Real Effects of Credit Supply Shocks: Evidence from Danish Banks, Firms, and Workers*

Simon Juul Hviid
Danmarks Nationalbank

Christofer Schroeder
Stockholm School of Economics

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Abstract

Bank lending cuts can lead firms to reduce their level of employment, yet little is known how these shocks affect the composition of firms' employees and outcomes at the worker level. This paper investigates the effect of bank distress on the provision of credit, and its effects on employment beyond firm level aggregates. To do so, we use a novel dataset built from administrative and tax records linking all banks, firms, and workers in Denmark. We show that banks that were particularly exposed to the 2008/2009 financial crisis cut lending to firms, and firms were unable to fully compensate with financing from alternate sources. The decrease in credit supply led to a drop in firm level employment with effects concentrated amongst firms with low pre-crisis liquidity, and on employment of nonmanagerial and low-educated employees. At the worker level, we find that positive effects on unemployment were driven by effects on nonmanagerial, low-educated, and short-tenured workers, as well as workers in low-skill occupations. Our estimates suggest that cuts in bank lending can account for up to 6% of the fall in total employment, and are an important factor behind heterogeneous employment dynamics in times of contractionary credit.

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1 Introduction

There is growing evidence that pressures within the banking system can spread to the real economy via bank lending cuts. Recent studies have documented that a drop in credit supply during the 2008/2009 financial crisis had significant impacts on firm level outcomes, including employment (Bentolila et al., 2018; Berton et al., 2018; Chodorow-Reich, 2014; Huber, 2018; Popov and Rocholl, 2018) and investment (Campello et al., 2010; Cingano et al., 2016; Duchin et al., 2010). Yet little is known about effects on the composition of employment and outcomes at the worker level. Do shocks to credit supply lead firms to simply downscale or fundamentally adjust their labour inputs used in production? Do workers suffer consequences on the labour market as a result? If so, which ones?

Answers to these questions are important in understanding the impacts of frictions in credit and labour markets. They also provide a potentially deeper understanding of heterogeneous occupational and skill-group employment dynamics over the business cycle (Hershbein and Kahn, 2018; Jaimovich and Siu, 2020), and their impacts on workers (Hoynes et al., 2012). Pursuing these answers is challenging, however, as it requires identifying credit supply from credit demand, as well as detailed data at the bank, firm, and worker levels. In this paper, we study the transmission of shocks to banks' liquidity on the provision of credit, and estimate its effects on real outcomes for firms and workers. Our approach exploits a novel bank-firm-worker linked dataset built from Danish administrative and tax records between 2004-2011. Specifically, we identify banks that were particularly exposed to the 2008/2009 financial crisis and compare the evolution of outcomes of their client firms — and those firms' employees — to outcomes of firms and their employees connected to less exposed banks.

We find evidence of a reduction in credit supply and its effects on both firms and workers. Beginning in 2008, firms shifted their borrowing away from exposed banks. Firms primarily connected to more exposed banks were unable to fully offset the drop in lending with credit from alternate sources as both bank debt and total debt fell. The decline in borrowing was accompanied by a reduction in firm level employment. Effects were concentrated amongst firms with low pre-crisis liquidity, and on employment of nonmanagers and low-educated workers. Workers employed on the verge of the crisis at firms facing a reduction in credit supply experienced an increase in the probability of unemployment. These effects were largest

amongst nonmanagers, low-educated, and short-tenured workers, as well as workers in low-skill occupations.

Our approach to identifying a shift in credit supply, and estimating its effects, closely follows that of Jensen and Johannesen (2017).[1] As do they, we identify for each firm, in each year, a primary bank based on the firm's loan and deposit balances. In the run up to the financial crisis, some of these banks departed from a largely deposit-based model of loan financing, relying to an increasing degree on funding acquired on foreign inter-bank markets. Once these markets suddenly froze in the fall of 2008, banks with larger deposit deficits experienced severe liquidity shortfalls. We harness this variation to define the banks in our sample as more or less exposed to the financial crisis based on their pre-crisis loans to deposits ratio.[2]

We then provide evidence that bank distress permeated to the real economy through two subsequent steps in a causal chain. The first of these is through the 'bank lending channel' — that exposed banks reduced their supply of credit to firms relative to nonexposed banks. We document that lending from exposed banks decreased more than that from nonexposed banks through the crisis. While consistent with a drop in credit supply, differences in lending patterns could of course also be due to a contemporaneous drop in credit demand. To control for demand, we then study the subsample of firms that borrowed from both exposed and nonexposed banks, and find a persistent reduction in loan balances at exposed banks over the years 2008-2011. Comparing the growth in loan balances for the same firm in the same year completely absorbs firm-specific credit demand, and any systematic fall in balances at exposed banks must be due to a drop in credit supply.[3]

[1] Jensen and Johannesen (2017) exploit a companion dataset at the household level, estimating the effects of a reduction in credit supply through the financial crisis on household consumption in Denmark. They document a relative drop in bank debt and total debt of a similar magnitude for households as we do for firms, and find significant negative effects of the shock to household credit supply on consumption.

[2] To be exact, we look to each bank's outstanding loans to deposits ratio in 2007. Empirical studies employ a number of proxies for bank's exposure to the financial crisis including government bailouts (Bentolila et al., 2018), loss announcements (Popov and Rocholl, 2018), exposure to Lehman Brothers (Chodorow-Reich, 2014), reliance on the interbank market (Cingano et al., 2016; Iyer et al., 2014), exposure to mortgage-backed securities, trading account losses, real-estate write-offs, and the loans to deposits ratio (all Chodorow-Reich, 2014).

[3] This is an application of the within estimator introduced by Khwaja and Mian (2008).

Next, we provide evidence of the 'firm borrowing channel' — that firms were unable to perfectly compensate for the drop in lending from exposed banks with credit from alternate sources. To do so, we turn to our main differences-in-differences identification strategy, comparing outcomes of firms with exposed pre-crisis primary banks to those of firms with nonexposed pre-crisis primary banks. Exposure of the pre-crisis primary bank was associated with a significant decrease in borrowing from the primary bank along with a small increase from other banks. This resulted in a net decrease of roughly 6% in total bank borrowing over the years 2008-2010, along with a 0.2 percentage point increase in the effective interest rate, providing further evidence of a shift in supply. Total debt for firms with an exposed pre-crisis primary bank fell by roughly 2% suggesting that these firms were unable to fully offset the reduction in bank lending with nonbank credit. This includes debt from suppliers which decreased by 3%, suggesting that bank debt and trade credit may be compliments (Burkart and Ellingsen, 2004).[4]

A key premise of the firm borrowing channel is that firm-bank relationships are sticky. Otherwise, the exposure of firms' pre-crisis banks would matter little if firms could costlessly and easily form new banking relationships. Sticky relationships may be a feature of credit markets with frictions for a number of reasons including asymmetric information on credit worthiness of new clients (Sharpe, 1990), switching costs (Klemperer, 1987), or bank-market specialisation (Paravisini et al., 2017). We show that bank relationships in our data are indeed persistent, and find evidence that relationships are less sticky for more transparent firms, suggesting asymmetric information may be an important factor.

In our first set of main results we show that the reduction in credit supply had an impact on firm level employment. Over the years 2008-2010, employment at firms with an exposed pre-crisis primary bank fell by nearly 2% relative to firms with a nonexposed pre-crisis primary bank. Back-of-the-envelope calculations suggest that the reduction credit supply can explain roughly 6.2% of the overall reduction in employment from 2007-2008. Over half, but not all

[4]There is a large literature documenting the heavier reliance on trade credit of financially constrained firms including contributions by Casey and O'Toole (2014), Garcia-Appendini and Montoriol-Garriga (2013), Petersen and Rajan (1997), and Wilner (2000). Burkart and Ellingsen (2004) develop a model of trade credit provision in which trade credit and bank debt can be compliments for financially constrained firms. Crucially, trade credit is less liquid than bank financing and cannot be as easily diverted (used in ways that do not maximize the borrower's return, such as paying wages).

of the effect on employment can be attributed to firm exit.[5] Effects on employment for firms with low pre-crisis liquidity were nearly ten times as large in magnitude as for firms with high liquidity. These results are consistent with models in which firms use liquid assets to protect their physical and employee search capital (Boeri et al., 2018) or to pay wages (Melcangi, 2017). We also find that the drop in credit supply had an effect on the composition of firms' labour inputs. Broadly consistent with the empirical findings of Sforza (2019), we show that effects were driven by a drop in employment in nonmanagerial positions, increasing the ratio of top managers to nonmanagers thereby decreasing top managers' span of control. Further, we find that effects occurred overwhelmingly on employment of low-educated workers. These findings suggest that access to credit may be an important factor in explaining the large aggregate decrease in employment of low-educated workers through the financial crisis in Denmark.

At the firm level, we also study the effect of the reduction in credit supply on the tenure profile of firms' employees. Our estimates suggest a negligible effect on average years of employee tenure, yet these results may mask heterogeneous effects along the tenure distribution. More generally, employment effects of a shock to credit supply at the firm level do not necessitate effects at the worker level. Small or no changes in the stock of a firm's employees may hide larger flows in and out of its workforce. Further, workers may be spared from unemployment when labour markets are able to absorb employment shed at some firms. In our next set of main results we show that the effects of the reduction in credit supply did extend to workers. Our empirical approach at the worker level mirrors that at the firm level, comparing outcomes of workers employed pre-crisis at firms with an exposed pre-crisis primary bank to those of workers employed pre-crisis at firms with a nonexposed pre-crisis primary bank. We find a modest positive effect of the reduction in firm credit supply on the probability of worker unemployment, yet effects vary substantially with employee characteristics. Nonmanagerial and low-educated workers experienced greater increases in unemployment. Together with our findings at the firm level, these results suggest that workers in groups most affected by the cut in employment were not spared from periods of unemployment. Further, we find substantial effects for employees in low-skill occupations, despite the rising share of employment in these occupations during the crisis and post-crisis years. Along the tenure dimension, our results

[5]The evidence in the literature on the importance of the extensive margin is mixed. Bentolila et al. (2018) find that the majority of job losses due to the drop in credit supply were driven by firm exits, while Berton et al. (2018) find that firm exit played a smaller role.

show a significant and persistent increase in unemployment for short-tenured workers, as well as a positive but temporary effect on unemployment for longer-tenured workers. These results may reflect differences in firing costs (Cavalcanti, 2004), wages (and therefore immediate costs to the firm; Mincer and Jovanovich, 1979), or productivity (Shaw and Lazear, 2008).

A primary concern with our research design is that shocks to firms' credit supply may correlate with their credit demand. This may be the case if firms borrowing primarily from exposed banks experienced a dip in credit demand concurring with the drop in credit supply. Systematic sorting of 'bad' (less liquid, more bank-dependent) firms to 'bad' (riskier, less capitalised, more wholesale funded) banks may lead our approach to pick up an effect driven by a mix of supply and demand factors.[6] We address this concern in a number of ways. First, we show that over a broad range of characteristics, the average firm with an exposed pre-crisis primary bank is remarkably similar to the average firm with a nonexposed pre-crisis primary bank. Second, in our main empirical approach we include firm fixed effects and control for a number of pre-crisis covariates interacted with time dummies to account for factors such as region- and industry-level demand shocks.

This paper relates to several literatures. Starting with Bernanke (1983), a large literature studies the real effects of disruptions in credit markets.[7] The events of the Great Recession brought renewed interest with a number of empirical studies identifying cuts to bank lending and estimating their effects at the firm level.[8] The literature has paid little attention, however, to effects within the firm and at the worker level. Exceptions include Bentolila et al. (2018), Berton et al. (2018), and Popov and Rocholl (2018) who study firms' use of permanent vs. fixed-term contracts, Sforza (2019) who studies responses in firms' organizational hierarchies, Moser et al. (2020) who study effects on workers at different paygrades, and Hochfellner et al. (2015) who study effects on individuals' employment status and earn-

[6] In the US context, Schwert (2018) finds evidence to the contrary: more bank-dependent firms tend to match with better capitalised banks. This matching serves to improve access to more bank-dependent firms during crises and dampens the transmission of credit shocks through the bank lending channel.

[7] Peek and Rosengren (1997) offer early empirical evidence of the bank lending channel, while Peek and Rosengren (2000) study effects on construction activity in US commercial real estate markets.

[8] See Alfaro et al. (2019), Bentolila et al. (2018), Campello et al. (2010), Chodorow-Reich (2014), Cingano et al. (2016), Cortes et al. (2019), Duchin et al. (2010), Huber (2018), and Popov and Rocholl (2018)

ings.[9] We contribute to this literature by showing that the reduction in credit supply led firms to not only decrease employment but also change its composition, specifically reducing employment of nonmanagerial and low-educated workers. Further, we show that the effects extended to workers and document which groups were most affected.

More generally, our paper relates to the literature on firm behaviour in the face of credit constraints. When capital markets are perfect and complete, as in Modigliani and Miller (1958), financial constraints have no bearing on firms' decisions. In contrast, Greenwald and Stiglitz (1990) propose a theoretical framework in which information asymmetries in financial markets can lead to financial constraint, affecting investment and productivity. A large body of literature has attempted to empirically estimate these effects, as well as the impact of firm financial constraints on innovation (Hall, 2002), exporting decisions (Greenaway et al., 2007), and even corporate philanthropy (Hong et al., 2012).[10] In a paper closely related to ours, Caggese, Cuñat, and Metzger (2019) study the effect of financial constraints on firms' firing decisions across worker tenure. Their results suggest that financial constraints lead firms to sub-optimally let go of less-tenured workers, who have higher expected productivity growth. Our findings are broadly consistent with theirs, and in addition, suggest that short-tenured workers also experience persistent increases in unemployment following separation.

Finally, our paper relates broadly to the literature studying the heterogeneous impacts of recessions across different types of workers. Hoynes (1999) and Hoynes et al. (2012) show that less educated, nonwhite, and female workers are more vulnerable in terms of employment and earnings over the business cycle in the US. In the context of the 2008/2009 financial crisis, Hershbein and Kahn (2018) show that worsening economic conditions led firms to restructure production towards more-skilled workers. We contribute to this literature by documenting that the fall in aggregate employment through the Great Recession in Denmark occurred largely amongst low-educated, nonmanagerial workers, and highlight access to credit as a potentially important factor. Further, we show that workers in these groups suffered real

[9] Compared this paper, these studies differ in important ways. Berton et al. (2018) only have data from a single region in Italy and only focus on effects at the firm level. Hochfellner et al. (2015) rely on shocks to credit supply at the regional level rather than through direct firm-bank linkages. Bentolila et al. (2018), Popov and Rocholl (2018), and Sforza (2019) only focus on effects at the firm level. Importantly, none of these papers consider differential effects along the tenure dimension.

[10] See Stein (2003) for a survey of the empirical literature on firm investment under financial constraints more generally.

consequences in terms of unemployment.

The remainder of this paper is structured as follows. Section 2 provides some background information on the Danish labour and credit markets, and the financial crisis in Denmark. Section 3 describes the data, sample restrictions, and presents descriptive statistics. In Section 4 we provide evidence of firm-bank relationship persistence in our data. In Section 5 we provide evidence of a shock to firms' credit supply. Section 6 presents and discusses results of the effect of the credit supply shock on outcomes at the firm and worker levels. Section 7 concludes.

2 Background

The Danish banking sector features a few large banks and many medium and small sized banks. Together, the four largest commercial banks account for upwards of 80 % of total lending. Bank debt is often the primary source of funding for nonfinancial, particularly small and medium sized firms in Denmark. This is in part thanks to the Danish tax system which incentivises debt financing over equity (Abildgren et al., 2014).

Unique to the Danish credit landscape are mortgage lending institutions (*realkreditinstitutter*). These institutions are funded entirely by publicly traded bonds, are more regulated than retail banks, and lend exclusively to commercial and private borrowers in financing real estate purchases. As credit from mortgage lending institutions is securitised by the value of an underlying property, it is typically available to more attractive terms than credit from commercial banks. Mortgage lending institutions are therefore often the lenders of long-term debt, while commercial banks provide marginal, short-term credit typically used to cover operating expenses (Andersen, 2017).

The Danish labour market is characterised by a unique combination of flexibility and worker mobility with a comprehensive social security net. A pillar of the Danish 'flexicurity' model is the relatively lenient employment protection legislation reflected in high levels of job turnover (Andersen, 2017). Pay, hours of work, and terms of employment are largely defined by collective agreements between unions and employers' organisations, and the Salaried Employees Act (*funktionærloven*) for salaried employees. In line with the Salaried Employees Act, employers are typically required to provide 1-6 months of notice upon termination

of salaried employees depending on the duration of the employment spell. For non-salary employees, notice requirements are stipulated by collective agreements and are often shorter than those for salaried employees. These features of the Danish labour market, together with the firms' reliance on bank debt make Denmark an attractive setting for studying responses in employment to shifts in credit supply.

In the years prior to the financial crisis, the Danish economy experienced a period of sustained economic growth with steady inflation and low interest rates. During this time, growth in credit extended from Danish banks was high and firms became highly leveraged: in 2007 roughly one-fifth of Danish firms had a debt to assets ratio of at least 80 % (Kuchler, 2015). This growth is evident in the trends in total lending (panel (a)) and its annual growth rate (panel (b)) depicted in Figure 1.

Parallel to the growth in credit, Denmark's large and medium sized banks accumulated growing deposits deficits with a collective deficit of nearly 400 billion DKK in 2007 (roughly 63 billion USD). This deficit had built up over time, a result of a general shift away from mainly deposit-financed lending towards lending financed through short-term funding acquired on foreign inter-bank markets (Rangvid, 2013). Those Danish banks that relied to a greater degree on financing via these markets were more exposed to their fluctuations. Given the global freeze in inter-bank markets that occurred at the onset of the financial crisis, banks' pre-crisis deposit deficits can provide one measure of exposure to the financial crisis. For this reason, a number of empirical studies have looked to banks' loans to deposits ratios prior to the crisis to capture variation in bank health during the crisis (Chodorow-Reich, 2014; Jensen and Johannesen, 2017). We follow the literature and use each bank's outstanding loans to deposits ratio in 2007 as an indicator of exposure which we describe in detail in Section 3.2.

The financial crisis, triggered by the sudden and unexpected collapse of Lehman Brothers in September 2008, hit Danish banks and the Danish economy particularly hard. Many banks experienced serious liquidity shortfalls resulting in a string of bailout packages introduced by the Danish government. Despite the government's efforts, between 2008-2013, 62 banks ceased operations while many others were absorbed by healthier banks (Rangvid, 2013). The dramatic drop in lending plotted in Figure 1 was matched by a fall in per-capita output and employment growth of roughly 6 % and 4 % respectively from the third quarter of 2007 to

the third quarter of 2009. The fall in employment did not, however, occur uniformly across worker skill groups and occupations. Figure 2 plots trends in employment by worker and occupational skill groups between 2003-2013. Panel (a) shows that essentially all of the loss in aggregate employment starting in 2007 occurred amongst workers with at most a primary or secondary level of education (low-educated workers). In contrast, employment of workers with a tertiary level of education (high-educated workers) remained relatively stable, and if anything, increased slightly. Panel (a) plots aggregate employment by occupational skill group, and shows that employment fell post-2007 in all occupational skill groups, but fell the most in middle-skill occupations. While employment in low- and high-skill occupations began to rebound already in 2009, employment in middle-skill occupations continued to fall through to 2013.

