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Burcu Duygan-Bump
Federal Reserve Bank of Boston

Alexey Levkov
Federal Reserve Bank of Boston

Judit Montoriol-Garriga
Federal Reserve Bank of Boston

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Financing Constraints and Unemployment: Evidence from the Great Recession*

Burcu Duygan-Bump, Alexey Levkov, and Judit Montoriol-Garriga

Federal Reserve Bank of Boston

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This paper exploits the differential financing needs across industrial sectors and provides strong empirical evidence that financing constraints of small businesses are important in explaining the unemployment dynamics around the Great Recession. In particular, we show that workers in small firms are more likely to become unemployed during the 2007-2009 financial crisis if they work in industries with high external financing needs. According to our estimates, eliminating financial constraints of small firms could add up to 850,000 jobs to the economy. We suggest that policies aimed at making credit available to small businesses would significantly help stabilize the labor markets and economic activity in the U.S.

JEL Classification: E32, G21, J63

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I. INTRODUCTION

Lending to small businesses in the United States has fallen dramatically since the onset of the Great Recession. According to the most recent data, small business loans made by commercial banks declined by over \$40 billion between the second quarter of 2008 and the second quarter of 2010 (Table 1). Similarly, the responses to the Federal Reserve’s Senior Loan Officer Opinion Survey on Bank Lending Practices indicate that banks have significantly tightened credit standards on Commercial and Industrial loans to small firms in thirteen consecutive quarters (2007:Q1 to 2010:Q1).¹

The decline in small business lending has received much attention from policy makers and the media, especially because of its potential link to the high rate of unemployment. Indeed, almost 80% of all firms in the U.S. have fewer than nine employees, and small firms employ roughly 50% of all Americans.² Unlike larger firms, which have broader access to capital markets, small businesses are highly dependent on bank financing for their initial establishment and subsequent growth.³ Accordingly, smaller firms are likely to have been impacted disproportionately when banks restricted credit following the shocks to their balance sheets.

In this paper we investigate the link between small business lending and unemployment during the Great Recession. If the reduction in small business lending affects unemployment, then we expect unemployment to rise more in smaller firms, but only for firms that depend on bank financing. We test our hypothesis by exploiting variation across firm size and external financial dependence following the pioneering work of Rajan and Zingales [1998]. Specifically, we combine information on workers’ firm size and unemployment status from the Current Population Survey with firms’ financial information from Compustat, and construct measures of

1. Small business lending figures are from Consolidated Reports of Condition and Income, where small business loans are defined as loans with original amounts of \$1 million or less. The responses to the Senior Loan Officer Opinion Survey on Bank Lending Practices are from Figure 1 in the July 2010 report. This report is available online at the Board of Governors website.

2. See the speech by Federal Reserve Chairman Bernanke on July 12, 2010 in Washington, D.C. and U.S. Census Bureau, Statistics of U.S. Businesses for 2007.

3. For example, Cole, Wolken and Woodburn [1996] document that banking institutions provide above 60 percent of the dollar value of credit to small businesses.

external financial dependence for industrial sectors. We then estimate changes in unemployment during the recent financial crisis by firm size and across industrial sectors with different degrees of financial need. This approach is a triple difference-in-differences methodology which exploits variation across time, firm size, and firms' financing needs. The third difference is especially useful because it helps isolate factors that affect unemployment differentially by firm size. It is possible, for example, that the reduction in the demand for goods and services during the recession fell disproportionately on small firms and therefore affected their unemployment level more than in large firms. Our estimates difference-out this potential effect.

We find that during the Great Recession individuals are more likely to become unemployed if they work in sectors with high external financial dependence. In these sectors the impact of the recession on unemployment is stronger for smaller firms. By contrast, we do not find significant differences in unemployment propensity between small and large firms in sectors with low external financial dependence. These results indicate that the reduction in bank lending to financially constrained firms during the recent financial crisis is associated with increased layoffs of workers. The findings are robust to the different measures of external financial dependence.

One potential criticism of our findings is that changes in unemployment are not driven by the supply of credit, but rather reflect a disproportional reduction in the demand for goods and services produced by finance-dependent sectors. To address the difficult question of the role of the credit supply shock above and beyond the role of changes in the demand for bank loans, we repeat our analyses using data around the 2001 recession. We exploit the fact that the 2001 recession did not originate in banks' balance sheets. The resulting estimates show almost identical changes in unemployment among small and large firms in industries with both high and low external financial dependence. The findings highlight the importance of banks' financial health for credit availability and their impact on the macroeconomy, along the lines of Bernanke and Blinder [1988], Holmstrom and Tirole [1997], Peek and Rosengren [2000], and most recently Ivashina and Scharfstein [2010].

Our findings are consistent with the vast literature that highlights the role of financial markets in shaping economic growth and in particular with papers that

analyze the mechanisms through which finance affects real economic activity. Examples include Demirgüç-Kunt and Maksimovic [1998], Jayaratne and Strahan [1996], King and Levine [1993], Levine and Zervos [1998], Rajan and Zingales [1998], Guiso, Sapienza and Zingales [2004], and Cetorelli and Strahan [2006]. Similarly, recent empirical evidence strongly suggests that during recessions industries with higher external financial dependence are hit harder in terms of production growth (Braun and Larrain [2005]), value added (Kroszner, Laeven and Klingebiel [2007]), capital formation, and number of establishments (Dell’Ariccia, Detragiache and Rajan [2008]). A recent study of 1,050 Chief Financial Officers conducted by Campello, Graham and Harvey [2010] indicates that financially constrained firms planned deeper cuts in employment in the midst of the recent financial crisis. The paper’s key contribution is to emphasize the channels underlying the important role of finance in real economic activity, as we show that small businesses have been laying off workers in the current recession due to credit constraints.

Our results are also relevant to the literature that focuses on the role of small businesses in job creation and labor markets more generally. The academic literature in this area, however, has mixed findings. Haltiwanger, Jarmin and Miranda [2010], for example, show that small firms do not create jobs faster once firm age is accounted for. On the other hand, Neumark, Wall and Zhang [2010] find an inverse relationship between net growth rates and firm size, though not in the manufacturing sector. Similarly, Moscarini and Postel-Vinay [2009] find that small businesses create more jobs in periods of high unemployment and recessions. Our paper highlights the importance of credit availability to achieve this outcome.

This paper has important implications for policy intervention. We suggest that policies aimed at making credit available to small business, such as the recent \$30 billion Small Business Bill or the loans guaranteed by the Small Business Administration, would help stabilize the labor markets and economic activity in general. According to our estimates, eliminating financial constraints of small firms could add up to 850,000 jobs to the economy.

The rest of the paper is organized as follows. In the next section we describe our empirical strategy and data. Section III presents our main results and the associated

robustness tests, and section IV concludes.

