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Firm subsidies, financial intermediation, and bank stability

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Abstract

We use project-level information for the largest regional economic development program in German history to study whether government subsidies to firms affect quantity and quality of bank lending. We combine recipient firms under the Improvement of Regional Economic Structures program (GRW) with their local banks during 1998-2019. The modalities of GRW subsidies to firms are determined at the EU level. Therefore, we use it to identify bank outcomes. Banks with relationships to more subsidized firms exhibit higher lending volumes without any significant differences in bank stability. Subsidized firms, in turn, borrow more indicating that banks facilitate regional economic development policies.

Keywords: Government subsidies, Financial intermediation, Bank stability

JEL Classification: G21, G28, H25

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1 Introduction

Government subsidies to firms are canonical tools of economic policy if market frictions prevent the optimal allocation of capital and labor in incomplete markets (Criscuolo et al., 2019). Financial constraints faced by firms are a prominent example of such frictions, which prevail especially during structural transformations or sudden economic shocks like the Covid-19 crisis (ESRB, 2021). While the (in)ability of subsidies to mitigate financial frictions so as to foster investment and employment has been studied intensively (Cerqua and Pellegrini, 2014; Ehrlich and Seidel, 2018; Brachert et al., 2019; Criscuolo et al., 2019), the effects on the financial system remain unclear. This gap is surprising because subsidies affect not only the incentives and constraints under which firms optimize, but also those of banks who screen and monitor investors that seek credit. Ex ante, it remains an open question whether more generous government support in terms of loan guarantees or direct subsidies increase credit supply (Bachas et al., 2021). Alternatively, these tools may function as an unpriced insurance to banks that crowds out non-subsidized lending and lowers bank stability (Wilcox and Yasuda, 2019) due to moral hazard incentives (Gropp et al., 2011; Dam and Koetter, 2012; Gropp et al., 2013; Allen et al., 2015). The open question that we address in this paper is therefore how *direct governmental subsidies* to firms affect bank lending and stability.

More specifically, we analyze whether banks' lending choices and their stability exhibit significant differences in case a larger share of their corporate borrowers receive GRW subsidies. A number of challenges complicate the answer to this question. First, corporate subsidies are conventionally not observable at a granular firm level given the potential stigma associated with government support and opaque publication requirements of small and medium sized enterprises (SME), which are the target group of most place-based programs. We overcome this challenge by having access to unique and comprehensive corporate subsidy data at the project level from the most important place-based policy scheme in Germany, the Improvement of Regional Economic Structures program (GRW) (*"Gemeinschaftsaufgabe Verbesserung der regionalen Wirtschaftsstruktur"*) between 1998 and 2019. This extensive

sample period allows us to evaluate bank responses over the entire economic cycle.

A second hurdle to identify the relationship between bank responses and corporate subsidies is the potential for reverse causality between banks' lending choices and firms receiving GRW subsidies. Our approach exploits a number of institutional features that mitigate such concerns. First, a systematic selection of banks into lending relationships to GRW subsidized firms is unlikely. Firms can apply for these non-repayable capital grants but need a bank to evaluate the business plan beforehand. The evaluation is in most cases done by their relationship bank, which constitutes a bank-firm link that is established ex ante. Second, only non-financial firms located in GRW eligible regions can apply for subsidies. Both the regions' eligibility and the amount of the subsidy relative to the investment volume, or funding intensity, are determined at the level of the European Union (EU) and therefore orthogonal to the actions of analyzed regional banks in the run-up to GRW funding periods. Third, the specific funding structure of the GRW program is adjusted every seven years, which introduces uncertainty about program accessibility. Finally, because the GRW targets non-financial firms only, banks are not directly exposed to the subsidy program. Therefore, we isolate indirect bank lending and risk-taking responses due to relationships with subsidized firms, which we establish by string-matching firms' and regional banks' names in historical vintages of the Dafne database (Dwenger et al., 2020; Koetter et al., 2020).

The headline result is that regional banks with more exposure to subsidized firms increase mean total lending between 1998 to 2019. Yet, average effects obfuscate notable bank-level heterogeneity. Average lending hikes are driven by medium-sized banks with large local asset shares, less sectoral experience, low capitalization, and high liquidity buffers. The main finding of an increased lending volume based on bank-level regressions also obtains from a firm-level perspective. Corporate borrowing increases significantly when realizing a subsidized project. Importantly, banks' distance to default is not lower if they are exposed to subsidized firms, which bodes well for financial stability.

The paper relates to three main strands of literature. First, a number of studies investigate

the effects of government policies that directly *guarantee* the credit risk exposure of banks for selected firms. 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. Brown and Earle (2017) and Bachas et al. (2021) study the loan support program by the Small Business Administration (SBA) to smaller firms in the U.S. and document an increase in employment among recipient firms as well as an increase in credit supply in response to the program. 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. In contrast to the literature on loan guarantees, we evaluate the effects of governmental *subsidies* to corporate firms on bank outcomes. We hypothesize that banks' lending volumes and stability can be affected if banks are involved in routing subsidies from the government to non-financial firms.

A second strand of literature focuses on *firm behavior* and regional developments due to place-based policies like the GRW program. Effects of the GRW on regional economic development and firm outcomes have been studied by, e.g., Brachert et al. (2018a, 2019) and 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) and Cerqua and Pellegrini (2014) for Italy or Criscuolo et al. (2019) for the UK. Aside from reporting mixed output and employment effects, these studies remain silent on the financial viability of subsidized firms and the possible implications for their suppliers of outside funding, which is an important gap that we seek to fill with this paper. A few related studies touch upon the role of such policies for firms' financial constraints. Banerjee and Duflo (2014) analyze a targeted lending program in India to evaluate whether firms face a credit constraint and

show that targeted lending succeeded to fund 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, at least during crisis times. We add to this literature an evaluation of subsidy effects on *regional credit markets* and banking stability.

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 became 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., 2022). Such credit constraints can threaten the viability of solvent but illiquid firms. 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. 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. We complement this literature by evaluating a subsidy program that is *long-lived* and affects the universe of German banks via their links to subsidized firms.

2 Institutional setting and identification

The subsidy program Improvement of Regional Economic Structures (GRW) has existed since 1969 in West Germany. Since 1990 it has spanned the reunified country and it is the most important program to foster regional development across Germany. The budget spent for the program is considerable – it amounts to about 68 billion euros in the period 1991-

2019. In regions qualifying for subsidies during the period 2000-2017, around 30% of the total investment volume in the manufacturing sector has been co-financed by the GRW program. The budget is jointly provided by the German Federal Government and the Governments of the States (Bundesländer), while the latter administer the operative funding process. The main goal of the program is to reduce regional disparities in terms of employment and income by stimulating investment activity.

The institutional features of the program facilitate the identification of relationships between bank outcomes and corporate subsidies. First, we can exploit granular data to match subsidized firms, mostly small and medium-sized enterprises (SMEs), with their relationship bank ("Hausbank"). We observe the firms that received a project-specific subsidy over the funding periods from 1997 to 2020 and relate them to their "Hausbank" to gauge banks' exposure to the GRW program, which is a prerequisite for our analysis. The subsidies constitute a direct capital grant to non-financial firms to cover a share of a pre-defined investment volume. We provide information on the subsidy numbers in Section 3.2.

Second, general rules for state aid across EU Member States are determined at the EU level. This setting introduces an exogenous element from the perspective of the individual firm and bank alike. For the GRW program, firms' access to the subsidy program bears an exogenous component due to the determination of eligible regions. Whether a region is eligible is determined at the level of labor market regions (LMR), which are defined by commuting patterns. For each of the 258 (as of 2019) LMRs, a structural weakness score is calculated prior to the start of each EU funding period and based on four measures of socio-economic outcomes: underemployment, gross wages and salaries, quality of infrastructure, and projected employment. The standardized single indicators are then weighted and determine the final score. LMRs are (inversely) ranked by their scores and weak regions receive subsidies until the population threshold of approximately 40% is reached.[1] LMRs are geographically

[1]Figure A1 illustrates how the eligibility of a LMR depends on the population threshold and the weakness score. The population threshold for Germany resulted from initial calculations of the EU Commission for the first program period and remained fixed at a level of around 40% afterwards.

larger regions than, for example, German counties (Kreise) and not the conventional unit to report economic conditions for. We argue that small and local firms do not fully gauge the conditions of their significantly larger LMR compared to the county in which they are located. This feature mitigates concerns that firms and banks anticipate whether their LMR will be eligible for the GRW program.

Another parameter that introduces uncertainty refers to the LMR's aid intensity, that is, the maximum share of a subsidy in the total investment volume. Across eligible regions, firms can have different access to subsidies depending on the assigned aid intensity (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 firms (and banks) actively affect their treatment status.

Obviously, whether firms are located in a county that belongs to an eligible LMR is not independent of regional economic characteristics. Hence, we need to ensure that a change in observed bank outcomes is due to the exposure to subsidized firms and not driven by underlying structural characteristics determining eligibility. Table A1 reveals that observable traits of banks located in LMRs with similar structural weakness scores do not differ significantly from bank traits in the full sample. In robustness tests, we also control for the structural weakness score and we narrow the sample down to banks located in eligible regions. The latter extension accounts for the fact that these regions might differ in their economic strength compared to non-eligible parts of the country.

Third, we rely on the role of regionalism regarding the bank-firm relationship and the application process to trace out confounding factors. Corporate access to the GRW program is determined in several steps. In a first step, the firm needs to be located in a county that belongs to an eligible region. In a second step, the firm needs to fulfill one of two requirements. Either the investment project is accompanied by an increase in the labor force by 15%, or the planned investment expenditures exceeds 50% of the average amount of depreciation over the last three years before the application is filed to ensure that the project

is sizable. Furthermore, at least 50% of revenues are generated from inter-regional sales. As a consequence of these criteria, 60% of subsidized firms are from the manufacturing sector. Half of these are high- or medium-high-technology firms, followed by knowledge-intensive services (17%), accommodation (11%) and other (12%) industries. In a third step, the firm has to file a form that specifies the investment project and a bank has to verify the financing plan before the firm can finalize the application and deliver it to its State Government.[2]

Hence, banks are an integral component of the subsidy program as the government delegates the screening of qualifying and promising investment projects to financial intermediaries. Whereas applicants can in principle inquire with any bank to evaluate their plans, the convention among these mostly SME applicants is to resort to their "Hausbank" to conduct the assessment of application files.[3] In case the investment volume exceeds the sum of the firm's available funds, the assessing bank can complete the investment funding by granting a credit to the GRW applicant. Firms' applications are likely to be approved by the respective authorities when all requirements are fulfilled and the financing plan is approved.[4] After successful application, the project needs to be usually completed within three years. We illustrate a typical funding structure of a GRW subsidized project in Figure 1.

[Insert Figure 1 here]

Since banks are not eligible for the GRW subsidies, outright self-selection into treatment is not a concern in our setting. Yet an issue of indirect self-selection could arise if banks systematically establish relationships with subsidized firms. Whereas the practice of SMEs

[2]The maximum aid intensity is determined by the eligibility status (less disadvantaged regions receive higher aid intensities than most disadvantaged) and firm size (small firm receive higher aid intensities than large firms). In the funding periods 2000-2006 and 2007-2014, the subsidy could amount up to 50% of the planned investment volume (small firms in most disadvantaged regions). In the period 2015-2020, the subsidy rate amounts up to 40% (small firms in border regions to Poland). Direct R&D investments is not funded but firms may acquire new machinery to expand existing business or finance new establishment sites.

