decline in their access to funds. Also Table 3 reveals that the total amount of subsidies has been the lowest in the last wave with 1.1 billion Euros. Recent research by Siegloch et al. (2021) points into the direction that phase-outs can have significant effects. The authors find that a decline in the subsidy rate has negative effects for employment and might generate spillovers to other sectors or counties as well.

Selection into treatment: A possible concern for our identification might stem from the selection of banks into treatment, which can both take place in an active or a more passive way. On the one hand, from expert talks, we know that some banks might actively inform the firm about the possibility to receive subsidies when negotiating about a loan contract. For the bank, this can be beneficial, as the inclusion of a subsidy allows the bank to offer a more favorable loan to the firm, which might imply a competitive advantage for the bank. On the other hand, bank-firm relationships are not random, nor so is the allocation of subsidies. Firms being granted a subsidy tend to be older, belong to the manufacturing sector and have more qualified workers (Brachert et al., 2018a). To account for such confounders, we control for firm-level characteristics. However, as Table A2 in the online appendix shows, we do not find evidence that, for example, weakly capitalized banks are more likely to be exposed to subsidized and financially constraint firms in our sample. If at all, key determinants are bank and firm size, whereas larger banks linked to on average smaller firms are most likely to be exposed.

[22]Formally, the subsidy period ended in 2013. However, the actual change between this and the subsequent funding period was on July 1, 2014. Against this backdrop, we count the entire year 2014 to the formal period 2007-2013 and 2015 to the period 2014-2020.

[23]The last period lacks the year 2020 in our sample due to data constraints regarding firm and bank level observations.

5 Regression results

In this section, we start by showing results of the baseline model and we study whether responses differ across banks or by subsidy periods. We then assess the role of factors underlying monitoring and screening abilities of banks, which might be relevant in case we find that the GRW program induces banks to lend more.

5.1 How do public subsidies granted to firms affect bank behavior?

Baseline model: Results when estimating equation 1 are shown in Table 6. The estimated coefficient of interest β_1 for the model with *Log Loans* as the dependent variable is positive but insignificant for both the baseline specification (Column 1) and for the model with firm demand controls (Column 2) suggesting that there is, on average, no impact on bank lending due to banks' exposure to subsidized and financially constraint firms. The coefficients for the model with *Z-Score* as the dependent variable, however, indicate significant results. Point estimates for the baseline model and the model with firm demand controls are negative and significant at the 10% level providing indicative support for hypothesis $H1$ implying lower screening and/ or monitoring by the exposed banks, for example, as a result of less "skin-in-the-game". The effect is economically relevant, but small: Bank stability (as measured by the *Z-Score*) of the treated banks declines by around 0.02 of its standard deviation (Columns 3 and 4). Regarding further bank controls, it turns out that banks with a lower cost to income ratio as well as larger banks tend to lend more. While size relates negatively to stability, capitalization comes with higher values of the *Z-Score*.

[Insert Table 6 here]

Interaction model: We extend the model by introducing an interaction term between the exposure variable and bank characteristics such as size, capitalization and liquidity. For example, better capitalized banks might have more "skin-in-the-game" inducing them to be more prudent. Alternatively, higher capital buffers might allow them to expand lending without intervening with regulatory constraints too quickly in case of losses. Also anecdotal evidence from talks to bankers suggests that better capitalized banks might make use of the subsidy program to offer profitable firms better conditions while low-capitalized banks might ask interconnected firms to obtain the subsidy to lower the required loan amount and thus capital requirements.

Results of this exercise are shown in Table 7 and marginal effects are depicted in Figure 3. The results confirm previous considerations: The coefficients for the interaction term of *Subsidy Exp.* (0/1) and bank size, capitalization or liquidity are positive and statistically significant. These results suggest that larger banks with higher capital and liquidity ratios tend to lend more to subsidized firms but without threatening their stability significantly.

[Insert Table 7 here]

Marginal effects of banks' subsidy exposure depending on their size, capitalization or liquidity are depicted in Figure 3, panels a) to c). The panels on the left hand side consider the marginal effects on bank lending. It turns out that the on aggregate insignificant effect hides important dynamics. It is especially large banks (panel a), well-capitalized banks (panel b) and banks with sufficient liquidity buffers (panel c) that expand loan volumes when being more exposed to subsidized firms facing financial constraints. For example, banks from the top 25% of the distribution as regards capitalization and liquidity experience an increase in bank lending of around 1%. This result is in line with the anecdotal evidence and suggests that better capitalized and more liquid banks being able to expand lending easily engage in subsidized lending to profitable firms. In contrast, especially small banks tend to decline lending, potentially because these small banks are linked to small firms that manage to then finance the project without access to bank lending resulting in a crowding out effect.

[Insert Figure 3 here]

The panels on the right hand side consider the marginal effects on bank stability and show that the, on average, negative impact of treatment on bank stability is driven by smaller (panel a) and less capitalized banks (panel b). In terms of magnitude, results indicate that banks in the bottom 50% of the size or capitalization distribution experience a decline in stability ranging from around 0.03 to 0.05 of the standard deviation of the *Z-Score*. This result, in turn, confirms the hypothesis that less capitalized banks with lower "skin-in-the-game" might behave less prudent in lending relationships. It also correlates with anecdotal evidence suggesting that weaker banks benefit from being linked to subsidized firms by overcoming capital requirement constraints, which might, however, have negative consequences for stability due to lower screening and monitoring

incentives. In general, our results coincide with those of recent studies on support programs during the pandemic, which find that large banks play an important role regarding participation in support programs (Minoiu et al., 2021), as well as large and sound banks provide more guaranteed loans to to firms (Altavilla et al., 2021).

Subsidy periods: Given the different subsidy periods, we check whether results are driven by one period or even differ across periods. The first window spans 2000-2006 with highest subsidy amounts as shown in Table 3. The second window relates to 2007-2014 and the third window to 2015-2019, while subsidy rates have declined over time. A coincidence of the different subsidy periods is that they align with different business cycle periods, i.e., expansion, financial crisis, and pre-pandemic period.

Results are shown in Table 8 and Columns 1 and 5 show the baseline result for the full sample, while the other columns show subsample results for the different subsidy windows. Results reveal that also across subsidy periods, on average, bank lending responses following an exposure to subsidized and financially constraint firms are positive but insignificant. However, the negative effect on bank stability is mostly driven by the first subsidy period ranging from 2000 to 2006.

[Insert Table 8 here]

Acknowledging the previous finding that banks adjust their behavior differently depending on, for example bank size, we test whether these differential effects are consistent across subsidy periods. Results are provided in the online appendix in Table A3, whereas panel a) considers the role of size, panel b) relates to capitalization and panel c) shows interaction results with liquidity. Again, Columns 1 and 5 show the baseline result for the full sample, while the other columns show subsample results for the different subsidy windows. Panel a) in Table A3 indicates that along the bank size distribution, results are robust in terms of coefficient signs. However, in terms of significance, it turns out that the positive lending response of larger banks is mostly prevalent in the first subsidy period, which is reasonable given that then the subsidy program has been most sizable with many firms making use of it and banks facing the largest exposure. During the financial and sovereign debt crisis period, the subsidy program had no relevant impact on bank lending while effects are present again for the period from 2015 to 2019. For bank capitalization and liquidity (panel b and c), results are mixed. If at all, it can be seen that during the period 2007-2014, declines in loan

volumes due to exposure to subsidized firms are mitigated for better capitalized banks, as well as in the period 2015-2019, liquidity seemed to be key to expand lending when being linked to subsidized firms, which themselves face financial constraints as well as relatively high investment costs.

5.2 The role of expertise and governance

The literature on the importance of banks' screening and monitoring skills for bank stability is abundant. Thus, we take this into account and investigate whether such skills also matter when it comes to public subsidies granted to firms, while banks being involved in the granting process. For example, in a recent paper, Degryse et al. (2021) highlight based on syndicated loan data that sectoral experience can have negative implications for monitoring incentives. De Jonghe et al. (2019) find for Belgian banks that in the presence of negative liquidity shocks, banks might decide more positively on lending depending on their sector market share and experience.

In this regard, Table 9 reveals the importance of expertise and governance structure when it comes to banks' lending and risk-taking depending on their exposure to subsidized and financially constraint firms. We extend the regression model (equation 1) by introducing interactions between the indicator variable for banks' subsidy exposure and variables proxying local and sectoral experience as well as a bank's governance type. Local experience is measured by a bank's local asset share within a German county (Kreis). Differences in governance are indicated by a dummy variable taking a value of one for savings banks and zero otherwise. Sectoral experience is defined as the weighted average of the relationship lengths of a bank with the sectors it is linked to. Sectors are defined along the 2-digit NACE codes.

[Insert Table 9 here]

When looking at the marginal effects presented in Figure 4, we see that banks tend to increase lending in response to their exposure to subsidized firms if they have larger experience – either local or sectoral – with banks in the top 25% of the distribution of both proxies of experience exhibiting an increase of lending of about 1.5%. With regard to the impact on bank stability, we see that local experience does not play a significant role, while sectoral experience matters: Banks in the bottom 50% of the distribution of sectoral experience see a slight decline in bank stability ranging from 0.03 to 0.06 of the *Z-Score*'s standard deviation while most experienced banks improve their

stability by 0.05 in terms of the standard deviation. This might reflect the fact that a higher degree of sectoral experience allows banks to better allocate and monitor loans, even if, on average, we find that subsidized loans are screened and monitored less (Table 6). We also find that the governance structure matters: Columns 3 and 4 in Table 9 show that it is mostly savings banks that tend to increase lending when being linked to subsidized firms, which is in line with the local development target of German savings banks. However, this lending expansion seems to be accompanied by a decline in stability compared to the cooperative banks.

