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Discussion Papers

No. 24
October 2022

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ISSN 2194-2188

The Effect of Firm Subsidies on Credit Markets*

First version: 26.10.2022
This version: 11.09.2024

Abstract

We use project-level information for the largest regional economic development program in German history to study how government subsidies to firms affect credit markets. We identify credit market responses by considering both, bank lending and firm borrowing during 1998-2019. We find that subsidies lead to larger lending volumes without crowding out credit to non-subsidized firms. Banks that are more exposed to subsidized firms exhibit moderately higher credit risk though. Firm subsidies support lending especially when credit constraints are elevated during the years of the financial crisis.

Keywords: bank stability, financial intermediation, government subsidies

JEL classification: G21, G28, H25

* We received most valuable feedback from Bastian Alm, Tim Adam, Max Bruche, Matthias Brachert, Stefan Eichler, Yi Huang, Agnese Leonello, Shasha Li, Melina Ludolph, Mikhail Mamonov, Camelia Minoiu, Huyen Nguyen, Felix Noth, Daniel Ostry, Oana Peia, Gregor von Schweinitz, Elizaveta Sizova, Daniel Streitz, Shuo Xia, as well as by seminar participants at the Halle Institute for Economic Research, the CEMLA 2022 conference, the 1st Humboldt-IWH Finance workshop, the EEA annual congress 2022, the Tri-City Day-Ahead Workshop on the Future of Financial Intermediation, the 29th Annual Meeting of the German Finance Association, the VfS Annual Meeting 2023, and Dublin University College. We thank Deutsche Bundesbank for funding this project in the context of its annual donation program. Special cudos to Alexander Giebler for outstanding data support. We do not have conflicts of interests. All errors are our own.

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). The (in)ability of subsidies to foster investment and employment have been studied intensively (Cerqua and Pellegrini, 2014; Ehrlich and Seidel, 2018; Brachert et al., 2019; Criscuolo et al., 2019). However, the effects on credit markets, which are pivotal to finance corporate activities, remain surprisingly unclear.[1] This gap in the literature reflects various hurdles to identify the effect of subsidies on credit markets, which we tackle in this paper.

The main obstacle is that government transfers affect the incentives and constraints subject to which firms take investment decisions, but also those of banks who screen and monitor investors that seek credit. We answer the question how firm subsidies affect credit markets therefore by studying both banks' lending choices *and* firms' borrowing decisions. Thereby, we can test for two opposing channels that can be at play. On the one hand, subsidizing projects that would have gone ahead even absent any transfer payments may distort credit markets. Subsidized corporates may replace planned borrowing with transfers, thus reducing their need for bank loans. Reversely, subsidies might also unfold a multiplier effect in credit markets, which would be accompanied by loan expansion via banks. On the other hand, subsidies can reduce the cost of capital sufficiently to turn negative net-present value projects profitable, thereby increasing aggregate investment. As long as a fraction of this additional investment is debt financed, banks could be expected to lend more. Banks that are unwilling or unable to expand total lending may re-allocate credit towards subsidized firms at the expense of non-subsidized ones. Such a mechanism would result in a crowding out of credit. We argue that it is necessary to consider *both* banks' and firms' balance sheets to separate these cases.

Another challenge is that corporate subsidies are conventionally not observable at a gran-

[1] A few papers document how loan guarantees affect credit supply and banks' risk taking (Allen et al., 2015; Wilcox and Yasuda, 2019; Bachas et al., 2021), but the effects of outright equity subsidies on credit markets are so far neglected in the literature.

ular firm level given the potential stigma associated with government support and opaque publication requirements of small and medium sized enterprises (SMEs), 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.

An important empirical 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 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. This effect is economically significant. We estimate

that an increase of banks' exposures to GRW subsidies is associated with an average 2% hike in lending. The magnitude of this loan expansion increases by approximately a quarter when considering firms, which have an arguably above average need for external funding. This main finding of an increased lending volume based on bank-level regressions also obtains from a firm-level perspective. Corporate borrowing increases significantly by 76% when realizing a subsidized project. Importantly, we do not find evidence for crowding out effects for non-subsidized firms. Subsidized firms exhibit moderately higher credit risk whereas banks' default risk is not significantly affected if they are more exposed to subsidized firms, which bodes well for financial stability.

This paper relates mainly to two 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. (2023) 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). The effects of programs in other countries 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 creditors, 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.

2 Priors and institutional background

2.1 Hypotheses and identification

A crucial reason for the inherent ambiguity how subsidies affect firm borrowing D or bank lending L is due to the missing counterfactual, which investment projects would also have been conducted without a subsidy. Suppose that only with a subsidy S the net present value of some investment I is positive, thereby also increasing aggregate investment (see, e.g., Bronzini and de Blasio, 2006; Cerqua and Pellegrini, 2014; Brachert et al., 2018a). As long as a fraction of this investment volume is financed by debt, banks might supply additional credit to such projects, thereby giving rise to what we coin the *"loan expansion hypothesis"*. But if banks mobilize this additional L by reducing their credit exposure to non-subsidized firms, we would expect to observe no (significant) loan responses on banks' balance sheets

and reduced borrowing by non-subsidized firms, D_{NS}, that are connected to the same bank.

To test the *"loan expansion hypothesis"* vis-à-vis such a *"crowding-out hypothesis"*—and other alternatives illustrated below,—requires to analyze both loans L provided by banks *and* debt borrowed by subsidized (D_S) *as well as* non-subsidized (D_{NS}) firms in response to transfer payments. To our knowledge, we are the first to conduct such a joint assessment of both sides in credit markets, lenders and borrowers. Let us fix next our priors more explicitly for cases where subsidies are allocated to positive and negative NPV projects, respectively.

The possible effects of subsidies on credit markets are even more ambiguous if we assume that supported projects would have been conducted anyways. Suppose that a firm i plans an investment project of unity size I, which is funded by a share of equity $E = \alpha I$ and bank debt $D = \beta I$, respectively. The firm executes the project if and only if the expected return from the project r_I^* exceeds the cost of capital, which equals the weighted cost of equity r_E and debt r_D, $\alpha r_E + \beta r_D$, faced in financial markets. Assuming a positive net present value project (NPV) also without the subsidy, $\alpha r_E + \beta r_D \leq r_I^*$, the initial funding structure to which we compare four cases is depicted in Panel (a) of Figure 1.

[Insert Figure 1 here]

We summarize the expected correlations between subsidy indicators and loans in both bank- and firm-level regressions in Table 1. Panel I depicts cases where we assume that the project would have been conducted also without a subsidy.

[Insert Table 1 here]

If a subsidy of $\gamma I = S$ substitutes equity as shown in Panel (b), the cost of capital are reduced for a project of given size I. Since we assume $\alpha r_E + \beta r_D < r_I^*$, the project would have been conducted anyways. Relative to this counterfactual, aggregate demand by both subsidized D_S and non-subsidized firms D_{NS} remains unaffected. Alternatively, the subsidy might neither replace E nor D, but scales the originally planned project I by S as depicted in Panel (d). In this stylized scenario, aggregate investment expands. Yet subsidies do not unfold a multiplier

effect on aggregate credit demand, which remains also in this case unaffected. Therefore, we coin these scenarios the *"irrelevance hypothesis"*. We expect neither significant relationships between subsidy exposure and observed lending in bank-level regressions nor when comparing corporate debt between subsidized and non-subsidized firms.

Panel (c) of Figure 1 illustrates the case when subsidized firms invest in projects of identical size I, but reduce leverage and demand less credit $\Delta D_S < 0$, where Δ denotes changes. More subsidies without an increase in aggregate investment spending will therefore substitute bank credit as long as loan supply L is variable. Under what we coin the *"credit substitution hypothesis"*, we thus expect to estimate negative correlations between subsidy indicators and lending in bank-level and borrowing in firm-level regressions, respectively. Alternatively, if loan supply is constant $\Delta L = 0$, banks can reallocate lending towards non-subsidized firms $\Delta D_{NS} > 0$. This alternative *"reallocation hypothesis"* would thus receive empirical support if the relationship between subsidy exposure and total corporate lending in bank-level regressions is not statistically different from zero while the relationship of corporate debt between subsidized and non-subsidized firms would exhibit a significantly negative correlation.

Panel (e) of Figure 1 depicts a scenario, in which subsidies S to profitable projects do not only unfold a multiplier effect on aggregate investment activity, but also in credit markets. In addition to the scaling effect of investment project by the amount of the subsidy, subsidized firms demand additional debt $\Delta D_S > 0$ to increase project size to $I_S > I_{NS} + S > 1$. This *"loan expansion hypothesis"* would thus entail positive correlations between both bank debt and firm borrowing with respective subsidy indicators.

Finally re-consider situations when the subsidy is necessary to turn the project profitable, i.e. $\alpha r_E + \beta r_D > r_I^* > (\alpha - \gamma) r_E + \beta r_D$, in Panel II of Table 1. This scenario implies that the subsidized project is conducted in addition to non-subsidized ones, thereby always increasing credit demand of subsidized firms $\Delta D_S > 0$. Aggregate credit market effects will depend on banks adjustments. If banks do not increase total lending, i.e. if $\Delta L^S = 0$, a project as depicted in case (b) of Figure 1 would imply that credit to non-subsidized firms

D_{NS} is reallocated to meet higher demand by subsidized ones D_S. Put differently, GRW subsidies would crowd-out lending to non-subsidized incumbent borrowers similar to the effects documented for credit guarantees that are granted to selected recipients (see, e.g., Core and De Marco, 2021; Custodio et al., 2021; Minoiu et al., 2021; Koulischer et al., 2021). Consequently, these cases would be in line with a *"crowding-out hypothesis"*. If, in contrast, banks are unconstrained and willing to provide additional lending, $\Delta L > 0$, we would again observe empirical support of the *"loan expansion hypothesis"*.

2.2 Institutional background

Our identification approach exploits the uncertainty resulting from the institutional framework to determine regional eligibility and aid intensities when jointly considering banks' lending and firms' borrowing responses to subsidies. This approach hinges on several critical data issues and assumptions: (i) an observable and relevant subsidy program; (ii) a mechanism how banks participate in the policy process, and (iii) a quasi-random allocation of subsidies to firms. We describe how the institutional features of the place-based policy that we study facilitate the identification of relationships between bank outcomes and corporate subsidies to answer the question if subsidized firms receive credit more easily.

2.2.1 The Improvement of Regional Economic Structures (GRW) program

Since 1969, GRW subsidies are a place-based policy tool in West Germany, spanning the reunified country since 1990. The declared policy objective is to reduce regional disparities in terms of employment and income by stimulating investment activity. Federal and State governments jointly funded a budget of around 68 billion Euros between 1991 and 2019, rendering the GRW the most important place-based subsidy program to foster regional development in Germany. Between 2000 and 2017, around 30% of the total investment volume in the manufacturing sector was co-funded by the GRW program in eligible regions. We observe the universe of project-specific subsidies to mostly small and medium-sized enterprises

(SMEs) for three subsidy periods: 2000-2006, 2007-2014, and 2015-2020, which we describe together with all other data in Section 3.2.[2]

Federal states ("Bundesländer") administer the operational funding process and determine access to the GRW program in several steps. First, only non-financial firms that are located in a county nested in an eligible region, which we define shortly, can apply. Second, applicants need 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 exceed 50% of the average amount of depreciation over the last three years before the application is filed to ensure that the project is sizable. Also, at least 50% of revenues need to be inter-regional. Third, 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. Whereas each GRW application undergoes a rigorous evaluation process whether the project aligns with the program targets, formal rejections are rare since applicants go through intense personal consultation with the responsible administrators of the GRW. Applications are typically approved by the government authorities when all requirements are fulfilled and the financing plan is approved by a bank. Subsidized projects usually need to be completed within three years.

2.2.2 The role of banks

Until today, a characterizing feature of the German financial system is relationship banking, where intermediaries establish close and stable ties especially with SMEs (Elsas and Krahnen, 1998; Lehmann and Neuberger, 2001; Elsas, 2005; Bersch et al., 2020). This trait is commensurate with the last step in the subsidy allocation process, which underpins that banks are an integral component of the GRW program as the government delegates the screening of qualifying investment projects partly to financial intermediaries. Applicants are mostly

[2]Formally, the second subsidy period ended in 2013, but the effective date of change was July 1, 2014. We assign the year 2014 (2015) to the period 2007-2013 (2014-2020). We do not observe firm and bank data in 2020 such that the estimation sample ends in 2019.

SMEs that can inquire with any bank to evaluate their plans, but the convention among these firms is to resort to their "Hausbank" for an assessment. For SMEs, these relationship banks are typically savings banks and cooperative banks. Ad hoc interviews with bankers and the chambers of commerce in eligible regions clearly indicated that this verification task is usually only done for incumbent customers that apply for a subsidy. Banks may offer a loan if it optimizes or adds to the funding structure of the project that the firm seeks GRW subsidies for, as illustrated in Figure 1.

Despite the integral role played by banks in the administration of the policy, outright self-selection of banks into treatment is ruled out as banks cannot apply themselves for GRW subsidies. Likewise, indirect self-selection if banks anticipated precisely, which firms will obtain GRW subsidies, is also unlikely because bank-firm relationships between SMEs and their "Hausbank" are very stable over time (Popov and Rocholl, 2018; Dwenger et al., 2020; Koetter et al., 2020).[3] We match subsidized firms with their relationship bank ("Hausbank") to gauge banks' exposure to the GRW program, which is a prerequisite for our analysis.

Since geographical proximity matters from various perspectives for our identification approach, we focus on regional savings and cooperative banks for several reasons. First, most SMEs 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 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 German banking markets has been used before to analyze bank behavior (e.g., Puri et al., 2011; Dam and Koetter, 2012; Gropp et al., 2013).

[3]We scrutinize the possible self-selection by banks into relationships with subsidized firms in Section 4.5.3.