[3]Ad hoc interviews with bankers and representatives from the chambers of commerce in eligible regions unequivocally indicated that banks denied this verification task for customers without an existing credit relationship due to a lack of private information.

[4]The GRW is a discretionary program and each project proposal undergoes a rigorous evaluation process to check whether the project contributes to the program targets. Formal rejections are rather untypical since applicants go through intense personal consultation with the responsible administrators of the GRW.

to approach their relationship bank for the evaluation of the financing plan mitigates such concerns, we cannot fully ignore the issue. Banks may select indirectly into treatment in two ways, an active and a more passive one. 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. In robustness tests, we also estimate the baseline regression on a matched sample of banks.

Finally, we exploit the uncertainty resulting from the adjustment of regional eligibility and aid intensities for each 7-year subsidy period. We have data on three complete subsidy periods: 2000-2006, 2007-2014, and 2015-2020, which allows us to analyze the effects of phase outs.[5] The reason is that in more recent years, firms in selected regions saw a significant decline in their access to funds. Other regions are among the most subsidized ones across different phases of the GRW program while some regions have never had access to it. To account for this high certainty about (not) being in an eligible region, we further narrow down the sample to regions being more unsure about future eligibility, namely those that rank from the 25th to the 75th percentiles of the structural weakness score distribution. Another concern might arise for banks being in an eligible region and adjusting their behavior over the seven years of the program period. Thus, in robustness tests, we also narrow down the sample period around the initial years of these seven-year funding periods.

[5]Formally, the subsidy period ended in 2013. However, the actual change between this and the subsequent funding period was on July 1, 2014 and we assign the entire year 2014 to the formal period 2007-2013 and 2015 to the period 2014-2020. We do not observe firm and bank data in 2020.

3 Empirical specification

3.1 Regression model and hypotheses

We specify the following regression model to analyze the role of banks' exposures to subsidized firms for bank lending and stability:

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

where Y_{bt} is either the natural logarithm of bank b's loan volume or its Z-Score in year t. The Z-Score is defined as $Z\text{-}Score = Ln(\widetilde{Z\text{-}Score} + 1)$, where $\widetilde{Z\text{-}Score} = (\frac{Equity}{Assets} + ROA)/SD(ROA)$. Higher values of the Z-score indicate a larger distance to default of the bank and thus reflect a higher stability. 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.

The coefficient β_1 describes the role of a bank's exposure to firms receiving a subsidy. The variable $Subsidy\ Exp_{bt}$ equals the ratio of the number of links to subsidized firms to the number of a bank's total firm links (including also non-subsidized firms). In the baseline model, we take into account the links to subsidized firms throughout the whole period of the subsidized investment project (three years), a choice that we scrutinize below. We focus on the three year period since especially effects on bank stability might only become visible over a period longer than one year. In case a subsidized firm reports relationship links to two banks, both are considered as equally exposed to the GRW program. We provide descriptive statistics on banks' exposure in Section 3.2.

Given the absence of credit registry data, we do not know if a bank maintains a credit relationship with a subsidized firm, but only observe effects on total lending volumes. To get more insights of whether links to subsidized firms that are likely to be in need of bank

funding to realize the project matter differently, we use alternative definitions of the exposure variable $Subsidy\ Exp_{bt}$. First, we consider only subsidized firms with an increase in borrowing during the three years period of the investment project. For SMEs, the most likely source of borrowing can be attributed to bank credit.

Second, we capture only the links to subsidized firms with large project volumes that are financially constrained because especially these firms need further bank credit to realize the project. In line with, e.g., Almeida et al. (2004); Fagiolo and Luzzi (2006), we define financially constrained firms as those that are in the bottom 50% of the distribution, in a given year, 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 volume) to the firm's total assets.

We control for bank characteristics $Bank\ Controls_{bt-1}$, because, for example, larger and better capitalized banks are more likely to maintain a larger loan volume. Higher capital and liquidity ratios buffer losses or deposit withdrawals, thereby affecting bank stability. Controls are lagged by one period to reduce simultaneity issues and we include bank capitalization, the management quality approximated by including the cost to income ratio, bank profitability measured by the return on assets, the liquidity ratio (liquid assets to total assets), and size (natural logarithm of total assets). Time-invariant bank traits are controlled for by bank fixed effects α_b.

Firm characteristics ($Avg.\ Firm\ Controls_{bt-1}$) are averaged across all firms to which a bank maintains a relationship at time t to gauge potential drivers of firms' loan demand. State-time fixed effects α_{st} capture state-level business cycles and associated loan demand dynamics. In robustness tests, we add the structural weakness score of the LMR in which the bank is located as well as county-level controls.

Against the backdrop of the institutional setting outlined in Section 2 and the role of

banks during the approval process, our null hypothesis regarding total lending effects is an increase of outstanding credit among those banks that have relationships with more firms that obtain GRW subsidies. We expect two mechanisms to be at play that give rise to this "*loan expansion hypothesis*". First, under the assumption that firms have a fixed latent demand for the funding of investment projects, an approved GRW subsidy application increases the committed equity share in the project and reduces its loss given default. Therefore, banks might provide loans to firms to which they would not have extended credit without governmental support. Besides this extensive margin, a second mechanism would increase the loan size for any given project. If firms' latent demand for funding is not fixed, for example because the investment project generates additional corporate activities or can be scaled, an equity commitment funded by the government should increase the intensive margin of the bank's exposure to incumbent customers. Such an increase in total bank lending can also be expected if the subsidy increases firms' free cash-flows that are allocated to non-subsidized projects or creates new growth opportunities in subsequent years.

Alternatively, like in the case of credit guarantees to selected recipient groups (see, e.g., Core and De Marco, 2021; Custodio et al., 2021; Minoiu et al., 2021; Koulischer et al., 2021), GRW subsidies may crowd-out loans extended to non-subsidized incumbent borrowers. If banks' loan supply capacities are fixed, for example because of binding capital constraints, the quasi-random allocation of subsidies to selected incumbent customers should spark a re-allocation of banks' loan portfolios without affecting the aggregate lending volume of the bank. Therefore, we test this alternative "*loan re-allocation hypothesis*" by comparing total lending responses of regional banks with and without borrowers that receive GRW subsidies instead of analyzing bank decisions at the project level.

Besides the implications of place-based subsidy programs on lending volume choices in the banking sector, the risk-profile of banks may be affected. 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 increases in

the share of guaranteed loans. Likewise, GRW subsidies increase the equity stake of firms in the project. Holding constant the size of investment projects, this government support of the firm reduces banks' incentives to monitor the customer due to reduced "skin in the game". We therefore test below this *"skin-in-the-game hypothesis"* and expect that banks with more credit to customers that receive GRW subsidies exhibit higher risk and are thus less stable compared to banks with less exposure to subsidized customers.

Alternatively, if firms fund projects partly with a bank loan, the subsidy increases the ratio of cash-flows generated by the project relative to interest payments, which 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. It reduces risk-taking incentives of banks and we expect banks with more subsidized firms in their loan portfolio to be more stable under this alternative *"charter value hypothesis"*.

3.2 Data and descriptives

The main analysis is based on 1,202 savings and cooperative banks in Germany from 1998 to 2019. We focus on these regionally active banks because geographical proximity matters from various perspectives in our setting. First, SMEs tend to rely on regionally close savings and cooperative banks as their relationship bank. Second, it is mostly SMEs that apply for GRW subsidies and need the evaluation of their bank during the application process. Finally, firms need to apply for subsidies in the state (Bundesland) in which they are located. This regional setting allows controlling for potential confounders, such as business cycle dynamics at the state level affecting banks and firms. The de jure and de facto regional delineation of banking markets in Germany has been used before to analyze bank behavior (see, e.g., Puri et al., 2011; Dam and Koetter, 2012; Gropp et al., 2013).

Table 1 summarizes variable definitions and our three main data sources. First, we gather data from Bankscope and Orbis Bankfocus to study banks' responses following their exposure

to subsidized firms. Second, we use the Dafne database to link banks and firms. Third, we obtain granular GRW data on a firm's subsidy amount and investment volume per project, from which we compute banks' exposure to subsidized firms.

[Insert Table 1 here]

Bank-level data: To obtain a long history of balance sheets and income statements for German banks, we combine the Bankscope and Orbis Bankfocus databases using a correspondence file of variable labels provided by the data vendor Bureau van Dijk. We switch from one database to the other in 2013 to maximize the coverage and availability of data. We harmonize the two samples as follows. First, we convert all monetary amounts to Euros using annual average exchange rates. Second, we measure all variables except ratios in thousands of Euros. Third, we restrict the sample to regional savings and cooperative banks. Based on bank names and web searches, we verify all cases where the relevant variable describing the "specialization type" differed across the two datasets. Fourth, whenever possible we use unconsolidated data to gauge regional banks' choices. If unconsolidated data are unavailable, we draw on consolidated data. Fifth, we remove implausible observations defined as negative assets, equity or loan amounts, as well as ratios that are negative or larger than 100%. Finally, we winsorize variables at the 1st and 99th percentiles. Summary statistics for the dependent and control variables are provided in Table 2. The average bank has a capital ratio of 7.59% and the natural logarithm of banks' assets amounts to 13.8.

[Insert Table 2 here]

Banks' share of subsidized firms in total firms ranges between zero and 4.6%. Figure 2 shows the evolution of banks' exposure to subsidized firms. Banks located in eligible regions show a larger exposure to subsidized firms. While the share of subsidized firms a bank maintains relationships with tends to be small, those of their corporate customers receiving a subsidy can benefit substantially from it. Table 3 reveals that subsidies relative to investment volumes (or the aid intensity) amount on average to 27.7%. Similarly, the subsidy program

can have positive spillover effects stimulating investment activity in general such that the number of a bank's links to subsidized firms relative to total firm links rather gives a lower bound for banks' exposure to the subsidy program.

[Insert Figure 2 here]

[Insert Table 3 here]

Further, the share of banks that are linked to subsidized firms is quite substantial amounting on average to 42%. Table 4 shows descriptive statistics for banks' exposure to subsidized firms across the different subsidy periods. The number of exposed banks is higher in eligible regions, which reflects the role of distance: banks maintain relationships to more subsidized firms if they are located in eligible regions themselves (panel a)). The average share of exposed banks measured at the county level is the highest between 2007 and 2014, for both banks located in eligible and non-eligible regions, and amounts up to 81% in eligible regions (panel b)). Considering only the sample of banks exposed to subsidized firms, panel c) reveals that banks' average subsidy exposure is higher for banks in eligible regions. The two alternative exposure measures are more restrictive and decline on average. The exposure to subsidized firms tends to be smallest in the last subsidy period (2015-2020) in line with the declining size of the program.

[Insert Table 4 here]

Finally, Table 5 shows summary statistics of bank characteristics by banks' exposure status. Banks with a non-zero exposure to subsidized firms show lower levels of capitalization, are larger and linked to firms with on average more capital but less liquidity. Given these differences, we add respective controls in our model as outlined above.