II. EMPIRICAL STRATEGY AND DATA

II.A. Empirical Strategy

Our econometric analysis is based on specifications of the following form,

$$(1) \quad y_{ijrt} = \Lambda\{\alpha_j^d + \lambda_r^d + \boldsymbol{\theta}^d \mathbf{x}_{ijrt} + \delta^d recession_t + \mu^d small_{ijrt} + \rho^d (recession_t \times small_{ijrt}) + u_{ijrt}^d\},$$

where y_{ijrt} is unemployment status of person i in year t , with industry of occupation j , and region of residency r . y_{ijrt} takes the value of unity if person i is unemployed and equals zero otherwise. Λ denotes the functional form that relates the right-hand variables to the unemployment status (e.g., probit, logit, or linear). α_j and λ_r are industry and region fixed effects, respectively. \mathbf{x} is a vector of workers' observable characteristics that includes age, gender, ethnicity, and years of completed education. For simplicity of notation we include in vector \mathbf{x} the growth rate of real household income at the metropolitan area of residence. *recession* is an indicator that equals unity in the years 2007-2009 and equals zero in the years 2005-2007. *small* takes the value of unity if person i was employed by a small firm (1-499 employees) in the previous year. The upper index d (low, high) indicates external financial dependence of industry j . We divide the industries into groups of "high" and "low" external financial dependence based on the median value. We then estimate all the coefficients in equation (1) separately by the median external financial dependence.⁴

The industry fixed effects control for industry level observable and unobservable characteristics that impact unemployment rate and do not change over time. The

4. Because of potential bias of nonlinear estimates with fixed effects, we estimate equation (1) using a linear specification. In Appendix Table 1 we show that our findings are very robust to the functional form.

region fixed effects capture region-specific, time invariant factors. The vector of characteristics \mathbf{x} controls for workers' observable differences in age, gender, ethnicity, and education. The growth rate of real household income accounts for changes in the demand for goods and services produced in a specific metropolitan area that might affect the level of unemployment. The *recession* indicator accounts for the impact of the 2007-2009 recession on the unemployment rate across all firms and industries. Finally, the small-firm indicator *small* controls for the differences in unemployment rate between small and large firms.⁵

The main variable of interest is the interaction term between the recession and small-firm indicators, *recession* \times *small*. Specifically, $\hat{\rho}^{low}$ estimates the impact of the recession on unemployment rate in small firms relative to large firms in industries with low external financial dependence, whereas $\hat{\rho}^{high}$ has the same interpretation for industries with high external financial dependence. Our main interest is in the triple difference,

$$(2) \quad \hat{\rho}^{high} - \hat{\rho}^{low},$$

which exploits variation in unemployment rate across three dimensions: time (before and after the recession), firm size (small versus large), and external financial dependence (above or below the median). When estimating the difference in (2), we cluster the standard errors by industry to deal with concerns with serial correlation (Bertrand, Duflo and Mullainathan [2004]).

The third difference is especially useful because it helps isolate factors that have a differential impact on unemployment by firm size but not by external financial dependence. It is possible, for example, that the reduction in the demand for goods and services during the recession fell disproportionately on small firms and there-

5. We include fixed effects for the following industries: manufacturing non-durable goods, manufacturing durable goods, trade, services, and other industries. We do not include industry fixed effects at a more granular level because it will difference out all the variation in external financial dependence. The regional fixed effects include fixed effects for New England, Middle Atlantic, East North, West North, South, East South, West South, Mountain, and Pacific regions. We control for years of completed education using the following categories: 0-11, 12, 13-15, 16, and 17+ years of completed education.

fore affected their unemployment level. The estimates in (2) will difference-out this potential effect as long as the reduction in the demand is not differential by firms' external financial dependence.

II.B. Data

The unemployment status of workers is obtained from the Current Population Survey (CPS). The CPS is a monthly survey of about 50,000 households conducted by the Bureau of the Census for the Bureau of Labor Statistics. The survey represents the civilian population in the United States and is the official source of U.S. unemployment statistics. In this paper we use the Annual Demographic Supplements to the CPS which are conducted every March. The March surveys are especially useful because they include socio-demographic characteristics of respondents, allowing us to control for these characteristics in the regression analyses. The surveys also include information about the size of each individual's employer in the year prior to the survey, which is key for our analyses.

We restrict the CPS sample to adult civilians aged 16-65 in the year of the survey and exclude respondents whose main industry of occupation is the military, the public sector, or the financial sector. We also exclude respondents with missing information about the size of their employer. In all of our analyses we use sampling weights provided by the Census Bureau to ensure representativeness of the sample. We focus on March surveys in the years 2005-2009, thus capturing three years before the recent financial crisis and two years following the crisis.

We follow the procedures described in Cetorelli and Strahan [2006] and define external financial dependence as the proportion of capital expenditures financed with external funds. We use Compustat firms between the years 1980 and 1996 and separate them based on the number of years they have been on Compustat. We only use firms that have been on Compustat for at least 10 years. The reason for this choice is to capture firms' *demand* for credit and not the amount of credit supplied to them. It has been widely documented that young firms are financially constrained and their debt is likely to be determined by the amount of credit offered to them

and not by the optimal equity-to-debt ratio (see e.g., Fazzari, Hubbard and Petersen [1988]).

We sum across all years each firm’s total capital expenditures minus cash flows from operations and then divide it by total capital expenditures. A negative value of the resulting ratio indicates that firms have free cash, whereas a positive value indicates that firms must issue debt or equity to finance investments. Next, we aggregate the firm-level ratios of external financial dependence using the median value for all firms in each two-digit Standard Industrial Classification (SIC) category. Finally, we match the two-digit SIC categories to the industrial categories in the CPS. Table 2 in the Appendix reports measures of external financial dependence for each of the 60 industrial sectors in our sample. Looking across the sectors, we find that leather and leather products, insurance carriers, and forestry have the lowest need for external finance. Pipelines, metal mining, and home furniture, on the other hand, have the highest external financial dependence.

As a robustness test, we use two additional measures of external financial dependence. First, we use the measure of external financial dependence developed by Rajan and Zingales [1998]. This measure is different from the Cetorelli-Strahan measure because it is calculated at a more granular level of 3- and sometimes 4-digit International SIC categories and is available only for manufacturing sectors. Within manufacturing the correlation between Cetorelli-Strahan and Rajan-Zingales measures of external financial dependence is 0.98.

We also calculate industries’ financial dependence using the 1998 Survey of Small Business Finance (SSBF). The survey covers a sample of 3,561 small firms with fewer than 500 employees. The SSBF measure of financial dependence captures *bank* dependence more accurately than the measure based on Compustat because it is based on small firms which primarily use bank loans. For each firm we calculate the share of assets financed with debt from financial institutions. Debt includes loans, capital leases and lines of credit (limit), as well as personal mortgages. Bank dependence in each two-digit SIC category is equal to the median value of firms’ share of assets financed with debt. Bank dependence is constructed for all industrial sectors, not just manufacturing, and then matched to the industrial categories in the

CPS.⁶

III. RESULTS

III.A. Descriptive Statistics

Table 2 reports mean characteristics of Compustat firms and CPS respondents by the median external financial dependence (EFD from now on) of their industry. Panel A shows a similar pattern of growth of assets, capital expenditures, and sales for Compustat firms with low and high EFD during the period 1980-1996. For example, the average real growth rate of assets of low EFD firms over the period 1980-1996 is 4.2% versus 2.1% for high EFD firms. The difference between the growth rates of assets is statistically insignificant (column 3). The differences in growth rates of capital expenditures and sales between high and low EFD industries are insignificant as well. These figures suggest that the greater demand for external finance does not seem to reflect greater growth or investment opportunities. Instead, external finance reflects differences in financing needs.