[Insert Figure 4 here]

We extend the previous specification to verify whether the experience effect varies with banks' linkages to strong versus weak firms. To do so, we include a triple interaction with a dummy that takes a value of one in case the bank is, on average, linked to stronger firms and zero otherwise, whereas firm soundness is based on the Altman's Z-score in period t.[24] Results are depicted in Table 10. For savings banks, we do not find that they show relevant differential effects depending on their exposure to stronger or weaker firms (Columns 3-4).

[Insert Table 10 here]

Regarding the effect of subsidy exposure across banks' local asset share distribution, we see in panel a) of Figure 5 that for banks linked, on average, to weak firms lending increases with local asset share in response to treatment. For banks connected to strong firms, this pattern is almost insignificant (right hand side of panel a). On the other hand, there is no significant difference with regard to the impact on bank stability depicted in panel b). Hence, locally dominant banks tend to increase loan volumes but with minor impact on their stability.

[Insert Figure 5 here]

Repeating the same exercise for banks' sectoral experience, we find that especially banks linked, on average, to strong firms and having high levels of sectoral experience increase loan volumes in case of higher exposure to subsidized firms. Banks linked to weak firms do not show significant lending responses when being linked to subsidized firms irrespective of their level of sectoral experience

[24] Results remain robust when calculating the dummy for strong firm based on $t-1$ information.

(Figure 6, panel a). The impact of treatment on bank stability, on the other hand, is evolving in a similar manner for the two types of banks (Figure 6 b). Again, the increase in lending by experienced banks linked to strong firms, does not harm them in terms of stability.

[Insert Figure 6 here]

6 Conclusions

We study the effect of corporate subsidies on the financial system using the universe of all assisted investment projects to German firms since 1998 until 2019 under the Improvement of Regional Economic Structures program (GRW), the largest regional development program of its kind in Germany. Specifically, we use the relationship of both GRW recipients as well as non-subsidized firms to 1,570 local banks to identify, how local financial intermediaries that are exposed to this economic policy adjust their lending and risk-taking. A number of features render the GRW particularly suited as an exogenous shock to isolate causal bank responses. Most importantly key indicators for (firm) eligibility as well as the volume of the subsidy are determined at the EU level and independent of bank traits.

Average lending responses by banks exposed to GRW subsidies are insignificant. Likewise, the average response of bank risk-taking is small in magnitude and only weakly significant. However, these aggregate effects conflate important bank-level heterogeneity that we unravel in further analyses. First, we condition lending and risk-taking responses on selected bank traits and find that larger, better capitalized, and more liquid banks increase their lending in response to maintaining relationships to subsidized firms which are financially constraint and face high investment costs. Thus, economic policies supporting financially constrained firms also mobilize additional bank credit if these firms maintain relationships with sufficiently large and stable local banks. Importantly, this credit expansion does not imply a deterioration in financial stability as these banks exhibit no significant response in empirical risk-taking proxies. In contrast, small and relatively poorly capitalized banks do show signs of higher financial instability in responses to being exposed to subsidized firms. Hence, corporate subsidies allocated to firms that are connected to smaller and weaker banks might have the undesirable effect of undermining adequate incentives of these banks to screen and monitor their borrowers.

Second, we document that lending expansion and risk-taking results are most pronounced during the first wave of the program in 2000–2006, which was also the largest wave in terms of aggregate subsidy volumes. This result suggests that this economic policy has the largest effect during expansionary times since the programs' effects during the period spanning the financial crisis (2007–2014) and the pre-pandemic period (2015–2019) do not exhibit a similarly clear picture.

Third, we investigate the role played by bank heterogeneity in terms of market expertise and observable difference in bank governance. Conditional marginal effects reveal that those regional banks with larger local and sectoral expertise also expand their lending in response to subsidized borrowers more. Also government-owned savings banks expand their lending by more compared with privately-owned cooperative banks. This latter result is consistent with the local development objective of German savings banks. Importantly, the lending expansion of savings banks occurs jointly with a significant deterioration of financial stability indicators compared to subsidy-exposed cooperative banks. Thus, politically motivated lending expansions that are arguably more likely at play among government-owned banks may be hazardous for the stability of these banks. In contrast, banks with more sectoral expertise exhibit a lending expansion that is accompanied by a significant enhancement of financial stability.

Overall, the evidence thus sketches a nuanced picture about the implications of economic policies providing subsidies to firms for local bank lending and stability. Average effects are by and large negligible in terms of additional credit provision and financial instability alike. But more detailed analyses stress the importance of sufficiently resilient local banks of sufficient size with enough lending expertise to increase credit provision to constrained firms while safeguarding local financial stability. These insights are important to consider when designing future place-based subsidy programs to the real side of the economy.

References

Acharya, V.V., Steffen, S., 2020. The Risk of Being a Fallen Angel and the Corporate Dash for Cash in the Midst of COVID. The Review of Corporate Finance Studies 9, 430–471.

Allen, F., Carletti, E., Goldstein, I., Leonello, A., 2015. Moral Hazard and Government Guarantees in the Banking Industry. Journal of Financial Regulation 1, 30–50.

Almeida, H., Campello, M., Weisbach, M.S., 2004. The Cash Flow Sensitivity of Cash. The Journal of Finance 59, 1777–1804.

Altavilla, C., Barbiero, F., Boucinha, M., Burlon, L., 2020. The great lockdown: pandemic response policies and bank lending conditions. Working Paper Series 2465. European Central Bank.

Altavilla, C., Ellul, A., Pagano, M., Polo, A., Vlassopoulos, T., 2021. Loan Guarantees, Bank Lending and Credit Risk Reallocation. Working Paper 629. Centre for Studies in Economics and Finance.

Banerjee, A.V., Duflo, E., 2014. Do Firms Want to Borrow More? Testing Credit Constraints Using a Directed Lending Program. The Review of Economic Studies 81, 572–607.

Brachert, M., Dettmann, E., Titze, M., 2018a. Public Investment Subsidies and Firm Performance – Evidence from Germany. Jahrbücher für Nationalökonomie und Statistik 238, 103–124.

Brachert, M., Dettmann, E., Titze, M., 2019. The regional effects of a place-based policy – Causal evidence from Germany. Regional Science and Urban Economics 79, 103483.

Brachert, M., Giebler, A., Heimpold, G., Titze, M., Urban-Thielicke, D., 2018b. IWH-Subventionsdatenbank: Mikrodaten zu Programmen direkter Unternehmenssubventionen in Deutschland. IWH Technical Reports 02. Halle Institute for Economic Research.

Bronzini, R., de Blasio, G., 2006. Evaluating the impact of investment incentives: The case of Italy's Law 488/1992. Journal of Urban Economics 60, 327–349.

Brown, J.D., Earle, J.S., 2017. Finance and Growth at the Firm Level: Evidence from SBA Loans. The Journal of Finance 72, 1039–1080.

Carletti, E., Leonello, A., Marquez, R., 2021. Loan guarantees, bank underwriting policies and financial fragility. Technical Report. Mimeo.

Cerqua, A., Pellegrini, G., 2014. Do subsidies to private capital boost firms' growth? a multiple regression discontinuity design approach. Journal of Public Economics 109, 114–126.

Chodorow-Reich, G., Darmouni, O., Luck, S., Plosser, M., 2021. Bank liquidity provision across the firm size distribution. Journal of Financial Economics https://doi.org/10.1016/j.jfineco.2021.06.035.

Cole, A., 2020. The Impact of the Paycheck Protection Program on Small Businesses: Evidence from Administrative Payroll Data. Available at SSRN: https://ssrn.com/abstract=3730268.

Core, F., De Marco, F., 2021. Public Guarantees for Small Businesses in Italy during Covid-19. Center for Economic Policy Research 15799. C.E.P.R. Discussion Papers.

Criscuolo, C., Martin, R., Overman, H.G., Van Reenen, J., 2019. Some causal effects of an industrial policy. American Economic Review 109, 48–85.

Custodio, C., Bonfim, D., Raposo, C.C., 2021. The Sensitivity of SME's Investment and Employment to the Cost of Debt Financing. Available at SSRN: https://ssrn.com/abstract=3879737.

Dam, L., Koetter, M., 2012. Bank Bailouts and Moral Hazard: Evidence from Germany. The Review of Financial Studies 25, 2343–2380.

De Jonghe, O., Dewachter, H., Mulier, K., Ongena, S., Schepens, G., 2019. Some borrowers are more equal than others: Bank funding shocks and credit reallocation. Review of Finance 24, 1–43.

Degryse, H., Kokas, S., Minetti, R., 2021. Banking on Experience. CEPR Discussion Paper 16142. Centre for Economic Policy Research.

Denes, M., Lagaras, S., Tsoutsoura, M., 2021. First Come, First Served: The Timing of Government Support and Its Impact on Firms. Available at SSRN: https://ssrn.com/abstract=3845046.

Dwenger, N., Fossen, F.M., Simmler, M., 2020. Firms' financial and real responses to credit supply shocks: Evidence from firm-bank relationships in Germany. Journal of Financial Intermediation 41, 100773.

Ehrlich, M.v., Seidel, T., 2018. The Persistent Effects of Place-Based Policy: Evidence from the West-German Zonenrandgebiet. American Economic Journal: Economic Policy 10, 344–74.

ESRB, 2021. Prevention and management of a large number of corporate insolvencies. Note April. European Systemic Risk Board.

Fagiolo, G., Luzzi, A., 2006. Do liquidity constraints matter in explaining firm size and growth? Some evidence from the Italian manufacturing industry. Industrial and Corporate Change 15, 1–39.

Granja, J., Makridis, C., Yannelis, C., Zwick, E., 2020. Did the Paycheck Protection Program Hit the Target? Working Paper 27095. National Bureau of Economic Research.