2.2.3 Quasi-random subsidy allocation

We argue that the allocation of subsidies to firms is sufficiently hard to anticipate for firms and close-to-random for banks for three main institutional reasons: (i) the modalities how to designate regions eligible for GRW subsidies; (ii) the determination of aid intensity at the EU level, and (iii) dynamic adjustments of these modalities for subperiods of the program.[4]

Eligibility Access to state aid under the GRW program is determined at the EU level and depends on whether a labor market region (LMR) is eligible. LMRs are defined by commuting patterns rather than administrative boundaries. They are geographically larger regions than counties ("Kreise") and the administrative spatial unit for which statistical offices conventionally report economic conditions. While local firms may observe the economic state of their home county, they are generally unable to gauge the conditions of their LMR. For each of the 258 (as of 2019) LMRs, a structural weakness score (SWS) is calculated prior to each EU funding period and based on four socio-economic indicators: underemployment, gross wages and salaries, quality of infrastructure, and projected employment. Weighted individual indicators determine the final score, according to which LMRs are (inversely) ranked. Weak regions receive subsidies until the population threshold of approximately 40% is reached.[5] Thus, GRW access is arguably exogenous to individual firms and banks as both cannot anticipate if their county will be eligible for state aid.

Aid intensity is the maximum share of a subsidy permitted by the GRW program modalities in the total investment volume. This parameter is determined also per LMR, thereby adding uncertainty for firms even across eligible regions regarding the intensive margin of

[4]Analyses focusing on the causal effects of place-based programs in general (Cerqua and Pellegrini, 2014) and the GRW program in particular (Brachert et al., 2018a, 2019) oftentimes exploit the random variation in regions' eligibility statuses in a regression discontinuity design (RDD). Whereas we also find quasi-random variation of firm responses to subsidies around the structural weakness score (SWS) threshold, the loan growth of banks located around the SWS threshold does not exhibit the discontinuity needed to mobilize a RDD framework to identify causal effects. Therefore, we resort to our strategy of considering both banks' and firms' balance sheets simultaneously.

[5]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.

GRW subsidies (Brachert et al., 2018a; Siegloch et al., 2021). Aid intensities depend on firms' size and on pre-determined performance scores not only of one region, but also of all other regions within the EU. Between 2000 and 2014, subsidies could amount up to 50% of the planned investment volume for the smallest firms in the most disadvantaged regions. This ratio was at most 40% in the latest period 2015-2020.[6] Given the determination of maximum intensity relative to all EU regions, firms –and even more so their banks– cannot actively affect their treatment status.

Dynamics The aggregate volume of the subsidy program available to German firms declined over time due to the enlargement of the EU. Previously eligible regions did not rank among the most disadvantaged ones in later subsidy periods and firms in selected regions faced more difficult access to subsidies in more recent years. 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 certainty about (not) being in an eligible region, we limit the sample in robustness tests to regions facing higher uncertainty regarding future eligibility, namely those that rank from the 25th to the 75th percentiles of the structural weakness score distribution. A related concern is that banks from eligible regions might adjust their behavior during a program period. Therefore, we also study only the initial years of each funding period for robustness.

3 Methods and data

We first present the bank- and firm-level specifications used to identify credit market responses to GRW subsidies granted to firms, followed by a description of the data employed.

[6] Figure A2 shows the average aid intensity of the GRW program over the years 2000-2019 across German counties. Out of the 403 counties that exist in Germany today, 216 were eligible for GRW subsidies during the sample period at least once while 76 (140) are located in the East (West) of Germany.

3.1 Empirical specifications

3.1.1 Bank-level regressions

To test whether subsidies granted under a place-based program also ease credit market access, we begin by specifying the natural logarithm of bank b's lending volume L in year t as the dependent variable in the following panel regression model:

$$\ln L_{bt} = \beta_0 + \beta_1 Subsidy_{bt} + \beta_2 X_{bt-1}^{Bank} + \beta_3 \overline{X}_{bt-1}^{Firm} + \alpha_b + \alpha_{st} + \epsilon_{bt}. \quad (1)$$

Parameters are estimated using a sample of virtually all German savings and cooperative banks between 1998 and 2019. Standard errors are clustered at the bank level. The coefficient β_1 gauges the role of a bank's exposure to firms receiving a subsidy. The baseline specification of the variable $Subsidy_{bt}$ is the ratio of the number of links to subsidized firms relative to the number of all firm links of a bank. In the baseline model, we consider links to treated firms throughout the entire period of the subsidized investment project (three years), a choice that we scrutinize below. If a subsidized firm reports relationship links to two banks, both are considered as equally exposed to the GRW program.

The absence of a comprehensive credit register implies that we can neither observe banks' loan supply L nor corporate debt demand D directly.[7] However, we can control for observable factors that arguably affect these relationships. Although this sample of regional savings and cooperative banks is homogeneous in terms of shared business models, we use bank controls X_{bt-1}^{Bank} to account for systematically different capacities to lend and heterogeneous risk preferences. We specify bank capitalization, the management quality (cost-to-income ratio), bank profitability (return on assets), the liquidity ratio (liquid assets to total assets), and size (natural logarithm of total assets). All controls are lagged by one period to reduce si-

[7]The German central bank collects information on large exposures and aggregate borrower statistics by sector. But credit register data that permit to identify loan supply and demand as in, e.g., Portugal (Iyer et al., 2014), Uganda (Abuka et al., 2019) or Spain (Jiménez et al., 2012, 2014), are absent for the German financial system. Such data would have to contain the intensive margin of loans per bank-borrower relation without a reporting threshold as well as information on loan application rejections.

multaneity issues. Time-invariant bank traits are controlled for by bank fixed effects α_b. We gauge potential drivers of firms' loan demand D, by the same traits ($\overline{X}^{Firm}_{bt-1}$), i.e. capitalization, profitability, liquidity, and size. We average firm controls per bank b across all existing firm-relationships of each bank. 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.

3.1.2 Firm-level regressions

As discussed in Section 2.1, we test the loan expansion hypothesis vis-à-vis the alternatives summarized in Table 1 by jointly considering the effect of subsidy exposure on banks' and firms' balance sheets, respectively. To test if lending responses L among banks linked to subsidized firms are echoed by borrowed debt D responses on corporate balance sheets, we specify the mirror image to the bank-level regression specified in Equation (1) at the firm level. We explain the natural logarithm of firm f's corporate bank debt volume D in year t by estimating:

$$\ln D_{ft} = \gamma_0 + \gamma_1 Subsidy_{ft} + \gamma_2 X^{Firm}_{ft-1} + \alpha_f + \alpha_{st} + \varepsilon_{ft}. \tag{2}$$

Note that the variable $Subsidy_{ft}$ is here a binary indicator equal to one if the firm receives a subsidy and zero in the years before. We include firm (α_f) and state-time (α_{st}) fixed effects and cluster standard errors at the firm level. We estimate the parameters of Equation (2) for a sample of both subsidized and non-subsidized firms. As shown in Figure A3, subsidized firms differ from non-subsidized ones. Therefore, we match control firms by drawing on the universe of German firms covered by the database Amadeus to all firms that receive a subsidy and that we can link to Amadeus. We match by firms' 3-digit NACE industry codes to control for possible industry-level shocks and by observable traits X^{Firm}_{ft-1}, namely firm assets, capitalization, cash ratio and percentage change in fixed assets based on the values

of the year before a firm received for the first time a subsidy.[8] The matched estimation sample spans the period from 2002 to 2020 and we also specify X_{ft-1}^{Firm} as controls in a most conservative specification.

3.2 Data

Table 2 summarizes variable definitions and the 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' exposures to subsidized firms and firms' subsidy indicators. Fourth, we link subsidized firms to Amadeus to obtain firm-level variables and a sample of control firms.

[Insert Table 2 here]

Bank-level data: The bank-level analysis relies on a sample of 1,202 savings and cooperative banks in Germany from 1998 to 2019. We combine the Bankscope and Orbis Bankfocus databases using a correspondence file of variable labels provided by the vendor, Bureau van Dijk, to obtain a long history of financial accounts. To maximize coverage and availability, we switch databases in 2013 and harmonize the data in five steps. First, all monetary amounts are in Euros using annual average exchange rates. Second, we measure all level variables in thousands of Euros. Third, we only sample 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, we use unconsolidated data to gauge regional banks' choices and draw on consolidated data only if the former is unavailable. Fifth, we remove implausible observations defined as negative assets, equity or loan amounts, and ratios below 0% or above 100%. Table 3 summarizes the dependent and

[8] We omit return on assets to increase the sample size. Results are qualitatively identical when including ROA and available upon request.

control variables, which are winsorized at the 1st and 99th percentiles. Mean capital ratios are 7.3% and the natural logarithm of banks' assets amounts to 13.8.

[Insert Table 3 here]

Panel (a) of Figure 2 shows the evolution of banks' exposure to subsidized firms for those banks maintaining relationships with subsidized firms. The share of subsidized firms in banks' customer portfolios ranges between zero and 4.6%. Banks that are located in eligible regions exhibit a higher exposures to subsidized firms, which underpins the close spatial proximity between regional banks and SME borrowers. The share of subsidized firms per bank tends to be small, but Panel (b) shows that subsidized borrowers can benefit substantially from subsidies. Subsidies relative to investment volumes, or aid intensities, amount on average to 27.7% (see also Panel (a) of Table 4).

[Insert Figure 2 here]

[Insert Table 4 here]

The average share of banks that are linked to subsidized firms is a sizable 42% whereas the share of subsidized firms in banks' portfolio is small as shown by Figure 2. Panel (b) in Table 4 shows descriptive statistics for banks' exposure to subsidized firms across the 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 (section i)). 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 (section ii)). Considering only the sample of banks exposed to subsidized firms, section iii) confirms 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 in German regions driven by the EU enlargement in previous years.

Finally, Columns 4-6 of Table 3 show 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 and re-run estimations on a matched sample of exposed and non-exposed banks for robustness.

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 main relationship bank ("Hausbank") (Popov and Rocholl, 2018; Dwenger et al., 2020; Koetter et al., 2020). 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 symmetrically to optimize coverage.[9] 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. Most subsidized firms are from the manufacturing sector (60%),

[9]The Dafne database provides data from 2003 onwards and we extend the data backward such that the bank-level analysis can start in 1998. For any bank-firm pair with a shorter-than-median relationship length of the bank, we extend links backward and forward by at least three years in both directions and up to the median length.

of which half are high- or medium-high-technology firms, followed by knowledge-intensive services (17%), accommodation (11%), and other (12%) industries. We observe on a yearly basis which firms received a subsidy, the size of the subsidy, and 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, i.e. those where firm and plant location are identical, sample selection due to the funding of multi-plant firms is a subordinate issue.

On average, 2,282 projects are subsidized per year with 350,000 Euros. Around 56% of subsidized firms apply for and receive a subsidy only once. Panel (a) of Table 4 depicts more detailed breakdowns, such as the total amount of subsidies over the different periods and the number of subsidized firms. Over time, and driven by the EU enlargement, the total amount of subsidies across eligible regions declines 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 Panel (b) of Figure 2 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.

Using the record linkage method described in Brachert et al. (2018b), subsidized firms are matched to Amadeus identifiers except for micro firms, which are not covered by Amadeus. We construct historical financial accounts time series using various vintages of the database and sample all firms that maintain a link to savings or cooperative banks. All firm-level data obtained from Amadeus are winsorized at the 1st and 99th percentiles and we remove firm observations with negative assets and equity, and implausible values of ratios. Bank-level analyses employ average firm controls per bank, namely 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 approximate the performance and resulting loan demand of the average firm.

Regional controls: We observe in which county of a federal state a bank is located. To control for regional dynamics, we use state-time fixed effects. In robustness checks, we specify county-level GDP and household income expressed in growth rates as well as per capita to account for local economic dynamics at a more granular level. We also control for employment growth, population density, and the employment share of manufacturing firms. Finally, we include the structural weakness score (SWS) of the LMR to which a county belongs as this score drives regional eligibility.

4 Results

4.1 Bank lending and firm borrowing responses

Table 5 shows the estimation results pertaining to Equations (1) and (2).[10] The estimated coefficient of interest β_1 for the model with the log-levels of bank lending ($\ln L$) as the dependent variable is positive and significant for the baseline specification in Column 1. This result implies a positive average impact on bank lending due to banks' exposure to subsidized firms, which supports the *"loan expansion hypothesis"*. The effect is economically relevant. Bank lending increases by around 2% for a 1 percentage point increase in banks' exposure to subsidized firms and a one standard deviation increase in banks' subsidy exposure generates approximately 10 million Euros of additional credit on average.[11]

[Insert Table 5 here]

Columns 2 and 3 show two first-order tests to scrutinize that we only observe effects on total lending volumes, but not directly credit relationships between banks and subsidized

[10]To scrutinize whether log-levels of bank lending $\ln L$ and corporate debt $\ln D$ violate distributional assumptions underlying linear regression models, we also specify the respective variables as a share of banks' and firms' assets as dependent variables. Online Appendix Table A1 corroborates the established direction of results to that alternative specification.

[11]We calculate: 10 mln. $\approx 0.49 \times 0.208 \times 1\ 006$ mln. $= \hat{\sigma}^{Subsidy} \times \hat{\beta}_1 \times \bar{L}$. This is equivalent to 20 thousand Euros per any firm in an average bank's portfolio with an average of 520 firms per bank.

firm.[12] To focus on bank-firm links for which a credit relationship during the subsidy period is likely, we use two alternative definitions of the exposure variable $Subsidy_{bt}$. 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 is 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) or Fagiolo and Luzzi (2006), we define financially constrained firms in each year as those that are in the bottom 50% of the annual distribution by any two of the following traits: size, capitalization, asset share of cash holdings, or year-to-year turnover growth based on firms' sales. A subsidized firm's project is regarded as large if, in a given year, a firm is in the top 50% of the distribution of the investment volume to total assets ratio.