In panel B of Table 2 we compare characteristics of 2005 CPS respondents by EFD of their industry. Implicit in our identification strategy is the assumption that workers in high and low EFD industries share similar characteristics. We find that workers' characteristics differ across industries, but for the most part these differences are not large. High EFD industries have more men (59% vs. 51%) and whites (84% vs. 83%), have less workers with at least college education (21% vs. 37%), and higher unemployment rate (5.1% vs. 3.5%). Due to the large sample of respondents ($N=63,657$), all of the differences are statistically significant from zero. The difference in the proportion of workers with at least college education is "economically" significant. In our view, this difference is explained by varying skill

6. Mortgages include both commercial and residential mortgages if funds were used for business purposes. We use the limits on the lines of credit to better capture the supply of credit to those businesses. The results are robust to alternative definitions that exclude mortgages from debt and use the balance on the lines of credit instead of the limits.

requirements in the different industries due to different technological production processes (as highlighted in Rajan and Zingales [1998]).

Since workers seem to differ across sectors with different financing needs, we directly control for these differences. Specifically, our specifications control for workers' age, gender, ethnicity, and years of completed education.

III.B. Difference-in-Difference-in-Differences Estimates

Our empirical strategy is to emphasize the differential impact of the recession on unemployment using the variation in firm size and industries' financing needs. We illustrate this strategy in Table 3 using the specification in equation (1). The columns of the table are divided by workers' firm size and external financial dependence (EFD) of their industry. Small firms are firms with 1-499 employees, whereas large firms have 500+ employees. Industries with low external financial dependence are industries with below median EFD.

The first two columns indicate an identical increase of 1.4 percentage points in unemployment rate among workers in small and large firms in industries with low EFD. The next two columns, on the other hand, show that the recession has a much more pronounced impact on unemployment in small firms in high EFD industries. In these industries the unemployment rate among small firms increased by 1.3 percentage points more than in large firms. The second row of the table shows that this difference is statistically significant.

The third row of Table 3 exploits the variation across the dimensions of firm size and external financial dependence by taking the difference between the two differences in the second row. In the notation of equation (2) this triple difference is,

$$\hat{\rho}^{high} - \hat{\rho}^{low} = (.027 - .014) - (.014 - .014) = .013$$

The point estimate of .013 means that the *relative* impact of the recession on unemployment by firm size is 1.3 percentage points larger in industries with high financing needs. This difference is economically large. During the recession the unemployment rate doubled from 5.0 percent in December 2007 to 10.0 percent in December 2009

(Bureau of Labor Statistics). Thus a 1.3 percentage point change represents a quarter of the overall rise in unemployment rate during the recession. This difference is not only economically large but also statistically significant at 5% after adjusting the standard errors for clustering by two-digit SIC category.

Another way to look at the economic magnitude of our findings is to consider the proportion of workers working in small firms in industries with high financing needs. Our estimations suggest that eliminating financial constraints of small firms in high EFD sectors would reduce the overall unemployment by 0.55 percentage points, which translates into roughly 850,000 workers using the August 2010 levels of unemployment and labor force participation.⁷

One potential interpretation of the findings in Table 3 is that the recession was especially harmful for the demand for goods and services produced by small businesses. This interpretation, however, seems unlikely given that the changes in unemployment in small and large firms in low EFD industries are the same.

Another possibility is that changes in the demand fell disproportionately on certain industries and these industries tend to have higher external financial dependence and a larger proportion of small firms. We explore this possibility across two dimensions. First, we account for industry fixed effects, thus estimating the changes in unemployment in small versus large firms within the same industry. The identifying assumption here is that changes in the demand were not differential by firm size within an industry. Next, realizing that the construction sector have especially suffered during the recession, we exclude the construction sector from the analysis.

Table 4 repeats the exercise in Table 3, excluding the construction sector. The construction sector has external financial dependence above the median and thus the results in the first two columns of Table 4 are identical to the previous table. In high EFD industries, changes in unemployment are smaller for both small and large firms

7. The 0.55 percentage point reduction in unemployment is a product of 1.30 percentage points from Table 3 times the share of workers in small firms in high EFD industries, which is 43%. According to the Bureau of Labor Statistics, there were 14,860,000 unemployed workers in August 2010, which corresponds to unemployment rate of 9.6. Assuming a constant labor force (154,110,000 in August 2010), a reduction in unemployment rate of 0.55 percentage points means an increase in employment of roughly 851,354 workers.

once the construction workers are excluded. Nevertheless, the differential impact of the recession by firm size is significant ($.021 - .012 = .009$) both statistically and economically. The triple difference ($.009 - .000 = .009$) is significant as well, indicating that the potential demand changes for goods and services during the recession are not driving our findings.

Figure 1 graphically depicts the results in the previous tables. It shows the evolution of unemployment rate between the years 2005 and 2009 by firm size and external financial dependence. In this figure we simply plot the unemployment data without relying on regression analysis. The left plot is for industries with low EFD and the right plot is for high EFD industries. The dark lines represent unemployment rate among workers in small firms (1-499 employees), while the light lines are for workers in large firms (500+ employees). For ease of illustration the trends are normalized to 100 in the year 2005.

For low EFD industries the unemployment rate has risen by 2.5 percentage points between 2005 and 2009, with most of the rise occurring between 2008 and 2009. Strikingly, the unemployment trends for workers in small and large firms move very closely, indicating that for low EFD industries the recession has no differential impact on unemployment by firm size. In high EFD industries, on the other hand, the unemployment rate has evolved differently for small and large firms. Starting from 2007, the unemployment rate among small firms is accelerating, whereas there are no apparent changes in unemployment among large firms until 2008. After 2008 both large and small firms have experienced rapid changes in unemployment, with the unemployment rate changing by 3 and 4 percentage points for large and small firms, respectively.

III.C. Monotonicity Analysis

In Figure 2 we plot changes in unemployment rate in the years 2008-2009 relative to the years 2005-2007. Here instead of separating firms into only two categories, we separate them into three categories of size based on the number of employees: 1-99, 100-499, and 500+. As before, we separate industries by the median external

financial dependence. The bars in Figure 2 represent point estimates of δ from the following specification,

$$(3) \quad y_{ijrt} = \alpha_j + \lambda_r + \boldsymbol{\theta}\mathbf{x}_{ijrt} + \delta recession_t + u_{ijrt},$$

where y is the unemployment rate, α_j and λ_r are industry and region fixed effects, respectively, \mathbf{x} is a vector of observable characteristics as in equation (1), and $recession$ takes the value of unity in the years 2008-2009 and equals zero in the years 2005-2007. We estimate equation (3) using Ordinary Least Squares because of concerns of bias of nonlinear estimates with fixed effects. We use sampling weights provided by the CPS to ensure representativeness of our sample.

We estimate δ in equation (3) six times for each category of firm size and by the median external financial dependence. Figure 2 shows that during the recession the unemployment rate is changing *monotonically* with firm size and *only* for industries with above-median dependence on external finance. The largest changes in unemployment are for the smallest firms (1-99 employees), whereas the smallest changes are for the largest firms (500+ employees). In particular, the unemployment rate is rising by 2.7 percentage points for firms with 1-99 employees, by 2.1 percentage points for firms with 100-499 employees, and by 1.4 percentage points for firms with 500+ employees. In industries with low external financial dependence there is no clear cut relationship between firm size and changes in unemployment during the recession.

