

Depression firms^{*}

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Abstract

We study the long-term borrowing behavior of firms exposed to a large and unexpected financial shock. Using census and credit registry data for Hungarian firms, we examine how a balance sheet shock stemming from foreign currency denominated debt during the 2008 financial crisis affects borrowing decisions in the decade after the crisis. Our identification strategy relies on the comparison of unhedged Swiss franc borrowers to domestic currency borrowers. Firms exposed to a large revaluation in outstanding debt are less likely to obtain a new loan up to seven years after the shock and even if they do so, borrowing from the pre-crisis bank is less likely. While the shortage in credit supply contributed to the slow recovery after the crisis, these results suggest that demand side factors might have also played a role.

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1 Introduction

External financing determines many firm level outcomes. Firms borrow in order to finance their investment, raise working capital or refinance their debt. Despite the importance of bank credit for firms' operation, we know little about their behavior in credit markets and attitude towards borrowing.¹

This paper studies how the attitude of firms towards borrowing changes on the long term, using a large and unexpected financial shock. Combining credit registry with firm level census data for Hungary, we show that firms affected by the financial shock are less likely to borrow up to seven years. In the period after the crisis, affected firms are less likely to sign a loan contract (in comparison with other types of bank lending, e.g. leasing) and are less likely to return to their pre-crisis bank.

To study the effect of a large financial shock on firm level borrowing, we exploit the abrupt and unexpected Hungarian forint/Swiss frank (HUF/CHF) exchange rate depreciation in Hungary in October 2008. After years of stable HUF/CHF exchange rate, at the onset of the crisis, the forint depreciated relative to the Swiss frank by 32 percent from September 2008 to March 2009. This large change in exchange rate is explained by investors' withdrawal of funds from emerging markets, motivated by 'flight to safety' and is unrelated to Hungarian corporate sector developments.

In the years prior to 2008, Hungarian firms built up a large amount of debt denominated in foreign currency. By 2008, 60 percent of corporate debt is denominated in foreign currency, with around 15 percent of total debt denominated in Swiss frank. CHF borrowers, as they were less likely to be exporters, did not have income in foreign currency and did not hedge against exchange rate risk, were severely affected by the large domestic currency depreciation.

In order to show that being exposed to a financial shock has long term effects on firm level borrowing, We use a difference-in-differences approach and compare the behavior of HUF and CHF borrower firms for the period 2005-2017. we define the control group as those firms which had only HUF denominated outstanding debt in September 2008, the month before the start of the large exchange rate depreciation. The treated group is composed of firms with CHF exposure. The key identifying assumption is that there are no time varying shocks affecting firm level outcomes that are correlated with foreign exchange (FX) debt.² First, the estimates are conditional on a wide set of firm level controls, such as sales, investment, outstanding debt, employment, age, industry, location and main bank of the firm. This allows the comparison of exchange rate shock affected firms with those unaffected by the shock and with similar observable characteristics in 2007. Second, our dataset allows to test for the presence of parallel trends for treated and control firms for the pre-shock period. As we show later, conditional on observable characteristics, in the pre-crisis period, the difference between the outcomes for treated

¹Evidence on firms' expectations and more specifically on their attitude towards financing and lending conditions is rather scarce. In the years after the crisis, survey data on firms' external financing needs and attitude towards existing lending conditions became available. For example, the SAFE Survey for access to finance for European enterprises asks a representative sample of European firms on the current developments in their financial situation, need and availability of external financing. For the most recent survey see [link](#).

²Throughout the paper, we will use CHF debt and FX debt interchangeably.

and control firms is statistically not significant.

Our main findings are as follows. Affected firms are significantly more likely to become 90 days past due on their loans in the period 2011-2013, 3 years after the onset of the crisis. Moreover, treated firms are 3.5 percentage point less likely to recover from delinquency than control firms. While it seems that it takes time to de-leverage, it takes firms a much longer time to borrow again. Treated firms are 2.7 percentage point less likely to borrow in the period after the crisis. There is a significant negative effect on new borrowing for seven years, for the period 2009-2015. After the crisis, firms are 3.8 percentage point less likely to obtain a bank loan (versus other types of borrowing such as financial leasing). Finally, we show that treated firms are 4 percentage point less likely to approach their pre-crisis bank when they borrow and this effect is significantly negative for 2009-2017. We find that small firms, younger firms and firms operating in manufacturing and services with CHF debt at the time of the crisis are more negatively affected in their financing related decisions.

All else unchanged, the 2.7 percentage point difference in new borrowing between treated and control firms translates into a HUF 193 billion decrease in the stock of debt in the decade after the crisis. Altogether, the new borrowing that did not materialize is equivalent to 4.4 percent of total corporate debt in 2007. It is widely documented that banks were affected in the 2008 crisis, but the reduction in lending cannot be explained by supply side factors alone (e.g. Ivashina and Scharfstein (2010)).

While it is challenging to disentangle credit supply from demand, we provide further empirical evidence suggesting that the differences in bank financing related outcomes between treated and control firms are rather driven by firms' borrowing decisions. The main concern is that banks are simply not willing to lend to highly indebted firms for many years after the crisis. To the extent that banks take their lending decisions based on firm level outcomes and firm level credit history, we show that controlling for these variables does not affect our main coefficient of interest. First, we show that the ability to repay, as observed by the bank, does not explain our results. Loan request forms submitted to commercial banks in Hungary³ show that beyond general information (e.g. industry of activity) about the firm that we also control for, the main firm level outcome considered by banks is sales. In order to capture the creditworthiness of firms in a certain period and its ability to repay, we control for log sales value in our regressions. The estimated coefficient of interest is unchanged, showing that the creditworthiness of firms, as observed by banks, has no impact on financing related outcomes. Second, banks can observe the creditworthiness of firms from the credit registry. Banks have access to all information regarding firms' loan contracts, including events such as delinquency, for up to five years after the end of a contract. We construct a variable indicating whether the firm has no observable credit history, has a good credit history or has a bad credit history in a given year. Adding this variable to our regression does not change the results regarding financing related outcomes. Third, we use the exact date when a bank queried a firm's credit status from the credit registry as observed firm credit demand and show that there is no significant difference in loan acceptance rate for treated and control firms.

This paper relates to several strands of literature. First, after the emerging market

³These forms are filled in by firms upon applying for a new loan.

crises in the 1990s, theoretical literature focused on explaining the recessions unfolding after exchange rate depreciations through the mismatch in firm balance sheet (e.g. Christiano et al. (2002), Krugman (1999), Aghion et al. (2001), Eichengreen et al. (2007)).

This paper is also related to the literature examining foreign currency borrowing using country level data for emerging economies. According to Basso et al. (2011), debt dollarization in transition economies is driven by the increase in foreign funding and interest rate differentials. Firms borrowing in foreign currency build up a mismatch in their balance sheet, which leads to higher growth in tranquil times but to severe recessions afterwards (Ranciere et al., 2010). Kalemli-Ozcan et al. (2018), for a sample of ten Asian economies and for the period 2002-2015 shows that more indebted firms increase their leverage after exchange rate appreciations.

Fewer papers analyze the effect of currency mismatch and depreciation using firm level data. Mexican firms, especially those with large short term FX debt experience low levels of investment after the Mexican peso crisis of 1994 (Aguilar, 2005). Varela and Salomao (2018) develop a model and using micro data show that firms with less capital who are less productive self select into foreign currency borrowing. On the aggregate, this results in higher investment and lower default, but this is not the case when less productive firms borrow in foreign currency. According to Niepmann and Schmidt-Eisenlohr (2017), firms are more likely to default on their foreign currency loans as they do not hedge perfectly against exchange rate risk in normal times. Vonnák (2018) finds that higher default rates of foreign currency borrowers are explained by both currency denomination and firm characteristics. Hardy (2018), using a small sample of stock exchange listed firms in Mexico which borrow in foreign currency and are exposed to a large domestic currency depreciation by the end of 2008, finds that below median firms (in terms of their log assets) borrow less which subsequently translates into lower employment and investment growth. Endrész and Harasztosi (2014) show that before the 2008 FX crisis in Hungary, FX lending increased corporate investment rates, while after the crisis, due to the balance sheet effect, investment rates decrease for FX borrower firms. Compared to these papers, we study the effect of an exchange rate shock and its subsequent balance sheet effect using firm level census data on bank financing related decisions for a period of ten years after the crisis.

Third, this paper also relates to the literature showing that firm level leverage is an important propagator of business cycles with substantial effect on the real economy. According to Dinlersoz et al. (2018), leverage and the growth of private firms are positively related for U.S. firms, but leverage declines during the Great Recession for these firms. Kalemli-Ozcan et al. (2019) show that high leverage accumulated in the pre-crisis period hinders investment in the aftermath of the crisis for European firms. The effect of debt overhang is larger if firms are connected to weaker banks with exposures to sovereign risk. Giroud and Mueller (2016), using US census data shows that higher firm level leverage reinforces the effect of consumer demand shocks during the Great Recession, as more levered firms face higher employment losses when local consumer demand declines. According to Giroud and Mueller (2018), changes in firm borrowing are associated with regional business cycles: on the short run, U.S. regions where firms build up higher leverage face larger growth in employment, but on the medium term, these regions face larger declines in employment.

More broadly, this paper relates to earlier work on economic agents' beliefs and change in their attitudes in response to financial and macroeconomic conditions. Regarding availability of credit since the crisis, using survey data, it has been shown that firms update their belief based on their available data set, but they do not use information efficiently (Ferrando et al., 2019). Ferrando and Mulier (2013) find that firms' perceived financial constraints (and not their actual constraints) increase when they are more indebted on the short term. Coibion et al. (2018), using a survey of firms in New Zealand show that there is a large dispersion about recent beliefs and expectations about the economy (inflation, unemployment, GDP growth), but inattentiveness decreases for firms which face more competitors or expect to change prices soon. Firm level decisions can be attributed to the decisions of managers who operate the firms. Some recent papers looked at how the experience of managers affects corporate policies. Dittmar and Duchin (2015) find that firms run by CEOs who worked earlier at firms facing financial difficulties (e.g shocks to cash flow, stock returns and credit ratings) hold less debt and invest less. Malmendier et al. (2011) shows that corporate CEOs who experienced the Great Depression prefer internal finance over debt and CEOs experiencing natural disasters throughout their life prefer more conservative corporate policies regarding leverage and cash holdings Bernile et al. (2017). Malmendier and Nagel (2011), Knüpfer et al. (2017) and Crujisen et al. (2016) find that individuals who faced negative economic events during their lifetime (e.g. low stock market returns, adverse labor market conditions or depressions) show lower willingness to take financial risk and loose trust in banks.

The remainder of the paper is structured as follows. In section 2 we briefly describe the Hungarian corporate borrowing market and the foreign exchange shocks faced by firms. Section 3 describes the data. Section 4 presents the empirical strategy. Section 5 presents the main results of the paper. Section 6 presents some robustness checks while section 7 discusses the potential mechanism explaining the results. The last section concludes.

2 Corporate foreign currency debt and exchange rate shocks in Hungary

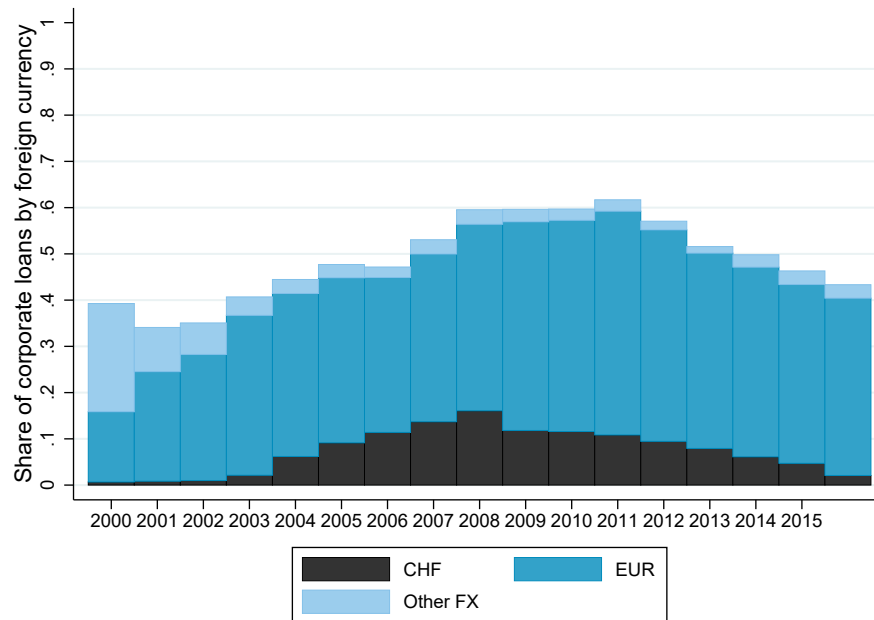
In Hungary, by the beginning of the 2000s, the majority of commercial banks were privatised by foreign banks. Initially, they served for a long period only the corporate market, with corporate credit representing their main assets (Banai et al., 2011a).⁴

In the period leading to the crisis, due to the sharp increase in lending mostly in the retail sector, banks became reliant on foreign parent bank funding and FX swap market to obtain liquidity. The availability of FX funding represented an incentive to increase their FX lending to corporates too.

In the period before 2004, more foreign firms entered the market and more firms started to export. As these firms had revenues in foreign currency it was natural that they had FX loans as they were hedged against exchange rate movements. If we look at the composition of corporate debt by denomination, Figure 1 shows that FX denominated debt was present from the very beginning in the corporate sector.

⁴Berger (2007) shows that in the Central-Eastern European region the privatisation processes led to a high foreign bank dominance in the sector.

Figure 1: Share of corporate loans denominated in foreign currency



Notes: The figure shows the share of corporate foreign currency debt to total debt. Shares calculated based on end of year debt value reported in banks' balance sheets.

The share of FX loans increased from around 40 percent to 60 percent between 2004 and 2008 and, as MNB (2006) points out, this increase was no longer backed by increasing foreign currency revenues. While there was no credit boom in the corporate sector pre-2008, risks have built up because of the lack of natural hedge among FX borrowers. Using representative survey data for the small and medium enterprise sector for 2005, Bodnar (2006), shows that around one third of corporate debt is denominated in foreign currency, and 70 percent of FX borrowers are not naturally hedged against exchange rate risk through foreign currency revenues. Most of these firms are not aware of the fact that unfavorable exchange rate changes could significantly increase their installments. The majority of these firms think that managing exchange rate risk is too costly. More than 50 percent of these firms think that exchange rate depreciation would not significantly affect their financial positions and competitiveness. However, survey data based simulations show that a 25 percent exchange rate depreciation would lead to 50 percent increase in the number of firms with negative profits Bodnar (2006). The 2007 wave of the survey, which includes large corporations too, shows that the choice of FX debt is driven by lower interest rates Bodnar (2009). While large firms are mostly naturally hedged, the majority of firms think that there are no suitable FX risk management tools or expect external solutions for exchange rate risk reduction, such as the introduction of euro. Endr sz et al. (2012) show that in 2007 all firms with mismatch have sizeable contribution to various economic aggregates (2/3 of debt, around 1/3 of aggregate investment and value added).

Katay and Harasztosi (2017) study non-financial corporations' motives to match the currency composition of their assets and liabilities and find that natural hedging explains new foreign currency borrowing to a small extent.

After years of stable HUF/CHF exchange rate (Figure 2), at the onset of the crisis the Forint depreciated relative to the Swiss franc by 32 percent from September 2008 to March 2009. This abrupt change in exchange rate is explained by investors' flight to safety motive from emerging markets, in the conditions when Hungary built up a large public and private sector debt and the country was highly reliable on external funding (Banai et al., 2011b). The depreciation continued until the end of 2012.

Figure 2: Domestic currency (HUF) depreciation against CHF



Notes: The figure shows the percentage change in HUF/CHF exchange rate compared to September 2008. The vertical line represents September 2008, the month prior to HUF depreciation.