3 Data

3.1 Sources and Sample Selection

The data we use combine administrative information on Danish banks, firms, and individuals. Tax records of all loan and deposit accounts held in Denmark allow us to produce a novel dataset linking banks to their client firms. In this section we provide a brief overview of the data and the sample restrictions we imposed; a detailed account of the raw data and how we constructed the dataset can be found in Appendix A.

We begin by constructing an employer-employee matched dataset from administrative registers maintained and provided by Statistics Denmark. We make use of the Integrated Database for Labour Market Research (IDA) which documents labour market status during the last week of November in each year for all individuals registered in Denmark. Employer identifiers are provided for each job held, and amongst these, a primary job is identified for each employee. Importantly, IDA also contains information on the percentage of each year an individual spent unemployed, and the years of tenure for each worker-firm match. On the worker side, we supplement the data with comprehensive demographic, educational, and income information from additional administrative registers. For some worker-firm matches, occupational codes according to the Danish version of the International Labour Organisation's International Standard Classification of Occupations (DISCO) are reported. In Denmark, wages in collective agreements are often based to a large extent on occupational classification

ensuring a high accuracy amongst the occupations reported. On the firm side, we use the Firm-Integrated Database for Labor Market Research (FIDA) to add detailed background and balance sheet information from the Firm Accounting Statistics Register (FIRE) as well as information on the year and month in which firms declared bankruptcy.

Our data's innovating feature is the complete mapping of Danish banks to their client firms using tax records provided by the Danish Tax Authority (SKAT). Each year, all entities in Denmark having issued credit or accepted deposits over the previous 12 months are required to report information on each account open during year, including the identity of the account holder, the account number, balance, and the sum of interest payments made on the account over the course of the year.[11] These reportings are used to determine tax obligations and are of accordingly high quality. We collapse the raw data at the firm-bank-account-year level to the firm-bank-year level by summing balances and interest payments across accounts held by the same firm at the same bank in each year. We do not net out loan and deposit accounts. On the bank side, we add detailed annual balance sheet information from the Danish Financial Supervisory Authority (*Finanstilsynet*), as well as monthly data on lending and deposits from Danmarks Nationalbank's MFI statistics.

To arrive at our baseline sample we restrict the data in a number of ways. At the firm-level, we begin with all active firms in 2007 excluding those in the financial, agricultural, and public sectors. We then drop all firms with missing balance sheet information in 2007 and those with less than 5 employees, removing many sole-proprietorships and small family-run businesses. We also remove a small number of firms registered on the islands of Christansø and Bornholm. Further, we further restrict the sample of firms to those that had total outstanding loans of at least 5% of total assets in 2007 to discard those firms for which bank lending constitutes a negligible share of overall financing.

3.2 Measure of Bank Exposure

Having restricted our sample, we construct a measure of banks' exposure to the financial crisis in the following way: first, for each firm we identify a primary bank in each year following

[11] As opposed to loan level data from national credit registries (Bentolila et al., 2018) or compiled databases (Chodorow-Reich, 2014), our data pose the limitation of not observing terms and the stated purposes of credit issued. As such, we are unable to capture changes in credit supply that may manifest themselves outside of price and quantity, such as with covenants as in Chodorow-Reich and Falato (2018).

Jensen and Johannesen (2017). If a firm has only one banking relationship in a year, then that bank is its primary bank. If a firm has multiple banking relationships in a year, then the bank at which the firm has the greatest outstanding loan balance is its primary bank in that year. If a firm has multiple banking relationships with equal outstanding loan balances in a year, then the bank at which the firm has the largest balance of deposits is its primary bank in that year. With this procedure we are able to identify a primary bank for all firm-years in the sample. We then remove firms from the sample that had a pre-crisis primary bank that failed between 2008-2011.[12] In many cases these banks were acquired by other banks and clients' accounts were simply transferred over, subjecting these clients to a potentially different treatment than from those banks that did not fail. Together with the previously described sample restrictions, this leave us with a panel of 13,924 firms covering the years 2004-2011. In 2007, prior to the crisis, the firms in our sample were connected to 83 primary banks.

Banks which were funding lending to larger degree with financing acquired on foreign inter-bank markets experienced experienced severe liquidity shortfalls when these markets froze in 2008. We therefore use each bank's pre-crisis loans to deposits ratio as a measure of exposure to the financial crisis. For each bank, we calculate the total outstanding loans to deposits ratio in 2007 using banks' balance sheet information. Next, we line up all firms in the baseline sample by the loans to deposits ratio of their primary bank in 2007 and split the sample at the median: primary banks of firms at the median and above are defined as exposed, while primary banks of firms below the median firm are defined as nonexposed. In this way we end up with roughly the same number of firms with exposed and nonexposed primary banks in 2007.

3.3 Descriptives

Table 1 presents descriptive statistics of firm characteristics in 2007 by primary bank exposure in 2007. Column 1 reports means and standard deviations for all 13,924 firms in the baseline sample. Columns 2 and 3 reports these statistics for firms with nonexposed or exposed primary banks in 2007 respectively. Column 4 reports the ratio of the means (firms with

[12]The vast majority of banks that failed were small regional banks such that this restriction does not remove many firms from the sample. The largest banks to fail were Roskilde Bank, the 8th largest bank in Denmark when it was taken over by Danmarks Nationalbank in August 2008, and Amagerbanken, the 11th largest bank when it was dissolved by the Danish Financial Supervisory Authority in February, 2011.

nonexposed primary banks to firms with exposed primary banks), while column 5 reports the p-value from a two-sided t-test against the null hypothesis of equal means between the groups of firms with exposed and nonexposed primary banks in 2007.

In terms of most characteristics in Table 1, firms with pre-crisis exposed primary banks are similar to those with nonexposed pre-crisis primary banks. The top panel of Table 1 contains basic firm demographic characteristics. Apart from firms with a pre-crisis exposed primary bank being slightly older on average, the two groups of firms are similar in terms of the share that are located in the Copenhagen region, the share that are incorporated (A/S firms, or *aktieselskaber*), and size in terms of number of employees. The industrial composition of firms in both groups is also relatively similar as displayed in the middle panel. This alleviates concerns that industry-specific shocks may have correlated with exposure of firms' primary banks. Based on the balance sheet characteristics in the bottom panel, firms in both groups were also similar in terms of financial health. This alleviates the concern that 'bad' (highly leveraged, low-liquidity, inefficient) firms were systematically matched with 'bad' (exposed) banks prior to the crisis.

Compared to the entire population of firms, our sample is fairly representative in terms of industrial composition, and is comparable to the average Danish firm in terms of indebtedness and liquidity.[13] Given the sample restrictions we impose, our sample does focus on firms slightly larger than the average Danish firm in terms of number of employees and revenue.

4 Bank Relationship Persistence

Our approach is based on the premise that firms and banks form relationships which are sticky. Otherwise, firms borrowing from banks that cut lending could easily and costlessly switch to borrowing from banks with excess lending capacity, and credit supply from the initial bank would carry no subsequent implications.

[13]For detailed data on the population of firms in Denmark see the general firm statistics in Tables G1-G7 and the account statistics in Tables REGN2/REGN2X compiled by Statistics Denmark and available at https://www.statistikbanken.dk/.

To get a sense of the persistence of banking relationships in the data, we follow Chodorow-Reich (2014) and estimate the following model:

$$R_{jbt} = \alpha_b + \gamma_1 R_{jbt-1} + \gamma_2 R_{jbt-1} \times AS_{jt} + e_{jbt} \tag{1}$$

R_{jbt} is an indicator variable equal to one if firm j has a banking relationship with bank b in year t. α_b is a bank fixed effect and AS is an indicator variable equal to one if a firm is an incorporated company (*aktieselskab*). ϵ_{jbt} is the error term, clustered at the bank level.

The estimated value of γ_1 provides an estimate of the likelihood that a firm-bank relationship survives from year $t-1$ to year t, even after controlling for the bank's market share (α_b). In a world in which firm-bank relationships were perfectly persistent and firms never formed new, or ended old relationships after entry, γ_1 would be equal to one. In a world in which firm-bank relationships were completely random in each year, γ_1 would be equal to zero. The estimated value of γ_2 shows whether the persistence in firm-bank relationships is higher or lower for incorporated companies. If bank relationships are sticky due to asymmetric information (ie. incumbent banks knowing more about the creditworthiness of existing firm clients than other banks; Sharpe, 1990), then we should expect relationships to be less persistent for more transparent firms (for there is less asymmetric information). To the extent that incorporated companies in Denmark are more transparent, we would expect $\hat{\gamma_2}$ to be negative if asymmetric information is an important factor behind firm-bank relationship persistence. If firm-bank relationships are sticky for other reasons including switching costs (Klemperer, 1987), or bank-market specialization (Paravisini et al., 2017), then we might expect $\hat{\gamma_2}$ to be close to zero.

We estimate equation (1) using all firm-bank relationships we have data on over the years 2004-2011 and present the results in Table 2. The results show strong evidence of sticky relationships and suggest that asymmetric information may be a key driver. In column 1 the dependent variable is an indicator equal to one if the firm had an open account with the bank in a particular year and zero otherwise. The estimated value of γ_1 is 0.882, which means that a bank that was previously in a relationship with a firm has a roughly 88 percentage point greater likelihood of being in a relationship with that same firm in the following year than any other bank. The estimated value of γ_2 is negative, indicating that the persistence of banking relationships amongst incorporated, more transparent, firms is lower. This suggests that

asymmetric information may be a key driver of firm-bank relationship persistence. Column 2 applies a more stringent definition of a firm-bank relationship where the dependent variable is an indicator equal to one if the firm has an open account and has a positive outstanding loan balance from the bank in a particular year and zero otherwise. The results in column 2 remain very similar to those in column 1. Column 3 estimates the persistence of firm-primary bank relationships. Here, the dependent variable is an indicator equal to one if the bank is the firm's primary bank in a particular year and zero otherwise. The results show that firm-primary bank relationships are estimated to be even more persistent than ordinary firm-bank relationships, and that asymmetric information seems to be a particularly important factor.

5 Evidence of a Shock to Credit Supply

5.1 The Bank Lending Channel

In this section we provide evidence of the first of two links in the causal chain transmitting bank distress to the real economy. This first link is the 'bank lending channel' — that exposed banks reduced their supply of credit to firms relative to nonexposed banks. Figure 3 plots mean real lending to domestic nonfinancial firms relative to 2007 from exposed and nonexposed banks in our sample. Over the pre-crisis years, both types of banks display similar, upward trends in relative lending. By 2009, lending trends had diverged with exposed banks exhibiting a slight negative growth rate in lending from 2007 to 2008. Through the post-crisis years, relative lending from exposed banks remained below that from nonexposed banks.

The trends plotted in Figure 3 are broadly in line with the findings in Kuchler (2012), and consistent with a drop in relative credit supply from exposed banks.[14] They could, however, also be consistent with a drop in relative credit demand from firms borrowing from exposed banks. To identify differential trends in lending, while controlling for firm credit demand, we estimate the following within-firm model for the subset of firms borrowing from both exposed and nonexposed banks in 2007

$$\log(loans_{jbt} + 1) = \theta_{jt} + \phi\Gamma_t \times exposed_b + \delta exposed_b + \eta_{jbt} \tag{2}$$

[14] Kuchler (2012) finds that self-reported credit standards in a sample of large and medium-sized Danish banks were positively related to changes in the interest rate banks were charged on the intra-MFI (inter-bank) market between Q4 2008 and Q2 2012. Further, the author finds evidence that banks adjusted their credit standards largely by adjusting the price of credit rather than collateral requirements.

The dependent variable is the log of outstanding loans firm j holds at bank b in year t. θ_{jt} is a firm-year fixed effect, Γ_t a vector of year dummies (where 2007 is the omitted year), and $exposed_b$ an indicator variable equal to 1 if bank b had a loans to deposits ratio above the median firm's primary bank's, and zero otherwise. The vector ϕ contains the coefficients of interest. In words, its elements indicate the percentage point increase in loan balances at exposed banks relative to nonexposed banks in a given year, relative to 2007. The firm-year fixed effects in equation (2) absorb all confounding shocks at the firm-year level, including firm-year specific credit demand shocks. This is an application of the within estimator proposed by Khwaja and Mian (2008).

Table 3 provides estimates of the within-firm model. The results indicate a clear and persistent shift in borrowing away from exposed towards nonexposed banks, even within firm-years. Column 1 presents estimates of a parsimonious specification of equation (2) without firm-year fixed effects. From 2008 on, firms decreased their outstanding loan balances at exposed banks significantly more than at nonexposed banks. The small and insignificant coefficients prior to 2007 indicate that loan balances at exposed and nonexposed banks exhibited parallel trends in growth prior to the financial crisis. Column 2 adds industry-year, region-year and A/S firm-year fixed effects to the specification estimated in column 1. These terms control for any possible credit demand shocks at the industry and region level, and for A/S firms in particular. Finally, column 3 provides estimates of the full within-firm model including firm-year fixed effects; Figure 4 plots these estimates. The results suggest that by 2009, outstanding loan balances at exposed banks had fallen by roughly 1 percentage point relative to balances at nonexposed banks.

Comparing the results across the specifications in Table 3 sheds light on the direction and magnitude of any potential bias from not accounting for observed and unobserved firm-year specific characteristics. Lacking these controls, one interpretation of the results in column 1 might be that firms borrowing largely from nonexposed banks experienced negative relative credit demand shocks during and after the crisis. This may be due, for instance, to selective sorting of 'bad' firms to 'bad' (exposed) banks. That the post-2007 estimates in columns 2 and 3 are negative and larger in magnitude than the estimates in column 1 — after accounting for unobserved industry-year, region-year, A/S firm-year, and firm-year heterogeneity — suggests that firms borrowing chiefly from exposed banks in fact exhibited a slight relative

increase in credit demand.

5.2 The Firm Borrowing Channel

In this section we provide evidence of the second of two links in the causal chain transmitting bank distress to the real economy. This second link is the 'firm borrowing channel' — that firms were unable to perfectly compensate the drop in credit from exposed banks with credit from alternate sources. To estimate the effect of pre-crisis primary bank exposure on debt outcomes, we employ our main differences-in-differences model,

$$y_{jt} = \lambda_j + \gamma\Omega_t + \beta\Omega_t exposed_{j,2007} + \varphi\Omega_t X_{j,2007} + \epsilon_{jt} \tag{3}$$

y_{jt} is an outcome for firm j in year t, λ_j is a firm fixed effect, and Ω_t is a vector of year dummies. $exposed_{j,2007}$ is an indicator equal to one if firm j's primary bank had a loan to deposits ratio in 2007 above the median firm's primary bank's, and zero otherwise. $X_{j,2007}$ is a vector of firm-level controls from 2007 including indicators for industry, region, and status as an A/S firm, as well as decile of the pre-crisis distributions of revenue per worker, EBITDA, and interest rate due across all loans. ϵ_{jt} is the error term clustered at the level of the firm's primary bank in 2007, the level of treatment.

For simplicity, and given concerns over the precision of estimates in differences-in-differences models with many time periods (Bertrand et al., 2004), we also employ a collapsed version of equation (3), averaging outcomes over the pre-crisis (2005-2007), and crisis/post-crisis (2008-2010) years. In all instances where we employ the collapsed model, we present estimates of the full year-by-year model in Appendix B. In addition to providing a more precise picture of the timing of effects, estimates of the year-by-year model allow us to evaluate the parallel trends assumption, the key identifying assumption of our approach.

In each year some firms exit our sample. We retain these firms in the data and assign a value of zero for monetary and aggregate count variables in years in which the firm is outside of the sample. The estimates of β in equation (3) when we retain in the sample firms that exit are estimates of the combined extensive and intensive margin effect of the reduction in credit supply on the particular outcome. Figure 5 shows that firms with a pre-crisis exposed primary bank were slightly more likely to exit the sample in each of the crisis and post-crisis years, but that the differences were small. In Table B3 in Appendix B we

present estimates of the full differences-in-differences model for indicator variable outcomes capturing firm exit. The results confirm the visual evidence in Figure 5, and show a small and statistically significant effect of exposure of the pre-crisis primary bank on firm exit.

Table 4 provides estimates of the collapsed version of equation (3) for firms' bank debt; Table B1 in Appendix B presents companion estimates of the full year-by-year model. The results show that firms with an exposed pre-crisis bank were largely unable to compensate the drop in credit supply with financing from other banks. Moving from the parsimonious specification in column 1 to the full model in column 4, we progressively add controls for firm characteristics in 2007 and finally firm fixed effects to the model. The estimates in column 4 suggest that bank debt of firms with an exposed pre-crisis primary bank fell by roughly 6% over the crisis/post-crisis years relative to the pre-crisis years. The full year-by-year estimates of this specification are plotted in Figure 6. The estimates of the 'Post x Exposed' coefficient remain relatively stable across columns 1-4 suggesting that potential bias due to observed time varying, and unobserved but fixed firm characteristics is negligible. In columns 5 and 6 we estimate the model for the log of bank debt from the pre-crisis primary bank, and the log of bank debt from all other banks respectively. The estimates show that firms with an exposed pre-crisis primary bank reduced borrowing from their primary bank, while slightly increasing borrowing from all other banks. While these estimates of the collapsed version of our model lack precision, the estimates of the full year-by-year model in columns 5 & 6 of Table B1 report statistically significant effects occurring in 2008. Together, these results suggest that firms were unable to completely offset the reduction in credit supplied from their exposed primary banks with credit from other banks. Column 7 restricts the sample to include only those firms that remained active in the years following the financial crisis, producing estimates of the intensive margin response. The results show that roughly half of the overall effect on total borrowing in column 4 is due to firms which exit the sample.

The results presented thus far show that firms with a pre-crisis exposed primary bank exhibited a decrease in the quantity of bank borrowing. Thanks to the detailed nature of our data, we can also estimate the effect of pre-crisis primary bank exposure on the price of bank borrowing. To do so, we follow Jensen and Johannesen (2017) and calculate the effective

interest rate for firm j in year t as

$$ir_{jt} = \frac{interestpaid_{jt}}{0.5(loans_{jt} + loans_{j,t-1})} \tag{4}$$

In words, the effective interest rate is calculated as the sum of interest payments made in year t divided by the average outstanding loan balance at the end of the current and previous years. The denominator is an approximation of the average amount of loans outstanding during the current year and implicitly assumes that loan balances evolve linearly over the course of a year.