[Insert Table 5 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 without applying a size threshold. The database reports a bank-firm link if managers report a bank to be their relationship bank ("Hausbank"), which are those at which firms are most likely to ask for a loan. We proceed similar to Koetter et al. (2020) but extend the bank-firm links to recent years. Reported links exhibit breaks in the raw data due to the survey nature of the database. Specifically, 69% of all bank-firm pairs have no gaps in the reported years, 16% have gaps of at most one year, 9% of at most two years, 3% of at most three years, and 1% of at most four years. Since bank-firm links tend to be stable over time in practice, we adjust the data in the following ways. First, we use a 3-year rolling window approach to fill the gaps in the reported bank-firm links. As a result, 98% of bank-firm pairs exhibit no more gaps in their links during the sample period. Second, we extend the links in a symmetric way to obtain reasonable coverage.[6] Finally, we adjust for outliers in terms of banks having an implausibly low number of reported firm links and remove banks with less than 100 firms in a given year. These cases mainly occur in the initial years of the sample period. The average bank is linked to 962 firms in the final sample, whereas the maximum number of firm links equals 18,590.

Firm-level data: 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 volume of the subsidized project. The GRW program subsidizes investment projects at the plant and not at the firm level to which we match banks. Because 85% of the subsidized firms in the sample are single-plant firms, sample selection due to the funding of multi-plant firms seems

[6]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.

to be a subordinate issue.[7]

In our sample, the average number of subsidized projects per year is 2,282, with an average subsidy amount of 350,000 Euros. Around 56% of subsidized firms apply only once for a subsidy. Table 3 depicts more detailed breakdowns, such as the total amount of subsidies over the different periods and the number of subsidized firms. Over time, the total amount of subsidies across eligible regions falls from 9.3 billion Euros to 1.1 billion Euros. The number of subsidized firms in the sample declines from around 12,000 to around 6,000. The distribution of firms' subsidies to investment volume is shown in Figure 3 and reveals that aid intensities at the firm level are relatively constant over time. Hence, while over time fewer firms access the program, those that receive a subsidy do not see substantial changes in subsidized funds relative to the investment volume.

[Insert Figure 3 here]

Using the record linkage method described in Brachert et al. (2018b), subsidized firms are matched to Amadeus identifiers except for micro firms that are not covered by Amadeus. From various vintages of Amadeus, we obtain historical balance sheet and income statement times series. We sample all firms that maintain a link to savings or cooperative banks and winsorize the data 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 baseline analysis is at the bank level, we construct average firm controls per bank gauging corporate capitalization (ratio of equity to assets), profitability (return to assets), liquidity (the difference between current assets and current liabilities relative to total assets), and size. These variables do not only approximate how well the average firm linked to a bank is doing, but might also proxy determinants of firms' loan demand.

Regional controls: We know in which county (Kreis) of a federal state (Bundesland) a bank is located. To control for regional dynamics, we use state-time fixed effects. In robustness checks, we also add county-level controls to account for local economic dynamics

[7] We define single-plant firms as those where firm and plant location are identical.

at a more granular level. The controls include county-level GDP and household income expressed in growth rates as well as per capita. We also control for value added, employment growth, population density and the employment share of manufacturing firms. Finally, we include the structural weakness score of the LMR to which a county belongs to because this score directly determines regional eligibility.

4 Regression results

4.1 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 and significant for the baseline specification (Column 1) as well as for the two alternative exposure variable definitions (Columns 2 & 3). The coefficient increases in magnitude for the more restrictive exposure definitions, which is in line with expectations. The reason is that these are the banks more likely linked to firms in need of loans to co-finance the subsidized project. Overall, the results suggest that there is, on average, a positive impact on bank lending due to banks' exposure to subsidized firms, which supports the "lending expansion hypothesis". The effect is economically relevant: Bank lending (as measured by *LogLoans*) of the exposed banks increases by around 2% for a 1 percentage point increase in banks' exposure to subsidized firms.[8] In Section 4.4, we consider additionally whether subsidized firms borrow more compared to non-subsidized firms, providing further evidence that bank lending is relevant for firms to realize a subsidized project.

[Insert Table 6 here]

In Columns 4-6, the dependent variable is the *Z-Score*. The negative coefficients for the *Subsidy Exp.* variable point towards the less "skin-in-the-game hypothesis". Lower

[8]For comparability, all regressions in Table 6 are based on the same sample of bank-year observations. Otherwise, estimations in Columns 1-3 would be based on up to 17,162 bank-year observations while the coefficients would still be significant and similar in size.

screening and/ or monitoring would reduce the stability of banks that are more exposed to subsidized firms. However, the estimates are insignificant, which is a result that also obtains for most of the following robustness tests. Regarding the coefficient estimates for bank-level controls, it turns out that better capitalized banks with a lower cost to income ratio as well as larger banks tend to lend more. While size relates negatively to stability, capitalization and profitability come with higher values of the *Z-Score*. Most average firm-level controls exert no significant effect.

Robustness tests: We scrutinize the baseline results to explain *Log Loans* based on the concerns discussed in Section 2 and show results in Table 7.[9] Column 1 reports the baseline result. To control for local economic dynamics that might affect bank lending, we include county-level controls such as local GDP or employment growth in Column 2. In Column 3, we exclude the firm-level controls as they showed limited evidence for having an impact. In Column 4, we define banks' exposure to the GRW program based on links to subsidized firms but base the calculations only on the first year of the subsidized project. Across all specifications, the coefficient of interest remains significant. Omitting firm controls or focusing on the first years of the link to a subsidized firm increases the estimate. This might indicate that firm controls gauging credit demand are relevant to include to avoid an upward bias. Further, probably most of the credit dynamics take place directly when the firms receive the subsidy and need additional funds to realize the project.

[Insert Table 7 here]

To trace out whether there are confounding effects due to banks being located in dissimilar regions, we proceed as follows. First, we only include banks located in counties that belong to eligible regions, that is, regions in which firms have access to the subsidy program (Column 5). Second, we match banks based on the bank-level controls included in the baseline specification and for the years before they are first exposed to subsidized firms using a coarsened exact

[9]Results for the *Z-Score* in the online appendix confirm the insignificant effects in the main test (Table A2).

matching approach (Column 6). Third, for the matched sample, we only keep banks in similar regions based on the LMR's structural weakness score (Column 7). We do so by excluding banks located in regions that have a score in the upper or lower quartile of the distribution. Like this, we also exclude regions where it is relatively certain that they will, respectively, will not be eligible. Finally, to account for the long time span of each subsidy period and possible adjustment effects, we only consider matched bank pairs for which the treated banks have been exposed to subsidized firms in the first two years of each subsidy period and keep the bank-year observations up to 4 years after the start of the respective period (Column 8).[10] Comparing results for these samples that aim at mitigating confounders, it can be seen that the coefficient for banks' exposure to subsidized firms remains significant and rather gains in size such that the coefficient in Column 1 constitutes a lower bound.

4.2 The role of bank heterogeneity

Size, capitalization and liquidity: We extend the model by introducing an interaction term between the exposure variable and lagged 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 suggested 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.

[Insert Table 8 here]

Results including these interaction terms are shown in Table 8. Corresponding marginal effects of banks' subsidy exposure depending on their size, capitalization or liquidity are

[10] For example, for the first subsidy period starting in 2000, we only keep a savings bank if it had a link to a subsidized firm in 2000 or 2001 and if this is the case, we include the years 2000-2004 in the estimations.

depicted in Figure 4 for *Log Loans* as the dependent variable. On average, there is limited evidence that these bank characteristics matter heterogeneously for the transmission of banks' subsidy exposure to lending responses. However, marginal effects show that the general increase in bank lending prevails for medium-sized banks that are less well capitalized but have more liquidity at hand. For the *Z-Score*, results remain insignificant also along the distribution of these interacting variables. In sum, these results suggest that firm subsidies help to overcome capital constraints of medium-sized banks and induce more lending without threatening banks' stability.

[Insert Figure 4 here]

Local expertise and governance: The literature on the importance of banks' screening and monitoring skills for bank lending and stability is abundant. 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 sectoral market share and experience. Thus, we take such considerations into account and Table 9 reveals the importance of banks' local expertise and governance structure when it comes to bank lending and stability of banks exposed to the GRW program. For this analysis, we extend the regression model in Equation 1) by introducing interactions between 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. Sectoral experience is defined as the weighted average of the relationship lengths of a bank with the sectors it is linked to, where sectors are defined along the 2-digit NACE codes and weights are defined as the number of firms to which a bank is linked in a specific sector. Differences in governance are indicated by a dummy variable taking a value of one for savings banks and zero otherwise.

[Insert Table 9 here]

Column 1 of Table 9 shows that a higher local asset share significantly increases loan volumes of exposed banks. This is confirmed when looking at the marginal effects presented in Figure 5. Banks in the top 25% of the distribution of the local asset share exhibit an increase in loan volumes of about 2 to 4%. In contrast, banks in the bottom 50% of the distribution of sectoral experience see an increase in loans by about 2 to 3%. For bank lending in response to GRW exposure, the governance type does not introduce heterogeneous responses (Column 3). Again, we do not find much evidence that bank stability is affected. Only in Column 6, there is slight evidence that exposed savings banks see a decline in stability when being linked to subsidized firms. This might indicate some influence of the governance structure, which should not be overemphasized, however.[11]

[Insert Figure 5 here]

4.3 Subsidy periods and time dynamics

Subsidy periods: To test for the role of different subsidy periods, we check whether results are driven by one period or even differ across periods. The first window spans the period 2000-2006 with highest subsidy amounts as shown in Table 3. The second window relates to the years 2007-2014, for which we have the highest share of exposed banks in the sample, and the third window covers the years 2015-2019. 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. Related results are shown in Table 10.

[Insert Table 10 here]

Columns 1 and 5 show the baseline result for the full sample, while the other columns show results for the different subsidy periods. The positive effect on loan volumes is mostly driven by the period spanning the years from 2007 to 2014 (Column 3). This result might

[11] Marginal effects plots for the *Z-Score* can be obtained upon request but are not included due to their insignificance.

be due to the fact that the share of exposed banks is largest in this period as well as a possible relaxation of financing constraints during the crisis years due to the subsidy program. The non-significant result of banks' subsidy exposure for bank stability remains.[12] Our results, thus, complement the findings of Anginer et al. (2014) who find for the case of deposit insurance and the implied guarantee that it increases bank risk in good times but supports banks during crisis times. In our setting, we find that firm subsidies support lending during a period including the financial crisis, whilst we do not observe significantly negative implications for bank stability.

Time dynamics: To account for the fact that lending and the effects of risk-taking on stability might build up over time, we adjust the estimation equation as follows. We define banks' exposure variable based on links to subsidized firms for the first year of the project and include different leads and lags of the variable $Subsidy\ Exp_{bt-\tau}$. This allows testing for ex ante or delayed dynamics in bank outcomes around the time when banks get exposed to subsidized firms. We specify the following model, again with $Log\ Loans$ or the $Z-Score$ as dependent variables, and estimate it now repeatedly using different leads and lags of the variable $Subsidy\ Exp.$:

$$\begin{aligned} Y_{bt} =& \beta_0 + \beta_1^{\tau} Subsidy\ Exp_{bt-\tau} + \beta_2 Bank\ Controls_{bt-1} + \beta_3 Avg.\ Firm\ Controls_{bt-1} \\ &+ \alpha_b + \alpha_{st} + \epsilon_{bt}, \end{aligned} \tag{2}$$

where $\tau \in \{-4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7\}$ such that $\tau = 0$ would refer to the result in Column (4) of Table 7 while $\tau = 1$ refers to the coefficient estimate if we lag the exposure variable by one year. Hence, we run twelve different regressions and obtain the estimates for β_1 for the different leads and lags, which we plot in Figures 6-7.

