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# The Effect of Personal Financing Disruptions on Entrepreneurship

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## Non-Technical Summary

Anecdotal evidence suggests that small business owners and entrepreneurs rely on personal loans, credit cards, and savings when starting or growing their businesses. A natural hypothesis is that if small business owners are exposed to personal financial losses or borrowing constraints, it may potentially affect the growth and survival of their firm. The academic literature has shown that financial crises and bank-specific credit supply shocks can have a large negative impact on commercial lending to firms. To date however, there is relatively little known about how firms respond to financing shocks experienced directly by entrepreneurs themselves.

In this paper, I attempt to fill this gap by asking how the growth and survival of small firms are affected when an entrepreneur is directly exposed to personal financing disruptions. This focus may have been previously understudied because detailed information about the financial well-being of individual owners within a private firm is generally withheld from financial reporting. Furthermore, sources of personal financing are often correlated with characteristics of owners and potential determinants of firm performance, and a causal relationship is therefore difficult to identify.

To overcome these challenges, I use administrative data on firm owners which include detailed information on their personal assets and their retail banking relationships, merged to a comprehensive dataset on labor market activity. I identify bank-specific shocks by using variation in the solvency of retail banking institutions in Denmark following the 2007-2009 financial crisis. This period was characterized by extensive banking consolidation and bankruptcies of several retail banks which were publically traded on the Copenhagen Stock Exchange. These bankruptcies exposed small business owners who were retail bank investors to significant losses in personal wealth. Furthermore, for small business owners with savings and deposit accounts at affected banks, their ability to access to personal lending products deteriorated.

My results suggest that financial disruptions experienced individually by business owners have significant effects on firm survival and performance. I find that exposure to personal liquid wealth losses for the firm owner stemming from lost investments increases the hazard rate of firm exit for entrepreneurs holding investment accounts by almost 50 percent. This effect is stronger for owners with early-stage ventures. To pin down the underlying mechanism, I show that entrepreneurs exposed to personal borrowing frictions from defaults and mergers have lower survival rates suggesting that the main findings are driven by financing, rather than differences in risk aversion. Finally, conditional on remaining in business, firm owners reduce employment after being exposed to financial losses.

In total, this paper shows that financial shocks experienced directly by firm owners can influence important decisions for the firm. Particularly in times of economic crisis, personal wealth and personal borrowing play a key role in entrepreneurial decision making.

# The Effect of Personal Financing Disruptions on Entrepreneurship\*

Tobin Hanspal<sup>†</sup>

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## Abstract

This paper studies how disruptions to personal sources of financing, aside from commercial lending supply shocks, impair the survival and growth of small businesses. Entrepreneurs holding deposit accounts at retail banking institutions that defaulted following the financial crisis reduce personal borrowing and are consequently more likely to exit their firm. Exposure to corresponding investment losses from delisted publicly traded bank stocks strongly reduces the rate of firm survival, particularly for early-stage ventures. At the intensive margin, owners who remain in business reduce employees after personal wealth losses. My results suggest that personal finance is an important component of firm financing.

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# 1 Introduction

How access to finance affects the growth and survival of firms is a fundamental question of entrepreneurial finance. Although there is ample evidence suggesting that credit market disruptions affect commercial lending and the borrowing ability of firms, we know relatively little about how firms respond to financing shocks experienced directly by entrepreneurs themselves. If small businesses are reliant on financing supplied by principal owner equity through savings, and debt financing from retail loans, personal financing disruptions are likely to play an important role in their creation and dissolution.

Previous literature has focused on how shocks to commercial lenders are transmitted to firms and their affect on real economic activity. Researchers have studied this by using variation in bank-branch consolidation and measuring aggregate local market outcomes,<sup>1</sup> with bank-firm matched data and detailed information on commercial lending,<sup>2</sup> and by examining larger firms with access to syndicated loan and capital markets.<sup>3</sup> By construction, the literature on credit market shocks largely excludes disruptions to personal finance in the outcomes of small business owners and entrepreneurial firms. Furthermore, the focus of existing research in entrepreneurship and personal finance has been on whether loosening financial constraints allows individuals from the general population to start a business, rather than how financing disruptions may affect established firms.

In this paper, I investigate how firms respond to idiosyncratic financing shocks experienced directly by small business owners. I use administrative data on firm owners which include detailed information on their personal assets and their retail banking relationships, merged to a comprehensive dataset on labor market activity. I identify bank-specific shocks by using variation in the solvency of retail banking institutions in Denmark following the 2007-2009 financial crisis. This period was characterized by extensive banking consolidation and bankruptcies, exposing entrepreneurs and small business owners to heterogeneous, and arguably exogenous, disruptions in retail financial markets. In the years preceding the financial crisis, Danish banking institutions increased their exposure to international capital markets and money markets in response to deposit deficits. As the financial crisis unfolded many financial institutions found themselves on the verge of bankruptcy. As a result of write-offs on domestic real estate investments, thirteen retail banks defaulted between 2008 and 2012, eight of which were publicly traded on the Copenhagen Stock Exchange. These banks were taken over by a state-owned financial supervisory authority. An additional twelve distressed banks resolved their liquidity

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<sup>1</sup>Berger & Udell (1998); Peek & Rosengren (2000); Ashcraft (2003); Greenstone *et al.* (2014); Nguyen (2014); Black & Strahan (2002); Adelino *et al.* (2014)

<sup>2</sup>Gan (2007); Khwaja & Mian (2008); Paravisini (2008); Degryse *et al.* (2011); Schnabl (2012); Iyer *et al.* (2014)

<sup>3</sup>Chodorow-Reich (2014)

needs in private merger and acquisition activity.

To understand how changes in personal wealth may affect entrepreneurial survival, I focus on a sample of small business owners who held retail bank stock investments outside of their own bank in the years leading up to the financial crisis. As an attempt to increase capital, many retail banks followed an expansionary policy consisting largely of selling stock to individual investors since the year 2000 ([Danish Financial Supervisory Authority \(2009\)](#)). These investments were relatively common among investors. Prior to the financial crisis, more than 60% of all Danish investors held an investment portfolio containing the stocks of a retail banking institution ([Andersen \*et al.\* \(2018\)](#)). The shareholders of these banks were exposed to sizable investment losses when the banks defaulted and their shares were eventually delisted from exchanges. Conditional on investment in the banking sector, the portfolios of exposed and unexposed investors were highly similar in composition and risk, however exposed entrepreneurs lost liquid assets from investments equal to 133,250 DKK (\$24,225 USD) at the mean and held approximately 30% less liquid wealth in the years after the financial crisis.<sup>4</sup>

Exposure to personal financial wealth losses for firm owners stemming from lost investments increases the average rate of firm closure by nearly 50%, an economically meaningful result given a baseline pre-crisis rate of exit of approximately 4 percentage points per year. This effect is accentuated for less experienced and more financially constrained entrepreneurs. Entrepreneurs who started a firm prior to the financial crisis face a hazard of firm closure of about 50% over the sample period. Exposure to personal financial losses of any size increases this rate of hazard by more than 8 percentage points, or a marginal effect of 17.5%. For small business owners in the top quartile of liquid wealth losses, this translates into an approximate 73% probability of firm failure, or an increase of 22 percentage points. Furthermore, using a matched sample and a difference-in-differences research design, I show that prior to the financial crisis, investors of banks which became distressed compared to those that remained solvent, show statistically equivalent rates of exit.

Consistent with the conjecture that firm owners may attempt to reduce costs prior to firm closure, I find that personal wealth losses of entrepreneurs result in significant intensive margin decisions. Conditional on remaining in business, firm owners reduce employment by approximately 0.6 full time workers after being exposed to financial losses, a meaningful decrease given the average firm in the sample consists of 5 employees. These intensive margin decisions only affect full-time labor, while part-time employment rates and wage levels remain unaffected. This is likely in part due to the flexible nature of the

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<sup>4</sup>1 USD = 5.5 DKK.

Danish labor market for employers.<sup>5</sup>

I hypothesize that financial constraints, rather than alternative mechanisms such as differences in preferences or changes in risk aversion, are the main driver of changes in firm survival after experiencing personal wealth shocks. Pre-crisis similarities in portfolio choice and risk taking, statistically insignificant differences in pre-trends, labor adjustments at the intensive margin, and heterogeneity across the sample support this argument. To further disentangle the mechanisms behind the results, I turn to a sample of entrepreneurs who were *deposit customers* of distressed banks rather than investors. These entrepreneurs were, by construction, unexposed to wealth losses, instead they held insured deposit accounts in distressed retail banks which were controlled by a state-owned institution created to unwind the bank prior to its resale. As such, customers were likely unable to access additional credit in the short run following the bank's default. I document the significance of this unexpected shock on debt accumulation for small business owners: the average exposed entrepreneur decreased his level of personal borrowing by approximately 10 percent, or 47,800 DKK (\$8,750 USD) in the year of the default of his personal retail bank relative to comparable small business owners with accounts in solvent banks. These exposed depositors are consequently 3 percentage points more likely to close their firm following the default of their retail bank, a marginal effect of approximately 30%.

If investors or depositors that select distressed banks are potentially worse business owners compared to those who select banks which remain solvent, they may also start weaker firms, or demand less credit for smaller or worse performing businesses. To address this challenge of potential unobservable heterogeneity in credit demand, I rely on the observation that during the aftermath of the financial crisis a number of distressed banks were either acquired by, or merged with, more stable retail banks. In these cases, the continuing or acquiring bank directly took control of the distressed bank without responsibilities or assets being transferred to a third party. These bank mergers provide an ideal counterfactual group. Unobservable characteristics of firm owners correlated with selection into potentially weaker banks are unlikely to differ between deposit account holders at banks which defaulted compared to deposit account holders at banks which were acquired, as both sets of banks became distressed at the onset of the financial crisis. Ex-ante, retail clients of these banks are unlikely to know if their bank would become distressed, and if so, if it would be acquired versus default. Exploiting this variation, I confirm a strong, negative effect on both debt accumulation and firm performance for

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<sup>5</sup>Denmark's labor model of 'Flexicurity' aims to provide businesses with the ability to make flexible hiring and firing decisions. By combining a strong social welfare safety net, the model makes it "easy for the employers to dismiss employees during downturns and hire new staff when things improve. (Denmark.dk, 2018)"

affected entrepreneurs.

This paper departs from existing literature on entrepreneurial and small business finance by focusing on successful and established firm owners, rather than individuals from a broad population. Entrepreneurs which hold investments are wealthy. In fact, the individuals in the sample hold above median net wealth positions and are in the top quartile of income, compared to all other *firm owners* in Denmark. Furthermore, the average entrepreneur in the sample has amassed a significant amount of business experience: the average firm owner started his or her first firm almost 20 years prior to the financial crisis. In this respect, my results suggest that even wealthy and experienced entrepreneurs may have firms which are vulnerable to unexpected personal shocks. I contribute to a vast literature on how personal financing constraints may affect potential entrants to entrepreneurship (Evans & Jovanovic (1989); Gentry & Hubbard (2004); Blanchflower & Oswald (1998) Holtz-Eakin *et al.* (1994); Hvide & Møen (2010); Andersen & Nielsen (2012); Nanda (2011)). A recent literature has suggested that loosening constraints may enable a lower quality marginal entrants into firm ownership (Andersen & Nielsen (2012); Jensen *et al.* (2015)). Surprisingly, there seems to be little evidence of how changes in owners' ability to provide financing may have effects that propagate ongoing firm dynamics and alter the survival or performance of established firms. Furthermore, the previous literature has focused almost exclusively on positive wealth shocks such as inheritances or gains in housing wealth while financial losses have yet to be studied.

These results expand upon the existing literature which question the importance of the credit supply channel by asking if financial institutions transmit bank-specific shocks to firms. Schnabl (2012) analyzes how credit availability effects business lending to borrowing firms in Peru using the 1998 Russian default as an exogenous shock to bank-to-bank international lending liquidity. Similarly, Khwaja & Mian (2008) use cross-bank changes in liquidity stemming from nuclear tests in Pakistan to show that firm borrowing of corporate loans is heavily reliant on bank liquidity. Iyer *et al.* (2014) uses the unexpected freeze of European interbank market to investigate the change of commercial and industrial loans to non-financial public firms in Portugal. Finally, Paravisini (2008) shows that an increase in government funding to local banks in Argentina increases total borrower debt without decreasing bank profitability. In addition, many researchers have used bank mergers as credit supply shocks to state-, county-, and even census track-level local markets and have considered the aggregate effects on rates of entrepreneurship and lending outcomes (Berger & Udell (1998); Peek & Rosengren (2000); Ashcraft (2003); Greenstone *et al.* (2014); Nguyen (2014), and Black & Strahan (2002)). Results generally show that bank consolidation in local markets and less banking competition reduce aggregate lending outcomes and firm activity.

Finally, my results are related to a literature on entrepreneurial performance. Studies on entrepreneurial performance and firm survival have focused on the initial start-up conditions of the firm and on inherent characteristics of the firm's owner. For example, human capital endowments and demographic characteristics (Cooper *et al.* (1994); Shane & Stuart (2002); Van Praag (2003)), and prior experience of the owner (Lafontaine & Shaw (2016); Bayus & Agarwal (2007)). Recent research has considered how macroeconomic events may affect firm performance, e.g., the Great Recession (Cowling *et al.* (2012); Cowling *et al.* (2015); Zarutskie & Yang (2015)), and entry conditions and the business cycle (Fairlie (2013); Moreira (2016)). A number of studies have considered the capital structure of the firm at the onset of creation and its effect on performance or survival. Firms that self-finance and take on external debt seem to have higher rates of survival (Reid (1991)), initial outside debt seems to be correlated with higher firm revenues later in the firm's lifecycle (Robb & Robinson (2012)), early start-up loans have a strong impact on survival (Fracassi *et al.* (2013)), and firms supported by lending programs fare better with higher rates of growth (Brown *et al.* (2015)).

I contribute to the existing literature above by showing that personal financing disruptions experienced directly by business owners, aside from shocks which affect commercial and business lending, can have large effects on the survival and growth of established firms. This channel may have been previously understudied for a number of reasons. Detailed information about the financial well-being of individual owners of a private firm is generally withheld from financial reporting. Datasets that link these firm owners to their personal financial market histories and experiences with information about the performance of their private firms are difficult to obtain. Finally, sources of personal financing are often correlated with characteristics of owners and potential determinants of firm performance, and a causal relationship is therefore difficult to identify. My analysis overcomes these issues by using high quality, administrative data from Denmark eliminating sources of measurement error and a natural experiment from the financial crisis. I look specifically at firm outcomes and performance rather than intensive margin changes in borrowing and lending. In addition, I focus on smaller, entrepreneurial firms and small business owners in an advanced European country.

The study proceeds as follows: In Section 2 I discuss the motivation and institutional background. The following section discusses in detail the sources of data and the sample. In Section 4, I discuss the identification strategy and empirical approach. Section 5 discusses the results and Section 6 follows with a focus on the mechanism, additional specifications, and robustness checks. The final section concludes.



## 2 Background

### 2.1 Related literature and hypothesis development

For most new firms the majority of capital financing comes from outside debt via personal loans made to the owner, commercial loans, and personal and business credit cards, as documented by [Robb & Robinson \(2012\)](#). The authors consider outside debt which is either a claim on the owner's personal assets or on the business's assets. Furthermore, their analysis suggests that personal debt is a significant component of early stage financing. More than 50 percent of the average firm's early financial capital stems from personal debt. At the extensive margin approximately 26 percent of firms use business lending and business credit cards, while 20 and 31 percent use personal bank loans and personal credit cards.<sup>6</sup>

The Kauffman Firm Survey data further suggests that more than 75% of firms are financed by at least some degree of owner equity ([Robb & Robinson \(2012\)](#)). Of these firms, owners provide on average \$40,500 of financing. Equity investments therefore make up a substantial fraction of household wealth for established small businesses, as pointed out by [Moskowitz & Vissing-Jorgensen \(2002\)](#), households with entrepreneurial equity on average invest more than 70% of their wealth in their own business. [Berger & Udell \(1998\)](#) show that smaller enterprises (less than 20 employees) finance their firms with a larger share of principal owner equity compared to larger firms (45% compared to 27%), and owner equity increases with the age of the firm while commercial and personal bank debt decrease.<sup>7</sup> [Robb & Robinson \(2012\)](#) find that for smaller businesses, owner equity constitutes approximately one-third of total financial capital in a firm's first year of business and a sizable fraction of initial and subsequent capital injections during operations.