Gropp, R., Gruendl, C., Guettler, A., 2013. The Impact of Public Guarantees on Bank Risk-Taking: Evidence from a Natural Experiment. Review of Finance 18, 457–488.

Gropp, R., Hakenes, H., Schnabel, I., 2011. Competition, Risk-shifting, and Public Bail-out Policies. The Review of Financial Studies 24, 2084–2120.

Haas Ornelas, J.R., Pedraza Morales, A.E., Ruiz Ortega, C., Silva, T., 2019. Winners and Losers When Private Banks Distribute Government Loans : Evidence from Earmarked Credit in Brazil. Policy Research Working Paper Series 8952. The World Bank.

Imbens, G.W., Wooldridge, J.M., 2009. Recent developments in the econometrics of program evaluation. Journal of Economic Literature 47, 5–86.

Koetter, M., Noth, F., Rehbein, O., 2020. Borrowers under water! Rare disasters, regional banks, and recovery lending. Journal of Financial Intermediation 43, 100811.

Koulischer, F., Pierret, D., Steri, R., 2021. The Visible Hand when Revenues Stop: Evidence from Loan and Stock Markets during Covid19. Available at SSRN: https://ssrn.com/abstract=3735052.

Li, L., Strahan, P.E., Zhang, S., 2020. Banks as Lenders of First Resort: Evidence from the COVID-19 Crisis. The Review of Corporate Finance Studies 9, 472–500.

Minoiu, C., Zarutskie, R., Zlate, A., 2021. Motivating Banks to Lend? Credit Spillover Effects of the Main Street Lending Program. Available at SSRN: https://ssrn.com/abstract=3773242.

Siegloch, S., Wehrhöfer, N., Etzel, T., 2021. Direct, Spillover and Welfare Effects of Regional Firm Subsidies. IZA Discussion Papers 14362. Institute of Labor Economics (IZA).

Wilcox, J.A., Yasuda, Y., 2019. Government guarantees of loans to small businesses: Effects on banks' risk-taking and non-guaranteed lending. Journal of Financial Intermediation 37, 45–57.

7 Appendix

Table 1: Variable description

Variable	Description	Source
Dependent variables:		
Loans (Log)	Natural logarithm of loan volume (with loans in thousands of EUR)	Bankscope / Bankfocus
Z-Score	$\ln\left(\left(\frac{\text{Equity}}{\text{Assets}} + \text{ROA}\right) / SD(\text{ROA}) + 1\right)$	Bankscope / Bankfocus
Bank Controls:		
Bank Subsidy Exp. (0/1)	A dummy taking a value of one if a bank's exposure to subsidized firms (which are financially constrained and receive the subsidy for a project with high investment costs[1]) is non-zero, and zero otherwise. Exposure is defined as the number of links to such firms relative to the number of links to all (including non-subsidized) firms.	GRW database, Dafne
Bank Capitalization	Ratio of equity to total assets (in %)	Bankscope / Bankfocus
Bank Cost to Income	Cost to income ratio (in %)	Bankscope / Bankfocus
Bank ROA	Return on assets (in %)	Bankscope / Bankfocus
Bank Liquidity	Ratio of liquid assets to total assets (in %)	Bankscope / Bankfocus
Bank Size	Natural logarithm of total assets (with assets in thousands of EUR)	Bankscope / Bankfocus
Local Asset Share	Ratio of assets to total assets of banks from the same county (in %)	Bankscope / Bankfocus
Sectoral Experience	Sectoral experience of a bank is proxied by the wheighted average of the relationship lengths of a bank with the sectors (defined by 2-digit NACE codes) it is linked to (in number of years)	Dafne / Amadeus
Savings Bank Dummy	Dummy variable being one for savings banks and zero otherwise	Bankscope / Bankfocus
Firm Controls:		
Firm Capitalization	Average across all firms' ratio of equity to total assets (in %) to which a banks is linked	Amadeus
Firm ROA	Average across all firms' return on assets (in %) to which a banks is linked	Amadeus
Firm Liquidity	Average across all firms' ratio of the difference between current assets and current liabilities to total assets (in %) to which a banks is linked	Amadeus
Firm Size	Average across all firms' natural logarithm of total assets to which a banks is linked	Amadeus
Strong Firm	A dummy taking a value of one if the average across all firms' inverse Altman's Z-Score to which a banks is linked is in the top 50% of the distribution, and zero otherwise	Amadeus
State Controls:		
State GDP Growth	Growth rate of regional GDP (in %)	Destatis
State Unemployment Rate Change	Difference between annual unemployment rates (in pp)	Destatis

[1] The firm is regarded as financially constrained if, in a given year, it is in the bottom 50% of distribution by any two of the following characteristics: size, capitalization, share of cash holdings in assets or turnover growth. The project is regarded as relatively large for the firm if, in a given year, a firm is in the top 50% of the distribution of the ratio of the subsidized project size to firm total assets.

Table 2: Policy parameters by subsidy period

Subsidy Period	Range Max Aid Intensity (%)	Number of Eligible Municipalities (N = 11,264)	Share of Eligible Municipalities (%)
2000 - 2006	15-50	5,382	47.8
2007 - 2014	20-50	5,468	48.5
2015 - 2020	20-40	4,972	44.1

This table shows descriptive statistics for the subsidy program by period. The range of maximum aid intensities (in %), the number of eligible municipalities and their share in total municipalities (in %) is shown.

Table 3: Aid intensities and bank exposure

Program Characteristics		Subsidy Periods 2000-2006	2007-2014	2015-2020	2000-2020
Avg. Max Aid Intensity (%)	*All*	36.0	38.7	29.1	34.1
Total Amount of Subsidies (Bil. EUR)	*All*	9.3	7.2	1.1	17.6
Avg. Amount of Subsidies (Bil. EUR)	*All*	1.3	0.9	0.2	0.8
Number of Subsidized Firms	*All*	21,652	17,542	8,884	48,078
	Sample	12,043	11,492	6,236	29,771
Avg. Actual Aid Intensity (%)	*All*	26.2	30.1	26.8	27.7
	Sample	26.1	30.3	27.7	28.0
Avg. *Subsidy Exposure*	*Sample*	2.4	0.6	0.4	1.1

This table shows descriptive statistics for the subsidy program and banks' exposure. Row 1 presents the average (across municipalities) maximum aid intensity (maximum possible subsidy to investment costs, in %). Rows 2 presents the total amount of provided subsidies in billion Euros. Row 3 shows the average subsidy amount in billion Euros, for the full sample period and the different subsidy waves. Rows 4 and 5 show the number of subsidized firms for the full subsidy dataset (*All*) and for our estimation sample (*Sample*) by subsidy waves. Rows 6 and 7 present the average (across subsidized firms) actual aid intensity (subsidy to investment costs, in %) for the full subsidy dataset and for our estimation sample. The last row shows for the banks in the estimation sample their average exposure to subsidized firms. Banks' *Subsidy Exposure* is defined as the number of links of a bank to subsidized firms (which are financially constraint and have large investment costs) to all firm links in a given year (in %).

Table 4: Descriptives

	N Obs. (1)	Mean (2)	SD (3)	Min (4)	Max (5)
Dependent Variables					
Loans (Log)	22 413	12.99	1.24	8.47	17.97
Z-Score	22 413	1.28	0.48	0.17	2.30
Bank Controls					
Bank Subsidy Exposure	22 413	0.10	0.62	0.00	50.00
Bank Capitalization	22 413	7.35	2.40	2.97	36.68
Bank Cost to Income	22 411	71.40	9.64	47.44	105.07
Bank ROA	22 413	0.25	0.18	-0.06	2.82
Bank Liquidity	22 413	12.36	7.29	2.40	52.59
Bank Size	22 413	13.53	1.18	10.10	17.48
Firm Controls					
Firm Capitalization	22 334	8.96	3.96	0.37	59.00
Firm ROA	22 069	4.43	3.20	-27.74	45.13
Firm Liquidity	22 334	0.34	0.13	-0.40	0.80
Firm Size	22 336	15.77	0.99	9.51	21.61
State Controls					
State GDP Growth	22 413	2.74	2.45	-9.45	8.33
State Unemployment Rate Change	22 413	-0.26	0.69	-2.50	3.60

This table shows summary statistics of the dependent and control variables used in the baseline model. See Table 1 for a detailed description of every variable.

Table 5: Descriptives, by treatment status

	Mean Untreated *Subsidy Exp.* = 0 (1)	Mean Treated *Subsidy Exp.* = 1 (2)	Normalized Difference (3)
Dependent Variables			
Loans (Log)	12.06	13.11	0.66 *
Z-Score	1.32	1.25	-0.09
Bank Controls			
Bank Subsidy Exposure	0.00	0.40	0.16
Bank Capitalization	7.36	5.86	-0.46 *
Bank Cost to Income	71.36	70.33	-0.08
Bank ROA	0.29	0.24	-0.19
Bank Liquidity	12.73	12.53	-0.02
Bank Size	12.61	13.65	0.69 *
Firm Controls			
Firm Capitalization	8.48	10.29	0.25
Firm ROA	4.73	3.95	-0.13
Firm Liquidity	0.38	0.29	-0.37 *
Firm Size	15.29	16.24	0.53 *
State Controls			
State GDP Growth	2.83	2.28	-0.17
State Unemployment Rate Change	-0.20	-0.11	0.08

This table shows descriptive statistics by treatment status for dependent and control variables used in the baseline model. The first column shows mean values for control group banks, the second column for treated banks. The third column depicts the normalized difference in means between treated and untreated. * indicates the cases with normalized difference larger than 0.25 in magnitude (Imbens and Wooldridge, 2009). See Table 1 for a detailed description of every variable.

