Bank Lending Channels During the Great Recession

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Abstract

We study the existence and economic significance of bank lending channels that affect U.S. manufacturing industries' employment. In particular, we address the question of how a dramatic worsening of firm and consumer access to bank credit, such as the one observed over the Great Recession, translate into worker displacement (job losses) in these industries. To identify these channels, we rely on differences in the degree of external finance dependence and of asset tangibility across manufacturing industries and in the sensitivity of these industries' output to changes in supply of consumer credit. We show that household access to loans matters more for employment than firm access to local loans and that access to credit affects emplyment more through changes in the average size of firms rather than the number of firms. Our results suggest that, over the recent financialcrisis, tightening access to commercial and industrial loans and consumer installment loans, and a decrease in the availability of home equity loans explain jointly about a quarter of the drop in employment in the manufacturing sector during 2007-2010.

JEL Classification: G21, G28, G30, J20, L25
Keywords: access to bank credit, bank lending standards, home equity, employment, net firm dynamics, Great Recession.

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1 Introduction

We study the existence and economic significance of several bank lending channels. In particular, we address the question of how a dramatic worsening of firm and consumer access to bank credit, such as the one observed during the Great Recession, translate into worker displacement (job losses) in non-financial industries. To fix the ideas further, Figure 1 shows four separate channels through which bank credit might affect the employment and industry dynamics-the first through the supply of commercial and industrial loans to firms, the second through home equity loans to household-owners to prop up their businesses, the third through the supply of consumer installment loans to households, and the fourth through home equity loans to households. In this paper, we examine these four channels using data for U.S. manufacturing industries over the 1991-2011 period.

There are three main reasons behind our choice of studying specifically the linkages between access to bank credit and the U.S. manufacturing employment. First, by studying the real effects of changes in supply of bank credit, we account for the possible substitution of funding sources at the firm and household level. One might imagine that firms and households will substitute away from more limited (more expensive) bank credit to more easily available (more cheaper) alternatives, perhaps mitigating the effect of a decline in the supply of bank credit on manufacturing employment. Second, we believe that the U.S. manufacturing industries do rely on (local) external finance to finance their physical capital investments. The manufacturing industries have had relatively stable establishment structures over the last few decades. In contrast, other industries, such as retail trade, have experienced a shift over time towards multi-unit firms; this shift is associated with the expansion of national retail chains with access to national capital markets. Hence, the shift might weaken the reliance of these industries on (local) bank funding. Third, manufacturing industries' output, in particular durable goods output, is sensitive to changes in the supply of consumer credit. Indeed, most purchases of household durable goods, such as large appliances or cars, tend to be financed.

Our explained variables number of establishments, average establishment size, and employment are from the Quarterly Census of Employment and Wages (QCEW). To our knowledge, this is a novel application of the QCEW data. One of the advantages of this dataset is that it does not contain a structural break due to the transition from the Standard Industrial Classification to the North American Industry Classification System (NAICS) in the late 1990s. Moreover, the dataset covers several recessions, including the Great Recession.

Our explanatory variables come from a couple of sources. We associate state-level and national-level changes in firm and household access to bank credit with changes in

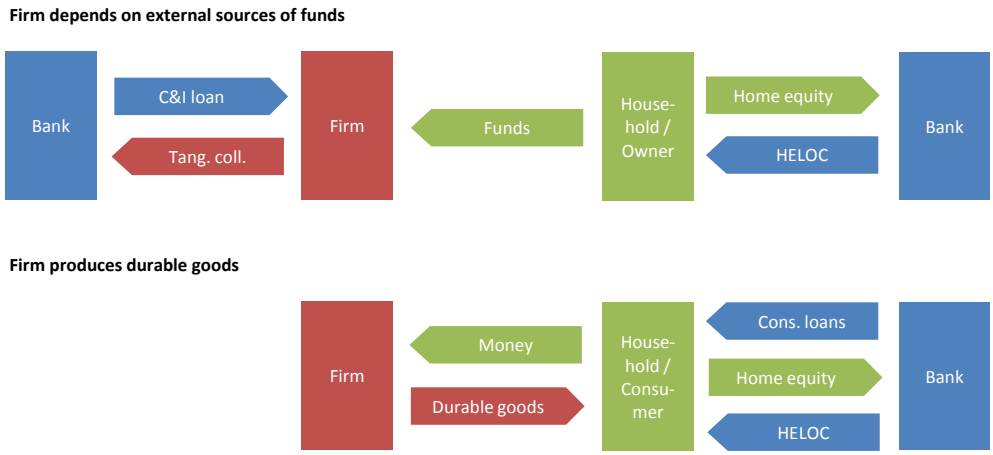


Figure 1: Four Credit Supply Channels

commercial banks' lending standards and willingness to originate loans based on bank-specific responses to questions about changes in lending standards and terms from the Senior Loan Officer Opinion Survey of Bank Lending Practices (SLOOS). We associate changes in household access to home equity loans with changes in home equity. We use the state- and national level house price indices compiled by CoreLogic, state- and national level mortgage debt per borrower taken from TransUnion's Trend Data, and national level household balance sheet data from the Federal Reserve's statistical release Z.1 to construct proxies for home equity.

To better isolate the bank lending channels, we minimize the risk that our results will be driven by either reverse causality or by an omitted factor.

Our identification assumption takes advantage of the differences in national bank presence across U.S. states and is somewhat similar to that in Peek and Rosengren (2000), Garmaise and Moskowitz (2006), and Lee and Stebunovs (2012).[1] In this vein, we posit that changes in major banks's lending standards, apportioned for a particular state, and home equity are exogenous to developments in a given manufacturing industry in a given state and time.[2] In accordance with the questions in the SLOOS, we postulate that na-

[1]For example, Peek and Rosengren (2000) use the Japanese banking crisis to test whether a loan supply shock to branches and agencies of Japanese banks affected construction activity in the U.S. commercial real estate market. Similarly, Garmaise and Moskowitz (2006) study the effects of changes in large bank mergers on changes in crime at the MSA level, arguing that such merger activity instruments for changes in bank competition at the local level. Lee and Stebunovs (2012) use a similar set-up to study the effects of bank balance sheet pressure manifested through bank capital ratios on the employment and net firm dynamics in the U.S. manufacturing industries.

[2]We choose our unit of observation to be a NAICS 3-digit industry in a given state and year. To ensure

tional banks tighten commercial and industrial lending standards broadly across the country rather than target a particular state or a particular industry in a given state. Variation in geographical presence of national banks and in timing of tightening generates variation of our commercial and industrial lending standards measure across states.

We control for omitted variable bias (1) by comparing manufacturing industries which do or do not depend on external source of finance and do or do not have pledgeable tangible assets and (2) by comparing industries which produce durable or non-durable goods. The first comparison is an improvement on the setup that has been widely used in the literature to tease out a differential impact of credit supply changes on industries dependent on external finance, for example, as in Cetorelli and Strahan (2006).

The novelty of the first comparison is that we take into account not only the need to borrow to finance physical capital investment (captured by the Rajan-Zingales measure of external finance dependence) but also the ability to access commercial and industrial loans by manufacturing firms (captured by tangible asset measures as in Braun (2002) and Claessens and Laeven (2003)) at the same time. We interact these industry-specific measures with changes in state-level commercial banks' commercial and industrial loan lending standards to isolate the (local) bank lending channel to firms.

The second comparison is novel and quite intuitive. Unambiguously, consumption of durable goods is more likely to be financed rather than paid for outright, hence changes in consumer access to credit, although affecting both consumption of durable and non-durable goods, is more likely to affect the consumption of the former. We recognize the convention that the location of production and the location of consumption of durable goods may be not the same. After all, if a household in one state has difficulties obtaining a consumer installment loan or a home equity loan, then production of durable goods in other states should take a hit. Hence, we interact national-level measures of household access to bank loans to identify the bank lending channel to households.[3]

Our results show that changes in lending standards on commercial and industrial loans, willingness to originate consumer installment loans by major commercial banks, and the availability of home equity lines of credit affect notably the non-financial employment and

even more robust identification, we could have worked with county- or MSA-level data, but, at such a low level of aggregation, there would have been too many missing observations due to non-disclosure issues. In contrast, the industry data at the state level are available over a long period and include the undisclosed data suppressed within the detailed tables.

[3]Our setup is a more robust refinement of the approach in Mian, Rao, and Sufi (2011), which classifies jobs by industries producing either non-tradable (retail) or tradable goods (manufacturing). We believe that the this split into treatment and control industries requires some improvement, in part, because of the distinction between industries producing potentially tradeable and actually traded goods. For an extreme example of this distinction, consider Cement Manufacturing (NAICS 327310). This industry's output is potentially tradeable across state lines (a cement producer located on the border of two states) but is not likely to be widely traded (because of transportation costs).

net firm dynamics over the sample period.[4] We show that household access to loans matters more for employment than firm access to loans and that household access to credit affects employment through both the average size and number of firms, while firm access to credit only affects employment through the average size.

The finding that supply of bank credit to firms have little effect on the number of establishments appears to be consistent with a few literature strands. First, for the the larger and more mature firms, consistent with the "exporter hysterisis" international trade literature, we conjecture that following a tightening of access to credit, the sunk cost aspect of the firm entry decision in the presence of fixed per period costs to maintain that sunk asset leads firms to continue serving the market, despite unfavorable economic (weak demand for output) or financial (costly and limited access to external finance) conditions, but perhaps at a smaller scale requiring less employees.[5] Second, at the other extreme, for smaller firms, consistent with the literature on lending relationships as in Berger and Udell (1994) and Petersen and Rajan (1994), nascent (smaller) firms may depend less on bank loans than older (larger) firms. In addition, setting up a firm may not be that costly. For example, according to Djankov, Porta, Lopez-De-Silanes, and Shleifer (2002), entrepreneurs average cost of starting a firm (including the time to start up a firm) was 1.7 percent of per-capita income in the United States in 1999, or $520. Likewise, layoffs by firms that are induced by stricter lending standards may spur some creation of establishments, which may boost the number of establishments in times of distress. Aaronson, Rissman, and Sullivan (2004), for example, document the increase in the number of firms, which was accompanied by a fall in employment at the aggregate level.

Regardless, our results highlight the adverse effects that tightening access to credit, especially for households, over the Great Recession and the subsequent slow recovery had on employment in manufacturing industries. Estimating our model only up to 2007 provides us with similar results, which supports the idea that the bank credit channels observed during the Great Recession was the manifestation of unusually large tightening of credit availability to the economy rather than a structural change in the bank lending channel mechanism itself.

Indeed, our model-based back-of-the-envelope calculations suggest that, between 2007 and 2010, the tightening of lending standards alone caused a 3 to 6 percent drop in employment, depending on the type of the manufacturing industry. The explanatory power of the lending standards is notable, as the actual drop in employment, depending on the

[4] Although we do not consider a short-term credit supply channel, which includes trade credit or short-term bank loans, we believe that disruptions in supply of short-term credit over the Great Recession also had a significant impact on the manufacturing employment.