Next we test the monotonicity of our findings with respect to severity of external financial dependence. Specifically, we split the sample into three equal-sized buckets based on the distribution of external financial dependence. Workers in the lowest 33 percentiles of the EFD distribution belong to the “low” EFD bucket, whereas workers in the top 33 percentiles fall into the “high” EFD bucket. Workers between the 34th and the 65th percentiles are in the “medium” category.

This time we estimate equation (3) separately by the three categories of external financial dependence and two categories of firm size (1-499 versus 500+ employees). The results are presented in Figure 3. We find a clear-cut monotonic relationship

between changes in unemployment and external financial dependence. During the recession the unemployment rate is rising by 1.7 percentage points in the “low” EFD bucket, by 2.2 percentage points in the “medium” bucket, and by almost 3 percentage points in the “high” EFD bucket. There is no evidence for a monotonic relationship between changes in unemployment rate and external financial dependence for large firms.

The monotonicity analyses provide further evidence for the channels that drive the unemployment rate during the 2008-2009 financial crisis. We find a monotonic relationship between firm size and changes in unemployment rate. Importantly, this relationship holds only for industries with ex-ante high external financial dependence. From a different angle, we find a monotonic relationship between external financial dependence and changes in unemployment rate. Strikingly, this relationship holds only for small firms. The unemployment rate therefore is changing in a predictable manner with respect to firm size and external financial dependence, and only for firms in which we would expect this relationship to exist. The results, therefore, provide a strong support for the hypothesis that changes in unemployment rate among small firms during the financial crisis are driven by changes in the amount of credit supplied by the banks.

III.D. Robustness Tests

So far our findings indicate that the financial crisis of 2008-2009 is especially harmful for small firms in industries with ex-ante high financing needs. Our understanding is that changes in unemployment in these firms are driven by changes in the supply of credit. To provide further evidence for this hypothesis we repeat our empirical exercise for the 2001 recession. This recession was triggered by the technological sector and did not originate in banks’ balance sheets. The 2001 recession, therefore, serves as a “placebo” test: if changes in unemployment in small, finance-constrained firms are driven by changes in the supply of credit, then we should find no differential impact of the 2001 recession on unemployment by firms’ size and external financial dependence. If, on the other hand, our main findings are driven by changes in the

demand for goods and services, then we should more or less replicate the 2008-2009 findings using the 2001 recession.

Table 5 reports triple difference point estimates from equation (1), except that the *recession* indicator now takes the value of unity in the years 2001-2002 and takes the value of zero in the years 1998-2000. During the 2001 recession the unemployment rate has clearly gone up. However, the recession had an even impact on unemployment by firm size and external financial dependence. In low EFD industries the unemployment rate has increased by 1.1 percentage points for both large and small firms. In high EFD industries the unemployment rate has increased by 0.8 and 1.0 percentage points for small and large firms, respectively. For both low and high EFD industries there is no differential change in unemployment rate by firm size ($\hat{\rho}^{low} = -.000$ and $\hat{\rho}^{high} = -.003$). The triple difference ($-.003 + .000 = -.003$) is insignificant as well.

The results in Table 5 show that financing constraints become insignificant in explaining the employment patterns of small or large firms during the 2001 recession. This is exactly in line with our prior based on the fact that the 2001 recession was concentrated in the technological sector, and banks were largely unaffected by that crisis. This finding also provides additional assurance that changes in unemployment rate in small, finance-dependent firms during the 2008-2009 financial crisis are mainly driven by changes in the supply of credit. These results are very consistent with Duchin, Ozbas and Sensoy [2010] who show a steep decline in the supply of credit to firms in industries that depend on external finance. Duchin et al. [2010] find this effect only during the 2008-2009 financial crisis and not during the 2001 recession, which perfectly aligns with our results.

Next we test the robustness of our results to the measure of external financial dependence. Thus far we followed the procedures described in Cetorelli and Strahan [2006] and constructed external financial dependence based on “mature” Compustat firms, aggregating the proportion of firms’ capital financed with external funds to two-digit Standard Industrial Classification categories. In Table 6 we estimate our basic specification in (1) using external financial dependence from Rajan and Zingales [1998]. The Rajan-Zingales measure differs from the Cetorelli-Strahan measure in

three respects. First, it is based on more granular three- or sometimes four-digit International Standard Industrial Classification categories. Second, it is based on all Compustat firms, not just the “mature” firms that have been on Compustat for more than 10 years. Finally, it is available only for manufacturing sectors.

The interpretation of our findings remains unchanged using the Rajan-Zingales measure of external financial dependence. Workers in smaller firms are more likely to become unemployed during the financial crisis of 2008-2009 if they work in industries with ex-ante high financing needs. Strikingly, the point estimate of the triple difference (.012) is similar to the point estimate in Table 3 (.013), although it is statistically insignificant. Note, however, that the lack of statistical significance is primarily due to smaller sample size and the resulting larger standard error.

As a final robustness check we construct measures of bank dependence using the 1998 Survey of Small Business Finance. For each firm we calculate the share of assets financed with debt from financial institutions. Debt includes loans, capital leases and lines of credit, as well as personal mortgages. Bank dependence in each two-digit SIC category is equal to the median value of firms’ share of assets financed with debt. It is constructed for all industrial sectors and not just manufacturing. We split the industries by the median dependence on banks. Industries with below median bank dependence have “low” bank dependence, whereas industries with above median bank dependence have “high” bank dependence.

The results in Table 7 are very similar to the results in the previous tables. There is no differential impact of the recession on unemployment rate by firm size in industries with low bank dependence. For both small and large firms the unemployment rate rises by 1.3 percentage points during the recession. In industries with high bank dependence, on the other hand, the unemployment rate rises by 1.5 (.032 – .017) percentage points more for small firms. The triple difference (.015 – .000) is statistically significant at the 1% level and is very similar in magnitude to the triple differences using the two alternative measures of external financial dependence. Overall, the results in tables 6 and 7 show that our core findings are robust to the measures of external financial dependence.

IV. CONCLUSIONS

This paper shows that small business financing constraints are important drivers of the observed unemployment dynamics around the Great Recession. In particular, our results show that workers who worked in small firms in industries with higher external financial dependence were more likely to become unemployed following the financial crisis. On the other hand, we do not find significant differences in unemployment propensity between small and large firms in sectors with low external financial dependence. These results indicate that the reduction in bank lending to financially constrained firms during the Great Recession is associated with increased layoffs of workers.

These findings are robust to various alternative measures of financial dependence, as well as to using the 2001 recession as a placebo test. The latter test based on the 2001 recession is especially interesting as it also highlights the importance of bank health and capital constraints for credit availability and their impact on the macroeconomy. Specifically, we show that financing constraints become insignificant in explaining the employment patterns of small or large firms. This is exactly in line with our prior based on the fact that the 2001 recession was concentrated in the technological sector, and banks were largely unaffected by that crisis. This finding also provides additional assurance that our empirical strategy captures credit supply shocks, and not demand shocks associated with the Great Recession.