Table 6: Baseline specification

	Loans (Log)		Z-Score	
	Baseline	Firm Controls	Baseline	Firm Controls
	(1)	(2)	(3)	(4)
Effect of GRW Subsidies				
Subsidy Exp. (0/1)=1	0.0090*	0.0090*	0.0004	0.0004
	(0.0050)	(0.0050)	(0.0074)	(0.0074)
Bank Controls $(t-1)$				
Bank Capitalization	0.0045*	0.0045*	0.0090***	0.0090***
	(0.0026)	(0.0026)	(0.0025)	(0.0025)
Bank Cost to Income	-0.0006***	-0.0006***	-0.0005*	-0.0005*
	(0.0002)	(0.0002)	(0.0003)	(0.0003)
Bank ROA	-0.0031	-0.0031	0.4940***	0.4940***
	(0.0110)	(0.0110)	(0.0314)	(0.0314)
Bank Liquidity	-0.0050***	-0.0050***	-0.0006	-0.0006
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Bank Size	0.7784***	0.7784***	-0.0867***	-0.0867***
	(0.0141)	(0.0141)	(0.0162)	(0.0162)
Bank FE	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes
N of Obs.	No	Yes	No	Yes
N of Banks	20,565	20,565	20,565	20,565
R Sq. Within	1,548	1,548	1,548	1,548
r2_w	0.747	0.747	0.228	0.228

Standard errors in parentheses

* p¡0.10, ** p¡0.05, *** p¡0.010

This table shows regression results where the dependent variable is either *Loans* (*Log*) or *Z-Score* of bank b in year t as indicated in the table header. The sample includes German savings and cooperatives banks and spans the period from 1998 to 2019. The main variable of interest is *Subsidy Exp.* (0/1) that is a dummy variable being one in case the bank is linked to financially constrained firms receiving a subsidy for a project with high investment costs. Further controls include bank-level variables and averaged firm-level variables. Fixed effects are included as indicated at the bottom of the table. Standard errors clustered at the bank level are given in parentheses. ***, **, * indicate significance at the 1%, 5%, 10% level. See Table 1 for a detailed description of every variable.

Table 7: Interactions with bank size, capitalization and liquidity

	Loans (Log)			Z-Score		
	Size	Capitalization	Liquidity	Size	Capitalization	Liquidity
	(1)	(2)	(3)	(4)	(5)	(6)
Effect of GRW Subsidies						
Subsidy Exp. (0/1)=1	-0.2198***	-0.0189	-0.0055	-0.1274**	-0.0498***	-0.0126
	(0.0489)	(0.0129)	(0.0071)	(0.0615)	(0.0192)	(0.0089)
Bank Var.	0.8866***	-0.0158***	-0.0024***	0.0514***	0.0837***	-0.0016***
	(0.0195)	(0.0038)	(0.0004)	(0.0190)	(0.0053)	(0.0005)
Subsidy Exp. (0/1)=1 × Bank Var.	0.0161***	0.0032*	0.0009*	0.0084*	0.0054**	0.0003
	(0.0035)	(0.0017)	(0.0005)	(0.0044)	(0.0025)	(0.0006)
Bank Controls $(t-1)$						
Bank Capitalization	0.0059***	0.0160***	0.0042	0.0100***	-0.0606***	0.0101***
	(0.0022)	(0.0027)	(0.0026)	(0.0024)	(0.0045)	(0.0024)
Bank Cost to Income	0.0004**	-0.0006***	-0.0006***	-0.0007***	-0.0010***	-0.0008***
	(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0003)	(0.0003)
Bank ROA	-0.0123	0.0004	-0.0040	0.4942***	0.4766***	0.4937***
	(0.0089)	(0.0105)	(0.0105)	(0.0279)	(0.0277)	(0.0280)
Bank Liquidity	-0.0044***	-0.0050***	-0.0037***	-0.0007*	-0.0013***	0.0002
	(0.0004)	(0.0004)	(0.0003)	(0.0004)	(0.0004)	(0.0005)
Bank Size	0.0724***	0.7799***	0.7789***	-0.1271***	-0.0796***	-0.0857***
	(0.0164)	(0.0135)	(0.0136)	(0.0181)	(0.0149)	(0.0152)
Firm Controls $(t-1)$						
Firm Capitalization	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
	(0.0004)	(0.0004)	(0.0004)	(0.0006)	(0.0006)	(0.0006)
Firm ROA	0.0000	0.0001	0.0001	0.0003	0.0003	0.0004
	(0.0003)	(0.0004)	(0.0004)	(0.0005)	(0.0005)	(0.0005)
Firm Liquidity	0.0017	-0.0009	-0.0012	-0.0142	-0.0140	-0.0150
	(0.0106)	(0.0135)	(0.0136)	(0.0183)	(0.0181)	(0.0183)
Firm Size	-0.0060***	-0.0042*	-0.0042*	0.0005	0.0011	0.0001
	(0.0021)	(0.0024)	(0.0024)	(0.0031)	(0.0030)	(0.0031)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
N of Obs.	22,413	22,413	22,413	22,413	22,413	22,413
N of Banks	1,570	1,570	1,570	1,570	1,570	1,570
R Sq. Within	0.879	0.774	0.774	0.227	0.263	0.227

This table shows regression results where the dependent variable is either *Loans* (*Log*) or *Z-Score* of bank b in year t as indicated in the table header. The sample includes German savings and cooperatives banks and spans the period from 1998 to 2019. The main variable of interest is *Subsidy Exp.* (0/1) that is a dummy variable being one in case the bank is linked to financially constrained firms receiving a subsidy for a project with high investment costs. This variable is interacted with bank size (columns 1 & 4), capitalization (columns 2 & 5), and liquidity (columns 3 & 6). Further controls include bank-level variables and averaged firm-level variables. Bank and state-time fixed effects are included. Standard errors clustered at the bank level are given in parentheses. ***, **, * indicate significance at the 1%, 5%, 10% level. See Table 1 for a detailed description of every variable.

Table 8: By subsidy period

	Loans (Log)				Z-Score			
	Full Sample	2000-2006	2007-2014	2015-2019	Full Sample	2000-2006	2007-2014	2015-2019
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Effect of GRW Subsidies								
Subsidy Exp. (0/1)=1	0.0051	0.0004	0.0009	0.0042	-0.0094*	-0.0443***	-0.0031	0.0029
	(0.0037)	(0.0056)	(0.0048)	(0.0049)	(0.0050)	(0.0131)	(0.0067)	(0.0068)
Bank Controls $(t-1)$								
Bank Capitalization	0.0039	0.0026	-0.0017	0.0028	0.0099***	-0.0333**	-0.0042	0.0126**
	(0.0026)	(0.0087)	(0.0028)	(0.0034)	(0.0024)	(0.0130)	(0.0037)	(0.0049)
Bank Cost to Income	-0.0006***	-0.0011***	-0.0002	-0.0001	-0.0008***	-0.0009	-0.0000	-0.0004
	(0.0002)	(0.0004)	(0.0003)	(0.0002)	(0.0003)	(0.0007)	(0.0005)	(0.0003)
Bank ROA	-0.0025	0.0114	0.0269**	-0.0055	0.4947***	0.1843***	0.1942***	0.1130*
	(0.0105)	(0.0126)	(0.0126)	(0.0130)	(0.0280)	(0.0382)	(0.0262)	(0.0599)
Bank Liquidity	-0.0051***	-0.0035***	-0.0035***	-0.0034***	-0.0008*	-0.0014	0.0002	-0.0016***
	(0.0004)	(0.0007)	(0.0004)	(0.0006)	(0.0004)	(0.0011)	(0.0006)	(0.0006)
Bank Size	0.7809***	0.5347***	0.4537***	0.5957***	-0.0843***	-0.1199***	-0.0990***	-0.1852***
	(0.0136)	(0.0285)	(0.0263)	(0.0243)	(0.0151)	(0.0384)	(0.0231)	(0.0289)
Firm Controls $(t-1)$								
Firm Capitalization	0.0005	0.0003	-0.0011	-0.0005	0.0005	0.0006	0.0026	0.0022
	(0.0004)	(0.0004)	(0.0012)	(0.0012)	(0.0006)	(0.0008)	(0.0019)	(0.0021)
Firm ROA	0.0001	-0.0007	0.0006	0.0014	0.0004	0.0002	-0.0010	0.0017
	(0.0004)	(0.0004)	(0.0006)	(0.0009)	(0.0005)	(0.0010)	(0.0011)	(0.0013)
Firm Liquidity	-0.0005	0.0101	-0.0507	-0.0010	-0.0146	-0.0169	0.0083	-0.0881
	(0.0136)	(0.0129)	(0.0333)	(0.0351)	(0.0183)	(0.0235)	(0.0570)	(0.0620)
Firm Size	-0.0041*	-0.0007	-0.0157	0.0041	0.0001	0.0061	0.0153	-0.0031
	(0.0024)	(0.0020)	(0.0115)	(0.0148)	(0.0031)	(0.0038)	(0.0204)	(0.0200)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N of Obs.	22,413	6,257	9,341	6,495	22,413	6,257	9,341	6,495
N of Banks	1,570	1,367	1,492	1,362	1,570	1,367	1,492	1,362
R Sq. Within	0.773	0.808	0.364	0.678	0.227	0.150	0.212	0.175

This table shows regression results where the dependent variable is either *Loans* (*Log*) or *Z-Score* of bank b in year t as indicated in the table header. The sample includes German savings and cooperatives banks. The period spans from 1998 to 2019 in columns 1 & 5 and is broken down by subsidy waves by looking at subsamples. The main variable of interest is *Subsidy Exp.* (0/1) that is a dummy variable being one in case the bank is linked to financially constrained firms receiving a subsidy for a project with high investment costs. Further controls include bank-level variables and averaged firm-level variables. Bank and state-time fixed effects are included. Standard errors clustered at the bank level are given in parentheses. ***, **, * indicate significance at the 1%, 5%, 10% level. See Table 1 for a detailed description of every variable.