This recent literature suggests that personal equity and formal credit are key elements of initial financing. If the performance and survival of firms is reliant on these sources of financing, shocks that affect these channels should have large detrimental effects on small businesses. For example, cash on hand may be needed to smooth out a downturn or recession, or seasonal sales cycles require inventory purchases at times when a firm is cash constrained. I therefore hypothesize that unexpected changes in the owner's household balance sheet should affect his or her ability to supply the firm with ongoing capital. Similarly, if growth or survival of a small firm is reliant on personal debt financing, external credit shocks affecting the owner's ability to obtain personal bank loans are likely to affect the firm to a detriment as well.

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<sup>6</sup>These values can be computed from Table 4 of [Robb & Robinson \(2012\)](#).

<sup>7</sup>See Table 1 in [Berger & Udell \(1998\)](#) for more information.

## 2.2 Institutional background

In the years preceding the financial crisis, Danish banking institutions saw a fundamental shift in the way that they accessed financing to lend to their customer base.<sup>8</sup> As a result of widespread deposit deficits, the retail banking sector turned to international capital and money markets in order to raise liquidity through new channels of financing. This in turn increased their exposure to international financial market fluctuations (Rangvid *et al.* (2013)). Prior to the financial crisis, however there was little concern that market financing may 'dry up.'

With the default of Lehman Brothers in the fall of 2008 Danish retail banks were effectively cut off from these international capital markets they had grown accustomed to. At the same time, many Danish banking institutions held sizable investments in domestic real estate and farmland, and as the financial crisis unfolded in the United States, asset values in these markets crumbled. This triggered a flight to liquidity, where some banks experienced the contraction more severely than others.

A group of small and medium-sized financial institutions were hit particularly hard. Indeed, there was considerable variation in how severely banks were affected (Rangvid *et al.* (2013)), and many banks were on the verge of defaulting on their obligations. Between 2008 and 2012, as a result of write-offs on real estate investments, thirteen retail banks defaulted, eight of which were publicly held. These thirteen default banks were taken over by *Finansiel Stabilitet A/S* (FS),<sup>9</sup> a state-managed company established at the onset of the financial crisis to unwind distressed banks. An additional twelve distressed banks consolidated with existing banks in private merger and acquisition arrangements.<sup>10</sup> The municipalities where the troubled banks were headquartered were distributed throughout Denmark, as shown in Figure 1.

## 3 Data

I access administrative register data encompassing the universe of all legal Danish residents and assemble a dataset of individuals spanning 2000 to 2013. My dataset contains economic, financial, and personal information about all individuals. The dataset is constructed based on several different administrative registers made available from Statistics

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<sup>8</sup>A feature of the banking environment in Denmark is an abundance of smaller, publicly held retail banks. In addition to the five largest retail banks (Danske Bank, Nykredit, Nordea Bank, Sydbank, and Jyske Bank), many smaller, local, retail banks are also publicly held and traded on the Copenhagen Stock Exchange.

<sup>9</sup>*Finansiel Stabilitet A/S* is an independent public corporation owned by the Danish government through the Ministry of Economic and Business Affairs. Not to be confused with the Danish Financial Supervisory Authority, *Finanstilsynet* (FSA).

<sup>10</sup>Refer to Appendix A.1 for additional information.

Denmark.

Individual-level data originate from the official Danish Civil Registration System. These data provide individual characteristics, such as age, gender, and marital status, and give unique identification across individuals and time. Educational records are from the Danish Ministry of Education. All completed (formal and informal) education levels are registered annually and made available through Statistics Denmark. Income, wealth, and employment status are from the official records at the Danish Tax and Customs Administration (SKAT). This dataset contains personal income and wealth information by individual social security number (CPR) for the Danish population. SKAT receives this information directly from the relevant sources; financial institutions supply information to SKAT on their customers' deposits and holdings of investments. Employers similarly supply statements of wages paid to their employees.

I access data containing the 4-digit registration number of each individual's primary retail banking account at year-end, from 2005-2012. I map these registration numbers into retail banks across Denmark using a hand-collected dataset. In addition, I obtain access to ISIN-level stocks and mutual funds from 2006-2012 for all equity market participating Danish individuals. This data provides year-end information on the specific composition and the value of individual investment portfolios held outside of pension accounts. I supplement the portfolio level holdings with Datastream monthly returns data.

### 3.1 Business owners and firms

The above datasets are complemented with a matched employer-employee panel dataset drawn from the Integrated Database for Labor Market Research in Denmark (IDA). In this administrative register, entrepreneurship and self-employment are defined by *primær arbejdsstilling*, or primary occupation. For each individual, I observe the annual primary occupation as designated in the last week of November. The dataset allows me to identify entrepreneurs precisely, distinguishing between self-employment and part-time work. The administrative designation of employment removes measurement error typically contained in survey data.<sup>11</sup> I define *self-employed* individuals as individuals who have a primary occupation code of *individual tax payer* or *employer* who employ no other individuals in the firm. Most importantly, *entrepreneurs*, are defined as individuals with a primary occupation of *employer* and employ at least one other individual in the firm, similar to the definition used in Jensen *et al.* (2015), Nanda (2008), Nanda & Sørensen (2010), and Nanda (2011), among others. By definition these individuals are owners of ventures with unlimited liability (UL), which encompass approximately 63 percent of new Danish

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<sup>11</sup>See Jensen *et al.* (2015) for a more in depth discussion of this dataset.

enterprises ([Statistics Denmark \(2016\)](#)).

The data do not allow me to identify firm owners with limited liability (LL). This however, is not problematic for the analysis as LL entrepreneurs are employees within their company, rather than employers employing others in this dataset ([Nanda & Sørensen \(2010\)](#)). Throughout the analysis I therefore compare exposed UL firm owners with unexposed UL firm owners, rather than a sample consisting of various types of firm owners. Theory suggests that entrepreneurs with riskier ventures may select into a limited liability firm structure and entrepreneurs interested in holding more control over the firm's decisions may rather opt for sole-proprietorship. On the other hand, in the presence of asymmetric information, high-ability entrepreneurs may select into UL to signal their quality by pledging higher personal guarantees and contracting lower borrowing rates ([Stiglitz & Weiss, 1981](#); [Chamley, 1983](#)). By focusing solely on UL firms, one concern could be a lack of external validity, however in this particular setting, it seems plausible that personal losses could affect both UL and LL firm owners, particularly in the presence of borrowing constraints and/or firms are in growth phases of their lifecycle. I use firm owners, small business owners, and entrepreneurs interchangeably however the sample is likely more representative of owner-managed businesses rather than high growth start-ups. Finally, because I use the IDA database on UL firm owners, I do not observe the business assets or revenues of the firm, only the individual assets of the firm owner him- or herself.<sup>12</sup>

## 3.2 Sample

To be included in the final dataset, individuals must have a full record for each year for inclusion, including a retail bank account. I then exclude any individuals with missing employment information during any year as well as individuals with incomplete education records. Finally, I limit the sample to individuals over the age of 25 and under the age of 60 in order to avoid entrepreneurs retiring from their businesses or withdrawing equity in pre-retirement years. This dataset results in 5,422,699 individuals in the year 2006, 40,569 (0.74 percent) of whom are entrepreneurs who employ other individuals. [Appendix A.2](#) shows that these entrepreneurs have an average firm size of 5 employees. Additionally, I constrain the analysis to focus on the main firm for owners who own multiple businesses. For approximately 10 percent of entrepreneurs in the sample, I include the largest establishment (in terms of employees) for firm owners with more than one business. This however, does not affect my results and point estimates are highly similar using the full, unconstrained sample.

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<sup>12</sup>A possible extension of this analysis would be to focus on LL firms where firm asset and revenue data is more widely available, however this is outside the scope of this current paper.

Table 1 reports summary statistics for all individuals in the sample in the year 2006. The table divides individuals by their primary employment; Column 1 focuses on all individuals in the sample, Column 2 on self-employed individuals, Column 3 on entrepreneurs that employ at least one other individual, and Column 4 on individuals who are in traditionally salaried labor employment. Consistent with the existing literature, entrepreneurs are more likely to be male, married, and have more children than their salaried counterparts. Additionally, they have significantly higher income with a higher standard deviation, and have accumulated more net wealth – while holding significantly higher levels of debt in their mortgage and personal bank loans. In fact, entrepreneurs have approximately three-fold the amount of personal bank debt as salaried employees. This highlights the relative importance of personal borrowing on the balance sheets of entrepreneurs.<sup>13</sup>

## 4 Empirical strategy

To analyze the effect personal financing disruptions may have on entrepreneurship I turn to a unique setting in Denmark resulting from bank defaults following the financial crisis. The disruptions in the banking sector allows me to estimate the causal effect on firm survival using a multiple-treatment difference-in-differences specification, given by the following estimation:

$$y_{it} = \alpha_t + \rho_i + \gamma \text{exposed}_{it} + \beta' \mathbf{X}_{it} + \epsilon_{it}, \quad (1)$$

where  $\alpha_t$  and  $\rho_i$  are year and individual-entrepreneur fixed effects, respectively, which account for variation across the sample years and time-invariant differences between individuals. The vector  $\mathbf{X}_{it}$  controls for individual time-varying control variables such as log. income, log. net wealth and if the entrepreneur purchases a home or has a child in year  $t$ . I identify unexpected personal wealth losses, unrelated to an entrepreneur's firm, with investment losses in the stock market. I define *investors* as entrepreneurs who held investments in publicly traded retail banks outside of the bank in which they have a deposit account. Investors who are *unexposed* and *exposed* are determined by whether the bank they hold investments in remained solvent or defaulted during the financial crisis. The sample is limited to bank investors, and as  $\text{exposed}_{it}$  takes the value of one in post-default periods,  $\gamma$  provides the average treatment effect of exposure after the default occurs compared to unexposed entrepreneurs (i.e. the difference-in-differences

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<sup>13</sup>Personal bank loans may include a top-up loan to facilitate initial mortgage down-payments. These are discussed in further detail in [Jensen & Johannesen \(2015\)](#), however they are not unique to entrepreneurs and are not what drives the differences between entrepreneurs and salaried individuals.

estimate).<sup>14</sup>

Many retail banks in Denmark followed an expansionary policy consisting largely of selling stock to individual investors since the year 2000 (Danish Financial Supervisory Authority (2009)). These investments were common among investors, as described in Andersen *et al.* (2018); more than 60 percent of all investors held these assets in their portfolio. As these banks defaulted, the value of their traded shares rapidly declined until they held zero value and exposed investors to additional losses in a declining market.

To demonstrate, the top panel of Figure 2 plots a simple index of market returns in log terms of different types of investments held in the portfolios of market participants. The gray line, plots the average market returns of all equities outside of the Danish banking sector over time. The black solid line plots the returns of the equities of retail banking institutions which defaulted throughout the crisis, whose total value eventually diminishes to zero. These equities were eventually delisted from the Copenhagen Stock Exchange. Finally, the dashed black line plots the market returns for *unexposed* bank investors. These retail banking equities remained solvent throughout the crisis, and while their value decreased in comparison to all other equities, they retained a significant portion of their value compared to defaulting banks. Comparing the difference between the solid and dashed black lines serves as variation in personal wealth losses, while holding constant the investment style of the investor. In fact, as shown in the bottom panel of Figure 2, the ex-post returns for a market-capitalization weighted portfolio of retail bank stocks which remain solvent compared to a portfolio bank stocks which end up in default had near identical risk and market returns in the 36 months preceding the financial crisis. The figure plots the distribution of monthly returns for the two portfolios containing retail banking stocks weighted by market capitalization from January 2005 to December 2007.<sup>15</sup> A Kolmogorov-Smirnov test suggests that the distributions of monthly returns are not statistically different from each other, not surprising considering the time-series correlation of monthly returns between the two portfolios is more than 90 percent.

For the average investor, these delisted investments led to sizable losses of liquid wealth. Appendix A.3 provides a tabulation of the distribution of losses for unexposed and exposed investors. The table states the mean, 25th, 50th, and 75th percentiles of total investment losses, total losses as a percentage of savings, as a percentage of liquid wealth, and as a percentage of net wealth. The table shows that on average, unexposed bank-investor entrepreneurs lost 41,500 DKK (\$7,500 USD) in the declining market following

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<sup>14</sup>In order to address potential serial correlation across time common in DD estimations with several pre- and post time periods as noted in Bertrand *et al.* (2004), I cluster all standard errors at the pre-crisis primary retail bank level.

<sup>15</sup>December 2007 is an accepted starting date for the Great Recession (NBER), however similar distributional plots for varying time periods show qualitatively the same result, as does using an equally weighted portfolio.

the financial crisis, while exposed entrepreneurs lost on average three times the amount, 133,250 DKK (\$24,000 USD), equal to approximately 30 percent of pre-crisis savings, or 20 percent of financial wealth.

In general, this identification strategy has several strengths. Firstly, for small businesses, personal and business expenditures are likely to overlap considerably, but stock investments are generally a financial instrument held in personal accounts and separately from an entrepreneur's firm. Therefore a shock to personal investments serves as an ideal proxy for understanding the effect of changes in personal financial liquidity on firm performance. Secondly, because variation comes from the specific bank, and not in the type of investment, I compare investors with similar investment styles and portfolios with similar risk-return structures who are exposed to idiosyncratic variation from the delisted equities. In addition, the time-fixed effects across specifications control for general changes in financing conditions associated with the financial crisis and exposure indicates the incremental shock above general macroeconomic conditions. Finally, these investments made up a significant fraction of the liquid wealth held by entrepreneurs in the sample. It should also be noted that the related literature has shown that individual investors are likely to be under-diversified, hold on to losing investments, invest in local assets, and are sluggish to update their portfolio or to realize returns.<sup>16</sup> This suggests that it is not surprising, per se, that individuals may have let their portfolios containing defaulting bank stocks diminish instead of actively rebalancing away from these assets.

#### 4.1 Descriptive characteristics of small business owners

The validity of estimates obtained by Equation 1 rests on the assumption that entrepreneurs who are exposed to banking defaults are similar to unexposed entrepreneurs, and selection into these two groups is near random. Therefore I pay particular attention to testing for differences in observable characteristics between entrepreneurs, controlling for fixed and time-varying demographic and financial characteristics, and examining common pre-trends in outcomes.

In Table 2, I focus on the main sample of entrepreneurs who invest in retail bank stocks outside of their own bank prior to the financial crisis. Columns 3 and 4 show that demographic, financial, and portfolio characteristics of *unexposed* and *exposed* investors are similar, with the differences and significance of the two groups displayed in Column 5. Column 5 suggests that the differences between the two groups is economically and statistically insignificant. This includes important indicators of background consumption such as housing assets, mortgage loan-to-value, non-mortgage retail bank debt.

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<sup>16</sup>See Barberis & Thaler (2003), Kaustia (2010), and Andersen *et al.* (2018) for related literature reviews.



Of particular importance is the investment and portfolio characteristics of investors in the sample. If exposed investors held less diversified portfolios or invested with dramatically different levels of risk, this would challenge the near random assumptions of the identification strategy. Table 3 compares exposed and unexposed entrepreneur-investors in terms of their portfolio characteristics in 2006, prior to the financial crisis. Exposed investors hold slightly more non-mutual fund risky assets, however this value is not statistically different from unexposed investors. This is highlighted by the observation that exposed investors hold a qualitatively similar measure of risky assets relative to financial wealth, where financial wealth measures the sum of year-end market value of stocks, bonds, and bank deposits. Furthermore, the two groups of investors hold a similar number of assets in their portfolio, approximately 2.5 at the mean. I use monthly returns from 10 years of data (1997-2006) and the MSCI World All-Market index as a benchmark to investigate the risk and return trade off of investors portfolios. Exposed investors, on average have a slightly less volatile portfolio indicated by a smaller beta-coefficient, and tend to have a slightly higher Sharpe ratio. However, both exposed and unexposed investors on average hold portfolios with low and statistically similar levels of idiosyncratic risk. If anything, exposed investors appear to be slightly more diversified relative to their unexposed counterparts.<sup>17</sup>

Perhaps unsurprisingly, these entrepreneurs also own similar firms. Exposed and unexposed investors have similar levels of entrepreneurial experience and employ approximately 5 employees in their firms. In general, entrepreneurs who held investments in banks which defaulted are highly similar to other entrepreneurs with similar investors in observable characteristics. It seems likely that the balance sheets of retail banks may not have necessarily been an important selection criteria among retail bank customers and investors prior to the financial crisis in Denmark.