[Insert Figures 6-7 here]

[12] Robustness tests as conducted in Table 7 but by subsidy period are available in the online appendix (Table A3).

In panel a), the model is estimated based on the full sample and in panel b) based on the matched sample, whereas the matching procedure is the same as in Section 4.1. Figure 6 shows that the increase in loans is temporary and fades away after two years. This finding is in line with the duration of three years in which interlinked subsidized firms need to realize the project. In Figure 7, we report results for the *Z-Score* and find that despite there is no contemporaneous impact on bank stability, there is some indication supporting the (less) "skin-in-the-game hypothesis" given that we observe a temporary decline in banks' stability around five years after being exposed.

4.4 Is the increase in bank lending mirrored in subsidized firms' borrowing?

Firms' borrowing dynamics: To corroborate that banks expand loan volumes and at least part of this credit goes to subsidized firms, we exploit the availability of firm-level data. More specifically, we check whether the increase in bank lending for those banks being linked to more subsidized firms is mirrored in an expansion of borrowing on the firms' end. Table 2 shows descriptives for the firm-level data. Given that subsidized firms might differ from non-subsidized ones, we apply a matching procedure to trace out effects. To all firms that receive a subsidy and that we can link to Amadeus, we match control firms by drawing on the universe of German firms covered by Amadeus. The matched sample spans the period from 2002 to 2020. Matching is done by firms' 3-digit NACE industry codes to control for possible industry-level shocks. Additionally, we match by firm assets, capitalization, cash ratio and fixed assets growth based on the values of the year before a firm received for the first time a subsidy.

Based on the matched sample, we estimate Equation 3:

$$Y_{ft} = \beta_0 + \beta_1 D_{ft} + \alpha_f + \alpha_t + \epsilon_{ft}, \tag{3}$$

where Y_{ft} is the natural logarithm of firm f's loan volume in year t. The dummy variable D_{ft} turns one when the firm receives a subsidy and is zero in the years before. Firm (α_f) and time (α_t) fixed effects are included. Standard errors are clustered at the firm level. Furthermore and similar to Brachert et al. (2018a), we want to trace out time dynamics at the firm level and set up Equation 4:

$$Y_{ft} = \beta_0 + \sum_{\tau=-4;\tau\neq-1}^{7} \beta_1^{\tau} D_{ft}^{\tau} + \alpha_f + \alpha_t + \epsilon_{ft}, \tag{4}$$

where D_{ft}^{τ} is a firm-specific dummy variable being one τ years before or after a firm received a subsidy, and zero otherwise. We do not include the dummy for the year before the firm received the subsidy ($\tau = -1$), which then constitutes the reference category.

The firm-level results confirm the "loan expansion hypothesis" and related results at the bank level. Column 1 of Table 11 shows that, on average, subsidized firms' borrowing increases significantly compared to non-subsidized but similar firms. Column 2 of Table 11 reveals that the positive impact on borrowing is happening during the subsidized project period of three years, which is well in line with the bank-level results showing an increase in loan volumes during the initial three years of the subsidy period (Figure 6). Hence, the observed transitory impact on firm borrowing fits to the subsidy period and suggests that GRW subsidies have not created additional loan uptakes in the years following the subsidized investment period. In sum, these results provide suggestive evidence for the importance of banks in the GRW program: Banks do not seem to only verify firms' application but also to

provide loans to firms when they realize their subsidized investment project.

[Insert Table 11 here]

5 Conclusions

We study the effect of government subsidies granted to non-financial firms on bank lending and stability. In the process of granting government support, banks usually play a crucial role in two ways. They verify firms' financing plans and they provide credit in addition to the subsidy so that firms can actually realize proposed investment projects. So far, previous literature has mostly focused on the effects of government subsidies on firm outcomes, a gap that we aim to fill with our study.

Our analysis uses the universe of investment projects to German firms since 1998 until 2019 under the Improvement of Regional Economic Structures program (GRW), one of the largest regional economic development programs of its kind in Germany. Specifically, we use the relationship of both subsidized and non-subsidized firms to 1,202 local banks to study how lending volumes and the stability of local financial intermediaries that are exposed to the GRW program are affected. Identifying a relationship between banks' exposure to subsidized firms and bank outcomes is challenging. Yet, the institutional setting of the subsidy program contains exogenous elements, most importantly the determination of eligible regions at the EU level, which help to establish a relationship and reduce confounding factors.

Our results suggest that banks that are more exposed to subsidized firms exhibit a significant increase in loan volumes. This increase does not come at the cost of significant immediate declines in bank stability. Banks' lending expansion is most pronounced for capital constrained but highly liquid banks with a higher local asset share. The result that banks expand lending when being linked to subsidized firms is corroborated when looking at firm-level data. Firms receiving a subsidy show a significant increase in borrowing over the duration of the subsidized project.

In sum, we provide evidence on the role of local banks for subsidy programs such as the GRW. The significant increase in lending suggests that firms' increase in investment is partially only feasible by a combination of subsidies and bank lending. Probably, due to the non-excessive scale of the program, we do not find relevant effects on bank stability.

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6 Appendix

Table 1: Variable description

Variable	Description	Source
Bank-Level Regressions		
Dependent variables:		
Loans (Log)	Natural logarithm of loan volume (loans in thousands of EUR)	Bankfocus
Z-Score	$\ln\left(\left(\frac{\text{Equity}}{\text{Assets}} + \text{ROA}\right) / SD(\text{ROA}) + 1\right)$ where the standard deviation SD is based on all available years starting from 1997 until year t	Bankfocus
Bank controls:		
Bank Subsidy Exp.	Exposure of a bank to subsidized firms (in %). Exposure is defined as the share of links to subsidized firms relative to the number of links to all (including non-subsidized) firms. The link to a subsidized firm is assumed to be present throughout the whole length of a project, which is legally set to be equal to three years.	GRW, Dafne
Bank Capitalization	Ratio of equity to total assets (in %)	Bankfocus
Bank Cost to Income	Cost to income ratio (in %)	Bankfocus
Bank ROA	Return on assets (in %)	Bankfocus
Bank Liquidity	Ratio of liquid assets to total assets (in %)	Bankfocus
Bank Size	Natural logarithm of total assets (assets in thousands of EUR)	Bankfocus
Bank Local Asset Share	Ratio of assets to total assets of banks from the same county (in %)	Bankfocus
Bank Sectoral Experience	Sectoral experience of a bank is proxied by the weighted 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). Weights are defined as the number of firms to which a bank is linked in a specific sector.	Dafne, Amadeus
Savings Bank Dummy	Dummy variable being one for savings banks and zero otherwise	Bankfocus
Firm controls:		
Firm Capitalization	Average *Equity / Total Assets* (in %) of firms to which a banks is linked	Amadeus
Firm ROA	Average *ROA* (in %) of firms to which a banks is linked	Amadeus
Firm Liquidity	Average (*Current Assets − Current Liabilities*) / *Total Assets* (in %) of firms to which a banks is linked	Amadeus
Firm Size	Average ln(*Total Assets*) of firms to which a banks is linked	Amadeus
County controls:		
County GDP p.c./ gr.	GDP per capita / growth (in %)	Destatis
County Income p.c./ gr.	Household income per capita / growth (in %)	Destatis
County Value Added	Value added (in millions of EUR)	Destatis
County Empl. Growth	Employment growth (in %)	Destatis
County Population Dens.	Population density	INKAR
County Manuf. Sh.	Employment share in the manufacturing sector (in %)	Destatis
County SWS	Respective labor market region's "structural weakness score" (SWS)	GRW data

Table 1: Variable description – continued

Variable	Description	Source
Firm-Level Regressions		
Dependent variables:		
Loans (Log)	Natural logarithm of loan volume (loans in thousands of EUR)	Amadeus
Firm controls		
D	A dummy being equal to 1 if the firm received a subsidy	GRW, Amadeus
D^{τ}	A dummy being equal to 1 in the τth year after the firm received a subsidy	GRW, Amadeus

Table 2: Descriptives

	N Obs. (1)	Mean (2)	SD (3)	Min (4)	Max (5)
Bank-Level Regressions					
Dependent variables:					
Loans (Log)	17,120	13.26	1.09	10.34	17.97
Z-Score	17,120	1.28	0.47	0.17	2.24
Bank controls:					
Bank Subsidy Exposure	17,120	0.21	0.49	0.00	4.64
Bank Capitalization	17,120	7.59	2.32	2.97	21.79
Bank Cost to Income	17,118	71.31	9.79	47.44	105.07
Bank ROA	17,120	0.24	0.18	0.00	2.82
Bank Liquidity	17,120	12.12	7.18	2.40	51.82
Bank Size	17,120	13.80	1.03	11.16	17.48
Firm controls:					
Firm Capitalization	17,119	7.27	3.13	1.87	21.12
Firm ROA	17,079	3.92	2.09	-2.50	11.50
Firm Liquidity	17,119	0.50	0.10	-0.05	0.80
Firm Size	17,119	13.51	0.60	11.50	19.23
Firm-Level Regressions					
Dependent variables:					
Loans (Log)	38,787	3.11	5.54	0.00	19.19
Matching variables:					
Log Assets	62,202	14.43	1.52	1.10	22.30
Cash Ratio	61,306	16.38	18.27	0.02	89.39
Capitalization	61,665	8.12	13.59	0.06	100.00
Fixed Assets Growth	55,756	14.08	49.99	-91.00	236.00

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 3: Aid intensities and subsidy size

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

This table shows descriptive statistics for the subsidy program by the three subsidy periods and, on average, for the period 2000-2020. Row 1 presents the average maximum aid intensity (maximum possible subsidy to investment volume, in %). Row 2 presents the total amount of provided subsidies in billion Euros. Row 3 shows the average yearly total subsidy amount for each subsidy period in billion Euros. Rows 4 and 5 show the number of subsidized firms for the full subsidy dataset (*All*) and for our estimation sample (*Sample*). Rows 6 and 7 present the average (across subsidized firms) actual aid intensity (subsidy to investment volume, in %) for the full subsidy dataset and for our estimation sample.

Table 4: Banks' subsidy exposure

Bank Exposure Measures		Subsidy Periods 2000-2006	2007-2014	2015-2020	2000-2020
a) Avg. # of Exposed Banks					
	Baseline	139	504	342	831
	Eligible Regions	101	333	248	485
	Non-eligible Regions	38	171	94	346
b) Avg. % of Exposed Banks$_c$					
	Baseline	30	53	43	42
	Eligible Regions	51	81	71	68
	Non-eligible Regions	11	25	16	17
c) Avg. Subsidy Exposure, %					
	Baseline	0.64	0.62	0.38	0.55
	Eligible Regions	0.81	0.85	0.47	0.71
	Non-eligible Regions	0.21	0.16	0.14	0.17
	Fin. Constr. & Large Proj.	0.40	0.31	0.21	0.31
	Eligible Regions	0.45	0.36	0.22	0.34
	Non-eligible Regions	0.18	0.11	0.16	0.15
	Increased Borrowing	0.55	0.48	0.31	0.45
	Eligible Regions	0.66	0.63	0.36	0.55
	Non-eligible Regions	0.20	0.14	0.13	0.16

This table shows descriptive statistics for banks' exposure to the subsidy program for each of the three subsidy periods and for the period 2000-2020. In panel a), the first three rows show the average number of banks exposed to subsidized firms (Avg. # of Exposed Banks) for the baseline sample, and banks located in eligible or non-eligible regions. In panel b), the following three rows show the average share of exposed banks (Avg. % of Exposed Banks$_c$). In panel c), the remaining rows show the average exposure of banks to subsidized firms (Avg. Subsidy Exposure) based on the three exposure definitions and containing only banks with non-zero exposure values. Subsidy Exposure is defined as the number of links of a bank to subsidized firms relative to all firm links in a given year (in %). In the other two cases, we restrict to subsidized firms that are either also financially constrained and have large investment volumes or experience an increase in borrowing.

