Fiscal Stimulus, Credit Frictions and the Amplification Effects of Small Firms*

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Abstract

How does the effectiveness of fiscal stimulus depend on the composition of firms where the stimulus takes place? I study the role of firm size heterogeneity and credit frictions on the amplification effects of fiscal stimulus. This paper shows that the local fiscal multiplier increases with the share of small firms, implying multipliers of 0.95-2.15 in the interquartile range. Using firm-level data, I document that small firms are more responsive than large firms to government spending. Small firms increase operating revenues, investment and financing relative to large firms after a local fiscal stimulus. I propose a heterogeneous firm credit channel of fiscal stimulus to interpret these findings.

Keywords: *Fiscal stimulus, Firm size distribution, Financial Accelerator, Indirect effects*

JEL classification: E62, E52

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1 Introduction

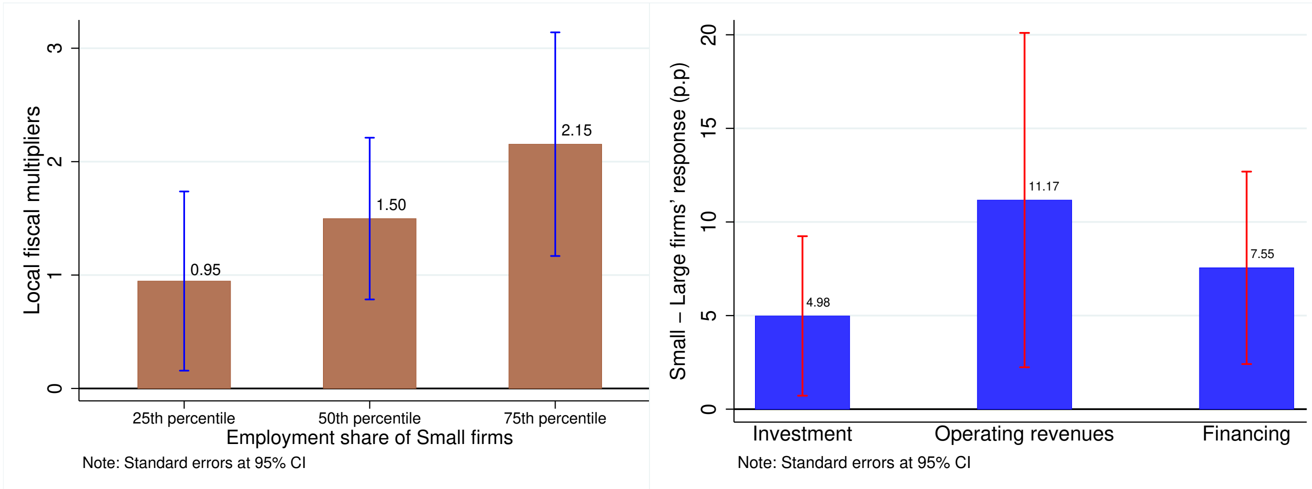
Which firms are the most responsive to aggregate fiscal stimulus? Small firms are different from large firms: for example, small firms are cyclically more sensitive and exhibit different investment, revenue and financing dynamics along the business cycle (Fort et al., 2013; Dinlersoz et al., 2019); and are typically more bank dependent and credit constrained (Beck et al., 2005). Given this rich heterogeneity across firms: How does firm size heterogeneity affect the fiscal multiplier?

I document that the *local* fiscal multiplier increases with the share of small firms using cross-sectional and time variation in national military procurement and the firm size distribution across metropolitan areas (MSAs) in the US. Figure 1(a) shows that the median *local* fiscal multiplier is 1.50 and increases with the employment share of small firms, implying multipliers of 0.95-2.15 in the interquartile range. To explain this result, I combine local fiscal stimulus with firm-level balance sheet information, *excluding government contractors*. I document positive indirect effects for non-contractor small firms and neutral impacts for non-contractor large firms (within the region). Figure 1(b) shows that among firms that did not receive a government contract, small firms increase operating revenues by 11 percentage points (p.p), investment by 5 p.p, and financing by 7.5 p.p relative to large firms in response to a *local* fiscal stimulus. This implies that non-contractor small firms are more responsive to local fiscal stimulus than non-contractor large firms.

To interpret this evidence, I propose a heterogeneous firm credit channel of fiscal stimulus. I embed the standard *"financial accelerator"* mechanism in a New Keynesian open economy model with two types of firms that have different access to credit markets (Bernanke et al., 1998; Nakamura and Steinsson, 2014). Small firms face a higher credit spread in equilibrium that is more sensitive to changes in firms' balance sheets. The fiscal stimulus improves firms' net worth, reducing small firms' credit spreads and relaxing borrowing constraints.[1] This boosts borrowing, investment and production; and amplifies the local fiscal multiplier endogenously. Calibrated to match cross-sectional and firm-level US data, the model can account for 2/3 of the heterogeneous response in firms' investment. Moreover, the model explains 10-20% of the sensitivity of the local fiscal multiplier to the share of small firms.