[5] Notable papers in the literature are Baldwin (1998), Baldwin and Krugman (1989), Dixit (1989a), Dixit (1989b), and Alessandria and Choi (2007).

manufacturing industry, ranged between 10 to 25 percent. Tightening access to consumer installment and commercial industrial loans jointly explains between 10 and 40 percent of the drop in employment for certain manufacturing industries. Our further back-of-theenvelope calculations suggest that, over the same period, the decline in home equity explain an additional 10 percent, depending on the type of the manufacturing industry. Our results suggest that, over the recent crisis, tightening access to commercial and industrial and consumer installment loans and a decrease in the availability of home equity loans explain jointly about a quarter of the drop in employment in the manufacturing sector.

In contrast to one or two related studies, we err on the conservative side in generalizing the back-of-the-envelope excercises. In particular, we are cautious in distinguishing worker displacement from job losses in the macroeconomic context and in generalizing our results to the entire economy. By concentrating on the manufacturing industries alone, we do not consider how many of the displaced employees might have been absorbed by other industries in the economy. Moreover, in our benchmark regressions, we do not control for the international slippage explicitly. Some of the adverse effects on the overall employment may be less pronounced as some manufacturing industries might have taken an advantage of the weak U.S. dollar and ramped up exports to the regions relatively unaffected by the financial crisis and the subsequent recession. In fact, one of our robustness check regressions suggests exactly that.

Our estimate of the impact of lending standards and house prices on the manufacturing industries may also have implications for the recovery in the labor market going forward. To some extent, the tightening of lending standards and decrease in willingness to originate loans reflects commercial banks intent to preserve risk-weighted capital positions. The greater anticipated regulatory burden faced by commercial banks may temporarily hold back employment growth in manufacturing, thus contributing to weak labor-market conditions. Moreover, the sluggish housing market improvement might be a further drag on manufacturing employment. In the longer term, the displaced manufacturing workers might be absorbed by other sectors in the economy as our results do not suggest permanent impediments to growth. For boosting employment in manufacturing, the policy prescription that follows from our back-of-the-envelope exercises is that policy makers should focus on restoring functioning first of the household credit supply channel and second of the firm credit supply channel, be it the traditional bank lending channels or the loan securitization channel.

Our results should not be taken as advocating activation of Keynesian policies in a recession. Our estimates are for the impact of supply of bank credit on the manufacturing employment, and changes in supply of bank credit are not equivalent to changes in aggregate demand.

The outline of the paper is as follows. The second section provides a description of our data sources and the ways we transformed the raw data. The third section goes over our empirical strategy, econometric specification, and summary statistics of the variables of interest. The fourth section presents the estimation results. We then detail the economic significance of the effects to the manufacturing sector by estimating how many employees would be displaced. We end with some concluding remarks.

2 Description of the data

In this section we justify our focus on manufacturing industries and review our main data sources—the Senior Loan Officer Opinion Survey (SLOOS) and the Quarterly Census of Employment and Wages (QCEW)—and the ways we transformed the raw data. In particular, we derive our explanatory variables from the SLOOS, TransUnion's Trend Data, Federal Reserve's statistical release Z.1, and other sources and our explained variables come from the QCEW.

2.1 Focus on manufacturing industries at state level

We focus in our analysis on manufacturing industries. These industries are well understood and frequently studied in the finance and banking literature, for example, Cetorelli and Strahan (2006) and Kerr and Nanda (2009). The manufacturing industries have had relatively stable structures. In contrast, some other industries have experienced a shift over time towards multi-unit firms, which might weaken the reliance of these industries on bank funding. For example, the retail trade sector has undergone a pronounced shift away from single-unit firms to national chains with access to national capital markets. In fact, Jarmin, Klimek, and Miranda (2009) report that the share of U.S. retail activity accounted for by single-establishment firms fell from 60 percent in 1967 to just 39 percent in 1997. Moreover, Foster, Haltiwanger, and Krizan (2006) and Jarmin, Klimek, and Miranda (2009) point out that, in retail trade, firms' primary margin of expansion is by opening up new stores rather than expanding existing stores.

We choose our unit of observation to be a NAICS 3-digit industry in a given state and year. To ensure even more robust identification, we could work with county- or MSA-level data, but, at such a low level of aggregation, there would have been too many missing observations due to confidentiality and non-disclosure issues. In contrast, the QCEW industry data at the state level are available over a long period and include the undisclosed data suppressed within the detailed disaggregated tables. Hence, working with state-level data appears to strike a balance between exogeneity concerns and data availability. Although, the QCEW is a quarterly frequency dataset, we choose to work with annual averages for a

few reasons. We are interested neither in immediate responses of employment to changes in access in credit which later might be reverse nor in seasonality of manufacturing employment.[6]

2.2 Definitions of loan types and the Senior Loan Officer Opinion Survey

2.2.1 Definitions of loan types

We focus on three types of loans: commercial and industrial loans, consumer installment loans, and home equity loans.

Commercial and industrial loans include loans for commercial and industrial purposes to sole proprietorships, partnerships, corporations, and other business enterprises, whether secured (other than by real estate) or unsecured, single-payment, or installment. Loans to individuals for commercial, industrial, and professional purposes, but not for investment or personal expenditure purposes, also are included. Commercial and industrial loans reported on the FFIEC Call Report exclude the following: loans secured by real estate; loans to financial institutions; loans to finance agricultural production and other loans to farmers; loans to individuals for household, family, and other personal expenditures; as well as other miscellaneous loan categories. Typically, the interest rate for commercial and industrial loans is set as a spread over the prime rate or Libor and adjusts with movement in the benchmark rate over the loan term.[7]

Consumer installment loans are loans to individuals, for household, family, and other personal expenditures, that are not secured by real estate, such as auto loans. Typically, the interest rate for new consumer installment loans is set as a spread over the prime rate or Libor and remains fixed over the full loan term.

In recent years the popularity of home equity loans—revolving, open-end lines-of-credit secured by 1-to-4 family residential properties—has overshadowed the use of non-collateralized consumer installment loans. Due to the popularity of home equity loans, the growth rate of consumer installment loans has been s one-half of the growth rates of other types of core loans. These lines of credit, commonly known as home equity lines, are typically secured by junior lien and are usually accessible by check or credit card. The rate on new home equity loans is often set as a spread to the prime rate or Libor. Rate differences among competitors for home equity loans usually are determined by differences in the loan to value ratio. Lenders typically offer home equity loans only up to 100 percent of appraised property value, less the amount of any first mortgage lien.

[6] In a quarterly model, a set of lagged explanatory variables would weaken identification because of collinearity.

[7] For this and other loan types, the U.S. dollar Libor rate might serve as a benchmark rate too.

2.2.2 The Senior Loan Officer Opinion Survey

Our commercial and industrial and consumer installment loan lending standards are based on bank-specific responses to questions about changes in lending standards and terms from the Federal Reserve's Senior Loan Officer Opinion Survey of Bank Lending Practices.[8]

The survey is usually conducted four times per year by the Federal Reserve Board, and up to 60 banks participate in each survey. The survey is voluntary and typically includes the largest banks in each Federal Reserve district and is roughly nationally representative. Banks are asked to report whether they have changed their credit standards over the past three months on six categories of core loans including commercial and industrial (C&I) and consumer installment loans. Data measuring changes in credit standards on C&I loans are available beginning with the May 1990 survey. Questions regarding changes in standards on credit card loans and other consumer loans were added to the survey in February 1996 and May 1996, respectively. However, a series indicating changes in banks' willingness to make consumer loans is available over the entire sample period. The SLOOS surveys follow a somewhat irregular schedule and the wording of the questions. The SLOOS asks banks to report changes in their lending practices over the previous three months, and the survey is conducted so that it coincides with regular meetings of the Federal Open Market Committee. Hence, the January SLOOS refers to the period from October to December of the prior year.

We transform individual bank responses in two steps.

First, we map individual bank responses into indicator variables. The question about changes in C&I lending standards reads, "Over the past three months, how have your bank's credit standards for approving applications for C&I loans or credit lines—other than those to be used to finance mergers and acquisitions—to large and middle-market firms and to small firms changed?" Banks respond to that question using a categorical scale from 1 to 5: 1 = eased considerably, 2 = eased somewhat, 3 = remained about unchanged, 4 = tightened somewhat, 5 = tightened considerably. Although banks were extremely unlikely to characterize their changes in lending standards as "eased considerably" or "tightened considerably,"we depart from Bassett, Chosak, Driscoll, and Zakrajšek (2012) in that we use all the five classifications available to survey respondents. Letting j index the respondent banks and t index time, we define an indicator variable $T_{j,t}$ as follows: $T_{j,t} = -2$ if bank j reported considerable easing of standards at time t, $T_{j,t} = -1$ if bank j reported somewhat easing, $T_{j,t} = 0$ if bank j reported no change in standards at time t, $T_{j,t} = 1$ if bank j reported somewhat tightening, and $T_{j,t} = 2$ if bank j reported considerable tightening.

Second, we aggregate individual bank responses across banks for each U.S. state and

[8]Individual bank survey responses are confidential. For more details see Bassett, Chosak, Driscoll, and Zakrajšek (2012).

convert those from quarterly to annual frequency. Using the indicator variables, we construct a composite of changes in lending standards for a particular state s by calculating the following business-loans (C&I loans plus CRE loans)weighted average for each year t:

$$T_{s,t} = \frac{\sum_{q=1}^{4}\sum_{j=1}^{J}(business\ loans)_{j,q,t} \times T_{j,q,t}}{\sum_{q=1}^{4}\sum_{j=1}^{J}(business\ loans)_{j,q,t}},$$

where q denotes a quarter of the year.[9] Out of all the banks that participate in the SLOOS, we select only those that have deposit taking branches in a state s according to the Summary of Deposits. Hence, J may be below 60 for a particular state. We limit the coverage of the states to those where the J selected banks have at least a 15 percent cumulative share of deposits in every year of our sample. We believe that these filters ensure that our state-level tightness measure is in fact representative for a given state. The 29 states, which include the largest three economies in the country are: Arizona, California, Colorado, Connecticut, District of Columbia, Delaware, Florida, Georgia, Illinois, Indiana, Kentucky, Massachusetts, Maine, Michigan, Minnesota, Missouri, North Carolina, Nevada, New York, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Virginia, Washington. Figure 2 depicts the maximum, median, and minimum deposit shares of SLOOS respondents for the 29 states that make the cutoff.

In turn, the question about changes in consumer installment loans reads, "Please indicate your bank's willingness to make consumer installment loans now as opposed to three months ago. "By analogy with the C&I index, we construct a composite index of changes in willingness to make consumer installment loans for each state, $W_{s,t}$, weighted by total consumer loans (excluding residential real-estate loans). We think of $W_{s,t}$ as a proxy for changes in the tightness of lending standards for consumer installment loans.

Two sets of figures (Figures 3 and 4) show tightening of C&I lending standards and willingness to make consumer installment loans for the entire country and for three states - New York, Texas, and California. The first pair of figures shows a drastic tightening of C&I lending standards around the past three recessions as well as a notable loosening of the standards in the mid-2000s. The second pair, with the measure of bank willingness to originate consumer installment loans, to a large extent, mirrors the first pairs. Both sets of figures also show notable variation in C&I lending standards and willingness to make consumer installment loans across selected states prior to the Great Recession.

[9]Note that the SLOOS asks banks to report changes in their lending practices over the previous three months. Hence, the January SLOOS refers to the period from October to December of the prior year, the April SLOOS to the period from January to March of the current year, and so on. In calculating the composite we remap the SLOOS quarters into the calendar quarters accordingly.