The results in column 8 of Table 4 show a clear increase in the price of bank debt for firms with an exposed pre-crisis primary bank. For these firms, the effective interest rate increased by around 0.2 percentage points post-2007 relative to firms with a nonexposed pre-crisis primary bank. This positive effect on the effective interest rate is in line with that found at the household level by Jensen and Johannesen (2017), albeit a little less than a third as large in magnitude. Figure 7 plots the corresponding estimates from the full year-by-year model, providing evidence of pre-crisis parallel trends in the effective interest rate and persistent effects through the crisis and post-crisis years. These results may capture increases in interest rates at firms' existing banks, or any increases firms may experience in newly established new banking relationships. Together with the results indicating a relative drop in the quantity of borrowing, evidence of a relative increase in price are indicative of a shift in credit supply.

Aside from banks, firms may have been able to compensate for the drop in credit supply by amassing debt from other sources. The results in Table 5 suggest that firms were not able to fully do so. Its columns present estimates of the collapsed version of equation (3) for the subset of firms in the baseline sample for which balance sheet figures have been directly reported by the Danish Tax Authority in each year. Table B2 in Appendix B presents companion estimates of the full year-by-year model. The outcome in columns 1 and 2 is the log of firms' total debt including debt from banks, mortgage lending institutions, suppliers, and other creditors. The estimate of the combined extensive and intensive margin effect in column 1 of pre-crisis primary bank exposure on total debt is negative, yet imprecisely estimated. The estimate in column 2 is more precisely estimated and suggests that primary bank exposure was associated with a 2% relative decrease in overall debt along the intensive

margin.

One particular type of alternate financing we might expect firms to turn is trade credit. The outcome in column 3 of Table 5 is the log of total debt to suppliers. The estimates show that pre-crisis primary bank exposure was associated with a 3% reduction in debt to suppliers and are consistent with models in which trade credit and debt financing may be compliments (Burkart and Ellingsen, 2004).

6 Effect of the Credit Supply Shock on Real Outcomes

In this section we consider the effects of the reduction in firm credit supply on both firm (6.1) and worker (6.2) level outcomes. Section 6.4 presents a brief discussion of our findings.

6.1 Firm Level Outcomes

In our first set of main results we consider the effect of the reduction in credit supply on firm level employment. To do so, we remain with our differences-in-differences model in equation (3) for the log number of employees. Table 6 provides estimates of the collapsed version of our model, while Table B4 in Appendix B provides estimates of the full year-by-year model for each of the same specifications. Though imprecise, the results in column 1 suggest that exposure of the pre-crisis primary bank was associated with a nearly 2% relative decrease in total firm level employment from the pre-crisis to crisis/post-crisis years. The estimated effect in column 1 is a combination of the intensive and extensive margin effects as the sample includes both firms that remained active post-2007 and firms that exited the sample. Firms that exited the sample are recorded as having zero employees for the years in which they are outside of the sample. Column 2 presents estimates of the intensive margin effect on employment using the sample of firms that remained active between 2008-2011. The estimates show that the reduction in credit supply induced a 0.7% fall in employment, statistically significant at the 10% level. This suggests that more than half of the overall effect occurred along the extensive margin. Figure 8 plots the full year-by-year estimates of the specification in column 2, validating the parallel trends assumption and showing that the negative employment effects were almost entirely concentrated in 2008.

Firms with higher pre-crisis liquidity may have been better able to dampen the effects of the reduction in credit supply by utilising liquid assets to continue to pay workers' wages (Jermann and Quadrini, 2012) or to protect their search capital (the cost of attracting and hiring workers; Boeri et al., 2018). Columns 3 and 4 of Table 6 present estimates of the collapsed version of (3) for employment separately for firms with low and high pre-crisis liquidity. We measure pre-crisis liquidity using each firm's current ratio (current assets over current liabilities) in 2007. We then split the sample of firms at the median current ratio and define firms with a below median pre-crisis current ratio as low liquidity firms, and firms with a pre-crisis current ratio above the median as high liquidity firms. The estimates in columns 3 and 4 suggest that the negative effect of the reduction in credit supply on employment was overwhelmingly concentrated amongst firms with low pre-crisis liquidity, in line with some previous empirical findings.[15]

In our next set of main results we use the collapsed version of our main empirical model in equation (3) to study how the reduction in credit supply affected the composition of firms' employees. The results are presented in Table 7; Table B5 in Appendix B provides estimates of the full year-by-year model for each of the same specifications. The sample in all columns includes only those firms that remained in the sample in all years between 2008-2011 providing estimates of effects along the intensive margin. The outcome variables in columns 1 and 2 are log employment of managers and nonmanagers respectively. Information on managerial status of employees stems from mandatory annual employer reports to the Danish Tax Authority and is available in the raw IDA data. The estimates in columns 1 and 2 suggest that the negative intensive margin employment effects of the reduction in credit supply were largely concentrated amongst nonmanagerial workers. Firms with an exposed pre-crisis primary bank reduced employment in nonmanagerial positions by roughly 1% while employment in managerial positions remained largely unaltered. These results are broadly consistent with the empirical findings of Sforza (2019) and may reflect differences in firing costs (Pfann, 2006), tenure, or expected future productivity (Caggese, Cuñat, and Metzger,

[15] Berg (2016) finds that the negative effect of a loan application rejection on firm level employment is larger for firms with low liquidity, also measured using the current ratio. Bentolila et al. (2018), however, find that effects of the credit supply shock to Spanish firms on their employment did not vary with pre-crisis liquidity, but did vary with other measures of financial fragility including past defaults and loan rejections, dependence on bank debt, and share of short-term liabilities due within the next year.

2019).[16]

Aside from hierarchical adjustments, firms may have also adjusted the skill composition of their employees. The outcome variables in columns 3 and 4 of Table 7 are log employment of low- and high-educated workers respectively. We classify workers as low- or high-educated based on the highest level of education completed: workers who have completed at most a primary or secondary level education are defined as low-educated, and workers who have completed a tertiary level education are defined as high-educated. While noisy, the estimates suggest that firms largely reduced their employment of low-educated workers in response to the shock to credit supply. A closer look at the timing of the effects from the full year-by-year model in Table B5 in Appendix B shows a significant negative effect on employment of low-educated workers along the intensive margin of roughly 1.2% in 2008. These findings are consistent with Berton et al. (2018) and suggest that firms facing a reduction in credit supply not only downsized, but also changed their mix of labour inputs. In column 5 we study the effect of the shock to credit supply on the average years of employee tenure. The results do not provide evidence of a significant effect, which could be due to a number of reasons. First, employee tenure may not be a relevant dimension upon which firms decide to cut employment when facing a shock to credit supply. Second, short-tenured employees may be let go and partially replaced with new hires with no tenure, effectively changing the average years of tenure at a firm very little. Third, firms may be inclined to cut employment on both ends of the tenure distribution effectively changing the average employee years of tenure very little. We next turn to estimating the effects of the reduction in firm credit supply on worker level outcomes in an attempt to distinguish between these alternative explanations.

6.2 Worker Level Outcomes

The results presented thus far suggest that firms facing a reduction in credit supply reduced employment. In a frictionless labour market, workers affected by the squeeze on employment might transition directly to a new employer at terms reflecting their productive capacity. In a labour market with frictions or during a recessionary period, however, workers may experience a period of unemployment and reduced earnings. In our next set of main results

[16]The rough categorization of firms' managerial hierarchies we use is courser than that of Sforza (2019) who finds that firms faced with a credit supply shock reduced employment most amongst middle managerial positions. Our findings do, however, confirm a positive effect on the span of control (number of workers per manager) of top managerial workers.

we estimate the effect of pre-crisis primary bank exposure on real outcomes for workers. To do this, we adapt our main differences-in-differences approach to the worker level with the following model:

$$y_{ijt} = \psi_i + \gamma\Omega_t + \beta\Omega_t exposed_{ij,2007} + \varphi\Omega_t X_{j,2007} + \pi\Omega_t W_{i,2007} + \nu_{ijt} \tag{5}$$

for worker i employed in 2007 at firm j in year t. ψ_i is a worker fixed effect. $exposed_{ij,2007}$ is an indicator variable equal to one if the firm j that worker i was employed at in 2007 had a primary bank that was exposed to the financial crisis in 2007. Ω_t is a vector of year dummies and $X_{j,2007}$ is the same vector of pre-crisis characteristics for firm j as in equation (3). $W_{i,2007}$ is a vector of pre-crisis individual characteristic measured in 2007, including an indicator variable equal to one if the individual had completed tertiary education, and an indicator variable equal to one if the individual was born in Denmark. ν_{ijt} is the error term which we cluster at the level of firm j's primary bank in 2007 — the level of treatment. As with the analyses at the firm level, we primarily refer to estimates of a collapsed version of equation (5) where outcomes over the years 2005-2007 have been averaged in to a pre-crisis period, and outcomes over the years 2008-2010 have been averaged in to a crisis/post-crisis period.

We restrict the sample of workers to include all employees aged 35 to 60 who were employed in 2007 at one of the firms in our baseline sample. We remove a small number of individuals for whom we have missing information in any year between 2004-2011 leaving us with a balanced panel of 259,441 workers. Table 8 reports descriptive statistics in 2007 for the workers in our sample by exposure of their employer's pre-crisis primary bank. While workers employed at firms with an exposed pre-crisis primary bank are, on average, slightly older, more educated, tenured, experienced, and more likely to be male and born in Denmark, the differences in these averages across groups are relatively small when considering the ratio of means. A large body of research shows that individuals sharing the characteristics of workers at firms with exposed pre-crisis primary banks are more attached to the labour market and fare better during recessions.[17] As such, the balance of characteristics between workers at firms

[17]See Hoynes et al. (2012) for an overview in the US context; Andersen (2017) in the Danish context. Clark and Summers (1981), and more recently Jaimovich and Siu (2009) provide evidence that volatility of employment and hours worked is higher for young workers than prime-aged and elderly workers across the G7 countries. Hoynes (1999) shows that employment and earnings of less educated, nonwhite, and particularly female workers are more cyclically volatile using US data. Bratsberg et al. (2004) use Norwegian register data

with exposed and nonexposed pre-crisis primary banks may serve to dampen any potential negative effects of the reduction in credit supply on workers' labour market outcomes.

Table 9 presents estimates of the collapsed version of equation (5) for workers' unemployment outcomes; Table B6 in Appendix B reports companion estimates of the full year-by-year model. The outcome variable in all columns is an indicator equal to 1 if worker i was unemployed at any time during year t, and zero otherwise.[18] The estimates in column 1 suggest that workers employed at firms with an exposed pre-crisis primary bank were 0.4% more likely to experience a period of unemployment between 2008-2010 than those employed at firms with a nonexposed pre-crisis primary bank. This estimated average effect for all workers in the sample masks considerable heterogeneity by position in the firm and educational attainment. In columns 2 and 3, we estimate the model for unemployment separately for workers employed in 2007 in managerial and nonmanagerial positions respectively. The results clearly show that the effect of the reduction in credit supply on unemployment was highly concentrated amongst workers in nonmanagerial positions. Being employed at a firm with an exposed pre-crisis primary bank is associated with a 0.4% increase in the likelihood of experiencing unemployment post-2007 for workers in nonmanagerial positions. Similarly, total effects at the worker level are shown to be driven by low-educated workers. Exposure of the pre-crisis primary bank is associated with a 0.4% increase in the likelihood for low-educated workers, but does not seem to have an effect on the risk of unemployment for high-educated workers. Panels (a) and (b) of Figure 9 plot the estimates from the full year-by-year model for an indicator of unemployment amongst nonmanagerial workers and low-educated workers respectively. The small and insignificant estimates on the exposure-year dummy interaction terms for the years prior to 2007 lend credibility to our identifying assumption of pre-treatment parallel trends in unemployment. The magnitude and significance of the estimates in 2008 and 2009 suggest that the bulk of the effect of the reduction

to show that the earnings of immigrants from non-OECD countries are more sensitive to local unemployment than that of natives. Orrenius and Zavodny (2010) show that Mexican immigrants in the US were particularly hard hit by the Great Recession both overall and within education groups. Arozamena and Centeno (2006) present empirical evidence that the wage-unemployment rate elasticity is lower for more tenured workers. Hershbein and Kahn (2018) find that firms increased education and experience requirements, within both occupation and firm, during the 2008/2009 financial crisis.

[18] We construct this outcome variable using information on the fraction the year that an individual received unemployment benefits, available in the IDA database. This information builds on records of unemployment that were sourced until 2007 from the *Centrale register for arbejdsmarkedsdata* (CRAM), and from 2008 on from *Personer uden Ordinaer Beskaeftigelse* statistics

in credit supply occurred in these years.

We further study how the effects on worker unemployment varied by tenure and occupational skill group. Columns 1-3 in Table 10 estimate our worker level model separately for short- (0-2 years), mid-(3-8 years), and long-tenured (9+ years) workers. The results show that effects were highly concentrated on short-tenured workers as these workers experienced a 0.5% increase in the probability of unemployment over the period 2008-2010. The results of the full year-by-year model in Table B7 in Appendix B show that effects for short-tenured workers were largest in magnitude in 2009 and remained persistently high through 2011. We also find evidence of a smaller, less precisely estimated effect on unemployment in 2008 for long-tenured workers.

In columns 4-5, we estimate our model of worker level unemployment separately by the occupational skill group workers were employed in in 2007. To classify occupations in to skill categories we rely on employer reported occupational codes accord- ing to the International Standard Classification of Occupations (ISCO). We follow standard occupational skill classifications (OECD, 2019) and categorise occupations in ISCO major groups 5 (service workers and shop and market sales workers) & 9 (elementary occupations) as low-skill occupations, 4 (clerks), 7 (craft and related trades workers) & 8 (plant and ma- chine operators and assemblers) as middle-skill occupations, and 1 (legislators, senior officials, and managers), 2 (professionals) & 3 (technicians and associate professionals) as high-skill occupations. The results clearly show that the effect of the reduction in credit supply on unemployment was highly concentrated amongst workers employed in low-skill occupations in 2007. Being employed at a firm with an exposed pre-crisis primary bank is associated with a 1.5% increase in the likelihood of experiencing unemployment post-2007 for workers in low-skill occupations. The effect for workers in middle-skill occupations remains positive, yet less than a third as large in magnitude as that for workers in low-skill occupations, while there appears to be no evidence of an effect for workers in high-skill occupations. Panels (c) and (d) of Figure 9 plot the estimates from the full year-by-year model for an indicator of unemployment amongst short-tenured workers and workers in low-skill occupations respectively. The small and insignificant estimates on the exposure-year dummy interaction terms for the years prior to 2007 lend credibility to our identifying assumption of pre-treatment parallel trends in unemployment. The magnitude and significance of the estimates in 2008 and 2009 suggest that

the bulk of the effect of the reduction in credit supply occurred in these years.

6.3 Aggregate Implications

Following Chodorow-Reich (2014), we can use our estimates in Section 6.1 together with the following two assumptions to infer the extent to which the shock to credit supply drove the fall in aggregate employment from 2007-2008 in our sample.

1. The total effect of the shock to credit supply on employment is the sum of the direct effects at the firm level.

2. Nonexposed banks did not shift their supply of credit.

Both assumptions are, of course, quite strong. To the extent that these assumptions do not hold, however, our simple calculations of the aggregate effect will represent a lower bound on the true effect on employment in our sample.

Let us first define counterfactual log employment for firm j in 2008 if its pre-crisis primary bank was nonexposed

$$\tilde{y}_{j,2008}(exposed) = E[y_{j,2008}|exposed_{j,2007} = 0] = \hat{y}_{j,2008} - \hat{\beta}_{2008} \times exposed_{j,2007}$$

$\hat{y}_{j,2008}$ is the fitted value of log employment in 2008 from our main differences-in-differences model. $exposed_{j,2007}$ is an indicator equal to one if the firm's primary pre-crisis bank was exposed to the financial crisis. $\hat{\beta}_{2008}$ is the estimate from our main differences-in-differences model of the coefficient on the interaction term between $exposed_{j,2007}$ and a year dummy for the year 2008. The total decrease in employment (in levels) from 2007 to 2008 due to the shock to credit supply is then

$$\sum_{exposed_{j,2007}=1} \exp(\hat{y}_{j,2008}) - \sum_{exposed_{j,2007}=1} \exp(\tilde{y}_{j,2008})$$

That is, for firms with an exposed pre-crisis primary bank, we sum predicted employment and subtract the sum of counterfactual employment. The share of the total decrease in employment from 2007-2008 that can be explained by the shock is then

$$\frac{\sum_{exposed_{j,2007}=1} \exp(\hat{y}_{j,2008}) - \sum_{exposed_{j,2007}=1} \exp(\tilde{y}_{j,2008})}{\sum_j \exp(y_{j,2008}) - \sum_j \exp(y_{j,2007})} \tag{6}$$

A summary of our calculations is presented in Table 11. From 2007-2008 employment at the firms in our sample declined by roughly 72,000 or 14%. The shock to credit supply through exposure of pre-crisis primary banking relationships accounts for roughly 6% of this fall.

6.4 Discussion

The results presented in Section 6.1 suggest that the reduction in credit supply caused firms to reduce employment, in line with previous empirical findings. It remains an open question, however, which mechanisms drive the link between credit and employment. The theoretical literature offers a number of possibilities. Petrosky-Nadeau (2014), Petrosky-Nadeau and Wasmer (2013), and Wasmer and Weil (2004) introduce credit markets with search frictions in to a standard search and matching model of the labour market. With greater frictions in the credit market, it is harder for firms to access credit and they do not post as many vacancies. Monacelli et al. (2011) instead focus on the wage bargaining process building a model in which higher debt reduces the net surplus which firms and workers negotiate over. Access to credit allows firms to accumulate more debt and bargain for lower wages, increasing the incentive to create jobs. More recently a number of papers have focused on the role of liquidity. Garín (2015), Jermann and Quadrini (2012), and Melcangi (2017) build models in which financial frictions constrain firms' holdings of liquid assets which are needed to prepay employees salaries. Boeri et al. (2018) incorporate firm credit constraints in the form of limited pledgeability into a standard job search model where firms hold liquid assets for precautionary reasons.[19] Frictions in the credit market lead firms to increase the amount of liquidity they hold at the expense of investing in greater capacity and more employees. Our findings that the employment impacts of the reduction in credit supply were greatest for firms with low pre-crisis liquidity lend credence to these theories.

At the firm level we further find that credit supply induced cuts to employment occurred largely amongst employment of nonmanagerial and low-educated workers. These results suggest that firms not only downscaled in terms of their use of labour, but also changed the

[19]Limited pledgeability introduced by Holmstrom and Tirole (2011) captures the idea that firms can only commit repay a portion of expected future income when securing financing. This may be the case when part of the income from a particular project or investment is nonpecuniary in nature, or cannot otherwise easily be transferred to the creditor. In addition, the firm must have a sufficiently large stake in the outcome of the project or investment to have the proper incentives to maximise the expected future gain.

skill composition and hierarchical structure of their workforce. The extent to which the above mentioned mechanisms are of greater relevance for employment in nonmanagerial positions and low-educated workers may help in rationalising our findings. For instance, firms that become strapped for liquidity due to a reduction in credit supply may alter their demand for production inputs in such a way that forces them to reduce immediate costs at the expense of future productivity (Caggese and Cuñat, 2008; Caggese, Cuñat, and Metzger, 2019; Eisfeldt and Rampini, 2006). If adjustment costs for employment of low-educated, nonmanagerial workers are relatively low, this may lead firms to cut employment more amongst workers in these groups (Oi, 1962; Rosen, 1968). Employment of low-educated, nonmanagerial workers may also be more negatively affected if wages for these workers are more rigid (due to binding wage floors) than for high-educated, managerial workers (Moser et al., 2020).