Table 5: Descriptives, by banks'/ firms' exposure status

	Mean Non-exposed	Mean Exposed	Normalized Difference
	(1)	(2)	(3)
Bank-Level Variables			
Dependent Variables			
Loans (Log)	12.78	13.37	0.42 *
Z-Score	1.31	1.25	-0.08
Bank Controls			
Bank Subsidy Exposure	0.00	0.32	1.03 *
Bank Capitalization	7.78	6.48	-0.43 *
Bank Cost to Income	70.78	69.98	-0.06
Bank ROA	0.28	0.24	-0.15
Bank Liquidity	11.67	13.37	0.17
Bank Size	13.29	13.90	0.47 *
Firm Controls			
Firm Capitalization	7.13	9.16	0.46 *
Firm ROA	4.34	3.61	-0.23
Firm Liquidity	0.52	0.48	-0.29 *
Firm Size	13.45	13.38	-0.08
Firm-Level Variables			
Dependent Variables			
Loans (Log)	1.49	3.72	0.31 *
Matching Variables			
Log Assets	12.93	14.47	0.57 *
Cash Ratio	21.41	13.23	-0.28 *
Capitalization	27.58	7.95	-0.50 *
Fixed Assets Growth	8.00	68.00	0.64 *

This table shows descriptive statistics by exposure 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 exposed banks, that is the variable *Subsidy Exposure* is larger than zero. In case of firms, exposure refers to firms with an approved subsidy and the sample of unexposed firms contains those that are matched to exposed (i.e. subsidized) ones. The third column depicts the normalized difference in means between exposed and unexposed. * 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	Fin. Constrained & Large Project	Increased Borrowing	Baseline	Fin. Constrained & Large Project	Increased Borrowing
	(1)	(2)	(3)	(4)	(5)	(6)
Subsidy Exp.	0.0199***	0.0229*	0.0245***	-0.0043	-0.0044	-0.0015
	(0.0067)	(0.0123)	(0.0088)	(0.0081)	(0.0148)	(0.0101)
Bank Controls $(t-1)$						
Bank Capitalization	0.0054**	0.0054**	0.0053**	0.0078***	0.0078***	0.0078***
	(0.0023)	(0.0023)	(0.0023)	(0.0027)	(0.0027)	(0.0027)
Bank Cost to Income	-0.0005**	-0.0005**	-0.0005**	-0.0001	-0.0001	-0.0001
	(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0003)	(0.0003)
Bank ROA	-0.0048	-0.0050	-0.0050	0.4400***	0.4401***	0.4402***
	(0.0098)	(0.0098)	(0.0098)	(0.0328)	(0.0328)	(0.0328)
Bank Liquidity	-0.0049***	-0.0049***	-0.0049***	-0.0005	-0.0005	-0.0005
	(0.0004)	(0.0004)	(0.0004)	(0.0005)	(0.0005)	(0.0005)
Bank Size	0.7825***	0.7831***	0.7824***	-0.1105***	-0.1106***	-0.1105***
	(0.0130)	(0.0130)	(0.0130)	(0.0182)	(0.0182)	(0.0182)
Firm Controls $(t-1)$						
Firm Capitalization	-0.0012	-0.0013	-0.0012	-0.0008	-0.0007	-0.0007
	(0.0008)	(0.0008)	(0.0008)	(0.0014)	(0.0013)	(0.0014)
Firm ROA	-0.0011*	-0.0011*	-0.0011*	0.0018*	0.0018*	0.0018*
	(0.0006)	(0.0006)	(0.0006)	(0.0010)	(0.0010)	(0.0010)
Firm Liquidity	-0.0057	-0.0045	-0.0061	-0.0064	-0.0067	-0.0067
	(0.0179)	(0.0179)	(0.0178)	(0.0293)	(0.0293)	(0.0293)
Firm Size	-0.0042	-0.0042	-0.0043	0.0077	0.0077	0.0077
	(0.0040)	(0.0040)	(0.0040)	(0.0064)	(0.0064)	(0.0064)
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.	17,120	17,120	17,120	17,120	17,120	17,120
N of Banks	1,202	1,202	1,202	1,202	1,202	1,202
R Sq. Within	0.711	0.710	0.711	0.236	0.236	0.236

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 cooperative banks and spans the period from 1998 to 2019. The main variable of interest is *Subsidy Exp.* that is defined as the share of links to a) all subsidized firms (Columns 1 & 4), b) subsidized firms that are financially constrained and have a project of large investment volume (Columns 2 & 5), and c) subsidized firms that experience an increase in borrowing in a given year (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 7: Baseline specification: Robustness checks

	Loans (Log)							
	Baseline	County Controls	W/o Firm Controls	1-Year Project	Eligible Regions	Matched Sample	Similar Regions	First 2 Years
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Subsidy Exp.	0.0199***	0.0183***	0.0201***	0.0222***	0.0229***	0.0273***	0.0222**	0.0277*
	(0.0067)	(0.0068)	(0.0067)	(0.0079)	(0.0072)	(0.0081)	(0.0100)	(0.0143)
Bank Controls $(t-1)$								
Bank Capitalization	0.0054**	0.0058**	0.0054**	0.0054**	0.0087**	0.0006	0.0040	0.0090
	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0040)	(0.0027)	(0.0029)	(0.0065)
Bank Cost to Income	-0.0005**	-0.0005**	-0.0005**	-0.0005**	-0.0010**	-0.0000	-0.0010***	0.0004
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0004)	(0.0002)	(0.0004)	(0.0005)
Bank ROA	-0.0048	-0.0032	-0.0050	-0.0050	0.0027	-0.0010	0.0031	0.0419*
	(0.0098)	(0.0096)	(0.0098)	(0.0098)	(0.0159)	(0.0120)	(0.0155)	(0.0221)
Bank Liquidity	-0.0049***	-0.0050***	-0.0049***	-0.0049***	-0.0040***	-0.0046***	-0.0039***	-0.0023***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0007)	(0.0004)	(0.0006)	(0.0008)
Bank Size	0.7825***	0.7764***	0.7818***	0.7831***	0.7935***	0.7867***	0.7766***	0.7578***
	(0.0130)	(0.0138)	(0.0130)	(0.0130)	(0.0209)	(0.0149)	(0.0217)	(0.0393)
Firm Controls $(t-1)$								
Firm Capitalization	-0.0012	-0.0010		-0.0013	0.0003	-0.0003	-0.0006	-0.0002
	(0.0008)	(0.0008)		(0.0008)	(0.0015)	(0.0010)	(0.0013)	(0.0017)
Firm ROA	-0.0011*	-0.0010		-0.0011*	-0.0008	-0.0008	-0.0020**	0.0003
	(0.0006)	(0.0006)		(0.0006)	(0.0012)	(0.0006)	(0.0009)	(0.0012)
Firm Liquidity	-0.0057	-0.0068		-0.0048	0.0232	-0.0234	-0.0331	-0.0069
	(0.0179)	(0.0181)		(0.0179)	(0.0352)	(0.0185)	(0.0220)	(0.0290)
Firm Size	-0.0042	-0.0037		-0.0043	-0.0056	-0.0015	0.0010	-0.0113
	(0.0040)	(0.0041)		(0.0040)	(0.0074)	(0.0053)	(0.0075)	(0.0078)
Matched Sample	No	No	No	No	No	Yes	Yes	Yes
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	No	Yes	Yes	Yes	Yes	Yes
County Controls	No	Yes	No	No	No	No	No	No
N of Obs.	17,120	16,451	17,120	17,120	6,803	11,460	6,120	1,961
N of Banks	1,202	1,156	1,202	1,202	474	794	542	240
R Sq. Within	0.711	0.712	0.711	0.710	0.693	0.729	0.741	0.800

This table shows regression results where the dependent variable is *Loans* (*Log*) of bank b in year t as indicated in the table header. The sample includes German savings and cooperative banks and spans the period from 1998 to 2019. The main variable of interest is *Subsidy Exp.* that is defined as the share of links to subsidized firms to total links of a bank b at time t. Column 1 shows the baseline specification, while Column 2 also includes county controls as listed in Table 1 and Column 3 represents the baseline specification without firm controls. In Column 4, the *Subsidy Exp.* variable is defined based on the first year of the subsidy only. Column 5 shows results when only including banks in eligible regions. Column 6 shows results when we match exposed and control banks based on the variables Capitalization, Cost to Income, ROA, Liquidity and Size. For the matched sample, in Column 7, we exclude banks located in regions with a structural weakness score in the upper or lower quartile of the distribution. In Column 8, we exclude matched pairs of banks for which an exposed bank entered the treatment later than 2 years after the start of each subsidy period (i.e. we keep those banks first exposed either in 2000, 2001, 2007, 2008, 2014 or 2015). 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: Interactions with bank size, capitalization and liquidity

	Loans (Log)			Z-Score		
	Size	Capitalization	Liquidity	Size	Capitalization	Liquidity
	(1)	(2)	(3)	(4)	(5)	(6)
Subsidy Exp.	0.0155**	0.0178***	0.0162**	-0.0098	-0.0041	-0.0034
	(0.0070)	(0.0063)	(0.0065)	(0.0092)	(0.0083)	(0.0083)
Bank Var.$_{t-1}$	0.9029***	-0.0114***	-0.0020***	0.0908***	0.0904***	-0.0009
	(0.0147)	(0.0033)	(0.0004)	(0.0195)	(0.0048)	(0.0006)
Subsidy Exp. × Bank Var.$_{t-1}$	0.0037	-0.0021	0.0011*	-0.0123	-0.0007	-0.0003
	(0.0066)	(0.0028)	(0.0006)	(0.0081)	(0.0027)	(0.0006)
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.	17,120	17,120	17,120	17,120	17,120	17,120
N of Banks	1,202	1,202	1,202	1,202	1,202	1,202
R Sq. Within	0.864	0.711	0.712	0.238	0.277	0.237

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 cooperative banks and spans the period from 1998 to 2019. The main variable of interest is *Subsidy Exp.* that is defined as the share of links to subsidized firms to total links of a bank b at time t. 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 9: Interactions with bank local asset share, governance type and sectoral experience

	Loans (Log)			Z-Score		
	Asset Share	Sectoral Experience	Savings Bank	Asset Share	Sectoral Experience	Savings Bank
	(1)	(2)	(3)	(4)	(5)	(6)
Subsidy Exp.	0.0051	0.0309**	0.0144*	0.0051	-0.0123	0.0071
	(0.0089)	(0.0141)	(0.0076)	(0.0106)	(0.0152)	(0.0098)
Bank Var.$_{t-1}$	0.0033***	-0.0042		0.0007**	0.0224***	
	(0.0004)	(0.0064)		(0.0003)	(0.0084)	
Subsidy Exp. × Bank Var.$_{t-1}$	0.0004**	-0.0019	0.0134	-0.0002	0.0015	-0.0258*
	(0.0002)	(0.0020)	(0.0119)	(0.0002)	(0.0021)	(0.0148)
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.	17,120	17,117	17,120	17,120	17,117	17,120
N of Banks	1,202	1,202	1,202	1,202	1,202	1,202
R Sq. Within	0.721	0.711	0.711	0.237	0.237	0.237