Banks faced severe disruptions in interbank, FX and swap markets in the last quarter of 2008. Beyond the measures taken by the Central Bank to manage the liquidity crisis, parent banks showed their commitment and increased funding as well as intra-group swaps (Banai et al., 2011a). Major banking sector player in the Central and Eastern European (CEE) region and governments signed The Vienna Initiative in January 2009, with parent banks committing to continue lending in the region through their affiliates. This helped ensure the financial stability in the CEE region and calm financial markets. Temesvary and Banai (2017) finds that while the crisis significantly lowered subsidiary lending growth in the region, this effect is less pronounced for banks participating in the Vienna Initiative.

Starting from 2013, the Central Bank of Hungary introduced the *Funding for Growth Scheme* to alleviate corporate credit supply problems. As most of the firms in the economy

are SMEs with no alternative sources of external finance⁵, in the second quarter of 2013 the Central Bank of Hungary introduced its Funding for growth program, aiming at alleviating SME lending conditions. Through the Program, participating banks gained access to domestic currency denominated liquidity with long maturity that they could use to lend to SMEs with an interest of maximum 2.5 percent and for a period of maximum 10 years. In the first phase of the program, lasting until the third quarter of 2013, the use of the loan was restricted to financing long-term investment, working capital, pre-financing EU funds and refinancing existing loans. The program was continued immediately afterwards with the second phase, with a more accentuated scope on new lending to SMEs, especially for investment purposes. In the closing phase, which lasted between the first quarter of 2016 and the first quarter of 2017, SMEs could apply for new loans only with investment financing purposes (MNB, 2017). An alternative version of the program was run between the first quarter of 2015 and the end of 2016, which, beyond alleviating the liquidity problem of banks, also contributed to overtaking part of their credit risk. As a consequence, lending to riskier, but still credit-worthy firms, who would have otherwise been excluded from the program, was also increasing. Through this extension of the program, firms could only apply for new loans, financial leasing and factoring from banks, excluding the purpose of refinancing (MNB, 2015). All banks were participating in the Scheme from the launch of the program until the last phase.

3 Data used and definition of treated firms

We build a novel firm-year level database for the period 2005-2017 by combining data from credit registry with administrative firm-level data, firm location data and credit registry query data for firms in Hungary. This data set allows me to follow the bank financing related decisions of around 35,000 firms for ten years after the crisis. All listed databases can be linked using a unique firm level identifier. Below, we briefly describe the main sources of data and treatment definition.

3.1 Data

Credit registry The corporate credit registry contains the universe of loan contracts granted to firms by all credit institutions in Hungary. The data set is available for the period 2005-2017 on a monthly frequency from reporting done by all lending institution to the Central Bank of Hungary. The credit registry offers information on the loan contract level on the borrowed amount, outstanding amount, date of origination, maturity, type of reimbursement, loan type, currency of denomination, delinquency, firm and bank identifier. It also offers information on delinquency and recovery events for the loans as well as how did a problematic contract end. All existing contracts are in the credit register (no reporting threshold). In addition, all contracts after closure are kept for 5 years in the database. We use this database to define the debt composition of firms at a certain point in time. Outcome variables of interest such as delinquency, recovery from delinquency,

⁵In Hungary, for the studied period, there is no developed corporate bond market. External financing is possible only through banks.

new borrowing, new bank loan, bank of the new loan are either given or defined based on this database and aggregated to the firm-year level. Table ?? in the Appendix provides a detailed description of the variables used.

Firm-level data We use the census of firms for Hungary which is based on corporate tax filings to the National Tax and Customs Administration (NAV) and contains balance sheet and income statement entries on a yearly frequency. It provides information on capital, assets, sales, export sales, employment, payrolls, intermediates, value added and industry of the firm. Further variables of this data set allow us to track whether these firms have any income in foreign currency, profit or loss from FX transactions, financial investments and any other FX-related assets or liabilities. We use the employment, sales and investment variables from this data set as firm level controls.

Firm register The firm register offers information on the birth and death of the firm, the location of its headquarter, type of the firms and various other firm level characteristics. We use the information on firm birth to determine firm age. Headquarter location data is used to proxy for firm location. It gives the exact address of the firm's headquarter, from which we extract the county of the firm.

Bank credit registry query data The bank query shows the day on which a given bank queried a firm from the credit registry. In case of an existing bank-firm connection such as loan contract, the bank has the obligation to query the firm yearly. Banks also have the obligation to query a firm from the credit registry when they seriously consider giving a loan to a firm. Upon query, banks can see all the variables from the credit registry listed earlier, allowing them to track the credit history of a firm. This dataset is available starting from 2011.

3.2 Definition of treated and control firms

we estimate the effect of being exposed to a shock by comparing firms with exposure to foreign currency debt to firms with debt denominated in local currency. The dataset used for estimation is on the firm-year level, covering the period 2005-2017. we follow those firms ⁶ through time, which had CHF or HUF debt in September 2008.

Treatment is defined based on CHF debt exposure.⁷ we define treated and control firms based on their existing debt contracts in September 2008, one month before the start of the sharp exchange rate depreciation.⁸ Firm level loan contracts taken into consideration must have existed for at least one more month after September 2008. Further on,

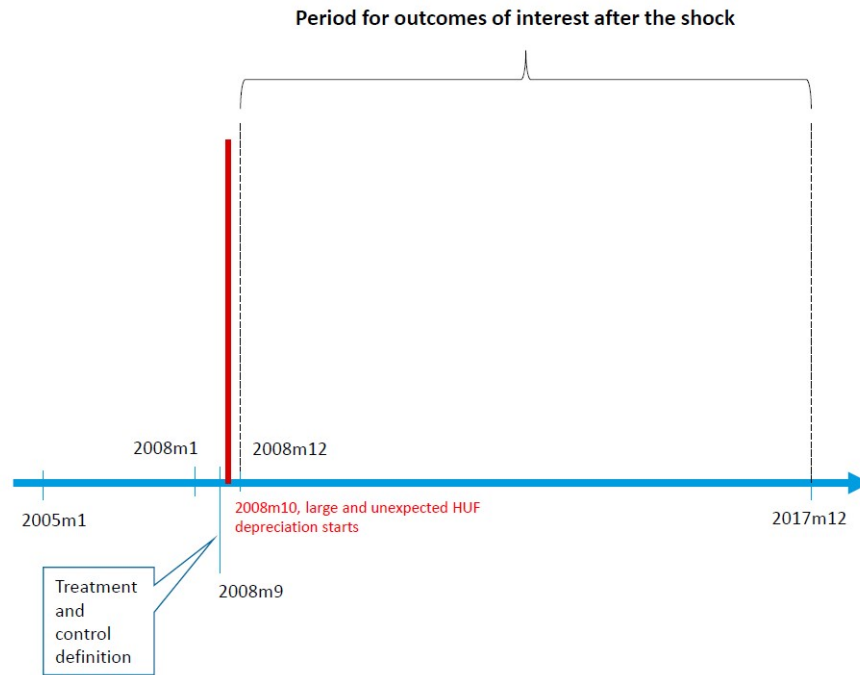
⁶we exclude state owned firms from our analysis as well as firms operating in the financial sector, postal services, public administration, education, health, cultural and other services.

⁷While EUR borrowing was also prevalent in Hungary, we exclude from our analysis those firms which had EUR denominated debt as these firms are larger and more likely to be exporters, thus being able to hedge against exchange rate changes through their foreign incomes. See for example Vonnák (2018) and Varela and Salomao (2018).

⁸In 2007, 50 percent of total debt stock was owned by firms in the sample. Control firms held around 66 percent of this debt. Treated firms held around 33 percent of the debt, which amounted to 857 billion HUF. 857 billion HUF is equivalent to 3,38 billion EUR using 2007 december HUF/EUR exchange rate.

welook only at exposures from loans with maturity beyond one year and loans which are in the balance sheet of the bank (e.g. exclude unused credit lines). The financing-related outcomes of HUF and CHF borrower firms are followed and compared before (2005-2007) and after the crisis (2008-2017). Figure 3 summarizes the timeline of events.

Figure 3: Timeline of events

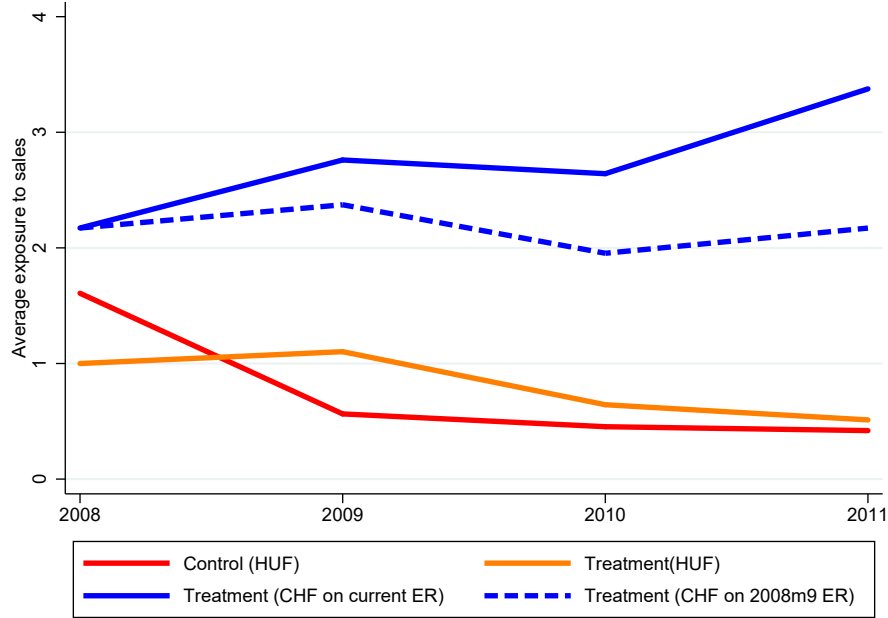


Notes: This graph summarizes the periods for treatment definition and outcomes of interest. Based on September 2009 loan exposures, the month prior to the start of the sudden HUF depreciation, firms with HUF-only debt are grouped into the control group, whereas firms with CHF (and some HUF) denominated debt are treatment firms. It is required that debt contracts existing in September 2009 do not expire for at least one more month and debt has long term maturity and is in the balance sheet of the bank.

To get a sense of the magnitude of the shock faced by CHF borrowers, figure 4 plots the change in exposure relative to 2007 sales for debt contracts existing in September 2008 by assuming September 2008 HUF/CHF exchange rate throughout the period. While exposures from HUF denominated contract are gradually decreasing for both control and treated firm, the exposures from CHF contracts for treated firms change on average from the value of twice their 2007 sales value in 2008 to three times their 2007 sales value by the end of 2011.

Importantly, for firms in the sample the increase in the value of debt is not offset by any income in foreign currency. Firms are non-exporters and have no income from abroad, so they are not naturally hedged against exchange rate risk. In addition, firm do not manage exchange rate risk. Based on balance sheet entries, they do not have financial investments or income from financial investments, do not have stocks of FX holdings and

Figure 4: Change in debt burden due to depreciation (relative to sales)



Notes: The figure shows average outstanding debt to total assets. Sales is fixed to its 2007 value. Debt is defined as end of year outstanding debt by currency, on the firm level. The dashed line gives the average CHF exposure to sales for treatment firms by assuming September 2008 HUF/CHF exchange rate throughout the period.

do not use financial instruments for hedging.

Table 1 compares control and treated firms in their observable characteristics by the end of 2007.⁹ The last column of the table shows whether there is a significant difference between affected and non-affected firms in their observable characteristics pre-crisis. Control and treated firms are not significantly different in employment, sales, assets, investment, productivity, leverage and foreign ownership. Treated firms are significantly older and are more likely in the manufacturing and services industries.

4 Empirical strategy

we estimate the effect of an unexpected and large change in the HUF/CHF exchange rate on the long term borrowing outcomes of firms and their banking related attitudes. we compare the outcomes of firms affected by an FX shock through their foreign debt holdings to the outcomes of non-affected domestic currency-only borrowers before and after the FX shock, using the following difference-in-differences model:

$$Outcome_{it} = \alpha_i + \theta_t + \beta FX_{we} \times Post_t + \Gamma X_{it} + \varepsilon_{it}, \quad (1)$$

⁹2007 is the last year which does not comprise the effect of the crisis.

Table 1: Correlates of foreign currency borrowing on the firm level

Variable	(1) Control		(2) Treated		T-test Difference
	N	Mean/SE	N	Mean/SE	t-stat
Employment	22442	10.052 (0.349)	10920	10.412 (0.254)	-0.360
Sales	24300	180.785 (13.445)	11628	172.484 (6.165)	8.301
Assets	24300	132.232 (10.168)	11628	125.933 (4.097)	6.300
Investment	24300	14.626 (5.945)	11628	14.052 (0.756)	0.574
Productivity	22439	4.074 (0.078)	10918	4.123 (0.068)	-0.050
Leverage	20892	2.112 (0.589)	10296	3.006 (1.540)	-0.894
Age	24300	7.189 (0.029)	11628	7.354 (0.042)	-0.164***
Foreign	24300	0.019 (0.001)	11628	0.017 (0.001)	0.002
Manufacturing	24300	0.124 (0.002)	11628	0.134 (0.003)	-0.009**
Construction	24300	0.164 (0.002)	11628	0.154 (0.003)	0.010**
Service	24300	0.608 (0.003)	11628	0.625 (0.004)	-0.017***

Notes: Correlates for 2007 foreign currency debt exposure and 2007 firm level characteristics. Control firms are those which have only HUF denominated debt in September 2008, the month prior the depreciation starts. Treatment firms are those firms which have some CHF exposure in September 2008. Employment is number of employees. Sales, assets, investment, productivity and debt are in million HUF. Productivity is defined as real value added per employment. Leverage is defined as debt to sales. Foreign, manufacturing, construction and service are indicator variables taking value 1 for the respective categories.

where $Outcome_{it}$ is a borrowing related outcome for firm i at time t , α_i represents firm fixed effects, θ_t represents year fixed effects, FX_i is a dummy indicating whether the firm had some CHF exposure in September 2008, the month before the depreciation starts. $Post$ is a dummy variable taking value 0 for the period 2005-2007 and 1 for the period after the crisis, 2008-2017. X_{it} is a vector of characteristics of firm i in 2007 interacted with $Post_t$ dummy. In this specification, the parameter of interest is β , which gives the effect of FX debt for treated relative control firms, for the post-crisis period (2008-2017) relative to the period before the crisis (2005-2007).

To assess the dynamic effect of FX debt, we estimate the following model:

$$Outcome_{it} = \alpha_i + \theta_t + \sum_{k \neq 2007} \beta_k FX_{we} \times I(t = k) + \Gamma X_{it} + \varepsilon_{it}, \quad (2)$$

where $I(t = k)$ is an indicator variable that equals 1 in year t , and 0 otherwise. The vector of parameters of interest is β_k . For each year, it shows the difference in outcomes between treated and control firms relative to the difference in outcomes in 2007. These regressions are estimated on 240,510 firm-year observations. Standard errors are clustered at the firm level.

The key identifying assumption behind the employed difference-in-differences strategy is that the outcomes for treated and control firms would have evolved similarly, had there been no FX shock. In equations 1 and 2, we control for a wide set of firm level observable characteristics. In the preferred specification, difference-in-difference estimates are conditional on sales, value added, investment, end of year debt, employment, age, 2-digit NACE industry code, bank and location in 2007, interacted with time dummies. This allows the comparison of outcomes for two firms with similar observable characteristics, same bank and same county in 2007, some with FX and some with HUF-only debt. Firm level outcomes such as sales, value added and investment reflect the operation of a firm. Size, captured through employment and age both reflect the life cycle of a firm. All these variables are indicative of firm level demand for loan. Existing debt determines the increased future value in debt. The county of the firm allows to control for firm-location specific shocks such as demand.¹⁰ Controlling for pre-crisis bank is important as it allows to compare firms facing the same bank level shocks, thus controlling for the supply side.¹¹

Further on, the dataset allows to test for the presence of parallel trends for treated and control firms for 2005-2007. As we show later, conditional on observable characteristics, in the pre-crisis period, the difference between the outcomes for treated and control firms is statistically not significant.