The main result holds for the alternative exposure variable definitions. In Columns 2 and 3, we estimate approximately 25% larger lending responses to these more restrictive exposure definitions. These results corroborate the notion that banks are particularly important in routing credit to firms with above average need for debt to co-finance subsidized projects.

As a last test at the bank level, we acknowledge that even within the homogeneous group of savings and cooperative banks, lending choices might differ systematically across observable traits of financial intermediaries. Beyond the specification of according control variables, we therefore construct a matched sample of banks without any exposure to subsidized firms. Specifically, 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 matching approach.[13] Results in Column 4 confirm the positive and significant effect.

[12]For comparability we hold the sample size constant in Table 5. Otherwise, estimations in Columns 1-3 would be based on up to 17,162 bank-year observations, yielding significant coefficients of similar magnitude.

[13]Specifically, we use the coarsened exact matching approach as applied by Brachert et al. (2018a) and match ever- and never-exposed banks from the same state and banking group based on capitalization, cost to income ratios, ROA, liquidity, and size. We split each of the listed variables into quartile bins. For each ever-exposed bank b we match never-exposed counterparts that belong to the same bins across all variables as bank b in the year prior to first being exposed. By 'ever-exposed banks,' 'ever-subsidized firms,' and 'ever-eligible regions,' we refer to banks that were linked to a subsidized firm, firms that received a subsidy, and

In Column 5, we investigate the flip-side of banks' lending activity by analyzing firms' demand for debt ($\ln D$). We mobilize a sample of subsidized German firms, which constitute the treatment group, that we match to a control group of firms operating in the same 3-digit NACE industry. We identify counterfactual firms using the coarsened exact matching approach based on the values of their assets, cash ratio, capitalization and fixed assets growth one year prior to receiving the subsidy.[14]

The firm-level results confirm the *"loan expansion hypothesis"*, a conclusion that was also supported by results at the bank level. The estimated coefficient of interest $\hat{\gamma}_1$ for the model with $\ln D$ as the dependent variable is positive and significant in Column 5 of Table 5. On average, subsidized firms' demand for debt increases significantly compared to non-subsidized but otherwise similar firms. Recall that the *Subsidy* variable is an indicator variable in the firm-level specifications, such that we follow van Garderen and Shah (2002) to compute the effect of the subsidy indicator variable. Receiving a GRW subsidy thus increases debt borrowed from banks by around 76%.[15] In Column 6, we saturate the specification with firm-level controls lagged by one period, and in Column 7, the specification includes state-time fixed effects as specified in Equation 2, which control, for example, for local business cycle dynamics and resulting credit demand by firms. Both tests using these tighter specifications do not alter the "loan expansion" result qualitatively.

In sum, the joint consideration of banks' and firms' balance sheets leads us to reject alternative hypotheses including the *"irrelevance hypothesis"* or the *"reallocation hypothesis"* depicted in Table 1. Exposure to GRW subsidies does neither appear to substitute for equity in conducted projects nor to merely scale up projects without affecting subsidized

regions that were eligible for the GRW program at least once during the entire sample period, respectively. Table A2 in the Online Appendix shows descriptives for the matched bank sample.

[14]Similarly to the bank sample, we apply the coarsened exact matching approach as in Brachert et al. (2018a) and match same-industry firms by the bins of listed variables.

[15]van Garderen and Shah (2002) suggest to use the following calculation in semi-logarithmic equations with the explanatory variable being a dummy variable: $100 \times (exp(\hat{\gamma}_1 - 0.5\hat{\sigma}^2 - 1)$, where $\hat{\sigma}^2$ refers to the estimated variance of $\hat{\gamma}_1$. Compared to the average level of debt, this would imply an increase by 17 thousand Euros (76% of 22 thousand Euros).

firms' borrowing. It also does not spark a reallocation of credit towards non-subsidized firms following a decline in borrowing by subsidized firms. Instead, our results support the *"loan expansion hypothesis"* and the effects summarized by Panel (e) of Figure 1. Hence, our results underpin the importance of banks in the GRW program: beyond verifying firms' applications, banks provide more loans to firms that conduct subsidized investment projects and they expand lending in regional credit markets in general.

4.2 Lending expansion or crowding-out non-subsidized borrowers?

Under the assumption that recipient firms would have conducted their projects also without a subsidy, the headline results suggest that GRW subsidies have sparked credit demand. However, if the subsidy is a necessary condition to turn a project profitable, we also hypothesized in Panel (b) of Table 1 that *additional* bank borrowing by subsidized firms might displace bank borrowing by non-subsidized firms. Such dynamics could undermine the effectiveness of the program for local development and speak in favor of the *"crowding-out hypothesis"*. The ideal test would rely on observing planned investments by non-subsidized firms that cancel their projects due to credit frictions. Such a test is infeasible because latent credit demand D is unobservable.

Instead, we test the *"crowding-out hypothesis"* indirectly from both the firm and the bank perspective. Regarding the former, we test if both subsidized and non-subsidized firms exhibit higher levels of bank debt if they are located in counties receiving more aggregate subsidies, which we coin *GRW Intensity*. The intuition of this test is simple. Suppose that more firms receive more subsidies in one eligible county compared to another eligible one. In such high *GRW Intensity* counties, it is arguably more likely that subsidies turn relatively more projects into positive NPV ones compared to low intensity counties as in Panel (b) of Table 1. If the resulting *additional* demand for debt by subsidized firms is supplied by regional banks that reduce credit extended to non-subsidized firms, we expect a negative effect of

GRW Intensity on bank debt $\ln D$ of the *non-subsidized* firms.[16] Support for the alternative *"loan expansion hypothesis"* would, in turn, imply that both higher *GRW Intensity* at the county level as well as its interaction with a firm-specific *Subsidy* indicator exert significantly positive effects on firms' bank debt $\ln D$ because both subsidized and non-subsidized firms receive more bank credit compared to firms residing in counties with a lower amount of GRW subsidies.

To operationalize this test, we augment the comparison of corporate bank debt responses (D_{ft}) to whether or not the firm received a $Subsidy_{ft}$ with two proxies of aggregate *GRW Intensity* in the county c where the firm is located and specify Equation 3:

$$\begin{aligned}\ln D_{ft} =& \delta_0 + \delta_1 Subsidy_{ft} + \delta_2 GRW\ Intensity_{ct} + \delta_3 Subsidy_{ft} \times GRW\ Intensity_{ct} \\ &+ \delta_4 X_{ft-1}^{Firm} + \delta_5 X_{ct-1}^{County} + \delta_6 \overline{X}_{ft-1}^{Bank} + \alpha_f + \alpha_t + \varepsilon_{ft}.\end{aligned} \tag{3}$$

As in Equation (2), $Subsidy_{ft}$ is a binary indicator equal to one if the firm receives a subsidy and zero in the years before. We sample only eligible counties and ever-subsidized sectors to compare subsidized to non-subsidized firms. For the firms located in these eligible counties, we estimate parameters as we are interested in the average debt demand responses of not only subsidized but especially also those many non-subsidized firms in eligible counties. To cope with the inevitably larger firm heterogeneity in this non-matched sample, we include lagged firm controls X_{ft-1}^{Firm} as before, but also add lagged county X_{ct-1}^{County} and bank controls $\overline{X}_{ft-1}^{Bank}$. The latter include capitalization, cost to income, return on assets, liquidity and size, and these variables are averaged across all banks to which a firm reports a relationship. All variables are listed and described in Table 2.

The main variable of interest is $GRW\ Intensity_{ct}$, which we measure in two variants. First, we aggregate the total amount of subsidies (in millions of Euros) allocated to a county c in year t. This variable gauges within this sample of eligible counties cross-sectional hetero-

[16] On average, the share of subsidized firms in a county during our sample period ranges from 24 to 29%. Hence, non-subsidized firms constitute the majority.

geneity pertaining to the intensive margin of government aid. Second, we count the number of subsidized firms per county to acknowledge that credit access by non-subsidized firms might suffer if more subsidized firms apply for loans at regional banks.

[Insert Table 6 here]

Column 1 of Table 6 shows the result when interacting the firm-specific subsidy indicator with the aggregate GRW volume allocated to a county. For non-subsidized firms, we estimate that an increase of total subsidies to the average eligible county by 1 million Euros *cet. par.* increases corporate bank debt by 0.8% ($\hat{\delta}_2 \times 100$). The increase in bank debt in counties with a higher subsidy intensity borrowed by non-subsidized as well as subsidized firms (reflected by the positive and significant coefficient $\hat{\delta}_3$) suggests that the GRW program unfolds a positive multiplier effect in regional credit markets. Again the positive direct effect of $GRW\ Intensity$ reflected by $\hat{\delta}_2$ paired with the significantly positive coefficient $\hat{\delta}_3$ support the *"loan expansion hypothesis"*. Additionally, this result suggests that more state aid under the GRW program is generally not crowding out corporate debt as indicated, for example, in Panel (b) of Table 1. The result in Column 2 when using the alternative proxy for $GRW\ Intensity$, i.e. the number of all subsidized firms per county, confirms the previous conclusions.

We turn next to circumstantial tests of a potential crowding out effect of non-subsidized firms from the angle of banks resembling mirror images of the tests conducted from the firm perspective. As hypothesized in Section 2 and in Table 1, the displacement of credit to non-subsidized firms hinges on additional credit demand by subsidized firms and on loan supply $L^S\ frictions$ that vary across banks. Columns 3 and 4 in Table 6 concern the latter. The first potential lending friction is bank capitalization because lower equity buffers vis-à-vis regulatory minimum requirements imply a reduced capacity to originate new loans. Thus, additional demand by subsidized firms that would not have conducted a project without additional government funds should be more likely to receive funds from better capitalized banks. A second $L^S\ friction$ pertains to sufficient shares of liquid assets, such as cash and money market assets, that banks can intermediate into loans of longer maturity. Similar to

minimum capital requirements, banks have to meet prudential liquidity requirements, such as the liquidity coverage ratio or the net stable funding ratio. Accordingly, we expect banks with larger liquidity buffers to be able to lend more to subsidized firms.

Resembling the firm perspective, we implement these tests by augmenting the bank specification in Equation (1) with an interaction term between the baseline $Subsidy_{bt}$ indicator (see Section 3.1.1) and both L^S $friction$ proxies in Equation (4):

$$\begin{aligned} \ln L_{bt} =& \phi_0 + \phi_1 Subsidy_{bt} + \phi_2 L^S\ friction_{bt-1} + \phi_3 Subsidy_{bt} \times L^S\ friction_{bt-1} \\ &+ \phi_4 X_{bt-1}^{Bank} + \phi_5 \overline{X}_{bt-1}^{Firm} + \alpha_b + \alpha_{st} + \epsilon_{bt}. \end{aligned} \tag{4}$$

For better interpretation, the L^S $friction$ proxies are demeaned. The parameter estimates of $\hat{\phi}_1$ in Columns 3 and 4 of Table 6 show hence the effect for the average capitalized or liquid bank, which confirms the significantly positive effect on bank lending if banks are exposed to a larger share of subsidized firms in their credit portfolios. For both credit supply friction proxies, and the case of banks with zero exposure to subsidized firms, the average capitalized bank tends to lend more, while the opposite is observed for liquidity. The coefficients of the interaction terms, $\hat{\phi}_3$, are either not or only marginally significantly different from zero suggesting that these frictions do not result in differential effects of the subsidy exposure on bank lending. This interpretation is supported by the total marginal effects of banks' subsidy exposure across capitalization and liquidity distributions shown in Figure 3, which always yield positive bank lending responses.

[Insert Figure 3 here]

Taken together, the results indicate that all firms residing in counties exhibiting higher subsidy activity have easier access to credit and that less constrained banks in terms of capital meet additional demand by subsidized firms without reducing lending to non-subsidized firms in their customer portfolios, thereby further corroborating the *"loan expansion hypothesis"*.

4.3 Subsidies, loan quality, and bank risk

The joint assessment of banks' and firms' balance sheets unequivocally indicates that subsidies under the GRW program unfolded a multiplier effect in local credit markets of eligible regions. However, government support of some borrowers may affect the risk-profile of banks adversely, as shown by Wilcox and Yasuda (2019) in a stylized model in which larger shares of loan guarantees increase credit portfolio risk. We therefore test if banks with more links to customers that receive GRW subsidies exhibit higher risk by estimating a variant of Equation (1), in which we replace the dependent variable with two bank risk proxies and an interaction term gauging two potential mechanisms that we discuss shortly:

$$\begin{aligned} Risk_{bt} =& \eta_0 + \eta_1 Subsidy_{bt} + \eta_2 Monitoring_{bt} + \eta_3 Subsidy_{bt} \times Monitoring_{bt} \\ &+ \eta_4 X_{bt-1}^{Bank} + \eta_5 \overline{X}_{bt-1}^{Firm} + \alpha_b + \alpha_{st} + \epsilon_{bt}. \end{aligned} \tag{5}$$

The sample and specification is identical to that described in Section 3.1.1. The first proxy for risk of bank b in year t is the share of non-performing loans (NPL) relative to total loans measured in percent. It gauges the concern that subsidies might induce banks to provide credit to projects they would not have funded otherwise, thereby increasing credit risk. The second proxy measures risk as the distance to default of the entire bank using the Z-Score. More precisely, we take the natural logarithm of $((\frac{Equity}{Assets} + ROA)/\theta_{ROA} + 1)$, where θ_{ROA} is the standard deviation of banks' return on assets which is calculated for each bank b at year t based on all the available years from T_b up to t with T_b being the first year available in the sample for bank b (Noth and Tonzer, 2017). Higher values of the Z-score reflect a lower distance to default of the bank.

[Insert Table 7 here]

Column 1 of Table 7 demonstrates that banks with a higher exposure to subsidized borrowers do also incur higher credit risk. An increase of subsidized customers as a share of all firm relationships by one percentage point increases the NPL share by 26 basis points.