## 5 Results

### 5.1 The effect of personal financing disruptions on firm survival

The first stage of the analysis is to examine how changes in financial wealth affect firm survival. I explore this in Table 4 with two definitions of exposure to retail banking defaults. Columns 1 and 2, first analyze the probability that the entrepreneur exits from the firm for any reason. Columns 3 and 4 then specifies that the firm was closed down by the owner. I consider two measures of losses. The first, *exposed investor*, indicates

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<sup>17</sup>These results are highly similar when using alternative benchmark indexes such as the the Copenhagen OMX, or the MSCI Euro Stock index.



whether the entrepreneur held stock investments in a default bank and incurred *any* financial losses. The second definition indicates if the investor incurred losses *above the median* value of losses for firm owners investing in a bank which defaulted. The variables take the value of one if year  $t$  is after the bank default year and zero if otherwise.

I find that investors exposed to any, and above median losses, are marginally more likely to exit from their firm for any reason. In this definition, entrepreneurs may enter a salaried position, file bankruptcy, or a number of alternative outcomes. In Columns 3 and 4, I condition the outcome to specific firm closures. Investors incurring personal wealth losses are significantly more likely to close their firms in the years following the banking defaults. Investors who lost wealth above the median are 2 percentage points more likely to exit. This is relative to a pre-crisis marginal effect of firm closure in the sample of approximately 4 percent.<sup>18</sup> A 2 percentage point increase therefore corresponds to a marginal effect of almost a 50 percent increase in the hazard of failure for entrepreneurs experiencing additional wealth losses. Firm closure is my preferred definition as it is the definition most closely aligned to a measure of firm bankruptcy that the data allow.

One question which arises is whether firm owners attempt to liquidate their firms or sell their firms rather than close down. In Table 5, each column represents a different dependent variable for different survival outcomes of the entrepreneur's firm. As in the previous table, Column 1, analyzes the probability that the entrepreneur exits from the firm for any reason and Column 2 focuses on firms that were specifically closed down by the owner. Column 3 specifies that the firm was closed and resulted in a merger or acquisition, and finally, Column 4 specifies that the firm remained open, however was downsized to a single owner-employee. The main variable of interest is the above median losses variable previously defined. Entrepreneurs who were exposed to significant financial wealth losses are approximately 2.3 percentage points more likely to exit from entrepreneurship compared to other bank-investor entrepreneurs unaffected by wealth losses. Columns 2 and 3 suggest that this result is predominantly driven by the fact that these firm owners actually close down their business, rather than sell their business or merge with another firm. While affected entrepreneurs have firms which close and are less likely to be directly acquired, it is possible that the business owners close their firms and sell some assets or sell part of all of their business in the years following. If the firm's assets are sold indirectly or in subsequent years, it would not be recorded in this variable

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<sup>18</sup>The average rate of firm closure over the sample period is depicted in Appendix Figure A.1. I note that while the unconditional probability of firm closure is approximately 4 percent per year, the long-run rate of firm survival is significantly lower. For example for a firm established in 2000, there is a 67 percent unconditional probability that it continues to exist in 2005, and a less than 50 percent probability of survival in 2010. In this example, the long-run rate of survival is almost 10 percentage points lower for firm owners exposed to personal financing disruptions. These hazard rates are further examined in Section 7 where I estimate firm survival models.

construction. The effect would potentially bias the merger definition downward, and the main outcome variable, firm closure, would remain unaffected.

Because entrepreneurs in the sample are defined by the fact that they employ other individuals, a potential driver of firm changes at the extensive margin may simply be that firm owners downsize to firms with a single entrepreneur-employee or become self-employed as in Column 2 of Table 1. Column 4, therefore analyzes the effect of financial wealth losses on the probability of this outcome. I note that individuals with personal financing disruptions are no more likely to exit due to downsizing compared to unaffected entrepreneurs.<sup>19</sup>

In total, Tables 4 and 5 shows that personal wealth shocks seem to have a strong positive effect on firm closure. One potential concern however, is that the results may be confounded by individual characteristics correlated with investors who were exposed to financial losses. In addition, investors who experienced high, or above median losses, may have taken higher risk in their business ventures or in their investment portfolios compared to less exposed entrepreneurs, which may also be correlated with firm-level decisions.

To address these items I turn to an analysis using a sample matching exposed investors to unexposed business owners using a variety of characteristics. For each exposed investor entrepreneur in the sample I match up to 5 nearest-neighbor unexposed investors in year  $t_{-1}$  from the bank default. The matching is based on five-year age cohorts, twenty-vigintiles of net wealth, five-percentage point bins of the share of wealth in risky assets, the number of investments in bank stocks, gender, marital status, and the municipality of residence. Matching methods allow analysis relative to  $v$ , years from bank default, rather than solely calendar-year,  $t$ . The regression therefore takes the form,

$$y_{it} = \alpha_t + \rho_i + \mathbf{t}_v + \gamma(\text{exposed}_i \times \mathbf{t}_v) + \beta' \mathbf{X}_{it} + \epsilon_{it}, \quad (2)$$

where  $\mathbf{t}_v$  is a vector of indicator variables for each year relative to the bank default and year of matching. The results from this analysis are shown graphically in Figure 3. Panel B includes all matching elements listed above, while in Panel A I allow the pre-default risk share and the number of bank assets to vary between investors, this increases the sample size and adds further power to the analysis. Each point on the figure states the difference in the probability of firm closure between exposed and unexposed investors. Both panels reveal that prior to the bank default exposure the probability of firm closure for the

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<sup>19</sup>The results presented thus far are also robust to alternative definitions of entrepreneurship. In an unreported analysis I create a dataset consisting of entrepreneurs *and* self-employed individuals and find qualitatively similar results. If the sample consists of *only* self-employed individuals, the effect of bank defaults and investments losses decreases in magnitude. This can potentially be explained if self-employed individuals are more likely to be consultants and/or work in less capital intensive businesses.

unexposed and exposed entrepreneur does not significantly deviate from zero. However in the years following, exposed investors are approximately 3-4 percentage points more likely to close their firm. Furthermore, this analysis defines exposed investors as investors who were exposed to *any degree* of losses from the delisted bank stocks, rather than losses above the median.<sup>20</sup> To further control for differences between exposed and unexposed investors, in Appendix Figure A.2, I additionally condition the sample to investors who invested in exactly one retail banking institution pre-crisis, and match on the share of wealth invested in that bank. I note that the results remain statistically and economically similar in magnitude. Finally, as the analysis is a difference-in-differences estimation, it would be natural to investigate if there are any observable differences in firm outcomes between exposed and unexposed entrepreneurs *prior* to the unexpected bank default. In general, Figure 3 provides satisfactory evidence of parallel pre-trends prior to the financial crisis. The regression results from these analysis are also stated in Appendix A.5.

## 5.2 Personal financing disruptions and employment decisions

As shown, changes in personal wealth affect the extensive margin of firm operations. It is logical to assume that if financing disruptions affect the ability of a firm owner to supply capital to the firm rather than through another channel, firm owners may attempt to reduce the variable costs associated with labor inputs prior to ceasing operations. In Table 6 I focus on changes at the intensive margin for small business owners. I test whether employers reduce employee headcount when facing an unexpected decrease in their personal financial wealth.

Conditional on a firm owner remaining in business, the table analyzes employment outcomes for full and part-time employees. Column 1 specifies the total number of employees measured in November of each year. Columns 2 and 3 decompose this value into full-time and part-time employees. In Column 4 I use an alternative measure from tax data on the number of employed full-time equivalents and Column 5 measures the average log. of wages for all employees. Beginning with Column 1, Table 6 shows that investor-entrepreneurs exposed to wealth losses from delisted stock investments, decrease their number of total employees by approximately 0.59 employees in the years after experiencing wealth losses. This effect is statistically significant at the 1% level. The average firm in the sample has just 5 employees, therefore this corresponds to a 12% marginal effect. Perhaps more interesting Columns 2 and Columns 3 reveal that exposed investors reduce the number of full-time employees significantly, but part-time labor remains relatively unaffected. Column 4 suggests a similar relationship using an alternative measure of full

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<sup>20</sup>Using the previous definition of above median losses are unreported and produce a similar result with a larger post-period effect, however the presented estimation provides a more conservative approach.

time equivalents. Finally, I note that the average wages paid out to employees remains unaffected. The finding that the effect is driven by changes in full time labor is likely due to the flexible nature of the Danish labor market often referred to as 'Flexicurity.' This system is characterized by lax employment protection and generous unemployment insurance such that employers can easily downsize at will (Andersen & Svarer, 2007; Andersen, 2015).

The results from this table suggests that wealth losses drive changes at the intensive margin of operations for firm owners. This finding complements a recent literature examining the effect of credit market disruptions on employment (Chodorow-Reich (2014). While Greenstone *et al.* (2014)) finds a limited effect of credit market disruptions on employment in smaller businesses perhaps more comparable to this analysis, Table 6 suggests that personal wealth shocks, aside from credit market disruptions may also contribute to the real effects on employment. Firm owners who lose a significant source of personal liquidity operate smaller firms after they experience personal losses.<sup>21</sup> On average, exposed employers reduce their number of full-time employees by approximately 10% after experiencing financial wealth losses.

### 5.3 Heterogeneity in entrepreneurs

The results thus far suggest that an unexpected decrease in personal financial wealth plays an important role in determining exit from entrepreneurship. In order to quantify this effect across the distribution of losses, I turn to a DD specification with a continuous treatment variable.

$$\text{pr}(y_{it} = 1 | \textit{exposed}_{it}, \mathbf{X}) = \Lambda(\boldsymbol{\alpha}_t + \boldsymbol{\sigma}_c + \gamma(\textit{exposed}_{it} \times \phi_{i,2006}) + \beta' \mathbf{X}_{it} + \epsilon_{it}) \quad (3)$$

where  $\boldsymbol{\alpha}_t$  and  $\boldsymbol{\sigma}_c$  are year and bank-treatment cohort fixed effects. Note that in specifications without individual-entrepreneur fixed effects the bank-treatment fixed effect is necessary to identify  $\gamma$ . As previous,  $\textit{exposed}_{it}$  indicates entrepreneurs with exposure to investment losses stemming from retail bank investments and  $\phi_{i,2006}$  is the share of liquid wealth (i.e. the year-end market value sum of bank savings, bond holdings, and stock investments) invested in retail bank stocks prior to the financial crisis.  $\gamma$  provides the average treatment effect of exit from entrepreneurship for exposed entrepreneurs after the default of their bank investment at varying levels of pre-crisis investment in stocks which go on to default. The results from this specification are presented graphically in Figure 4, showing the effect of the size of lost investment on the probability of  $y_{it} = 1$ .

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<sup>21</sup>This effect could be driven by employers actively reducing staff, by employers simply choosing not to renew employment contracts, or alternatively by employees selecting out of certain ventures.

The figure shows the marginal effect on *any exit* from entrepreneurship (in diamonds), and *firm closure* (dots). The  $x$ -axis plots the fraction of liquid wealth lost from an investment in a default bank for exposed entrepreneurs after the banking defaults. The results suggest that the probability to exit is an increasing function of the size of lost wealth; when entrepreneurs experience a complete loss of their liquid wealth the probability that they exit from their firm increases by nearly 4 percentage points greater than the baseline hazard of exit.

In order to examine how wealth losses affect entrepreneurship as a function of experience, I refer to Figure 5. Similar to Figure 4, I plot the probability of firm closure at year  $t$  conditional on the establishment year of the entrepreneur's firm. As the coefficients plot an increasing monotonic relationship, I note that firm owners with less experience, established in the years shortly preceding the financial crisis are more likely to exit following personal financing disruptions. Exposed entrepreneurs with limited experience appear to be driving the large effect on firm closure. These results lend confirmatory evidence to existing cross-sectional studies such as Berger & Udell (1995) and Robb & Robinson (2012), who suggest that owner provided equity may be more crucial for younger firms in the earlier stages of their life-cycle.

In Table 7, I examine heterogeneity in pre-crisis personal wealth. The sample is divided into terciles of net wealth and the ratio of debt to assets such that Column 1 (2) (3) includes the bottom (middle) (top) third of the distribution. Panel A presents this for *net wealth* while Panel B is the *debt to asset ratio*. Examining the coefficients across columns, suggests that entrepreneurs outside of the top third of the distribution of wealth are more impacted by personal wealth losses. Panel B shows that investors with mid to high debt as a function of the total assets are almost 3 percentage points more likely to exit from their firm after exposure to personal wealth losses from lost investments. These results suggest that, perhaps unsurprisingly, more financially constrained small business owners are more affected by personal wealth losses.

## 6 Why do personal financing disruptions affect firms?

### 6.1 Ruling out alternative mechanisms

The main channel that has been discussed so far suggests that firm exit is driven by limited financing, or credit supply contractions, as a barrier to firm survival. However, a financial wealth shock may also cause changes in risk taking behavior which in turn could affect the desire of an individual to continue with an entrepreneurial firm. A large literature examining how households react to changes in wealth finds individual portfolio

risk aversion to be either constant or slightly decreasing.<sup>22</sup> In general, individuals seem to keep their portfolio risky asset share constant around changes in wealth. Andersen *et al.* (2018) indeed find that personal experiences are linked to less future financial risk taking. The literature also suggests that entrepreneurs may perceive risk differently from salaried individuals.<sup>23</sup> Regardless, when analyzing wealth changes on labor market decisions, changes in willingness to take risk becomes difficult to disentangle empirically.

One main indication that the results presented thus far are driven by financing constraints rather than idiosyncratic differences in preferences or behavior across entrepreneurs was referenced in Figure 3. If exposed small business owners had different preferences for risk, or if entrepreneurs with riskier business ventures were also to take more risk in their personal accounts, they should have different rates of firm closure *prior* to experiencing any wealth shocks. However, as depicted in Figure 3 and Appendix A.5, this does not appear to be the case. This is also evidenced by the fact that the riskiness of their portfolios pre-crisis were indistinguishable. In fact, as shown in Panel B of Figure 3 and Appendix Figure A.2, increasing the precision of the match with measures of risk taking only increases the post-crisis wedge between exposed and non-exposed entrepreneurs in survival rates.

A number of the additional findings presented also lean in favor of financial constraints, rather than differences in preferences or changes in risk aversion as the mechanism which drives the results. Firstly, the previous section on heterogeneity shows that the results are driven by entrepreneurs in younger firms, i.e., with less experience. On one hand, it's likely that these entrepreneurs are more financially constrained in the formative years of their business (Berger & Udell (1998); Fracassi *et al.* (2013)). On the other hand, it would be difficult to argue that entrepreneurs in the initial years of their business would be more willing, relative to more experienced entrepreneurs, to close their business and exit their firm due to alternative mechanisms such as changes in risk appetite. If the findings ran in the opposite direction, and more established firm owners were more likely to shut down their firm, the effect could be due potentially to early retirement or exit from a riskier stream of income.

Firm owners most likely to exit from their business following wealth shocks are more likely to be financially constrained in terms of net wealth and their relative debt position. The effect of financial losses at the intensive margin of employment decisions also contributes a powerful test, as it focuses on firm owners who remain in business. Those who experience larger losses, reduce costs associated with employees relative to those who

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<sup>22</sup>See Calvet *et al.* (2007), Brunnermeier & Nagel (2008), and Chiappori & Paiella (2011).

<sup>23</sup>See Åstebro *et al.* (2014) and Koudstaal *et al.* (2015) for recent discussions. In addition, recent evidence suggests that these differences may be attributable to entrepreneurs' willingness to risk losses (Koudstaal *et al.* (2015)).

remain less affected.