The policy implications of these findings are especially important. They suggest that small business financing constraints may be significantly hampering job creation, and as such highlight an important dimension of the current debate on policies related to supporting small business lending to stimulate economic growth. We suggest that policies aimed at making credit available to small business, such as the recent \$30 billion Small Business Bill or the loans guaranteed by the Small Business Administration, would help stabilize the labor markets and economic activity in general.

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TABLE 1
Trends in Small Business Lending and Unemployment

	June 2008 (1)	March 2010 (2)	Diff. (3)
Volume of outstanding loans (\$bill.)			
Original amount < \$1,000,000	655.3	614.8	-40.5
Commercial and industrial loans	304.5	284.9	-19.6
Original amount < \$100,000	147.5	139.6	-7.9
Commercial and industrial loans	120.1	116.5	-3.6
Unemployment rate	5.5	9.7	4.2
Percent unemployed > 27 weeks	.19	.44	.25
Median number of weeks unemployed	9.4	20.0	10.6

Source – Reports of Condition and Income and Bureau of Labor Statistics.

TABLE 2
Characteristics of Firms and Workers by External Financial Dependence

	Low External Financial Dependence (1)	High External Financial Dependence (2)	Difference (3)
A. Characteristics of Compustat Firms			
Assets growth	.042	.021	-.021 (.017)
Capital expenditures growth	.203	.137	-.066 (.084)
Sales growth	.062	.044	-.017 (.032)
B. Characteristics of CPS Respondents			
Male	.507	.587	.080 (.005)***
White	.829	.843	.014 (.004)***
Have at least college education	.365	.213	-.152 (.005)***
Unemployed	.035	.051	.017 (.002)***

Note - The table reports characteristics of Compustat firms and CPS workers by external financial dependence of their industry. Column (3) reports the difference between the first two columns. Robust standard errors are in parentheses. Panel A is based on 4,708 mature Compustat firms in the years 1980-1996. Mature firms are firms that have been on Compustat for at least 10 years. The growth rates of assets, capital expenditures, and sales are median values of year-to-year real (\$1997, CPI adjusted) growth rates over the period 1980-1996. Panel B is based on 63,657 adult (ages 16-65) civilian respondents to the 2005 March Current Population Survey (CPS), excluding military and public-sector workers. The estimates in panel B are weighted by probability sampling weights provided by the CPS. External financial dependence equals the proportion of capital expenditures financed with external funds. A negative value (low external financial dependence) indicates that firms have free cash flow. A positive value (high external financial dependence) indicates that firms must issue debt or equity to finance their investment. External financial dependence is calculated at a 2-digit Standard Industrial Classification codes using mature COMPUSTAT firms for the period 1980-1996. *** indicates statistical significance at the 1% level.

TABLE 3
The Impact of the December 2007 Recession on Unemployment
by External Financial Dependence and Firm Size

	Low External Financial Dependence		High External Financial Dependence	
	Small Firms (1)	Large Firms (2)	Small Firms (3)	Large Firms (4)
December 2007 recession	.014 (.003)***	.014 (.003)***	.027 (.006)***	.014 (.004)***
	.000 (.004)		.013 (.006)**	.013 (.004)***
Observations	61,262	36,457	135,386	84,601

Note - The dependent variable is an indicator that equals to one if a person is unemployed. The table reports Ordinary Least Squares estimates. Standard errors are adjusted for clustering at 2-digit Standard Industrial Classification code and appear in parentheses. The sample includes respondents to the March Current Population Surveys (CPS) in the years 2005-2009. Information about each worker's employer size is available for the year prior to the survey, i.e., 2004-2008. The sample is limited to adult civilians aged 16-65 in the year of the survey and excludes workers in the military, the public sector, and the financial sector. External financial dependence equals the proportion of capital expenditures financed with external funds. A negative value indicates that firms have free cash flow, whereas a positive value indicates that firms must issue debt or equity to finance their investment. External financial dependence is calculated using mature COMPUSTAT firms for the period 1980-1996. Mature firms are firms that have been on COMPUSTAT for at least 10 years. Recession equals to one in the years 2008 and 2009. Small firms have at most 499 employees. Large firms have at least 500 employees. All specifications control for workers' characteristics which include: age, gender, ethnicity (white indicator), and indicators of years of completed education (0-11, 12, 13-15, 16, and 17+). The specifications also control for region fixed effects (New England, Middle Atlantic, East North, West North, South, East South, West South, Mountain, and Pacific), industry fixed effects (manufacturing non-durable goods, manufacturing durable goods, trade, services, and other), and metropolitan area growth rate of household income over the period 2004-2008. All estimates are weighted by probability sampling weights provided by the CPS. ** and *** indicate statistical significance at the 5% and 1% levels, respectively.

TABLE 4
The Impact of the December 2007 Recession on Unemployment
by External Financial Dependence and Firm Size
(Excluding the Construction Sector)

	Low External Financial Dependence		High External Financial Dependence	
	Small Firms (1)	Large Firms (2)	Small Firms (3)	Large Firms (4)
December 2007 recession	.014 (.003)***	.014 (.003)***	.021 (.004)***	.012 (.003)***
	.000 (.004)		.009 (.003)***	
		.009 (.005)*		
Observations	61,262	36,457	107,985	81,166

Note - The dependent variable is an indicator that equals to one if a person is unemployed. The table reports Ordinary Least Squares estimates. Standard errors are adjusted for clustering at 2-digit Standard Industrial Classification code and appear in parentheses. The sample includes respondents to the March Current Population Surveys (CPS) in the years 2005-2009. Information about each worker's employer size is available for the year prior to the survey, i.e., 2004-2008. The sample is limited to adult civilians aged 16-65 in the year of the survey and excludes workers in the military, the public sector, and the financial sector. Additionally, we exclude the construction sector. External financial dependence equals the proportion of capital expenditures financed with external funds. A negative value indicates that firms have free cash flow, whereas a positive value indicates that firms must issue debt or equity to finance their investment. External financial dependence is calculated using mature COMPUSTAT firms for the period 1980-1996. Mature firms are firms that have been on COMPUSTAT for at least 10 years. Recession equals to one in the years 2008 and 2009. Small firms have at most 499 employees. Large firms have at least 500 employees. All specifications control for workers' characteristics which include: age, gender, ethnicity (white indicator), and indicators of years of completed education (0-11, 12, 13-15, 16, and 17+). The specifications also control for region fixed effects (New England, Middle Atlantic, East North, West North, South, East South, West South, Mountain, and Pacific), industry fixed effects (manufacturing non-durable goods, manufacturing durable goods, trade, services, and other), and metropolitan area growth rate of household income over the period 2004-2008. All estimates are weighted by probability sampling weights provided by the CPS. * and *** indicate statistical significance at the 10% and 1% levels, respectively.