Time varying shocks affecting firm level outcomes that are correlated with FX debt would represent possible threats to identification. For instance, a boom-bust cycle in credit supply, if we assume that firms with FX debt are less creditworthy, would allow firm with FX debt to easily obtain new loans in the boom period, but less likely in a credit rationing period. While our main specification cannot entirely separate loan supply from loan demand in the realization of the FX shock, we show that treated firms are not less creditworthy in the pre-crisis period, to the extent that creditworthiness is captured by firm level outcomes observed by the bank. While we cannot directly observe loan supply, in the 7 part of the paper we show indirect evidence that firm level financing decisions are not driven by credit supply.

Further on, it is important to note that the financing related outcomes for firms do not imply any general equilibrium effects. If for instance, less new borrowing on the

¹⁰Controlling for settlement level firm location does not change our results. There are 19 counties in Hungary and the capital city and around 3200 settlements.

¹¹Following Oster (2019), we provide a test for evaluating robustness to omitted variable bias in Table 27 in the Appendix. We show that the coefficients are not quantitatively different when unobservables are accounted for.

firm level translates to less investment and lower economic growth, this effect will not be captured by β_k . Any changes in economic conditions faced by firms are subsumed in time fixed effects.

Finally, it could be the case that some firms in the treatment group strategically interact with some firms in the control group, if the firms are active in the same industry. For example, firms not hit by the shock might start to more aggressively acquire clients and expand through their pricing behavior. Unfortunately, there is no data available (e.g. on prices) to measure the outcome of strategic interaction between firms, caused by financial market distress.

5 Results

In this section, we present our results for firm level financing related outcomes, for firms with existing HUF or CHF debt in September 2008, and we follow the outcomes of these firms for the period 2005-2017.¹² Our main outcome of interest is new borrowing in the years after the crisis. At the same time, we explore the behavior of firms related to contracts existing from the time around the crisis (e.g. delinquency and no recovery from delinquency) and we document the circumstances of new borrowing, such as type of new borrowing and the provider bank.

5.1 Delinquency

Table 2 shows the effect of foreign currency debt on firm delinquency. The outcome variable is 1, if the firm is 90 days past due on at least one of its loans in a given year.¹³ The reported coefficient is β from equation 1 with a different set of controls in each column. The period covered in the estimation sample is 2005-2017, with after period starting in 2008. In the specification in column 1, only firm and time fixed effects are included. In column 2, we add 2007 firm level controls interacted with year dummies. Further on, in column 3 we include the location of the firm in 2007 interacted with year dummies and in column 4, in addition we include firms' bank in 2007, interacted with years. After the inclusion of controls the coefficient of interest decreases slightly, from 1.1 percentage point to 0.7 percentage point. As explained earlier, our preferred specification is column 4. The estimated coefficient shows that changing the foreign currency debt from 0 to 1 causes a 0.7 percentage point increase in delinquency in the period after the crisis.

How does the magnitude of this effect change over time? Figure 5 plots the estimated β_k coefficients from equation 2 and it shows the effect for each year. Two years after the shock, there is no significant difference between treated and control firms. However,

¹²In this period, firms might exit the sample, however, with the available data, we are not able to disentangle between true exit (due to bankruptcy or other issues) and omitting to submit a tax declaration. The studied outcome variables delinquency or no recovery refer to past due on at least one loan contract of the firm in a specific year but it does not capture firm level bankruptcy. In order to avoid any confusion, we redo our estimations for a balanced panel of treated and control firms existing in the period 2005-2017. Results are unchanged, see Table 17 and Charts 14, 15, 16, 17, 18 for more detail.

¹³Commercial loans are considered non-performing if the borrower is 90 days past due.

Table 2: Delinquency

	(1)	(2)	(3)	(4)
treatedxafter	0.0114*** (0.0012)	0.0079*** (0.0013)	0.0075*** (0.0013)	0.0070*** (0.0017)
<i>N</i>	373997	250647	240993	240510
<i>R</i> ²	0.181	0.182	0.185	0.203
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Firm controls	NO	YES	YES	YES
Location	NO	NO	YES	YES
Bank	NO	NO	NO	YES

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level. The outcome variable is 1, if the firm is 90 days past due on at least one of its loans. The specification in the first column contains firm and year fixed effects. In addition, in column 2 we control for 2007 firm level characteristics (sales, employment, investment, age, real value added and industry) interacted with year. In column 3 we further control for firm location in 2007, interacted with year. In column 4, we add firms' bank in 2007, interacted with year to the previous set of controls. In all specifications standard errors are clustered at the firm level.

there is a spike in delinquencies in 2011, which fades away by 2015. For the 2005-2007 period, the estimated coefficients are not significantly different from zero; this supports the parallel trends assumption.

5.2 No recovery

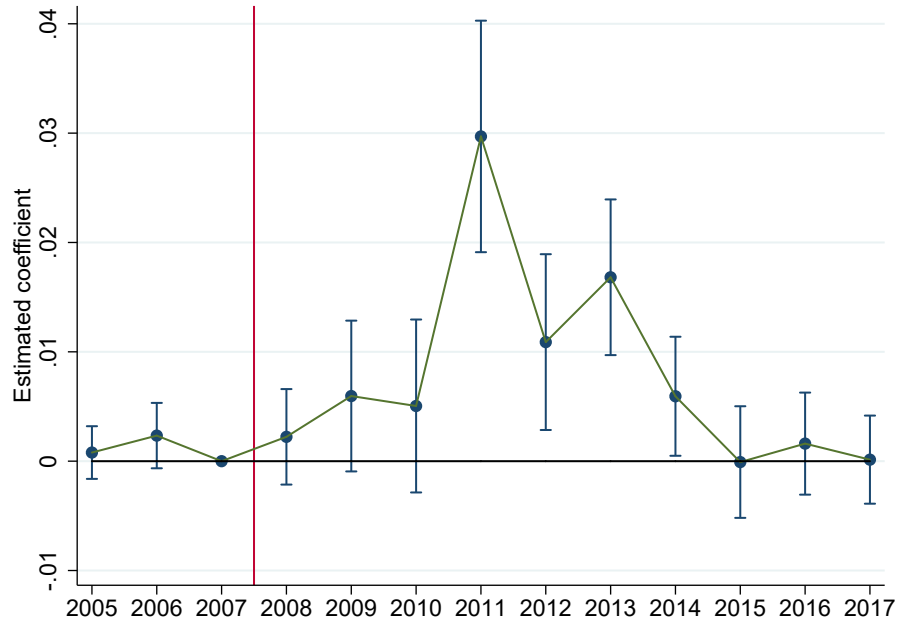
Moreover, as Figure 11 in the Appendix shows, firms are less likely to recover from delinquency. The outcome of no recovery is 1 for a firm, if, by the end of the year, it does not recover on at least one of its delinquent loan contracts. For the period after the crisis, firms are 0.3 percentage point less likely to recover from the delinquency, as shown in Table 13 in the Appendix. No recovery is significantly larger for FX borrowers in the period 2011-2013. Again, the parallel trends assumption is valid, as the estimated coefficients are not significantly different from zero for the period 2005-2007.

These results confirm that relative to HUF borrowers, CHF denominated loans put a burden on FX borrowers and two years after the FX shock are unable to meet their repayment obligations on their existing loans due to the unexpected increase in installments.

5.3 New borrowing

Next, we return to the analysis of new borrowing following the sudden increase in debt. Table 3 shows the estimates from equation 1 for new borrowing under various specifications. The outcome variable is 1, if the firm has at least one new borrowing in a given year. By adding more controls to the regression, the estimated coefficient of interest changes from -3.67 percentage point to -2.72 percentage point. The results in column 4, which is

Figure 5: Does the firm become delinquent?



Notes: The figure shows estimated β coefficients from equation 2. The outcome variable is 1, if the firm is 90 days past due on at least one of its loans. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard errors are clustered at the firm level.

the preferred specification, show that having foreign currency debt is associated with a 2.7 percentage point decrease in new borrowing in the period after the crisis.

While firms are less likely to borrow while they are 90 days past due on their debt contracts, they may begin to borrow once they find a solution to repay their obligations from contracts with an unexpected increase in debt. Thus, it is more interesting to look at the effect on new borrowing in each year, which is given by Figure 6.

While treated firms still manage to borrow more in the year when the crisis starts, 2008, they borrow significantly less than HUF-only borrowers up until 2016. This result shows that new borrowing is affected negatively for CHF borrowers up to 7 years after the start of the depreciation and up to 3 years after affected firms cease to have significantly more non-repayment related issues.¹⁴ As confirmed by non-significant coefficients before 2008, pre-crisis borrowing for treated and control firms evolved similarly.

¹⁴Firms might have various options to finance their activities, e.g. by issuing shares or bonds or by raising their own capital. In Hungary, bond financing is almost non-existent. Also, 98 percent of the sample represent SMEs with an organisational structure not allowing bond issuance. Chart 19 in the Appendix shows that treated firms are indeed not likely to finance their activities by increasing their own capital.

Table 3: New borrowing

	(1)	(2)	(3)	(4)
treatedxafter	-0.0367*** (0.0044)	-0.0210*** (0.0049)	-0.0237*** (0.0050)	-0.0272*** (0.0060)
N	373997	250647	240993	240510
R ²	0.410	0.432	0.433	0.445
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Firm controls	NO	YES	YES	YES
Location	NO	NO	YES	YES
Bank	NO	NO	NO	YES

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level. The outcome variables is 1, if the firm is 90 days past due on at least one of its loans. The specification in the first column contains firm and year fixed effects. In addition, in column 2 we control for 2007 firm level characteristics (sales, employment, investment, age, real value added and industry) interacted with year. In column 3 we further control for firm location in 2007, interacted with year. In column 4, we add firm's bank in 2007, interacted with year to the previous set of controls. In all specifications standard errors are clustered at the firm level.

5.4 Type of new borrowing

Further on, we analyze what is the type of new borrowing (14). Do firms take out bank loans or do they prefer other types of bank financing? Figure 12 in the Appendix shows that FX borrower firms are significantly less likely to borrow a bank loan in the period 2009-2017. Even if affected firms' new borrowing is not significantly different for the years 2016-2017, their new financing is not through bank credit.¹⁵ Again, as confirmed by non-significant coefficients before 2008, pre-crisis borrowing of bank loans for treated and control firms evolved similarly.

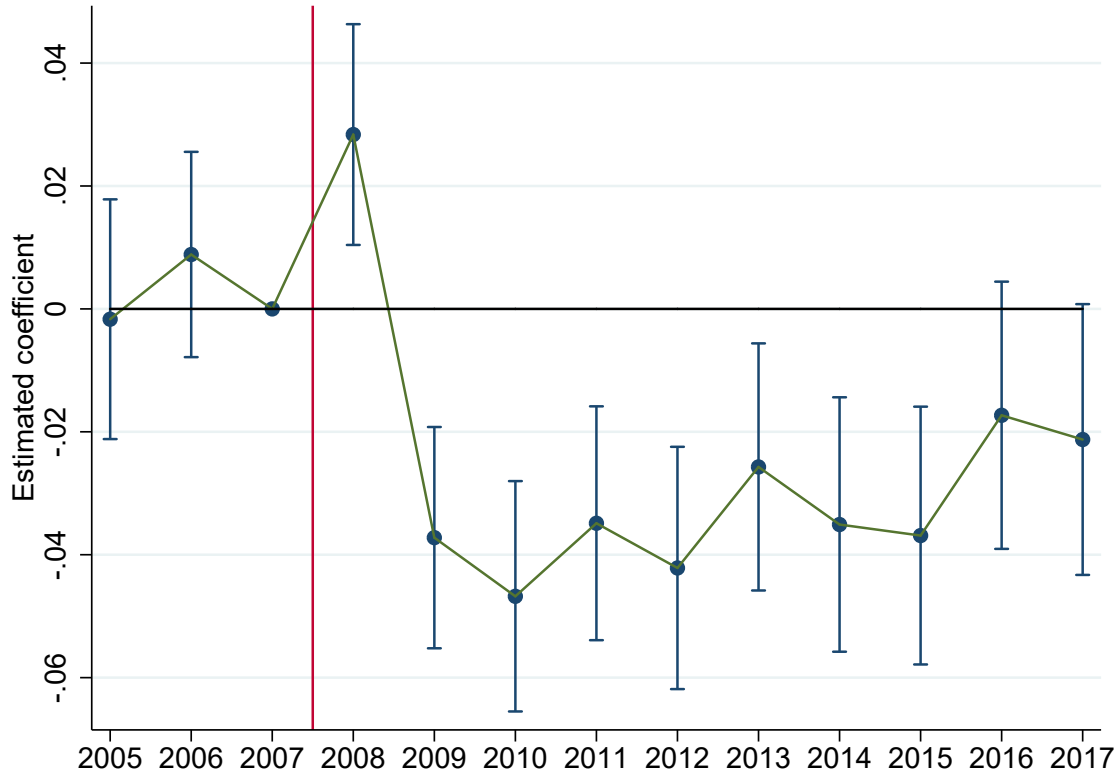
5.5 Bank for new borrowing

After analyzing the status of existing loans and new borrowing we look at which bank the firm borrows from in the years after the shock. The outcome variable of interest takes value 1, if the firm takes out at least one new loan from its pre-crisis bank in a given year. Table 4 summarizes the results and according to the specification in column 4, affected firms are 4 percentage point less likely to take out a new loan from their pre-crisis bank.

Figure 7 shows the effect on bank choice for each year. While there is a significant, slight increase in the coefficient in 2006 for threatened firms, there is a large decrease in 2008 which continues until the end of the studies period. These results might be interpreted as lack of trust towards the bank.

¹⁵Other types of new banking relationship could be bank guarantee, documentary letter of credit, credit line, financial leasing or loan guarantee.

Figure 6: Does the firm borrow?



Notes: The figure shows estimated β coefficients from equation 2. The outcome variable is 1, if the firm borrowed at least once in a given year. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard error are clustered at the firm level.

5.6 Aggregate effects

In this section we quantify the effect of the shock on aggregate lending using a back-of-the-envelope calculation. The estimated yearly effect of the shock is a 5 percent decrease in the probability of obtaining a new loan.¹⁶ For the period 2008-2017, treated firms borrowed 3862 billion HUF in total. In the decade after the crisis, the 5 percent decrease in the probability of obtaining a new loan for treated firms translates into a 193 billion HUF borrowing that was not realized due to the shock. This is equivalent to 4.4 percent of total debt in 2007.

¹⁶This effect is obtained as the sum of differences of predicted values from two regressions. The first regression is the baseline regression, whereas the second regression is the baseline regression with 0 treatment value for all observations.

Table 4: Bank for new borrowing

	(1)	(2)	(3)	(4)
treatedxafter	-0.0465*** (0.0039)	-0.0373*** (0.0047)	-0.0388*** (0.0048)	-0.0418*** (0.0058)
N	373997	250647	240993	240510
R ²	0.475	0.488	0.489	0.504
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Firm controls	NO	YES	YES	YES
Location	NO	NO	YES	YES
Bank	NO	NO	NO	YES

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level. The outcome variables is 1, if the firm takes out at least one new loan from its pre-crisis bank in a given year. The specification in the first column contains firm and year fixed effects. In addition, in column 2 we control for 2007 firm level characteristics (sales, employment, investment, age, real value added and industry) interacted with year. In column 3 we further control for firm location in 2007, interacted with year. In column 4, we add firm's bank in 2007, interacted with year to the previous set of controls. In all specifications standard errors are clustered at the firm level.