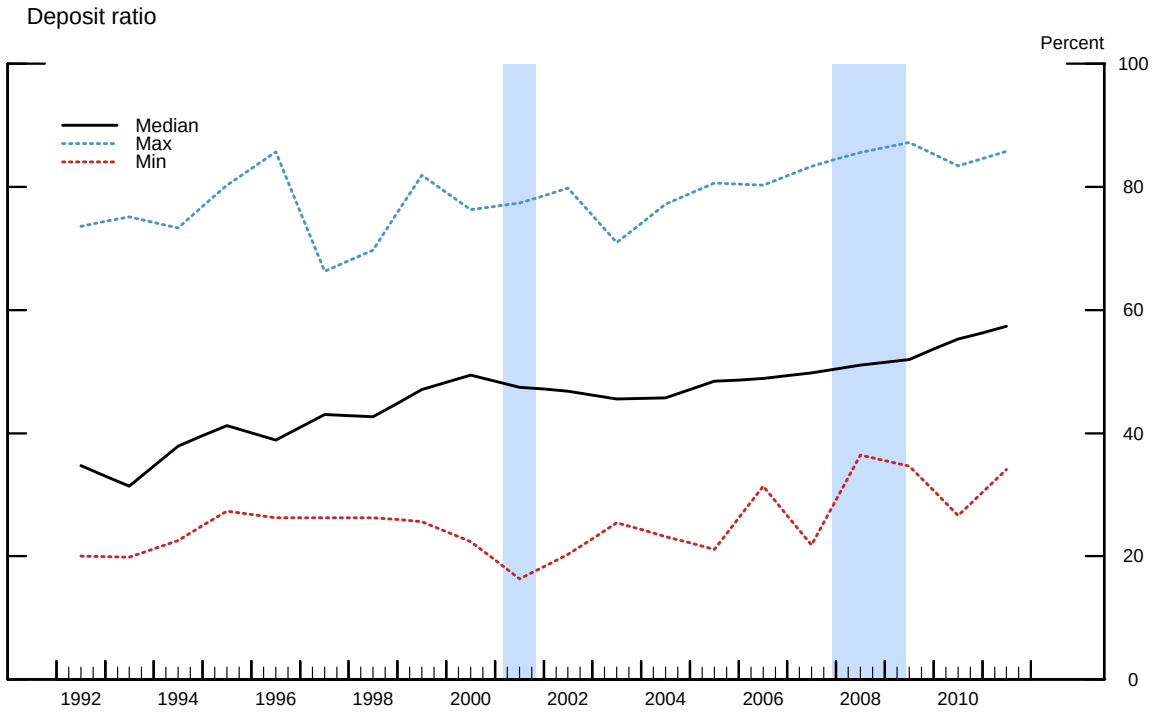


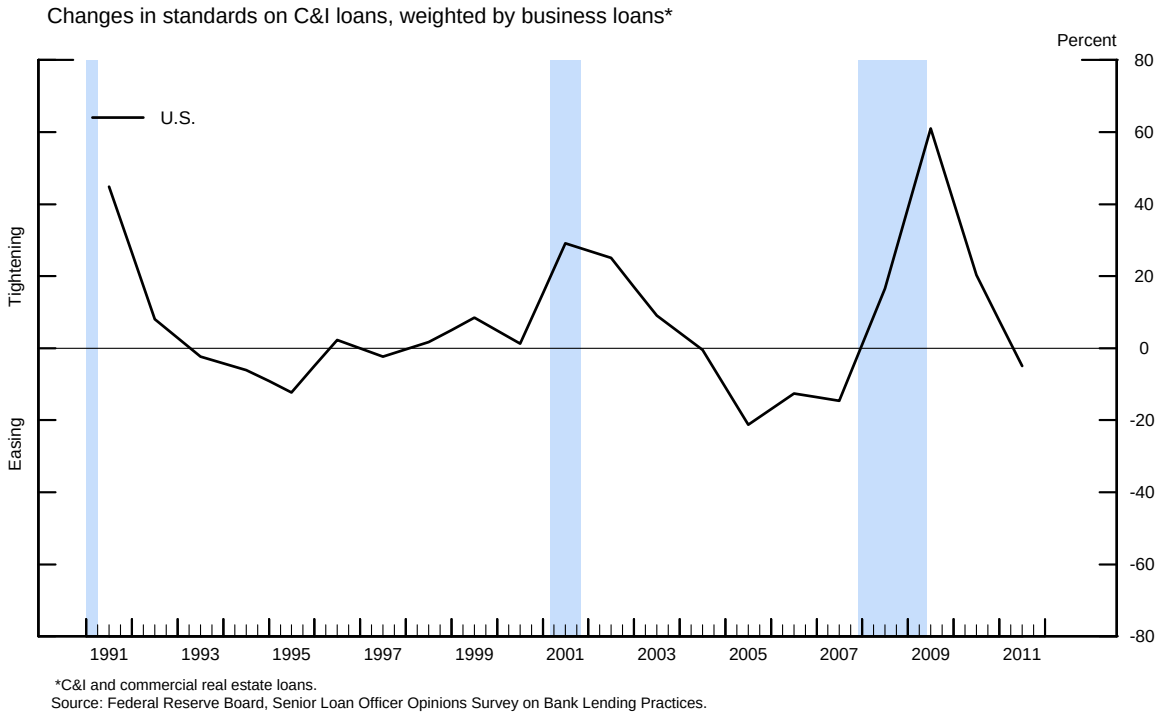
Figure 2: Deposit Share of SLOOS Respondents Across 28 States in Sample

2.3 The Quarterly Census of Employment and Wages

The Quarterly Census of Employment and Wages program publishes a quarterly count of employment and wages reported by employers covering 98 percent of U.S. jobs, available at the county, MSA, state and national levels by industry.[10] The primary economic product is the tabulation of employment and wages of establishments which report to the Unemployment Insurance (UI) programs of the U.S. Employment covered by these UI programs represents about 99.7 percent of all wage and salary civilian employment in the country. Ultimately, the QCEW data have broad economic significance for the evaluation of labor market trends and major industry developments, for time-series analyses, and for interindustry comparisons.

The QCEW data are collected on establishment basis. An establishment is an economic unit, such as a farm, mine, factory, or store that produces goods or provides services. It is typically at a single physical location and engaged in one, or predominantly one, type of economic activity for which a single industrial classification may be applied. Occasionally, a single physical location encompasses two or more distinct and significant activities. Each activity is then reported as a separate establishment, if separate records are kept, and the

[10] We draw on the Bureau of Labor Statistics materials to write parts of this section.



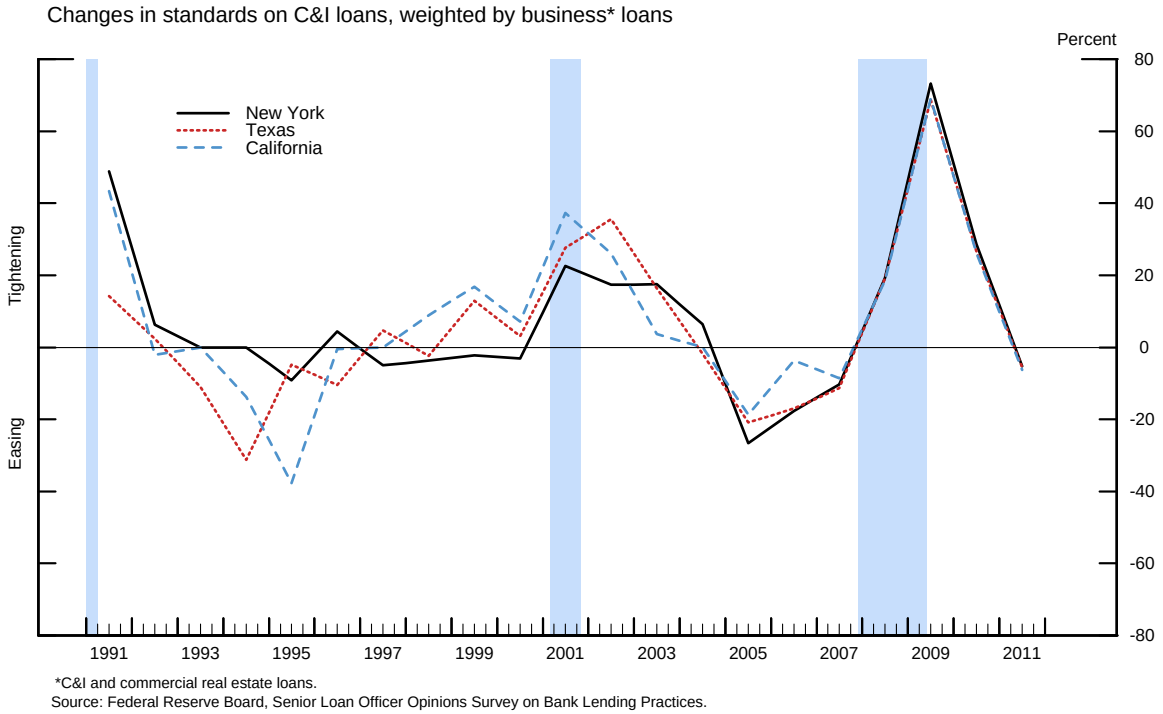
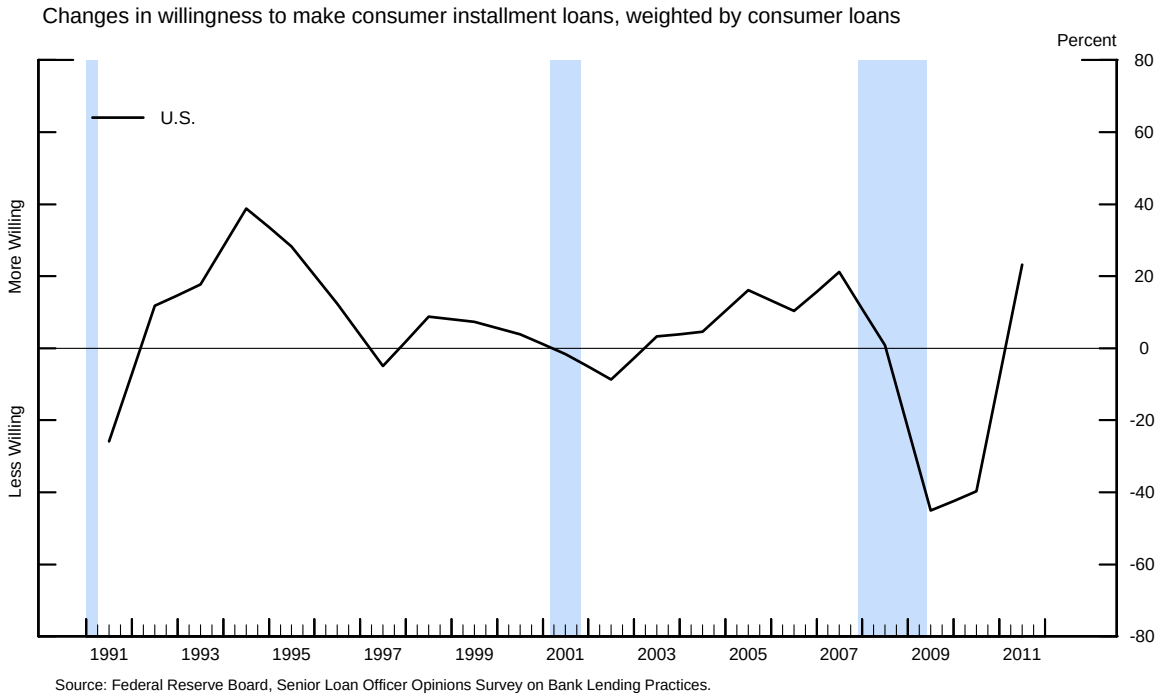