Table 9: Interactions with bank local asset share, governance type and sectoral experience

	Local Asset Share		Savings Bank		Sectoral Experience	
	Loans (Log)	Z-Score	Loans (Log)	Z-Score	Loans (Log)	Z-Score
	(1)	(2)	(3)	(4)	(5)	(6)
Effect of GRW Subsidies						
Subsidy Exp. (0/1)=1	-0.0068	-0.0094	-0.0016	0.0025	-0.0058	-0.0510***
	(0.0059)	(0.0074)	(0.0054)	(0.0065)	(0.0070)	(0.0099)
Subsidy Exp. (0/1)=1 × Bank Var.	0.0004***	-0.0000	0.0145**	-0.0260***	0.0016*	0.0058***
	(0.0001)	(0.0002)	(0.0072)	(0.0099)	(0.0009)	(0.0012)
Bank Controls $(t-1)$						
Bank Capitalization	0.0039	0.0099***	0.0039	0.0099***	0.0037	0.0088***
	(0.0026)	(0.0024)	(0.0026)	(0.0024)	(0.0026)	(0.0024)
Bank Cost to Income	-0.0005***	-0.0008***	-0.0006***	-0.0008***	-0.0006***	-0.0008***
	(0.0002)	(0.0003)	(0.0002)	(0.0003)	(0.0002)	(0.0003)
Bank ROA	-0.0041	0.4944***	-0.0019	0.4936***	-0.0027	0.4853***
	(0.0106)	(0.0280)	(0.0105)	(0.0279)	(0.0107)	(0.0280)
Bank Liquidity	-0.0050***	-0.0008*	-0.0051***	-0.0007*	-0.0051***	-0.0007*
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Bank Size	0.7416***	-0.0906***	0.7814***	-0.0852***	0.7822***	-0.0857***
	(0.0144)	(0.0151)	(0.0136)	(0.0151)	(0.0136)	(0.0152)
Firm Controls $(t-1)$						
Firm Capitalization	0.0005	0.0005	0.0005	0.0005	0.0006	0.0004
	(0.0005)	(0.0006)	(0.0004)	(0.0006)	(0.0004)	(0.0006)
Firm ROA	0.0001	0.0004	0.0001	0.0004	0.0004	0.0004
	(0.0004)	(0.0005)	(0.0004)	(0.0005)	(0.0004)	(0.0005)
Firm Liquidity	-0.0046	-0.0153	-0.0004	-0.0147	0.0056	-0.0180
	(0.0136)	(0.0183)	(0.0136)	(0.0183)	(0.0139)	(0.0190)
Firm Size	-0.0039	0.0001	-0.0039	-0.0003	-0.0036	0.0018
	(0.0024)	(0.0031)	(0.0024)	(0.0031)	(0.0026)	(0.0033)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
N of Obs.	22,413	22,413	22,413	22,413	22,101	22,101
N of Banks	1,570	1,570	1,570	1,570	1,565	1,565
R Sq. Within	0.778	0.227	0.773	0.227	0.767	0.230

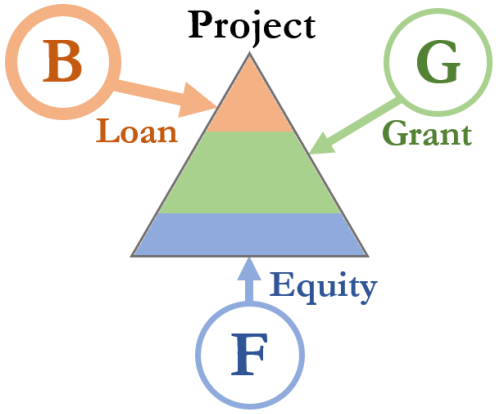
This table shows regression results where the dependent variable is either *Loans* (*Log*) or *Z-Score* of bank b in year t as indicated in the table header. The sample includes German savings and cooperatives banks and spans the period from 1998 to 2019. The main variable of interest is *Subsidy Exp.* (0/1) that is a dummy variable being one in case the bank is linked to financially constrained firms receiving a subsidy for a project with high investment costs. This variable is interacted with banks' local (county-level) asset share (columns 1 & 2), a savings bank indicator (columns 3 & 4), and banks' sectoral experience (columns 5 & 6). Further controls include bank-level variables and averaged firm-level variables. Bank and state-time fixed effects are included. Standard errors clustered at the bank level are given in parentheses. ***, **, * indicate significance at the 1%, 5%, 10% level. See Table 1 for a detailed description of every variable.

Table 10: Interactions with bank local asset share, governance type and sectoral experience, by firm strength

	Local Asset Share		Savings Bank		Sectoral Experience	
	Loans (Log)	Z-Score	Loans (Log)	Z-Score	Loans (Log)	Z-Score
	(1)	(2)	(3)	(4)	(5)	(6)
Effect of GRW Subsidies						
Subsidy Exp. (0/1)=1	-0.0035	-0.0063	0.0020	0.0032	0.0045	-0.0416***
	(0.0066)	(0.0083)	(0.0061)	(0.0070)	(0.0079)	(0.0117)
Subsidy Exp. (0/1)=1 × Bank Var.	0.0003**	0.0000	0.0114	-0.0207*	0.0004	0.0050***
	(0.0001)	(0.0002)	(0.0079)	(0.0115)	(0.0010)	(0.0014)
Strong Firm (0/1)=1	-0.0006	0.0034	0.0044	0.0026	-0.0002	-0.0046
	(0.0046)	(0.0071)	(0.0046)	(0.0063)	(0.0062)	(0.0087)
Subsidy Exp. (0/1)=1 × Strong Firm (0/1)=1	-0.0110	-0.0122	-0.0144	-0.0034	-0.0316**	-0.0295
	(0.0101)	(0.0144)	(0.0097)	(0.0125)	(0.0127)	(0.0185)
Strong Firm (0/1)=1 × Bank Var.	0.0002	-0.0001	-0.0016	-0.0071	0.0005	0.0008
	(0.0001)	(0.0002)	(0.0071)	(0.0113)	(0.0009)	(0.0011)
Subsidy Exp. (0/1)=1 × Strong Firm (0/1)=1 × Bank Var.	0.0001	0.0000	0.0127	-0.0133	0.0036**	0.0025
	(0.0002)	(0.0003)	(0.0127)	(0.0180)	(0.0017)	(0.0021)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
N of Obs.	22,413	22,413	22,413	22,413	22,101	22,101
N of Banks	1,570	1,570	1,570	1,570	1,565	1,565
R Sq. Within	0.778	0.227	0.773	0.227	0.767	0.230

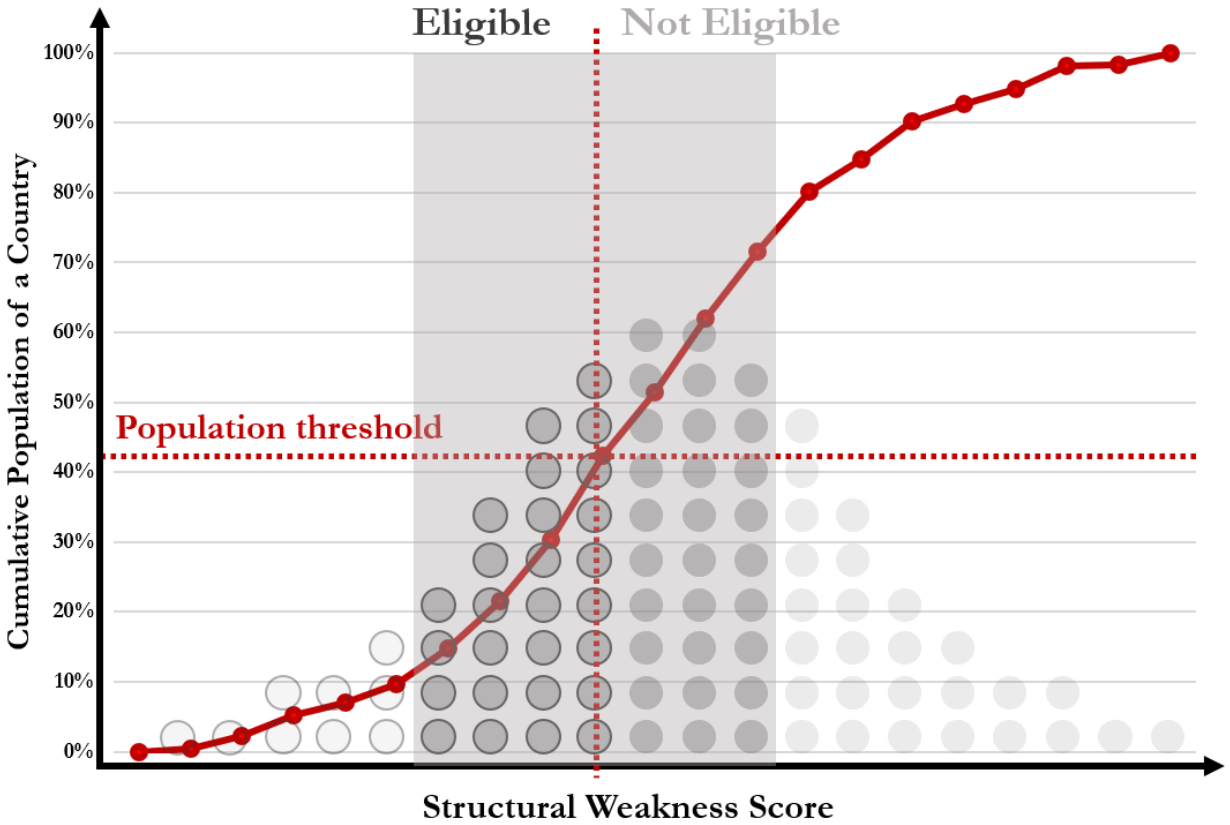
This table shows regression results where the dependent variable is either *Loans* (*Log*) or *Z-Score* of bank b in year t as indicated in the table header. The sample includes German savings and cooperatives banks and spans the period from 1998 to 2019. The main variable of interest is *Subsidy Exp.* (0/1) that is a dummy variable being one in case the bank is linked to financially constrained firms receiving a subsidy for a project with high investment costs. This variable is interacted with banks' local asset share (columns 1 & 2), a savings bank indicator (columns 3 & 4), and banks' sectoral experience (columns 5 & 6), as well as an indicator variable being one in case the bank is linked to, on average, strong firms (where firm strength is measured with an inverse of the Altman's Z-Score). Further controls include bank-level variables and averaged firm-level variables (which are included but not reported). Bank and state-time fixed effects are included. Standard errors clustered at the bank level are given in parentheses. ***, **, * indicate significance at the 1%, 5%, 10% level. See Table 1 for a detailed description of every variable.