Finally, in Table 8, I analyze the effect of a change in personal financial wealth on alternative individual outcomes of the entrepreneur. Column 1 first documents the change in the logarithm of financial wealth. The variable *exposed investor* indicates whether the entrepreneur held stock investments in a default bank and incurred (any degree of) financial losses. The coefficient is statistically significant at the 5% level and indicates that exposure to investment losses has a strong, and likely mechanical, negative effect on individual financial wealth. Entrepreneurs exposed to portfolio losses experience a 25 percent decrease in liquid asset holdings. This finding is shown graphically in Figure 6 with a matched sample of unexposed investors.<sup>24</sup>

Columns 2 through 6 show the effect of portfolio losses on alternative outcomes. Column 2 is the change in the logarithm of net wealth, while Column 3 is the change in the logarithm of total income. Column 4 investigates the change in the share of wealth in risky assets, conditional on holding risky investments. Column 5 focuses on total debt while Column 6 focuses on personal retail banking loans. Across all of these outcomes, I note that the effect of personal financing disruptions via investment losses is statistically indistinguishable from zero. This table highlights the finding that losses particularly affect financial wealth holdings, and not alternative outcomes which may be driving the changes of the firm. I observe no change in risky asset holdings, total sources of income, or personal debt.

## 6.2 Evidence from deposit holders

To further disentangle between financing constraints and alternative mechanisms which could be associated with wealth shocks, I turn to a related feature of the retail banking disruptions following the financial crisis. I focus on a subsample of entrepreneurs who were *deposit customers* of affected banks rather than investors. Customers of exposed retail banks held a personal deposit account at a bank which was unlikely to be able to supply additional credit to its client base in the short run following the onset of the crisis, and unlike investors, exposure to defaults are not accompanied by a direct wealth shock.

The activities of retail banks which defaulted in Denmark were immediately transferred to FS.<sup>25</sup> These transfers were part of the unwinding process for distressed banks as part of ‘Bank Rescue’ Packages I-IV spanning 2008-2012. In many cases, after FS held responsibility of the banks, their assets (customer accounts, bank branches, etc.) were

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<sup>24</sup>The matching specification is identical to that discussed in the previous section.

<sup>25</sup>In the case of the very first bank default of the 2007-9 financial crisis, the assets and responsibilities were actually first transferred to the Danish Nationalbank, and then shortly after transferred to the newly created Finansiel Stabilitet in October 2008.



later sold in full or partial sales to competing retail banks. Previously, FS maintained a passive role in advising banks on their borrowing and lending arrangements. Once the affected banks began default discussions, FS took an active role in all activities of the exposed banks in an effort to provide security to depositors.

Deposits of exposed bank customers were guaranteed by the state, and therefore the bank defaults had a limited effect on personal deposit holdings.<sup>26</sup> However, the default of an entrepreneur's bank may directly affect the entrepreneur's ability to access capital in the form of personal bank loans.

There are a number of reasons why deposit holders could be affected in their ability to borrow. Defaulted banks were likely to be more distressed than others which would directly affect their lending ability. After the default, the bank was controlled by FS, and it is unlikely that they would issue new loans or negotiate existing loans in the immediate term. As the assets were eventually sold to other banks, it seems likely that there may have been a time lag before operations resumed to normal. Finally, a large fraction of customers actively switched to an alternative bank, following their bank's default. In the short term, this could be detrimental to their borrowing ability, as it is well documented that borrower-lender relationships affect credit availability, term rates, and collateral requirements (Petersen & Rajan (1994); Berger & Udell (1998)).

Unfortunately the data do not contain objective measures of borrower-lender relationships in the data. However, I proxy the exposure to retail banking defaults by observing the change in retail bank loans held by affected entrepreneurs. To investigate the relationships between disruptions to retail banking and personal borrowing, I define *exposed depositors* as entrepreneurs with a personal deposit account at a retail bank which went on to default following the financial crisis. *Unexposed depositors* are similar entrepreneurs however held an account at a bank which remained solvent. While demographic and financial characteristics between the two groups are observantly similar.<sup>27</sup>

In Columns 1 through 3 of Table 9, I examine the effect of these retail banking disruptions on any exit from entrepreneurship, firm closure, and personal borrowing, respectively. Columns 1 and 2 indicate that deposit holders of exposed banks are significantly more likely to exit or close their business following their main bank's default. These effects are economically and statistically significant. Furthermore, Column 3 indicates that

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<sup>26</sup>Depositor insurance in Denmark is provided by The Guarantee Fund for Depositors and Investors and guarantees 100% deposits up to 750,000 DKK (100,000 EUR). Notably relevant for this study, the Danish government decided to provide unlimited guarantees to depositors from October 5, 2008 to September 30, 2010.

<sup>27</sup>Appendix A.6 focuses on the depositor sample of entrepreneurs in 2006 and compares entrepreneurs whose primary retail bank goes on to default during the financial crisis with entrepreneurs whose retail bank remains solvent. Column 4 presents the differences between *exposed* and *unexposed* depositors and the results of an unpaired *t*-test. In terms of observable demographic and financial characteristics exposed and unexposed entrepreneurs appear to be similar.



these deposit holders reduce personal borrowing by approximately 9 percent following their bank's default.

Additionally, I construct a sample of unexposed entrepreneurs matched to exposed depositors. The nearest neighbor matching specification is identical to that of investors, discussed in Section 5.1. The minor difference being that the risk share matching criteria may include a zero-value of wealth invested in risky assets. Panels A and B of Figure 7 display the effect of retail banking disruptions on firm closure and personal bank loans, respectively. Prior to the default, exposed and unexposed deposit holding entrepreneurs were statistically indistinguishable in their rates of firm closure, and in the amount of personal loans held. As the exposed group experiences the default, they significantly increase the rate of firm closure by approximately 3 percentage points. This is preempted by a significant reduction of personal borrowing immediately in the year of their bank's default. The decrease in consumption of personal loans amounts to approximately 10 percent, or 47,800 DKK (\$8,750 USD).

If a mechanism other than financing constraints were to drive the results presented thus far, for example differences in preferences or a change in risk taking behavior, it would be unlikely that deposit experiences should affect firm closure. Entrepreneurs affected via this channel are, by construction, not exposed to additional financial losses but significantly decrease their borrowing ability. As in the case with investors, prior to the bank defaults the groups of entrepreneurs had indistinguishable rates of firm closure.<sup>28</sup>

### 6.3 Heterogeneity in credit demand

The analysis thus far has emphasized the effect of changes in credit supply and its affect on firm survival with the implicit assumption that demand for credit remains constant across exposed and unexposed investors and depositors. If investors or depositors that select banks which default are for any reason somehow less financially sophisticated or potentially worse business owners compared to those who select banks which remain solvent, they may also start weaker firms, or demand less credit for smaller or worse performing businesses.

Unobservable heterogeneity in credit demand would lead to a spurious relationship between personal borrowing and bank default. To address this potential concern, I rely on the observation that during the aftermath of the financial crisis a number of distressed banks were either acquired by, or merged with, more stable retail banks. The banks which were acquired were local banking institutions and comparable to the banks which defaulted. In these cases, the continuing or acquiring bank directly took control of the

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<sup>28</sup>The full table of regressions are shown in Appendix A.5

distressed bank without responsibilities or assets being transferred to the FS as part of an unwinding or oversight process. Indeed, throughout the aftermath of the financial crisis, the FS enacted measures via its Bank Rescue packages to ‘supplement market solutions and private transfers,’ to help remove barriers for mergers between banks, so long as at least one of the merging banks remained under increased FS supervision (Rangvid *et al.* (2013)).

The benefit of this variation is that if unobservable characteristics of firm owners are somehow correlated with selection into potentially weaker banks or into institutions which took ex-ante more risk than banks which remained solvent, it is unlikely that these characteristics differ between deposit account holders at distressed banks which default compared to deposit account holders at distressed banks which were acquired.<sup>29</sup> Distressed banks which resulted in mergers therefore provide an ideal counterfactual group compared to banks which defaulted. The main difference being that merging banks potentially more quickly migrated their customers and assets to a liquid and more stable retail bank. Banks that defaulted, were first transferred to FS for further bank unwinding and supervision. It is likely that these additional frictions may impact available credit supply to small business owners borrowing directly via their personal retail accounts. At the same time, because both groups of banks became distressed at the onset of the financial crisis, deposit customers should be similar in their demand for credit and other unobservable dimensions.

In Columns 4 through 6 of Table 9, I sample deposit holders who held an account in a distressed bank which was either acquired or ended up in default. This therefore provides a measure of the effect of a banks’ default relative to a comparable counterfactual where the distressed bank becomes acquired. Columns 1 and 2 indicate that deposit holders of defaulted banks are significantly more likely to exit or close their business following their main bank’s default relative to those whose bank was acquired. These effects are economically and statistically significant. Column 3 suggests as hypothesized that these deposit holders reduce personal borrowing by 8.0 percent more than those whose distressed bank is acquired following the financial crisis.

The results of this test show, while controlling for potential differences in credit demand, that personal financing disruptions have a strong effect on firm outcomes for small

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<sup>29</sup>An existing literature uses bank merger and acquisition activity following banking law liberalization in the United States as a similar identification strategy. Results suggest that bank-branch closures reduce small business lending (Berger *et al.* (1998); Nguyen (2014)) and decrease employment (Greenstone *et al.* (2014)). However, Black & Strahan (2002) find a positive effect of banking consolidation on entrepreneurial activity, arguing that larger bank’s diversification strengths may outweigh smaller bank’s relationships strengths. Consistent with the results in this study, Strahan & Weston (1998) find that mergers have little effect on small business lending, and if anything the relationship may be positive. Sapienza (2002) uses individual loan contract data on small businesses in Italy and finds that borrowing and lending rates increase after small mergers but decrease after large mergers.

business owners. Furthermore, by focusing on a subset of the population unexposed to wealth losses, the findings suggest that the main mechanism is via constraints in retail credit supply.

## 6.4 Timing around defaults and firm closure

One concern with Table 9 and Figure 7, is that while the effect is clearly after the bank's default, it need not be prior to the firm's closure. Therefore it is important to carefully examine the timing of the wealth or borrowing shock to test whether this is an appropriate mechanism for explaining the firm exit.

In Table 10, I investigate in detail these financing channels for exposed entrepreneurs who eventually close their firms relative to unexposed entrepreneurs who also close their firms. The table analyzes the effect of retail bank defaults on investment losses and personal borrowing exactly *prior* to firm closure. In Column 1 the sample consists of bank investor entrepreneurs, Column 2 focuses on bank depositor entrepreneurs, while Column 3 samples depositors with default or merger experiences as in Columns 4-6 of Table 9. The dependent variable in Column 1 is therefore log. of financial wealth, while in Columns 2 and 3 it is the log. of personal borrowing. The variable of interest, *event window*, takes the value of one in the time period for each exposed investor (depositor) after experiencing an investment (bank) default in years,  $j$ , and the time period before the investor's (depositor's) firm closes,  $t$ . The coefficient provides the difference in the financial wealth holdings, and personal borrowing relative to the pre-bank default and pre-firm closure window. I note in Column 1 that investor entrepreneurs who are exposed to the personal investment losses face significantly less liquid financial losses in the years leading up to their firm's closure, after the delisting of their investment. Similarly in Columns 2 and 3, entrepreneurs exposed to their personal retail bank's default, strongly reduce personal loan borrowing in the years between the bank's default and the closure of their firm. The results presented in Table 10 are significantly larger than in the previously presented figures for a number of reasons. Firstly, the sample contains entrepreneurs who *only* exit from their firm. Also, the entrepreneurs are not matched to other unexposed entrepreneurs with similar demographic characteristics. Finally, the coefficient now presents the effect on the outcome variable in the smaller window of time where the entrepreneur is most effected, rather than an average treatment effect across the sample of exposed entrepreneurs. In total, the results from this table present evidence of entrepreneurs facing sizable financing shocks stemming from default experiences in the period just prior to firm closure.

## 7 Alternative specifications

There are several dimensions of the data that warrant additional analysis prior to making conclusions regarding the effects of financing disruptions on firm survival. In previous linear specifications I estimated the probability of firm closure at calendar-year  $t$ , while controlling for the year that the entrepreneur started-up the firm. It may be more reasonable to estimate the survival or hazard rate of entrepreneurial-firm  $i$ , conditional on the length of time in years  $\tau$  that the firm has survived. In this case, the Cox proportional hazard model is a reasonable choice as it allows estimation of the baseline hazard without making any assumptions about its shape over time.<sup>30</sup> In addition, the hazard class of models are particularly well suited to handle the right-censored nature of entrepreneurial firm survival.

While the identification strategy remains similar, the econometric model changes to the form,

$$\lambda_i(\tau|exposed_i, \mathbf{X}) = \lambda_{i,0}(\tau) \exp\{\boldsymbol{\alpha}_t + \boldsymbol{\rho}_i + \mathbf{t}_v + \gamma(exposed_i \times t_{\geq 0}) + \beta' \mathbf{X}_{it} + \epsilon_{it}\}$$

where  $\tau$  is the length in years entrepreneur  $i$  has been the owner of the current firm. The coefficient  $\gamma$ , represents a shift in the baseline hazard,  $\lambda_{i,0}(\tau)$ , due to bank default exposure affecting the entrepreneur via a change in personal wealth. As in Equation 2,  $t_v$  measures the years relative to the bank's default, and the interaction term with  $exposed_i$  captures time periods in the post-bank default period. Again,  $\mathbf{X}_{it}$  is a vector of control covariates.<sup>31</sup>

There are two sources of left-censoring that need to be addressed. The first is that I exclude entrepreneurs who began their firm after 1980 and shut down prior to the study period beginning in 2000. This is a trivial exclusion as it occurs by construction. The second is more serious and pertains to entrepreneurs who started their firm prior to 1980 and remain entrepreneurs after 2000 such that they are included in the study period. Because of data limitations if entrepreneurs started their firm before 1980, I will only capture the start year as 1980. To address this source of data censoring I also confirm that the results hold in a subsample limited to entrepreneurs who began their firm after

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<sup>30</sup>In an unreported table, I estimate the model using a Weibull distribution which allows for duration dependence in the shape parameter  $\rho$ , i.e., whether the probability of firm exit is increasing or decreasing as  $\tau$  increases. The results from the Weibull model suggest a slight positive duration dependence, and the hazard rates and standard errors are comparable to the results using a Cox proportional hazard.

<sup>31</sup>As demonstrated by Ai & Norton (2003) the coefficients of interaction terms in non-linear models do not translate directly to difference-in-differences estimates as in linear models. Instead, in non-linear estimations, difference-in-differences should be evaluated using the full underlying model. To account for this, I compute each coefficient as described based on the conditional probability including all covariates held at their mean values as a robustness exercise (unreported) and verify that coefficients and standard errors appear similar.

1980.

I estimate the above empirical model with the sample of matched data on bank investors. The results are presented graphically in Figure 8. The  $y$ -axis states the cumulative hazard of firm closure, while the  $x$ -axis is the time since the firm was established in years. The lines plot the cumulative hazard for various groups in the sample: the solid line is unexposed investors prior to the matched banking default, while the dashed line is exposed investors during that same time period. I note that these cumulative hazard plots are similar in appearance and are not statistically different. The dotted line is unexposed investors at time  $t_{\geq 0}$ , i.e., after the banking default, the long-dashed line is exposed investors during the post-default period. From the figure, it is apparent that exposed entrepreneurs in the post-period have significantly higher rates of firm closure. Indeed, exposed entrepreneurs have a long run rate of survival approximately 10 percentage points lower than that of unexposed entrepreneurs. Over time, the hazard of exposed entrepreneurs is near 50%. These results from the hazard model specification confirm previous findings using a linear probability model.

## 8 Conclusion

Much of the previous literature on financing for small businesses has focused on the initial starting conditions of entrepreneurs, liquidity constraints, and the capital structure of the firm. The previous research on how credit market disruptions affect firms focus on larger firms and shocks to commercial and business lending. In contrast, this paper studies how personal financing disruptions experienced directly by individual entrepreneurs can have large causal effects on the survival rate of their businesses during operations. I use detailed administrative data on individual entrepreneurs matched with data on their banking relationships and personal assets to estimate the effects of changes personal financial wealth on firm performance and survival rates. The wave of banking defaults that occurred throughout the Great Recession in Denmark serves as variation between small business owners and their borrowing ability, as well as changes in personal liquid asset positions.

My results suggest that for established entrepreneurs, shocks to the personal wealth of a small business owner substantially increases the hazard of firm exit, even for wealthy and experienced small business owners. Losses of individual wealth affect intensive margin decisions as well, affected firm owners are more likely to employ fewer individuals after losses in personal wealth. Furthermore, I have documented that these effects are driven by personal financing channels, rather than differences in preferences or changes in risk taking. In total, my results suggest that, particularly in times of economic crisis, personal

wealth and personal borrowing play a key role in entrepreneurial decision making.