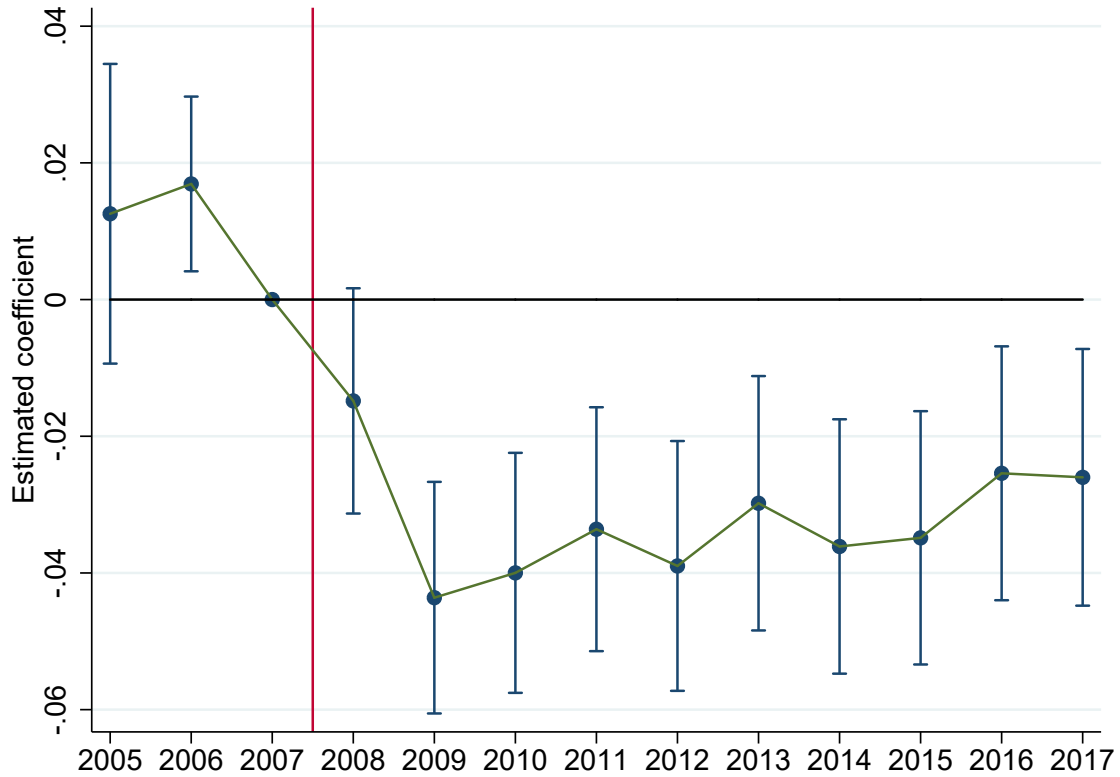
5.7 Heterogeneity across firms

In this section, we explore the effect of the shock on different firm types. First we look at the effect by different size groups defined based on employment. Second we explore the differential impact of the crisis in the manufacturing, services and construction sectors. Third, we look at the effect by firms in different periods of their life cycles. Firms are grouped based on their characteristics in 2007.

Firm size we divide our sample of firms in three size groups: the bulk of firms are small firms, with less than 10 employees.¹⁷ There are fewer medium sized firm, with employment between 10 and 49 employees and there are even less large firms, with at least 50 employees. Table 5 shows the results from equation 1 for different firm categories by employment. Small firms are the most affected by the shock. They are 0.7 percentage point more likely to enter delinquency, are 0.4 percentage point less likely to recover, are around 4 percentage point less likely to borrow, are 5 percentage point less likely to take out a new bank loan and are 4 percentage point less likely to borrow from their pre-crisis bank. These results are very similar to the earlier discussed results pointing to the fact that the results are driven by small firm behavior. While medium sized firms are more likely to enter delinquency and borrow later on from other banks, their overall new borrowing is not affected. Also, the few large firms in term of employment in the sample are not affected in their financing related outcomes. As small firms are more likely to be dependent on external financing, their financing-related decisions can have a large impact on the future of their activity.

¹⁷The balance tables by firm size are provided in Tables 24, 25 and 26 in the Appendix.

Figure 7: Does the firm take out a loan from its pre-crisis bank?



Notes: The figure shows estimated β coefficients from equation 2. The outcome variable is 1, if the bank from which the new loan is obtained coincides with at least one of the banks of the firm in 2007. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard error are clustered at the firm level.

Industry Table 6 Next, we return to the analysis of borrowing behavior in the manufacturing, services and construction sectors.¹⁸ Firms in the manufacturing (e.g. Rajan and Zingales (1998), Braun and Larrain (2005)) and construction sector are more credit dependent because of physical investment and their buyer-supplier links, as these transactions might need to be financed with short term credit. we classify firms based on their 2007 industry. Manufacturing firms represent about 12 percent, services firms around 60 percent and construction firms around 16 percent of the sample. Estimation result in Table 6 show that new borrowing is significantly negatively affected in the manufacturing and services industries. Firms in these sectors are also less likely to borrow a loan or to return to their pre-crisis bank in the decade after the crisis. While crisis affected firms in the manufacturing are not more likely to become delinquent, services and construction firms

¹⁸Balance tables for the subsamples of firms by industry are provided in Tables 18, ?? and 20 in the Appendix.

Table 5: Difference in differences regression by firm size groups

	(1)	(2)	(3)	(4)	(5)
	Delinquency	No recovery	Borrows	New is loan	Same bank
<10 empl.	0.0072*** (0.0022)	0.0040** (0.0016)	-0.0378*** (0.0077)	-0.0476*** (0.0078)	-0.0423*** (0.0071)
N	173006	173006	173006	173006	173006
R ²	0.205	0.208	0.433	0.441	0.481
10-49 empl.	0.0075*** (0.0028)	0.0026 (0.0023)	-0.0073 (0.0106)	-0.0119 (0.0110)	-0.0404*** (0.0109)
N	59696	59696	59696	59696	59696
R ²	0.238	0.229	0.423	0.439	0.515
>49 empl.	-0.0009 (0.0084)	-0.0005 (0.0062)	-0.0162 (0.0302)	-0.0528 (0.0336)	-0.0555 (0.0337)
N	6568	6568	6568	6568	6568
R ²	0.372	0.372	0.532	0.550	0.587
Firm FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. After period starts in 2008. Standard error are clustered at the firm level.

are more likely to be affected by loan default.

Age The need for and ability to raise external finance varies throughout firms' life cycle. In the first years of their activity, firms might need more external resources for establishing their business and expanding. Dinlersoz et al. (2018) show that young, private firms are in need of more external financing. We divide our sample into subsamples of firms who are younger than 6 years, who are between the age of 6 and 15 and firm older than 15 year, as of 2007.¹⁹²⁰ Table 7 shows the financing related outcomes for firms in different age groups. Firms who were younger when they faced the financial shock are more affected in their borrowing outcomes in the 10 year period after the shock. Firms up to 6 years and up to 15 years old are more likely to become delinquent are less likely to borrow and are less likely to borrow a loan and are less likely to return to their pre-crisis bank.

¹⁹Median firm age in the sample is 10 years.

²⁰Balance tables for the subsamples of firms by age group are provided in Tables 21, 22 and 23 in the Appendix.

Table 6: Difference in differences regressions by industry

	(1) Delinquency	(2) No recovery	(3) Borrows	(4) New is loan	(5) Same bank
Manufacturing	0.0037 (0.0046)	-0.0025 (0.0035)	-0.0550*** (0.0162)	-0.0486*** (0.0166)	-0.0543*** (0.0155)
<i>N</i>	33697	33697	33697	33697	33697
<i>R</i> ²	0.232	0.243	0.458	0.463	0.524
Services	0.0075*** (0.0021)	0.0027* (0.0016)	-0.0253*** (0.0076)	-0.0367*** (0.0079)	-0.0398*** (0.0073)
<i>N</i>	148089	148089	148089	148089	148089
<i>R</i> ²	0.210	0.209	0.444	0.447	0.501
Construction	0.0112** (0.0047)	0.0101** (0.0041)	-0.0152 (0.0158)	-0.0383** (0.0164)	-0.0158 (0.0158)
<i>N</i>	38540	38540	38540	38540	38540
<i>R</i> ²	0.235	0.239	0.477	0.479	0.542
Firm FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. After period starts in 2008. Standard error are clustered at the firm level.

6 Robustness

Weighted regressions (Harasztosi and Lindner, 2019), in their paper using Hungarian firm level data, propose log sales weighted regressions.²¹ We rerun a log sales weighted version of 1 and we show in Table 8 that the results for the outcomes of interest do not change in terms of magnitude or significance.

Continuous treatment So far, We used treatment as a dummy variable, taking value 1 if the firm had some outstanding CHF debt. This measure could be slightly misleading, as it is not explicit about the exact amount of CHF debt firms are holding.²² To be more precise, we redefine treatment as the share of CHF debt in total debt in September 2008 and we rerun equation 1 for all outcomes of interest as a robustness check.²³ Table 9 reports the financing related outcomes using this alternative measure of treatment. Results for new borrowing are very robust to the continuous definition of treatment: new borrowing is estimated to decrease by 3.4 percentage point, while earlier the obtained result was a decrease of 2.7 percentage point. The probability of obtaining a bank loan decreases by

²¹As sales are highly skewed, using level weights would be problematic.

²²Mean firm level CHF debt share is 0.27, with 0.42 standard deviation, based on September 2008 exposure.

²³Debt amounts used to construct the share of CHF debt in total debt are calculated from the contracts used before to define treatment dummy.

Table 7: Difference in differences regression by firm age groups

	(1) Delinquency	(2) No recovery	(3) Borrows	(4) New is loan	(5) Same bank
<6 years	0.0083*** (0.0031)	0.0036 (0.0024)	-0.0295*** (0.0100)	-0.0459*** (0.0101)	-0.0303*** (0.0093)
N	99641	99641	99641	99641	99641
R ²	0.224	0.221	0.450	0.449	0.504
6-15 years	0.0058*** (0.0022)	0.0031* (0.0016)	-0.0255*** (0.0084)	-0.0343*** (0.0086)	-0.0468*** (0.0082)
N	120463	120463	120463	120463	120463
R ²	0.207	0.211	0.447	0.456	0.503
>15 years	0.0094** (0.0047)	0.0029 (0.0027)	-0.0219 (0.0173)	-0.0264 (0.0188)	-0.0427** (0.0176)
N	24637	24637	24637	24637	24637
R ²	0.268	0.260	0.487	0.489	0.531
Firm FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. After period starts in 2008. Standard error are clustered at the firm level.

Table 8: Weighted regressions

	(1) Delinquency	(2) No recovery	(3) Borrows	(4) New is loan	(5) Same bank
treatedxafter	0.0063*** (0.0016)	0.0026** (0.0012)	-0.0269*** (0.0060)	-0.0370*** (0.0063)	-0.0434*** (0.0060)
N	231793	231793	231793	231793	231793
R ²	0.203	0.207	0.437	0.445	0.511
Firm FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level. Log sales weighted regressions. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard errors are clustered at the firm level.

3.2 percentage point under this specification, whereas earlier the coefficient indicated a 3.7 percentage decrease. The probability of returning to the pre-crisis bank decreases by 2.9 percentage point, this coefficient was 4.2 percentage point in the baseline specification.

The effect on delinquency and no recovery from delinquency is not significant.

Table 9: Regressions with continuous treatment

	(1)	(2)	(3)	(4)	(5)
	Delinquency	No recovery	Borrows	New is loan	Same bank
treatedxafter	0.0037* (0.0020)	0.0009 (0.0015)	-0.0342*** (0.0070)	-0.0324*** (0.0072)	-0.0285*** (0.0067)
<i>N</i>	240413	240413	240413	240413	240413
<i>R</i> ²	0.203	0.202	0.445	0.449	0.504
Firm FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, end of year debt industry, bank and location) interacted with year. Treatment is defined as the share of CHF debt to total debt in September 2008, the month prior the crisis. Standard error are clustered at the firm level.

Small firms Earlier research using the Hungarian census of firms argues that firms with less than 3 employees or less than 5 employees are very volatile and provide less reliant data, as they have higher incentives for tax evasion.²⁴ These firms are usually discarded from estimations. As firms in our estimation sample were borrowers, at least before the crisis, we assume that the financial statements were thoroughly examined for these firms when they obtained loans. Nevertheless, we follow earlier work and discard firms with less than 3 employees in 2007 from our sample. We rerun a log sales weighted version of 1 and we show in Table 10 that the results for the outcomes of interest do not change in terms of magnitude or significance.²⁵

Lagged dependent variable As firms past financing related outcomes might influence their current decisions, we rerun our main regressions by controlling for the first lag of the dependent variable. Table 11 summarizes the results for the main outcomes of interest. While the estimated effects slightly decrease, all coefficients of interest remain significant at 1 percent significance level.

Time trend To account for time varying firm specific factors, we rerun our main regressions by controlling for firm specific time trend. Table 12 summarizes the results for the main outcomes of interest. While the estimated effects change to some extent, all coefficients of interest remain significant at 10 percent significance level. Firm specific time trends might reflect omitted variables, however, the relatively short period before

²⁴For example (Harasztosi and Lindner, 2019), (Katay and Harasztosi, 2017), (Endr sz and Harasztosi, 2014).

²⁵Results are unchanged when we discard firms with less than 5 employees in 2007.

Table 10: Regressions without small firms

	(1)	(2)	(3)	(4)	(5)
	Delinquency	No recovery	Borrows	New is loan	Same bank
treatedxafter	0.0082*** (0.0019)	0.0041*** (0.0015)	-0.0267*** (0.0069)	-0.0340*** (0.0073)	-0.0438*** (0.0071)
N	143268	143268	143268	143268	143268
R ²	0.218	0.216	0.438	0.444	0.512
Firm FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level. Log sales weighted regressions. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard errors are clustered at the firm level.

Table 11: Controlling for lagged dependent variable

	(1)	(2)	(3)	(4)	(5)
	Delinquency 90d	No recovery	Borrows	New is loan	Same bank
treated_after	0.0059*** (0.0013)	0.0026*** (0.0010)	-0.0182*** (0.0054)	-0.0315*** (0.0058)	-0.0213*** (0.0061)
N	216115	216115	216115	216115	216115
R ²	0.075	0.056	0.329	0.340	0.406
Year FE	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level. Log sales weighted regressions. Year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard errors are clustered at the firm level.

the shock might result in misleading results from fitting panel-specific trends (Wolfers, 2006).

7 Mechanism

So far, we have documented that firms which were more affected by the crisis through their foreign currency borrowing are more likely to have financing difficulties and borrow less for up to seven years after the crisis. It is natural to ask whether these firms do not want to enter into new borrowing contracts later on or it is rather the banks who do not want to lend to these firms. While it is challenging to disentangle credit demand from supply, we provide further empirical evidence suggesting that the differences in financing related outcomes for treated and control firms are rather driven by firms' decisions to borrow.

Table 12: Controlling for time trend

	(1)	(2)	(3)	(4)	(5)
	Delinquency 90d	No recovery	Borrows	New is loan	Same bank
treated_after	0.0104*** (0.0027)	0.0037* (0.0020)	-0.0156* (0.0086)	-0.0151* (0.0089)	-0.0412*** (0.0078)
N	240510	240510	240510	240510	240510
R ²	0.204	0.202	0.445	0.449	0.504
Firm FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level. Log sales weighted regressions. Firm fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard errors are clustered at the firm level.

The main concern is that banks are simply not willing to lend to firms for many years after the crisis. To the extent that banks take their lending decisions based on firm level outcomes and firm level credit history, we show that these variables do not affect our main coefficient of interest. Further on, we provide suggestive evidence that it is not firms' ability to borrow that explains decreased borrowing on the long term.