This effect is moderate given an average NPL share of 2.83%.[17] The effect on total bank risk as gauged by the Z-Score is, however, not statistically affected by the presence of more subsidized credit customers, as we cannot reject $\hat{\eta}_1 = 0$ in Column 4.

A mechanism for increased bank risk is that GRW subsidies increase the equity stake of firms in a given project, which reduces banks' incentives to monitor the customer due to reduced "skin in the game". The literature on the importance of banks' screening and monitoring skills for bank lending and stability is abundant. Degryse et al. (2021) highlight that sectoral experience can have negative implications for monitoring incentives using syndicated loan data. De Jonghe et al. (2019) find for negative liquidity shocks that Belgian banks decide more positively on lending depending on their sectoral market share and experience.

Against the backdrop of this evidence, we test the effect of different *Monitoring* expertise across banks on risk. We specify an interaction term between GRW subsidy exposure and *Monitoring* expertise in Equation (5) which are measured by two variables that approximate local and sector expertise. The former is measured by a bank's local asset share within a county. The latter 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. We again demean the proxies for monitoring expertise for the ease of interpretation.

Columns 2 and 3 of Table 7 show that a higher local asset share increases loan quality mildly, yet significantly whereas sector expertise has no direct effect on NPL shares. These weak effects do also not differ significantly across banks that are more or less exposed to subsidized borrowers, as indicated by the interaction terms $\hat{\eta}_3$. Columns 5 and 6 indicate that bank stability benefits from both local and sector expertise as both direct terms are significantly positive. The coefficients for both direct as well as interacted *Subsidy* variables are, in turn, not statistically different from zero. This result bodes well for possible concerns that subsidies may undermine bank stability. Whereas loan quality apparently deteriorates,

[17] A one standard deviation increase in the subsidy exposure implies an increase in the NPL share by 0.06 standard deviations: $0.06 \approx (0.49 \times 0.2616) \ / \ 2 = (\hat{\sigma}^{Subsidy} \times \hat{\eta}_1)/\hat{\sigma}^{NPL\ Sh.}$.

possibly an inevitable side-effect of expanding credit also to some borrowers that would not have obtained credit without the subsidy program, this additional credit risk does not seem to jeopardize bank stability as a whole.

4.4 Lending response dynamics

The GRW program spans multiple business cycles and the sample period includes a number of extreme events, such as, for example, the financial crisis. Therefore, we scrutinize in particular whether bank lending results differ across the three different subsidy periods. The first period from 2000 to 2006 exhibits the highest subsidy amounts as shown in Panel (a) of Table 4. The second period between 2007 and 2014 features the highest share of exposed banks in the sample. The third period ranges from 2015 to 2019 and exhibits declining aid intensities in Germany due to the EU enlargement and an improved ranking of German regions vis-à-vis other EU regions. Coincidentally, the different subsidy periods align with different business cycle periods, i.e., expansion versus financial and sovereign debt crisis.

[Insert Table 8 here]

Results for the subsamples are shown in Table 8. Column 1 replicates the baseline result for the full sample and Columns 2 through 4 correspond to the three subsidy periods. Whereas the coefficient of interest is qualitatively identical across all subsamples, a precise point estimate for the positive effect on loan volumes only obtains for the subperiod 2007–2014 in Column 3. This result might reflect the largest share of exposed banks in this period and the lifting of financing constraints during the crisis years due to the subsidy program.

To zoom into the crisis years, we augment the baseline setup with an interaction of the *Subsidy* variable and a set of yearly dummies in Column 2 of Online Appendix Table A4. Columns 3-10 consider the differential effect of each year separately by introducing an interaction with a year dummy being equal to one for year t and zero otherwise. The results in Column 2 confirm the average positive impact of banks' subsidy exposure on bank lending

in the reference year, 2007, which is mitigated in 2009, 2010, and 2013. This finding might indicate negative repercussions of the economic downturn due to the crisis. When considering differential effects of selected years compared to the average effect, banks linked to subsidized firms increased their lending more in 2012. In 2013 – a year of low economic growth – we estimate the opposite effect. These results complement Anginer et al. (2014), who find that the guarantee implied by deposit insurance increases bank risk in good times but supports banks during crises. In our setting, firm subsidies support lending during a period including the financial crisis without impairing bank stability.

Next, we account for the fact that lending effects of subsidies might build up over time. 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 $Subsidy_{bt-\tau}$. Thereby, we test for lending dynamics around the time when banks get exposed to subsidized firms. We estimate 12 variants of the baseline model in Equation (1) for $Subsidy^{\tau}_{bt-\tau}$ with $\tau \in \{-4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7\}$:

$$\ln L_{bt} = \beta_0 + \beta_1^{\tau} Subsidy^{\tau}_{bt-\tau} + \beta_2 X^{Bank}_{bt-1} + \beta_3 \overline{X}^{Firm}_{bt-1} + \alpha_b + \alpha_{st} + \epsilon_{bt}, \tag{6}$$

such that $\tau = 1$ refers to the coefficient estimate if we lag the exposure variable by one year, and so on. We plot $\hat{\beta}_1$ for the different leads and lags of τ in Figure 4. We estimate the model using the full sample.[18] The left-hand side of Figure 4 shows that the increase in loans is temporary and tappers off after two years, which is in line with the three year deadline during which subsidized firms need to realize the project.

[Insert Figure 4 here]

We then turn to analyze corporate firms' borrowing dynamics by estimating, similar to

[18]Results based on the matched sample are virtually identical and available upon request.

Equation (2) specified in section 3.1.2, the time-varying effect of receiving a subsidy:

$$\ln D_{ft} = \gamma_0 + \sum_{\tau=-4;\tau\neq-1}^{7} \gamma_1^{\tau} Subsidy_{ft-\tau} + \gamma_2 X_{ft-1}^{Firm} + \alpha_f + \alpha_t + \varepsilon_{ft}. \quad (7)$$

where $Subsidy_{ft+\tau}$ 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 right-hand panel of Figure 4 shows the according lead- and lag-specific parameter estimates for firms' borrowing responses to receiving a subsidy obtained from the matched firm sample. These estimates reveal a positive impact on borrowing compared to the reference period 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. 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.

4.5 Limitations, concerns, and further tests

4.5.1 Do GRW eligibility determinants confound bank lending responses?

The location of firms in counties that are nested in eligible LMRs is not independent of regional economic characteristics. A resulting concern is then that the change in observed bank lending is due to underlying structural characteristics that co-determine eligibility rather than by the exposure to subsidized firms. As a first scrutiny check, we therefore compare bank outcomes and controls used in the bank-level regression across banks in all counties to banks in counties ranked between the 25th and the 75th percentiles of the structural weakness score. Applying the latter restriction implies that we exclude regions where it is relatively certain that firms will or won't be eligible. Online Appendix Table A3 reveals that observable traits in this sample of similar regions do not differ significantly from traits in the

full sample.

Next, we scrutinize the concern of confounding factors when explaining log-lending $\ln L$ at the bank-level in Online Appendix Table A5. Column 1 replicates the baseline result. To control for local economic dynamics that might affect bank lending directly, we include in Column 2 the county-level controls described in Section 3.2. The coefficient of interest as well as the coefficients of virtually all control variables are unaffected regarding direction, significance, and practically magnitude.

To further trace out potentially confounding effects due to banks being located in dissimilar regions, we consider the matched sample and include in Column 3 only banks that are located in eligible counties, that is where firms have access to the subsidy program. In Column 4, we also consider the matched sample and banks in eligible regions and, in addition, keep only banks 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 banks located in counties ranking among the 25th and 75th percentiles of the distribution of the structural weakness score as in Online Appendix Table A3. Across all these specifications, the main results remain intact.

In sum, we find little indication that regional macroeconomic conditions that co-determine eligibility confound the effect of subsidy exposure on bank lending documented until here. In fact, this result is not too surprising given the institutional determination of the program's modalities. Next, we scrutinize the role of firm controls and the dynamics of measuring subsidy exposure.

4.5.2 Bad controls, timing subsidized investments, and GRW periods

In Column 5, we exclude the firm-level controls as they showed limited evidence for having an impact and might, in fact, represent bad controls. In Column 6, 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 both specifications, the coefficient of interest remains significant. Omitting firm controls or focusing on the first years of the link to

subsidized firms increases the estimate. This result might indicate that firm controls gauging credit demand are relevant to include in order 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.

Next, we account for the long time span of each subsidy period and possible adjustment effects in Column 7. We sample only 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.[19] The coefficient for banks' exposure to subsidized firms remains qualitatively similar but cannot be estimated precisely given the much lower sample size.

4.5.3 Selection bias: do banks anticipate treatment?

Whereas banks cannot directly self-select into treatment, concerns about selection bias could arise if banks systematically establish relationships with subsidized firms. Whereas the practice of SMEs to approach their relationship bank for the evaluation of the financing plan mitigates such concerns, we conduct various scrutiny tests to this end, which are available upon request.

As a first test, we estimate the likelihood of observing a credit relationship between any bank b and any firm f in any year t during the entire sample period. For this panel of approximately 34 million observations pertaining to approximately 2.3 million distinct bank-firm pairs, the share of within variation in the likelihood of observing a relationship explained by the relationship status in the previous year is almost 40%. Likewise, the discriminatory power of a panel logistic regression is very high, exhibiting an Area under the ROC curve of 0.799 for a model with past relationships lagged by one and three years, respectively. Thus, contemporaneous bank-firm links depend very largely on whether the tie existed already before.

[19] 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. If this is the case, we include the years 2000-2004 in the estimations.

As a second test, we focus more explicitly on newly formed connections from the perspective of both banks and firms. Regarding banks, we regress the eligibility status of a bank's home county together with lagged bank and firm controls as well as state-time and bank fixed effects on the number of newly formed firm relationships, without finding a statistically significant effect. From the perspective of firms, we replace the dependent variable in Equation (7) with the number of new links to banks and estimate on the matched firm sample the parameters for leads and lags of $Subsidy_{f,t+\tau}$. None of these parameters is statistically different from zero.

In sum, we find no evidence that would suggest that banks systematically seek to enter relationships with firms that are subsidized.

5 Conclusion

Industrial policies have recently gained in importance also in advanced economies. While the effects of government subsidies on firm investment and employment have been extensively studied, we contribute to the literature by providing evidence on the role of subsidies for credit market outcomes. Our sample spans the universe of German regional banks from 1998 to 2019, and we link these banks to mostly smaller and medium-sized enterprises with which they maintain a relationship link. By drawing on information regarding firms' access to the most important place-based program over recent decades, we not only know which firms received a subsidy but also the exposures of banks to subsidized firms.

Based on this extensive bank-firm level dataset, we analyze both banks' lending side as well as the mirror image, namely firms' borrowing side, to evaluate credit market outcomes in the presence of government subsidies to non-financial firms. The institutional setting of the subsidy program contains exogenous elements, most importantly the determination of eligible regions at the EU level and dynamic adjustments regarding subsidy intensity, which help to reduce confounding factors, next to controlling for local demand side conditions.

We find that banks that are more exposed to subsidized firms exhibit a significant increase in loan volumes. While there is weak evidence for a deterioration of banks' credit portfolio, overall bank stability remains unaffected if banks are more exposed to subsidized firms. 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 but without crowding out credit to non-subsidized firms. The significant increase observed for both bank lending and borrowing by subsidized firms suggests that firms conduct the investment project due to a combination of subsidies and bank lending. While we focus on partial equilibrium effects of state aid in credit markets, future research could assess welfare implications of positive spillovers from place-based subsidies on both firms (direct channel) and banks (indirect channel), which arise in the longer run.

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Tables

Table 1: Hypotheses and associated correlations in bank- and firm-level regressions

Hypothesis	*Case*	Banks	Subsidized firms		Non-subsidized firms	
		Lending L	Debt D_S	Investment I	Debt D_{NS}	Investment I
Panel I: Positive NPV compared to case (a) in Figure 1 without subsidy S						
Irrelevance	(b)	0	0	1	0	1
Substitution	(c)	-	-	1	0	1
Reallocation	(c)	0	-	1	+	1
Irrelevance	(d)	0	0	> 1	0	1
Expansion	(e)	+	+	> 1	0	1
Panel II: Negative NPV compared to no investment I without subsidy S						
Crowding out		0	+	1	-	0
Expansion		+	+	1	0	0

Notes: This table shows the expected correlations between subsidy indicators and lending L in bank-level regressions and borrowing D in firm-level regressions for each of the hypotheses developed in Section 2. The columns distinguish banks, subsidized, and non-subsidized firms for each of the associated cases regarding funding structure and investment volume I depicted in Figure 1. The symbols "0/+/-" indicate no/positive/negative significant changes in response to subsidies in bank- and firm-level regressions, respectively. Panel I summarizes hypotheses if investment projects are also profitable without subsidies, thus formulating expected differential effects relative to case (a) in 1. Panel II summarizes hypotheses if projects are only conducted if firms receive a subsidy, as indicated in the last column of this table, which therefore apply to all cases depicted in Figure 1.