TABLE 5
The Impact of the March 2001 Recession on Unemployment
by External Financial Dependence and Firm Size

	Low External Financial Dependence		High External Financial Dependence	
	Small Firms	Large Firms	Small Firms	Large Firms
	(1)	(2)	(3)	(4)
March 2001 recession	.011 (.002)***	.011 (.003)***	.008 (.002)***	.010 (.003)***
		-.000 (.003)		-.003 (.002)
			-.003 (.004)	
Observations	55,006	33,133	111,157	73,602

Note - The dependent variable is an indicator that equals to one if a person is unemployed. The table reports Ordinary Least Squares estimates. Standard errors are adjusted for clustering at 2-digit Standard Industrial Classification code and appear in parentheses. The sample includes respondents to the March Current Population Surveys (CPS) in the years 1998-2002. Information about each worker's employer size is available for the year prior to the survey, i.e., 1997-2001. The sample is limited to adult civilians aged 16-65 in the year of the survey and excludes workers in the military, the public sector, and the financial sector. External financial dependence equals the proportion of capital expenditures financed with external funds. A negative value indicates that firms have free cash flow, whereas a positive value indicates that firms must issue debt or equity to finance their investment. External financial dependence is calculated using mature COMPUSTAT firms for the period 1980-1996. Mature firms are firms that have been on COMPUSTAT for at least 10 years. Recession equals to one in the years 2001 and 2002. Small firms have at most 499 employees. Large firms have at least 500 employees. All specifications control for workers' characteristics which include: age, gender, ethnicity (white indicator), and indicators of years of completed education (0-11, 12, 13-15, 16, and 17+). The specifications also control for region fixed effects (New England, Middle Atlantic, East North, West North, South, East South, West South, Mountain, and Pacific), industry fixed effects (manufacturing non-durable goods, manufacturing durable goods, trade, services, and other), and metropolitan area growth rate of household income over the period 1997-2001. All estimates are weighted by probability sampling weights provided by the CPS. *** indicates statistical significance at the 1% level.

TABLE 6
The Impact of the December 2007 Recession on Unemployment in Manufacturing
by External Financial Dependence and Firm Size
(Rajan-Zingales Measure of External Financial Dependence)

	Low External Financial Dependence		High External Financial Dependence	
	Small Firms	Large Firms	Small Firms	Large Firms
	(1)	(2)	(3)	(4)
December 2007 recession	.031 (.004)***	.029 (.005)***	.042 (.009)***	.028 (.009)***
	.002 (.006)		.014 (.007)*	
		.012 (.009)		
Observations	14,229	10,697	10,561	12,237

Note - The dependent variable is an indicator that equals to one if a person is unemployed. The table reports Ordinary Least Squares estimates. Standard errors are adjusted for clustering at U.S. Census of Bureau industrial codes and appear in parentheses. The sample includes respondents to the March Current Population Surveys (CPS) in the years 2005-2009. Information about each worker's employer size is available for the year prior to the survey, i.e., 2004-2008. The sample is limited to adult civilians aged 16-65 in the year of the survey whose primary industry is manufacturing. External financial dependence is the proportion of capital expenditures financed with external funds based on Table 1 in Rajan and Zingales [1998]. Recession equals to one in the years 2008 and 2009. Small firms have at most 499 employees. Large firms have at least 500 employees. All specifications control for workers' characteristics which include: age, gender, ethnicity (white indicator), and indicators of years of completed education (0-11, 12, 13-15, 16, and 17+). The specifications also control for region fixed effects (New England, Middle Atlantic, East North, West North, South, East South, West South, Mountain, and Pacific) and metropolitan area growth rate of household income over the period 2004-2008. All estimates are weighted by probability sampling weights provided by the CPS. * and *** indicate statistical significance at the 10% and 1% levels, respectively.

TABLE 7
The Impact of the December 2007 Recession on Unemployment
by Bank Dependence Based on Survey of Small Business Finance

	Low Bank Dependence		High Bank Dependence	
	Small Firms (1)	Large Firms (2)	Small Firms (3)	Large Firms (4)
December 2007 recession	.013 (.003)***	.013 (.004)***	.032 (.006)***	.017 (.004)***
	.000 (.003)		.015 (.005)***	.015 (.004)***
Observations	88,686	60,694	93,664	52,757

Note - The dependent variable is an indicator that equals to one if a person is unemployed. The table reports Ordinary Least Squares estimates. Standard errors are adjusted for clustering at 2-digit Standard Industrial Classification (SIC) code and appear in parentheses. The sample includes respondents to the March Current Population Surveys (CPS) in the years 2005-2009. Information about each worker's employer size is available for the year prior to the survey, i.e., 2004-2008. The sample is limited to adult civilians aged 16-65 in the year of the survey and excludes workers in the military, the public sector, and the financial sector. Bank dependence is the share of assets financed with debt. We use the 1998 Survey of Small Business Finance (SSBF) to calculate measures of bank dependence for each 2-digit SIC industry. The SSBF includes 3,561 small firms with fewer than 500 employees. Recession equals to one in the years 2008 and 2009. Small firms have at most 499 employees. Large firms have at least 500 employees. All specifications control for workers' characteristics which include: age, gender, ethnicity (white indicator), and indicators of years of completed education (0-11, 12, 13-15, 16, and 17+). The specifications also control for region fixed effects (New England, Middle Atlantic, East North, West North, South, East South, West South, Mountain, and Pacific), industry fixed effects (manufacturing non-durable goods, manufacturing durable goods, trade, services, and other), and metropolitan area growth rate of household income over the period 2004-2008. All estimates are weighted by probability sampling weights provided by the CPS. *** indicates statistical significance at the 1% level.

APPENDIX TABLE 1
The Impact of the December 2007 Recession on Unemployment:
Robustness to Functional Form

	Low External Financial Dependence		High External Financial Dependence	
	Small Firms (1)	Large Firms (2)	Small Firms (3)	Large Firms (4)
A. OLS Estimates				
December 2007 recession	.014 (.003)***	.014 (.003)***	.027 (.006)***	.014 (.004)***
B. Probit Marginal Effects				
December 2007 recession	.013 (.002)***	.014 (.003)***	.025 (.004)***	.012 (.003)***
C. Logit Marginal Effects				
December 2007 recession	.013 (.002)***	.013 (.003)***	.024 (.004)***	.012 (.003)***
Observations	61,262	36,457	135,386	84,601

Note - The dependent variable is an indicator that equals to one if a person is unemployed. The table reports Ordinary Least Squares estimates (panel A), Probit marginal effects (panel B), and Logit marginal effects (panel C). Standard errors are adjusted for clustering at 2-digit Standard Industrial Classification code and appear in parentheses. The sample includes respondents to the March Current Population Surveys (CPS) in the years 2005-2009. Information about each worker's employer size is available for the year prior to the survey, i.e., 2004-2008. The sample is limited to adult civilians aged 16-65 in the year of the survey and excludes workers in the military, the public sector, and the financial sector. External financial dependence equals the proportion of capital expenditures financed with external funds. A negative value indicates that firms have free cash flow, whereas a positive value indicates that firms must issue debt or equity to finance their investment. External financial dependence is calculated using mature COMPUSTAT firms for the period 1980-1996. Mature firms are firms that have been on COMPUSTAT for at least 10 years. Recession equals to one in the years 2008 and 2009. Small firms have at most 499 employees. Large firms have at least 500 employees. All specifications control for workers' characteristics which include: age, gender, ethnicity (white indicator), and indicators of years of completed education (0-11, 12, 13-15, 16, and 17+). The specifications also control for region fixed effects (New England, Middle Atlantic, East North, West North, South, East South, West South, Mountain, and Pacific), industry fixed effects (manufacturing non-durable goods, manufacturing durable goods, trade, services, and other), and metropolitan area growth rate of household income over the period 2004-2008. All estimates are weighted by probability sampling weights provided by the CPS. *** indicates statistical significance at the 1% level.