[1] I empirically document that local housing prices, the primary collateral value of small firms, rise by 1.25% after a local fiscal stimulus (Bahaj et al., 2019; Auerbach et al., 2019).

Figure 1: The local fiscal multiplier and firm size heterogeneity



(a) The local fiscal multiplier (b) Firms' responses

Note: Panel (a) displays the implied 1-year local fiscal multiplier along the distribution of the employment share of small firms in MSAs in the US from Equation (1). Data for the share of small firms is from Business Dynamic Statistics. The cross-sectional variation of military spending across MSAs identifies the government spending shock. Standard errors are clustered at MSA level. See Section 2 for details. Panel (b) shows the response of investment, operating revenues and financing for small firms relative to large firms that *did not receive* a military contract to a military spending shock. Firm level data is from ORBIS. See Equation (5).

I use the model to show that a higher *national* employment share of small firms also increases the *national* fiscal multiplier. The model implies that the national fiscal multiplier increases by 1.08% when the national employment share of small firms increases by 1%. Interestingly, this relationship is non-linear — it depends on the response of monetary policy to fiscal shocks (Woodford, 2011; Christiano et al., 2011). As the link between credit spreads and firms' balance sheets is stronger for small firms, a more aggressive monetary policy response is associated with a lower amplification of the national fiscal multiplier for small firms. The aggregate effects of government spending depend on the firm size distribution where the stimulus takes place and the response of monetary policy.

In my empirical analysis, I estimate the sensitivity of the local fiscal multiplier to the firm size distribution exploiting regional variation in national military procurement across MSAs in the US.[2] This method identifies an open economy local fiscal multiplier: it measures the effect of an increase in spending in one specific MSA within a monetary union *relative* to the response of all other MSAs (Nakamura and Steinsson, 2014).[3] Military spending is potentially endogenous since military contracts are notably political, and local politicians and politically connected firms can affect the allocation of spending (Choi et al., 2020). I use an IV strategy that exploits the heterogeneous sensitivity of military procurement at the MSA-level to an increase in (aggregate) *federal* military spending. For the firm size distribution across MSAs, I use panel data from

[2] Department of Defense (DOD) spending explains more than 50% of the discretionary spending of the federal government and is the third largest component of government spending, representing 18% of total US budget. See Demyanyk et al. (2019) and Cox et al. (2020) for a detailed characterization of total government procurement.

[3] This spending increase is financed by taxing individuals in all MSAs.

Business Dynamic Statistics (BDS).[4] The employment share of small firms will not be exogenous if firms in other MSAs change their location, entry or exit decisions because of military spending. To avoid this endogeneity concern, I instrument the employment share of small firms with a 20-year lag in firm entry.[5] Results show that increasing the employment share of small firms by 1% above the average, increases the local fiscal multiplier by 4.3%, from 1.57 to 1.64.

To identify the heterogeneous indirect effects of government spending at the firm level it is necessary to recognize that government contracts are not allocated randomly. The types of firms that receive government contracts and the timing of procurement may be endogenous to firms' decisions.[6,7] To overcome this endogeneity, I use contract level data from *USAspending.gov* to identify the firms that receive government contracts, match them with firm-level panel data from ORBIS and exclude all firms that received any military contract during the sample period. Therefore, I estimate the indirect effects of local fiscal stimulus for different types of firms that did not receive a direct contract from the government. Using ORBIS, with more than 7,600 non-financial small and large firms headquartered in the state where the fiscal stimulus occurs, I find that non-contractor small firms are more responsive to a local fiscal stimulus: their operating revenues, investment, and financing increase more than those of non-contractor large firms.[8,9] The main advantage of ORBIS is that it covers listed, unlisted, small, and large firms.[10]

Quantitatively, the proposed heterogeneous credit channel can explain up to 20% of the estimated sensitivity of the local fiscal multiplier to the share of small firms. Other plausible mechanisms that may be driving the amplification effects but are beyond the scope of this paper may be: (i) heterogeneous pricing decisions (i.e., small firms adjust prices less frequently); (ii) small firms are relatively more locally sourced, both from their output demand and their demand for capital and labor inputs; (iii) small firms may be located downstream in the supply chain through the input-output linkages[11]; (iv) positive assortative matching between workers and firms credit constraints[12]; and/or (v) local fiscal multipliers may be larger in those

[4]BDS is the public-release sample of statistics aggregated from the Census' Longitudinal Business Database.