Table 2: Variable description

Variable	Description	Source
Bank-Level Regressions		
Dependent variables:		
$\ln L$	Natural logarithm of loan volume (loans in thousands of EUR)	Bankfocus
NPL Share	Ratio of non-performing to total loans (in %)	Bankfocus
Z-Score	$\ln\left(\left(\left(\frac{\text{Equity}}{\text{Assets}}+\text{ROA}\right)/\theta_{\text{ROA}}\right)+1\right)$ where ROA is return on assets and θ_{ROA} is calculated for each bank b at year t based on all the available years from T_b up to t with T_b being the first year available in the sample for bank b	Bankfocus
Bank controls:		
Subsidy_b	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
Capitalization	Ratio of equity to total assets (in %)	Bankfocus
Cost to Income	Cost to income ratio (in %)	Bankfocus
ROA	Return on assets (in %)	Bankfocus
Liquidity	Ratio of liquid assets to total assets (in %)	Bankfocus
Size	Natural logarithm of total assets (assets in thousands of EUR)	Bankfocus
Local Asset Share	Ratio of assets to total assets of banks from the same county (in %)	Bankfocus
Sectoral Experience	Weighted average of the relationship lengths of a bank with the sectors it is linked to (in number of years). Sectors are defined along the 2-digit NACE codes. 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:		
Capitalization	Average $\frac{\text{Equity}}{\text{Assets}}$ (in %) of firms to which bank b is linked at time t	Amadeus
ROA	Average ROA (in %) of firms to which bank b is linked at time t	Amadeus
Liquidity	Average $\frac{\text{Current Assets - Current Liabilities}}{\text{Assets}}$ (in %) of firms to which bank b is linked at time t	Amadeus
Size	Average ln Assets of firms to which bank b is linked at time t	Amadeus

Table 2: Variable description – continued

Variable	Description	Source
Bank-Level Regressions		
County controls:		
GDP p.c./ Growth	GDP per capita (in thousands of EUR) or growth (in %)	Destatis
Income p.c./ Growth	Household income per capita (in thousands of EUR) or growth (in %)	Destatis
Employment Growth	Employment growth (in %)	Destatis
Population Density	Population density	INKAR
Manufacturing Share	Employment share in the manufacturing sector (in %)	Destatis
SWS	Respective labor market region's "structural weakness score" (SWS)	GRW
Firm-Level Regressions		
Dependent variables:		
$\ln D$	Natural logarithm of corporate bank debt (in thousands of EUR)	Amadeus
Treatment variables:		
Subsidy_f	A dummy turning one if the firm received a subsidy and zero before that	GRW, Amadeus
Matching variables:		
Capitalization	Ratio of equity to total assets (in %)	Amadeus
Cash Ratio	Ratio of cash holdings to total assets (in %)	Amadeus
Size	Natural logarithm of total assets (assets in thousands of EUR)	Amadeus
Fixed Assets Growth	Growth rate of fixed assets (in %)	Amadeus
Firm controls:		
Capitalization	Ratio of equity to total assets (in %)	Amadeus
Cash Ratio	Ratio of cash holdings to total assets (in %)	Amadeus
Size	Natural logarithm of total assets (assets in thousands of EUR)	Amadeus
GRW intensity at county level:		
Total amount of subsidies	Total amount of GRW subsidies granted in county c in which firm f is located and at time t in millions of EUR	GRW
Number of subsidized firms	Number of firms that received GRW subsidies in county c in which firm f is located and at time t	GRW

Table 3: Descriptives

	N Obs. Full Sample (1)	Mean Full Sample (2)	SD Full Sample (3)	Mean Non-exposed (4)	Mean Exposed (5)	Normalized Difference (6)
Bank-Level Regressions						
Dependent variables:						
$\ln L$	17,120	13.25	1.07	13.08	13.51	0.29 *
NPL Share	7,337	2.83	2.04	2.73	3.00	0.09
Z-Score	17,120	1.28	0.47	1.29	1.26	-0.04
Treatment variables:						
Subsidy_b	17,120	0.21	0.49	0.00	0.55	0.83 *
Bank controls:						
Capitalization	17,120	7.30	2.28	7.41	7.13	-0.09
Cost to Income	17,120	71.06	9.49	70.94	71.24	0.02
ROA	17,120	0.25	0.18	0.27	0.22	-0.19
Liquidity	17,120	12.32	7.22	11.75	13.23	0.14
Size	17,120	13.77	1.03	13.56	14.11	0.39 *
Local Asset Share	17,120	31.05	29.15	15.73	36.20	0.57 *
Sectoral Experience	17,120	7.40	4.34	6.97	3.32	-0.83 *
Savings Bank Dummy	17,120	0.39	0.48	0.14	0.41	0.44 *
Firm controls:						
Capitalization	17,120	7.57	3.22	7.50	7.70	0.04
ROA	17,120	3.83	2.13	4.00	3.55	-0.16
Liquidity	17,120	0.49	0.11	0.50	0.48	-0.15
Size	17,120	13.54	0.71	13.60	13.44	-0.17
County controls:						
GDP Growth	16,451	2.84	3.67	2.91	2.73	-0.04
Income Growth	16,451	2.56	2.11	2.64	2.44	-0.07
Employment Growth	16,451	0.78	1.26	0.87	0.64	-0.13
GDP p.c.	16,451	30.80	12.52	31.95	28.94	-0.17
Income p.c.	16,451	23.77	4.96	25.04	21.71	-0.50 *
Population Density	16,451	0.43	0.57	0.42	0.46	0.06
Manufacturing Share	16,451	29.07	8.40	30.03	27.52	-0.21
SWS	16,451	100.06	0.73	99.92	99.51	-0.71 *
Firm-Level Regressions						
Dependent variables:						
$\ln D$	38,787	3.11	5.54	2.44	3.76	0.17
Matching & control variables:						
Capitalization	34,816	8.14	13.18	8.72	7.73	-0.05
Cash Ratio	34,816	15.75	17.91	17.45	14.15	-0.13
Size	34,816	14.63	1.64	14.54	14.69	0.06
Fixed Assets Growth	34,377	14.00	50.00	11.00	17.00	0.09

This table shows summary statistics of the dependent and control variables used in the baseline models of bank- and firm-level regressions (Columns 1-3) and compares the mean values by exposure status (Columns 4-6). For bank-level regression, Column 4 shows mean values for control group banks and Column 5 for exposed banks for which the variable Subsidy_b is larger than zero. In case of firms, exposure refers to firms with an approved subsidy (Subsidy_f being 1) and the sample of unexposed firms contains those that are matched to exposed (i.e. subsidized) ones. Column 6 depicts the normalized difference in means between exposed and unexposed. In Column 6 * indicates the cases with normalized difference larger than 0.25 in magnitude (Imbens and Wooldridge, 2009). See Table 2 for a detailed description of every variable.

Table 4: Subsidy program size and banks' exposure

	Subsidy periods			
	2000-2006	2007-2014	2015-2020	2000-2020
Panel (a): Program characteristics				
Average maximum aid intensity (%)	36.0	38.7	29.1	34.1
Total amount of subsidies (bil. EUR)	9.3	7.2	1.1	17.6
Average amount of subsidies (bil. EUR)	1.3	0.9	0.2	0.8
Number of subsidized firms	21,652	17,542	8,884	48,078
Estimation sample	12,043	11,492	6,236	29,771
Average actual aid intensity (%)	26.2	30.1	26.8	27.7
Estimation sample	26.1	30.3	27.7	28.0
Panel (b): Bank exposure measures				
i) Average number of exposed banks per year				
Baseline	139	504	342	831
Eligible regions	101	333	248	485
Non-eligible regions	38	171	94	346
ii) Average share of exposed banks to all banks per county				
Baseline	30	53	43	42
Eligible regions	51	81	71	68
Non-eligible regions	11	25	16	17
iii) Average subsidy exposure per year in %				
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
Financially constrained and large projects	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 the intensity of treatment by the GRW program in general (Panel (a)) and at the bank level (Panel (b)). Panel (a) shows descriptive statistics for the subsidy program by the three subsidy periods and 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 and for our estimation 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. Panel(b) shows descriptive statistics for banks' exposure to the subsidy program for each of the three subsidy periods and for the period 1998-2019. In section i), the first three rows show the average number of banks exposed to subsidized firms for the baseline sample, and for the sample of banks located in eligible or non-eligible regions. In section ii), the following three rows show the average share of exposed banks relative to all banks per counties. In section iii), the remaining rows show the average exposure of banks in any given year to subsidized firms based on 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 financially constrained and have large investment volumes or experience an increase in borrowing.

Table 5: Bank lending and corporate borrowing in response to GRW subsidies

	Bank lending: $\ln L$				Corporate borrowing: $\ln D$		
	Baseline	Financially Constrained & Large Project	Increased Borrowing	Matched	Matched	Matched	Matched
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Subsidy	0.0208***	0.0247**	0.0252***	0.0271***	0.5735***	0.3192***	0.5175***
	(0.0066)	(0.0123)	(0.0087)	(0.0081)	(0.1174)	(0.1219)	(0.1355)
Bank Controls $(t-1)$							
Capitalization	0.0050**	0.0050**	0.0050**	0.0003			
	(0.0022)	(0.0022)	(0.0022)	(0.0026)			
Cost to Income	-0.0005**	-0.0005**	-0.0005**	-0.0000			
	(0.0002)	(0.0002)	(0.0002)	(0.0002)			
ROA	0.0037	0.0035	0.0034	0.0029			
	(0.0097)	(0.0098)	(0.0097)	(0.0117)			
Liquidity	-0.0046***	-0.0046***	-0.0046***	-0.0045***			
	(0.0004)	(0.0004)	(0.0004)	(0.0004)			
Size	0.7849***	0.7855***	0.7848***	0.7853***			
	(0.0127)	(0.0127)	(0.0127)	(0.0149)			
Firm Controls $(t-1)$							
Capitalization	-0.0012	-0.0013	-0.0013	-0.0003		0.0077**	0.0086**
	(0.0008)	(0.0008)	(0.0008)	(0.0010)		(0.0037)	(0.0037)
ROA	-0.0011*	-0.0011*	-0.0011*	-0.0007			
	(0.0006)	(0.0006)	(0.0006)	(0.0006)			
Liquidity	-0.0017	-0.0006	-0.0021	-0.0231		-0.0146***	-0.0150***
	(0.0178)	(0.0179)	(0.0178)	(0.0184)		(0.0022)	(0.0021)
Size	-0.0032	-0.0031	-0.0032	-0.0013		0.6450***	0.6486***
	(0.0040)	(0.0040)	(0.0040)	(0.0053)		(0.0791)	(0.0784)
Firm FE	No	No	No	No	Yes	Yes	Yes
Time FE	No	No	No	No	Yes	Yes	No
State-Time FE	Yes	Yes	Yes	Yes	No	No	Yes
Bank Controls	Yes	Yes	Yes	Yes	No	No	No
Firm Controls	Yes	Yes	Yes	Yes	No	Yes	Yes
N of Obs.	17,120	17,120	17,120	11,460	38,787	34,816	34,816
N of Banks	1,202	1,202	1,202	794			
N of Firms					4,644	4,603	4,603
R Sq. Within	0.711	0.710	0.711	0.729	0.015	0.025	0.046

This table shows regression results where the dependent variable is either $\ln L$ (natural logarithm of loans) of bank b in year t (Columns 1-4) or $\ln D$ (natural logarithm of corporate bank debt) of firm f in year t (Columns 5-7). The two samples are German savings and cooperative banks for the period from 1998 to 2019 (Columns 1-4) including a matched sample in Column 4; and German non-financial subsidized firms with one matched non-subsidized counterpart for each for the period from 2002 to 2020 (Columns 5-7). The main variable of interest is *Subsidy*, which is either the share of subsidized firms among all links of bank b in year t (defined as the share of links to a) all subsidized firms (Column 1), b) subsidized firms that are financially constrained and have a project of large investment volume (Column 2), and c) subsidized firms that experience an increase in borrowing in a given year (Column 3)), or a dummy being 1 in the years after a firm f received a GRW subsidy and 0 otherwise (Columns 5-7). Further controls include bank-level and averaged firm-level variables of bank b in year $t-1$ (Columns 1-4) or firm-level variables of firm f in year $t-1$ (Columns 6-7). Bank and state-time fixed effects are added in bank-level regressions (Columns 1-4) and firm and time fixed effects are added in firm-level regressions in (Columns 5-6), while state-time fixed effects are added in Column 7. Standard errors are clustered at the bank and firm levels, respectively, and given in parentheses. ***, **, * indicate significance at the 1%, 5%, 10% level.

Table 6: Loan expansion versus crowding-out of non-subsidized borrowers

	Corporate borrowing: $\ln D$		Bank lending: $\ln L$	
Subsidy interacted with:	Total Subsidies	# of Subsidized Firms	Capitalization	Liquidity
	(1)	(2)	(3)	(4)
Subsidy	0.3451***	0.3617***	0.0165***	0.0172***
	(0.1003)	(0.1062)	(0.0063)	(0.0066)
GRW Intensity	0.0082**	0.0060***		
	(0.0038)	(0.0019)		
Subsidy × GRW Intensity	0.0096*	0.0034		
	(0.0053)	(0.0030)		
L^S Friction			0.0057**	-0.0050***
			(0.0022)	(0.0004)
Subsidy × L^S Friction			-0.0035	0.0010*
			(0.0028)	(0.0005)
Bank FE	No	No	Yes	Yes
Firm FE	Yes	Yes	No	No
Time FE	Yes	Yes	No	No
State-Time FE	No	No	Yes	Yes
Bank Controls	No	No	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	No	No
N of Obs.	338,912	338,912	17,120	17,120
N of Banks			1,202	1,202
N of Firms	57,882	57,882		
R Sq. Within	0.028	0.028	0.711	0.711

This table shows the estimation results where the dependent variable is either $\ln D$ (natural logarithm of corporate bank debt) of firm f in year t (Columns 1-2) or $\ln L$ (natural logarithm of loans) of bank b in year t (Columns 3-4). The two samples are German subsidized firms and their non-subsidized counterparts from ever-eligible counties and ever-subsidized sectors for the period from 2002 to 2020 (Columns 1-2), and German savings and cooperative banks for the period from 1998 to 2019 (Columns 3-4). The firm sample (Columns 1-2) is larger than the one in Columns 5-6 of Table 5 since we do not perform matching in order to test for crowding-out effects on a broader sample of non-subsidized firms; instead, we control for a number of firm- and county-level observables. The main variable of interest is *Subsidy*, which is either a dummy being 1 in the years after a firm f received a GRW subsidy and 0 otherwise (Columns 1-2), or the share of subsidized firms among all links of bank b in year t (Columns 3-4). In the firm sample, the subsidy variable is interacted with two measures of GRW intensity - the total amount of subsidies (Column 1) or the number of subsidized firms (Column 2) in the county where the firm is located. In the bank sample, the subsidy variable is interacted with lagged and demeaned measures of bank lending constraints - capitalization (Column 3) and liquidity (Column 4). Firm regressions controls (Columns 1-2) include lagged firm-level variables as those in Column 6 of Table 5, lagged averaged at the firm-level bank controls as those in Columns 1-4 of Table 5, as well as lagged county controls as those in Column 2 of Table A5 except for the structural weakness score. Bank regressions controls (Columns 3-4) include lagged bank-level as well as averaged firm-level variables as those in Columns 1-3 of Table 5. Firm and time fixed effects are added in firm-level regressions (Columns 1-2) and bank and state-time fixed effects are added in bank-level regressions (Columns 3-4). Standard errors are clustered at the firm and bank levels, respectively, and given in parentheses. ***, **, * indicate significance at the 1%, 5%, 10% level.