Figure 3: Changes in C&I Lending Standards



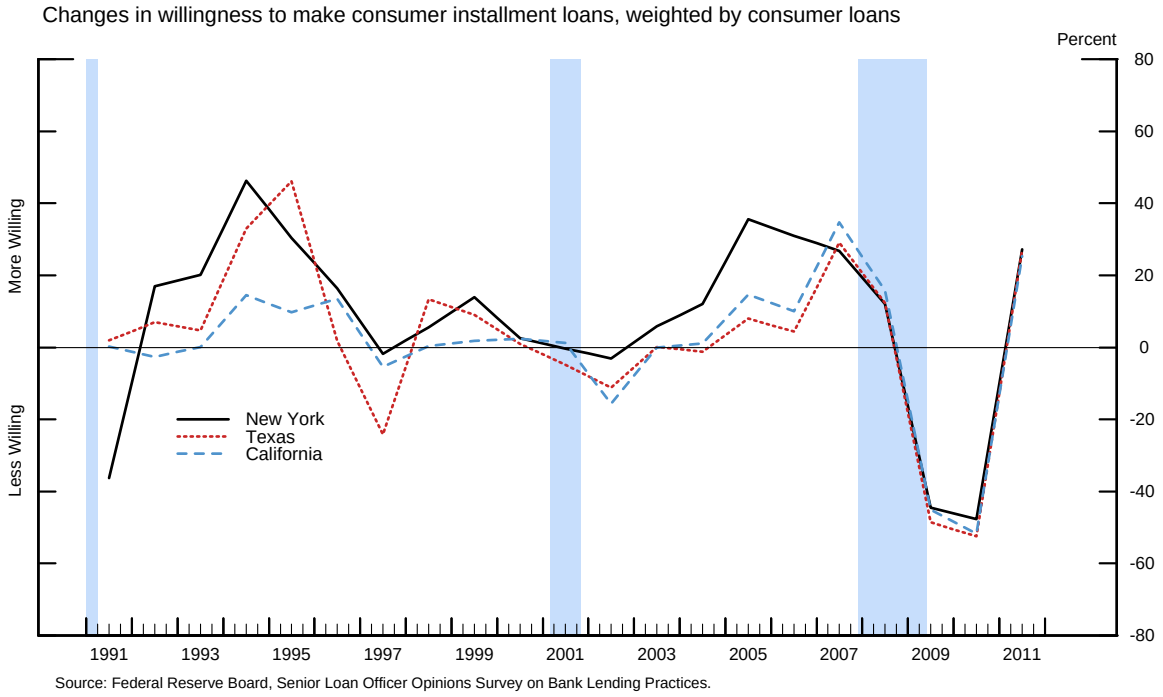


Figure 4: Changes in Willingness to Originate Consumer Installment Loans

various activities are classified under different North American Industry Classification System (NAICS) industries.[11] According the Bureau of Labor Statistics (BLS), most employers have only one establishment; thus, the establishment is the predominant reporting unit or statistical entity for reporting employment and wage data.

In accordance with BLS policy, data reported under a promise of confidentiality are not published in an identifiable way and are used only for specified statistical purposes. The BLS withholds the publication of UI-covered employment and wage data for any industry level when necessary to protect the identity of cooperating employers. Totals at the industry level for the States and the Nation include the undisclosed data suppressed within the detailed tables.

Admittedly, if someone is interested in the number of firms rather than the number of establishments or of economic activities in a given industry, then there might be some measurement error in our dependent variable induced by the fact that large firms often operate many establishments. Nevertheless, we think that the number of establishments from the QCEW ought to be highly correlated with the economic quantity (firms, net firms entry) that we are trying to observe for at least two reasons. First, the analysis of the U.S. Census Bureau's Longitudinal Business Database, suggests that most U.S. firms have only one establishment.[12] For example, Davis, Haltiwanger, Jarmin, and Miranda (2006) report that on average, each publicly traded firm operates about 90 establishments, while each privately held firm only 1.16 establishments. Note that in 1990 (2000) there were over 4.2 (4.7) million privately held firms and less than 6 (about 7.4) thousand publicly traded firms.[13] Second, earlier research, for example by Black and Strahan (2002), has shown that the rate of creation of new businesses is correlated with the share of new establishments in a local economy.

Although the QCEW data provide a wealth of disaggregate information, we limit ourselves to studying annual average employment, number of establishments, and average establishment size in privately owned firms over the 1991-2011 period at the state level.

[11] A NAICS code, based on a description provided by the employer on a questionnaire, is assigned to each establishment by the State workforce agency.

[12] The Longitudinal Business Database (LBD) covers all business establishments in the U.S. private nonfarm economy that file payroll taxes with the IRS. As such, it covers all establishments in the U.S. nonfarm business sector with at least one paid employee. In some industries, the share of multi-establishment firms is higher than in others. For example, the retail trade sector has undergone a pronounced shift away from single-unit firms to national chains.

[13] Similarly, Haltiwanger, Jarmin, and Miranda (2009) says that the LBD covers about 6 million firms and 7 million establishments in a typical year that have at least one paid employee, which implies that on average each firms operates 1.17 establishment.

2.4 External finance dependence for firms and households

We consider several channels on how bank credit might affect the non-financial employment and industry dynamics: the supply of commercial and industrial loans to firms, the supply of home equity loans to business-owners, the supply of consumer installment loans to households, and the supply of home equity loans to household-consumers. Our empirical strategy exploits differences in the degree of external finance dependence across manufacturing industries and in the sensitivity of these industries' output to changes in consumer credit.

To examine the various bank lending channel to firms or business-owners, we follow the literature in constructing a measure of dependence on external source of finance. External finance dependence (EF) is measured as the fraction of total capital expenditure not financed by internal cash flows from operations, and reflects firms' requirements for outside capital Rajan and Zingales (1998). This measure is viewed as technologically-determined characteristics of a sector which are innate to the manufacturing process and exogenous from the perspective of an individual firm.

We take the EF measure from Chor and Manova (2010), who use data on all publicly-traded firms in Compustat North America over the 1996-2005 period, which is roughly our sample period. The measure is relatively stable over time and varies more notably across industries than among firms within a given industry and, because the U.S. has one of the most advanced financial systems, likely reflects an optimal choice over external financing and asset structure of large, relatively financially unconstrained U.S. firms. Importantly, the 1996-2005 computation period pre-dates the financial crisis, so that its impact on firm behavior does not contaminate the measure. We are not interested in the exact value of the index for each industry as such; we sort industries into dependent or not dependent on external finance based on the whether a index value for a particular industry is below or above the median of -0.366. [14]

To sharpen our identification approach we consider firms' ability to pledge collateral in securing external finance if the need may be. Recall that, as suggested by the Survey of Terms of Bank Lending results, commercial and industrial loans tend to be secured by collateral other than real estate, such as equipment and machinery. To reflect this particular feature of C&I loans, we consider asset tangibility by industry. As Braun (2002) and Claessens and Laeven (2003), we reason that firms in the industries with high share of tangible assets in total book-value assets should be have easier access to external finance. Again, we are not interested in the exact value of the asset tangibility index (TA) for each industry as such; we sort industries into the industries with low tangible asset share (low

[14] The median-based approach to splitting the industries into dependent or not dependent on external sources of finance is from Cetorelli and Strahan (2006).

ability to pledge collateral for C&I loans) and high tangible asset share (high ability to pledge collateral for C&I loans) based on the whether a index value for a given industry is below or above the median of 0.289.

Finally, we can define our treatment group: these are the industries that dependent on external source of funding in Rajan and Zingales (1998) sense and have high ability to pledge collateral to secure access to C&I loans in the sense of Braun (2002) and Claessens and Laeven (2003). The first indicator tells us the need to borrow in a given industry, and the second indicator—the ability to borrow.

To examine the bank lending channel to household-consumers, we recognize that the degree of consumer reliance on bank credit for consumption of non-durable is different from that for durable goods. Consumption of durable goods is more likely to be financed with consumer installment or home equity loans (rather than paid for outright) than consumption of non-durable goods.[15] Hence, to a large extent, the producers of durable goods are at the mercy of lenders to consumers. We follow the U.S. Census Bureau's breakdown of manufacturing industries into either non-durable or durable goods producers.

Table 1 shows the breakdown of 3-digit manufacturing industries into industries dependent on external finance (EF), industries with high tangible asset shares (TA), industries producing durable goods (DG). We note that the correlation between the EF and durability numerical measures is very low, just -0.1, and the correlation between the EF and TA measures is high, about 0.68.

Having defined the control and treatment groups, we look into growth in the year-average total employment, the year-average number of establishments, and the average establishment size in each of the groups. Figures 5 to 7 plots these measures. The figures suggest that total employment and average establishment size in the treatment group are more procyclical than that in the control group. However, for the number of establishments the business cycle pattern is less clear. Over the expansionary 1990s, growth in the number of establishments in the control and treatment groups was rather similar, but prior to and during the Great Recession, the number of establishments in the treatment group exhibited somewhat higher growth rates.

2.5 State and national variables

We use the real GDP series from the Bureau of Economic Analysis and the state- and national level house price indices compiled by CoreLogic, and mortgages, home equity lines of credit and home equity loans secured by junior liens from the Federal Reserve's statistical release Z.1, and finally, state-level mortgage debt per borrower from TransUnion's Trend

[15] [For example, Mian Rao Sufi elasticities' finding...]