Our results at the firm level further suggest a small and insignificant negative effect of the shock to credit supply on the average years of employee tenure. This result, however, masks significant and heterogeneous employment effects along the employee tenure distribution. In general, results at the firm level do not necessarily imply corresponding effects at the worker level. Small or no changes in a firms' stock of employees can mask larger flows in and out of a firms' workforce. At the worker level, we find a modest positive effect on unemployment for long-tenured workers, as well as a larger, more persistent effect for short-tenured workers. These results may be a reflection of firing costs that increase with tenure (Cavalcanti, 2004), higher wages for more tenured workers (Mincer and Jovanovich, 1979), or greater firm-specific human capital — and higher productivity — amongst longer-tenured workers (Shaw and Lazear, 2008). That effects for short-tenured workers appear to be persistent may be an indication of longer-term scarring effects of job loss (Ouyang, 2009), and are consistent with models in which tenure of the discontinued employment relationship signals worker ability to potential future employers (Greenwald, 1986).

When interpreting our findings, it is important to keep in mind that our results are estimates of relative, partial equilibrium effects. For instance, our estimates of the elements of the β vector in equation (3) tell us how much *more* borrowing and employment fell at firms with an exposed pre-crisis primary bank than at firms with a nonexposed pre-crisis primary bank. Similarly, our estimates of the elements of the β vector in equation (5) tell us how much *more* unemployment rose for workers employed pre-crisis at firms with an exposed

pre-crisis primary bank compared to workers employed pre-crisis at firms with a nonexposed pre-crisis primary bank. These results do not rule out drops in employment or increases in unemployment associated with nonexposed pre-crisis primary banks.

7 Conclusion

In this paper, we show that pressures within the banking system can spread to the real economy with significant, and heterogeneous, impacts on firms and workers. We use a novel bank-firm-worker matched dataset built from Danish administrative and tax records to study the effects of bank distress during the 2008/2009 financial crisis. Prior to the crisis, some banks increased their reliance on funding acquired via inter-bank markets, leaving them exposed to liquidity shortfalls once these markets froze in the fall of 2008. Consistent with the literature, we show that the transmission of this shock from banks to firms occurred via two links in a causal chain. First, we document the bank lending channel whereby banks which were particularly exposed to the crisis reduced their supply of credit to firms. Next, we document the firm borrowing channel whereby firms that were primarily connected to exposed banks were unable to fully compensate for the reduction in credit supply with credit from alternate sources.

In line with previous empirical studies, we find significant effects of the reduction in credit supply on firm level employment. Firms primarily connected to exposed banks pre-crisis reduced employment by roughly 2% relative to firms primarily connected pre-crisis to nonexposed banks. Back-of-the-envelope calculations suggest that the reduction credit supply can explain roughly 6.2% of the overall reduction in employment from 2007-2008. Just over half of the total effect on employment occurred due to firm exit. The negative effect of pre-crisis primary bank exposure on employment was greatest for firms with low pre-crisis liquidity, and concentrated on employment in nonmanagerial positions. Further, we present evidence that exposure of the pre-crisis primary bank was associated with a significant reduction in employment low-educated workers. These findings highlight access to credit as a potentially important factor behind the large losses in employment of low-educated workers observed in the data through the financial crisis. At the worker level, the impact of the reduction in firms' credit supply varied with employee characteristics. We find that positive effects on unemployment were driven by nonmanagerial, low-educated, and short-tenured workers, as

well as workers in low-skill occupations.

Taken together, our findings shed light on the impacts of frictions in credit and labour markets, and highlight the role provision of credit plays in explaining heterogeneous employment dynamics. In a frictionless credit market, banking relationships would not exhibit the persistency we find that they do. Nor would there exist asymmetric information regarding the creditworthiness of firms as our findings suggest. As a result, firms are unable to fully and costlessly offset reductions in borrowing capacity from some creditors with additional financing from others — even when their underlying creditworthiness has not changed. In a frictionless labour market, workers affected by the squeeze on employment may more easily find new employment opportunities, sparing them from periods of unemployment. Our findings carry important policy implications in response to these frictions, whether concerning the importance of capital requirements for banks, or the targeting of labour market policies and supports during times of contractionary credit.

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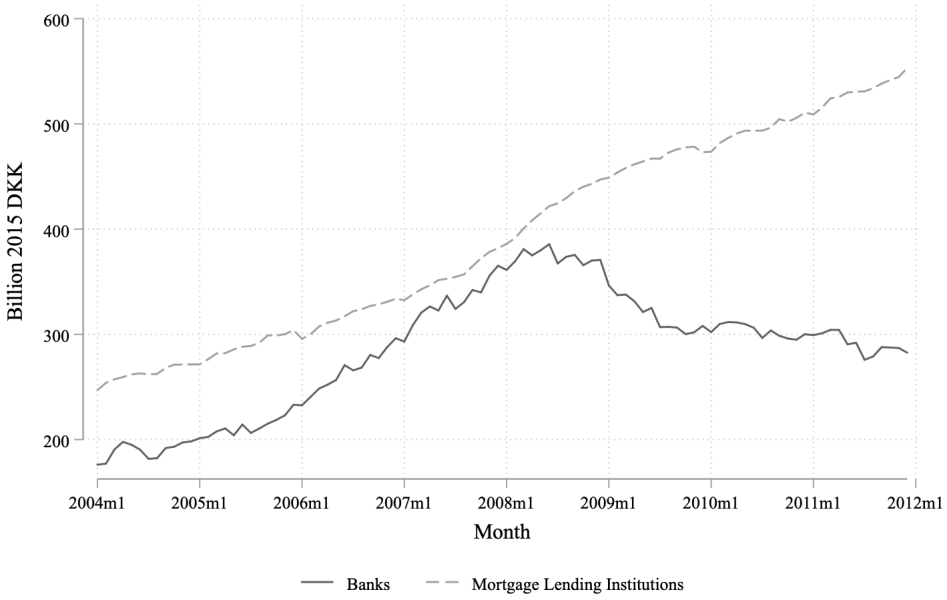
Tables and Figures

Figure 1: Lending to Danish Non-Financial Corporations, 2004-2011

(a) Total Lending

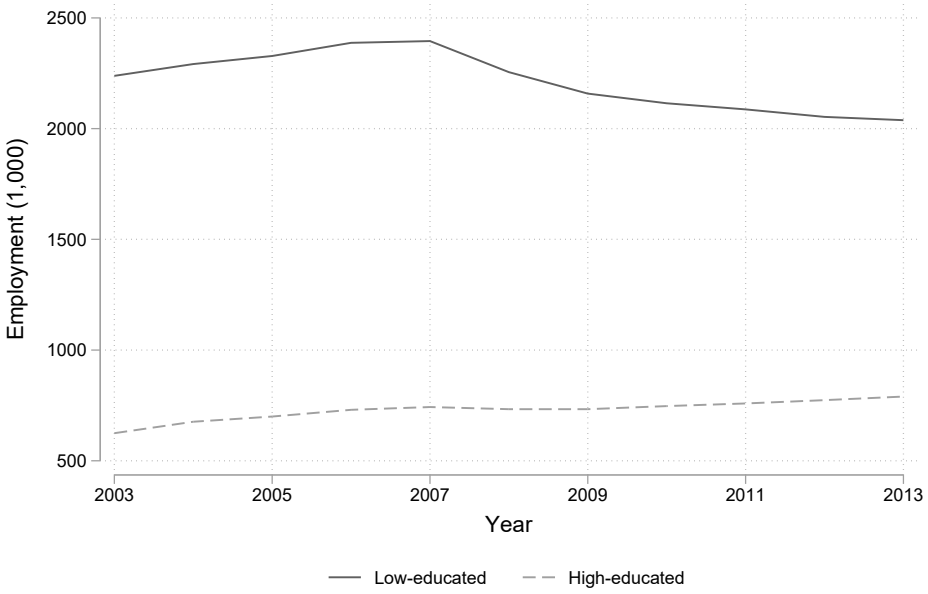


(b) Annual Growth in Lending

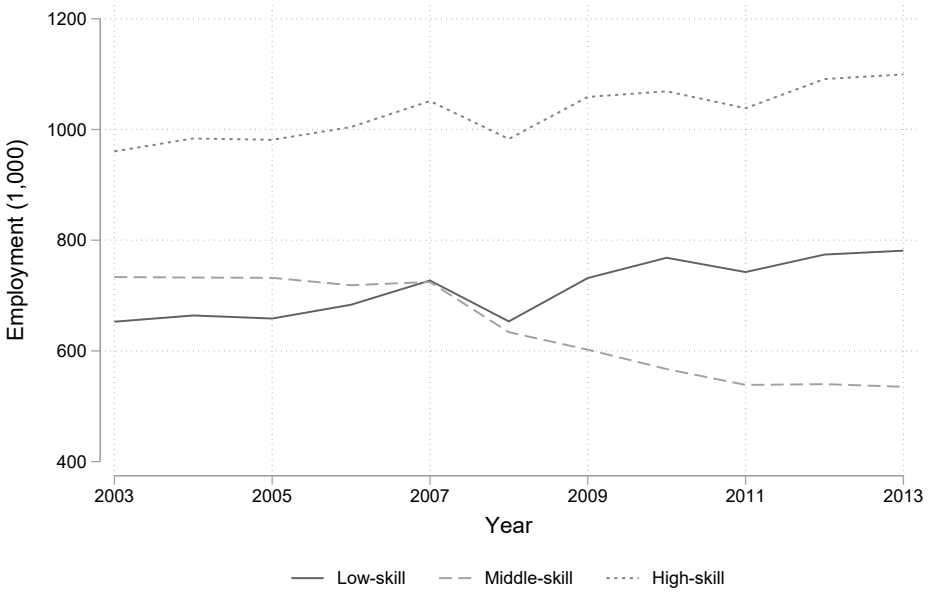
Source: Danmarks Statistik - statbank.dk/DNMUDL and statbank.dk/PRIS117
Notes: Panel (a) plots real monthly total lending from Danish banks and mortgage lending institutions to Danish non-financial corporations between January 2004 and December 2011. Panel (b) plots the annualised growth rate of the monthly lending totals in panel (a).

Figure 2: Total Employment, 2003-2013

(a) By Educational Attainment

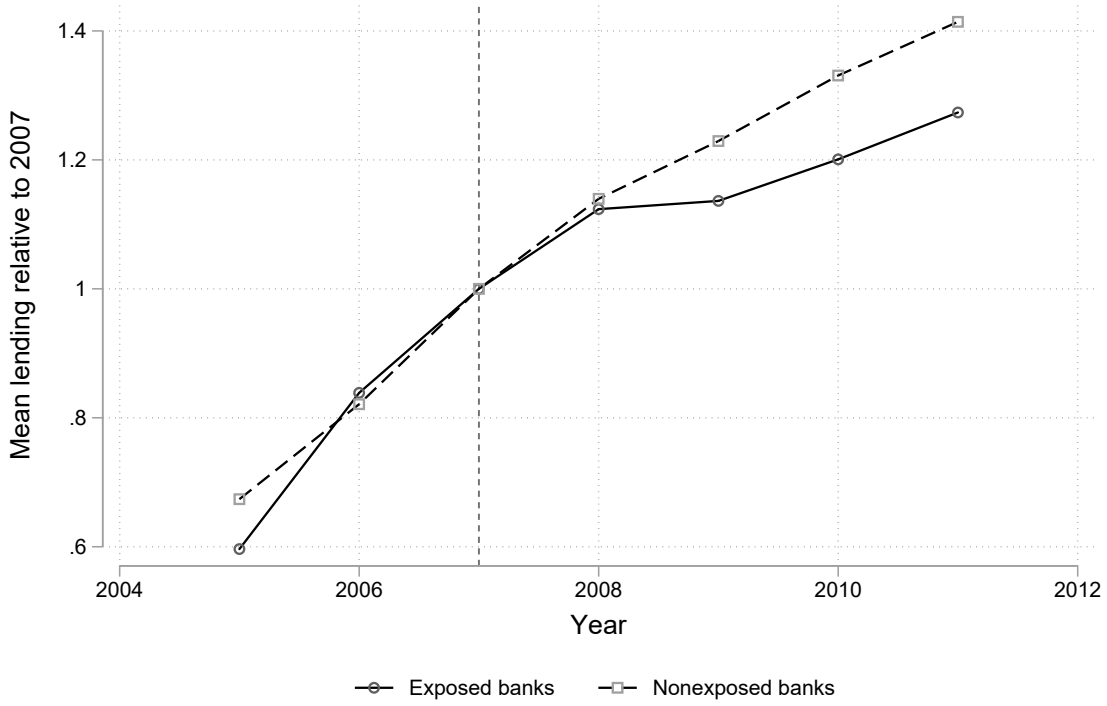


(b) By Occupational Skill Group



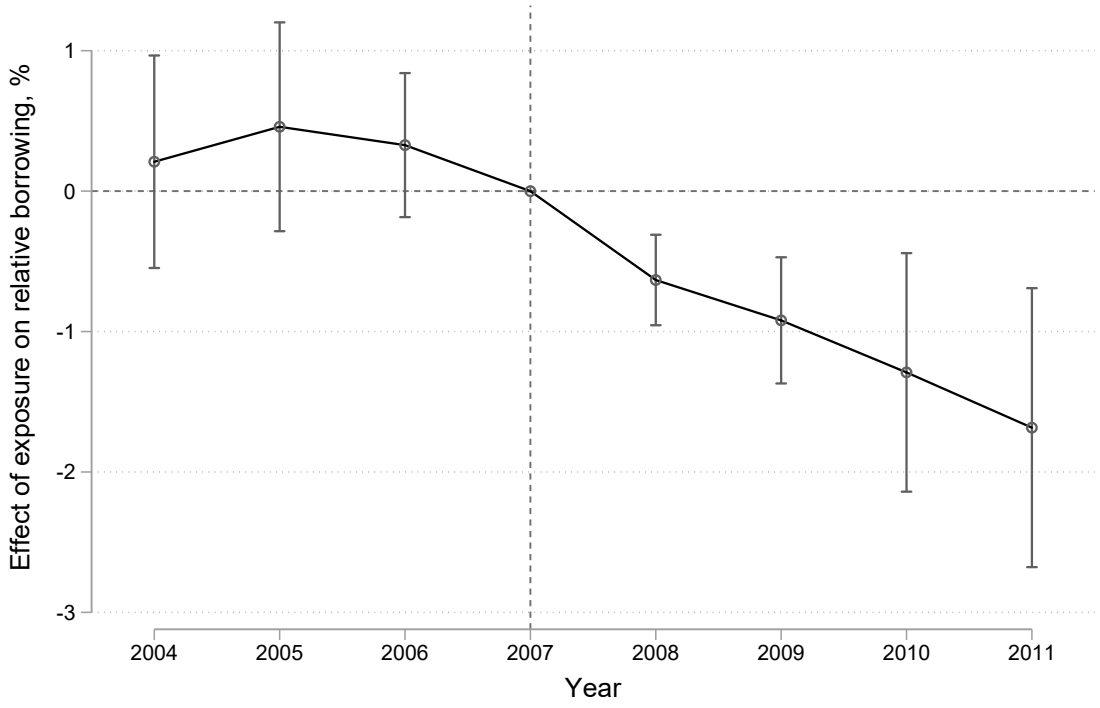
Notes: Panel (a) plots total employment during the last week of November in each year by educational attainment. Low-educated employees are those workers that have at most completed a primary or secondary level education. High-educated employees are those workers that have completed a tertiary level education. Panel (b) plots total employment during the last week of November in each year by occupational skill group. Low-skill occupations are those in major groups 5 (service workers and shop and market sales workers) and 9 (elementary occupations) of the International Standard Classification of Occupations (ISCO-88). Middle-skill occupations are those in major groups 4 (clerks), 7 (craft and related trades workers), and 8 (plant and machine operators and assemblers) of ISCO-88. High-skill occupations are those in major groups 1 (legislators, senior officials, and managers), 2 (professionals), and 3 (technicians and associate professionals) of ISCO-88.

Figure 3: Mean Lending Relative to 2007



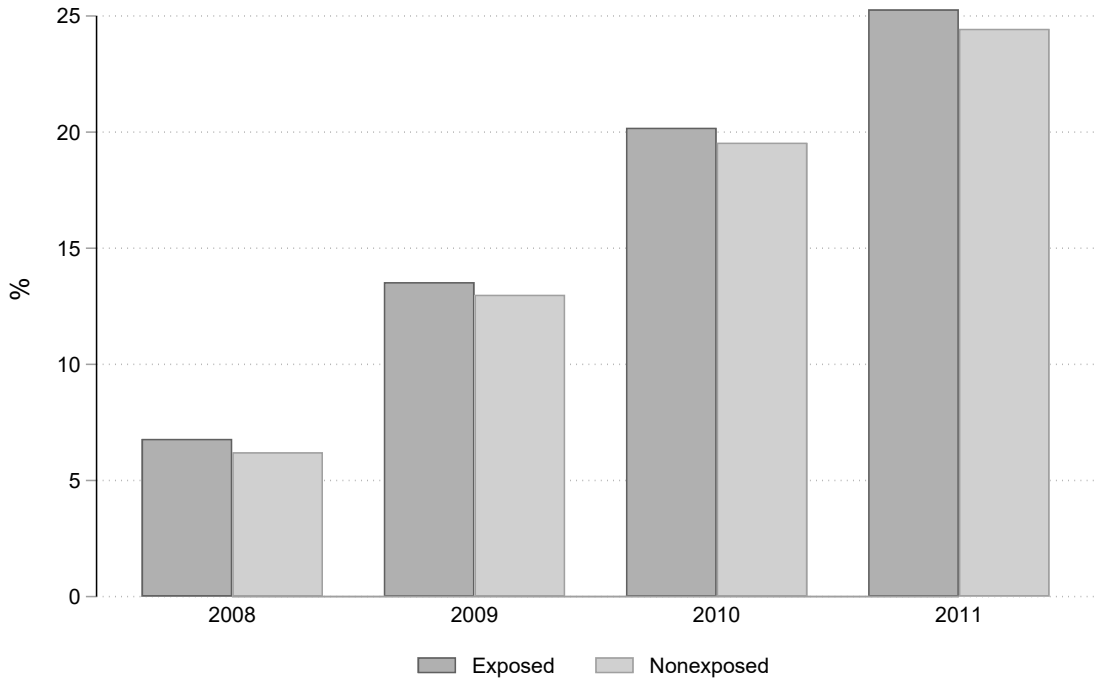
Source: Danmarks Nationalbank - MFI statistics
Notes: This figure plots mean real lending relative to 2007 to Danish non-financial firms from exposed and nonexposed banks in our sample. The banks in the sample include those banks identified as primary banks for the firms in our sample following the steps outlined in Sections 3.1 and 3.2. Further, we restrict the sample of banks to those with positive lending in each year between 2005 and 2011. Exposed banks are those that have a loans to deposits ratio in 2007 at and above the median firm's primary bank's; nonexposed banks are those with a loans to deposits ratio in 2007 below the median firm's primary bank's. Banks' relative lending to 2007 has been winsorized at the 5th and 95th percentiles in each year.