Table 7: Bank-level subsidy exposure, loan quality, and risk

	NPL Share			Z-Score		
	Baseline	Interacted		Baseline	Interacted	
		Asset Share	Sectoral Experience		Asset Share	Sectoral Experience
	(1)	(2)	(3)	(4)	(5)	(6)
Subsidy	0.2616**	0.1171	0.1830	0.0040	0.0024	-0.0118
	(0.1122)	(0.1566)	(0.4336)	(0.0088)	(0.0112)	(0.0183)
Monitoring		-0.0057*	-0.2188		0.0006**	0.0196*
		(0.0029)	(0.1343)		(0.0003)	(0.0105)
Subsidy × Monitoring		0.0043	0.0086		0.0000	0.0025
		(0.0028)	(0.0415)		(0.0002)	(0.0023)
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.	7,292	7,292	7,292	15,874	15,874	15,874
N of Banks	1,152	1,152	1,152	1,202	1,202	1,202
R Sq. Within	0.539	0.540	0.539	0.235	0.235	0.235

This table shows regression results where the dependent variable is either the Non-Performing Loans (NPL) Share (Columns 1-3) or Z-Score (Columns 4-5) of bank b in year t. The sample includes German savings and cooperative banks for the period from 1998 to 2019. The main variable of interest is *Subsidy*, which is the share of subsidized firms among all firm links of bank b in year t (Columns 1-4) as well as its interaction with the demeaned monitoring proxies Local Asset Share (Columns 2 & 5) and Sectoral Experience (Columns 4 & 6) of bank b at time t. Further controls include bank-level and averaged firm-level variables of bank b in year $t-1$ as those in Columns 1-3 of Table 5. Bank and state-time fixed effects are added. Standard errors clustered at the bank level are given in parentheses. ***, **, * indicate significance at the 1%, 5%, 10% level.

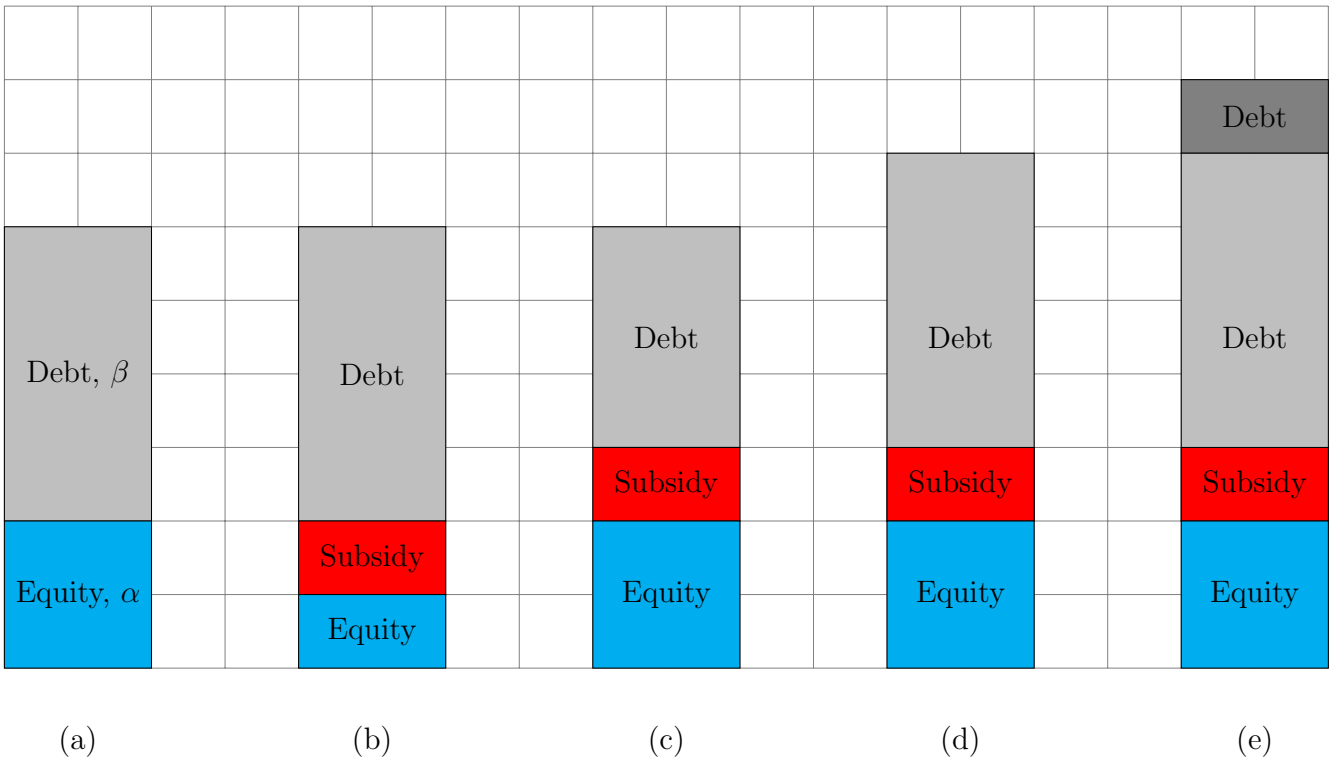
Table 8: Impact of GRW subsidies on bank lending over business cycle

	Bank lending: $\ln L$			
	Baseline	2000-2006	2007-2014	2015-2019
	(1)	(2)	(3)	(4)
Subsidy	0.0208***	0.0267	0.0215***	0.0010
	(0.0066)	(0.0175)	(0.0069)	(0.0116)
Bank FE	Yes	Yes	Yes	Yes
State-Time FE	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes
N of Obs.	17,120	3,531	9,002	4,577
N of Banks	1,202	1,056	1,199	1,112
R Sq. Within	0.711	0.702	0.417	0.591

This table shows regression results where the dependent variable is $\ln L$ (natural logarithm of bank loans) of bank b in year t. 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 (Columns 2-4). The main variable of interest is *Subsidy*, which is the share of subsidized firms among all firm links of bank b in year t. Further controls include bank-level and averaged firm-level variables of bank b in year $t-1$ as those in Columns 1-3 of Table 5. 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.

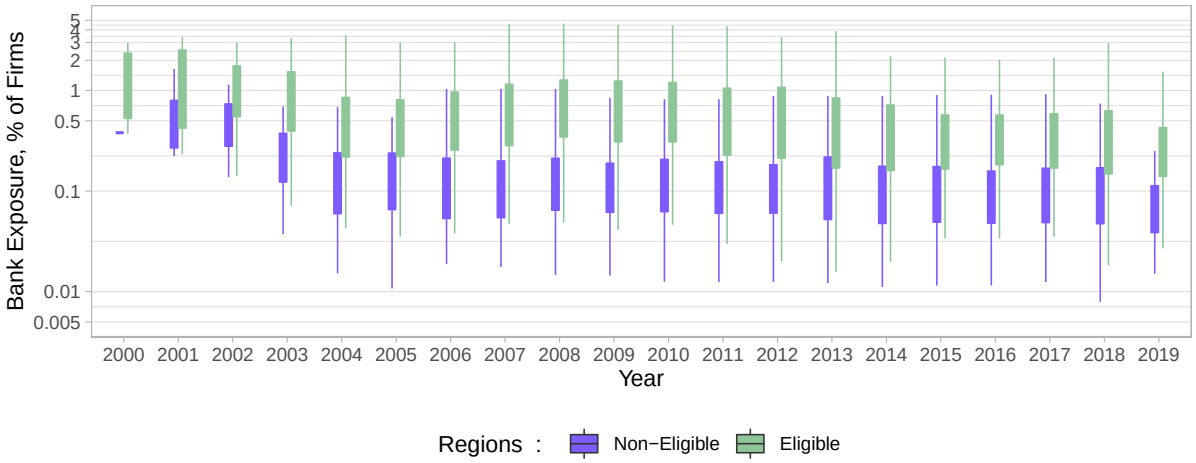
Figures

Figure 1: Stylized funding structure and volume of subsidized investment projects

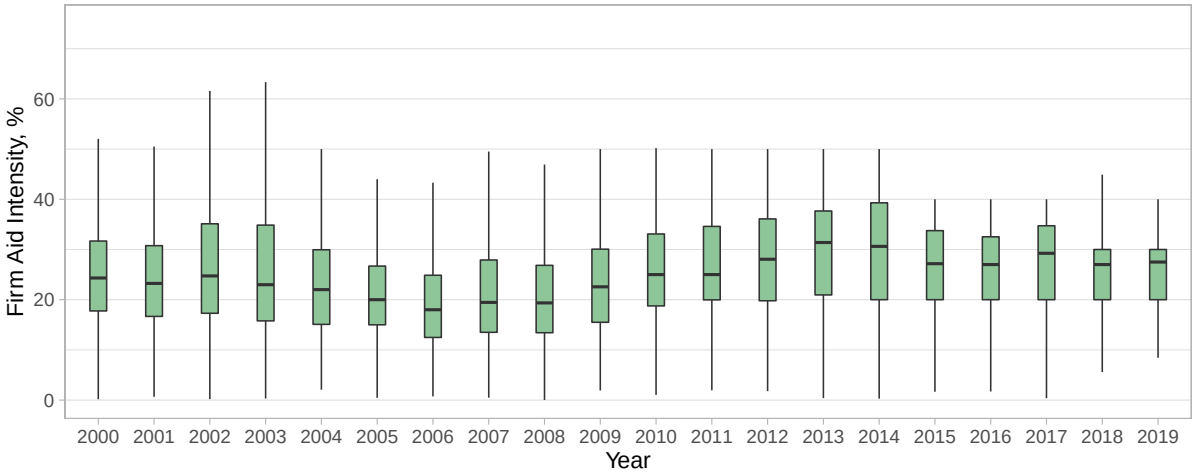


This figure illustrates four possible effects how subsidies can affect an investment project's volume and funding structure. Case (a) depicts the baseline case of an unsubsidized project that is financed by equity and debt.

Figure 2: Banks' and firms' treatment intensity over time



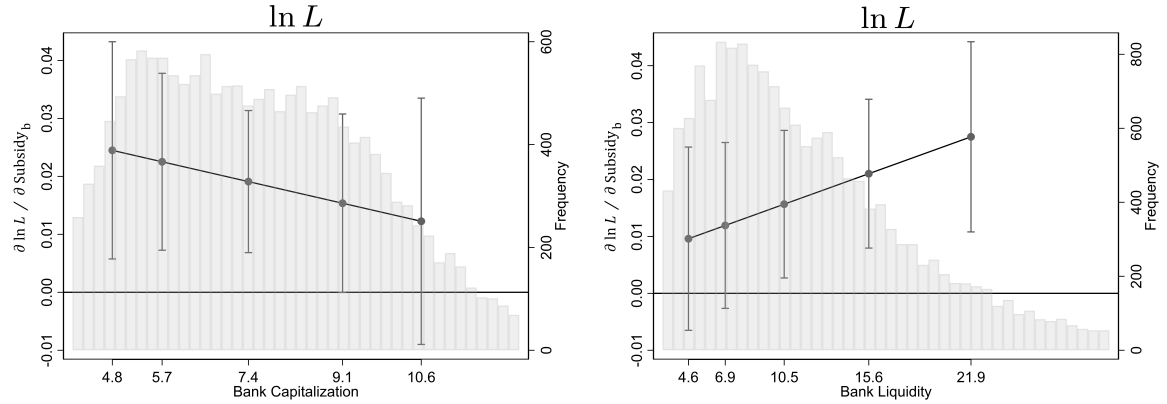
(a) Distribution of banks' exposures to subsidized firms (in % of all firms linked to a bank)



(b) Distribution of firms' subsidies to eligible investment volume (in %)

In Panel (a), 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 %) is shown. 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. Panel (b) shows how the distribution of the share of firms' subsidies in eligible investment volume (in %), or their aid intensity, evolved over time. Sources: own calculations, GRW and Dafne (Panel (a)); own calculations and GRW (Panel (b)).