Table 1: Manufacturing Industry Characteristics

NAICS	Description	EF	TA	DG	Empl. Share (percent)	Output Share (percent)
311	Food Manufacturing				1.17	2.78
312	Beverage and Tobacco Product Manufacturing					
313	Textile Mills	✓			0.23	0.24
314	Textile Product Mills	✓	✓			
315	Apparel Manufacturing		✓		0.17	0.10
316	Leather and Allied Product Manufacturing		✓			
321	Wood Product Manufacturing			✓	0.36	0.40
322	Paper Manufacturing	✓			0.32	0.67
323	Printing and Related Support Activities				0.43	0.42
324	Petroleum and Coal Products Manufacturing	✓			0.08	2.31
325	Chemical Manufacturing	✓	✓		0.60	2.63
326	Plastics and Rubber Products Manufacturing	✓			0.53	0.79
327	Nonmetallic Mineral Product Manufacturing			✓	0.35	0.49
331	Primary Metal Manufacturing	✓		✓	0.32	0.98
332	Fabricated Metal Product Manufacturing		✓	✓	1.09	1.31
333	Machinery Manufacturing	✓	✓	✓	0.83	1.30
334	Computer and Electronic Product Manufacturing	✓	✓	✓	0.89	1.56
335	Electrical Equipment, Appliance, and Component	✓	✓		0.30	0.49
336	Transportation Equipment Manufacturing		✓	✓	1.19	2.93
337	Furniture and Related Product Manufacturing			✓	0.37	0.31
339	Miscellaneous Manufacturing	✓	✓	✓	0.45	0.58
31-33	Total Manufacturing				9.66	20.29

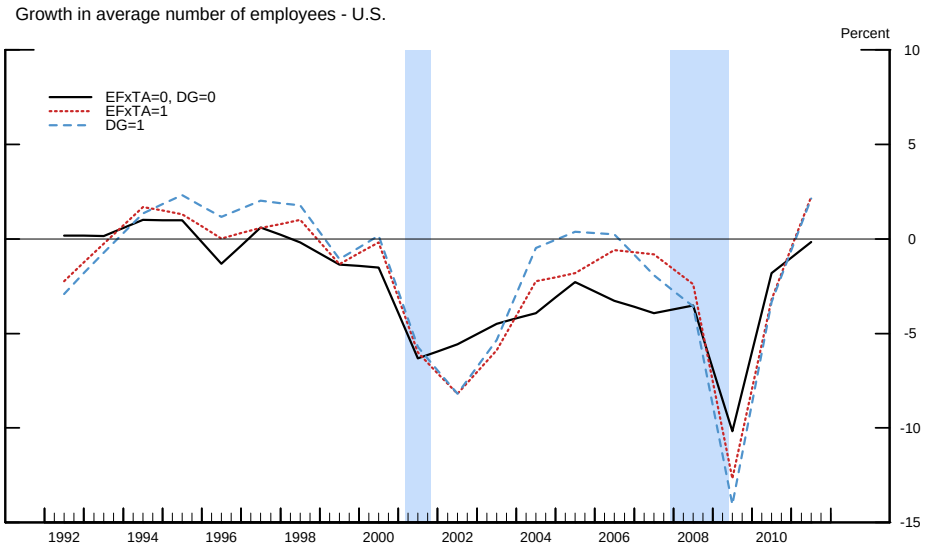


Figure 5: Growth in Employment

Data. [16] There is a notable heterogeneity across states in timing and magnitudes of prices changes. Some areas experienced strong increases in home values over the recent crisis,

[16] Trend Data is an aggregated consumer credit database that offers quarterly snapshots of randomly sampled consumers. Trend Data's time series are available from 1992Q2, which cuts the sample period in some of our regressions to the 1992-2011 period.

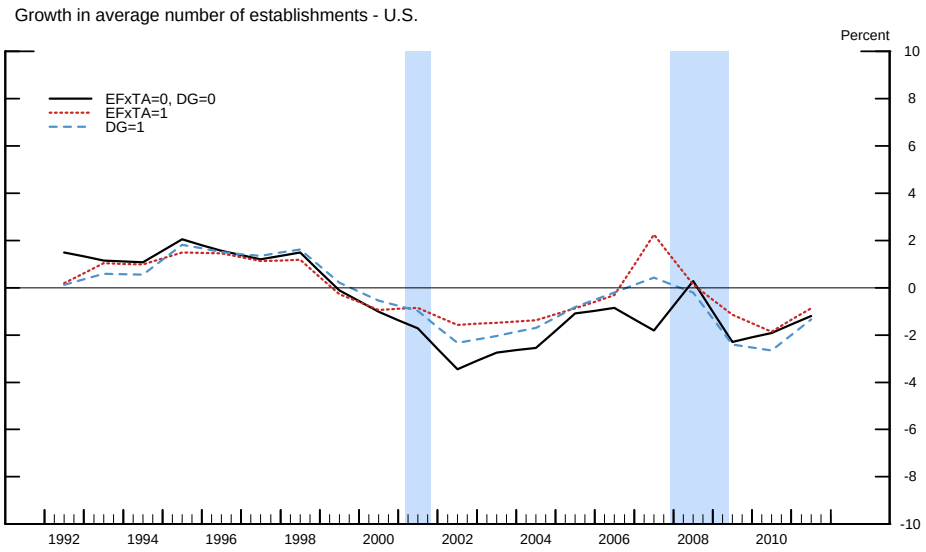


Figure 6: Growth in Number of Establishments

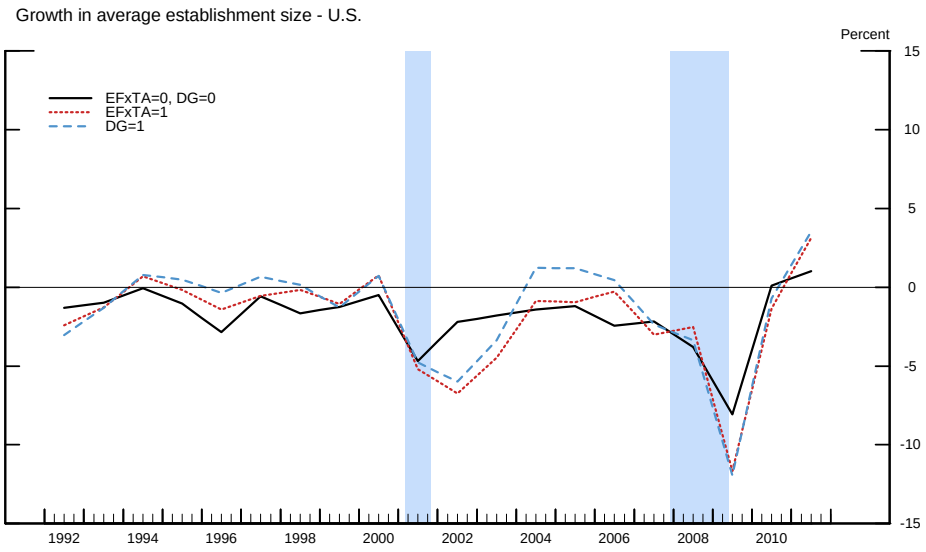


Figure 7: Growth in Average Size of Establishments

while other areas avoided the housing boom and experienced no significant house-price appreciation.

We construct our measure of home equity at the state or national level as follows. We start with the premise of Avery, Brevoort, and Samolyk (2011) that the difference between house prices and outstanding mortgage debt should approximate home equity. Since we cast our regression models in growth rates, we construct a proxy for growth rate of the

equity ratio (the inverse of the loan-to-value ratio):

$$\triangle HE_{s,t} = \triangle HP_{s,t} - \triangle MD_{s,t},$$

where $\triangle HE_{s,t}$ is the growth rate of home equity in state s at time t, $\triangle HP_{s,t}$ is the growth rate of house price (value) index in state s at time t, and $MD_{s,t}$ is the growth rate of mortgage debt in state s at time t.[17] This admittedly might be a noisy proxy for growth in the equity ratio, but we believe it is the best available state-level measure. At the national level, there are a few alternatives, all reported in the Z.1 release.[18]

Figures 8 to 11 guide through the construction of the measure $\triangle HE_{s,t}$: the first figure shows growth in house prices around the country, the second—growth rate in mortgage debt per borrower, and the third—growth in the home equity proxy.

2.6 Variation, identification, and the empirical model

We examine how credit supply conditions for both firms and households affect the non-financial industry dynamics. To isolate these effects, we exploit the variation in firm external finance dependence and asset tangibility across the manufacturing industries and the variation in consumer loan dependence across non-durable and durable goods manufacturing industries. Specifically, we examine whether changes in C&I loan lending standards by major commercial banks and in home equity extraction by potential, financially constrained entrants and whether changes in consumer installment loan lending standards by major commercial banks and home equity availability by households (a proxy for potential home equity loans) matter for the non-financial firm dynamics.[19]

Our identification assumption is that changes in major banks' lending standards, apportioned for a particular state, and home equity are exogenous to developments in a given manufacturing industry in a given state and time. In accordance with the questions in the SLOOS survey, we postulate that national banks tighten C&I lending standards broadly across the country rather than target a particular state. Variation in geographical presence of national banks and in timing of tightening generates variation of our C&I lending standards measure across states.[20]

[17] Define the equity ratio as $HE_{s,t} = HP_{s,t}/MD_{s,t}$ and after taking logs and differentiating obtain the expression in the text.

[18] CoreLogic produces another variable of interest—the share of negative home equity measures at the state level, however, the reporting began only in 2009.

[19] Since questions regarding changes in standards on credit card loans and other consumer loans were added to the SLOOS only in 1996, we proxy these changes with the changes in banks' willingness to make consumer loans, which are available over the entire sample period.

[20] Moreover, the SLOOS data suggest that C&I lending standards tightening for large or small firms is highly correlated, so that banks cut their exposure to C&I loans in general rather than target a subset of borrowers.

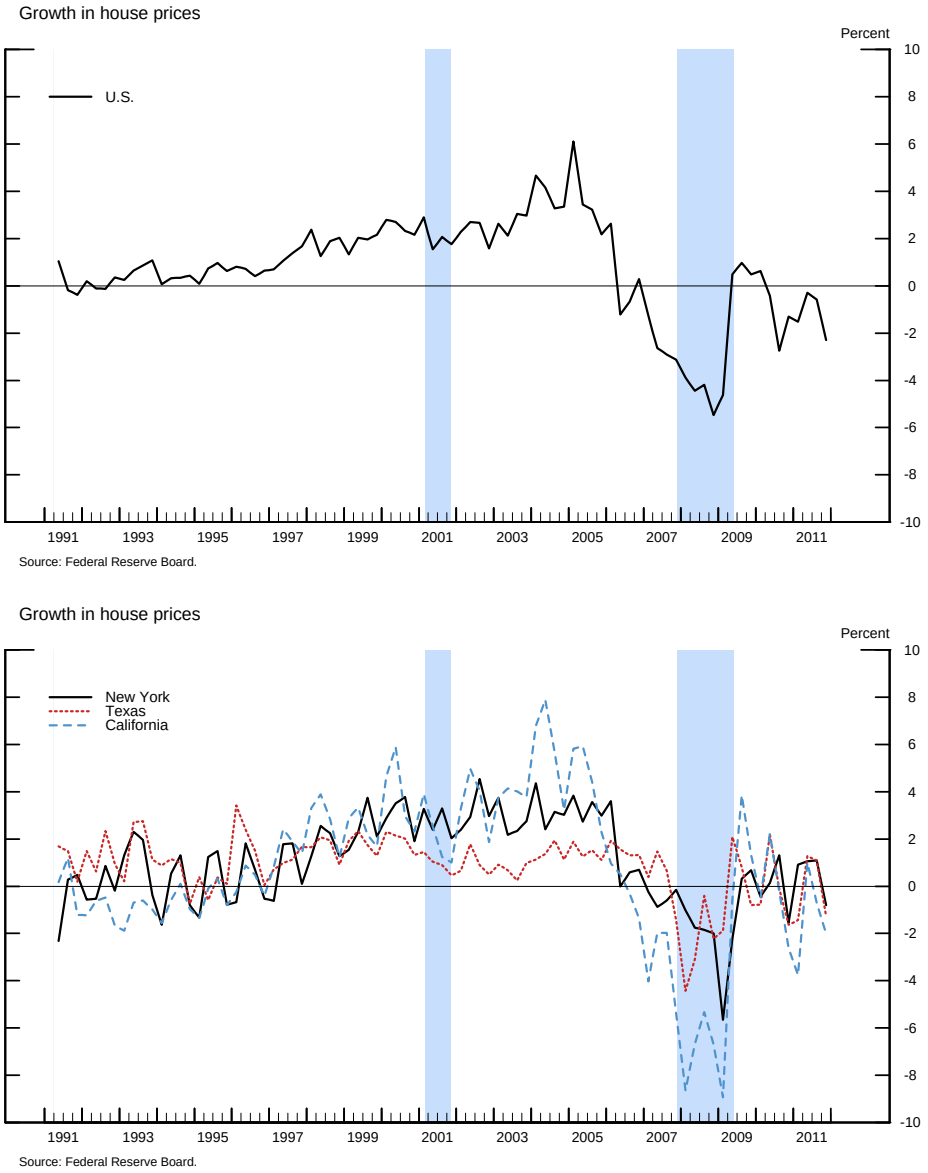


Figure 8: Growth in Home Prices

We control for omitted variable bias by comparing manufacturing industries which do or do not depend on external source of finance and do or do not have pledgeable physical assets and by comparing industries which produce non-durable or durable goods. The first comparison is an improvement on the setup that has been widely used in the literature to tease out a differential impact of credit supply changes on the external finance dependent industries, see for example, Cetorelli and Strahan (2006). The novelty here is that take into account both the need to borrow (through the EF measure) and the ability to access C&I