Figure 4: Within-Firm Model Estimates of the Effect of Pre-Crisis Exposure on Firms' Bank-Specific Outstanding Loans



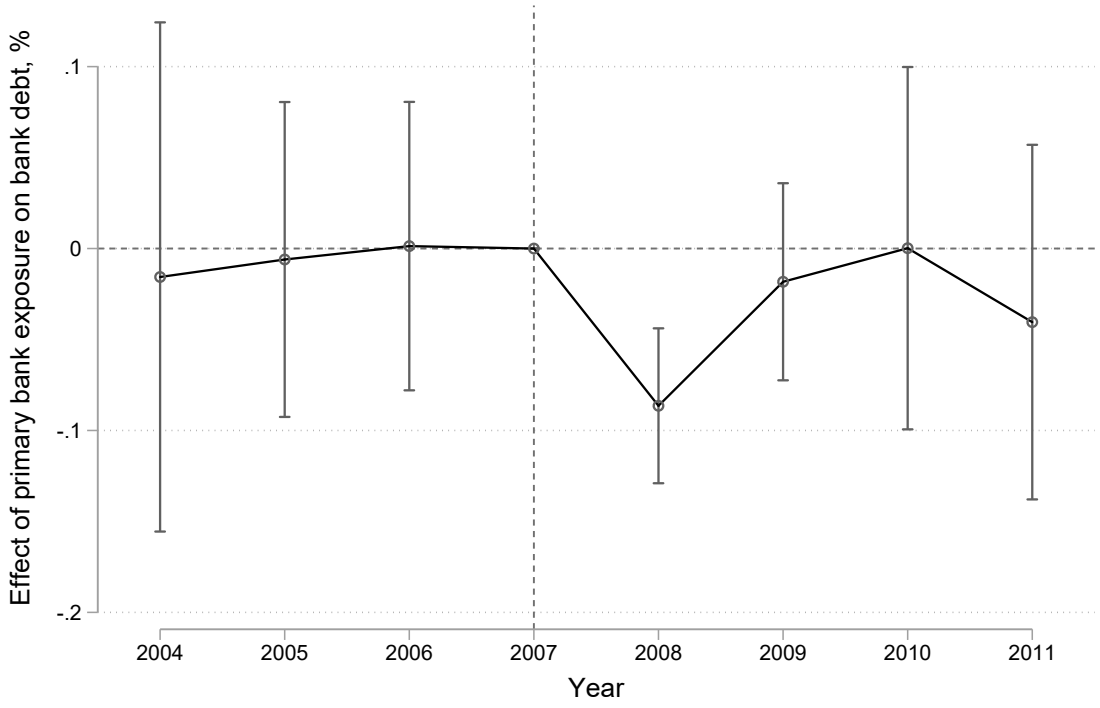
Notes: This figure plots OLS estimates of the within-firm model including firm-year fixed effects. The dependent variable is the log of outstanding loans (10,000 2005 DKK) held by a firm in each year at each bank it had a relationship with in 2007 plus one. The points plotted represent estimates of the coefficients on interaction terms between year dummies and an indicator for bank exposure in 2007 as defined in Section 3.2. These estimates correspond to those in column 3 of Table 3. The sample includes all firm-bank relationships with an average loan balance of at least 2% of average total assets over the years 2004-2011 for firms active in each of those years. Vertical bars represent 95% confidence intervals where the standard errors have been clustered at the bank level (the level of treatment).

Figure 5: Cumulative Percentage of Firms that Exit the Sample by Exposure of the Pre-Crisis Primary Bank



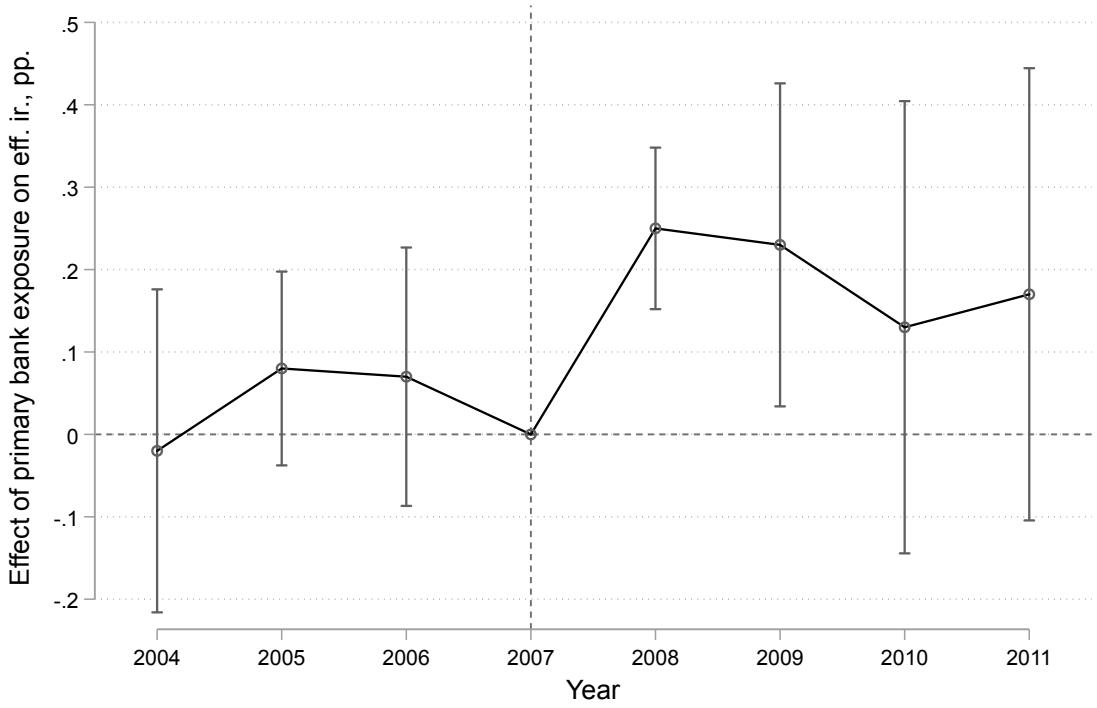
Notes: This figure plots the cumulative percentage of firms that exited the sample by each year by exposure of the pre-crisis primary bank. The sample includes all firms in our baseline sample as described in Section 3.1. Exposure of firms' pre-crisis primary banks is determined based on banks' outstanding loans to deposits ratios as detailed in Section 3.2.

Figure 6: Differences-in-Differences Estimates of the Effect of Pre-Crisis Primary Bank Exposure on Outstanding Loans



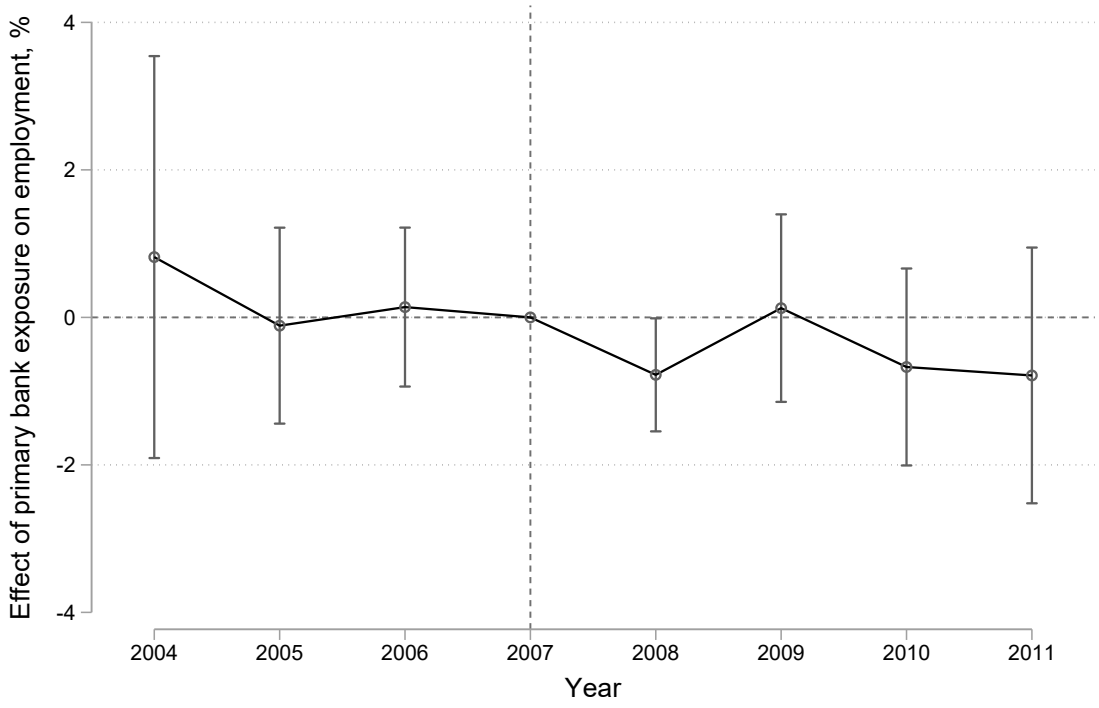
Notes: This figure plots OLS estimates of the effect of firms' pre-crisis primary bank exposure on outstanding loans using our year-by-year differences-in-differences model at the firm level. The dependent variable is the log of outstanding loans (10,000 2005 DKK) held across all banks by a firm in each year. The points plotted represent estimates of the coefficients on interaction terms between year dummies and an indicator for exposure of the firm's primary bank in 2007 (the elements of β in equation (3)). These estimates correspond to those in column 4 of Table B1 in Appendix B. A firm's primary bank is defined as exposed if it had a loans to deposits ratio in 2007 at or above the median firm's primary bank's as described in detail in Section 3.2. The sample includes all firms in our baseline sample as described in Section 3.1. Vertical bars represent 95% confidence intervals where the standard errors have been clustered at the level of the firm's primary bank in 2007 (the level of treatment).

Figure 7: Differences-in-Differences Estimates of the Effect of Pre-Crisis Primary Bank Exposure on the Effective Interest Rate



Notes: This figure plots OLS estimates of the effect of firms' pre-crisis primary bank exposure on the effective interest rate using our year-by-year differences-in-differences model at the firm level. The dependent variable is the imputed effective interest rate paid across all bank loans by a firm in each year. The points plotted represent estimates of the coefficients on interaction terms between year dummies and an indicator for exposure of the firm's primary bank in 2007 (the elements of β in equation (3)). These estimates correspond to those in column 8 of Table B1 in Appendix B. A firm's primary bank is defined as exposed if it had a loans to deposits ratio in 2007 at or above the median firm's primary bank's as described in detail in Section 3.2. The sample includes all firms in the baseline sample that were active and paid a positive effective interest rate in all years between 2004-2011. Vertical bars represent 95% confidence intervals where the standard errors have been clustered at the level of the firm's primary bank in 2007 (the level of treatment).

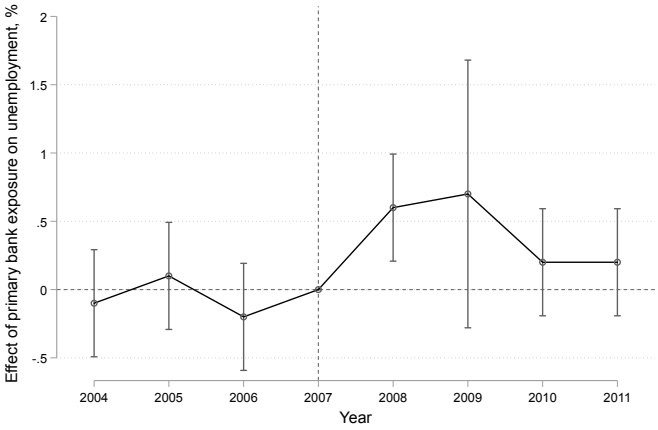
Figure 8: Differences-in-Differences Estimates of the Effect of Pre-Crisis Primary Bank Exposure on Intensive Margin Employment



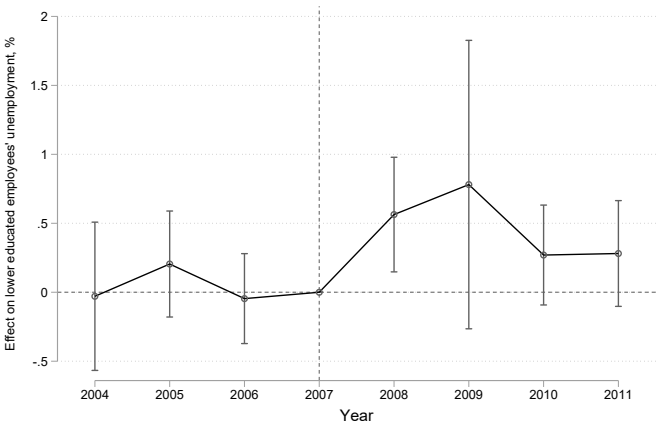
Notes: This figure plots OLS estimates of the effect of firms' pre-crisis primary bank exposure on employment using our year-by-year differences-in-differences model at the firm level. The dependent variable is the log of the number of employees at a firm in each year plus one. The points plotted represent estimates of the coefficients on interaction terms between year dummies and an indicator for exposure of the firm's primary bank in 2007 (the elements of β in equation (3)). These estimates correspond to those in column 2 of Table B4 in Appendix B. A firm's primary bank is defined as exposed if it had a loans to deposits ratio in 2007 at or above the median firm's primary bank's as described in detail in Section 3.2. The sample includes all firms in our baseline sample as described in Section 3.1 that were active in all years between 2004-2011. Vertical bars represent 95% confidence intervals where the standard errors have been clustered at the level of the firm's primary bank in 2007 (the level of treatment).

Figure 9: Effects of Pre-Crisis Primary Bank Exposure on Worker Unemployment

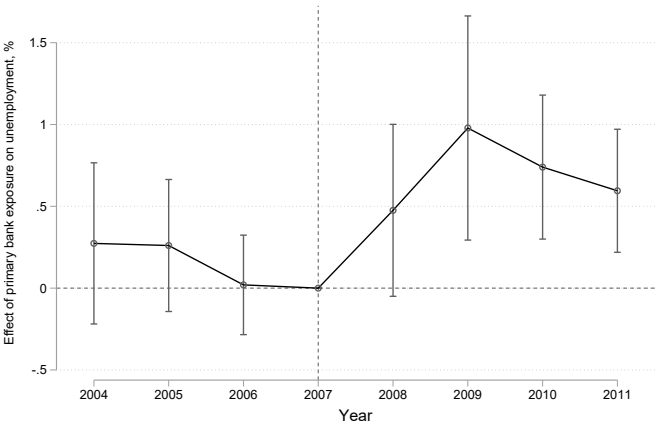
(a) Nonmanagerial Workers



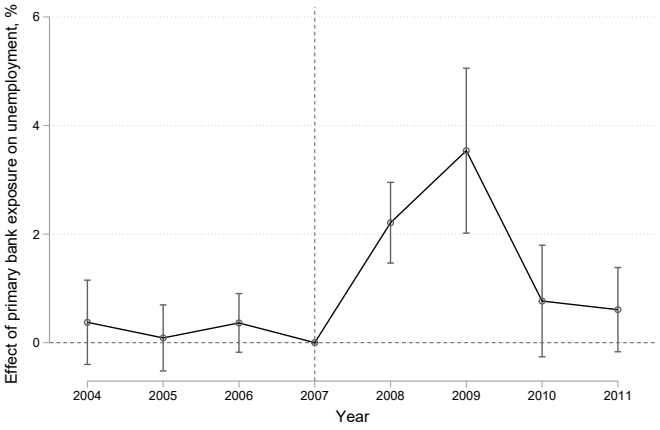
(b) Low-educated Workers



(c) Short-tenured Workers



(d) Workers in Low-skill Occupations



Notes: This figure plots OLS estimates of the effect of firms' pre-crisis primary bank exposure on employee outcomes using our year-by-year differences-in-differences model at the worker level. The dependent variable in all panels is an indicator variable equal to one if the worker spent any part of the year unemployed. The points plotted represent estimates of the coefficients on interaction terms between year dummies and an indicator for exposure of the firm's primary bank in 2007 (the elements of β in equation (5)). A worker's firm's primary bank is defined as exposed if it had a loans to deposits ratio in 2007 at or above the median firm's primary bank's as described in detail in Section 3.2. The baseline sample of workers includes all workers between age 35-60 employed in 2007 at firms in our baseline sample of firms. Panel (a) shows estimates of the effect for workers in nonmanagerial positions. Panel (b) shows estimates of the effect for low-educated workers. Low-educated workers are those employees that have at most completed a primary or secondary level education. Panel (c) shows estimates of the effect for short-tenured workers. Short-tenured workers are those workers with two or less years of tenure. Panel (d) shows estimates of the effect for workers in low-skill occupations. Low-skill occupations are those in major groups 5 (service workers and shop and market sales workers) and 9 (elementary occupations) of the International Standard Classification of Occupations (ISCO-88). Vertical bars represent 95% confidence intervals where the standard errors have been clustered at the level of the worker's firm's primary bank in 2007 (the level of treatment).