APPENDIX TABLE 2
External Financial Dependence by Industrial Sectors

Industry	SIC	EFD
Forestry	08	-4.63
Insurance carriers	63	-3.96
Leather and leather products	31	-0.96
Tobacco products	21	-0.92
Apparel and other finished products made from fabrics and similar materials	23	-0.61
Educational services	82	-0.55
Social services	83	-0.43
Miscellaneous repair services	76	-0.25
Food and kindred products	20	-0.24
Fabricated metal products, except machinery and transportation equipment	34	-0.24
Furniture and fixtures	25	-0.23
Stone, clay, glass, and concrete products	32	-0.20
Miscellaneous manufacturing industries	39	-0.20
Apparel and accessory stores	56	-0.16
Business services	73	-0.16
Local and suburban transit and interurban highway passenger transportation	41	-0.12
Personal services	72	-0.12
Printing, publishing, and allied industries	27	-0.07
Communications	48	-0.07
Engineering, accounting, research, management, and related services	87	-0.05
Measuring, analyzing, and controlling instruments; photographic, medical, and optical goods	38	-0.04

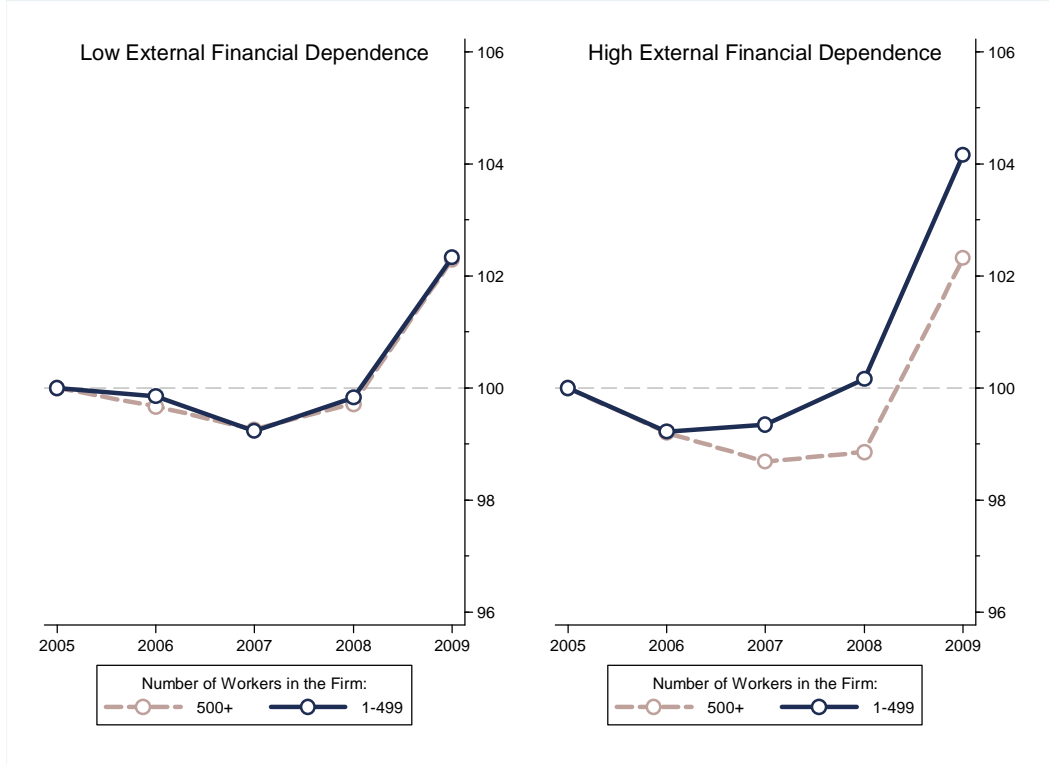
Note - This table reports measures of external financial dependence (EFD) for each industry at the 2-digit SIC category. External financial dependence equals the proportion of capital expenditures financed with external funds. A negative value indicates that firms have free cash flow, whereas a positive value indicates that firms must issue debt or equity to finance their investment. External financial dependence is calculated using mature COMPUSTAT firms for the period 1980-1996. Mature firms are firms that have been on COMPUSTAT for at least 10 years.

APPENDIX TABLE 2 (continued)
External Financial Dependence by Industrial Sectors

Industry	SIC	EFD
Transportation equipment	37	0.00
Transportation services	47	0.01
Industrial and commercial machinery and computer equipment	35	0.01
Primary metal industries	33	0.03
Agriculture	01-02-07	0.03
Railroad transportation	40	0.04
Lumber and wood products, except furniture	24	0.04
Rubber and miscellaneous plastics products	30	0.04
Mining and quarrying of nonmetallic minerals, except fuels	14	0.05
Paper and allied products	26	0.06
Petroleum refining and related industries	29	0.09
Wholesale trade: non-durable goods	51	0.10
Textile mill products	22	0.10
Motor freight transportation and warehousing	42	0.10
General merchandise stores	53	0.12
Coal mining	12	0.13
Miscellaneous retail	59	0.16
Food stores	54	0.16
Motion pictures	78	0.17
Amusement and recreation services	79	0.21
Electronic and other electrical equipment and components, except computer equipment	36	0.22
Electric, gas, and sanitary services	49	0.24
Eating and drinking places	58	0.25
Chemicals and allied products	28	0.28
Fishing, hunting, and trapping	09	0.31
Wholesale trade: durable goods	50	0.32
Health services	80	0.35
Real estate	65	0.38
Hotels, rooming houses, camps, and other lodging places	70	0.38
Oil and gas extraction	13	0.40
Automotive dealers and gasoline service stations	55	0.41
Automotive repair, services, and parking	75	0.43
Building materials, hardware, garden supply, and mobile home dealers	52	0.47
Transportation by air	45	0.48
Construction	15-16-17	0.57
Water transportation	44	0.67
Home furniture, furnishings, and equipment stores	57	0.69
Metal mining	10	0.96
Pipelines, except natural gas	46	1.00