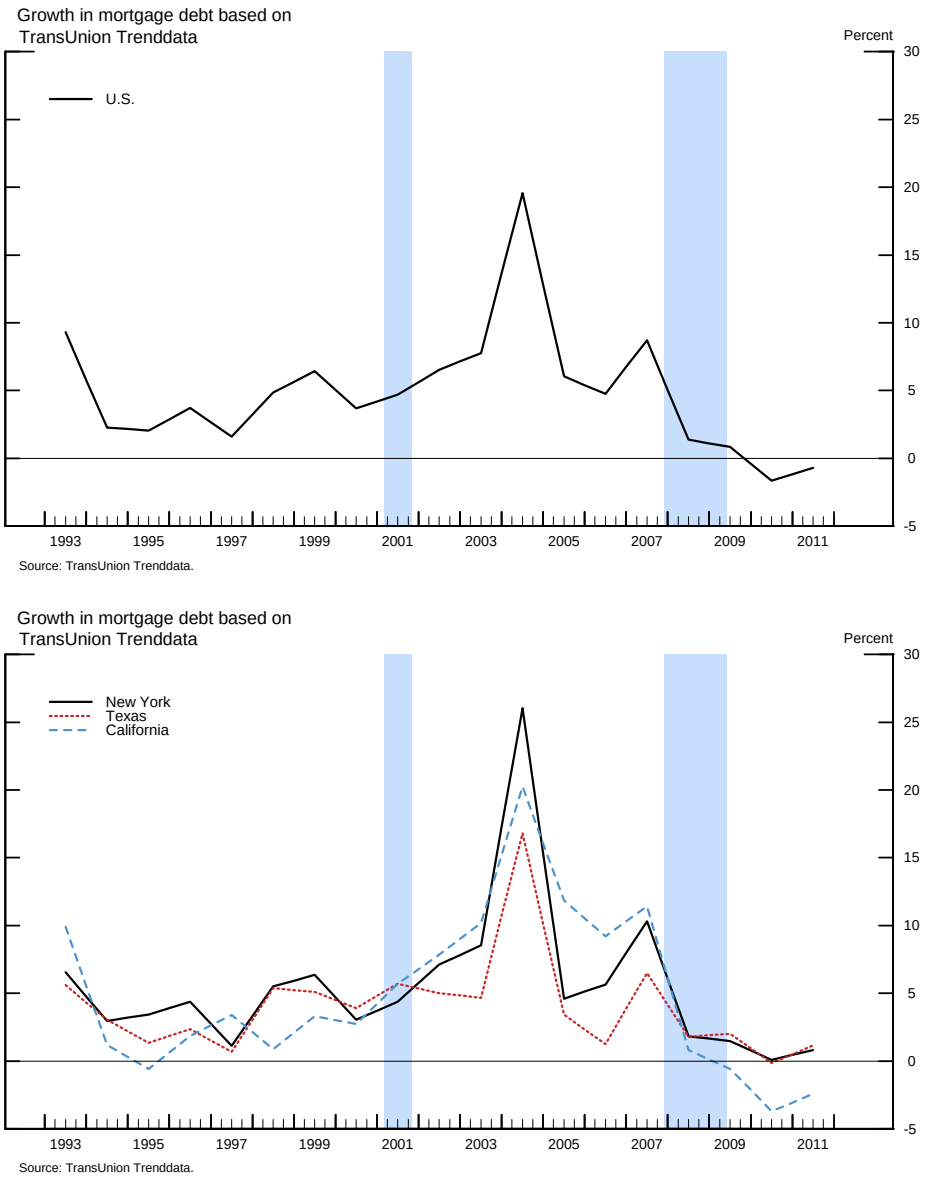


Figure 9: Growth in Mortgage Debt

loans (through the TA measure) by producers in manufacturing. The second comparison is novel and quite intuitive. Unambiguously, consumption of durable goods is more likely to be financed rather than paid for outright, hence changes in consumer access to credit, although affecting both consumption of durable and non-durable goods, is more likely to affect the consumption of the former.

Besides the omitted variables, we control for aggregate credit, national and state economic conditions. Aggregate credit conditions are proxied by the change in the realized real

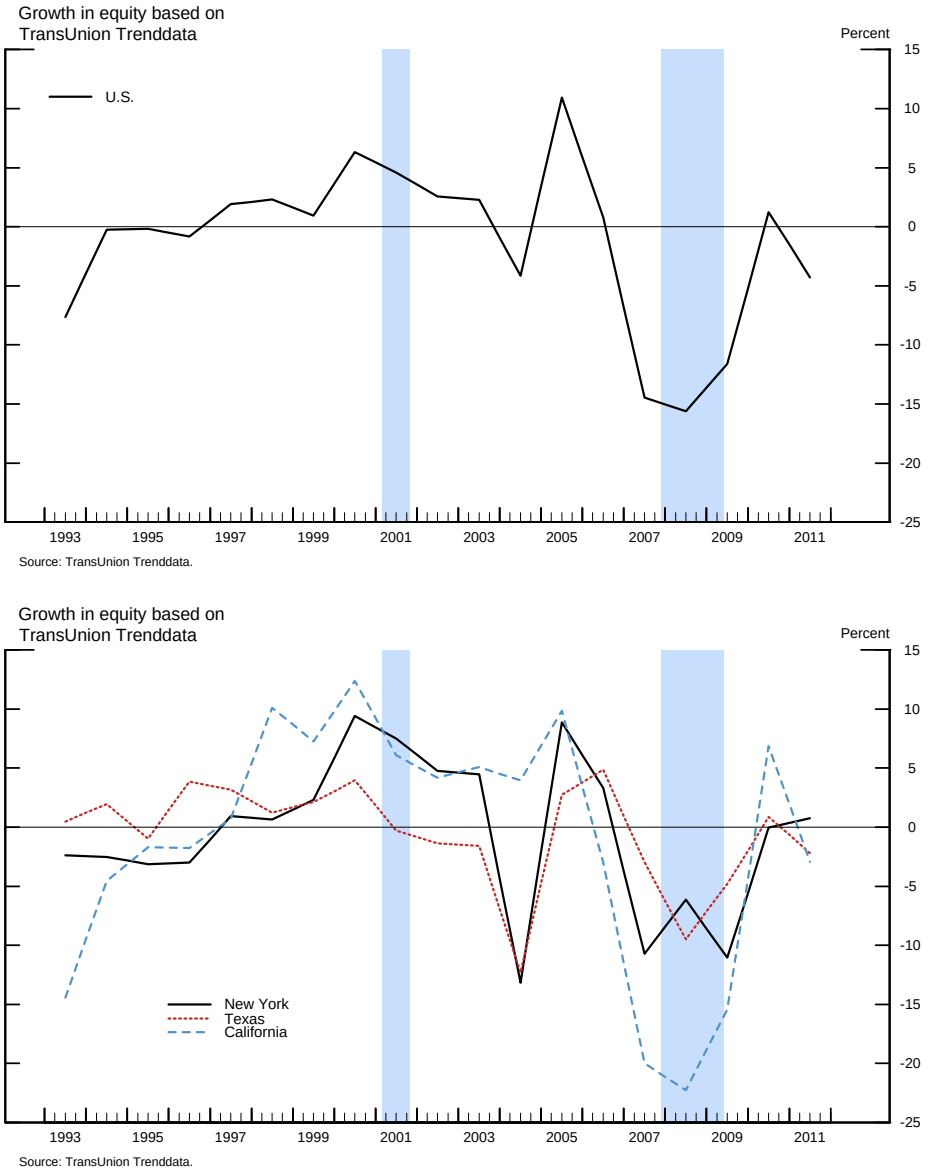


Figure 10: Growth in Home Equity

interest rate and by the spread of the primer rate (or Libor) and the 52-week (3-month) Treasury bill yield. As a proxy for state economic conditions, we include the growth rate of state level output deflated by the national GDP deflator. As a proxy for national economic conditions, we include the growth rate of U.S. real GDP. To address potential endogenous of industry location choices and state-industry specific trends, we include state-industry fixed effects into the benchmark model. To check robustness of our results and further address endogeneity concerns, we estimate additional models with time fixed effects to control for

national trends and with state-time fixed effects to control for state trends.

Given a high degree of persistence in the number of manufacturing establishments and their average size and other variables over the sample period as well as the nature of our measure of C&I and consumer installment loan lending standards, we work with an empirical model cast in growth rates; this model is stationary and allows us to control for aggregate trends. Hence, we estimate the following specification:

$$
\begin{aligned}
Y_{i,s,t} \quad = \quad & \underbrace{\beta_T EF_i \times TA_i \times T_{s,t} + \beta_H EF_i \times \triangle HE_{s,t}}_{\text{non-price factors for supply of credit to firms}} \\
& + \quad \underbrace{\gamma_W DG_i \times W_t + \gamma_H DG_i \times \triangle HE_t}_{\text{non-price factors for supply of credit to households}} \\
& + \underbrace{\delta_F EF_i \times RR_t + \theta_F EF_i \times RP_t^{STBL}}_{\text{price factors for supply of credit to firms}} \\
& + \underbrace{\delta_H DG_i \times RR_t + \theta_H DG_i \times RP_t^{AUTO}}_{\text{price factors for supply of credit to households}} \\
& + \psi_S SC_{s,t} + \psi_N NC_t + \alpha_{i,s} + \varepsilon_{i,s,t}
\end{aligned}
$$

where

- $Y_{i,s,t}$ is either the growth rate of employment, the growth rate of the number of establishments or the growth rate of the average establishment size in industry i and state s at time t;
- β_T is the coefficient of the interaction term between the indicator for External Finance dependence of industry i, EF_i, asset tangiblity, TA_i, and the net percentage of (domestic respondents) tightening standards for Commercial and Industrial loans in state s at time t, $T_{s,t}$;
- β_H is the coefficient of the interaction term between the indicator for External Finance dependence of industry i, EF_i, and the growth rate of house equity ratio in state s at time t, $\triangle HE_{s,t}$;
- γ_W is the coefficient of the interaction term between the indicator for Durable Goods output of industry i, DG_i, and the net percentage of (domestic respondents) reporting increased willingness to make consumer installment loans, $W_{s,t}$;
- γ_H is the coefficient of the interaction term between the indicator for Durable Goods output of industry i, DG_i, and the growth rate of house equity ratio in state s at time t, $\triangle HE_{s,t}$;

- δ_F and δ_H are the coefficients of the change in the realized real interest rate based on the prime rate, RR_t, interacted with whether an industry is dependent on external finance / has tangible assets and whether an industry is a durables industry, respectively;

- θ_F is the coefficient of the risk premium proxied by the change in the spread between the weighted-average C&I loan rate (from the Survey of Terms of Business Lending) and the prime rate, RP_{t-j}^{STBL}, interacted with whether an industry is dependent on external finance and has tangible assets;

- θ_H is the coefficient of the risk premium proxied by the change in the spread between the average new auto loan rate (from the G.19 Statistical Release) and the prime rate, RP_{t-j}^{AUTO}, interacted with whether an industry is a durable goods industry;

- ψ_S and ψ_N are the coefficient of the state and national economic conditions (business cycle) variables, captured by $SC_{s,t}$ and $NC_{s,t}$, respectively, which include $T_{s,t}$, $W_{s,t}$, $\triangle HE_{s,t}$, GDP measures, and all the interest rate variables, proxying for credit conditions;

- $\alpha_{i,s}$ is the coefficient for the industry-state fixed effect and finally $\varepsilon_{i,s,t}$ is the error term robust to heteroskedasticity (the combination of fixed effects and clustering varies across specifications).