Figure 1: Illustration of project funding including a GRW subsidy



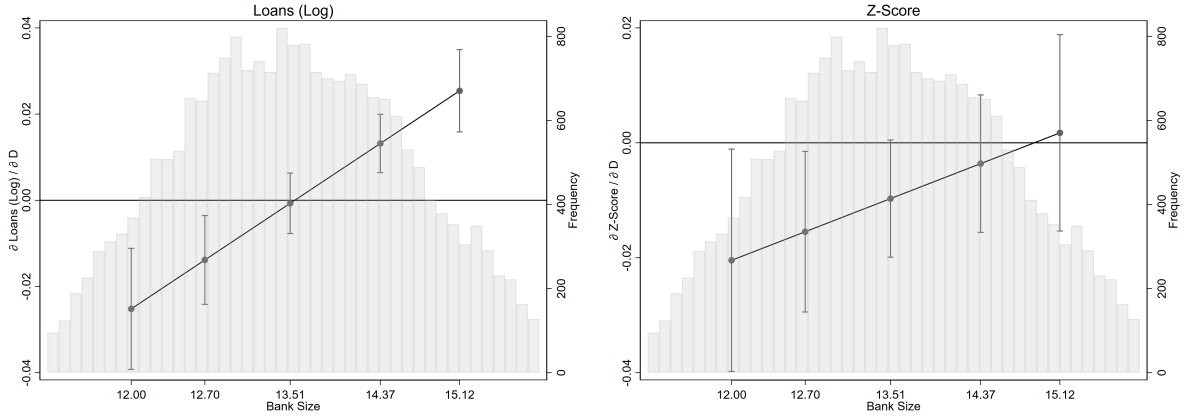
The figure illustrates how firms receiving a subsidy for an investment project might finance it. Next to the grant from the government, they might use own equity but also ask for a loan from a bank.

Figure 2: Determination of regional eligibility

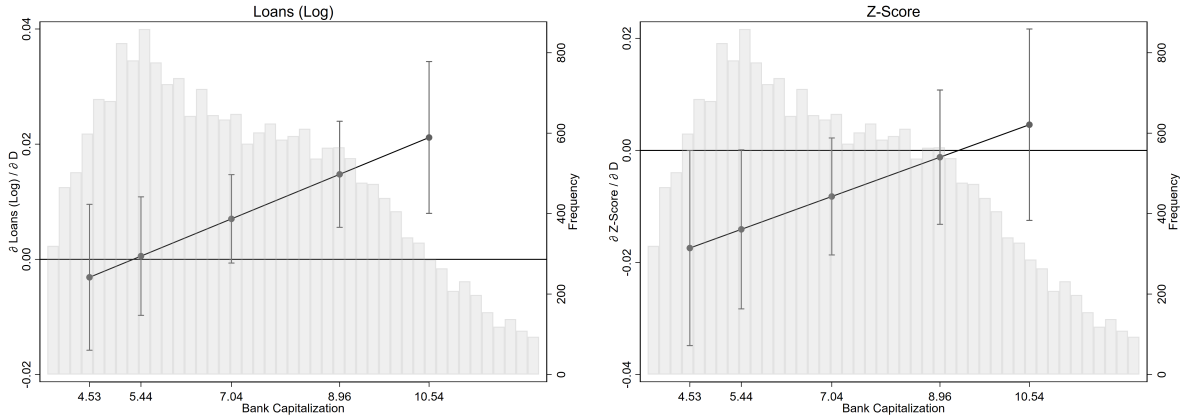


The figure illustrates the two key factors driving whether regions are eligible for the subsidy program. The x-axis depicts the structural weakness score, the lower it is, the weaker is the region. The y-axis depicts the cumulative population share in a country's total population. All regions in the left part are eligible due to a low weakness score and because the population threshold has not yet been hit.

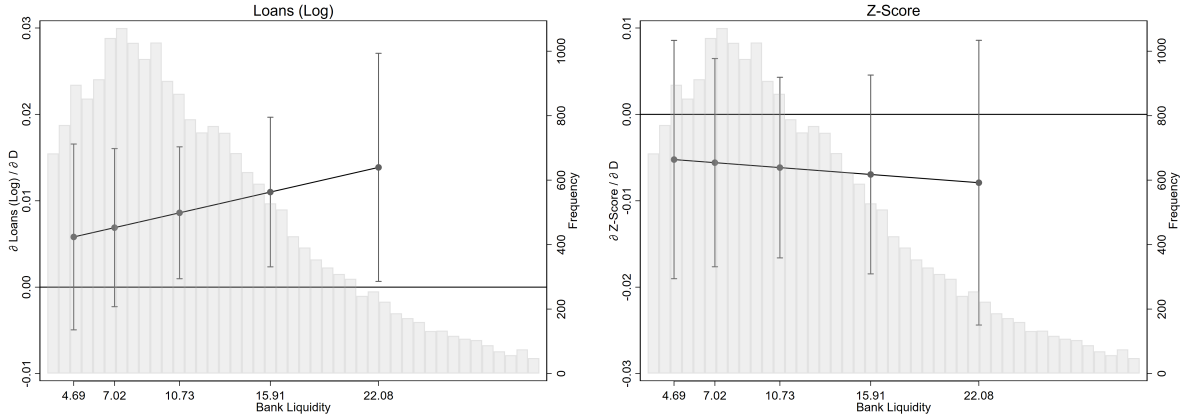
Figure 3: Marginal effects of treatment depending on bank size, capitalization and liquidity



(a) Size



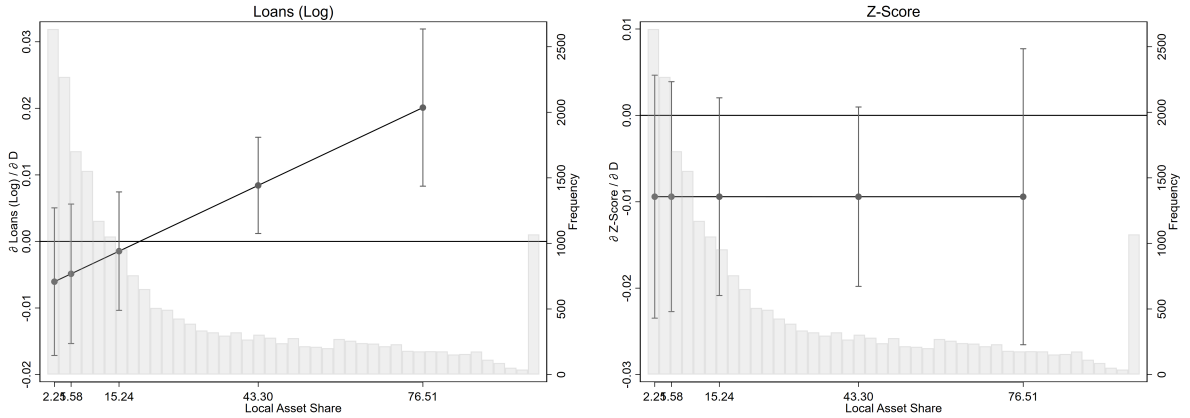
(b) Capitalization



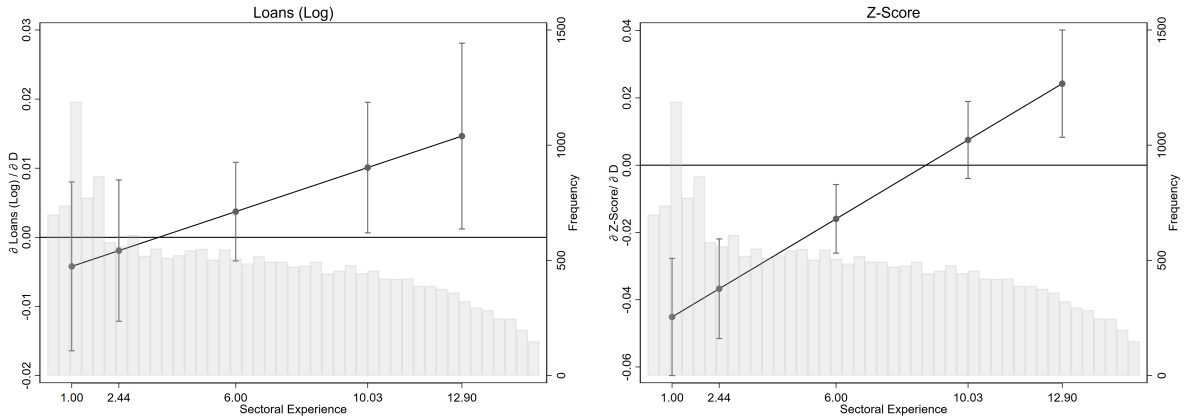
(c) Liquidity

The figures show marginal effects of the treatment variable *Subsidy Exp.* (0/1) on the dependent variable *Loans* (*Log*) or *Z-Score* (as indicated on top of each panel) conditional on a) bank size, b) capitalization, and c) liquidity. The sample spans the period 1998-2019. Effects are depicted for the 10th, 25th, 50th, 75th and 90th percentiles of the conditioning bank variable and surrounded by 95% confidence intervals.