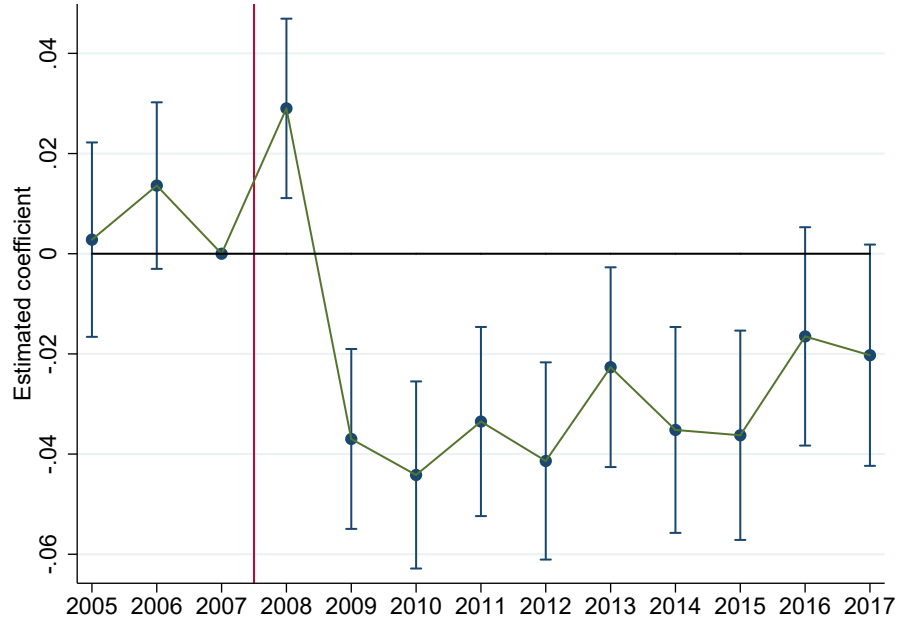
7.1 Ability to repay

Given that CHF borrower firms, in comparison with HUF-only borrowers, face an unexpected increase in their leverage and subsequent debt-related obligations, it is likely that the perspectives of these firms substantially worsen and even if they would like to obtain a new loan or refinance their existing debt, banks do not consider them creditworthy. They hit their credit constraint. Loan request forms from commercial banks suggest that beyond general information about the firm and a short description of the purpose of the requested credit, one of the main firm level outcomes that banks take into consideration for the application of a firm is sales. In order to capture the creditworthiness of the firm and its ability to repay, we control in our regression for the logged value of sales. Figure 8 shows the results from 2, with log sales as an additional control.²⁶ The estimated coefficients are unchanged, showing that the creditworthiness of firms, as observed by banks, has no impact on financing related outcomes.²⁷

²⁶It is likely that banks can observe all balance sheet entries for a firm, thus, we rerun the regression with various sets of controls defined from balance sheet items. Figure 13 in the Appendix shows the result for new borrowing, when controlling for sales, materials, total wagebill and capital as these variables capture to a larger extent the activity of a firm. Results for all other outcomes are shown in Table 15.

²⁷Firms have to fill in the credit request form with sales in t , $t - 1$ and $t - 2$, if applicable. Including contemporaneous and lagged values of sales does not change our main results.

Figure 8: Does the firm borrow? Controlling for sales



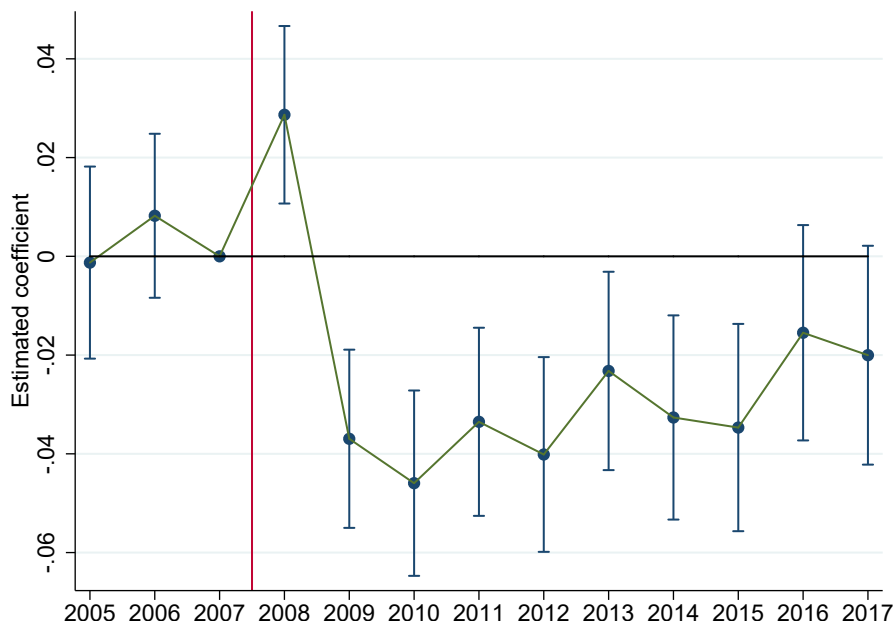
Notes: The figure shows estimated β coefficients from equation 2. The outcome variable is 1, if the firm borrows at least once in a year. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard errors are clustered at the firm level.

7.2 Credit history

Beyond realized firm level balance sheet outcomes, banks can observe the creditworthiness of firms from the credit registry. Banks can observe all existing contracts with characteristics of the firm, including any events such as delinquency. Even if a contract was ended, it is kept in the credit registry for 5 years after its closure. Following Jiménez et al. (2014), we construct a proxy for firm level credit risk using credit registry data. For a given year and a given firm, we construct a categorical variable indicating whether any bank would observe no history for that firm in the credit registry, no bad history or bad history. No history refers to the case when no entry is observable for a given firm in the credit registry. In the case of no bad history, the firm has at least one contract in the credit registry, but no bad event is observable for the firm, such as delinquency (90 days past due). Bad history refers to the case when there is at least one delinquency event in the past of the firm. We re-estimate our main regression with outcome for new borrowing by including in the regression the categorical variable for credit history. To the extent that the creditworthiness measure captures banks' willingness to lend to firms, by including the categorical variable for credit history in the regression we control for credit supply. Figure 9 shows the estimated coefficient from 2, with the credit history variable as an additional

control. The results are unchanged.²⁸

Figure 9: Does the firm borrow? Controlling for credit history



Notes: The figure shows estimated β coefficients from equation 2. The outcome variable is 1, if the firm borrows at least once in a year. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard errors are clustered at the firm level.

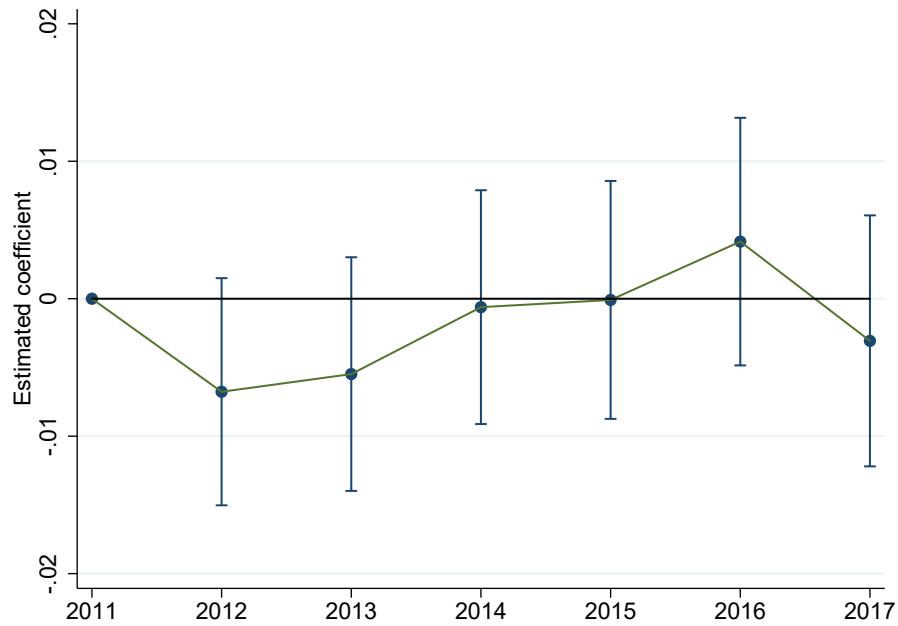
7.3 Bank query as observed demand

we further separate credit demand from supply by using data on the exact time when a bank obtained information about a firm from the credit registry. Following Jiménez et al. (2012), We use loan applications as an equivalent to observed loan demand by firms. Banks facing this loan demand have to decide about their firm specific loan supply. we define loan applications from the credit query database. we discard those observations where an existing client of the bank was queried, as in this case obtaining information because of a new loan application or checking the status of an existing loan cannot be separated. Instead we focus on queries done by banks with whom the firm does not have a loan. In this way, we focus on the extensive margin of new lending. At the same time, we observe which bank gave a new loan to a firm. we aggregate up the database on the firm-year level for the period 2011-2017 by counting the number of banks who gave a new loan to a firm and the number of banks who queried a firm in a given year. From

²⁸Results for all firm level financing related outcomes are reported in Table 16

these, we construct a variable giving the probability of granting new loans on the firm level for the period 2011-2017. We ask whether the difference in rate of granting a new loan is explained by treatment status in the period after the crisis. Figure 10 plots the estimated coefficients from equation 2 for the period 2011-2017, with the rate of granting a new loan as an outcome variable. There is no significant difference in the probability of granting a new loan for the treated and control firms, indicating that the evolution of the financing related outcomes in the decade after the crisis are rather driven by firm demand.

Figure 10: Rate of granting a new loan



Notes: The figure shows estimated β coefficients from equation 2. The outcome variable is the rate of granting a new loan, defined as the number of new loans to queries in a given year. Only those queries and new loans are accounted for where there is no contemporaneous relationship between the bank and the firm. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Base year is 2011. Standard errors are clustered at the firm level.

7.4 Borrowing from other banks

One of the main results of the paper is that affected firms borrow less from their pre-crisis bank. This finding could also be interpreted as a supply effect and it can be claimed that the pre-crisis bank knows the firm well and refuses to lend to the firm in the period after the crisis. In Appendix Figure 22 we show that, while there is an uptick in borrowing for treated firms in 2006, there is no significant difference in borrowing up until 2009 and that treated firms borrow less in the entire post-crisis period from banks which do not

coincide with their pre-crisis bank. This evidence suggests that treated firms borrow less compared to control firms from all banks.

7.5 Liquidity and wealth effect

How does the shock materialise at the firm level? Does it create a debt overhang on the long term which prevents firms from resuming their normal operations? First, in figure 20 in the Appendix we show that there is no significant difference in the cash flow of control and treated firms for the period 2005-2017. Thus, treated firms are no worse off in generating cash to pay their debt obligations and operating expenses. Second, in figure 21 in the Appendix we show that there is no significant difference in the share of own funds to total liabilities for the treated and control firms in the period 2005-2007. This suggests that there is no difference in the financial independence of the firms in the two groups but rather behavioral differences between the two groups of firms.

8 Conclusion

While firm-level real effects of being exposed to a crisis are widely documented, our understanding of borrowing decision is much less limited. To study the effect of a large financial shock on firm level borrowing, we exploit the large and unexpected HUF/CHF exchange rate depreciation in Hungary in October 2008. After years of stable HUF/CHF exchange rate, at the onset of the crisis the Forint depreciated relative to the Swiss frank by 32 percent from September 2008 to March 2009. This abrupt change in exchange rate is explained by investors' withdrawal of funds from emerging markets, explained by flight to safety motives.

In the years prior to 2008, Hungarian firms built up a large amount of debt denominated in foreign currency. By 2008, around 15 percent of total debt in Hungary is denominated in Swiss frank, while around 40 percent is denominated in domestic currency. CHF borrowers, with a mismatch in their balance sheet, were severely affected by the large domestic currency depreciation.

We compare the financing related outcomes of firms affected by the exchange rate through their debt holding to non-affected firms for up to ten years after the crisis. While on the medium term affected firms are more likely to be distressed by delinquency, on the long term not even bank supply explains their lower borrowing, compared to control firms. Firms exposed to a large revaluation in foreign currency debt are 0.7 percentage point more likely to become 90 days past due on their debt-related obligations. Affected firms are significantly more likely to become delinquent on their loans in the period 2011-2013, 3 years after the crisis. Moreover, treated firms are 3.5 percentage point less likely to recover from delinquency than control firms. This effect is significant and positive for the period 2011-2013. While it seems that it takes time for firms to de-leverage, it takes them a much longer time to borrow again. Treated firms are 2.7 percentage point less likely to borrow in the period after the crisis. There is a significant negative effect on new borrowing for seven years, for the period 2009-2015. In the period after the crisis, firms are 3.8 percentage point less likely to obtain a bank loan (versus other types of borrowing such as financial leasing). There is a significant negative effect for the entire

post crisis period. Finally, we show that treated firms are 4 percentage point less likely to turn to their pre-crisis bank when they borrow and this effect is significantly negative for 2009-2017. We show that small firms, firms operating in manufacturing and services and younger firms are more negatively affected in their financing related decisions. All else unchanged, the 2.7 percentage point difference in new borrowing between treated and control firms translates into a HUF 193 billion decrease in the stock of debt in the decade after the crisis. Altogether, the new borrowing that did not materialize is equivalent to 4.4 percent of total debt in 2007.

My results have several policy implications. First, they show the importance of leverage reduction after the crisis. For the time firms face and unexpected increase in debt in their balance sheets, they cannot continue their operations as in normal times, including borrowing. Second, they point to the severe effects of mismatch on delinquency and its possible impact on financial stability. Third, according to our results, it is important to raise financial awareness among firms as some early negative financial market experiences can have long term borrowing consequences.

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9 Tables and Figures

Table 13: No recovery

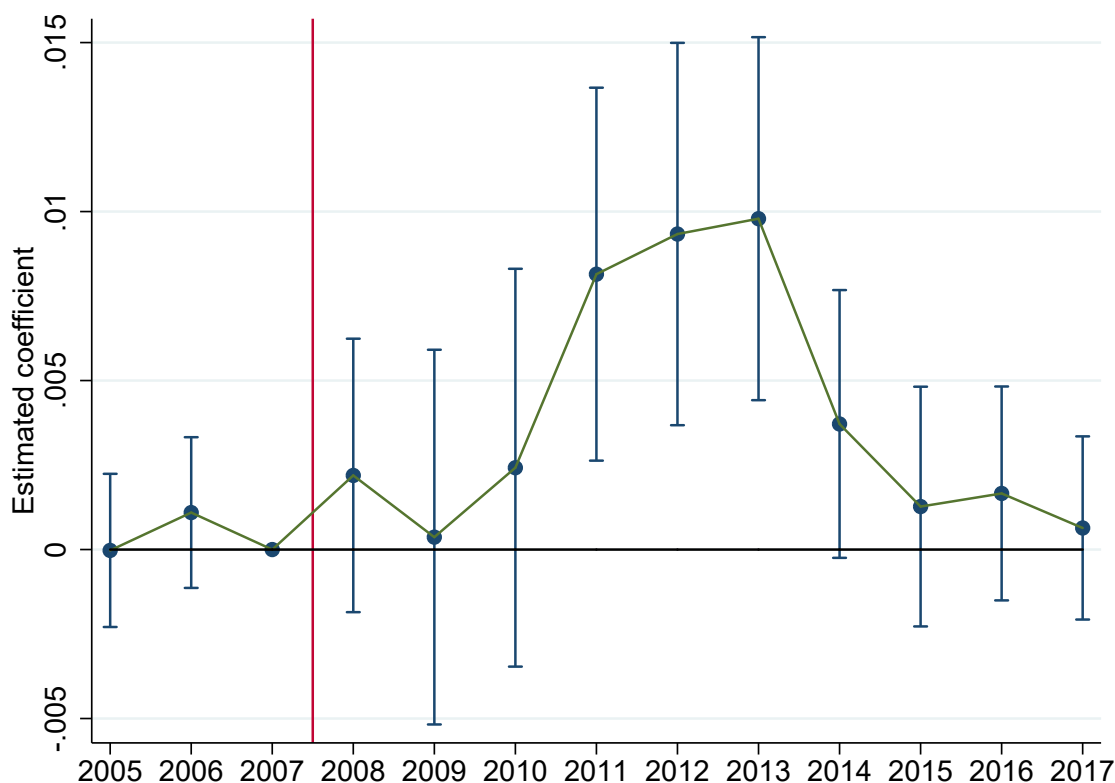
	(1)	(2)	(3)	(4)
treatedxafter	0.0061*** (0.0008)	0.0046*** (0.0009)	0.0045*** (0.0010)	0.0035*** (0.0013)
N	373997	250647	240993	240510
R ²	0.191	0.182	0.184	0.202
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Firm controls	NO	YES	YES	YES
Location	NO	NO	YES	YES
Bank	NO	NO	NO	YES

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level. The outcome variables is 1, if the firm is 90 days past due on at least one of its loans. The specification in the first column contains firm and year fixed effects. In addition, in column 2 I control for 2007 firm level characteristics (sales, employment, investment, age, real value added and industry) interacted with year. In column 3 I further control for firm location in 2007, interacted with year. In column 4, I add firm's bank in 2007, interacted with year to the previous set of controls. In all specifications standard errors are clustered at the firm level.