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 cooperative banks and spans the period from 1998 to 2019. The main variable of interest is *Subsidy Exp.* that is defined as the share of links to subsidized firms to total links of a bank b at time t. This variable is interacted with banks' local (county-level) asset share (Columns 1 & 4), banks' sectoral experience (Columns 2 & 5), and a savings bank indicator (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 10: 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)
Subsidy Exp.	0.0199***	0.0240	0.0236***	0.0093	-0.0043	-0.0085	-0.0023	-0.0043
	(0.0067)	(0.0178)	(0.0073)	(0.0091)	(0.0081)	(0.0233)	(0.0122)	(0.0167)
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.	17,120	3,531	7,865	5,714	17,120	3,531	7,865	5,714
N of Banks	1,202	1,056	1,192	1,138	1,202	1,056	1,192	1,138
R Sq. Within	0.711	0.701	0.350	0.688	0.237	0.180	0.226	0.178

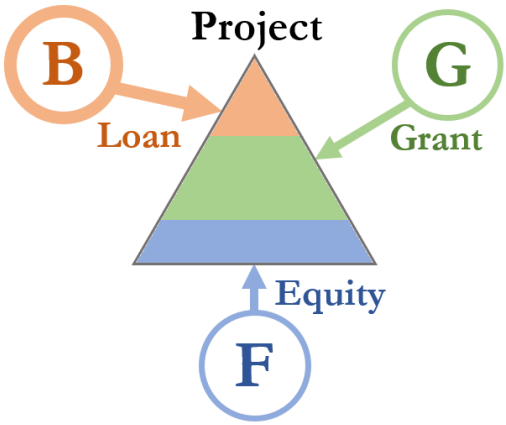
This table shows regression results where the dependent variable is *Loans* (*Log*) of bank b in year t as indicated in the table header. The sample includes German savings and cooperatives banks. The period spans from 1998 to 2019 in Column 1 and is broken down by subsidy waves by looking at subsamples. The main variable of interest is *Subsidy Exp.* that is defined as the share of links to subsidized firms to total links of a bank b at time t. 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 11: Firm-level results

	Loans (Log)	
	Average Impact	Impact Over Time
	(1)	(2)
Effect of GRW Subsidies		
D = 1	0.5735***	
	(0.1174)	
$D^{\tau=-4}$		0.1345
		(0.1137)
$D^{\tau=-3}$		0.2346**
		(0.0971)
$D^{\tau=-2}$		0.0924
		(0.0923)
$D^{\tau=0}$		0.3251***
		(0.1129)
$D^{\tau=1}$		0.1404
		(0.1169)
$D^{\tau=2}$		0.3481***
		(0.1229)
$D^{\tau=3}$		-0.1285
		(0.1204)
$D^{\tau=4}$		0.0255
		(0.1227)
$D^{\tau=5}$		0.0683
		(0.1281)
$D^{\tau=6}$		0.1524
		(0.1378)
$D^{\tau=7}$		-0.2674*
		(0.1496)
Firm FE	Yes	Yes
Time FE	Yes	Yes
N of Obs.	38,787	38,787
N of Firms	4,644	4,644
R Sq. Within	0.015	0.017

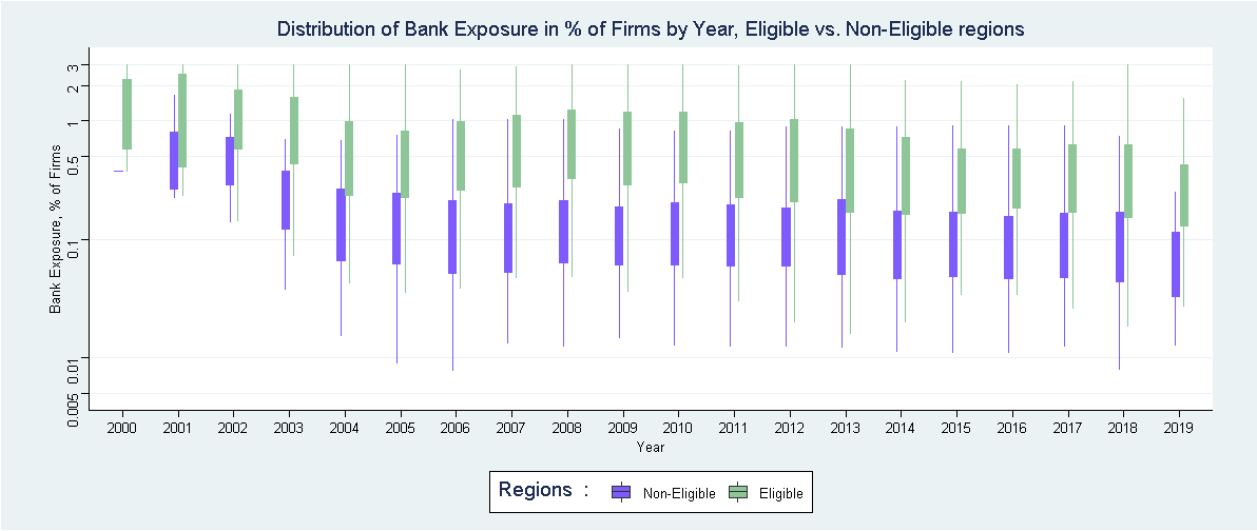
This table shows regressions where the dependent variable is *Loans* (*Log*) of firm f in year t. The sample includes German firms and spans the period from 2002 to 2020 including a treatment group of subsidized firms and a control group of firms of the same 3-digit NACE industry matched using the coarsened exact matching approach based on the values of their assets, cash ratio, capitalization and fixed assets growth as of one year before the firm received the subsidy. The main variable of interest is either D, which is a dummy turning one once a firm receives a subsidy (Column 1 – shows the estimation results for Equation 3) or D^{τ}, which is a dummy being equal to one τ years before / after a firm received a subsidy (Column 2 – shows the estimation results for Equation 4). Firm and time fixed effects are included. Standard errors are clustered at the firm level and 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



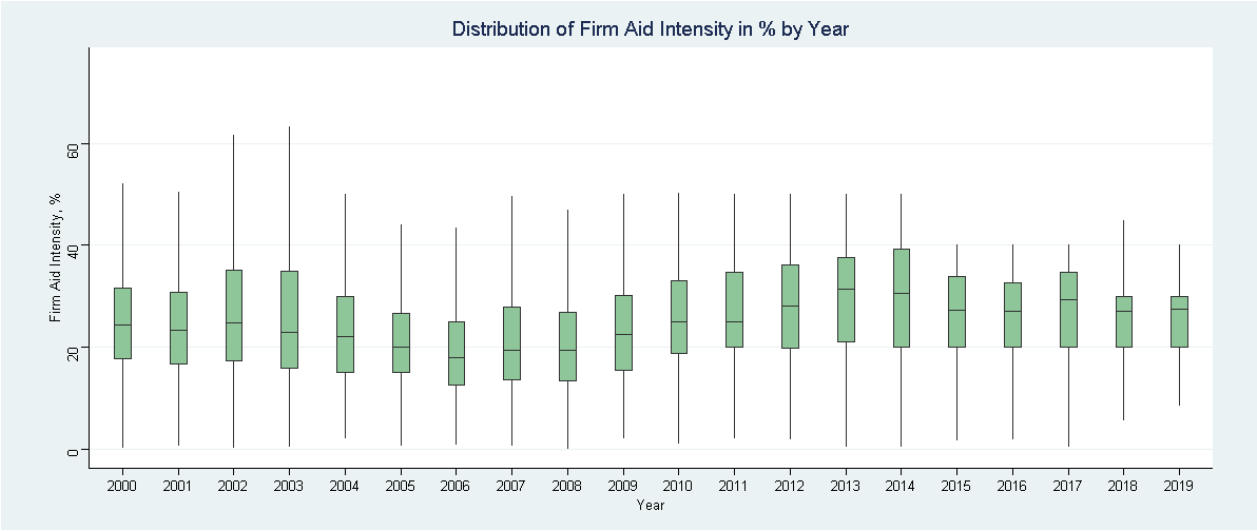
The figure illustrates how firms receiving a subsidy for an investment project might finance it. Next to the grant from the government, they might use own equity but also ask for a loan from a bank. Source: own illustration.

Figure 2: Distribution of banks' exposures to subsidized firms (in % of all firms of a bank)



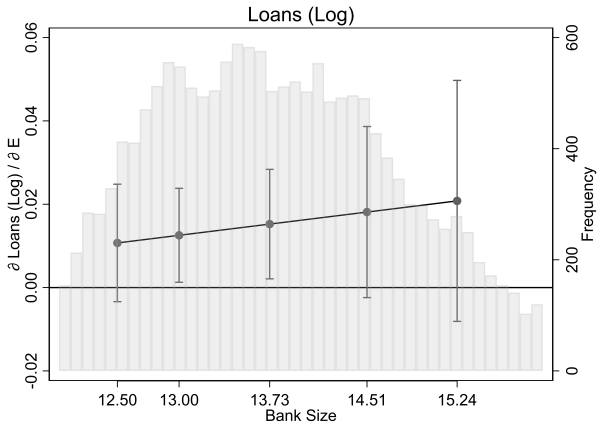
The figure illustrates how the distribution of banks' exposure to subsidized firms, defined as the number of a bank's links to subsidized firms relative to the total number of linked firms (in %), evolved over time. The figure is based on the sample of banks with a non-zero exposure to subsidized firms. The purple bars represent the distribution for banks located in regions non-eligible for the subsidy, the green bars for banks located in eligible regions. Source: own calculations, GRW, Dafne.

Figure 3: Distribution of firms' subsidies to eligible investment volume (in %)

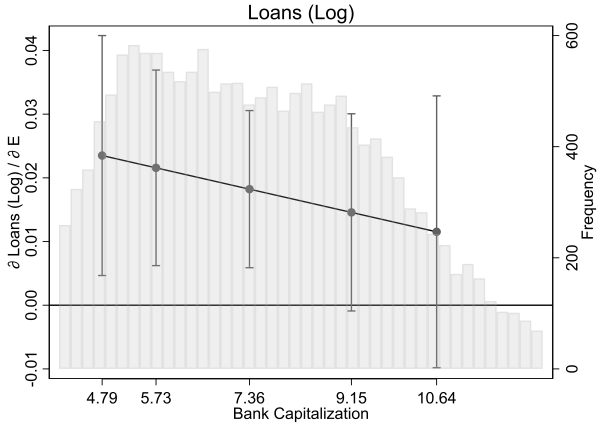


The figure illustrates how the distribution of the share of firms' subsidies in eligible investment volume (in %) or their aid intensity evolved over time. Source: own calculations, GRW.