Figure 4: Marginal effects of treatment depending on bank local asset share and sectoral experience



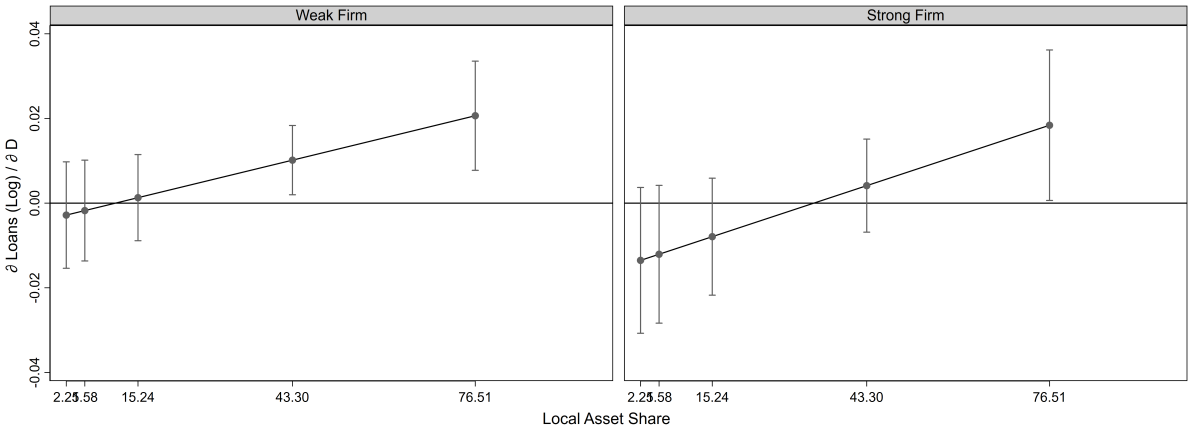
(a) Local asset share



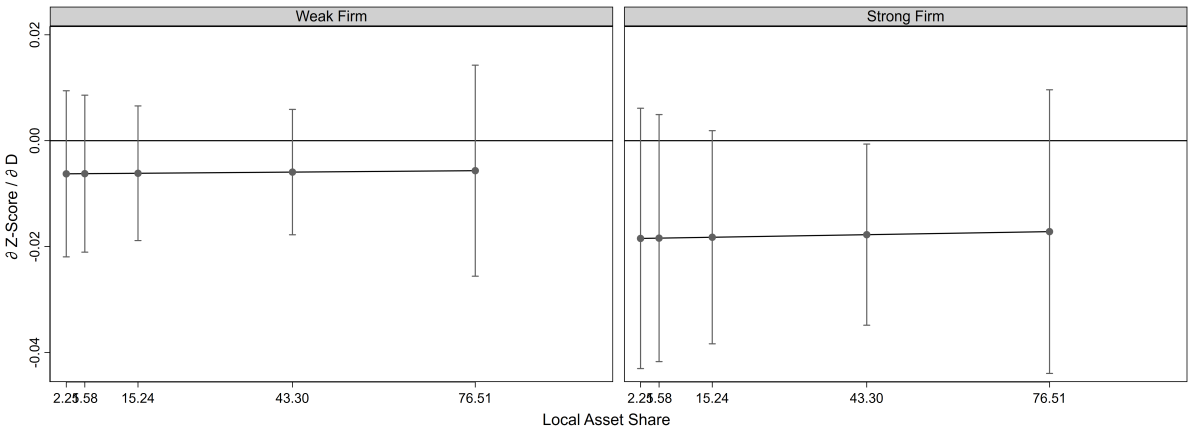
(b) Sectoral experience

The figures show marginal effects of the treatment variable *Subsidy Exp.* (0/1) on the dependent variable *Loans* (*Log*) or *Z-Score* (as indicated on top of each panel) conditional on a) bank local asset share, and b) sectoral experience. The sample spans the period 1998-2019. Effects are depicted for the 10th, 25th, 50th, 75th and 90th percentiles of the conditioning bank variable and surrounded by 95% confidence intervals.

Figure 5: Marginal effects of treatment depending on bank local asset share and firm strength



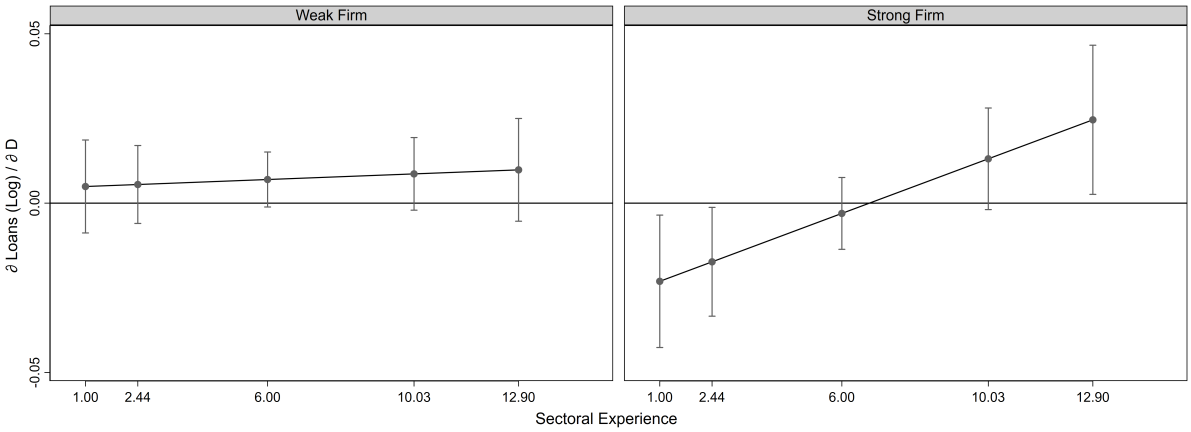
(a) Loans (Log)



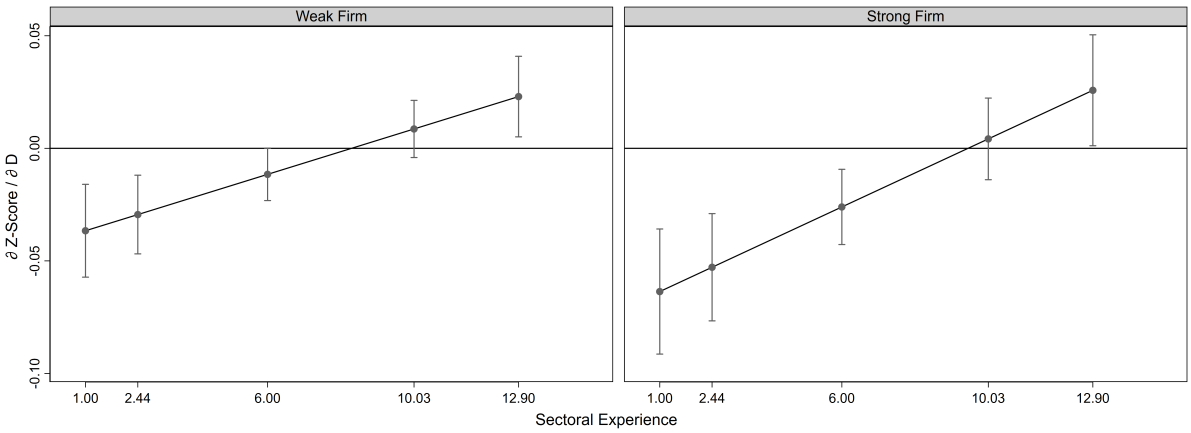
(b) Z-Score

The figures show marginal effects of the treatment variable *Subsidy Exp.* (0/1) on the dependent variable *Loans*(*Log*) (panels in first row) or *Z-Score* (panels in second row) conditional on bank local asset share and the indicator for strong firm connections being zero (left hand side) or one (right hand side). The sample spans the period 1998-2019. Effects are depicted for the 10th, 25th, 50th, 75th and 90th percentiles of the conditioning bank variable and surrounded by 95% confidence intervals.

Figure 6: Marginal effects of treatment depending on bank sectoral experience and firm strength



(a) Loans (Log)



(b) Z-Score

The figures show marginal effects of the treatment variable *Subsidy Exp.* (0/1) on the dependent variable *Loans* (*Log*) (panels in first row) or *Z-Score* (panels in second row) conditional on bank sectoral experience and the indicator for strong firm connections being zero (left hand side) or one (right hand side). The sample spans the period 1998-2019. Effects are depicted for the 10th, 25th, 50th, 75th and 90th percentiles of the conditioning bank variable and surrounded by 95% confidence intervals.

Online Appendix

Determination of countries' state aid application

On the one hand, state aid schemes like the GRW program are likely to distort competition within the Internal Market of the European Union (EU). On the other hand, economic, social and territorial cohesion represent important goals and core values of the EU. To solve this trade-off, the legal framework of the EU contains exemptions for aid granted by Member States, where the regional coverage of state aid is limited to a certain population share living in assisted areas (usually around 40%), which is then broken down to the Member States. In general, these exemptions are kept constant over the period of the EU's long-term budget (EU funding periods), usually periods of seven years. Member States applying any aid that might distort competition in the EU are obligated to notify the program to the EU, who then reviews all submitted documents in a rigorous formal evaluation process and informs the governments of the Member States whether this aid is compatible with the principles of the Internal Market. The derogation process takes into account different degrees of structural weaknesses that are mirrored in different maximum aid intensities an EU country can apply. The derogation relies on two rules: *first*, the Guidelines on National Regional Aid (differentiating between A-areas representing regions where the standard of living is abnormally low or where there is serious underemployment and C-areas representing regions where such aid does not adversely affect trading conditions to an extent contrary to the common interest) and *second*, the block exemption to certain categories of horizontal state aid (D-areas).