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## 9 Tables

Table 1: Summary statistics

	All (1)	Self-emp (2)	Entrepreneurs (3)	Salaried (4)	Differences (3)-(4)
Age	39.29 (22.94)	50.56 (14.81)	40.96 (7.28)	39.70 (13.25)	1.26*** [19.11]
Male	0.50 (0.50)	0.75 (0.43)	0.76 (0.43)	0.52 (0.50)	0.24*** [95.93]
Married	0.40 (0.49)	0.62 (0.49)	0.67 (0.47)	0.51 (0.50)	0.16*** [63.57]
Number of children	0.93 (1.16)	0.61 (1.00)	1.33 (1.18)	0.85 (1.05)	0.48*** [91.01]
College education	0.13 (0.34)	0.14 (0.35)	0.10 (0.30)	0.22 (0.41)	-0.12*** [-56.97]
Total income	254.79 (503.58)	328.56 (2484.10)	574.79 (1428.08)	335.61 (356.38)	239.18*** [118.99]
Liquid wealth	158.44 (401.33)	411.66 (698.94)	308.50 (596.97)	147.43 (341.34)	161.07*** [92.52]
Value of bank deposits	73.56 (158.22)	185.24 (274.95)	173.19 (279.81)	81.19 (152.92)	92.00*** [117.67]
Positive housing assets	0.33 (0.47)	0.67 (0.47)	0.72 (0.45)	0.48 (0.50)	0.24*** [96.59]
Total value of property	495.22 (900.59)	1665.07 (1726.78)	1662.67 (1693.61)	670.85 (904.98)	991.82*** [214.07]
Mortgage value	232.56 (456.80)	618.90 (779.58)	960.47 (881.73)	378.24 (512.85)	582.23*** [222.79]
Mortgage loan to value	0.55 (1.00)	0.48 (0.74)	0.77 (0.72)	0.64 (1.16)	0.13*** [19.10]
Total value of debt	334.44 (575.13)	896.09 (987.82)	1524.49 (1144.22)	521.66 (612.50)	1002.83*** [319.83]
Bank loans	93.18 (199.18)	237.11 (341.02)	509.37 (464.79)	131.96 (211.46)	377.41*** [344.73]
Observations	5,422,699	106,388	40,569	2,242,425	2,282,994

The above table reports summary statistics for all individuals in the sample in the year 2006. Column 1 includes all individuals, Column 2 includes *self-employed* individuals, Column 3 focuses on *entrepreneurs* who employ at least one other individual, and Column 4 focuses on individuals who are in traditional salaried labor employment or temporarily outside of the labor market. The last column states the differences between salaried individuals and entrepreneurs. *Age* is measured in years for each individual in 2006. *Married* indicates if the individual is married in the year 2006. *Number of children* is the total number of children of any age currently living in the same household. *College education* is an indicator variable taking the value of one if an individual has a high school and university education. *Total income* measures the income received by the individual from all sources, while *financial wealth* is the sum of bank deposits, stocks, and bonds at year-end 2006 market values, and *bank deposits* is year-end personal bank savings. *Positive housing assets* indicates if an individual owns real estate (market value greater than 500,000 DKK). *Total value of property* is the sum of current value debt and equity of all housing investments and *Mortgage value* is the year-end value of outstanding mortgage debt. *Mortgage loan to value* is the ratio of outstanding mortgage debt to total housing assets. *Value of debt* is the total outstanding value of debts. *Bank loans* is the value of retail banking loans. All amounts are in thousands at the year-end 2006 and deflated to year-2010 DKK. All variables are presented at the individual level unless otherwise indicated. Standard deviations are in parentheses and t-statistics are reported in brackets. \*\*\*, \*\*, and \* indicate significant at the 1, 5, and 10 percent levels, respectively.

Table 2: Descriptive statistics of entrepreneurs

	All (1)	Bank investors (2)	Unexposed (3)	Exposed (4)	Differences (3)-(4)
Age	40.96 (7.28)	42.71 (7.15)	42.70 (7.17)	42.94 (6.96)	0.24 [0.82]
Male	0.76 (0.43)	0.81 (0.39)	0.81 (0.40)	0.83 (0.37)	0.03 [1.59]
Married	0.67 (0.47)	0.71 (0.46)	0.71 (0.45)	0.67 (0.47)	-0.03* [-1.72]
Number of children	1.33 (1.18)	1.32 (1.18)	1.33 (1.18)	1.24 (1.17)	-0.09* [-1.85]
College education	0.10 (0.30)	0.10 (0.30)	0.10 (0.30)	0.12 (0.33)	0.02 [1.57]
Total income	574.79 (1428.08)	760.43 (2750.38)	733.41 (902.90)	1156.13 (10316.01)	422.72 [0.99]
Liquid wealth	308.50 (596.97)	574.77 (808.88)	573.87 (809.60)	587.99 (798.76)	14.12 [0.41]
Value of bank deposits	173.19 (279.81)	244.11 (333.88)	245.46 (335.26)	224.38 (312.54)	-21.08 [-1.57]
Positive housing assets	0.72 (0.45)	0.84 (0.37)	0.83 (0.37)	0.84 (0.36)	0.01 [0.58]
Total value of property	1662.67 (1693.61)	2412.61 (1904.15)	2407.39 (1904.61)	2489.05 (1897.42)	81.66 [1.00]
Mortgage value	960.47 (881.73)	1245.42 (953.19)	1240.55 (952.93)	1316.77 (955.03)	76.23* [1.86]
Mortgage loan to value	0.77 (0.72)	0.72 (0.75)	0.72 (0.76)	0.71 (0.54)	-0.01 [-0.25]
Total value of debt	1524.49 (1144.22)	1892.55 (1196.58)	1888.15 (1196.52)	1956.98 (1196.57)	68.83 [1.34]
Bank loans	509.37 (464.79)	608.75 (504.40)	607.08 (504.10)	633.29 (508.64)	26.22 [1.20]
Observations	40,569	9,106	8,524	582	9,106

The above table reports summary statistics for all individuals in the sample in the year 2006. Column 1 presents all *entrepreneurs* in the sample, Column 2 focuses on all entrepreneurs who hold a positive amount of retail banking investments in 2006. Column 3 focuses on *unexposed entrepreneurs* who hold investments in retail banks in 2006 which did not default in the following financial crisis. Column 4 is comprised of *exposed entrepreneurs* who hold investments in retail banking institutions in 2006 which goes on to subsequently default in 2008-2012. The last column presents the differences between exposed and unexposed entrepreneurs. *Age* is measured in years for each individual in 2006. *Married* indicates if the individual is married in the year 2006. *Number of children* is the total number of children of any age currently living in the same household. *College education* is an indicator variable taking the value of one if an individual has a high school and university education. *Total income* measures the income received by the individual from all sources, while *financial wealth* is the sum of bank deposits, stocks, and bonds at year-end 2006 market values, and *bank deposits* is year-end personal bank savings. *Positive housing assets* indicates if an individual owns real estate (market value greater than 500,000 DKK). *Total value of property* is the sum of current value debt and equity of all housing investments and *Mortgage value* is the year-end value of outstanding mortgage debt. *Mortgage loan to value* is the ratio of outstanding mortgage debt to total housing assets. *Value of debt* is the total outstanding value of debts. *Bank loans* is the value of retail banking loans. Bank loans and Total debt are winsorized at the 99th percentile. All amounts are in thousands at the year-end 2006 and deflated to year-2010 DKK. All variables are presented at the individual level unless otherwise indicated. Standard deviations are in parentheses and t-statistics are reported in brackets. \*\*\*, \*\*, and \* indicate significant at the 1, 5, and 10 percent levels, respectively.

Table 3: Portfolio characteristics of entrepreneurs

	Unexposed (1)	Exposed (2)	Differences (2)-(1)
Value of stocks	280.80 (852.11)	314.03 (838.04)	33.23 [0.91]
Risk share	0.42 (0.35)	0.48 (0.35)	0.06*** [3.94]
Unique stocks in portfolio	2.34 (2.80)	2.80 (3.16)	0.46*** [3.81]
Beta	0.74 (0.69)	0.67 (0.64)	-0.07* [-1.66]
Sharpe ratio	0.79 (0.30)	0.77 (0.30)	-0.02 [-1.09]
Idiosyncratic risk	7.78 (11.11)	7.45 (9.43)	-0.34 [-0.48]
Observations	8,524	582	9,106

The above table reports portfolio characteristics for entrepreneurs in the sample in the year 2006. Column 1 focuses on *unexposed entrepreneurs* who hold investments in retail banks in 2006 which did not default in the following financial crisis. Column 2 is comprised of *exposed entrepreneurs* who hold investments in retail banking institutions in 2006 which goes on to subsequently default in 2008-2012. The last column presents the differences between exposed and unexposed entrepreneurs. *Value of stock holdings* is the market value of year-end stock holdings outside of pension contributions. *Risk share* is the fraction of liquid assets held in stock investments and *Unique stocks in portfolio* is the number of unique assets in the stock market portfolio including mutual funds. *Beta* is the beta coefficient of the entrepreneur's portfolio from a single factor capital asset pricing model (CAPM) using monthly returns from 10 years of data (1997-2006) and the MSCI World All-Market index as a benchmark. The *Sharpe ratio* is the portfolio's return relative to its standard deviation. The *idiosyncratic risk* of the portfolio is the measured risk of the portfolio aside from the market component. Standard deviations are in parentheses and t-statistics are reported in brackets. \*\*\*, \*\*, and \* indicate significant at the 1, 5, and 10 percent levels, respectively.

Table 4: The effect of personal financing disruptions on entrepreneurship

	Any exit		Firm closure	
	(1)	(2)	(3)	(4)
Exposed investor (any loss)	0.008 (0.006)		0.010** (0.004)	
Exposed investor (above median)		0.023* (0.013)		0.021*** (0.006)
Control variables	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes
$R^2$	0.24	0.24	0.23	0.23
Observations	98,950	98,950	76,610	76,610

The above table analyzes the effect of a change in personal financial wealth on the propensity to exit entrepreneurship stemming from Equation (1). Each column of the table represents the various reasons for the exit from the firm. Columns 1 and 2, first analyze the probability that the entrepreneur exits from the firm for any reason. Columns 3 and 4 then specifies that the firm was closed down by the owner. I consider two measures of losses. The first, *exposed investor*, indicates whether the entrepreneur held stock investments in a default bank and incurred *any* financial losses. The second definition indicates if the investor lost *above median* losses. The variables take the value of one if year  $t$  is after the bank default year and zero if otherwise. In all columns the specifications include individual-entrepreneur fixed effects and the following time-varying demographic controls: *log wealth*, *log income*, *number of employees*, *average wages*, and if the entrepreneur has a *child* or purchases a *house* at time  $t$ . Regression coefficients are estimated with OLS. \*\*\*, \*\*, and \* indicate significant at the 1, 5, and 10 percent levels, respectively. Robust standard errors clustered at the pre-crisis primary bank level are in parenthesis.

Table 5: The effect of personal financing disruptions on entrepreneurship

	Any exit (1)	Firm closure (2)	Merger (3)	Downsize (4)
Exposed investor	0.023* (0.013)	0.021*** (0.006)	-0.003*** (0.001)	0.007 (0.012)
Control variables	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes
$R^2$	0.24	0.23	0.27	0.22
Observations	98,950	76,610	69,113	87,065

The above table analyzes the effect of a change in personal financial wealth on the propensity to exit entrepreneurship stemming from Equation (1). Each column of the table represents the various reasons for the exit from the firm. Column 1 includes any observed departure from the entrepreneurship from the previous period. Column 2 specifies that the firm was closed down by the owner. Column 3 specifies that the firm was closed due to the result of a merger. Column 4 specifies that the firm remained open, however was downsized to a single owner-employee. Finally Column 5 specifies that the entrepreneur closed down the firm and moved to an established firm as an employee. The variable *exposed investor* indicates whether the entrepreneur held stock investments in a default bank and incurred *above median* financial losses. The variable takes the value of one if year  $t$  is after the bank default year and zero if otherwise. In all columns the specifications include individual-entrepreneur fixed effects and the following time-varying demographic controls: *log wealth*, *log income*, *number of employees*, *average wages*, and if the entrepreneur has a *child* or purchases a *house* at time  $t$ . Regression coefficients are estimated with OLS. \*\*\*, \*\*, and \* indicate significant at the 1, 5, and 10 percent levels, respectively. Robust standard errors clustered at the pre-crisis primary bank level are in parenthesis.



Table 6: The effect of personal financing disruptions on employment decisions

	Total (1)	Full-time (2)	Part-time (3)	FTEs (4)	Log. wages (5)
Exposed investor	-0.598*** (0.180)	-0.531*** (0.195)	-0.068 (0.060)	-0.341* (0.189)	-0.008 (0.021)
Control variables	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes	Yes
$R^2$	0.82	0.82	0.62	0.84	0.72
Observations	73,794	73,794	73,794	73,794	73,794

The above table analyzes the effect of a change in personal financial wealth on employment decisions of the entrepreneur's firm. Conditional on a firm owner remaining in business, the table analyzes various outcomes for full and part-time employees. Column 1 specifies the total number of employees measured in November of each year. Columns 2 and 3 decompose this value into full-time and part-time employees. In Column 4 I use an alternative measure from tax data on the number of employed full-time equivalents. Column 5 measures the average log. of wages for all employees. The variable *exposed investor* indicates whether the entrepreneur held stock investments in a default bank and incurred *above median* financial losses. The variable takes the value of one if year  $t$  is after the bank default year and zero if otherwise. In all columns the specifications include individual-entrepreneur fixed effects and the following time-varying demographic controls: *log wealth*, *log income*, and if the entrepreneur has a *child* or purchases a *house* at time  $t$ . Regression coefficients are estimated with OLS. \*\*\*, \*\*, and \* indicate significant at the 1, 5, and 10 percent levels, respectively. Robust standard errors clustered at the pre-crisis primary bank level are in parenthesis.

Table 7: Personal financing disruptions and heterogeneity in wealth and debt

	Net wealth		
	Low (1)	Med (2)	High (3)
Exposed investor	0.026* (0.013)	0.016* (0.008)	0.012 (0.008)
Control variables	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes
$R^2$	0.06	0.06	0.07
Observations	28,240	28,038	27,418

	Debt to assets		
	Low (1)	Med (2)	High (3)
Exposed investor	0.006 (0.006)	0.028*** (0.010)	0.017 (0.011)
Control variables	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes
$R^2$	0.06	0.06	0.07
Observations	29,202	27,964	28,165

The above table analyzes the effect of a change in personal financial wealth on the propensity to exit entrepreneurship stemming from Equation (1). All columns specify that the firm was closed down by the owner. The variable *exposed investor* indicates whether the entrepreneur held stock investments in a default bank and incurred *above median* financial losses. The variable takes the value of one if year  $t$  is after the bank default year and zero if otherwise. The sample is divided into terciles such that Column 1 (2) (3) includes the bottom (middle) (top) third of the distribution. Panel A specifies this for *net wealth* while Panel B specifies this for *debt to assets ratio*. All specifications include individual-entrepreneur fixed effects and the following time-varying demographic controls: *log wealth*, *log income*, *number of employees*, *average wages*, and if the entrepreneur has a *child* or purchases a *house* at time  $t$ . Regression coefficients are estimated with OLS. \*\*\*, \*\*, and \* indicate significant at the 1, 5, and 10 percent levels, respectively. Robust standard errors clustered at the pre-crisis primary bank level are in parenthesis.

Table 8: Understanding the mechanism between disruptions and firm closure

	Financial wealth (1)	Net wealth (2)	Income (3)	Risk share (4)	Debt (5)	Bank loans (6)
Exposed investor	-0.254*** (0.084)	0.093 (0.116)	-0.009 (0.048)	0.008 (0.014)	-95.885 (243.335)	-20.313 (73.284)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
$R^2$	0.62	0.68	0.36	0.48	0.83	0.69
Observations	128,072	128,072	128,072	106,317	128,072	128,072

The above table analyzes the effect of a change in personal financial wealth on various financial outcomes of the entrepreneur stemming from Equation (1). Column 1 investigates the change in the logarithm of financial wealth, Column 2 is the change in the logarithm of net wealth, while Column 3 is the change in the logarithm of total income. Column 4 investigates the change in the share of wealth in risky assets, conditional on holding risky investments. Column 5 focuses on total debt while Column 6 focuses on personal retail banking loans. The variable *exposed investor* indicates whether the entrepreneur held stock investments in a default bank and incurred *above median* financial losses. The variable takes the value of one if year  $t$  is after the bank default year and zero if otherwise. In all columns the specifications include individual-entrepreneur fixed effects and the following time-varying demographic controls: *log wealth*, *log income*, *number of employees*, *average wages*, and if the entrepreneur has a *child* or purchases a *house* at time  $t$ . Regression coefficients are estimated with OLS. \*\*\*, \*\*, and \* indicate significant at the 1, 5, and 10 percent levels, respectively. Robust standard errors clustered at the pre-crisis primary bank level are in parenthesis.