We compute errors clustered in several ways: by industry×state also by and industry×state and by time. The multiple clustered errors are calculated using Cameron, Gelbach, and Miller (2011) code.

2.7 Sample selection and representativeness

The sample appears to be representative of the population of manufacturing industries. We checked the data breakdown by employment, number of establishments, and average establishment size for two years, 2007 and 2010. The population measures are shown in Table 2. In percentage terms, the breakdown of employment and number of establishments in our sample is very similar to that in the population, and the average establishment size in the sample is near identical to that in the population.

3 Results

We present our empirical results in Tables 3 to 5. Recall that we examine how credit supply conditions for both firms and households affect the manufacturing industry employment. To isolate these effects, we exploit the variation in firm external finance dependence

Table 2: Manufacturing Industry Breakdown

Total employment

2007				2010			
	EF×TA=0	EF×TA=1			EF×TA=0	EF×TA=1	
DG=0	4,881,030	158,879	5,039,909	DG=0	4,322,721	119,145	4,441,866
DG=1	7,252,569	1,521,680	8,774,249	DG=1	5,755,652	1,283,475	7,039,127
	12,133,599	1,680,559	13,814,158		10,078,373	1,402,620	11,480,993

Number of establishments

2007				2010			
	EF×TA=0	EF×TA=1			EF×TA=0	EF×TA=1	
DG=0	122,247	8,135	130,382	DG=0	116,121	7528	123,649
DG=1	185,384	45,792	231,175	DG=1	174,625	44,501	216,126
	307,631	53,927	361,558		290,746	52,029	342,775

Average size of establishments (in employees)

2007				2010			
	EF×TA=0	EF×TA=1			EF×TA=0	EF×TA=1	
DG=0	40	20	39	DG=0	37	16	36
DG=1	39	33	38	DG=1	33	29	32
	39	31	38		35	27	33

across all manufacturing industries (to identify supply of credit to firms) and the sensitivity of the manufacturing industries' output to changes in consumer credit (to identify supply of credit to households). Specifically, we examine whether changes in C&I loan lending standards by major commercial banks ("the tightness") and in home equity extraction by potential, financially constrained entrepreneurs/ potential entrants ("the equity extraction by entrants") and whether changes in consumer installment loan lending standards by major commercial banks ("the willingness") and home equity extraction by households ("the equity extraction by households") matter for the non-financial employment and firm dynamics. We are interested in examining whether credit supply conditions affect employment in manufacturing on the extensive or intensive margins. Hence, we estimate two sets of models: one for the number of manufacturing establishments and another for the average establishment size.

Table 3 shows regression results for the models for the number of establishments. Each model has a different specification of fixed effects and error clustering. Generally, if the model includes time fixed effects we do not include macroeconomic variables such as real GDP growth, since they are collinear with the time dummies (Thompson, 2011). We generally find that coefficients on the lag dependent variables are small and statistically insignificant hence validating our choice of looking at growth regressions; we do not report

the regression results for the models with the lag dependent variables. For credit supply to firms, the results show that the tightness does not appear to have a statistically significant effect. As for credit supply to households, the results show that a percentage point increase in the willingness increases growth of the number of establishment in the industries producing durable goods by 0.02 percent. However, home equity extraction by households for durable goods consumption and credit conditions, proxied by the changes in various interest rate variables do not appear to have a statistically signficant effect on the growth in the number of establishments.

The finding that supply of bank credit to firms have little effect on the number of establishments appears to be consistent with a few literature strands. First, for the the larger and more mature firms, consistent with the "exporter hysterisis" international trade literature, we conjecture that following a tightening of access to credit, the sunk cost aspect of the firm entry decision in the presence of fixed per period costs to maintain that sunk asset leads firms to continue serving the market, despite unfavorable economic (weak demand for output) or financial (costly and limited access to external finance) conditions, but perhaps at a smaller scale requiring less employees.[21] Second, at the other extreme, for smaller firms, consistent with the literature on lending relationships as in Berger and Udell (1994) and Petersen and Rajan (1994), nascent firms may depend less on bank loans than older firms. In addition, setting up a firm may not be that costly. For example, according to Djankov, Porta, Lopez-De-Silanes, and Shleifer (2002), entrepreneurs average cost of starting a firm (including the time to start up a firm) was 1.7 percent of per-capita income in the United States in 1999, or $520. Likewise, layoffs by firms that are induced by stricter lending standards may spur some creation of establishments, which may boost the number of establishments in times of distress. Aaronson, Rissman, and Sullivan (2004), for example, document the increase in the number of firms, which was accompanied by a fall in employment at the aggregate level.

Table 4 shows regression results for the models for the average establishment size. For credit supply to firms, the results show that a percentage point increase in the tightness reduces growth of the average size of the establishments with high share of tangible assets and dependent on external finance by 0.03 percent. For credit supply to households, the results show that a percentage point increase in the willingness increases growth of the average establishment size in the industries producing durable goods by 0.03 percent as well. In addition, a one percentage point increase in home equity—a measure of potential home equity extraction by households—boost growth of the average size by 0.11 percent. To judge the magnitude of these marginal effects, consider the impact of real GDP, a proxy

[21] Notable papers in the literature are Baldwin (1998), Baldwin and Krugman (1989), Dixit (1989a), Dixit (1989b), and Alessandria and Choi (2007).

for the broad economic environment, not shown, on both growth of the average size—the GDP impact is of an order of magnitude larger. However, risk premiums for consumer loans do seem to have a large impact on the average size of firms in the durables goods sector - A one percentage point increase in the risk premium leads to a one percent decline in the average size of firms.

Table 5 shows regression results for the models for the total employment in manufacturing as a sanity check. Given that the growth rate of total employment is just a sum of the growth rates of the number of establishments and the average establishment size, the regression coefficients are nearly exact sums of the corresponding coefficients in tables 3 and 4. For credit supply to firms, the results show that a percentage point increase in the tightness reduces growth of the average size of the establishments with high share of tangible assets and dependent on external finance by 0.02 percent. Note, however, that this regression coefficient is not statistically significant at conventional levels in the regressions with double-clustered errors. For credit supply to households, the results show that a percentage point increase in the willingness increases growth of the average establishment size in the industries producing durable goods by 0.05 percent. In addition, a one percentage point increase in home equity—a measure of potential home equity extraction by households—boost growth of the average size by 0.14 percent. Finally a one percentage point increase in the risk premium on consumer installment loans leads to a 0.9 percent decrease in durable-goods industries.

3.1 Robustness checks [to be expanded]

We conduct several robustness checks. Our results are robust to exclusion of the growth rate of real GDP, different home equity ratio definitions, inclusion of lagged dependent variables, different error clustering assumptions. In addition, our results are robust to using the levels of the interest rate variables and also to different definitions of risk premia. Furthermore, we also use alternative measures of the tightness and the willingness and find no material changes in our results: we experiment with different weights in construction of the tightness and willingness measures, with classification of responses from the SLOOS, and with the threshold for cumulative shares of deposits in every year of our sample for a given state. Our results also still hold when we exclude "bank-friendly" states, such as Delaware and South Dakota, and large states, such as California, New York, and Texas, from our sample.

We check whether our results will survive with inclusion of energy prices and the U.S. dollar real exchange rate as additional explanatory variables. Our results for the credit channels remain unaffected and both of these variables' coefficients tend be statistically significant and of expected sign. Hence, we provide some evidence for the international

Table 3: Number of Establishments Regression Results

Model	1	2	3
EF x TA x state C&I loan tightness (T_s)	0.01	0.01	0.01
	1.03	0.63	1.06
EF x state home equity (HE_s)	-0.03*	-0.03	-0.03*
	-1.69	-0.73	-1.68
DG x national cons. inst. loan willingness (W)	0.02***	0.02*	0.02***
	2.77	1.74	2.77
DG x national home equity (HE)	0.05	0.05	0.05
	1.58	0.81	1.57
EF x TA x real interest rate (RR)	-0.05	-0.05	-0.05
	-0.57	-0.44	-0.56
EF x TA x risk premium (RP)	-0.34	-0.32	-0.32
	-0.32	-0.24	-0.31
DG x real interest rate (RR)	-0.06	-0.06	-0.05
	-0.63	-0.34	-0.61
DG x risk premium (RP)	0.16	0.16	0.16
	0.89	0.59	0.89
Additional controls	National/state vars.	National/state vars.	State vars.
Fixed Effects	Ind. x State	Ind. x State	Ind. x State Year
Error clustering	Ind. x State	Ind. x State Year	Ind. x State
R-square	0.04	0.16	0.07
Observ.	9500	9500	9500

Note: EF denotes industries dependent on external finance, TA denotes industries with relatively high asset tangibility, DG denotes durable-goods industries. Additional controls include changes in C&I lending standards and willingness to originate consumer installment loans, in addition to growth in home equity and changes in various interest rate varaibles, uninteracted with any other variables. Coefficients are reported with * if significant at the 10% level, ** at the 5% level, and *** at the 1% level. t-statistics are reported below the coefficients.

slippage: some of the adverse effects on the overall employment were less pronounced in some export-oriented manufacturing industries.

3.2 Gross industry output regressions [to be expanded]

In addition to the number of establishment and average establishment size regression models, we also estimate a gross industry output model...