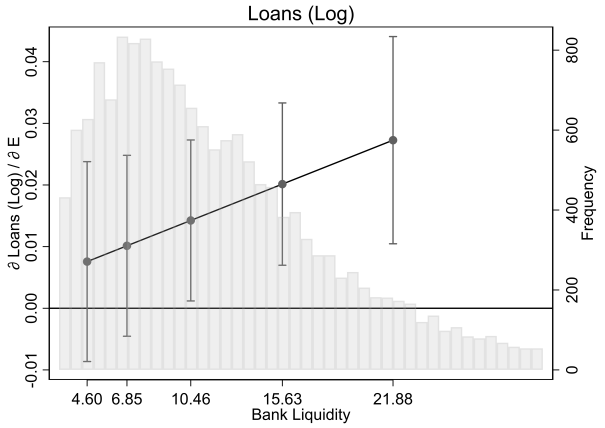
Figure 4: Marginal effects of banks' subsidy exposure depending on bank size, capitalization and liquidity



(a) Size



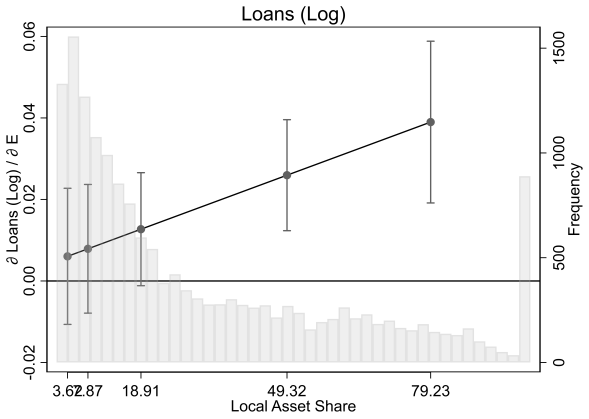
(b) Capitalization



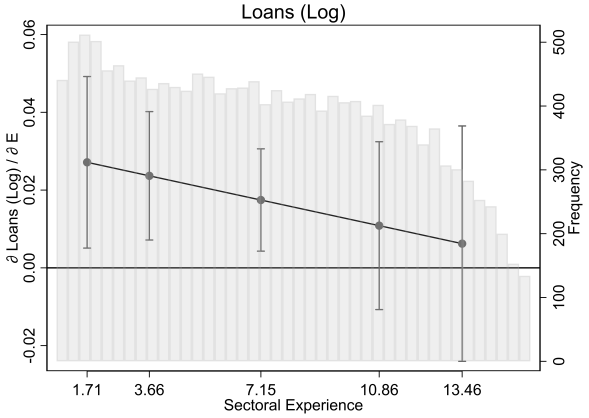
(c) Liquidity

The figures show marginal effects of the variable *Subsidy Exp.* on the dependent variable *Loans* (*Log*) (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 5: Marginal effects of banks' subsidy exposure depending on bank local asset share and sectoral experience



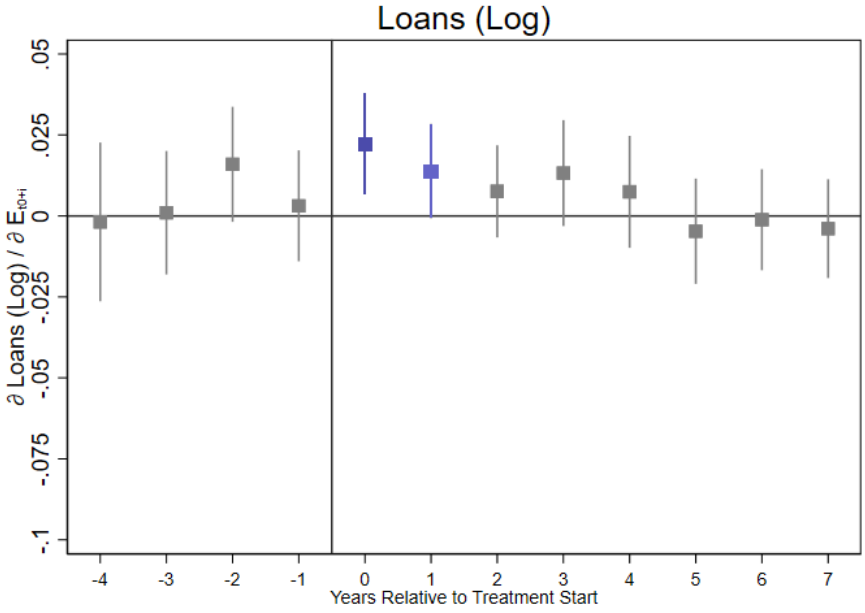
(a) Local asset share



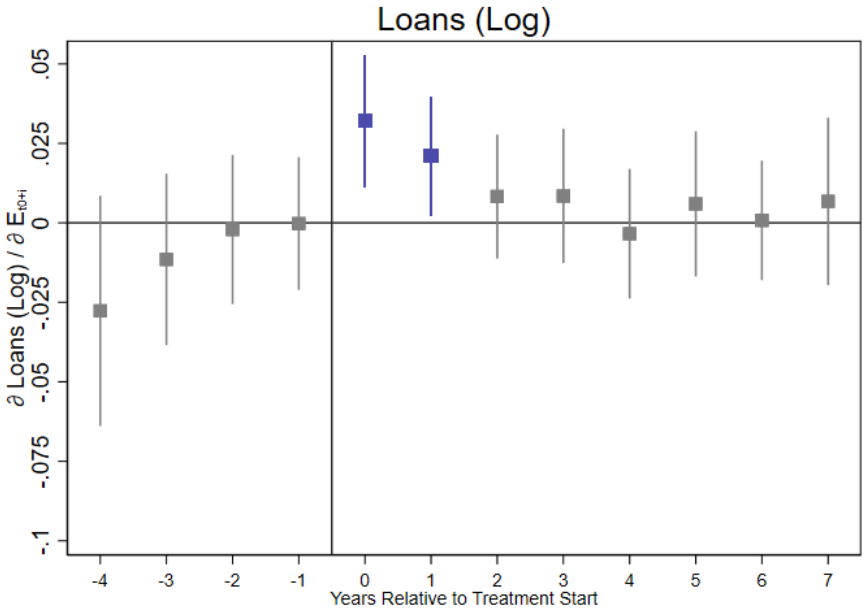
(b) Sectoral experience

The figures show marginal effects of the variable *Subsidy Exp.* on the dependent variable *Loans* (*Log*) (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 6: The effect of banks' subsidy exposure over time



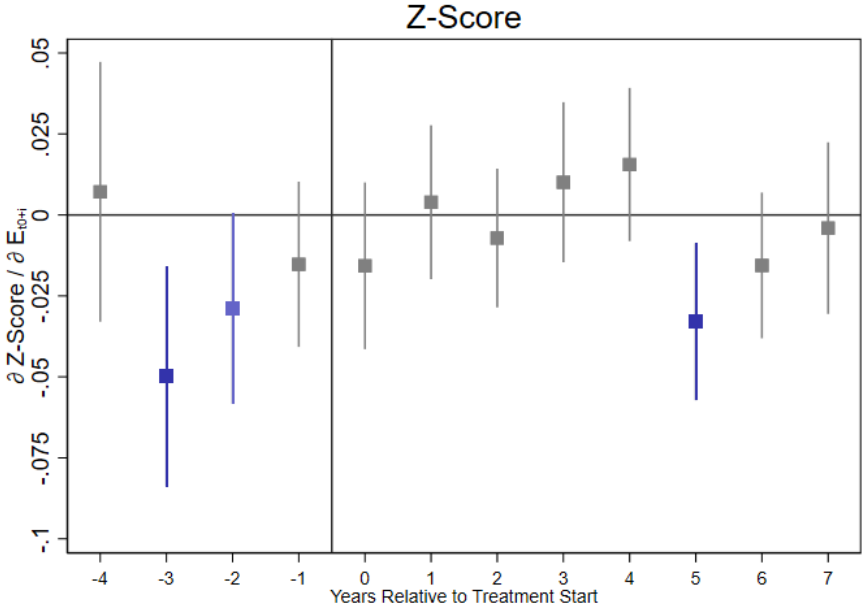
(a) Full Sample



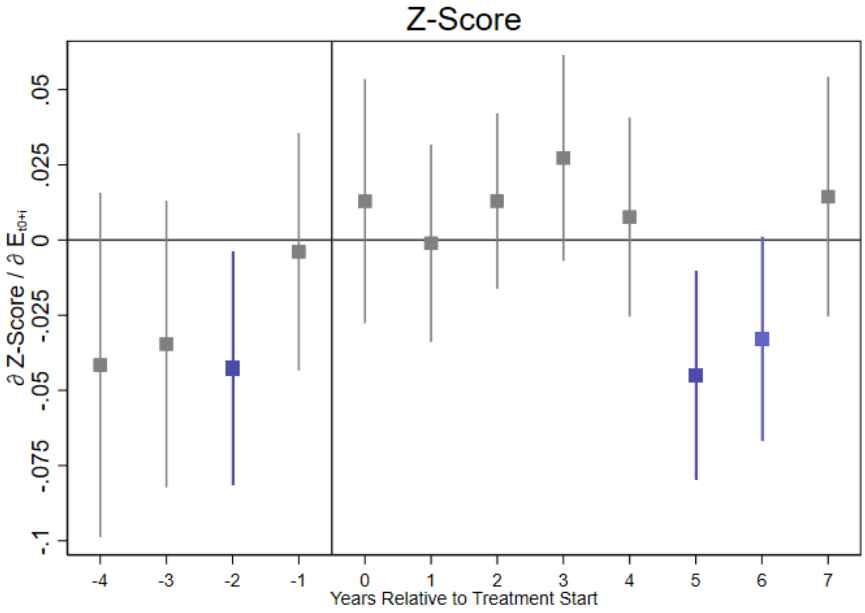
(b) Matched Sample

The figures show the effects of the variable *Subsidy* $Exp_{bt-\tau}$ (1-Year Project) over time on the dependent variable *Loans* (*Log*) based on the a) full sample and b) matched sample. The figure shows results when estimating Equation 2 and plots the coefficient estimates for the β_1^{τ} coefficient surrounded by the 95% confidence bands. The sample includes German savings and cooperative banks and spans the period from 1998 to 2019. Further controls include bank-level variables and averaged firm-level variables. Bank and state-time fixed effects are included. See Table 1 for a detailed description of every variable.

Figure 7: The effect of banks' subsidy exposure over time



(a) Full Sample



(b) Matched Sample

The figures show the effects of the variable *Subsidy* $Exp_{bt-\tau}$ (1-Year Project) over time on the dependent variable *Z-Score* based on the a) full sample and b) matched sample. The figure shows results when estimating Equation 2 and plots the coefficient estimates for the β_1^{τ} coefficient surrounded by the 95% confidence bands. The sample includes German savings and cooperative banks and spans the period from 1998 to 2019. Further controls include bank-level variables and averaged firm-level variables. Bank and state-time fixed effects are included. See Table 1 for a detailed description of every variable.