Additional tables and figures

Table A1: Descriptives, by banks in all vs. similar regions

	Mean All Regions	Mean Similar Regions	Normalized Difference
	(1)	(2)	(3)
Dependent Variables			
Loans (Log)	12.82	12.82	0.00
Z-Score	1.29	1.28	0.00
Bank Controls			
Bank Subsidy Exposure	0.09	0.06	-0.04
Bank Capitalization	7.13	7.28	0.04
Bank Cost to Income	71.38	71.26	-0.01
Bank ROA	0.26	0.26	0.02
Bank Liquidity	12.46	11.81	-0.07
Bank Size	13.37	13.34	-0.02
Firm Controls			
Firm Capitalization	9.03	9.26	0.04
Firm ROA	4.33	4.59	0.05
Firm Liquidity	0.34	0.34	0.03
Firm Size	15.70	15.67	-0.02
State Controls			
State GDP Growth	2.70	2.69	0.00
State Unemployment Rate Change	-0.24	-0.22	0.02

This table shows descriptive statistics by treatment status for dependent and control variables used in the baseline model. The first column shows mean values for all banks, the second column for banks located in regions that are more similar to each other in terms of criteria that define subsidy eligibility. In particular, the sample is limited to counties ranking among the 25th and 75th percentiles of the distribution of the structural weakness score. The third column depicts the normalized difference in means. * indicates the cases with normalized difference larger than 0.25 in magnitude (Imbens and Wooldridge, 2009). See Table 1 for a detailed description of every variable.

Table A2: Predictors of banks being linked to subsidized firms

	Full Sample	2000-2006	2007-2014	2015-2019	Full Sample	2000-2006	2007-2014	2015-2019
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bank Capitalization	0.0015	-0.0053	0.0003	0.0052	-0.0006	-0.0232*	0.0001	0.0011
	(0.0025)	(0.0044)	(0.0043)	(0.0045)	(0.0059)	(0.0131)	(0.0114)	(0.0256)
Bank Cost to Income	0.0007*	0.0012*	0.0012	0.0002	0.0003	0.0015	-0.0006	0.0026
	(0.0004)	(0.0006)	(0.0009)	(0.0010)	(0.0006)	(0.0011)	(0.0011)	(0.0024)
Bank ROA	-0.0367	-0.0481*	0.0273	-0.0902	-0.0304	-0.0255	0.0365	-0.2143**
	(0.0225)	(0.0279)	(0.0466)	(0.0656)	(0.0238)	(0.0326)	(0.0569)	(0.0972)
Bank Liquidity	0.0003	0.0005	0.0010	-0.0010	0.0016*	-0.0006	0.0033*	0.0028
	(0.0005)	(0.0007)	(0.0010)	(0.0014)	(0.0009)	(0.0015)	(0.0018)	(0.0044)
Bank Size	0.0599***	0.0547***	0.1001***	0.0020	0.0053	0.0030	-0.0856	-0.1432
	(0.0039)	(0.0056)	(0.0077)	(0.0106)	(0.0260)	(0.0541)	(0.0592)	(0.1255)
Firm Capitalization	-0.0002	-0.0002	-0.0042	0.0016	-0.0003	-0.0011	0.0014	0.0092
	(0.0007)	(0.0009)	(0.0026)	(0.0032)	(0.0008)	(0.0011)	(0.0056)	(0.0070)
Firm ROA	0.0010	-0.0007	0.0054**	-0.0038	0.0018**	0.0006	0.0068**	-0.0031
	(0.0009)	(0.0014)	(0.0027)	(0.0034)	(0.0007)	(0.0014)	(0.0027)	(0.0057)
Firm Liquidity	0.0026	-0.0178	0.0153	0.0559	-0.0506*	-0.0293	0.0575	-0.1612
	(0.0283)	(0.0338)	(0.1113)	(0.1309)	(0.0260)	(0.0289)	(0.1593)	(0.2611)
Firm Size	-0.0164***	-0.0098**	-0.0735***	-0.0245	-0.0203***	-0.0194***	-0.0006	0.0768
	(0.0041)	(0.0048)	(0.0176)	(0.0226)	(0.0047)	(0.0060)	(0.0508)	(0.0562)
Bank FE	No	No	No	No	Yes	Yes	Yes	Yes
State-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N of Obs.	8,788	3,928	3,361	973	8,788	3,928	3,361	973
R Sq. Overall	0.252	0.249	0.238	0.176	0.217	0.213	0.049	0.136
R Sq. Within					0.217	0.213	0.049	0.136

This table shows regression results where the dependent variable is *Subsidy Exp.* (0/1), which is a dummy variable being equal to one if a bank is linked to a subsidized and financially constraint firm in period t and zero otherwise. This dummy variable is regressed on a set of bank and bank-average firm controls using a sample of matched banks to account for possible differences in bank characteristics over the subsidy periods. To account for regional shocks which might drive banks' selection into treatment state-time fixed effects are used. Columns 1-4 present the results for the pooled OLS setting, while Columns 5-8 also include bank fixed effects to test if there is a selection arising from the within-bank variation of characteristics over time. Standard errors (which are clustered at the bank level for the fixed effects regressions) are given in parentheses. ***, **, * indicate significance at the 1%, 5%, 10% level. See Table 1 for a detailed description of every variable.

Table A3: Interactions with bank size, capitalization and liquidity, by subsidy period

	Loans (Log)				Z-Score			
	Full Sample	2000-2006	2007-2014	2015-2019	Full Sample	2000-2006	2007-2014	2015-2019
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Interaction with bank size								
Subsidy Exp. (0/1)=1	-0.2198***	-0.1901**	-0.0213	-0.0914*	-0.1274**	-0.1878	-0.1615*	-0.0939
	(0.0489)	(0.0788)	(0.0364)	(0.0536)	(0.0615)	(0.1758)	(0.0876)	(0.0775)
Bank Var.	0.8866***	0.9258***	0.8998***	0.7495***	0.0514***	0.0819*	0.0239	0.0370
	(0.0195)	(0.0270)	(0.0149)	(0.0634)	(0.0190)	(0.0451)	(0.0255)	(0.0348)
Subsidy Exp. (0/1)=1 × Bank Var.	0.0161***	0.0133**	0.0018	0.0071*	0.0084*	0.0101	0.0114*	0.0069
	(0.0035)	(0.0055)	(0.0026)	(0.0039)	(0.0044)	(0.0121)	(0.0063)	(0.0055)
Panel B: Interaction with bank capitalization								
Subsidy Exp. (0/1)=1	-0.0189	0.0015	-0.0245*	-0.0060	-0.0498***	-0.0180	-0.0402	0.0320
	(0.0129)	(0.0283)	(0.0145)	(0.0261)	(0.0192)	(0.0517)	(0.0261)	(0.0467)
Bank Var.	-0.0158***	-0.0064	-0.0104***	-0.0161***	0.0837***	0.2323***	0.0618***	0.0646***
	(0.0038)	(0.0080)	(0.0035)	(0.0051)	(0.0053)	(0.0180)	(0.0047)	(0.0059)
Subsidy Exp. (0/1)=1 × Bank Var.	0.0032*	-0.0003	0.0035*	0.0011	0.0054**	-0.0025	0.0050	-0.0031
	(0.0017)	(0.0053)	(0.0020)	(0.0027)	(0.0025)	(0.0095)	(0.0034)	(0.0051)
Panel C: Interaction with bank liquidity								
Subsidy Exp. (0/1)=1	-0.0055	-0.0013	-0.0003	-0.0114	-0.0126	-0.0675***	-0.0026	-0.0032
	(0.0071)	(0.0119)	(0.0089)	(0.0083)	(0.0089)	(0.0217)	(0.0134)	(0.0117)
Bank Var.	-0.0024***	-0.0026***	-0.0026***	-0.0020**	-0.0016***	-0.0031***	-0.0005	-0.0014
	(0.0004)	(0.0007)	(0.0005)	(0.0009)	(0.0005)	(0.0012)	(0.0007)	(0.0012)
Subsidy Exp. (0/1)=1 × Bank Var.	0.0009*	0.0002	0.0001	0.0016**	0.0003	0.0019	-0.0000	0.0006
	(0.0005)	(0.0011)	(0.0005)	(0.0007)	(0.0006)	(0.0015)	(0.0009)	(0.0009)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N of Obs.	22,413	6,257	9,341	6,495	22,413	6,257	9,341	6,495
N of Banks	1,570	1,367	1,492	1,362	1,570	1,367	1,492	1,362
R Sq. Within	0.774	0.810	0.369	0.679	0.227	0.152	0.213	0.175

This table shows regression results where the dependent variable is either *Loans* (*Log*) or *Z-Score* of bank b in year t as indicated in the table header. The sample includes German savings and cooperatives banks. The period spans from 1998 to 2019 in columns 1 & 5 and is broken down by subsidy waves by looking at subsamples. The main variable of interest is *Subsidy Exp.* (0/1) that is a dummy variable being one in case the bank is linked to financially constrained firms receiving a subsidy for a project with high investment costs. This variable is interacted with bank size (Panel A), capitalization (Panel B), and liquidity (Panel C). Further controls include bank-level variables and averaged firm-level variables. Bank and state-time fixed effects are included. Standard errors clustered at the bank level are given in parentheses. ***, **, * indicate significance at the 1%, 5%, 10% level. See Table 1 for a detailed description of every variable.

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