4 Economic significance and macro effects of changes in lending standards

4.1 The effects of changes in lending standards

The economic significance of our results can be quantified by at looking the combined marginal effect of tightening in C&I lending standards and weakening in willingness to originate consumer installment loans over the Great Recession and the subsequent slow

Table 4: Average Size of Establishments Regression Results

Model	1	2	3
EF x TA x state C&I loan tightness (T_s)	-0.03**	-0.03*	-0.03**
	-2.26	-1.87	-2.22
EF x state home equity (HE_s)	-0.03	-0.03	-0.03
	-0.92	-0.67	-0.90
DG x national cons. inst. loan willingness (W)	0.03***	0.03**	0.03***
	3.97	2.30	3.97
DG x national home equity (HE)	0.11***	0.11	0.11***
	2.78	1.60	2.78
EF x TA x real interest rate (RR)	-0.16	-0.16	-0.16
	-1.41	-0.84	-1.40
EF x TA x risk premium (RP)	0.48	0.49	0.43
	0.32	0.28	0.29
DG x real interest rate (RR)	-0.19	-0.19	-0.18
	-1.44	-0.66	-1.43
DG x risk premium (RP)	-1.06***	-1.06**	-1.06***
	-4.10	-2.26	-4.11
Additional controls	National/state vars.	National/state vars.	State vars.
Fixed Effects	Ind. x State	Ind. x State	Ind. x State Year
Error clustering	Ind. x State	Ind. x State Year	Ind. x State
R-square	0.12	0.17	0.13
Observ.	9500	9500	9500

Note: EF denotes industries dependent on external finance, TA denotes industries with relatively high asset tangibility, DG denotes durable-goods industries. Additional controls include changes in C&I lending standards and willingness to originate consumer installment loans, in addition to growth in home equity and changes in various interest rate varaibles, uninteracted with any other variables. Coefficients are reported with * if significant at the 10% level, ** at the 5% level, and *** at the 1% level. t-statistics are reported below the coefficients.

recovery. The marginal effects of a one percentage point increase (decrease) in the tightening (the willingness) are directly inferred from Tables 3 to 4. The changes in the tightness and the willingness are inferred from Figures 3 and 4. These figures suggest a 98 percentage point increase in the tightness and a 82 percentage point decrease in the willingness between 2007 and early 2010.

For the entire U.S. economy (rather than the sample used in estimation), the pre-crisis breakdown of employment, number of establishments, and average establishment size by industry type is shown in Figure 2. The treatment group of industries with high share of tangible assets and dependent on external source of finance (EFxTA=1) is small (in terms of total employment or number of establishments) and has notably smaller average establishments than the control group. In contrast, the treatment group of industries producing durable goods (DG=1) is large and its average establishments are similar in size to that in the control group. The post-crisis breakdown of employment, number of establishments, and average establishment size by industry type is shown in Table 2 as well. After the Great Recession, employment, number of establishments, and average establishment size declined.

Table 5: Total Employment Regression Results

Model	1	2	3
EF x TA x state C&I loan tightness (T_s)	-0.02*	-0.02	-0.02*
	-1.74	-1.25	-1.71
EF x state home equity (HE_s)	-0.06*	-0.06	-0.06*
	-1.96	-1.29	-1.94
DG x national cons. inst. loan willingness (W)	0.05***	0.05***	0.05***
	5.47	2.96	5.49
DG x national home equity (HE)	0.14***	0.14***	0.14***
	4.46	2.79	4.46
EF x TA x real interest rate (RR)	-0.21**	-0.22	-0.21**
	-2.13	-1.55	-2.13
EF x TA x risk premium (RP)	0.18	0.20	0.14
	0.13	0.11	0.10
DG x real interest rate (RR)	-0.23*	-0.23	-0.23*
	-1.92	-0.72	-1.89
DG x risk premium (RP)	-0.91***	-0.91*	-0.91***
	-3.58	-1.95	-3.60
Additional controls	National/state vars.	National/state vars.	State vars.
Fixed Effects	Ind. x State	Ind. x State	Ind. x State Year
Error clustering	Ind. x State	Ind. x State Year	Ind. x State
R-square	0.18	0.29	0.22
Observ.	9500	9500	9500

Note: EF denotes industries dependent on external finance, TA denotes industries with relatively high asset tangibility, DG denotes durable-goods industries. Additional controls include changes in C&I lending standards and willingness to originate consumer installment loans, in addition to growth in home equity and changes in various interest rate varaibles, uninteracted with any other variables. Coefficients are reported with * if significant at the 10% level, ** at the 5% level, and *** at the 1% level. t-statistics are reported below the coefficients.

With the estimates of the marginal effects in hand, we perform back-of-the-envelope calculations of the impact of the 98 percentage point increase in the tightness and the 82 percentage point decrease in the willingness between 2007 and early 2010. (That is, we assume about 33 percent of banks tightened C&I loan standards per year and about 27 percent of banks decreased willingness to originate consumer installment loans per year.) For the industries with high tangible asset shares that dependent on external source of funding and produce durable goods (DG=1 and (EFxTA=1)), the percentage reduction in the average establishment size is the largest, followed by the industries that do not depend on external source of funding and produce non-durable goods (DG=0 and (EFxTA=1)). The impact on the average establishment size in the industries with high share of tangible assets that depend on external source of funding and produce non-durable goods (DG=1 and (EFxTA=0)) was rather light. Our identification scheme does not allow to evaluate direct effects on the industries that do not depend on external source of funding and do not produce durable goods (DG=0 and (EFxTA=0)). As for the impact on the number of establishment, it appears that only the "credit-supply-to-households" channel is at work. (Of course, the

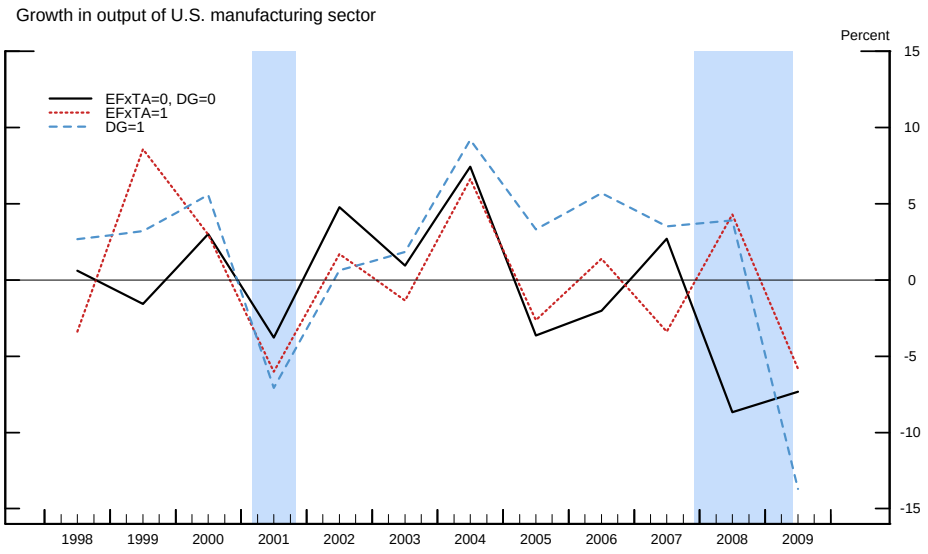


Figure 11: Industry gross output

identification scheme is geared towards the DG=1 and (EFxTA=1) industries, so it should not be surprising that our model does the best in explaining in these particular industries.)

Table 6 summarizes the impact estimates in levels. The knock-off growth effects can be easily mapped into the level effects of the number of establishments, the number of employed, and the total employment. The results in Table 6 suggest that the number of worker displaced in the industries with high tangible asset shares and dependent on external finance and producing durable goods is predicted to be around 92 thousand or about 6 percent of the employment in these industries in the base year, while that number in the industries dependent on external finance but producing non-durable goods is about 4.7 thousand (about 3 percent of the corresponding employment in 2007) and in the industries not dependent on external finance but producing durable goods is roughly 294 thousand (4 percent of the corresponding employment). Again, our identification scheme does not inform on the impact of the tightening of lending standards on the industries not dependent on external finance and producing non-durable goods.

Our best shot is at predicting employment changes for the industries with high share of tangible assets and dependent on external finance and producing durable goods. In deed, as the table shows, we have the highest "goodness of fit" for that category—about 39 percent. Generally, though, our calculations tend to have much lower goodness of fit.

Table 6: Back-of-the Envelope Macro Effects

Actual changes in employment in manufacturing (2007-10)

Employees	$EFxTA = 0$	$EFxTA = 1$	
$DG = 0$	-558,309	-39,734	-598,043
$DG = 1$	-1,496,917	-238,205	-1,735,122
	-2,055,226	-277,939	-2,333,165

Predicted changes in employment in manufacturing (2007-10)

Employees	$EFxTA = 0$	$EFxTA = 1$	
$DG = 0$	0	-4,719	-4,719
$DG = 1$	-293,729	-91,757	-385,486
	-293,729	-96,476	-390,205

"Goodness of fit" (actual change/predicted change)

Percent	$EFxTA = 0$	$EFxTA = 1$	
$DG = 0$	0.0	11.9	0.8
$DG = 1$	19.6	38.5	22.2
	14.3	34.7	16.7

Note: Home equity declining, on average, about 6% during this period, can explain an additional 10% of decline in employment in the durables industries.

4.2 The effects of home equity extraction

It should be noted though that we used only two variables—the tightness and the willingness—to explain changes in employment at both the extensive and intensive margins. When it comes to the industries producing durable goods, our regression results suggest that there is an additional channel at work—home equity extraction by households for consuming durable goods. As figure 11 suggests, the home equity proxy declined, on average, about 6 percent during the 2007-2010 period. Performing similar calculations to that above, we conclude that the reduction in home equity extraction explains an additional 10 percent of decline in employment in the durable goods industries, on average.

4.3 Generalization of the back-of-the-envelope exercise to the entire economy

In contrast to some related studies, we prefer to err on the conservative side in generalizing the back-of-the-envelope excercises. In particular, we are cautious in distinguishing worker displacement from job losses in the macroeconomic context and about generalizing our results to the entire economy. By concentrating on the manufacturing industries alone, we do not consider how many of the displaced employees might have been absorbed by other industries in the economy—the industries that do not depend on external source of finance or produce non-durable goods. Moreover, we do not control for the international slippage explicitly in our benchmark regressions. Some of the adverse effects on the overall employment may be less pronounced as the manufacturing industries might have taken an

advantage of the weak U.S. dollar and ramp up exports to the regions relatively unaffected by the financial crisis and recession. Indeed, one of our robustness check regressions suggests just that.

4.4 Prospects of the economic recovery

Our estimate of the impact of lending standards and house prices on the manufacturing industries may also have implications for the recovery in the labor market going forward. To some extent, the tightening of lending standards reflects commercial banks intent to preserving risk-weighted capital. By changing the composition of their balance sheet from lending towards U.S. Treasury securities, commercial banks might improve their risk-weighted capital ratios noticeably. So, the greater anticipated regulatory burden faced by commercial banks may temporarily hold back employment growth in manufacturing industries dependent on external finance (and/or producing durable goods), thus contributing to weak labor-market conditions. Moreover, the sluggish housing market improvement might be a further drag on the employment in the manufacturing industries. In the longer term, the displaced workers in these industries will likely be absorbed by other sectors in the economy as our results do not suggest permanent impediments to growth. The policy prescription that follows from our back-of-the-envelope exercises is that policy makers should mostly focus on restoring functioning of household credit supply channels rather than that for firm credit supply channels for boosting employment in manufacturing.

5 Conclusion

We examine how credit supply conditions for both firms and households affect the non-financial industry dynamics and employment. To isolate these effects, we exploit variation in lending standards and house prices across U.S. states and time. To control for omitted variable bias, we rely on differences in the degree of external finance dependence across manufacturing industries and in the sensitivity of these industries' output to changes in consumer credit. We show that changes in commercial and industrial loan and consumer installment loan lending standards by major commercial banks and home equity extraction by households affect notably the non-financial firm dynamics and employment over the 1991-2011 period. In conclusion, our results highlight the adverse effects that tightening access to credit and falling house prices over the Great Recession had on firms and employment in manufacturing industries.

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