10 Data Appendix

Corporate credit registry The corporate credit registry is built from four data tables. The first data table contains the matches between contract identifier and firm identifier. The second data table contains all time invariant contract level characteristics such as issue date, maturity date, termination date, amount, denomination, main type (4 categories: in

Figure 11: Does the firm have at least one loan which does not recover?



Notes: The figure shows estimated β coefficients from equation 2. The outcome variable is 1, if for at least one loan contract the delinquency does not end by the end of the year. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard error are clustered at the firm level.

the balance sheet, short or long term, outside the balance sheet, short or long term), secondary type (e.g. bank loan, credit line, financial leasing, documentary letter of credit, etc.) and bank id for the bank of origination. The third data table contains the reference date, outstanding amount in HUF and in foreign currency in case of FX loan, denomination, actual instalment and its denomination, repayment type (e.g. annuity, credit line) and repayment period (e.g. monthly). The fourth data table gives on the contract id level 30 days past due date, end of past due date, how delinquency ended (e.g. customer paid, someone else paid, ended with change in contract, loss) amount due and currency of denomination.

This information is reported by banks on a monthly level for the universe of loan contracts from banks and financial institutions operating in Hungary. Beyond ongoing loan contracts, information for each expired loan contract is kept in the registry for five years after contract closure.

Table 14: Bank loan

	(1)	(2)	(3)	(4)
treatedxafter	-0.0410*** (0.0044)	-0.0248*** (0.0049)	-0.0272*** (0.0050)	-0.0375*** (0.0062)
N	373997	250647	240993	240510
R ²	0.405	0.433	0.434	0.449
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Firm controls	NO	YES	YES	YES
Location	NO	NO	YES	YES
Bank	NO	NO	NO	YES

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level. if the firm borrowed at least one new bank loan in a given year. The specification in the first column contains firm and year fixed effects. In addition, in column 2 I control for 2007 firm level characteristics (sales, employment, investment, age, real value added and industry) interacted with year. In column 3 I further control for firm location in 2007, interacted with year. In column 4, I add firm's bank in 2007, interacted with year to the previous set of controls. In all specifications standard errors are clustered at the firm level.

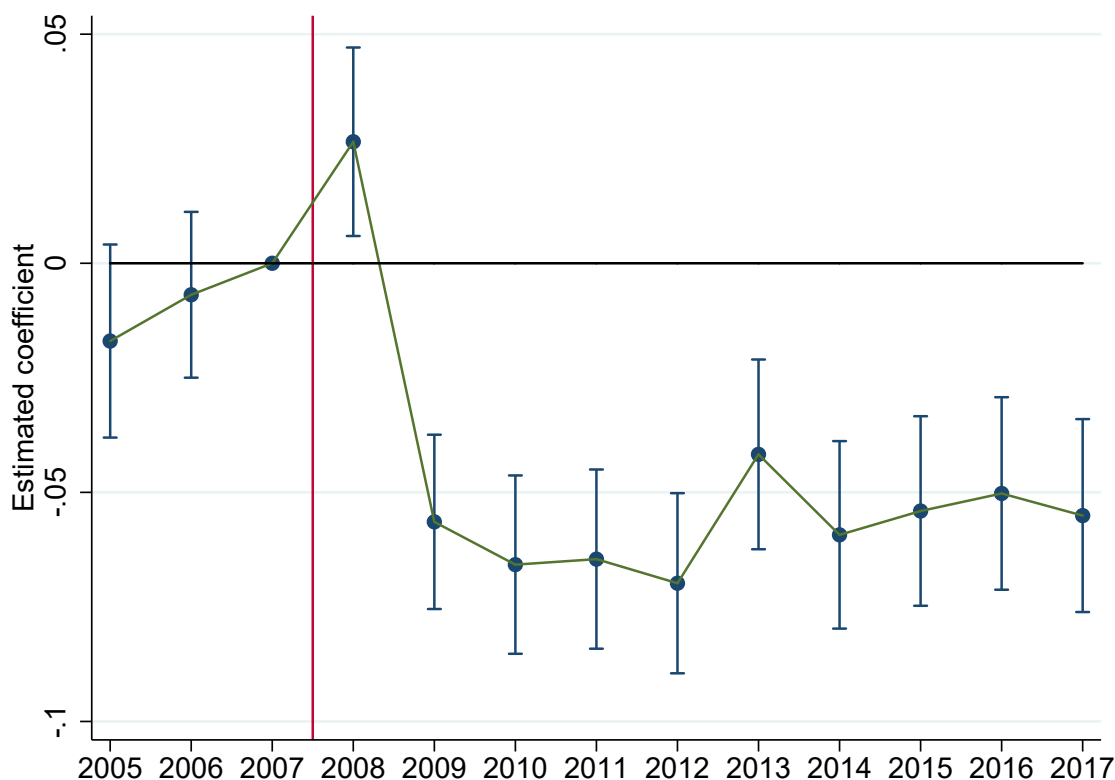
Table 15: Financing related outcomes when controlling for ability to repay (log sales)

	(1) Delinquency	(2) No recovery	(3) Borrows	(4) New is loan	(5) Same bank
treatedxafter	0.0065*** (0.0017)	0.0027** (0.0013)	-0.0288*** (0.0058)	-0.0388*** (0.0061)	-0.0428*** (0.0059)
Log sales	-0.0085*** (0.0005)	-0.0047*** (0.0004)	0.0793*** (0.0012)	0.0555*** (0.0012)	0.0238*** (0.0010)
N	231799	231799	231799	231799	231799
R ²	0.210	0.215	0.455	0.454	0.508
Firm FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level. Log sales weighted regressions. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. I control for contemporaneous sales as a measure of ability to repay. Standard errors are clustered at the firm level.

The database first became available in January 2010. Due to the time coverage of the database, the credit registry can be reconstructed fully for all contracts existing since January 2005. Given the original amount, issue date and termination date for each contract, we build a monthly contract level database where we calculate the outstanding amount using linear repayment schedule. For this first data reporting, some variables are not

Figure 12: Does the firm take out a bank loan?



Notes: The figure shows estimated β coefficients from equation 2. The outcome variable is 1, if the firm borrowed at least one new bank loan in a given year. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard errors are clustered at the firm level.

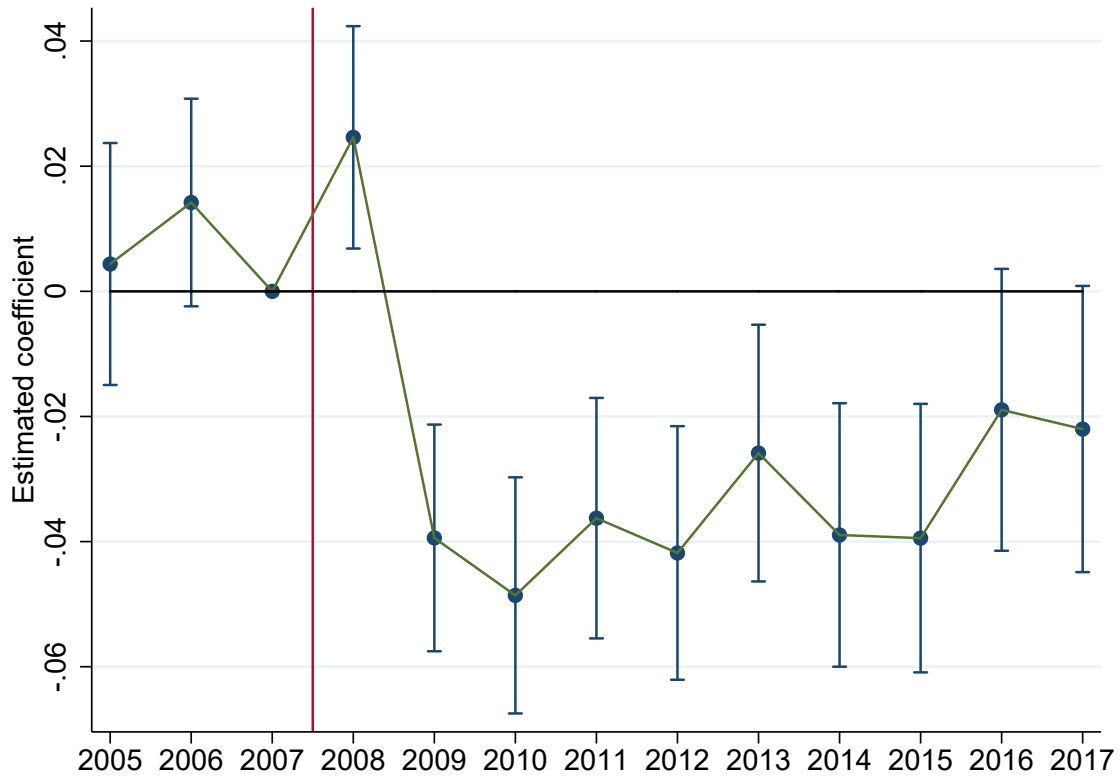
reported yet. For instance, the variable indicating the type for contract repayment is missing. However, later data reporting shows that the most likely repayment for firms is linear. In addition, we do not observe the data provider. Also, the delinquency events up to December 2009 are the last events in time that were registered, which might lead to some loss of information, although defaults very less likely before the crisis.²⁹

Since January 2010, the status of all loans is reported monthly.³⁰ Starting from April 2012, some changes in data reporting occurred. For firms and contracts, anonymized identifiers are reported, meaning that the credit registry database can no longer be merged

²⁹For more details about constructing the database for the period before January 2010 see Endr sz et al. (2012).

³⁰For variables that are assumed to be unchanged during the contract period, if a change in reporting occurs, we accept the most recent reporting. E.g. an observed change in the original amount is considered as an error correction from the reporter and the latest such information is accepted.

Figure 13: Does the firm take out a bank loan? Controlling for ability to repay



Notes: The figure shows estimated β coefficients from equation 2. The outcome variable is 1, if the firm borrowed at least one new bank loan in a given year. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard errors are clustered at the firm level.

to other firm level data. At the same time, the identity of the data provider is reported. Starting from August 2015, the real firm and contract identifiers are again reported. Based on August 2015 data, we can uncover the real firm and contract id for each firm which had a contract starting from August 2010. For contracts which ended before August 2010, firm and contract identifiers are reconstructed based on contract characteristics, using the earlier provided non-anonymized data.

After combining all the available data for the period 2005-2017, as all firm level data is yearly, I collapse the data from the credit registry for outcome variables of interest to yearly frequency. All outcomes variables are binary and described in Table ??.

Corporate credit registry query The corporate credit registry query shows the day on which a given bank queried a firm from the credit registry. This dataset is available starting from 2011 on a daily level. I aggregate the query database to the firm-bank-

Table 16: Financing related outcomes when controlling for history

	(1) Delinquency 90d	(2) No recovery	(3) Borrows	(4) New is loan	(5) Same bank
treatedxafter	0.0063*** (0.0017)	0.0030** (0.0012)	-0.0258*** (0.0060)	-0.0363*** (0.0062)	-0.0398*** (0.0058)
History	-0.0207*** (0.0006)	-0.0078*** (0.0003)	-0.0580*** (0.0037)	-0.0500*** (0.0035)	0.0103*** (0.0029)
Bad history	-0.0092*** (0.0017)	0.0038*** (0.0010)	-0.1308*** (0.0054)	-0.1120*** (0.0052)	-0.0483*** (0.0043)
N	240510	240510	240510	240510	240510
R ²	0.205	0.204	0.447	0.450	0.506
Firm FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level. Log sales weighted regressions. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. History refers to the state of the firm derived from credit registry when in a certain year a bank can observe credit history for a firm, but this history does not contain any negative events. In case of bad history, the bank can observe at least one negative event in a given year for a firm. Omitted category is no history. Standard errors are clustered at the firm level.

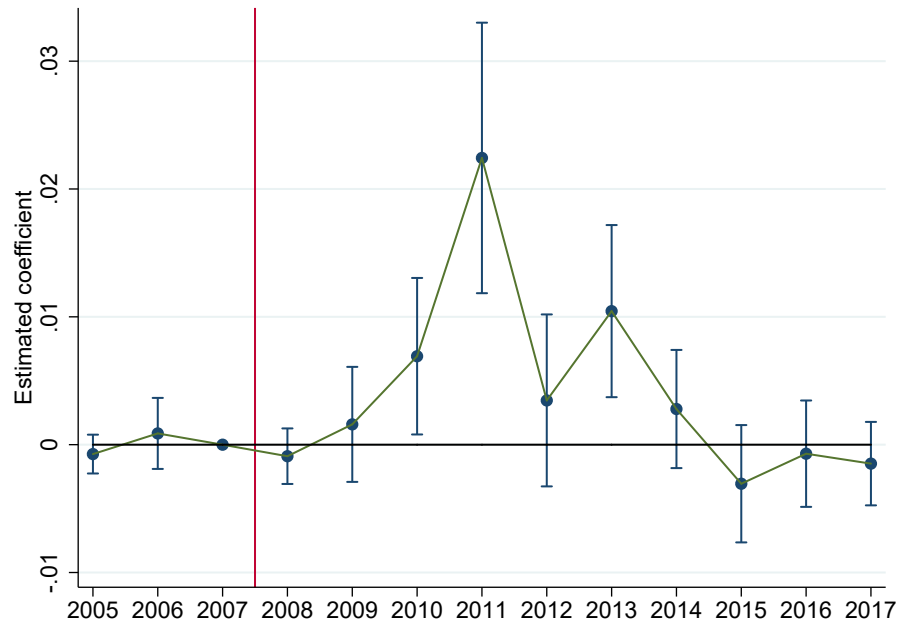
Table 17: Financing related outcomes for a balanced panel sample

	(1) Delinquency 90d	(2) No recovery	(3) Borrows	(4) New is loan	(5) Same bank
treatedxafter	0.0041*** (0.0012)	0.0008 (0.0007)	-0.0291*** (0.0077)	-0.0428*** (0.0079)	-0.0416*** (0.0075)
N	157352	157352	157352	157352	157352
R ²	0.145	0.118	0.436	0.444	0.496
Firm FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level. Log sales weighted regressions. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard errors are clustered at the firm level.

month level and discard those observation where the firm has an existing contract with a given bank. Bank-firm connection information comes from the credit registry. Further on, I merge to the query database new contracts from the credit registry on the firm-bank-

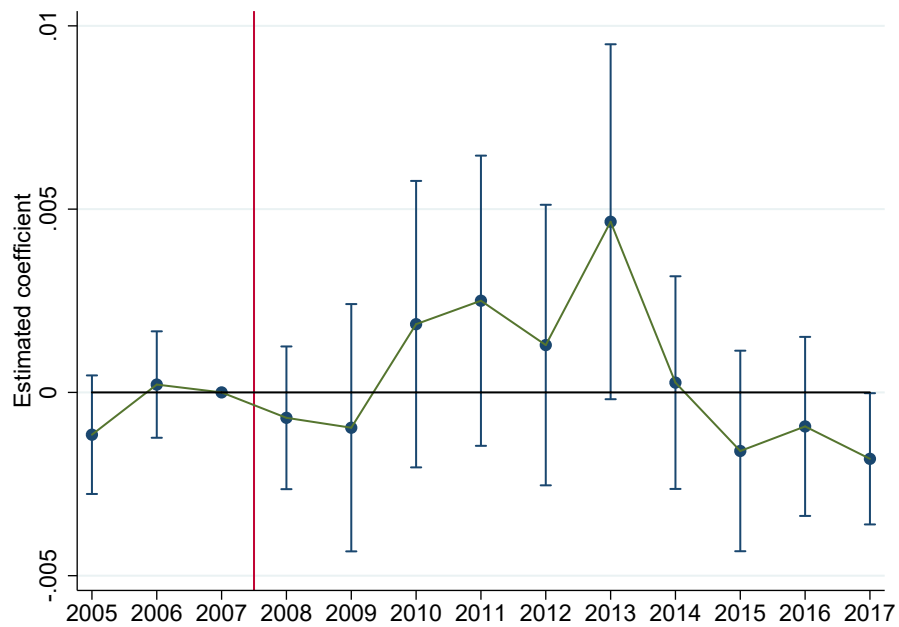
Figure 14: Does the firm become delinquent? Balanced panel results



Notes: The figure shows estimated β coefficients from equation 2. The outcome variables is 1, if the firm is 90 days past due on at least one of its loans. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard errors are clustered at the firm level.