Table 1: Pre-crisis Firm Descriptive Statistics

	All Firms	Nonexposed Primary Bank	Exposed Primary Bank	Ratio of Means	p-value
Firm Demographics					
Age (Years)	14.66	14.16	15.16	0.94	0.34
	(13.46)	(13.28)	(13.62)		
Share in Copenhagen	0.07	0.07	0.07	0.94	0.86
	(0.26)	(0.25)	(0.26)		
Share A/S	0.53	0.53	0.54	0.99	0.85
	(0.50)	(0.50)	(0.50)		
Number of Employees	36.65	35.07	38.21	0.92	0.70
	(153.69)	(149.20)	(157.99)		
Industry					
Share Manufacturing	0.22	0.21	0.24	0.87	0.36
	(0.42)	(0.41)	(0.43)		
Share Construction	0.18	0.18	0.17	1.07	0.37
	(0.38)	(0.39)	(0.38)		
Share Retail	0.44	0.45	0.43	1.06	0.12
	(0.50)	(0.50)	(0.49)		
Share ICT	0.03	0.03	0.03	0.95	0.79
	(0.17)	(0.17)	(0.17)		
Share Real Estate	0.02	0.02	0.02	0.88	0.41
	(0.15)	(0.14)	(0.15)		
Share Business Services	0.10	0.10	0.10	0.97	0.72
	(0.30)	(0.30)	(0.31)		
Financials (1,000 2005 DKK)					
Revenue	64,788	61,698	67,838	0.91	0.76
	(417,110)	(372,189)	(457,140)		
Revenue per Worker	1,671	1,761	1,583	1.11	0.17
	(4,263)	(5,237)	(3,004)		
EBITDA	9523	1,172	736	1.59	0.37
	(18,637)	(19,682)	(17,543)		
Total Assets	55,556	49,516	61,516	0.81	0.59
	(581,514)	(504,917)	(648,275)		
Bank Debt	13,990	12,471	15,489	0.81	0.51
	(100,378)	(77,855)	(118,467)		
Bank Deposits	1,674	1,502	1,843	0.82	0.51
	(15,351)	(15,730)	(14,966)		
Current Ratio	1.26	1.26	1.26	1.00	0.97
	(1.11)	(1.22)	(0.99)		
N	13,924	6,916	7,008		

Notes: This table provides descriptive statistics of firm characteristics in 2007 by exposure of firms' primary banks in 2007. The sample includes all firms in the baseline sample as described in detail in Section 3.1. Column 1, titled 'All Firms', reports means for all firms in the sample. Standard deviations are in parentheses below. Columns 2 and 3, titled 'Nonexposed Primary Bank' and 'Exposed Primary Bank', report the same statistics for firms with nonexposed and exposed primary banks in 2007 respectively. Column 4, titled 'Ratio of Means', reports the ratio of the mean in column 2 to the mean in column 3. Column 5, titled 'p-value', reports the p-value from a two-sided t-test against the null hypothesis of equal means where standard errors have been clustered at the level of the firm's primary bank in 2007. A/S (*aktieselskaber*) firms are stock-based incorporated firms. 'ICT' stands for Information and communications technology. 'EBITDA' stands for Earnings before interest, taxes, depreciation, and amortization and is a widely used indicator of a firm's cash flow. The current ratio is the ratio of current liabilities to current assets and measures a firm's liquidity. Monetary values have been winsorized at the 1st and 99th percentiles.

Table 2: Estimates of Firm-Bank Relationship Persistence

	(1) Current bank	(2) Current lending bank	(3) Current primary bank
Previous year's bank	0.882		
	(0.001)		
Previous year's bank X A/S firm	-0.012		
	(0.001)		
Previous year's lending bank		0.833	
		(0.002)	
Previous year's lending bank X A/S firm		-0.009	
		(0.003)	
Previous year's primary bank			0.894
			(0.002)
Previous year's primary bank X A/S firm			-0.036
			(0.002)
Bank FE	Yes	Yes	Yes
N	13,430,158	13,430,158	13,430,158

Notes: This table presents OLS estimates of the persistence of firm-bank relationships using the model in equation (1). The dataset contains one observation for each potential firm-bank relationship in each year. The dependent variable in column 1 is an indicator variable equal to one if the firm had an open account at a given bank in a given year and zero otherwise. The independent variable 'previous year's bank' is an indicator variable equal to one if the firm had an open account at a given bank in the previous year and zero otherwise. The dependent variable in column 2 is an indicator variable equal to one if the firm had a positive outstanding loan balance at a given bank in a given year and zero otherwise. The independent variable 'previous year's lending bank' is an indicator variable equal to one if the firm had a positive outstanding loan balance at a given bank in the previous year and zero otherwise. The dependent variable in column 3 is an indicator variable equal to one if the given bank was the firm's primary bank in a given year and zero otherwise. The independent variable 'previous year's primary bank' is an indicator variable equal to one if the given bank was the firm's primary bank in a given year and zero otherwise. 'A/S firm' is an indicator variable equal to one if the firm is a stock-based incorporated company (*aktieselskab*) in a given year. Standard errors appear in parentheses below the estimates and are clustered at the firm level.

Table 3: Within-Firm Model Estimates of the Effect of Banks' Pre-Crisis Exposure on Firms' Bank Debt

	(1)	(2)	(3)
	Log loans	Log loans	Log loans
Exposed	0.505	0.491	0.476
	(0.546)	(0.481)	(0.420)
2004 x Exposed	0.248	0.229	0.209
	(0.350)	(0.330)	(0.379)
2005 x Exposed	0.501	0.489	0.458
	(0.353)	(0.328)	(0.373)
2006 x Exposed	0.348	0.341	0.328
	(0.261)	(0.247)	(0.257)
2008 x Exposed	-0.598	-0.606	-0.633
	(0.156)	(0.150)	(0.161)
2009 x Exposed	-0.867	-0.876	-0.920
	(0.218)	(0.204)	(0.225)
2010 x Exposed	-1.242	-1.251	-1.291
	(0.358)	(0.341)	(0.426)
2011 x Exposed	-1.648	-1.647	-1.684
	(0.465)	(0.440)	(0.498)
Firm-year FE	No	No	Yes
Industry-year FE	No	Yes	No
Region-year FE	No	Yes	No
A/S Firm-year FE	No	Yes	No
N	27,206	27,206	27,206

Notes: This table presents OLS estimates of the effect of banks' pre-crisis exposure to the financial crisis on firms' outstanding loan balances using the within-firm model in equation (2). The dependent variable in all columns is the log of outstanding loans (10,000 2005 DKK) held by a firm at a bank it had a relationship with in 2007 plus one. 'Exposed' is an indicator equal to one if the bank at which the loans are held had a loans to deposits ratio equal to or higher than the median firm's primary bank's in 2007 (and as described in detail in Section 3.2). A/S firm refers to stock-based incorporated companies (*aktieselskaber*). The sample includes all firm-bank relationships with an average loan balance of at least 2% of average total assets over the years 2004-2011 for firms active in each of those years. Standard errors appear in parentheses below the respective estimates and are clustered at the bank level (the level of treatment).

Table 4: Differences-in-Differences Estimates of the Effect of Pre-crisis Primary Bank Exposure on Bank Borrowing

	Log loans (1)	Log loans (2)	Log loans (3)	Log loans (4)	Log loans pre-crisis pr. bank (5)	Log loans pre-crisis npr. banks (6)	Log loans (7)	Effective interest rate (8)
Exposed	0.06	0.02	0.02					
	(0.16)	(0.07)	(0.06)					
Post x Exposed	-0.05	-0.06	-0.06	-0.06	-0.11	0.06	-0.03	0.21
	(0.03)	(0.02)	(0.02)	(0.02)	(0.07)	(0.10)	(0.03)	(0.07)
Covariate-year FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes*
Municipality-year FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
A/S Firm-year FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	No	No	Yes	Yes	Yes	Yes	Yes
Sample	Full	Full	Full	Full	Full	Full	Surviving Firms	IR
N	27,848	27,848	27,848	27,848	27,848	27,848	22,088	16,368

Notes: This table presents OLS estimates of the effect of firms' pre-crisis primary bank exposure on bank borrowing using the collapsed version of our main differences-in-differences model in equation (3). The dependent variable in columns 1-4 and 7 is the log of outstanding loans (10,000 2005 DKK) held by a firm in each year across all banks plus one. The dependent variable in column 5 is the log of outstanding loans (10,000 2005 DKK) held by a firm at its 2007 primary bank in each year plus one. The dependent variable in column 6 is the log of outstanding loans (10,000 2005 DKK) held by a firm at all other banks except for the 2007 primary bank in each year plus one. The dependent variable in column 8 is the effective interest rate paid by a firm across all loans in each year, winsorized at the 5th and 95th percentiles in each year. We describe in detail how we impute the effective interest rate in Section 5.2. 'Exposed' is an indicator equal to one if the firm's pre-crisis primary bank had a loans to deposits ratio at or above the median firm's primary bank's in 2007. 'Post' is an indicator equal to one for the crisis/post-crisis years 2008-2010 and zero otherwise. Covariate-year fixed effects include indicators for decile in the 2007 distribution of revenue per worker, EBITDA, and the effective interest rate due across all loans interacted with year dummies. The specification in column 8 does not control for the effective interest rate in 2007. A/S firm refers to stock-based incorporated companies (*aktieselskaber*). The sample in columns 1-6 includes all firms in our baseline sample as described in detail in Section 3.1. The sample in column 7 includes firms in the baseline sample that were active in all years between 2008-2011. The sample in column 8 (IR) includes all firms in the baseline sample that were active and paid a positive effective interest rate in all years between 2004-2011. Standard errors appear in parentheses below the respective estimates and are clustered at the level of the firm's pre-crisis primary bank (the level of treatment).

Table 5: Differences-in-Differences Estimates of the Effect of Pre-Crisis Primary Bank Exposure on Firm Debt

	(1) Log total debt	(2) Log total debt	(3) Log debt to suppliers
Post x Exposed	-0.01	-0.02	-0.03
	(0.03)	(0.01)	(0.01)
Covariate-year FE	Yes	Yes	Yes
Municipality-year FE	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes
A/S Firm-year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Sample	All NI	Surviving NI	Surviving NI
N	12,510	10,860	10,860

Notes: This table presents OLS estimates of the effect of firms' pre-crisis primary bank exposure on debt using the collapsed version of our main differences-in-differences model in equation (3). The dependent variable in columns 1 and 2 is the log of total debt (10,000 2005 DKK) for a firm in each year plus one. The dependent variable in column 3 is the log of debt to suppliers (10,000 2005 DKK) for a firm in each year plus one. 'Exposed' is an indicator equal to one if the firm's pre-crisis primary bank had a loans to deposits ratio at or above the median firm's primary bank's in 2007. 'Post' is an indicator equal to one for the crisis/post-crisis years 2008-2010 and zero otherwise. Covariate-year fixed effects include indicators for decile in the 2007 distribution of revenue per worker, EBITDA, and the effective interest rate due across all loans interacted with year dummies. A/S firm refers to stock-based incorporated companies (*aktieselskaber*). The sample in column 1 includes all firms in our baseline sample (as described in detail in Section 3.1) for which we have nonimputed (NI) balance sheet data for each year a firm was active between 2004-2011. The sample in columns 2 and 3 includes all firms in our baseline sample for which we have nonimputed balance sheet data and were active in all years from 2008-2011. Standard errors appear in parentheses below the respective estimates and are clustered at the level of the firm's pre-crisis primary bank (the level of treatment).

Table 6: Differences-in-Differences Estimates of the Effect of Pre-Crisis Primary Bank Exposure on Firm Level Employment I

	(1)	(2)	(3)	(4)
	Log employees	Log employees	Log employees	Log employees
Post x Exposed	-0.019	-0.007	-0.015	0.001
	(0.011)	(0.004)	(0.008)	(0.005)
Covariate-year FE	Yes	Yes	Yes	Yes
Municipality-year FE	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
A/S Firm-year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Sample	Full	Surviving Firms	Low Liquidity Surviving Firms	High Liquidity Surviving Firms
N	27,848	22,088	11,044	11,044

Notes: This table presents OLS estimates of the effect of firms' pre-crisis primary bank exposure on employment using the collapsed version of our main differences-in-differences model in equation (3). The dependent variable in all columns is the log of employees for a firm in each year plus one. 'Exposed' is an indicator equal to one if the firm's pre-crisis primary bank had a loans to deposits ratio at or above the median firm's primary bank's in 2007. 'Post' is an indicator equal to one for the crisis/post-crisis years 2008-2010 and zero otherwise. Covariate-year fixed effects include indicators for decile in the 2007 distribution of revenue per worker, EBITDA, and the effective interest rate due across all loans interacted with year dummies. A/S firm refers to stock-based incorporated companies (*aktieselskaber*). The sample in column 1 includes all firms in our baseline sample (as described in detail in Section 3.1). The sample in column 2 includes all firms in our baseline sample which remained in the sample between 2008-2011. The sample in column 3 includes firms in the baseline sample that remained in the sample from 2008-2011 with a current ratio (current assets/current liabilities) in 2007 in the bottom half of the distribution of current ratios. The sample in column 4 includes firms in the baseline sample that remained in the sample from 2008-2011 with a current ratio in 2007 in the top half of the distribution of current ratios. Standard errors appear in parentheses below the respective estimates and are clustered at the level of the firm's pre-crisis primary bank (the level of treatment).

Table 7: Differences-in-Differences Estimates of the Effect of Pre-Crisis Primary Bank Exposure on Firm Level Employment II

	Log managers	Log nonmanagers	Log low-educated employees	Log high-educated employees	Mean employee tenure
	(1)	(2)	(3)	(4)	(5)
Post x Exposed	0.003	-0.010	-0.008	0.002	-0.014
	(0.010)	(0.004)	(0.005)	(0.004)	(0.027)
Covariate-year FE	Yes	Yes	Yes	Yes	Yes
Municipality-year FE	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes
A/S Firm-year FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Sample	Surviving Firms	Surviving Firms	Surviving Firms	Surviving Firms	Surviving Firms
N	22,088	22,088	22,088	22,088	22,088

Notes: This table presents OLS estimates of the effect of firms' pre-crisis primary bank exposure on employment outcomes using the collapsed version of our main differences-in-differences model in equation (3). The dependent variables in columns 1 and 2 are log of employees in managerial and nonmanagerial positions at a firm in a year plus one respectively. The dependent variables in columns 3 and 4 are the log number of low-educated and high-educated employees in a year plus one respectively. Low-educated employees are those workers that have at most completed a primary or secondary level education. High-educated employees are those workers that have completed a tertiary level education. The dependent variable in column 5 is the average tenure in years of a firm's employees in a year. 'Exposed' is an indicator equal to one if the firm's pre-crisis primary bank had a loans to deposits ratio at or above the median firms' primary bank's in 2007. 'Post' is an indicator equal to one for the crisis/post-crisis years 2008-2010 and zero otherwise. Covariate-year fixed effects include indicators for decile in the 2007 distribution of revenue per worker, EBITDA, and the effective interest rate due across all loans interacted with year dummies. A/S firm refers to stock-based incorporated companies (*aktieselskaber*). The sample in all columns includes all firms in our baseline sample (as described in detail in Section 3.1) that remain in the sample from 2008-2011. Standard errors appear in parentheses below the respective estimates and are clustered at the level of the firm's pre-crisis primary bank (the level of treatment).

Table 8: Pre-crisis Worker Descriptive Statistics

	All Workers	Nonexposed Primary Bank	Exposed Primary Bank	Ratio of Means	p-value	Short-tenured workers	Mid-tenured workers	Long-tenured workers
Age (Years)	45.99	45.81	46.14	0.99	0.00	44.91	45.78	48.13
	(7.23)	(7.21)	(7.23)					
Share Female	0.31	0.32	0.30	1.06	0.01	0.33	0.31	0.28
	(0.46)	(0.47)	(0.46)					
Share Danish Born	0.94	0.94	0.95	0.99	0.04	0.93	0.94	0.97
	(0.23)	(0.24)	(0.23)					
Years of Education	13.41	13.32	13.48	0.99	0.00	13.46	13.60	13.30
	(2.45)	(2.42)	(2.48)					
Share Tertiary Education	0.13	0.11	0.14	0.77	0.02	0.13	0.14	0.10
	(0.33)	(0.31)	(0.35)					
Share Managers	0.05	0.05	0.05	1.08	0.00	0.04	0.06	0.07
	(0.22)	(0.23)	(0.22)					
Experience (Years)	22.15	21.90	22.37	0.98	0.02	19.80	22.22	26.28
	(8.87)	(8.86)	(8.87)					
Tenure (Years)	5.74	5.52	5.93	0.93	0.12	0.71	5.12	16.11
	(6.76)	(6.55)	(6.93)					
Share New Hires	0.19	0.20	0.18	1.05	0.46	0.40	0.00	0.00
	(0.39)	(0.40)	(0.39)					
Share in First Job	0.01	0.01	0.01	1.09	0.45	0.01	0.01	0.00
	(0.08)	(0.08)	(0.07)					
N	259,441	119,498	139,943			119,221	73,280	66,940

Notes: This table provides descriptive statistics of worker characteristics in 2007 by exposure of workers' firms' primary banks in 2007. The sample includes all workers employed at firms in the baseline sample as described in detail in Section 3.1. Column 1, titled 'All Workers', reports means for all workers in the sample. Standard deviations are in parentheses below. Columns 2 and 3, titled 'Nonexposed Primary Bank' and 'Exposed Primary Bank', report the same statistics for workers employed at firms with nonexposed and exposed primary banks in 2007 respectively. Column 4, titled 'Ratio of Means', reports the ratio of the mean in column 2 to the mean in column 3. Column 5, titled 'p-value', reports the p-value from a two-sided t-test against the null hypothesis of equal means where standard errors have been clustered at the level of the worker's firm's primary bank in 2007. Columns 6, 7, and 8 report means for short-, mid-, and long-tenured workers in 2007 respectively. Short-tenured workers are those workers with two or less years of tenure. Mid-tenured workers are those workers with between 3 and 8 years of tenure. Long-tenured workers are those workers with 9 or more years of tenure.

Table 9: Differences-in-Differences Estimates of the Effect of Pre-Crisis Primary Bank Exposure on Worker Unemployment I

	Unemployment				
	(1)	(2)	(3)	(4)	(5)
Post x Exposed	0.004	0.002	0.004	0.004	0.000
	(0.002)	(0.003)	(0.002)	(0.002)	(0.004)
Firm covariate-year FE	Yes	Yes	Yes	Yes	Yes
Worker covariate-year FE	Yes	Yes	Yes	Yes	Yes
Municipality-year FE	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes
A/S Firm-year FE	Yes	Yes	Yes	Yes	Yes
Worker FE	Yes	Yes	Yes	Yes	Yes
Sample	All	Managers	Nonmanagers	Low-educated	High-educated
N	518,882	26,720	492,162	446,906	66,296

Notes: This table presents OLS estimates of the effect of workers' firms' pre-crisis primary bank exposure on worker unemployment using the collapsed version of our main differences-in-differences model in equation (5). The dependent variable in all columns is an indicator variable equal to one if the worker spent any part of the year unemployed. 'Exposed' is an indicator equal to one if the firm's pre-crisis primary bank had a loans to deposits ratio at or above the median firm's primary bank's in 2007. 'Post' is an indicator equal to one for the crisis/post-crisis years 2008-2010 and zero otherwise. Firm covariate-year fixed effects include indicators for decile in the 2007 distribution of revenue per worker, EBITDA, and the effective interest rate due across all loans interacted with year dummies. Worker covariate-year fixed effects include an indicator for being born in Denmark and an indicator for having completed tertiary education by 2007 interacted with year dummies. A/S firm refers to stock-based incorporated companies (*aktieselskaber*). The sample in column 1 includes all workers between age 35-60 employed at firms in our baseline sample (as described in detail in Section 3.1) in 2007. The sample in columns 2 and 3 includes all workers employed in managerial and nonmanagerial positions in 2007 respectively. The sample in columns 4 and 5 includes all low- and high-educated workers employed at firms in our sample in 2007 respectively. Low-educated workers are those employees that have at most completed a primary or secondary level education. High-educated workers are those employees that have completed a tertiary level education. Standard errors appear in parentheses below the respective estimates and are clustered at the level of the firm's pre-crisis primary bank (the level of treatment).