Table 9: Evidence from deposit and merger experiences

	Depositor experiences			Merger experiences		
	Any exit (1)	Firm closure (2)	Pers. loans (3)	Any exit (4)	Firm closure (5)	Pers. loans (6)
Exposed depositor	0.028*** (0.008)	0.020*** (0.005)	-0.085*** (0.032)	0.016* (0.009)	0.012** (0.006)	-0.080* (0.042)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
$R^2$	0.20	0.20	0.63	0.21	0.22	0.62
Observations	424,635	312,332	272,358	29,383	20,498	18,028

The above table analyzes the effect of personal financial disruptions for deposit customers on firm survival and personal borrowing. The dependent variable in Columns 1 and 4 is firm exit for any reason. In Columns 2 and 5 the dependent variable is firm closure. Finally, in Columns 3 and 6 the dependent variable is the log. of personal borrowing. The sample in Columns 1-3 are deposit customers of retail banks. In Columns 4-6 the sample consists of deposit customers matched to entrepreneurs whose retail bank merges or is acquired by another bank following the financial crisis. The variable *exposed depositor* indicates whether the entrepreneur had a retail bank which defaulted following the financial crisis. The variable takes the value of one if year  $t$  is after the bank default year and zero if otherwise. In all columns the specifications include individual-entrepreneur fixed effects and the following time-varying demographic controls: *log wealth*, *log income*, *number of employees*, *average wages*, and if the entrepreneur has a *child* or purchases a *house* at time  $t$ . Regression coefficients are estimated with OLS. \*\*\*, \*\*, and \* indicate significant at the 1, 5, and 10 percent levels, respectively. Robust standard errors clustered at the pre-crisis primary bank level are in parenthesis.

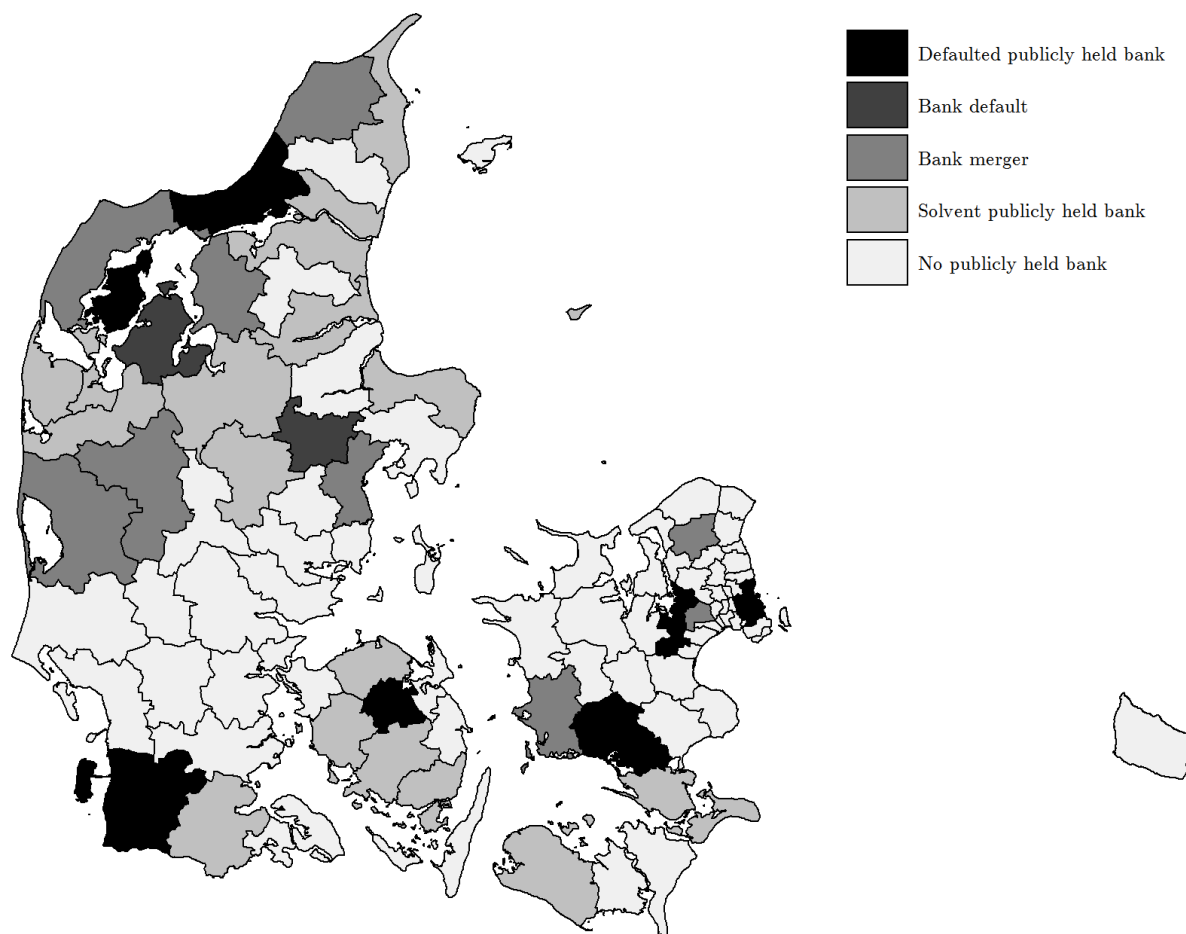
Table 10: Financing channels around default and firm closure

	Investors Log. fin. wealth (1)	Depositors Log. personal loans (2) (3)	
Event window	-0.571*** (0.186)	-0.136** (0.068)	-0.336*** (0.093)
Control variables	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes
$R^2$	0.62	0.66	0.67
Observations	10,150	61,227	5,504

The above table analyzes the effect of retail bank default on investment losses and personal borrowing prior to firm closure. In Column 1 the sample consists of bank investor entrepreneurs while Column 2 focuses on bank depositor entrepreneurs. Column 3 matches deposit entrepreneurs to small business owners whose bank was involved in a merger or acquisition. The dependent variable in Column 1 is the log. of financial wealth, while in Columns 2 and 3 it is the log. of personal borrowing. The variable of interest,  $Event\ window_{j \geq 0 \& t \leq 0}$ , measures the time period for each exposed investor (depositor) after experiencing an investment (bank) default in years,  $j$ , and the time period before the investor's (depositor's) firm closes. The variable therefore provides the difference in the outcome variable relative to the pre-default, pre-firm closure window. All specifications include individual-entrepreneur fixed effects and the following time-varying demographic controls: *log wealth*, *log income*, *number of employees*, *average wages*, and if the entrepreneur has a *child* or purchases a *house* at time  $t$ . Regression coefficients are estimated with OLS. \*\*\*, \*\*, and \* indicate significant at the 1, 5, and 10 percent levels, respectively. Robust standard errors clustered at the pre-crisis primary bank level are in parenthesis.

## 10 Figures

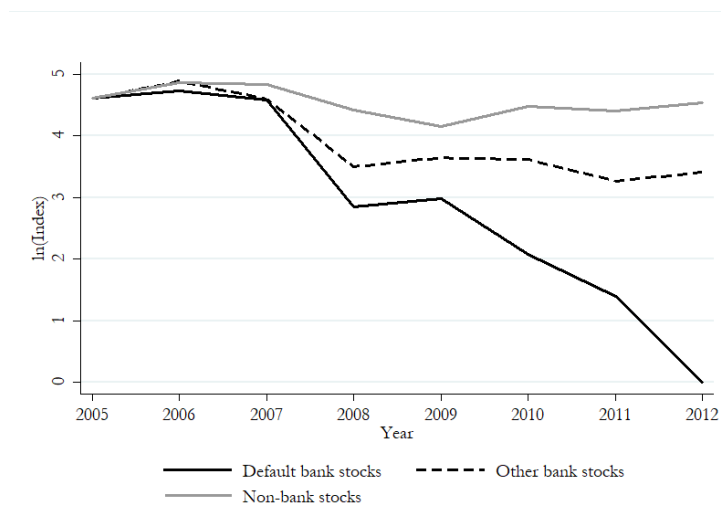
Figure 1: Locations of local banks and incidence of bank defaults in Denmark



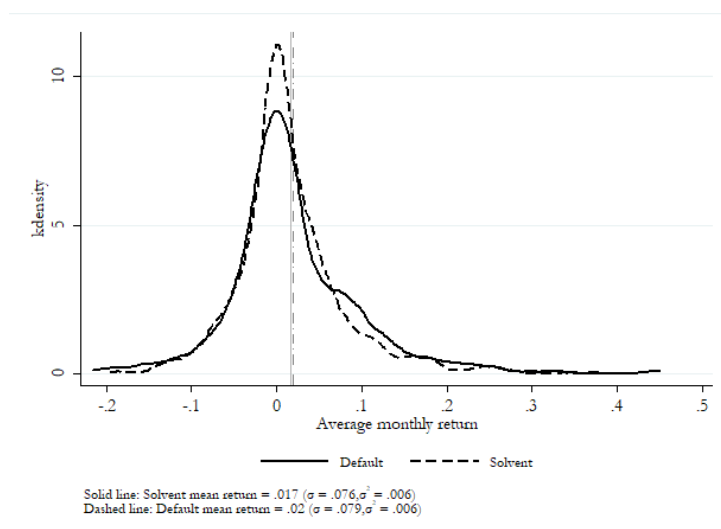
This map shows the location of publicly trading retail banks and incidences of bank defaults across municipalities in Denmark from 2006 to 2013 based on bank headquarters. Municipalities with a surviving publicly listed bank are displayed in light gray. Municipalities in which a troubled bank was involved in a merger or acquisition after the financial crisis are shown in darker gray. Municipalities in which a publicly traded retail bank defaulted between 2008 and 2012 are displayed in black. Finally, municipalities without a publicly listed retail bank are shown in the lightest shade of gray.

Figure 2: Investment returns

Panel A:



Panel B:

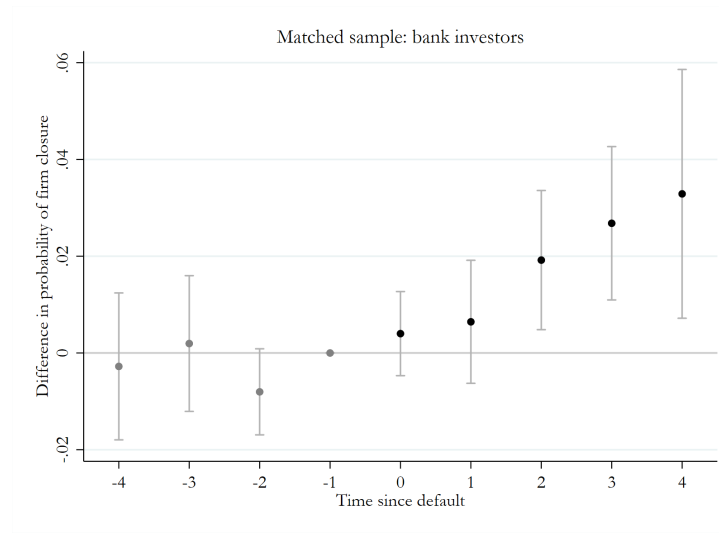


The figure in Panel A plots an index of market returns for investors in the sample using micro-data on year-end portfolio holdings at the individual asset level. The solid dark line plots an index of returns for retail bank stocks which go on to default throughout the financial crisis. The dashed line plots the index for bank stocks which remain solvent and do not default during the crisis, the solid gray line plots a portfolio of all other stocks. The portfolio is indexed to year 2006. In Panel B, the figure plots the distribution of monthly returns for Danish retail bank stocks between January 1<sup>st</sup>, 2005 and December 1<sup>st</sup>, 2007. The dashed line plots the the distribution for monthly returns for a market capitalization-weighted portfolio of retail bank stocks which remain solvent following the financial crisis while the solid line plots a portfolio of retail bank stocks which default between 2008-2012. The vertical lines provide the mean return for each distribution. A Kolmogorov-Smirnov test confirms that the two distributions do not statistically differ

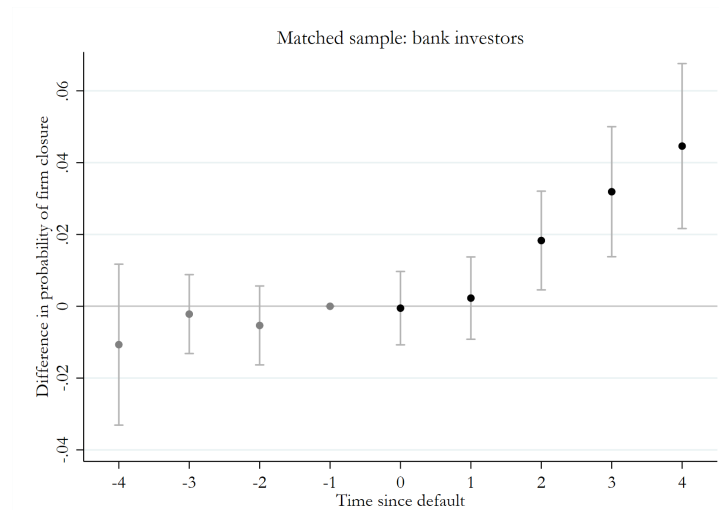


Figure 3: Probability of firm closure around personal financing disruptions

Panel A:

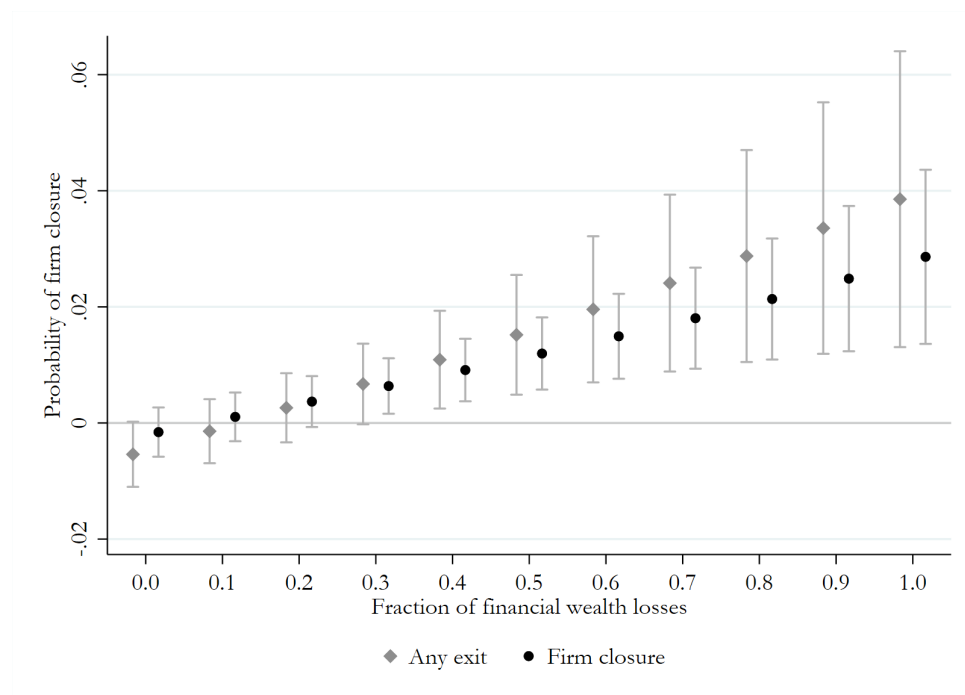


Panel B:



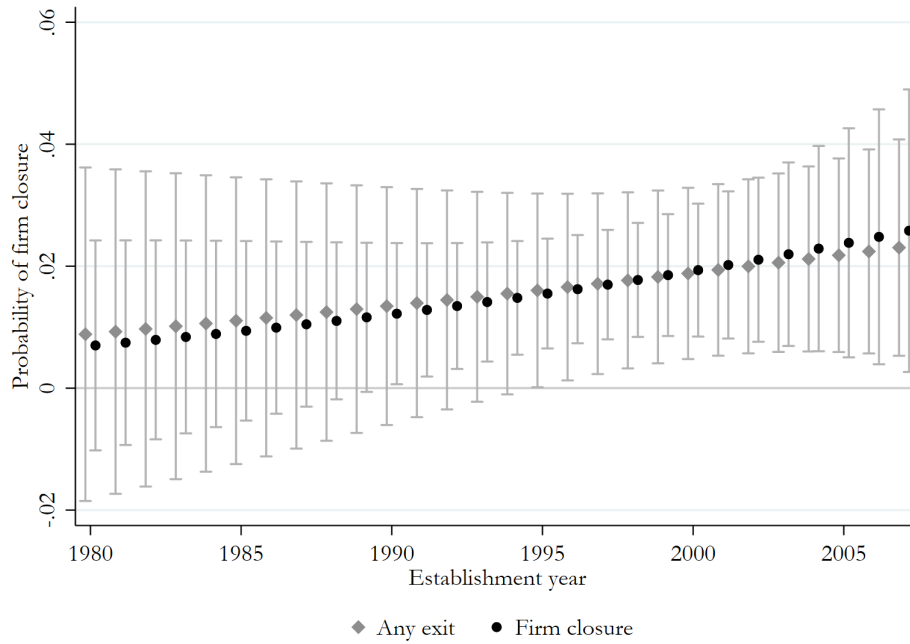
The above figures present event study plots of the effect of personal financing disruptions on firm closure using a matched sample. Up to 5 nearest-neighbor unexposed investors in year  $t_{-1}$  from the bank default are matched to each exposed investor. The matching is based on five-year age cohorts, twenty-vintiles of net wealth, five-percentage point bins of the share of wealth in risky assets, the number of bank assets, gender, marital status, and municipality of residence. Panel B includes all of these matching characteristics, while Panel A omits the risky asset share and the number of bank assets. The model is specified in Equation (2). The scatter points display coefficient of the interaction term between *exposed investor* entrepreneurs and year from bank default-indicators, therefore providing differences-in-differences estimates. The  $y$ -axis states the difference in probability of firm closure in percentage points. The  $x$ -axis is the time since default in years. 90% Confidence intervals are shown.