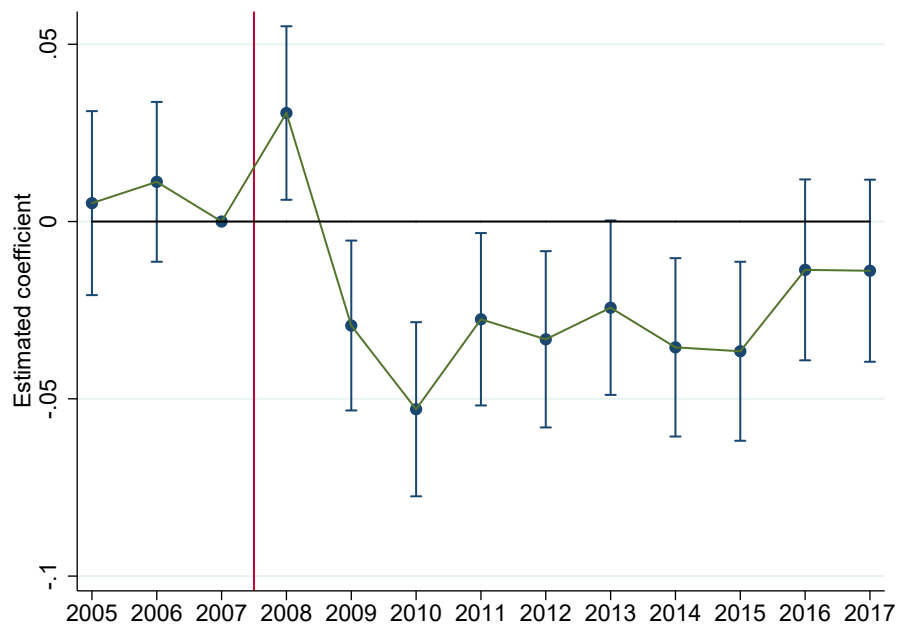
month level. I add the number of queries and the number of new loans for a firm in a given year to obtain yearly firm level loan acceptance rate.

Figure 15: Does the firm have at least one loan which does not recover? Balanced panel results



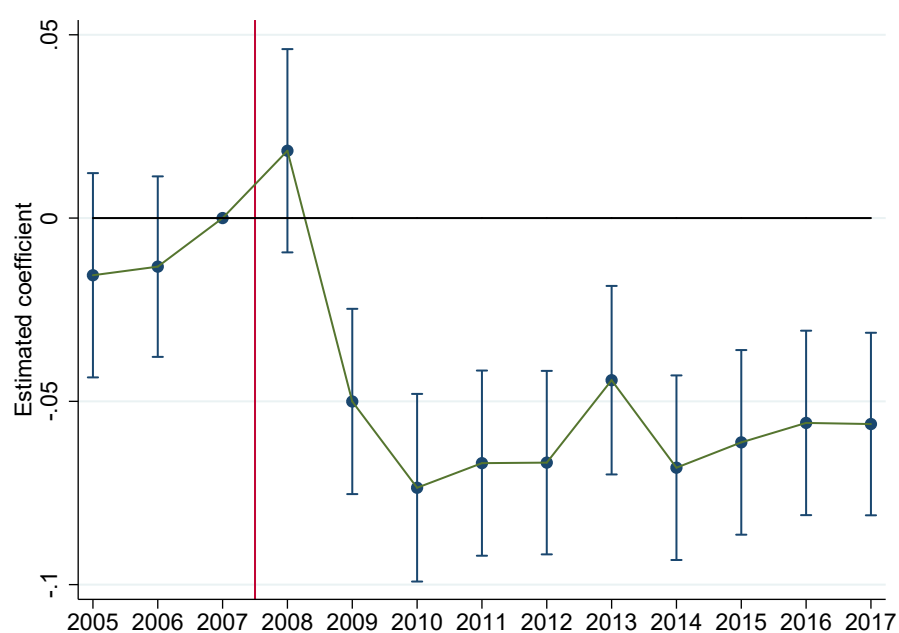
Notes: The figure shows estimated β coefficients from equation 2. The outcome variable is 1, if for at least one loan contract the delinquency does not end by the end of the year. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard error are clustered at the firm level.

Figure 16: Does the firm borrow? Balanced panel results



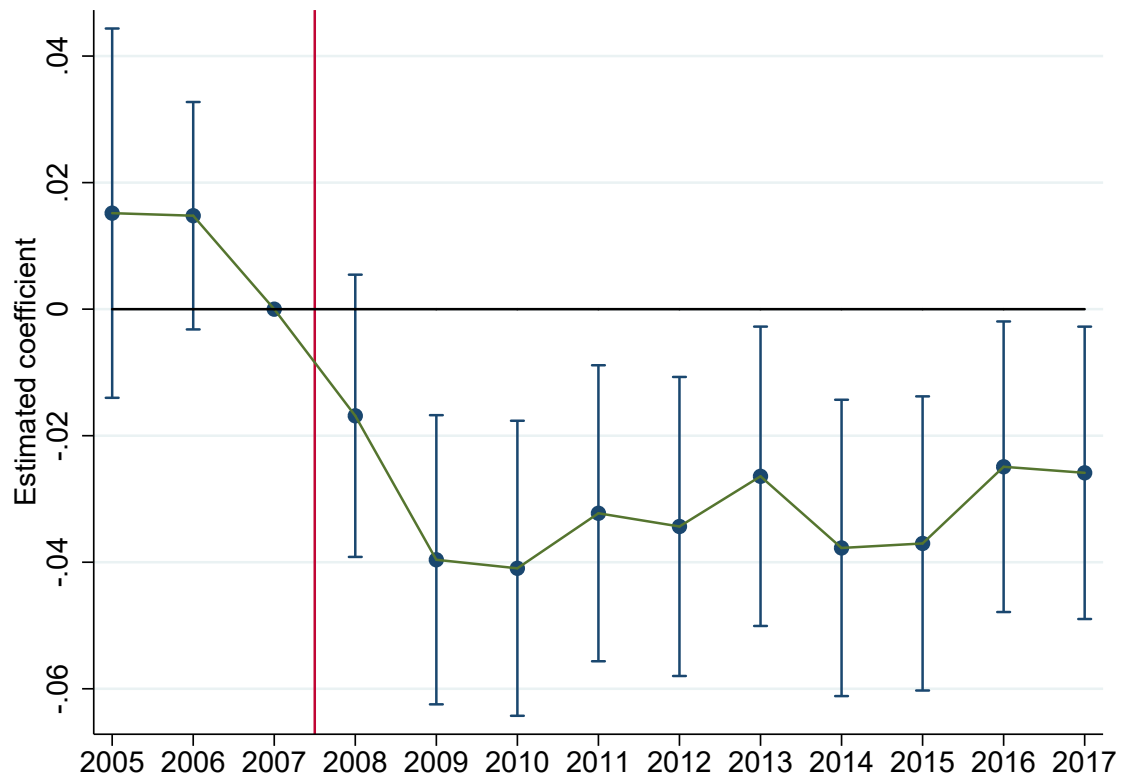
Notes: The figure shows estimated β coefficients from equation 2. The outcome variable is 1, if the firm borrowed at least once in a given year. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard error are clustered at the firm level.

Figure 17: Does the firm take out a bank loan? Balanced panel results



Notes: The figure shows estimated β coefficients from equation 2. The outcome variable is 1, if the firm borrowed at least one new bank loan in a given year. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard errors are clustered at the firm level.

Figure 18: Does the firm take out a loan from its pre-crisis bank?



Notes: The figure shows estimated β coefficients from equation 2. The outcome variable is 1, if the bank from which the new loan is obtained coincides with at least one of the banks of the firm in 2007. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard error are clustered at the firm level.

Table 18: Correlates of foreign currency borrowing on the firm level for the subsample of firms in manufacturing

Variable	N	(1) 0 Mean/SE	N	(2) 1 Mean/SE	T-test Difference (1)-(2)
Employment	2796	11.040 (0.426)	1431	13.379 (0.694)	-2.338***
Sales	2940	109.851 (6.408)	1486	141.479 (11.368)	-31.627***
Assets	2940	82.108 (4.633)	1486	102.331 (7.410)	-20.223**
Investment	2940	9.292 (1.700)	1486	11.415 (1.271)	-2.123
Productivity	2795	4.054 (0.108)	1430	4.204 (0.159)	-0.150
Leverage	2581	0.407 (0.059)	1363	0.613 (0.117)	-0.206*
Age	2940	7.853 (0.085)	1486	7.963 (0.120)	-0.110
Foreign	2940	0.012 (0.002)	1486	0.014 (0.003)	-0.002

Notes: Correlates for 2007 foreign currency debt exposure and 2007 firm level characteristics for the subsample of firms in manufacturing. Control firms are those which have only HUF denominated debt in September 2008, the month prior the depreciation starts. Treatment firms are those firms which have some CHF exposure in September 2008. Employment is number of employees. Sales, assets, investment, productivity and debt are in million HUF. Productivity is defined as real value added per employment. Leverage is defined as debt to sales. Foreign, manufacturing, construction and service are indicator variables taking value 1 for the respective categories.

Table 19: Correlates of foreign currency borrowing on the firm level for the subsample of firms in services

Variable	N	(1) 0 Mean/SE	N	(2) 1 Mean/SE	T-test Difference (1)-(2)
Employment	13200	8.830 (0.534)	6527	8.728 (0.344)	0.101
Sales	14317	179.916 (20.470)	6964	160.805 (8.722)	19.111
Assets	14317	93.902 (8.822)	6964	97.844 (4.743)	-3.942
Investment	14317	7.989 (0.521)	6964	11.733 (0.989)	-3.744***
Productivity	13199	4.127 (0.089)	6526	4.126 (0.084)	0.001
Leverage	12279	2.529 (0.965)	6136	3.667 (2.547)	-1.138
Age	14317	7.006 (0.036)	6964	7.152 (0.053)	-0.146**
Foreign	14317	0.022 (0.001)	6964	0.017 (0.002)	0.005**

Notes: Correlates for 2007 foreign currency debt exposure and 2007 firm level characteristics for the subsample of firms in services. Control firms are those which have only HUF denominated debt in September 2008, the month prior the depreciation starts. Treatment firms are those firms which have some CHF exposure in September 2008. Employment is number of employees. Sales, assets, investment, productivity and debt are in million HUF. Productivity is defined as real value added per employment. Leverage is defined as debt to sales. Foreign, manufacturing, construction and service are indicator variables taking value 1 for the respective categories.

Table 20: Correlates of foreign currency borrowing on the firm level for the subsample of firms in construction

Variable	N	(1) 0 Mean/SE	N	(2) 1 Mean/SE	T-test Difference (1)-(2)
Employment	3604	8.052 (0.206)	1618	9.686 (0.359)	-1.634***
Sales	3837	116.285 (6.401)	1716	152.347 (11.306)	-36.062***
Assets	3837	85.088 (6.572)	1716	107.900 (9.606)	-22.811*
Investment	3837	7.987 (1.741)	1716	8.656 (0.779)	-0.669
Productivity	3604	3.628 (0.146)	1618	4.066 (0.167)	-0.438*
Leverage	3306	2.176 (0.941)	1524	2.101 (1.092)	0.075
Age	3837	6.403 (0.069)	1716	6.794 (0.104)	-0.391***
Foreign	3837	0.007 (0.001)	1716	0.015 (0.003)	-0.008***

Notes: Correlates for 2007 foreign currency debt exposure and 2007 firm level characteristics for the subsample of firms in services. Control firms are those which have only HUF denominated debt in September 2008, the month prior the depreciation starts. Treatment firms are those firms which have some CHF exposure in September 2008. Employment is number of employees. Sales, assets, investment, productivity and debt are in million HUF. Productivity is defined as real value added per employment. Leverage is defined as debt to sales. Foreign, manufacturing, construction and service are indicator variables taking value 1 for the respective categories.

Table 21: Correlates of foreign currency borrowing on the firm level for the subsample of firms less than 6 years

Variable	N	(1) 0 Mean/SE	N	(2) 1 Mean/SE	T-test Difference (1)-(2)
Employment	9927	6.120 (0.554)	4630	6.092 (0.235)	0.028
Sales	11014	101.479 (19.882)	5060	92.300 (9.184)	9.179
Assets	11014	73.890 (16.545)	5060	57.293 (2.621)	16.597
Investment	11014	20.471 (12.125)	5060	9.543 (0.597)	10.928
Productivity	9926	3.611 (0.075)	4630	3.727 (0.093)	-0.116
Leverage	8934	3.429 (1.314)	4261	5.365 (3.669)	-1.936
Age	11014	3.424 (0.012)	5060	3.438 (0.017)	-0.014
Foreign	11014	0.014 (0.001)	5060	0.013 (0.002)	0.001
Manufacturing	11014	0.111 (0.003)	5060	0.118 (0.005)	-0.007
Construction	11014	0.190 (0.004)	5060	0.176 (0.005)	0.015**
Service	11014	0.625 (0.005)	5060	0.642 (0.007)	-0.018**

Notes: Correlates for 2007 foreign currency debt exposure and 2007 firm level characteristics for the subsample of firms younger than 6 years. Control firms are those which have only HUF denominated debt in September 2008, the month prior the depreciation starts. Treatment firms are those firms which have some CHF exposure in September 2008. Employment is number of employees. Sales, assets, investment, productivity and debt are in million HUF. Productivity is defined as real value added per employment. Leverage is defined as debt to sales. Foreign, manufacturing, construction and service are indicator variables taking value 1 for the respective categories.

Table 22: Correlates of foreign currency borrowing on the firm level for the subsample of firms 6-15 years old

Variable	N	(1) 0 Mean/SE	N	(2) 1 Mean/SE	T-test Difference (1)-(2)
Employment	9958	10.777 (0.381)	4916	11.944 (0.427)	-1.167*
Sales	10540	204.872 (19.520)	5123	197.870 (8.691)	7.002
Assets	10540	132.543 (6.150)	5123	142.554 (7.094)	-10.011
Investment	10540	10.232 (0.734)	5123	14.382 (1.298)	-4.150***
Productivity	9957	4.405 (0.097)	4914	4.390 (0.104)	0.015
Leverage	9589	1.139 (0.381)	4747	1.383 (0.541)	-0.244
Age	10540	9.479 (0.028)	5123	9.598 (0.039)	-0.119**
Foreign	10540	0.021 (0.001)	5123	0.016 (0.002)	0.004*
Manufacturing	10540	0.132 (0.003)	5123	0.141 (0.005)	-0.009
Construction	10540	0.141 (0.003)	5123	0.135 (0.005)	0.006
Service	10540	0.609 (0.005)	5123	0.625 (0.007)	-0.016*

Notes: Correlates for 2007 foreign currency debt exposure and 2007 firm level characteristics for the subsample of firms 6-15 years old. Control firms are those which have only HUF denominated debt in September 2008, the month prior the depreciation starts. Treatment firms are those firms which have some CHF exposure in September 2008. Employment is number of employees. Sales, assets, investment, productivity and debt are in million HUF. Productivity is defined as real value added per employment. Leverage is defined as debt to sales. Foreign, manufacturing, construction and service are indicator variables taking value 1 for the respective categories.