Table 10: Differences-in-Differences Estimates of the Effect of Pre-Crisis Primary Bank Exposure on Worker Unemployment II

	Unemployment					
	(1)	(2)	(3)	(4)	(5)	(6)
Post x Exposed	0.005	0.001	0.001	0.015	0.004	0.000
	(0.002)	(0.003)	(0.002)	(0.004)	(0.003)	(0.001)
Firm covariate-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Worker covariate-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes
A/S Firm-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Worker FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Short-tenured	Mid-tenured	Long-tenured	Low-skill occupations	Middle-skill occupations	High-skill occupations
N	238,442	146,560	129,282	67,386	224,454	145,836

Notes: This table presents OLS estimates of the effect of workers' firms' pre-crisis primary bank exposure on worker unemployment using the collapsed version of our main differences-in-differences model in equation (5). The dependent variable in all columns is an indicator variable equal to one if the worker spent any part of the year unemployed. 'Exposed' is an indicator equal to one if the firm's pre-crisis primary bank had a loans to deposits ratio at or above the median firm's primary bank's in 2007. 'Post' is an indicator equal to one for the crisis/post-crisis years 2008-2010 and zero otherwise. Firm covariate-year fixed effects include indicators for decile in the 2007 distribution of revenue per worker, EBITDA, and the effective interest rate due across all loans interacted with year dummies. Worker covariate-year fixed effects include an indicator for being born in Denmark and an indicator for having completed tertiary education by 2007 interacted with year dummies. A/S firm refers to stock-based incorporated companies (*aktieselskaber*). The sample in column 1 includes all workers between age 35-60 employed at firms in our baseline sample (as described in detail in Section 3.1) in 2007. The sample in columns 1, 2, and 3 includes all short-, mid-, and long-tenured workers employed at firms in our sample in 2007 respectively. Short-tenured workers are those workers with two or less years of tenure. Mid-tenured workers are those workers with between 3 and 8 years of tenure. Long-tenured workers are those workers with 9 or more years of tenure. The sample in column 4 includes all workers employed in low-skill occupations in 2007. Low-skill occupations are those in major groups 5 (service workers and shop and market sales workers) and 9 (elementary occupations) of the International Standard Classification of Occupations (ISCO-88). The sample in column 5 includes all workers employed in middle-skill occupations in 2007. Middle-skill occupations are those in major groups 4 (clerks), 7 (craft and related trades workers), and 8 (plant and machine operators and assemblers) of ISCO-88. The sample in column 6 includes all workers employed in high-skill occupations in 2007. High-skill occupations are those in major groups 1 (legislators, senior officials, and managers), 2 (professionals), and 3 (technicians and associate professionals) of ISCO-88.

Table 11: Aggregate Implications of the Shock to Credit Supply on Employment

	2007-2008
Change in Employment	-72,090
% Change in Employment	-14.1%
Share of Change in Employment due to Shock	6.2%

Notes: This table presents a basic summary of the total loss in employment from 2007-2008 at firms in our sample, and the share of this loss which can be explained by the reduction in credit supply following the calculations laid out in Section 6.3. The change in employment in row 1 represents the difference in the sum of employees at firms in our baseline sample between 2007 and 2008. This includes those firms which exited the sample due to bankruptcy or other reasons. The change in employment in row 1 corresponds to the % change in employment displayed in row 2. Row 3 presents the share of the fall in employment in row 1 that can be explained by the shock to credit supply in equation (6). In arriving at this calculation we make two assumptions: 1. the total effect of the shock to credit supply on employment is the sum of the direct effects at the firm level, and 2. nonexposed banks did not shift their supply of credit. The denominator of (6) is the change in employment in row 1. The numerator is the difference between the sum of predicted employment from model (3) and counterfactual employment in 2008 for firms with an exposed pre-crisis primary bank. Counterfactual employment in 2008 for firms with an exposed pre-crisis primary bank is taken to be the predicted value of employment less the estimated effect of pre-crisis primary bank exposure.

Appendix

A Data

This appendix provides details on the dataset used in this paper and how we combined the raw sources to create it. The information given here is meant to not only increase transparency with respect to the construction of our dataset, but is also meant to act as a source of documentation in English for researchers working with Danish register data.

The dataset used in this paper combines data from three different sources: administrative registers from Statistics Denmark, account level tax records from the Danish Tax Authority (SKAT), and bank balance sheet information that can be obtained either from the Danish Financial Supervisory Authority (*Finanstilsynet*) or the MFI Statistics at Danmarks Nationalbank. These datasets can be merged and analysed within Statistics Denmark's secure computing environment where ID variables for banks (*cvrnrs*), firms (*cvrnrs*), and workers (*pnrs*) are anonymised.

A.1 Administrative Data from Statistics Denmark

The dataset constructed in this paper builds off of IDA: the Integrated Database for Labor Market Research maintained and provided by Statistics Denmark. IDA contains annual cross-sections of employment information for individuals during the last week of November. In its raw form, IDA consists of the following separately stored datasets which can be linked together using unique personal identifiers and unique firm and workplace identifiers:

- **Personal Information (IDAP):** IDAP contains the information relating to persons in IDA including labour market experience, weeks during the past year in which the individual was unemployed, and net earnings across all jobs. The key information contained in IDAP is an individual's primary attachment to the labour market during the last week in November each year, contained in the *pstill* variable. This variable contains detailed information on an individual's labour market status and allows individuals to be identified as either working, unemployed, or out of the labour force. Where applicable, individuals are assigned a secondary (*sstill*) attachment to the labour market. For instance, full-time students that also work a part-time job on the side, are recorded

as undergoing education as their primary labour market attachment, and working as a secondary.

Starting from the raw IDAP files we had access to, we cleaned the data by dropping observations with missing personal identifiers. We then constructed labour market status indicators for persons that are working, unemployed, or outside of the labour market based on the value of *pstill* and following the groupings used in the IDAP documentation provided by Statistics Denmark and available here. We then used the variables *arledgr* (for observations prior to 2008) and *ledighed_brutto* (for observations from 2008 and on) to construct indicators for those individuals that were unemployed or out of the labour force at some point over the last 12 months. The variables *pstill*, *sstill*, *psoc_status_kode*, and *ssoc_status_kode* were then used to generate indicators of whether an individual was recorded as being self-employed, or in a managerial position in the data.

- **Employment Information (IDAN):** IDAN contains personal and firm & workplace identifiers for all jobs held during the last week in November each year making it the key which enables a matching of employees to employers for each employment relationship in the cross-section. That is, persons with multiple jobs will appear once in IDAN for each job they hold in the last week of November, even if they have multiple jobs with the same employer. While IDAP only contains information on each individual's primary and, when given, secondary employment relationship, there is no limit as to the number of jobs an individual is recorded as holding in IDAN. IDAN also records an hourly wage for each job, and contains information indicating the quality of the hourly wage measure which varies particularly for part-time and new employees (see Lund and Vejlin, 2015).

  Importantly, IDAN classifies each employment relationship as one of 8 different job types with the variables *TYPE* and *TYPE2008* from 2008 on. These job types are allow one to identify the primary job held during the last week in November each year if the individual was recorded as holding more than one job. Prior to and including 2007, employment relationships were only included in IDAN if the employee earned a total annual salary of at least 10.000 DKK. Since 2008, the requirement has been relaxed such that each employment relationship where the employee earns at least the equivalent of 4 hours employment at the guaranteed wage rate is included.

Starting from the raw IDAN files we had access to, we cleaned the data by dropping observations with missing personal identifiers and duplicate observations. From IDAN, we are primarily interested in obtaining the measure of hourly earnings recorded for each job. For individuals that are recorded as having more than one job at the same employer, we compute the average hourly wage across these jobs. We then collapsed the IDAN data such that employees with multiple jobs at the same employer are recorded only once in the data. To do this we dropped observations according to the following hierarchy: when one job is a type A job, keep this one; if none are type A jobs, but one is a type H job, keep this one; if none are type A or H jobs, but one is a type B job, keep this one. If all jobs are type N jobs, randomly select one and drop the rest. Finally, we constructed variables capturing the 2007 values of a number of different variables for individuals in the data.

- **FIRE-IDA Key (FIDA):** While IDAN contains firm identifiers linking employees to the firms they were employed at, these firm identifiers are not always the same ones that are recorded in the firm accounting statistics, FIRE (more on this register below). FIDA provides these firm identifiers. In addition, FIDA provides the same information regarding labour market attachment as in IDAN.

  Starting from the raw FIDA files we had access to, we cleaned the data by dropping duplicate observations. From FIDA we would like to have a listing of jobs in which observations are unique at the *pnr-year-cvrnr* level. For employees that have multiple jobs at the same employer, we keep only the observation for the primary job as indicated by *pstill* and drop the rest.

Using personal identifiers, the data in IDA/FIDA as described above, can be supplemented with data from the additional following registers maintained and provided by Statistics Denmark:

- **Population Register (BEF):** BEF contains background demographic information on the entire population of individuals registered in Denmark. For some individuals in IDAP, age is missing or improperly recorded. Thankfully, BEF contains the date of birth for each individual allowing an exact calculation of the age of each worker during the last week of November in each year to coincide with the data in IDA.

In 2007 the Danish parliament enacted a large scale reform of the public sector, (*Strukturreformen*) redrawing the boundaries for many municipalities, retiring some, and establishing new ones. To deal with this, we choose to assign pre-2007 observations to their post-2007 municipalities. For the vast majority of individuals, their municipality remained unchanged by the reform. For many living in a municipality affected by the reform, we can accurately assign them to their new municipality using their registered residential address (which is anonymized in the data files we work with, but still usable). For a small number of observations we are unable to accurately assign them to their new municipality and they are thus dropped from the data.

- **Education Register (UDDA):** UDDA contains information on the highest completed level of education for individuals in the population register. Statistics Denmark provides keys for assigning the average total number of months required to complete each qualification, and for categorising individuals into educational groups based on the highest attained qualification. These are: early childhood education, primary education, lower secondary education, upper secondary education, short-cycle tertiary education, bachelor or equivalent, master or equivalent, doctoral degree or equivalent. In most analyses we group these categories in to three broader categories: primary education (early childhood education, primary education), secondary education (lower and upper secondary education), vocational (short-cycle tertiary education), and tertiary education (bachelor, master, and doctoral degrees or equivalent).

- **Income Register (IND):** IND contains highly detailed information on income at the individual level. In particular, it allows one to decompose annual total income into earnings, income generated from self-employment, income from government transfers, and a number of other sources. As a measure of individuals' income, we use the variable *loenmv_13* (total income) which includes both taxable and tax-free elements of an individual's base pay, severance pay, stock options, and sick pay.

- **Occupational Classification Module (AKM):** AKM is a register that combines information on income, education, workplace industry, social insurance membership, and employer reporting to assign individuals a labour market status and occupational classification (for the employed) with respect to their primary attachment to the labour market. Occupations are classified according to DISCO: the Danish version of the

ILO's ISCO (International Standard Classification of Occupations) for the individuals' primary job in a year. From 2003-2008, the primary job was the job at the employer from which the individual earned the highest annual income. From 2009 on, the primary job is defined as the job at the employer where they individual worked the most hours.

Starting with the raw AKM files we had access to, we cleaned the data by dropping duplicate observations and observations with missing personal identifiers. We then extract the major groups (1 digit ISCO codes) from the raw 6 digit DISCO codes and construct variables capturing the 2007 occupational codes for individuals in the data.

- **Wage Statistics Register (LON/LONN):** The wage statistics register contains employer reported information on employees in firms with 10 or more full-time equivalent employees. Starting in 2010, Statistics Denmark changed their concept used to define and calculate hourly earnings; as such, LON files contain annual cross-sections from the wage statistics register up until 2010 while LONN files contain annual cross-section starting in 2009 applying the new definitions. In addition to information on earnings, LON and LONN also include employer reported information on employee pension contributions, working hours, and occupations.

  Starting with the raw LON and LONN files we had access to, we cleaned the data by dropping duplicate observations and observations with missing personal identifiers. For 2009 and 2010 we use the data from LON, using LONN from 2011 and on. We extract the major groups (1 digit ISCO codes) from the raw 6 digit DISCO codes and construct variables capturing the 2007 occupational codes for individuals in the data. *cvrnr* only becomes available in LONN on so to identify employers in LON (prior to 2011) we use the workplace identifier, *arbnr*. From LON and LONN we'd like to have a dataset that is unique at the *pnr*-*year*-employer level so we collapse the data taking the mean earnings and total hours worked across all jobs at the same employer; for occupations we take the occupational code from the job for which the employee is recorded as having the highest number or working hours.

- **General Firm Statistics Register (FIRM):** FIRM contains firm-level information sourced from the business statistics register (*ESR*). In particular, FIRM records entry and exit dates for Danish firms at the CVR number level. As FIRM does not impose restrictions based on firm size or level of activity, FIRM contains many firms which are

completely inactive or only active in a very limited sense.

Unfortunately the data in the FIRM registry are very messy. Starting with the raw FIRM files we had access to, we first identify the year of firm entry and exit according to the information in the data. There are some firms that are recorded as entering and exiting in multiple periods; here we define a firm's entry date as the earliest recorded year of entry and the exit date as the latest recorded year of exit. Some firms remain in the registry although they have been recorded as having exited. To deal with this we redefine a firm's exit date to be the last year they were recorded in the registry if they are still observed past their recorded exit year.

- **Firm-level Accounting Statistics (FIRE):** FIRE contains detailed accounting information at the *cvrnr*-level for all active businesses in Denmark with more than 50 employees as well as some smaller businesses (see Bobbio and Bunzel, 2018). Importantly, the firm identifiers in FIRE are not always the same as those that are recorded as the firm identifiers linked to workers in IDA. FIDA provides the link to match the firms in FIRE with the employers in IDA.

- **Firm Bankruptcies (Konkurser):** This dataset contains a list of all registered bankruptcies complete with the month and year in which the bankruptcy was declaired.

In preparing the dataset, we began by cleaning each register to remove duplicate entries, and remove firms or individuals with missing identifiers or key variables. We then merge the registers by proceeding in the following way:

1. **Individual Data**: BEF, IDAP, UDDA, and AKM are merged together at the pnr-year level. The pnr-year observations in IDAP make up our base population of individuals and as such we drop all observations in BEF, UDDA, and AKM that are not found in IDAP. The merged datasets are then temporarily saved as a dataset called 'individuals.dta'

2. **Firm Data**: FIRM and FIRE are merged at the cvrnr level. The cvrnr-year observations in FIRE make up our base population of firms and as such we drop all observations in FIRM that are not found in FIRE. The merged datasets are then temporarily saved as 'firms.dta'

3. **Linking Individuals and Firms**: In linking individuals to firms we carry out the following three successive merges:

   (a) Merge 'individuals.dta' and IDAN at the pnr-year level. The resulting dataset is a complete listing of jobs in IDA with supplementary individual background characteristics. Since the variables in 'individuals.dta' are crucial covariates, we drop any observations in IDAN which are not matched to the background information in 'individuals.dta'. Since we want to track individuals though time even when they are not attached to a job in IDAN, we keep the pnr-year observations in 'individuals.dta' that are not matched to observations in IDAN. This dataset is not unique at the pnr-year level as there are some individuals with multiple jobs in any given year.

   (b) Merge the dataset generated in (a) with FIDA. For reasons known to DSt., the firm identifier for an employer in IDAN is not the same as the one in FIRE for the same firm. FIDA is the link which provides the correct identifier for each employment relationship in IDA such that the firm balance sheet information in FIRE can be merged on.

   (c) Merge the dataset generated in (b) with 'firms.dta'.

Once all the administrative registers have been merged we are left with a dataset at the individual-firm-year level. At this point we use the raw data to generate a number of employment related variables at the individual level (years of tenure, indicator for being a new hire, indicator for being displaced due to firm exit, spells of unemployment, etc.) and firm level (aggregate number of employees, number of new hires, number of separations, new hire rate, mean log gross hourly wage, etc.).

A.2 Account Level Data

The account level data we use stems from the URTE and IRTE registers maintained and provided by the Danish Tax Authority (SKAT). These registers are constructed using compulsory reports on all accounts that were open over the course of a year by all entities granting credit and accepting deposits. As such, URTE and IRTE contain the accounts held not only at commercial banks, but also those linked to credit cards granted at, say, the local gas station or corner store.

URTEVIRK is the extract from register containing information on loan accounts held by firms and IRTEVIRK is the file containing firms' deposit accounts. Each file contains data at the account-firm-year level over these basic fields: account number, firm identifier, bank identifier, account balance as of the 31st of December, and the total interest paid on the account over the course of the year. We collapse the data to the firm-bank-year level by summing the account balances and interest payments made for all account held by the same firm at the same bank in the same year. By way of the unique firm and bank identifiers, we are able to merge this data with the merged register data described above, and the bank balance sheet data to be described below.

A.3 Bank Balance Sheet Data

We use data on banks' balance sheets collected for the MFI statistics by Danmarks Nationalbank. These same data are also made publicly available by the Danish Financial Supervisory Authority (*Finanstilsynet*) and can be access through their website here in English and here in Danish. Once submitted to Statistics Denmark, the bank identifiers (cvrnrs) were annonymized to match the annoymized identifiers in URTEVIRK and IRTEVIRK allowing the bank balance sheet data to be merged with the account level data.