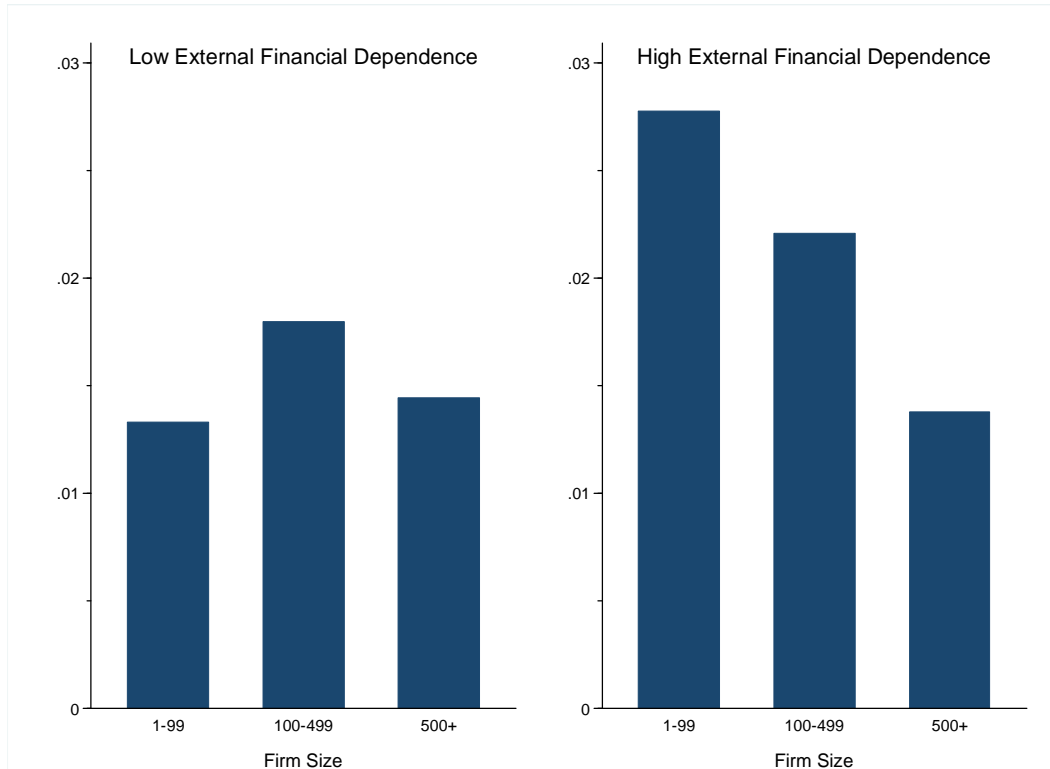
See notes in the first panel of the Table.

FIGURE 1 - Percentage Point Change in Unemployment
by External Financial Dependence and Firm Size



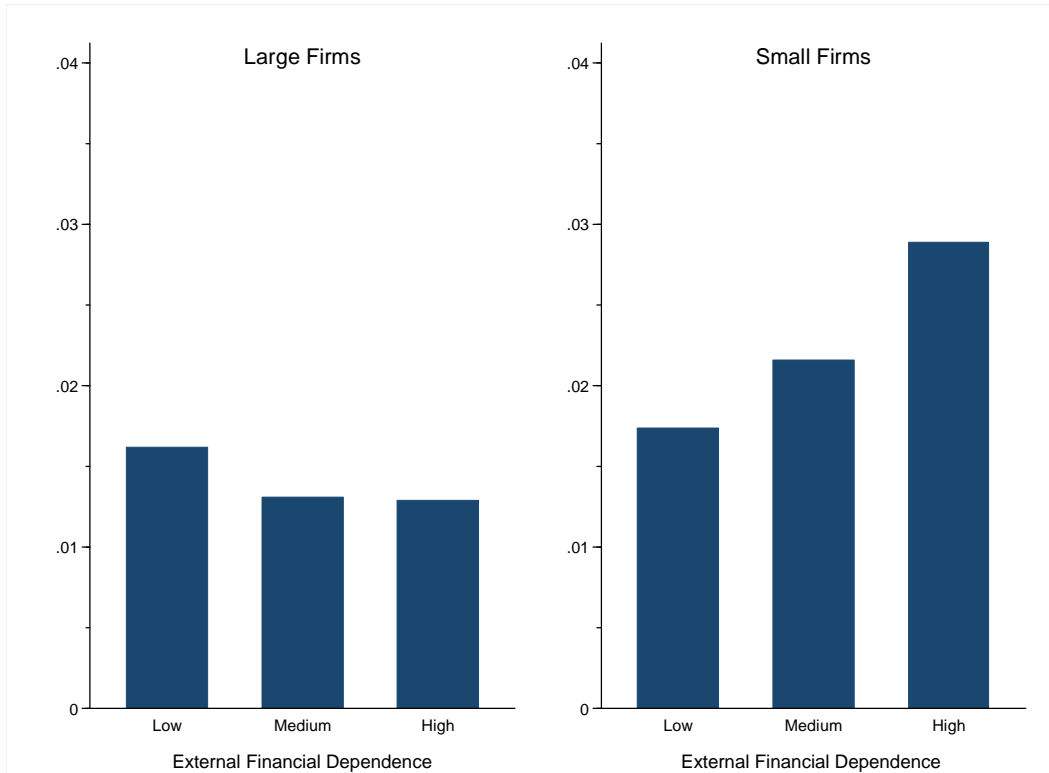
Note – For simplicity of illustration, unemployment is indexed to 100 in the year 2005. Solid lines represent trends in unemployment among workers in small firms (1-499 workers). Dashed lines represent workers in large firms (500+ workers). The sample includes respondents to the March Current Population Surveys (CPS) in the years 2005-2009. Information about each worker's employer size is available for the year prior to the survey, i.e., 2004-2008. The sample is limited to adult civilians aged 16-65 in the year of the survey and excludes workers in the military, the public sector, and the financial sector. The plot is divided by external financial dependence. External financial dependence equals the proportion of capital expenditures financed with external funds. A negative value indicates that firms have free cash flow (low external financial dependence), whereas a positive value indicates that firms must issue debt or equity to finance their investment (high external financial dependence). External financial dependence is calculated using mature COMPUSTAT firms for the period 1980-1996. Mature firms are firms that have been on COMPUSTAT for at least 10 years.

FIGURE 2 - Percentage Point Change in Unemployment:
Monotonicity of the Results by Firm Size



Note – The plots show changes in unemployment rate following the December 2007 recession by external financial dependence and firm size. The left plot is for workers in industries with low external financial dependence and the right plot is for workers in industries with high external financial dependence. Each plot is divided into three categories of firm size based on the number of workers in a firm: 1-99, 100-499, and 500+. External financial dependence equals the proportion of capital expenditures financed with external funds. External financial dependence is calculated using mature COMPUSTAT firms for the period 1980-1996. The bars represent estimates from 6 separate OLS regression of unemployment status on a recession indicator after controlling for workers' observable characteristics (age, gender, ethnicity, and years of completed education), industry fixed effects, region fixed effects, and growth rate of household income. The recession indicator equals to one in the years 2008 and 2009. All estimates are weighted by sampling weights provided by the Current Population Survey (CPS). The sample includes respondents to the March CPS in the years 2005-2009. The sample is limited to adult civilians aged 16-65 in the year of the survey and excludes workers in the military, the public sector, and the financial sector.

FIGURE 3 - Percentage Point Change in Unemployment:
Monotonicity of the Results by External Financial Dependence



Note – The plots show changes in unemployment rate following the recession by external financial dependence and firm size. The left plot is for workers in large firms (500+ employees) and the right plot is for workers in small firms (1-499 employees). Each plot is divided into three equal categories of external financial dependence: low, medium, and high. External financial dependence equals the proportion of capital expenditures financed with external funds. External financial dependence is calculated using mature COMPUSTAT firms for the period 1980-1996. The bars represent estimates from 6 separate OLS regression of unemployment status on a recession indicator after controlling for workers' observable characteristics (age, gender, ethnicity, and years of completed education), industry fixed effects, region fixed effects, and growth rate of household income. The recession indicator equals to one in the years 2008 and 2009. All estimates are weighted by sampling weights provided by the Current Population Survey (CPS). The sample includes respondents to the March CPS in the years 2005-2009. The sample is limited to adult civilians aged 16-65 in the year of the survey and excludes workers in the military, the public sector, and the financial sector.