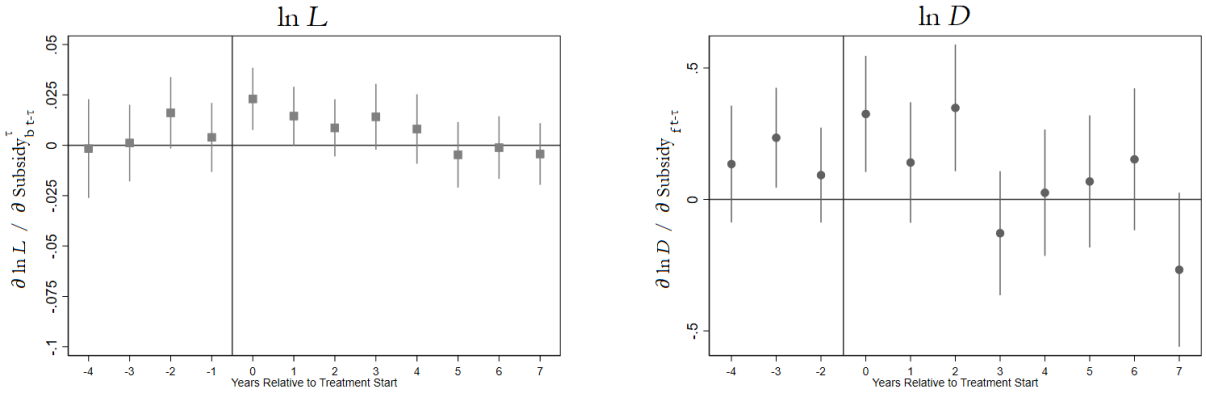
Figure 3: Marginal lending effects of banks' subsidy exposure conditional on lending frictions



(a) Capitalization (b) Liquidity

The figures show marginal lending effects of the variable $Subsidy_{bt}$ on the dependent variable $\ln L$ conditional on banks' (a) capitalization and (b) liquidity. The sample spans the period 1998-2019. Effects are depicted for the 10th, 25th, 50th, 75th and 90th percentiles of the conditioning bank variable and surrounded by 95% confidence intervals.

Figure 4: Dynamic effects of subsidies on bank lending and firm borrowing



(a) Bank lending $\ln L$ (b) Firm borrowing $\ln D$

The figures show the effects of the variable $Subsidy^{\tau}_{bt-\tau}$ over time on the log-level of loans $\ln L$ in Panel (a) and of the variable $Subsidy_{ft-\tau}$ on the log-level of firms' bank debt $\ln D$ in Panel (b). Panel (a) shows estimates pertaining to Equation (6) and plots the coefficient estimates for the $\hat{\beta}^{\tau}_1$ coefficients and the 95% confidence bands. Subsidy exposure is based on links to subsidized firms in the first year of the subsidized project. 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 lagged by one period as those in Columns 1-3 of Table 5. Bank and state-time fixed effects are included. Panel (b) shows estimates pertaining to Equation (7) and plots the coefficient estimates for the $\hat{\gamma}^{\tau}_1$ coefficients and the 95% confidence bands. The firm 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 firms' assets, cash ratio, capitalization, and fixed assets growth (%) as of one year before the firm received the subsidy. Further controls include firm-level variables lagged by one period. Firm and time fixed effects are included and standard errors are clustered at the firm level. ***, **, * indicate significance at the 1%, 5%, 10% level. See Table 2 for a detailed description of all variables.

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 for any aid that might distort competition in the EU are obligated to notify the program to the EU. Related documents submitted by the member states are then reviewed at the EU level in a rigorous formal evaluation process before the decision is made 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

Table A1: Bank lending and corporate borrowing scaled by total assets

	Share of Loans in Assets				Share of Corporate Debt in Assets	
	Baseline	Financially Constrained & Large Project	Increased Borrowing	Matched	Matched	Matched
	(1)	(2)	(3)	(4)	(5)	(6)
Subsidy	0.6571***	0.6525	0.5833*	0.0271***	0.4580***	0.2839
	(0.2450)	(0.4755)	(0.3256)	(0.0081)	(0.1544)	(0.3545)
Bank Controls $(t-1)$						
Capitalization	0.4391***	0.4392***	0.4392***	0.0003		
	(0.1070)	(0.1069)	(0.1070)	(0.0026)		
Cost to Income	0.0318***	0.0318***	0.0318***	-0.0000		
	(0.0096)	(0.0096)	(0.0096)	(0.0002)		
ROA	0.0849	0.0772	0.0738	0.0029		
	(0.4391)	(0.4399)	(0.4399)	(0.0117)		
Liquidity	-0.2176***	-0.2175***	-0.2176***	-0.0045***		
	(0.0175)	(0.0176)	(0.0176)	(0.0004)		
Size	-0.5491	-0.5296	-0.5476	0.7853***		
	(0.5690)	(0.5705)	(0.5696)	(0.0149)		
Firm Controls $(t-1)$						
Capitalization	-0.0616	-0.0650*	-0.0634	-0.0003		-0.0260
	(0.0385)	(0.0386)	(0.0385)	(0.0010)		(0.0162)
ROA	-0.0538**	-0.0535*	-0.0530*	-0.0007		-0.0629***
	(0.0273)	(0.0273)	(0.0273)	(0.0006)		(0.0102)
Liquidity	0.1365	0.1794	0.1477	-0.0231		-3.1776***
	(0.8301)	(0.8317)	(0.8296)	(0.0184)		(0.4284)
Size	-0.5144***	-0.5137***	-0.5167***	-0.0013		0.7765***
	(0.1888)	(0.1886)	(0.1886)	(0.0053)		(0.2467)
Bank FE	Yes	Yes	Yes	Yes	No	No
Firm FE	No	No	No	No	Yes	Yes
State-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	No	No
Firm Controls	Yes	Yes	Yes	Yes	No	No
N of Obs.	17,120	17,120	17,120	11,460	38,530	13,325
N of Banks	1,202	1,202	1,202	794		
N of Firms					4,643	2,096
R Sq. Within	0.238	0.238	0.238	0.729	0.015	0.043

This table shows regression results where the dependent variable is either the asset share of loans for bank b in year t (Columns 1-4) or the asset share of corporate bank debt of firm f in year t (Columns 5-6). The two samples are German savings and cooperative banks for the period from 1998 to 2019 (Columns 1-4) including a matched sample in Column 4; and German non-financial subsidized firms with one matched non-subsidized counterpart for each for the period from 2002 to 2020 (Columns 5-6). The main variable of interest is *Subsidy*, which is either the share of subsidized firms among all links of bank b in year t (defined as the share of links to a) all subsidized firms (Column 1), b) subsidized firms that are financially constrained and have a project of large investment volume (Column 2), and c) subsidized firms that experience an increase in borrowing in a given year (Column 3)), or a dummy being 1 in the years after a firm f received a GRW subsidy and 0 otherwise (Columns 5-6). Further controls include bank-level and averaged firm-level variables of bank b in year $t-1$ (Columns 1-4) or firm-level variables of firm f in year $t-1$. Bank and state-time fixed effects are added in bank-level regressions (Columns 1-4) and firm and time fixed effects are added in firm-level regressions (Columns 5-6). Standard errors are clustered at the bank and firm levels, respectively, and given in parentheses. ***, **, * indicate significance at the 1%, 5%, 10% level.

Table A2: Descriptives for the matched sample of banks

	N Obs.	Mean	SD	Mean Non-exposed	Mean Exposed	Normalized Difference
	(1)	(2)	(3)	(4)	(5)	(6)
Bank-Level Regression						
Matching & control variables:						
Subsidy_b	11460	0.10	0.34	0.00	0.27	0.523 *
Capitalization	11460	7.48	2.34	7.54	7.37	-0.053
Cost to Income	11460	70.61	9.50	70.58	70.65	0.005
ROA	11460	0.28	0.20	0.28	0.26	-0.067
Liquidity	11460	12.21	6.90	12.13	12.32	0.019
Size	11460	13.47	0.85	13.36	13.66	0.247

This table shows summary statistics for the matched sample of banks underlying the estimation in Column 4 of Table 5. Ever- and never-exposed banks from the same state and banking group are matched based on capitalization, cost to income ratios, ROA, liquidity, and size. The mean values of these variables for banks in the control (never-exposed) and treatment (ever-exposed) group are shown in Columns 4-6. For banks in the control group, the variable Subsidy_b is by definition equal to zero. Column 6 depicts the normalized difference in means between exposed and unexposed banks. In Column 6 * indicates the cases with normalized difference larger than 0.25 in magnitude (Imbens and Wooldridge, 2009). See Table 2 for a detailed description of every variable.

Table A3: Descriptives, by banks in all vs. similar regions

	Mean All Regions	Mean Similar Regions	Normalized Difference
	(1)	(2)	(3)
Bank Outcomes			
Ln Loans	13.25	13.24	-0.01
Z-Score	1.28	1.27	-0.01
NPL Share	2.83	2.70	-0.05
Bank Controls			
Subsidy	0.21	0.12	-0.16
Capitalization	7.59	7.75	0.05
Cost to Income	71.31	71.09	-0.02
ROA	0.24	0.25	0.03
Liquidity	12.12	11.37	-0.08
Size	13.80	13.75	-0.04
Firm Controls			
Capitalization	7.27	7.32	0.01
ROA	3.92	4.08	0.06
Liquidity	0.50	0.50	0.05
Size	13.51	13.52	0.01
County Controls			
GDP Growth	2.85	2.84	0.00
Income Growth	2.56	2.57	0.00
Employment Growth	0.79	0.83	0.03
GDP p.c.	30.75	29.01	-0.12
Income p.c.	23.76	23.77	0.00
Population Density	0.43	0.37	-0.08
Manufacturing Share	29.08	29.55	0.04

This table shows descriptive statistics by all versus similar regions for dependent and control variables used in the baseline regression (Table 5, Column 1). 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 banks located in 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 2 for a detailed description of all variable.

Table A4: Bank lending during the period 2007-2014

	Bank lending: $\ln L$									
	Baseline	x Years	x 2007	x 2008	x 2009	x 2010	x 2011	x 2012	x 2013	x 2014
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Subsidy	0.0215***	0.0364***	0.0192***	0.0213***	0.0230***	0.0232***	0.0204***	0.0194***	0.0232***	0.0218***
	(0.0069)	(0.0139)	(0.0068)	(0.0069)	(0.0073)	(0.0073)	(0.0070)	(0.0070)	(0.0071)	(0.0069)
Year=2008 × Subsidy		-0.0139								
		(0.0102)								
Year=2009 × Subsidy		-0.0220*								
		(0.0130)								
Year=2010 × Subsidy		-0.0233*								
		(0.0135)								
Year=2011 × Subsidy		-0.0080								
		(0.0160)								
Year=2012 × Subsidy		0.0010								
		(0.0176)								
Year=2013 × Subsidy		-0.0417**								
		(0.0206)								
Year=2014 × Subsidy		-0.0259								
		(0.0211)								
Year Dummy=1 × Subsidy			0.0173	0.0009	-0.0084	-0.0097	0.0092	0.0202*	-0.0291**	-0.0096
			(0.0121)	(0.0079)	(0.0077)	(0.0060)	(0.0085)	(0.0112)	(0.0133)	(0.0136)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Controls	No	No	No	No	No	No	No	No	No	No
N of Obs.	9,002	9,002	9,002	9,002	9,002	9,002	9,002	9,002	9,002	9,002
N of Banks	1,199	1,199	1,199	1,199	1,199	1,199	1,199	1,199	1,199	1,199
R Sq. Within	0.417	0.418	0.417	0.417	0.417	0.417	0.417	0.417	0.417	0.417

This table shows regression results where the dependent variable is $\ln L$ (natural logarithm of bank loans) of bank b in year t. The sample includes German savings and cooperatives banks and spans from 2007 to 2014. The main variable of interest is *Subsidy* that is defined as the share of links to subsidized firms to total links of a bank b at time t (in Column 1) and its interactions with the yearly indicators being one for the respective year and zero otherwise. Further controls include bank-level variables and averaged firm-level variables of bank b in year $t-1$ as those in Columns 1-3 of Table 5. 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 2 for a detailed description of every variable.

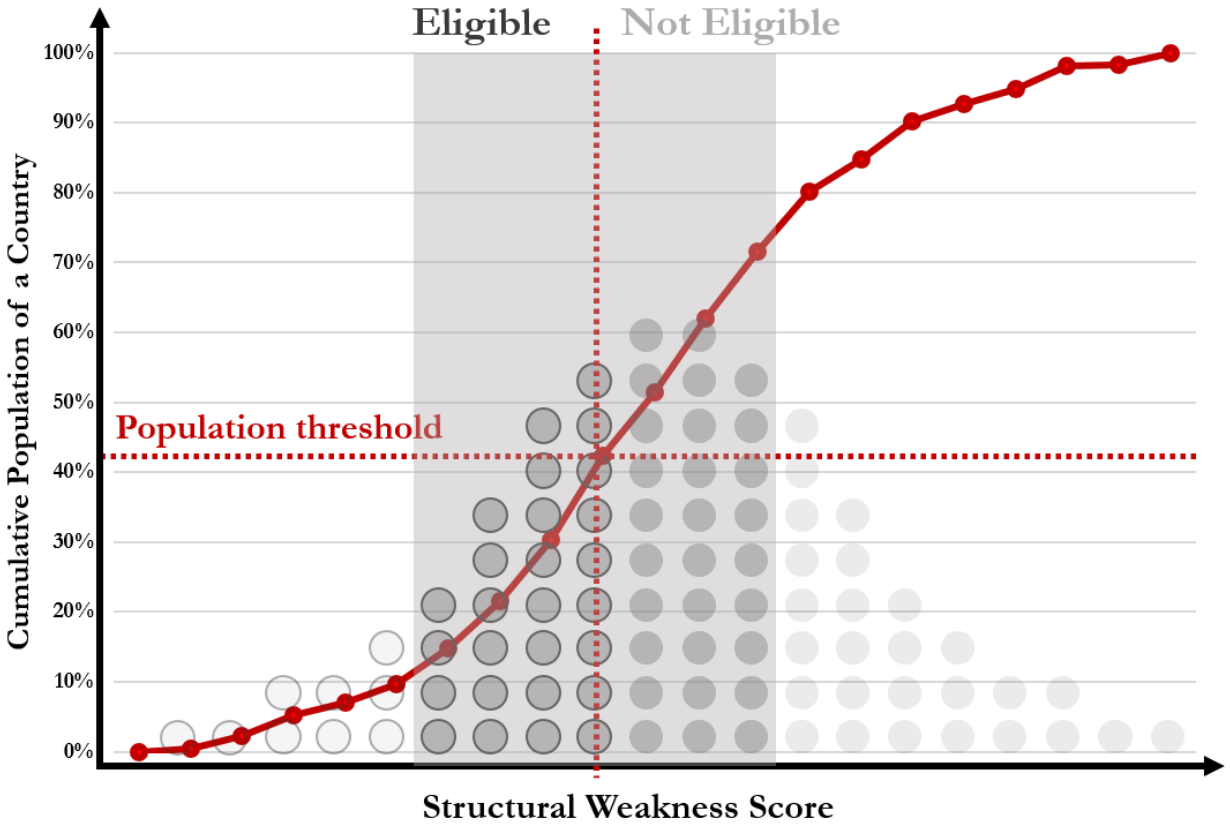
Table A5: Scrutinizing bank lending responses