[5]Gourio et al. (2016) show that firm entry shocks at the state level have persistent effects, affecting GDP growth for at least 12 years. To be cautious, I use a 20-year lag in firm entry.

[6]Small firms are different from large firms and government contractors. See Section 3.

[7]Ferraz et al. (2015), Lee (2017), Goldman (2020) and Choi et al. (2020) study the direct effects of government spending at firm level using quasi-natural experiments to deal with this endogeneity.

[8]Due to data availability, I do not exploit the geographic variation of DOD contracts at the MSA level. Appendix B.1 shows that the local fiscal multiplier also increases with the share of small firms at the state level, i.e., it is robust to this geographic aggregation.

[9]Similarly, Cohen et al. (2011) and Kim and Nguyen (2020) study the response of public corporations in Compustat to government spending shocks headquartered in the state that received the fiscal stimulus.

[10]In addition to excluding government contractors, my regressions include firm fixed effect to control for unobserved time-invariant heterogeneity at the firm level, state-year fixed effects to control for time-varying omitted variables at state level and other shocks occurring at the same time, and firm-level controls.

[11]Bouakez et al. (2020) use a New Keynesian model with multiple interconnected production sectors to show that the fiscal multiplier is amplified relative to a one sector model. Nevertheless, they do not consider firm size heterogeneity within industries.

[12]Flynn et al. (2020) explore the link between the heterogeneity of workers marginal propensity to consume (MPC) and the production network at the sectoral level for the size of the fiscal multiplier. Their results show that what matters is the heterogeneity in MPC. However, they do not consider heterogeneity across the firm size distribution.

MSAs with larger housing supply elasticities because this may support growth.[13] The purpose of the theoretical model is to quantify the role of the proposed mechanism.

Related literature. I contribute to four strands of literature. First, Neoclassical and Keynesian theories mostly ignore the role of firm heterogeneity on the fiscal multiplier. They typically employ a representative firm assumption (Baxter and King, 1993; Burnside et al., 2004; Galí et al., 2007).[14] I show that the heterogeneous behavior of small and large firms affects the size of the fiscal multiplier.

Second, I contribute to the literature that studies the links between credit frictions, firm heterogeneity and aggregate fiscal shocks. Regardless of the renewed interest in fiscal policy and the focus on the interaction with the response of monetary policy and heterogeneity in household credit constraints (Woodford, 2011; Christiano et al., 2011; Hagedorn et al., 2019; Auclert et al., 2018), the literature neglects the role of credit market imperfections for firms' financing decisions (Kaplan and Violante, 2014; Farhi and Werning, 2016; Demyanyk et al., 2019; Corbi et al., 2019). Melina and Villa (2014) and Olivero et al. (2019) document a negative relationship between credit spreads and national government spending shocks, which lead to an increase in bank lending. I show that the interaction between firm size and credit market imperfections amplifies the fiscal multiplier.[15] Auerbach et al. (2020b) show that the interest rate on consumer loans decreases after a local fiscal stimulus, with a larger reduction for riskier loans. I emphasize that these effects are present at the firm level and are heterogeneous by firm size.

Third, my paper contributes to the empirical literature that estimates firms' level responses to a fiscal stimulus. In the US, the focus has been exclusively on public and typically large firms from Compustat data. Hebous and Zimmermann (2021) merge a database of federal government contracts with US listed firms in Compustat and estimate the direct effects of government spending. They show that for those financially constrained contractors (proxied by firm size), direct demand shocks increase firm investment. They document null effects on contractors that are unconstrained, interpreting their findings as consistent with the financial accelerator model. Goldman (2020) finds that US listed firms that receive government contracts increase capital expenditures and have larger access to bank loans, with strong positive spillovers among firms through local supply chains. However, Cohen et al. (2011) document a reduction in capital expenditures and sales growth of public corporations in Compustat to local spending shocks. Similarly, Kim and Nguyen (2020) document negative effects that are particularly strong for smaller and financially constrained listed firms. Combining administrative data and quasi-natural designs in Brazil and Korea, Ferraz et al. (2015)

[13] I show preliminary evidence that this does not seem to be the case: the correlation between the local fiscal multiplier and MSAs housing supply elasticities documented in Saiz (2010) is -0.05, not statistically significant, and the R2 is 0.01.

[14] Ramey (2019) and Chodorow-Reich (2019) review the literature on the closed economy and cross-sectional fiscal multipliers.

[15] There is a rich literature which studies the role of heterogeneity in firms' credit frictions for the transmission mechanism of monetary policy (Gertler and Gilchrist (1994); Bernanke et al. (1998); Ottonello and Winberry (2018); Cloyne et al. (2019)).

and Lee (2017) find that small and young firms which receive a procurement contract tend to grow faster than large firms. These results are stronger for financially constrained contractors.[16] By using ORBIS and recognizing the differential responses of small and large firms to fiscal stimulus, I can reconcile the disagreement in the existing literature. To the best of my knowledge, there are no papers studying indirect effects of government spending at the firm level with both small and large firms.