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)	13.26	13.25	-0.01
Z-Score	1.28	1.27	-0.01
Bank Controls			
Bank Subsidy Exposure	0.21	0.12	-0.16
Bank Capitalization	7.59	7.75	0.05
Bank Cost to Income	71.31	71.09	-0.02
Bank ROA	0.24	0.25	0.03
Bank Liquidity	12.12	11.37	-0.08
Bank Size	13.80	13.75	-0.04
Firm Controls			
Firm Capitalization	7.27	7.32	0.01
Firm ROA	3.92	4.08	0.06
Firm Liquidity	0.50	0.50	0.05
Firm Size	13.51	13.52	0.01

This table shows descriptive statistics by all vs. similar region 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. This means that 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: Baseline specification: Robustness checks

	Z-Score							
	Baseline	County Controls	W/o Firm Controls	1-Year Project	Eligible Regions	Matched Sample	Similar Regions	First 2 Years
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Subsidy Exp.	-0.0043	-0.0057	-0.0040	-0.0157	-0.0064	0.0117	0.0059	0.0718
	(0.0081)	(0.0083)	(0.0081)	(0.0131)	(0.0088)	(0.0108)	(0.0164)	(0.0445)
Bank Controls $(t-1)$								
Bank Capitalization	0.0078***	0.0080***	0.0078***	0.0078***	0.0058	0.0106***	0.0071	-0.0168
	(0.0027)	(0.0027)	(0.0027)	(0.0027)	(0.0047)	(0.0031)	(0.0050)	(0.0132)
Bank Cost to Income	-0.0001	-0.0001	-0.0001	-0.0001	-0.0005	0.0006	0.0003	-0.0012
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0005)	(0.0004)	(0.0005)	(0.0013)
Bank ROA	0.4400***	0.4300***	0.4409***	0.4399***	0.4261***	0.4708***	0.3772***	0.2167***
	(0.0328)	(0.0328)	(0.0329)	(0.0328)	(0.0661)	(0.0256)	(0.0343)	(0.0534)
Bank Liquidity	-0.0005	-0.0007	-0.0005	-0.0005	0.0003	-0.0012**	0.0006	-0.0038**
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0007)	(0.0006)	(0.0008)	(0.0017)
Bank Size	-0.1105***	-0.1091***	-0.1092***	-0.1107***	-0.1104***	-0.0987***	-0.0991**	-0.0596
	(0.0182)	(0.0191)	(0.0182)	(0.0182)	(0.0339)	(0.0245)	(0.0397)	(0.0673)
Firm Controls $(t-1)$								
Firm Capitalization	-0.0008	-0.0003		-0.0008	-0.0020	0.0008	-0.0000	0.0014
	(0.0014)	(0.0014)		(0.0014)	(0.0023)	(0.0017)	(0.0024)	(0.0039)
Firm ROA	0.0018*	0.0014		0.0019*	0.0011	0.0028***	0.0025*	0.0019
	(0.0010)	(0.0009)		(0.0010)	(0.0016)	(0.0010)	(0.0014)	(0.0025)
Firm Liquidity	-0.0064	0.0011		-0.0060	0.0571	0.0263	-0.0599	0.0581
	(0.0293)	(0.0298)		(0.0293)	(0.0514)	(0.0329)	(0.0479)	(0.0784)
Firm Size	0.0077	0.0065		0.0077	-0.0013	0.0024	0.0041	0.0042
	(0.0064)	(0.0063)		(0.0064)	(0.0104)	(0.0073)	(0.0122)	(0.0165)
Matched Sample	No	No	No	No	No	Yes	Yes	Yes
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	No	Yes	Yes	Yes	Yes	Yes
County Controls	No	Yes	No	No	No	No	No	No
N of Obs.	17,120	16,451	17,120	17,120	6,803	11,460	6,120	1,961
N of Banks	1,202	1,156	1,202	1,202	474	794	542	240
R Sq. Within	0.236	0.235	0.236	0.237	0.238	0.274	0.251	0.318

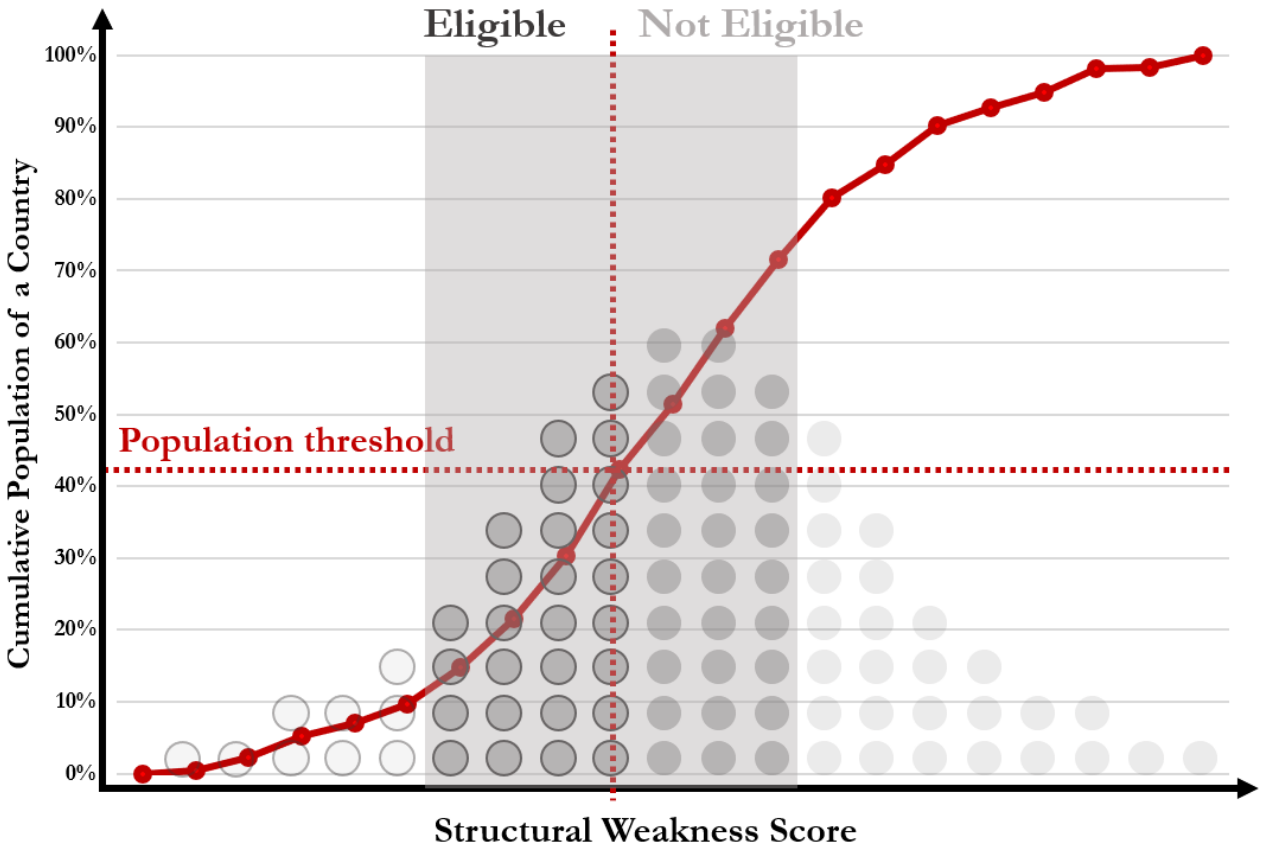
This table shows regression results where the dependent variable is *Z-Score* of bank b in year t as indicated in the table header. The sample includes German savings and cooperative banks and spans the period from 1998 to 2019. The main variable of interest is *Subsidy Exp.* that is defined as the share of links to subsidized firms to total links of a bank b at time t. Column 1 shows the baseline specification, while Column 2 also includes county controls as listed in Table 1 and Column 3 represents the baseline specification without firm controls. In Column 4, the *Subsidy. Exp.* variable is defined based on the first year of the subsidy only. Column 5 shows results when only including banks in eligible regions. Column 6 shows results when we match exposed and control banks based on the variables Capitalization, Cost to Income, ROA, Liquidity and Size. For the matched sample, in Column 7, we exclude banks located in regions with a structural weakness score in the upper or lower quartile of the distribution. In Column 8, we exclude matched pairs of banks for which an exposed bank entered the treatment later than 2 years after the start of each subsidy period (i.e. we keep those banks first exposed either in 2000, 2001, 2007, 2008, 2014 or 2015). 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 A3: Baseline specification: Robustness checks, by subsidy period

	Loans (Log)							
	Baseline	County Controls	W/o Firm Controls	1-Year Project	Eligible Regions	Matched Sample	Similar Regions	First 2 Years
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Full Sample								
Subsidy Exp.	0.0199***	0.0183***	0.0201***	0.0222***	0.0229***	0.0273***	0.0222**	0.0277*
	(0.0067)	(0.0068)	(0.0067)	(0.0079)	(0.0072)	(0.0081)	(0.0100)	(0.0143)
N of Obs.	17,120	16,451	17,120	17,120	6,803	11,460	6,120	1,961
N of Banks	1,202	1,156	1,202	1,202	474	794	542	240
R Sq. Within	0.711	0.712	0.711	0.710	0.693	0.729	0.741	0.800
Panel B: 2000 - 2006								
Subsidy Exp.	0.0263	0.0288	0.0268	0.0116	0.0317	0.0272	0.0118	0.0166
	(0.0178)	(0.0180)	(0.0174)	(0.0169)	(0.0196)	(0.0210)	(0.0290)	(0.0255)
N of Obs.	3,553	3,416	3,593	3,553	1,416	2,132	1,082	580
N of Banks	1,056	1,012	1,056	1,056	414	719	371	199
R Sq. Within	0.696	0.699	0.700	0.695	0.648	0.681	0.733	0.807
Panel C: 2007 - 2014								
Subsidy Exp.	0.0233***	0.0233***	0.0239***	0.0147*	0.0257***	0.0337***	0.0422***	0.0359**
	(0.0074)	(0.0074)	(0.0073)	(0.0085)	(0.0079)	(0.0098)	(0.0144)	(0.0166)
N of Obs.	7,878	7,562	7,887	7,878	3,102	5,389	3,002	1,189
N of Banks	1,192	1,145	1,192	1,192	468	793	442	217
R Sq. Within	0.350	0.369	0.350	0.349	0.354	0.417	0.444	0.436
Panel D: 2015 - 2019								
Subsidy Exp.	0.0094	0.0098	0.0087	0.0113	0.0140	0.0047	-0.0164	-0.0051
	(0.0091)	(0.0088)	(0.0091)	(0.0132)	(0.0091)	(0.0146)	(0.0169)	(0.0529)
N of Obs.	5,721	5,504	5,748	5,721	2,294	3,967	2,055	177
N of Banks	1,138	1,094	1,139	1,138	458	774	461	34
R Sq. Within	0.687	0.689	0.687	0.687	0.711	0.709	0.673	0.817
Matched Sample	No	No	No	No	No	Yes	Yes	Yes
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	No	Yes	Yes	Yes	Yes	Yes
County Controls	No	Yes	No	No	No	No	No	No

This table shows regression results where the dependent variable is *Loans* (*Log*) of bank b in year t as indicated in the table header. The sample includes German savings and cooperative banks and spans the period from 1998 to 2019. The main variable of interest is *Subsidy Exp.* that is defined as the share of links to subsidized firms to total links of a bank b at time t. The table presents the results for the baseline specification with (Column 1) and without (Column 2) firm controls. In Column 3, the *Subsidy. Exp.* variable is defined contemporaneously based on links to subsidized firms in the first year of the subsidy only. In Column 4, only banks located in eligible regions are included and in Column 5, a matching procedure based on the main bank controls of the baseline model is applied. 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.

Figure A1: 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 assigned to labor market regions, the lower it is, the weaker is the region. The y-axis depicts the cumulative population share in a country's total population. For Germany, this score is close to 40% across all years. All regions in the left part are eligible due to a low weakness score and because the population threshold has not yet been hit.