Figure 4: Heterogeneity in financial wealth losses



The above figure plots Equation 3. The  $y$ -axis states the probability of various types of firm closure in percentage points and the  $x$ -axis plots the fraction of liquid wealth lost from an investment in a default bank for *exposed* entrepreneurs after the banking defaults. *Any exit* from entrepreneurship is shown in diamonds, *firm closure* (dots), and *exit to the labor market* (square). 90% confidence intervals are shown.

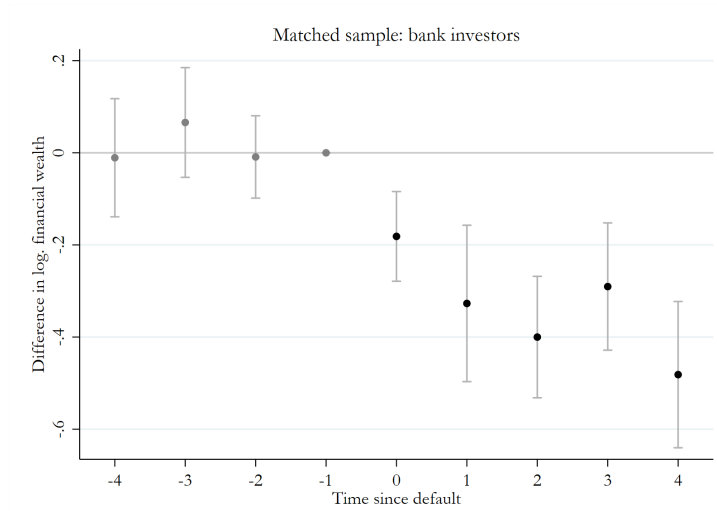
Figure 5: Heterogeneity in experience



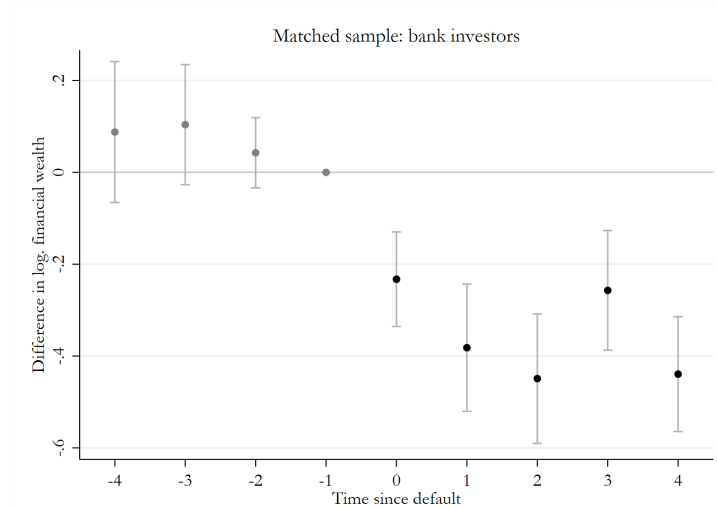
The above figures plots Equation 3. The  $y$ -axis states the probability of various types of firm closure in percentage points and the  $x$ -axis plots the year of firm establishment. *Any exit* from entrepreneurship is shown in diamonds, *firm closure* (dots), and *exit to the labor market* (square). 90% confidence intervals are shown.

Figure 6: Personal financial losses

Panel A:



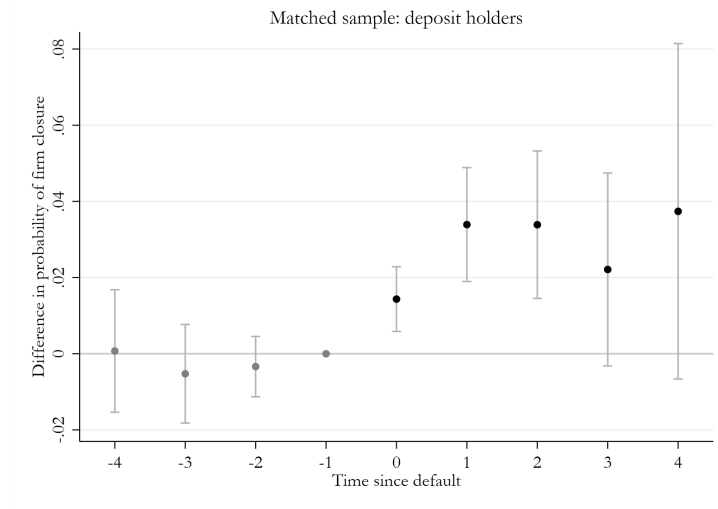
Panel B:



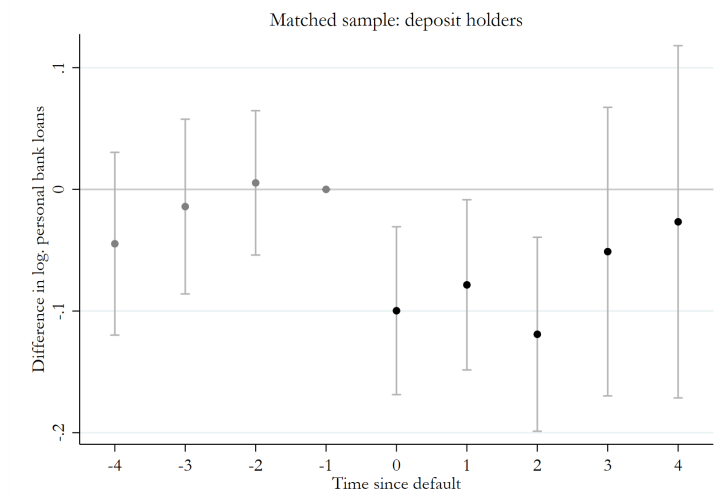
The above figures present event study plots of the effect of personal financing disruptions on log. financial wealth using a matched sample. Up to 5 nearest-neighbor unexposed investors in year  $t_{-1}$  from the bank default are matched to each exposed investor. The matching is based on five-year age cohorts, twenty-vigintiles of net wealth, five-percentage point bins of the share of wealth in risky assets, the number of bank assets, gender, marital status, and municipality of residence. The model is specified in Equation (2). Panel B includes additional matching on the share of risky wealth. The scatter points display coefficient of the interaction term between *exposed investor* entrepreneurs and year from bank default-indicators, therefore providing differences-in-differences estimates. The *y*-axis states the difference in the log. of financial wealth The *x*-axis is the time since default in years. 90% Confidence intervals are shown.

Figure 7: Probability of firm closure around financing disruptions for deposit holders and personal borrowing

Panel A:

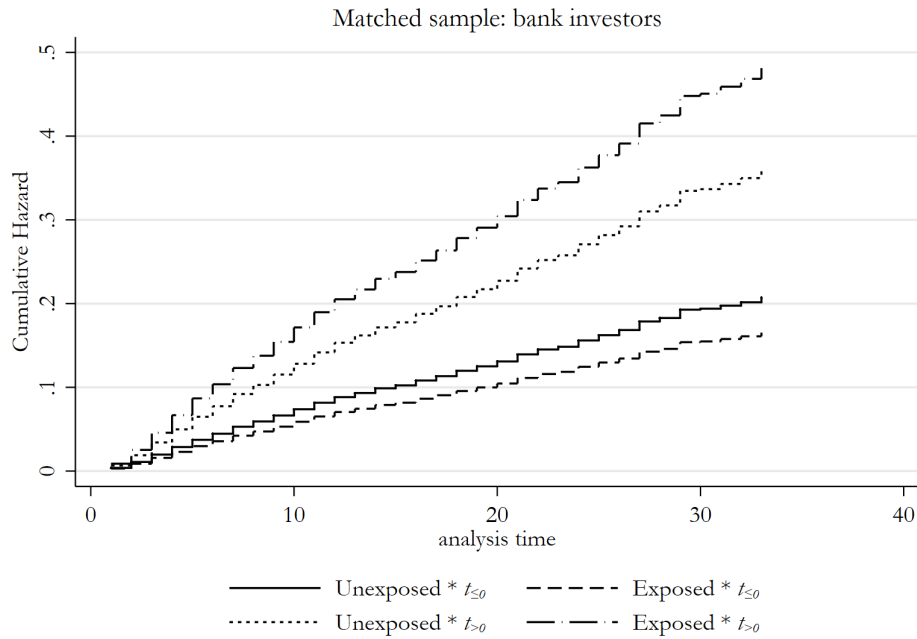


Panel B:



The above figures present event study plots of the effect of personal financing disruptions on firm closure and personal borrowing for deposit customer entrepreneurs using a matched sample. Up to 5 nearest-neighbor unexposed depositors in year  $t_{-1}$  from the bank default are matched to each exposed depositor. The matching is based on five-year age cohorts, twenty-vigintiles of net wealth, five-percentage point bins of the share of wealth in risky assets, gender, marital status, and municipality of residence. The model is specified in Equation (2). The scatter points display coefficient of the interaction term between *exposed depositor* entrepreneurs and year from bank default-indicators, therefore providing differences-in-differences estimates. The  $y$ -axis states the difference in probability of firm closure in percentage points, in Panel B it is the difference in log. personal borrowing. The  $x$ -axis is the time since default in years. 90% Confidence intervals are shown.

Figure 8: Hazard model specification



The figure above presents the effect of personal financing disruptions on firm closure using a matched sample and Cox proportional hazard model. Up to 5 nearest-neighbor depositors exposed to their own retail bank merging with another retail bank are matched to each exposed depositor in year  $t_{-1}$  from the bank default. The matching is based on five-year age cohorts, twenty-vigintiles of net wealth, five-percentage point bins of the share of wealth in risky assets, gender, marital status, and municipality of residence. The dependent variable is firm closure. The model is specified in Equation (4). The  $y$ -axis states the cumulative hazard of firm closure. The  $x$ -axis is the time since the firm was established in years. The lines plot the cumulative hazard for various groups in the sample: The solid line is unexposed investors prior to the matched banking default, while the dashed line is exposed investors during that same time period. The dotted line is unexposed investors at time  $t_{\geq 0}$ , i.e., after the banking default, the long-dashed line is exposed investors during the post-default period.

## A Appendix tables and figures

Table A.1: Retail bank defaults and mergers throughout the financial crisis

Year	Troubled bank	Outcome	Publicly held	Municipality	Surviving bank
2008	BankTrelleborg	Merged	No	Slagelse	Sydbank
2008	Roskilde	Defaulted	Yes	Roskilde	NA
2008	Bonusbanken	Merged	No	Herning	Vestjysk Bank
2008	Sparekassen Spar Mors	Merged	No	Morso	Morso Bank
2008	EBH Bank	Defaulted	Yes	Jammerbugt	NA
2008	Localbanken I Nordsaelland	Merged	No	Hillerød	Handelsbanken
2008	Forstaedernes Bank	Merged	No	Taastrup	Nykredit
2008	Ringkjobing Bank	Merged	No	Skjern	Vestjysk Bank
2009	Lokken Sparekasse	Defaulted	No	Hjørring	NA
2009	Gudme Raachou	Defaulted	No	Kobenhavn	NA
2009	Fionia Bank	Defaulted	Yes	Odensee	NA
2010	Capinordic	Defaulted	Yes	Gentofte	NA
2010	Finansbank	Merged	No	NA	Sparekassen Lolland
2010	EIK Banki	Defaulted	No	Farroe Islands	NA
2010	Skaelsor Bank	Merged	No	Slagelse	Max Bank
2011	Amagaerbanken	Defaulted	Yes	Kobenhavn S	NA
2011	Sparekassen Midtfjord	Merged	No	Vesthimmerland	Sparekassen Himmerland
2011	Fjordbank Mors	Defaulted	Yes	Morso	NA
2011	Max Bank	Defaulted	Yes	Naestved	NA
2011	Sparekassen Limfjorden	Merged	No	Thisted	Sparekassen Vendsyssel
2012	Sparekassen Farso	Merged	No	Vesthimmerland	Den Jyske Sparekassen
2012	Sparekassen Ostjylland	Defaulted	No	Favrskov	NA
2012	Aarhus Lokalbank	Merged	No	Aarhus	Vestjysk Bank
2012	Spar Salling Sparekasse	Defaulted	No	Skive	NA
2012	Tonder Bank	Defaulted	Yes	Tonder	NA

The following table outlines the Danish retail banks that faced liquidity challenges after the onset of the 2007-2009 financial crisis. Each of the following troubled banks either defaulted and were taken over by the state-owned *Finansiel Stabilitet*, or found a private solution (e.g. merger or acquisition). If the bank merged or was acquired the table states the overtaking or surviving retail bank. The municipality and whether the bank was publicly held by investors is also indicated below. Data comes [Buchholst & Rangvid \(2013\)](#) as well as the author's own research

Table A.2: Entrepreneurship and small business owners

Panel A: Number of entrepreneurs

	2005	2006	2007	2008	2009	2010	2011	2012	2013
<i>All individuals</i>	5,404,682	5,422,699	5,446,252	5,474,794	5,510,590	5,533,426	5,557,049	5,577,357	5,600,339
<i>Entrepreneurs</i>	42,372	40,569	38,603	35,720	33,102	30,833	28,699	26,738	24,817
<i>Entrepreneur bank investors</i>	9,501	9,106	8,700	8,136	7,651	7,231	6,850	6,447	6,082

Panel B: Number of employees

	2005	2006	2007	2008	2009	2010	2011	2012	2013
<i>Mean</i>	4.8	5.0	5.2	5.1	5.0	5.1	5.3	5.4	5.6
<i>p10</i>	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
<i>p50</i>	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
<i>p90</i>	10.0	11.0	11.0	11.0	10.8	11.0	11.0	11.0	12.0

Panel A presents the rates of entrepreneurship across the years in the sample. Panel B provides statistics on the number of employees employed by entrepreneurs across the years in the sample. Percentiles are composed of the 5 closest observations due to regulations about data security.