	Bank lending: $\ln L$						
	Full Sample		Matched Sample		Full Sample		Matched Sample
	Baseline	County Controls	Eligible Regions	Similar Regions	W/o Firm Controls	1-Year Project	First 2 Years
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Subsidy	0.0208***	0.0192***	0.0233***	0.0220**	0.0210***	0.0230***	0.0230
	(0.0066)	(0.0067)	(0.0072)	(0.0100)	(0.0067)	(0.0079)	(0.0178)
Bank Controls $(t-1)$							
Bank Capitalization	0.0050**	0.0055**	0.0084**	0.0034	0.0050**	0.0050**	0.0159***
	(0.0022)	(0.0022)	(0.0040)	(0.0029)	(0.0022)	(0.0022)	(0.0059)
Bank Cost to Income	-0.0005**	-0.0005**	-0.0010***	-0.0010***	-0.0005**	-0.0005**	-0.0001
	(0.0002)	(0.0002)	(0.0004)	(0.0004)	(0.0002)	(0.0002)	(0.0004)
Bank ROA	0.0037	0.0051	0.0041	0.0056	0.0036	0.0034	0.0532**
	(0.0097)	(0.0095)	(0.0159)	(0.0153)	(0.0097)	(0.0098)	(0.0218)
Bank Liquidity	-0.0046***	-0.0047***	-0.0039***	-0.0038***	-0.0046***	-0.0046***	-0.0027***
	(0.0004)	(0.0004)	(0.0007)	(0.0006)	(0.0004)	(0.0004)	(0.0008)
Bank Size	0.7849***	0.7786***	0.7920***	0.7752***	0.7843***	0.7855***	0.7781***
	(0.0127)	(0.0135)	(0.0208)	(0.0217)	(0.0127)	(0.0127)	(0.0387)
Firm Controls $(t-1)$							
Firm Capitalization	-0.0012	-0.0010	0.0001	-0.0008		-0.0013*	0.0007
	(0.0008)	(0.0008)	(0.0016)	(0.0013)		(0.0008)	(0.0018)
Firm ROA	-0.0011*	-0.0010	-0.0009	-0.0020**		-0.0011*	-0.0008
	(0.0006)	(0.0006)	(0.0012)	(0.0009)		(0.0006)	(0.0013)
Firm Liquidity	-0.0017	-0.0032	0.0283	-0.0316		-0.0008	0.0009
	(0.0178)	(0.0181)	(0.0353)	(0.0221)		(0.0178)	(0.0303)
Firm Size	-0.0032	-0.0025	-0.0032	0.0013		-0.0033	-0.0090
	(0.0040)	(0.0041)	(0.0075)	(0.0075)		(0.0040)	(0.0082)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes	No	Yes	Yes
County Controls	No	Yes	No	No	No	No	No
N of Obs.	17,120	16,451	6,803	6,120	17,120	17,120	1,996
N of Banks	1,202	1,156	474	542	1,202	1,202	242
R Sq. Within	0.711	0.713	0.694	0.740	0.710	0.710	0.790

This table shows regression results where the dependent variable is $\ln L$ (natural logarithm of bank loans) of bank b in year t. The sample includes German savings and cooperative banks and spans the period from 1998 to 2019. The main variable of interest is *Subsidy* 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 2. Columns 3 and 4 show results when we match exposed and control banks (based on the variables Capitalization, Cost to Income, ROA, Liquidity and Size). In Column 3 we only include banks in eligible regions. In addition in Column 4, we exclude banks located in regions with a structural weakness score in the upper or lower quartile of the distribution. Column 5 represents the baseline specification without firm controls. In Column 6, the *Subsidy* variable is defined based on the first year of the subsidy only. In Column 8, for the matched sample, 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 lagged by one period. 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 2 for a detailed description of all variables.

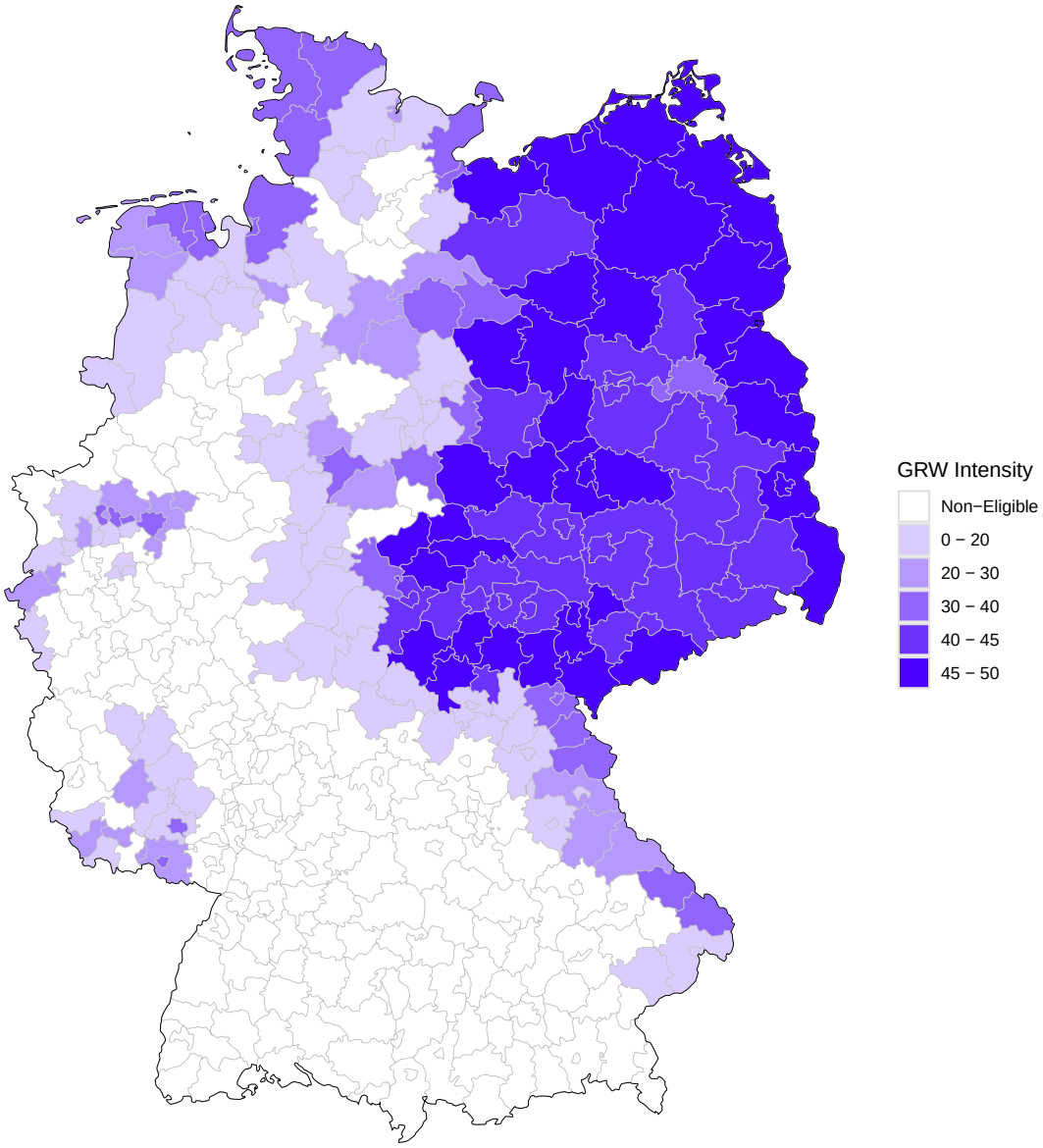
Additional figures

Figure A1: Determination of regional eligibility



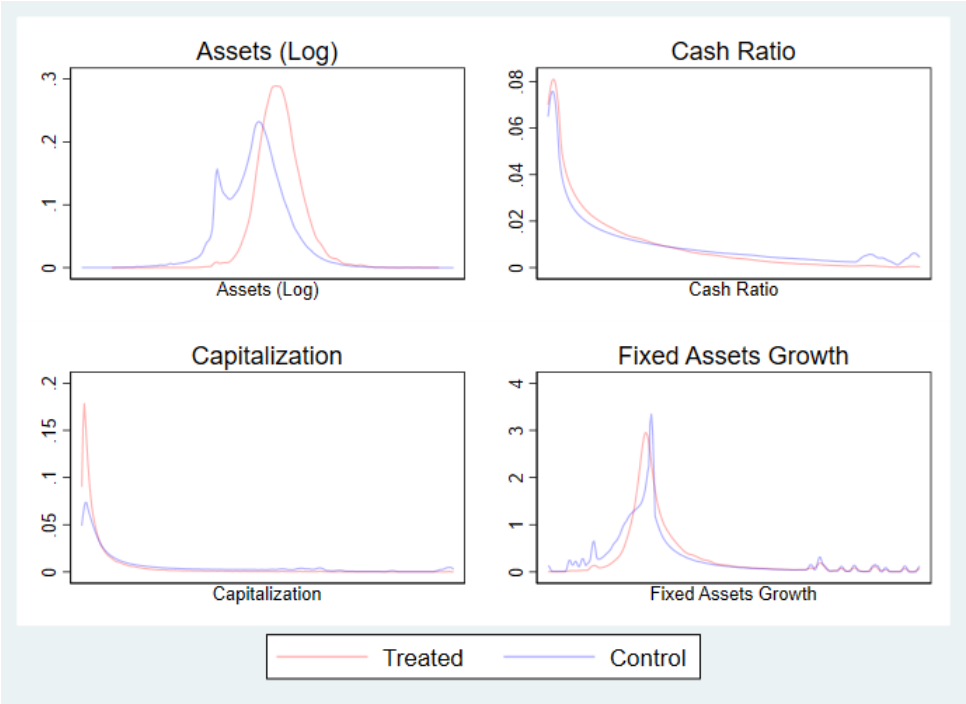
The figure illustrates the two key factors driving whether regions are eligible for the subsidy program. The x-axis depicts the structural weakness score assigned to labor market regions, the lower it is, the weaker is the region. The y-axis depicts the cumulative population share in a country's total 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.

Figure A2: Average aid intensity of German counties over the period 2000-2019

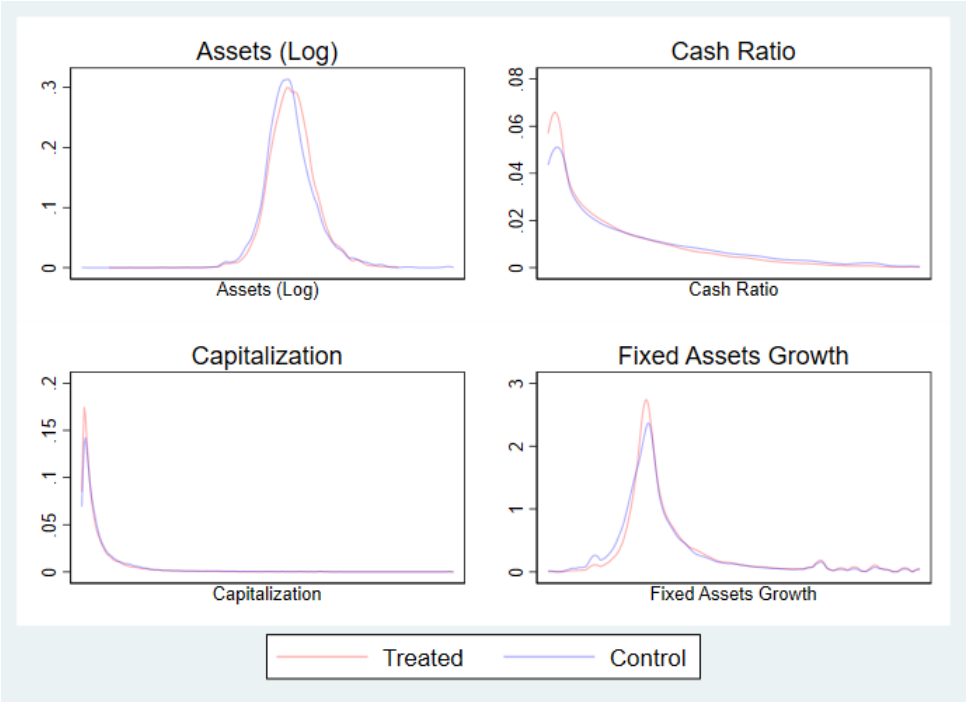


The figure illustrates the spatial distribution of aid intensities of the GRW program across Germany. Values for each county are calculated based on the average GRW intensity over the three last GRW program periods (2000-2019). Aid intensity is measured as the maximum share of the investment costs of a subsidized project, which can be covered by the subsidy.

Figure A3: Subsidized versus non-subsidized firms' characteristics pre- and post-matching



(a) Distribution of firm-level variables (pre-matching)



(b) Distribution of firm-level variables (post-matching)

The figure illustrates distributions of values for firm-level variables used to match subsidized and comparable non-subsidized firms. Panel (a) depicts the distribution before matching and Panel (b) after matching.

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ISSN 2194-2188

Leibniz Association

The IWH is funded by the federal government and the German federal states.