B Further Tables and Figures

Table B1: Difference in Difference Estimates of the Effect of Pre-crisis Primary Bank Exposure on Bank Borrowing

	Log loans (1)	Log loans (2)	Log loans (3)	Log loans (4)	Log loans pre-crisis pr. bank (5)	Log loans pre-crisis npr. banks (6)	Log loans (7)	Effective interest rate (8)
Exposed	0.04	0.01	0.01					
	(0.14)	(0.06)	(0.05)					
2004 x Exposed	0.05	0.00	-0.01	-0.02	0.02	-0.03	0.01	-0.02
	(0.09)	(0.08)	(0.07)	(0.07)	(0.15)	(0.09)	(0.08)	(0.10)
2005 x Exposed	0.04	0.01	0.00	-0.01	0.02	-0.02	0.01	0.08
	(0.07)	(0.05)	(0.04)	(0.04)	(0.13)	(0.09)	(0.05)	(0.06)
2006 x Exposed	0.04	0.01	0.00	0.00	0.01	0.01	-0.01	0.07
	(0.06)	(0.05)	(0.04)	(0.04)	(0.08)	(0.06)	(0.04)	(0.08)
2008 x Exposed	-0.06	-0.09	-0.09	-0.09	-0.12	0.07	-0.06	0.25
	(0.03)	(0.03)	(0.02)	(0.02)	(0.06)	(0.03)	(0.03)	(0.05)
2009 x Exposed	0.01	-0.01	-0.02	-0.02	-0.04	0.01	0.02	0.23
	(0.05)	(0.05)	(0.03)	(0.03)	(0.07)	(0.05)	(0.05)	(0.10)
2010 x Exposed	0.02	0.00	0.00	0.00	-0.08	0.06	0.04	0.13
	(0.07)	(0.07)	(0.05)	(0.05)	(0.08)	(0.07)	(0.07)	(0.14)
2011 x Exposed	-0.01	-0.02	-0.04	-0.04	-0.16	0.09	0.01	0.17
	(0.07)	(0.06)	(0.05)	(0.05)	(0.12)	(0.08)	(0.06)	(0.14)
Covariate-year FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes*
Municipality-year FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
A/S Firm-year FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	No	No	Yes	Yes	Yes	Yes	Yes
Sample	Full	Full	Full	Full	Full	Full	Surviving Firms	IR
N	107,754	107,754	107,754	107,754	107,754	107,754	80,101	54,040

Notes: This table presents OLS estimates of the effect of firms' pre-crisis primary bank exposure on bank borrowing using our main differences-in-differences model in equation (3). The dependent variable in columns 1-4 and 7 is the log of outstanding loans (10,000 2005 DKK) held by a firm in each year at across all banks plus one. The dependent variable in column 5 is the log of outstanding loans (10,000 2005 DKK) held by a firm at its 2007 primary bank in each year plus one. The dependent variable in column 6 is the log of outstanding loans (10,000 2005 DKK) held by a firm at all other banks except for the 2007 primary bank in each year plus one. The dependent variable in column 8 is the effective interest rate paid by a firm across all loans in each year, winsorized at the 5th and 95th percentiles in each year. We describe in detail how we impute the effective interest rate in Section 5.2. 'Exposed' is an indicator equal to one if the firm's pre-crisis primary bank had a loans to deposits ratio at or above the median firm's primary bank's in 2007. The estimates presented for the interactions of the 'Exposed' indicator with year dummies correspond to the elements of the β vector in equation (3). Covariate-year fixed effects include indicators for decile in the 2007 distribution of revenue per worker, EBITDA, and the effective interest rate due across all loans interacted with year dummies. The specification in column 8 does not control for the effective interest rate in 2007. A/S firm refers to stock-based incorporated companies (*aktieselskaber*). The sample in columns 1-6 includes all firms in our baseline sample as described in detail in Section 3.1. The sample in column 7 includes firms in the baseline sample that were active in all years between 2008-2011. The sample in column 8 (IR) includes all firms in the baseline sample that were active and paid a positive effective interest rate in all years between 2004-2011. Standard errors appear in parentheses below the respective estimates and are clustered at the level of the firm's pre-crisis primary bank (the level of treatment).

Table B2: Difference in Difference Estimates of the Effect of Pre-Crisis Primary Bank Exposure on Firm Debt

	(1) Log total debt	(2) Log total debt	(3) Log debt to suppliers
2004 x Exposed	-0.01	0.00	0.02
	(0.03)	(0.02)	(0.04)
2005 x Exposed	0.01	0.01	0.01
	(0.02)	(0.02)	(0.05)
2006 x Exposed	-0.02	-0.01	0.03
	(0.01)	(0.01)	(0.03)
2008 x Exposed	-0.03	-0.04	-0.02
	(0.05)	(0.01)	(0.03)
2009 x Exposed	-0.02	-0.03	-0.01
	(0.06)	(0.01)	(0.02)
2010 x Exposed	0.02	-0.01	-0.02
	(0.07)	(0.01)	(0.02)
2011 x Exposed	0.02	0.00	0.02
	(0.07)	(0.02)	(0.03)
Covariate-year FE	Yes	Yes	Yes
Municipality-year FE	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes
A/S Firm-year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Sample	All NI	Surviving NI	Surviving NI
N	37,101	30,908	30,908

Notes: This table presents OLS estimates of the effect of firms' pre-crisis primary bank exposure on debt using our main differences-in-differences model in equation (3). The dependent variable in columns 1 and 2 is the log of total debt (10,000 2005 DKK) for a firm in each year plus one. The dependent variable in column 3 is the log of debt to suppliers (10,000 2005 DKK) for a firm in each year plus one. 'Exposed' is an indicator equal to one if the firm's pre-crisis primary bank had a loans to deposits ratio at or above the median firms' primary bank's in 2007. The estimates presented for the interactions of the 'Exposed' indicator with year dummies correspond to the elements of the β vector in equation (3). Covariate-year fixed effects include indicators for decile in the 2007 distribution of revenue per worker, EBITDA, and the effective interest rate due across all loans interacted with year dummies. A/S firm refers to stock-based incorporated companies (*aktieselskaber*). The sample in column 1 includes all firms in our baseline sample (as described in detail in Section 3.1) for which we have nonimputed (NI) balance sheet data in each year the firm was active between 2004-2011. The sample in columns 2 and 3 includes all firms in our baseline sample for which we have nonimputed balance sheet data and were active in all years from 2008-2011. Standard errors appear in parentheses below the respective estimates and are clustered at the level of the firm's pre-crisis primary bank (the level of treatment).

Table B3: Difference in Difference Estimates of the Effect of Pre-Crisis Primary Bank Exposure on Firm Exit

	(1) Sample Exit	(2) Firm Exit
2004 x Exposed	0.004	0.003
	(0.002)	(0.001)
2005 x Exposed	0.003	0.002
	(0.001)	(0.001)
2006 x Exposed	0.00	0.00
	(0.00)	(0.00)
2008 x Exposed	0.007	-0.003
	(0.004)	(0.002)
2009 x Exposed	0.008	0.002
	(0.005)	(0.003)
2010 x Exposed	0.008	0.001
	(0.007)	(0.004)
2011 x Exposed	0.011	0.008
	(0.008)	(0.007)
Covariate-year FE	Yes	Yes
Municipality-year FE	Yes	Yes
Industry-year FE	Yes	Yes
A/S Firm-year FE	Yes	Yes
Firm FE	Yes	Yes
Sample	Full	Full
N	107,754	107,754

Notes: This table presents OLS estimates of the effect of firms' pre-crisis primary bank exposure on firm exit using our year-by-year differences-in-differences model in equation (3). The dependent variable in column 1 is an indicator variable equal to one if the firm exits the baseline sample in a particular year. A firm exits the sample when it is no longer included in the FIDA database which can occur when firms go out of business or do not pass minimum thresholds for being considered an active business as defined by Statistics Denmark. The dependent variable in column 2 is an indicator variable equal to one if the firm is documented as having gone out of business in the register of general firm statistics (*Generel firmastatistik*; FIRM). 'Exposed' is an indicator equal to one if the firm's pre-crisis primary bank had a loans to deposits ratio at or above the median firm's primary bank's in 2007. The estimates presented for the interactions of the 'Exposed' indicator with year dummies correspond to the elements of the β vector in equation (3). The sample in both columns includes all firms in our baseline sample as described in detail in Section 3.1. Standard errors appear in parentheses below the respective estimates and are clustered at the level of the firm's pre-crisis primary bank (the level of treatment).

Table B4: Difference in Difference Estimates of the Effect of Pre-Crisis Primary Bank Exposure on Firm Level Employment I

	(1)	(2)	(3)	(4)
	Log employees	Log employees	Log employees	Log employees
2004 x Exposed	0.002	0.008	0.030	-0.006
	(0.014)	(0.014)	(0.019)	(0.011)
2005 x Exposed	-0.008	-0.001	-0.003	0.005
	(0.008)	(0.007)	(0.011)	(0.005)
2006 x Exposed	0.000	0.001	0.000	0.002
	(0.006)	(0.006)	(0.008)	(0.005)
2008 x Exposed	-0.019	-0.008	-0.018	0.002
	(0.012)	(0.004)	(0.006)	(0.004)
2009 x Exposed	-0.018	0.001	0.003	-0.001
	(0.014)	(0.006)	(0.010)	(0.007)
2010 x Exposed	-0.016	-0.007	-0.011	-0.003
	(0.017)	(0.007)	(0.010)	(0.009)
2011 x Exposed	-0.024	-0.009	-0.019	0.002
	(0.022)	(0.009)	(0.011)	(0.012)
Covariate-year FE	Yes	Yes	Yes	Yes
Municipality-year FE	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
A/S Firm-year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Sample	Full	Surviving Firms	Low Liquidity Surviving Firms	High Liquidity Surviving Firms
N	107,754	80,101	39,885	40,216

Notes: This table presents OLS estimates of the effect of firms' pre-crisis primary bank exposure on employment using our year-by-year differences-in-differences model in equation (3). The dependent variable in all columns is the log of employees for a firm in each year plus one. 'Exposed' is an indicator equal to one if the firm's pre-crisis primary bank had a loans to deposits ratio at or above the median firms' primary bank's in 2007. The estimates presented for the interactions of the 'Exposed' indicator with year dummies correspond to the elements of the β vector in equation (3). Covariate-year fixed effects include indicators for decile in the 2007 distribution of revenue per worker, EBITDA, and the effective interest rate due across all loans interacted with year dummies. A/S firm refers to stock-based incorporated companies (*aktieselskaber*). The sample in column 1 includes all firms in our baseline sample (as described in detail in Section 3.1). The sample in column 2 includes all firms in our baseline sample which remained in the sample from 2008-2011. The sample in column 3 includes firms in the baseline sample that remained in the sample from 2008-2011 with a current ratio (current assets/current liabilities) in 2007 in the bottom half of the distribution of current ratios. The sample in column 4 includes firms in the baseline sample that remained in the sample from 2008-2011 with a current ratio in 2007 in the top half of the distribution of current ratios. Standard errors appear in parentheses below the respective estimates and are clustered at the level of the firm's pre-crisis primary bank (the level of treatment).

Table B5: Difference in Difference Estimates of the Effect of Pre-Crisis Primary Bank Exposure on Firm Level Employment II

	Log managers	Log nonmanagers	Log low-educated employees	Log high-educated employees	Mean employee tenure
	(1)	(2)	(3)	(4)	(5)
2004 x Exposed	-0.009	0.012	0.005	0.018	0.039
	(0.014)	(0.014)	(0.014)	(0.009)	(0.040)
2005 x Exposed	-0.006	0.002	-0.001	0.013	0.042
	(0.011)	(0.007)	(0.007)	(0.006)	(0.028)
2006 x Exposed	0.006	0.002	-0.001	0.015	-0.009
	(0.008)	(0.006)	(0.006)	(0.005)	(0.020)
2008 x Exposed	0.006	-0.011	-0.011	0.007	0.006
	(0.008)	(0.004)	(0.004)	(0.005)	(0.019)
2009 x Exposed	0.005	-0.001	0.000	0.013	-0.032
	(0.006)	(0.007)	(0.007)	(0.005)	(0.038)
2010 x Exposed	0.002	-0.009	-0.008	0.009	-0.012
	(0.009)	(0.008)	(0.006)	(0.007)	(0.046)
2011 x Exposed	-0.002	-0.010	-0.009	0.005	-0.070
	(0.008)	(0.009)	(0.009)	(0.010)	(0.039)
Covariate-year FE	Yes	Yes	Yes	Yes	Yes
Municipality-year FE	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes
A/S Firm-year FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Sample	Surviving Firms	Surviving Firms	Surviving Firms	Surviving Firms	Surviving Firms
N	80,101	80,101	80,101	80,101	80,101

Notes: This table presents OLS estimates of the effect of firms' pre-crisis primary bank exposure on employment outcomes using our main differences-in-differences model in equation (3). The dependent variables in columns 1 and 2 are log of employees in managerial and nonmanagerial positions at a firm in a year plus one respectively. The dependent variables in columns 3 and 4 are the log number of low-educated and high-educated employees in a year plus one respectively. Low-educated employees are those workers that have at most completed a primary or secondary level education. High-educated employees are those workers that have completed a tertiary level education. The dependent variable in column 5 is the average tenure in years of a firm's employees in a year. 'Exposed' is an indicator equal to one if the firm's pre-crisis primary bank had a loans to deposits ratio at or above the median firms' primary bank's in 2007. The estimates presented for the interactions of the 'Exposed' indicator with year dummies correspond to the elements of the β vector in equation (3). Covariate-year fixed effects include indicators for decile in the 2007 distribution of revenue per worker, EBITDA, and the effective interest rate due across all loans interacted with year dummies. A/S firm refers to stock-based incorporated companies (*aktieselskaber*). The sample in all columns includes all firms in our baseline sample (as described in detail in Section 3.1) that remain in the sample from 2008-2011. Standard errors appear in parentheses below the respective estimates and are clustered at the level of the firm's pre-crisis primary bank (the level of treatment).

Table B6: Differences-in-Differences Estimates of the Effect of Pre-Crisis Primary Bank Exposure on Worker Unemployment I

	Unemployment				
	(1)	(2)	(3)	(4)	(5)
2004 x Exposed	-0.001	-0.005	-0.001	0.000	-0.006
	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)
2005 x Exposed	0.001	-0.004	0.001	0.002	-0.005
	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)
2006 x Exposed	-0.001	0.001	-0.002	0.000	-0.006
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
2008 x Exposed	0.005	0.001	0.006	0.006	0.000
	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)
2009 x Exposed	0.007	0.002	0.007	0.008	-0.005
	(0.005)	(0.003)	(0.005)	(0.005)	(0.005)
2010 x Exposed	0.002	0.001	0.002	0.003	-0.006
	(0.002)	(0.002)	(0.002)	(0.002)	(0.005)
2011 x Exposed	0.002	0.006	0.002	0.003	-0.001
	(0.002)	(0.003)	(0.002)	(0.002)	(0.004)
Firm covariate-year FE	Yes	Yes	Yes	Yes	Yes
Worker covariate-year FE	Yes	Yes	Yes	Yes	Yes
Municipality-year FE	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes
A/S Firm-year FE	Yes	Yes	Yes	Yes	Yes
Worker FE	Yes	Yes	Yes	Yes	Yes
Sample	All	Managers	Nonmanagers	Low-educated	High-educated
N	2,075,528	106,880	1,968,648	1,787,624	265,184

Notes: This table presents OLS estimates of the effect of workers' firms' pre-crisis primary bank exposure on worker unemployment using our main differences-in-differences model in equation (5). The dependent variable in all columns is an indicator variable equal to one if the worker spent any part of the year unemployed. The dependent variable in columns 5, 6, 7, and 8 is the log of total weeks unemployed in a year plus one. 'Exposed' is an indicator equal to one if a worker's firm's pre-crisis primary bank had a loans to deposits ratio at or above the median firm's primary bank's in 2007. The estimates presented for the interactions of the 'Exposed' indicator with year dummies correspond to the elements of the β vector in equation (3). Firm covariate-year fixed effects include indicators for decile in the 2007 distribution of revenue per worker, EBITDA, and the effective interest rate due across all loans interacted with year dummies. Worker covariate-year fixed effects include an indicator for being born in Denmark and an indicator for having completed tertiary education by 2007 interacted with year dummies. A/S firm refers to stock-based incorporated companies (*aktieselskaber*). The sample in column 1 includes all workers between age 35-60 employed at firms in our baseline sample (as described in detail in Section 3.1) in 2007. The sample in columns 2 and 3 includes all workers employed in managerial and nonmanagerial positions in 2007 respectively. The sample in columns 4 and 5 includes all low- and high-educated workers employed at firms in our sample in 2007 respectively. Low-educated workers are those employees that have at most completed a primary or secondary level education. High-educated workers are those employees that have completed a tertiary level education. Standard errors appear in parentheses below the respective estimates and are clustered at the level of the firm's pre-crisis primary bank (the level of treatment).

Table B7: Differences-in-Differences Estimates of the Effect of Pre-Crisis Primary Bank Exposure on Worker Unemployment II

	Unemployment					
	(1)	(2)	(3)	(4)	(5)	(6)
2004 x Exposed	0.003	0.000	-0.005	0.004	-0.001	-0.005
	(0.002)	(0.004)	(0.005)	(0.004)	(0.004)	(0.002)
2005 x Exposed	0.003	0.000	0.003	0.001	0.006	-0.004
	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.001)
2006 x Exposed	0.000	-0.002	-0.002	0.004	0.000	-0.003
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.001)
2008 x Exposed	0.005	0.001	0.005	0.022	0.004	0.000
	(0.003)	(0.002)	(0.003)	(0.004)	(0.003)	(0.001)
2009 x Exposed	0.010	0.006	-0.001	0.035	0.007	-0.005
	(0.003)	(0.005)	(0.008)	(0.008)	(0.008)	(0.003)
2010 x Exposed	0.007	-0.003	-0.003	0.008	0.010	-0.004
	(0.002)	(0.004)	(0.005)	(0.005)	(0.003)	(0.003)
2011 x Exposed	0.006	-0.006	0.002	0.006	0.010	-0.001
	(0.002)	(0.004)	(0.004)	(0.004)	(0.003)	(0.002)
Firm covariate-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Worker covariate-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes
A/S Firm-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Worker FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Short-tenured	Mid-tenured	Long-tenured	Low-skill occupations	Middle-skill occupations	High-skill occupations
N	953,768	586,240	535,520	269,544	897,816	583,344

Notes: This table presents OLS estimates of the effect of workers' firms' pre-crisis primary bank exposure on worker unemployment using our main differences-in-differences model in equation (5). The dependent variable in all columns is an indicator variable equal to one if the worker spent any part of the year unemployed. 'Exposed' is an indicator equal to one if a worker's firm's pre-crisis primary bank had a loans to deposits ratio at or above the median firm's primary bank's in 2007. The estimates presented for the interactions of the 'Exposed' indicator with year dummies correspond to the elements of the β vector in equation (3). Firm covariate-year fixed effects include indicators for decile in the 2007 distribution of revenue per worker, EBITDA, and the effective interest rate due across all loans interacted with year dummies. Worker covariate-year fixed effects include an indicator for being born in Denmark and an indicator for having completed tertiary education by 2007 interacted with year dummies. A/S firm refers to stock-based incorporated companies (*aktieselskaber*). The sample in columns 1, 2, and 3 includes all short-, mid-, and long-tenured workers between age 35-60 employed at firms in our baseline sample in 2007 respectively. Short-tenured workers are those workers with two or less years of tenure. Mid-tenured workers are those workers with between 3 and 8 years of tenure. Long-tenured workers are those workers with 9 or more years of tenure. The sample in column 4 includes all workers employed in low-skill occupations at firms in our baseline sample in 2007. Low-skill occupations are those in major groups 5 (service workers and shop and market sales workers) and 9 (elementary occupations) of the International Standard Classification of Occupations (ISCO-88). The sample in column 5 includes all workers employed in middle-skill occupations at firms in our baseline sample in 2007. Middle-skill occupations are those in major groups 4 (clerks), 7 (craft and related trades workers), and 8 (plant and machine operators and assemblers) of ISCO-88. The sample in column 6 includes all workers employed in high-skill occupations at firms in our baseline sample in 2007. High-skill occupations are those in major groups 1 (legislators, senior officials, and managers), 2 (professionals), and 3 (technicians and associate professionals) of ISCO-88. Standard errors appear in parentheses below the respective estimates and are clustered at the level of the firm's pre-crisis primary bank (the level of treatment).