Table A.3: Investments and losses from banking defaults

Size of liquidity shock	Exposed				Unexposed			
	Mean	p25	p50	p75	Mean	p25	p50	p75
<i>Losses (1,000 DKK)</i>	-133.25	-73.17	-23.79	-10.24	-41.57	-36.13	-13.99	-5.18
<i>Percentage of savings (%)</i>	-26.20	-40.43	-10.18	-2.69	-16.24	-17.10	-4.70	-1.18
<i>Percentage of liquid wealth (%)</i>	-18.45	-25.47	-7.68	-2.19	-10.41	-11.80	-3.68	-0.97
<i>Percentage of net wealth (%)</i>	-27.28	-37.92	-4.73	-0.97	-20.64	-14.17	-1.91	-0.41

The following table provides a tabulation of the distribution of losses for *exposed* and *unexposed* bank investors. All investors included held investments in publicly traded retail banks. *exposed* investors held stocks of retail banks which defaulted, while *unexposed* investors held stocks which remained solvent. I present the mean, 25th, 50th, and 75th percentiles of total losses, losses as a percentage of savings in 2006, as a percentage of liquid wealth in 2006, and as a percentage of net wealth. Columns 1-4 compare the values of exposed investors to columns 5-8 of unexposed investors. Percentiles are composed of the 5 closest observations due to regulations about data security.

Table A.4: Bank characteristics

Panel A: Bank type

	Bank type		
	Large bank (1)	Local bank (2)	Default bank (3)
<i>Average number of depositors</i>	549,262	8,989	15,661
<i>Share of entrepreneurs (%)</i>	1.52	1.96	2.18
<i>Share of self-employed (%)</i>	2.46	2.97	3.14
<i>Average deposit balance</i>	108.18	105.57	117.23
<i>Average loan balance</i>	150.11	137.03	167.7.
<i>Market share of depositors (%)</i>	70.08	25.92	4.00
Observations	5	108	12

Panel B: FS grouping

	Bank type			
	FS Group 1 (1)	FS Group 2 (2)	FS Group 3 (3)	FS Group >3 (4)
<i>Average number of depositors</i>	653,226	58,318	9,540	2,112
<i>Share of entrepreneurs (%)</i>	1.50	1.66	2.10	1.75
<i>Share of self-employed (%)</i>	2.53	2.63	2.88	3.27
<i>Average deposit balance</i>	109.83	111.06	106.68	104.99
<i>Average loan balance</i>	151.12	144.99	149.53	116.26
<i>Market share of depositors (%)</i>	66.68	11.91	19.48	1.94
<i>Number of default banks</i>	0	3	9	0
Observations	4	11	80	36

The following table provides bank-level information about deposit customers by different segments of retail banks in Denmark. The columns of Panel A divide all retail banks in the sample by the large, local, and default designation. In Panel B banks are distinguished by the size classification introduced by the National Bank of Denmark and *Finansiel Stabilitet*. Group 1 (Column 1) includes banks which hold over 50 billion Danish krone in assets (Column 1), Group 2 (Column 2) includes banks which hold between 10 and 50 billion Danish krone in assets, Group 3 (Column 3) includes banks which hold between 250 million and 49 billion Danish krone in assets, and Column 4 includes all Danish banks with assets less than 250 million Danish krone. The rows contain information on the *average number of depositors*, the *share of entrepreneurs* and *self-employed* individuals in each bank. The *average deposit balance* and *average loan balance* (all sources of personal bank debt, excluding mortgages) in 1000 DKK of depositors per bank, as well as the *market share of depositors* captured by the classification type of the bank. In Panel B the *number of default banks* simply tallies up the number of banks that defaulted by group classification.

Table A.5: Exposed entrepreneurs: Event study

	Bank investors		Bank depositor	
	Firm closure	Fin. wealth	Firm closure	Pers. loans
	(1)	(2)	(3)	(4)
$t_{-8} \times exposure_i$	0.000 (0.022)	-0.005 (0.142)	-0.017 (0.016)	0.101 (0.078)
$t_{-7} \times exposure_i$	0.001 (0.022)	-0.035 (0.097)	-0.007 (0.012)	0.047 (0.060)
$t_{-6} \times exposure_i$	0.003 (0.017)	-0.080 (0.072)	-0.005 (0.014)	-0.010 (0.058)
$t_{-5} \times exposure_i$	-0.004 (0.016)	0.031 (0.087)	0.007 (0.015)	-0.008 (0.061)
$t_{-4} \times exposure_i$	-0.011 (0.013)	0.088 (0.092)	0.006 (0.010)	-0.016 (0.055)
$t_{-3} \times exposure_i$	-0.002 (0.007)	0.104 (0.079)	-0.007 (0.007)	0.014 (0.047)
$t_{-2} \times exposure_i$	-0.005 (0.007)	0.043 (0.046)	0.001 (0.004)	0.031 (0.049)
$t_{-1} \times exposure_i$	-	-	-	-
$t_0 \times exposure_i$	-0.001 (0.006)	-0.233*** (0.062)	0.007 (0.006)	-0.100** (0.042)
$t_1 \times exposure_i$	0.002 (0.007)	-0.382*** (0.083)	0.024*** (0.009)	-0.078* (0.042)
$t_2 \times exposure_i$	0.018*** (0.008)	-0.449*** (0.085)	0.023** (0.009)	-0.119** (0.048)
$t_3 \times exposure_i$	0.032*** (0.011)	-0.257*** (0.078)	0.017 (0.014)	-0.051 (0.068)
$t_4 \times exposure_i$	0.045*** (0.014)	-0.439*** (0.075)	0.025 (0.023)	-0.027 (0.091)
$t_5 \times exposure_i$	0.030** (0.014)	-0.142 (0.103)	0.028 (0.024)	-0.039 (0.114)
Control variables	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes
Calendar-year fixed effects	Yes	Yes	Yes	Yes
Time since default fixed effects	Yes	Yes	Yes	Yes
$R^2$	0.72	0.60	0.72	0.59
Observations	31,663	49,098	39,539	54,280

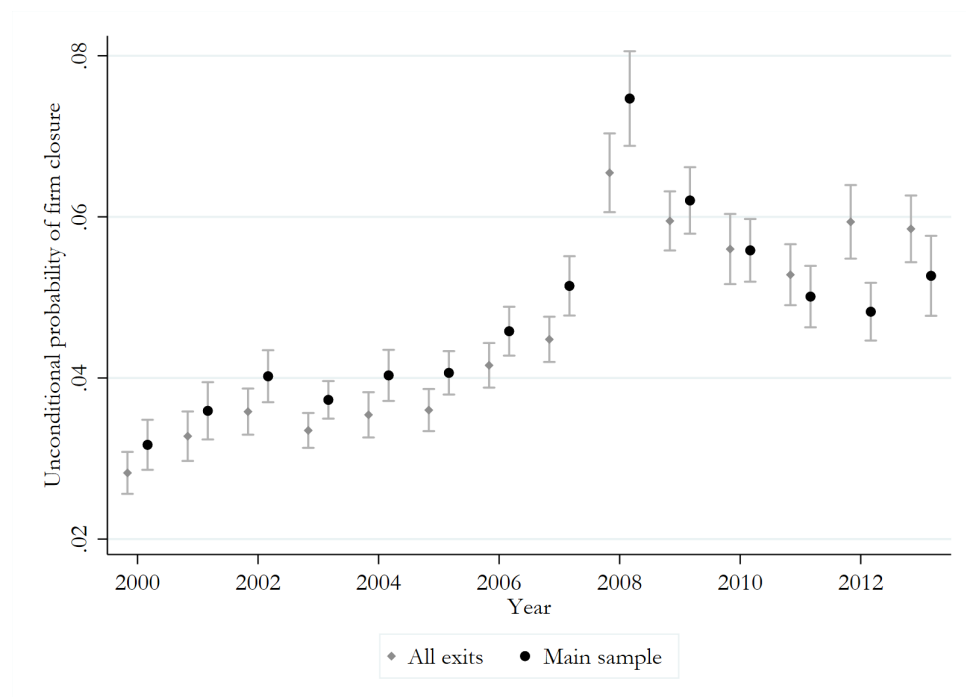
The above table presents event study regressions of the effect of personal financing disruptions on firm closure and financial wealth using matched samples. Columns 1 and 2 include bank investors while Columns 3 and 4 focus on bank deposit holders. Up to 5 nearest-neighbor unexposed investors (depositors) in year  $t_{-1}$  from the bank default are matched to each exposed investor (depositor). The matching is based on five-year age cohorts, twenty-vintiles of net wealth, five-percentage point bins of the share of wealth in risky assets, gender, marital status, and municipality of residence. The dependent variable in Columns 1 and 3 is firm closure while in Columns 2 and 4 it is log. financial wealth and log. personal borrowing. The model is specified in Equation (2). The variables of interest,  $t_t \times exposure_i$ , are interaction terms of time since default year-dummies and an indicator for exposure (investment or deposits) in a bank which goes on to default. All specifications include individual-entrepreneur fixed effects and the following time-varying demographic controls: *log wealth*, *log income*, and if the entrepreneur has a *child* or purchases a *house* at time  $t$ . The specifications also include time since default-year effects, and calendar-year fixed effects. Regression coefficients are estimated with OLS. \*\*\*, \*\*, and \* indicate significant at the 1, 5, and 10 percent levels, respectively. Robust standard errors clustered at the pre-crisis primary bank level are in parenthesis.

Table A.6: Descriptive statistics of bank depositors

	All (1)	Unexposed (2)	Exposed (3)	Differences (2)-(3)
Age	40.46 (7.23)	40.47 (7.24)	40.19 (7.17)	-0.28 [-1.34]
Male	0.75 (0.43)	0.75 (0.43)	0.76 (0.43)	0.01 [1.04]
Married	0.66 (0.47)	0.66 (0.47)	0.67 (0.47)	0.01 [0.63]
Number of children	1.33 (1.18)	1.34 (1.19)	1.33 (1.16)	-0.01 [-0.29]
College education	0.10 (0.30)	0.10 (0.30)	0.11 (0.31)	0.01 [0.82]
Total income	521.06 (653.84)	522.21 (658.19)	493.61 (539.93)	-28.60 [-1.53]
Liquid wealth	231.43 (493.67)	231.77 (493.79)	223.56 (490.96)	-8.21 [-0.58]
Value of bank deposits	152.67 (258.49)	153.08 (258.54)	142.86 (257.19)	-10.22 [-1.38]
Positive housing assets	0.68 (0.46)	0.68 (0.47)	0.71 (0.45)	0.03* [1.94]
Total value of property	1445.62 (1561.83)	1441.94 (1561.39)	1533.10 (1570.37)	91.17** [2.04]
Mortgage value	878.00 (842.15)	874.31 (841.50)	965.68 (852.98)	91.38*** [3.79]
Mortgage loan to value	0.78 (0.71)	0.78 (0.72)	0.80 (0.53)	0.01 [0.60]
Total value of debt	1417.96 (1106.00)	1413.70 (1106.11)	1519.10 (1099.05)	105.40*** [3.33]
Bank loans	480.61 (448.60)	479.82 (448.56)	499.32 (449.36)	19.50 [1.52]
Observations	31,463	30,190	1,273	31,463

The above table reports summary statistics for deposit customer entrepreneurs not included in the bank investor sample in the year 2006. Column 1 presents all bank depositor *entrepreneurs* in the sample, Column 2 focuses on *unexposed entrepreneurs* who have a retail banking institution in 2006 which did not default in the following financial crisis. Column 3 is comprised of *exposed entrepreneurs* who have a retail banking institution in 2006 which goes on to subsequently default in 2008-2012. The last column presents the differences between exposed and unexposed entrepreneurs. *Age* is measured in years for each individual in 2006. *Married* indicates if the individual is married in the year 2006. *Number of children* is the total number of children of any age currently living in the same household. *University education* is an indicator variable taking the value of one if an individual has a high school and university education. *Total income* measures the income received by the individual from all sources, while *liquid wealth* is the sum of bank deposits, stocks, and bonds at year-end 2006 market values, and *bank deposits* is year-end personal bank savings. *Positive housing assets* indicates if an individual owns real estate (market value greater than 500,000 DKK). *Total value of property* is the sum of current value debt and equity of all housing investments and *Mortgage value* is the year-end value of outstanding mortgage debt. *Mortgage LTV* is the ratio of outstanding mortgage debt to total housing assets. *Value of debt* is the total outstanding value of debts. *Bank loans* is the value of retail banking loans. All amounts are in thousands at the year-end 2006 and deflated to year-2010 DKK. All variables are presented at the individual level unless otherwise indicated. Standard deviations are in parentheses and t-statistics are reported in brackets. \*\*\*, \*\*, and \* indicate significant at the 1, 5, and 10 percent levels, respectively.

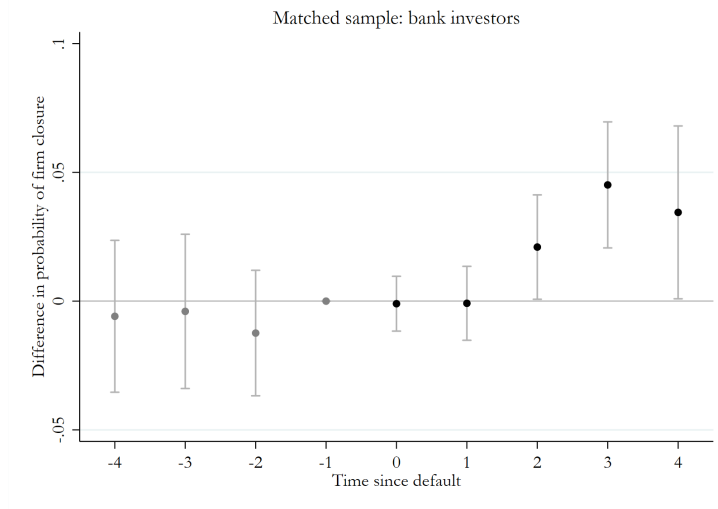
Figure A.1: Firm closure rate across sample



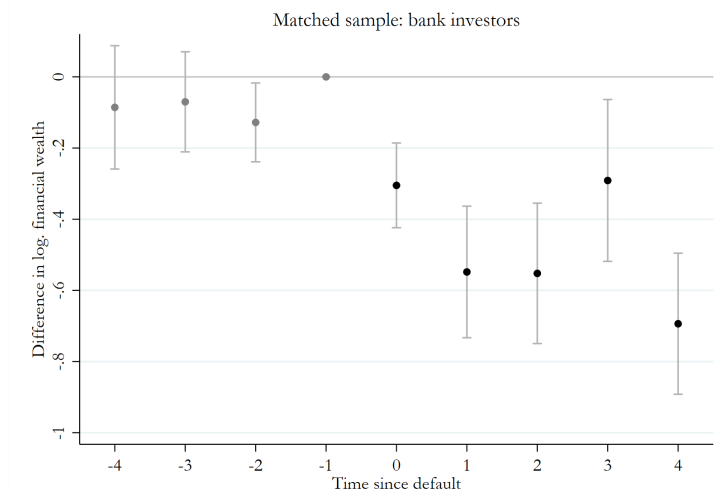
The above figures plots the marginal rate of firm closure across the sample period. The  $y$ -axis states the probability of various types of firm closure in percentage points and the  $x$ -axis plots the sample year. Exits from entrepreneurship across Denmark are shown in gray, the exits from entrepreneurship in the main analysis sample are shown in black. 90% confidence intervals are shown.

Figure A.2: Probability of firm closure and financial wealth losses around personal financing disruptions with additional matching criteria

Panel A:



Panel B:



The above figures present event study plots of the effect of personal financing disruptions on firm closure using a matched sample. Panel A presents the probability of firm closure, while Panel B plots the change in log financial wealth. Up to 5 nearest-neighbor unexposed investors in year  $t-1$  from the bank default are matched to each exposed investor. The matching is based on five-year age cohorts, twenty-vigintiles of net wealth, five-percentage point bins of the share of wealth in risky assets, gender, marital status, and municipality of residence. I additionally condition the sample to investors who invested in exactly one retail banking institution pre-crisis, and match on the share of wealth invested in that bank. The model is specified in Equation (2). The scatter points display coefficient of the interaction term between *exposed investor* entrepreneurs and year from bank default-indicators, therefore providing differences-in-differences estimates. The *y*-axis states the difference in probability of firm closure in percentage points. The *x*-axis is the time since default in years. 90% Confidence intervals are shown.

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