Table 23: Correlates of foreign currency borrowing on the firm level for the subsample of firms older than 15 years

Variable	N	(1) 0 Mean/SE	N	(2) 1 Mean/SE	T-test Difference (1)-(2)
Employment	1860	20.589 (1.574)	925	17.261 (1.121)	3.328
Sales	1919	378.021 (64.162)	940	279.485 (17.964)	98.536
Assets	1919	331.894 (77.167)	940	221.883 (13.186)	110.011
Investment	1919	-6.477 (28.273)	940	18.446 (2.101)	-24.923
Productivity	1859	3.931 (0.379)	925	4.287 (0.227)	-0.356
Leverage	1771	0.734 (0.345)	893	0.366 (0.030)	0.368
Age	1919	16.000 (0.000)	940	16.000 (0.000)	N/A
Foreign	1919	0.027 (0.004)	940	0.028 (0.005)	-0.001
Manufacturing	1919	0.166 (0.009)	940	0.176 (0.012)	-0.009
Construction	1919	0.132 (0.008)	940	0.140 (0.011)	-0.009
Service	1919	0.530 (0.011)	940	0.547 (0.016)	-0.016

Notes: Correlates for 2007 foreign currency debt exposure and 2007 firm level characteristics for the subsample of firms older than 15 years. Control firms are those which have only HUF denominated debt in September 2008, the month prior the depreciation starts. Treatment firms are those firms which have some CHF exposure in September 2008. Employment is number of employees. Sales, assets, investment, productivity and debt are in million HUF. Productivity is defined as real value added per employment. Leverage is defined as debt to sales. Foreign, manufacturing, construction and service are indicator variables taking value 1 for the respective categories.

Table 24: Correlates of foreign currency borrowing on the firm level for the subsample of firms with less than 10 employees

Variable	N	(1) 0 Mean/SE	N	(2) 1 Mean/SE	T-test Difference (1)-(2)
Employment	16961	3.323 (0.018)	7776	3.582 (0.027)	-0.259***
Sales	16961	66.175 (1.380)	7776	69.848 (1.514)	-3.673
Assets	16961	46.971 (1.126)	7776	50.651 (1.302)	-3.680*
Investment	16961	5.331 (0.266)	7776	7.254 (0.386)	-1.923***
Productivity	16958	4.037 (0.080)	7775	4.196 (0.085)	-0.160
Leverage	14918	2.020 (0.757)	6984	3.460 (2.249)	-1.441
Age	16961	6.651 (0.032)	7776	6.806 (0.048)	-0.154***
Foreign	16961	0.014 (0.001)	7776	0.014 (0.001)	0.000
Manufacturing	16961	0.113 (0.002)	7776	0.115 (0.004)	-0.001
Construction	16961	0.160 (0.003)	7776	0.145 (0.004)	0.016***
Service	16961	0.640 (0.004)	7776	0.661 (0.005)	-0.021***

Notes: Correlates for 2007 foreign currency debt exposure and 2007 firm level characteristics for the subsample of firms with less than 10 employees. Control firms are those which have only HUF denominated debt in September 2008, the month prior the depreciation starts. Treatment firms are those firms which have some CHF exposure in September 2008. Employment is number of employees. Sales, assets, investment, productivity and debt are in million HUF. Productivity is defined as real value added per employment. Leverage is defined as debt to sales. Foreign, manufacturing, construction and service are indicator variables taking value 1 for the respective categories.

Table 25: Correlates of foreign currency borrowing on the firm level for the subsample of firms with 10 to 49 employees

Variable	N	(1) 0 Mean/SE	N	(2) 1 Mean/SE	T-test Difference (1)-(2)
Employment	4286	19.240 (0.145)	2442	19.301 (0.194)	-0.061
Sales	4286	310.013 (7.406)	2442	310.995 (8.555)	-0.982
Assets	4286	220.240 (8.349)	2442	218.650 (7.876)	1.590
Investment	4286	20.582 (2.173)	2442	24.677 (2.202)	-4.095
Productivity	4286	3.853 (0.078)	2441	3.771 (0.081)	0.082
Leverage	4125	0.190 (0.007)	2378	0.315 (0.071)	-0.125**
Age	4286	9.560 (0.071)	2442	9.262 (0.092)	0.297**
Foreign	4286	0.022 (0.002)	2442	0.019 (0.003)	0.003
Manufacturing	4286	0.185 (0.006)	2442	0.199 (0.008)	-0.014
Construction	4286	0.195 (0.006)	2442	0.192 (0.008)	0.003
Service	4286	0.491 (0.008)	2442	0.516 (0.010)	-0.025*

Notes: Correlates for 2007 foreign currency debt exposure and 2007 firm level characteristics for the subsample of firms with with 10 to 49 employees. Control firms are those which have only HUF denominated debt in September 2008, the month prior the depreciation starts. Treatment firms are those firms which have some CHF exposure in September 2008. Employment is number of employees. Sales, assets, investment, productivity and debt are in million HUF. Productivity is defined as real value added per employment. Leverage is defined as debt to sales. Foreign, manufacturing, construction and service are indicator variables taking value 1 for the respective categories.

Table 26: Correlates of foreign currency borrowing on the firm level for the subsample of firms with more than 49 employees

Variable	N	(1) 0 Mean/SE	N	(2) 1 Mean/SE	T-test Difference (1)-(2)
Employment	498	135.631 (13.354)	253	110.300 (7.355)	25.330
Sales	498	3010.210 (634.274)	253	1712.159 (222.301)	1298.051
Assets	498	2000.168 (474.110)	253	1096.014 (118.535)	904.154
Investment	498	269.928 (289.094)	253	82.565 (15.888)	187.363
Productivity	498	4.102 (0.397)	253	3.807 (0.472)	0.295
Leverage	484	0.143 (0.008)	251	0.226 (0.045)	-0.083**
Age	498	10.715 (0.206)	253	10.818 (0.282)	-0.103
Foreign	498	0.084 (0.012)	253	0.028 (0.010)	0.057***
Manufacturing	498	0.165 (0.017)	253	0.217 (0.026)	-0.053*
Construction	498	0.096 (0.013)	253	0.103 (0.019)	-0.006
Service	498	0.476 (0.022)	253	0.490 (0.031)	-0.014

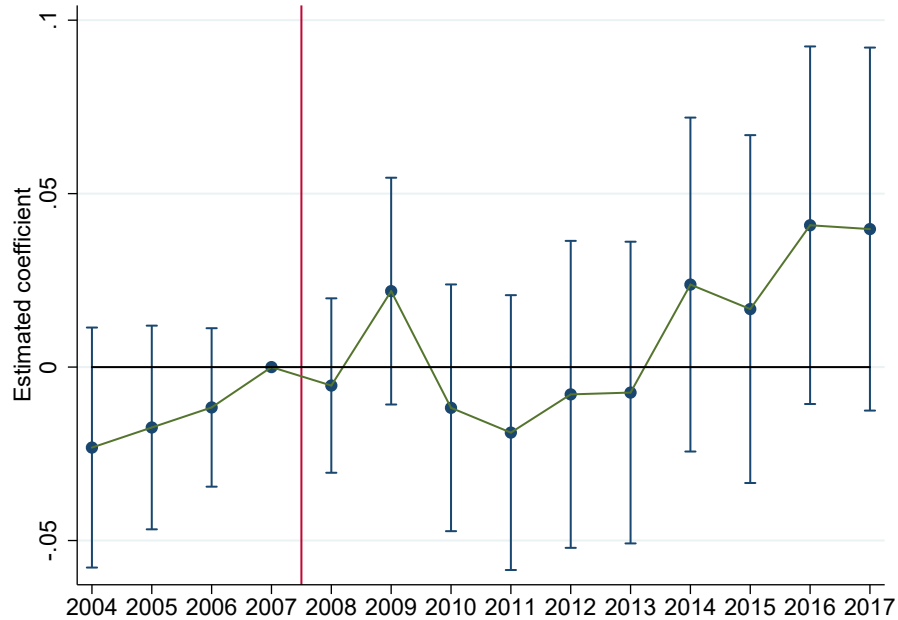
Notes: Correlates for 2007 foreign currency debt exposure and 2007 firm level characteristics for the subsample of firms with more than 49 employees. Control firms are those which have only HUF denominated debt in September 2008, the month prior the depreciation starts. Treatment firms are those firms which have some CHF exposure in September 2008. Employment is number of employees. Sales, assets, investment, productivity and debt are in million HUF. Productivity is defined as real value added per employment. Leverage is defined as debt to sales. Foreign, manufacturing, construction and service are indicator variables taking value 1 for the respective categories.

Table 27: Unobservable selection

	Delinquency	No recovery	Borrows	New is loan	Same bank
Full model					
R-squared	0.0055	0.0027	0.0177	0.0197	0.0185
Beta	0.0070	0.0035	-0.0272	-0.0375	-0.0418
Partial model					
R-squared	0.0002	0.0001	0.0003	0.0005	0.0007
Beta	0.0115	0.0056	-0.0371	-0.0476	-0.0453
Beta*	0.0056	0.0028	-0.0242	-0.0345	-0.0408

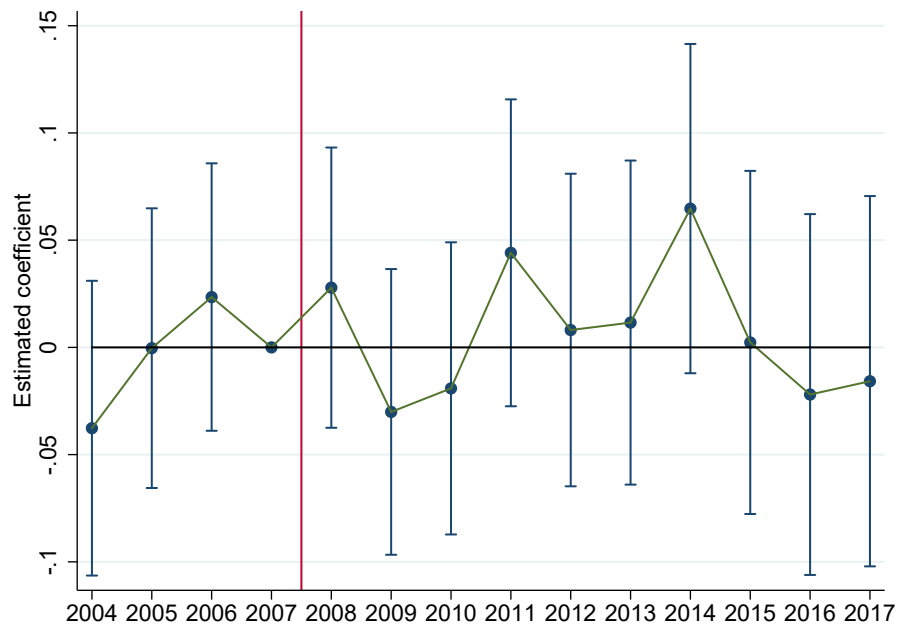
Notes: Following Oster (2019), omitted variable bias adjusted effects, β^* , are provided in the last line of the table. The full model refers to the original model as presented in Equation 1, while the partial model refers to the model in Equation 1 without controls. R_{\max} from the formula from the paper is taken to be equal to 1.3 times the R-squared from the full model.

Figure 19: Own capital



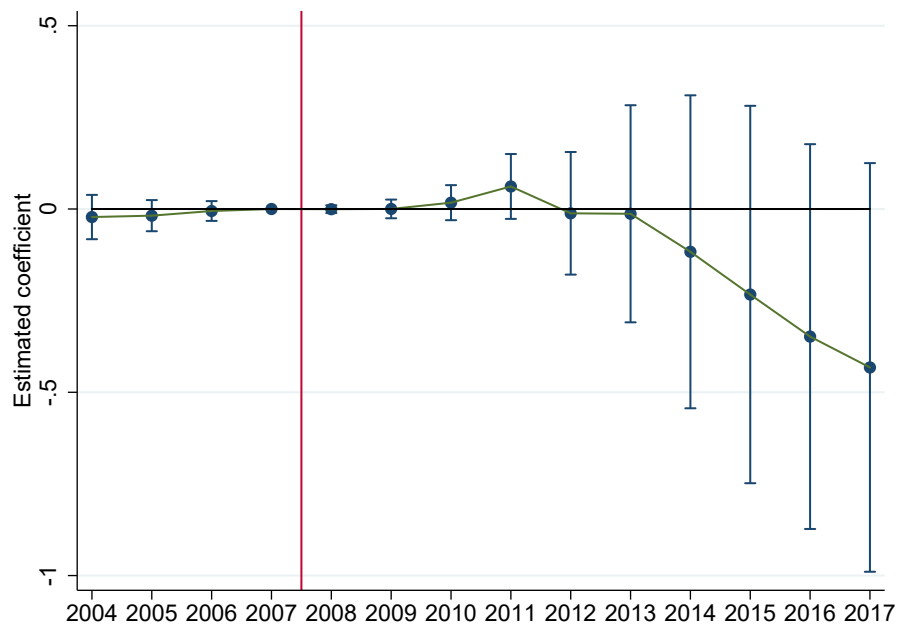
Notes: The figure shows estimated β coefficients from Equation 2. The outcome variable is log own capital. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard errors are clustered at the firm level.

Figure 20: Cash flow



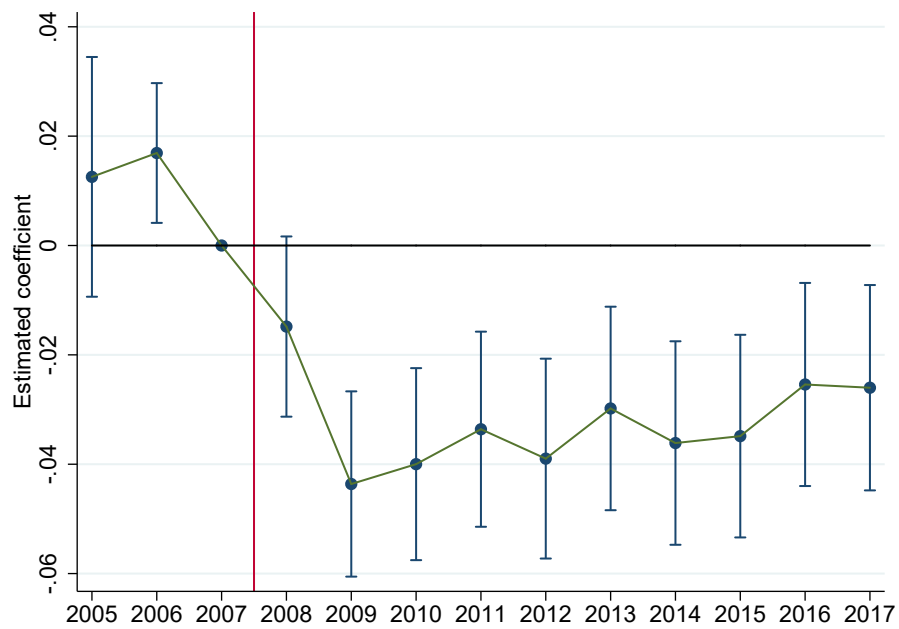
Notes: The figure shows estimated β coefficients from Equation 2. The outcome variable is log cash flow. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard errors are clustered at the firm level.

Figure 21: Own capital to total assets



Notes: The figure shows estimated β coefficients from Equation 2. The outcome variable is own capital to assets. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard errors are clustered at the firm level.

Figure 22: Borrowing from other banks



Notes: The figure shows estimated β coefficients from equation 2. The outcome variable is 1 if the firm borrowed from at least one bank which is different from its (main) bank in 2007. Firm and year fixed effects are included in the regression, as well as 2007 firm characteristics (sales, real value added, investment, employment, age, industry, bank, location and end of year debt) interacted with year. Standard errors are clustered at the firm level.

Table 28: Variable definition

Delinquency 90d		1, if the firm is
No recovery		1, if at least one
Borrows	1, if the firm forms at least one new banking relationship in a given year. This m	
New is loan		
Same bank		1, if the fir
Loan acceptance rate		The number of
Bank		For 2007, th
Exporter		
Location		
Sales		
Employment		
Assets total		
Investment		Capital le
Leverage		
Value added		
Foreign		
Age		
Manufacturing industry		Based on 2-digit
Construction industry		Based on 2-digit
Services industry	Based on 2-digit NACE Rev. 2 classifica	