Fourth, on the theory front, I extend a standard open economy model with the financial accelerator, including two types of firms with heterogeneous credit spreads. Fernández-Villaverde (2010) and Carrillo and Poilly (2013) show that financial frictions amplify the closed economy fiscal multiplier with a representative firm.[17] I contribute to this literature by showing that firm heterogeneity amplifies the local fiscal multiplier. Furthermore, heterogeneity in firms' financial frictions interacts with monetary policy to determine the national fiscal multiplier.

Road map. Section 2 presents the macro empirical evidence on how firm heterogeneity affects the size of the local fiscal multiplier. Section 3 presents the firm-level evidence on the differential response of small firms to a local fiscal stimulus. Section 4 presents a quantitative model to evaluate the proposed mechanism. Section 5 evaluates the role of small firms on the national fiscal multiplier. Section 6 concludes.

2 The local fiscal multiplier and the share of small firms

This section quantitatively documents that the local fiscal multiplier depends upon the firm size distribution. The empirical strategy uses a panel data set of output, government military spending and the share of small firms across MSAs in the US.[18]

2.1 Data

I use annual data on the geographical allocation of Department of Defense (DOD) procurement contracts for 2000-2013 from Demyanyk et al. (2019) aggregated at the MSA level. They collect DD-350 and DD-1057 military procurement forms from *USAspending.gov*. These forms contain information about the total amount obligated, the duration of the contract, along with the name and location of the prime contrac-

[16] Using comprehensive microdata with many small and private firms and large US firms, Zwick and Mahon (2017) find that small firms respond 95% more than large firms to investment tax incentives due to financial frictions.

[17] Canzoneri et al. (2016) show that fiscal multipliers are higher in recessions due to a counter-cyclical credit spread.

[18] The Bureau of Economic Analysis (BEA) defines an MSA as: "An area consisting of a core county or counties in which lies an urban area having a population of at least 50,000, plus adjacent counties having a high degree of social and economic integration with the core counties as measured through commuting ties.".

tors.[19] For most of the contracts, information regarding the location where most of the work was performed is available. Relative to studies that exploit the cross-sectional variation of DOD contracts at the state level to estimate state-level fiscal multipliers, this data allows me to reduce endogeneity concerns due to political lobbying and omitted variable bias with the inclusion of MSA fixed effects, increasing the cross-sectional dimension from 50 states to 344 MSAs.[20] To measure the employment share of small firms across MSAs, I use Business Dynamics Statistics (BDS). The BDS includes employment statistics by firm size operating in each MSA tabulated from microdata in the Longitudinal Business Database (LBD). The LBD covers the universe of firms and establishments in the nonfarm business sector with at least one paid employee.[21] Small firms are those with less than 250 employees. Data for real GDP is from the Bureau of Economic Analysis (BEA). Appendix A.1 presents the summary statistics.

2.2 Econometric specification

I estimate the causal effect of firm size heterogeneity on the local fiscal multiplier using the following panel specification:

$$\frac{Y_{m,t+l}-Y_{m,t-1}}{Y_{m,t-1}} = \delta_m + \delta_{t+l} + \beta\frac{G_{m,t+l}-G_{m,t-1}}{Y_{m,t-1}} + \gamma\frac{G_{m,t+l}-G_{m,t-1}}{Y_{m,t-1}} \times (S_{m,t-1}-\bar{S}) + \eta S_{m,t-1} + \epsilon_{m,t+l} \quad (1)$$

$Y_{m,t}$ is real GDP for MSA m in year t, $G_{m,t}$ denotes federal military spending allocated to MSA m in year t; $S_{m,t-1}$ is the log-employment share of small firms ($\times$ 100) in MSA m a year before the fiscal stimulus takes place ($t-1$) and represents the firm size structure of location m and $\bar{S} = \sum_m \sum_t \frac{S_{m,t}}{n_m n_t}$ is its average across all MSA-year observations, with n_m denoting the number of MSAs and n_t the number of years in the sample.[22] I include the employment share of small firms itself ($S_{m,t-1}$), and therefore, the interaction term captures the effect of the employment share of small firms on the local fiscal multiplier aside from the direct effect that small firms may have on output. I add MSA fixed effects to control for time-invariant unobserved heterogeneity across MSAs, such as industry production structure (e.g., share of manufacturing). Lastly, time-fixed effects control for aggregate shocks, such as national monetary and tax policies. Thus, the only possible confounding factors that may remain need to vary across MSAs and over time. I study the sensitivity of the local fiscal multiplier to the share of small firms at horizon $l = 1, 2$. Standard errors are clustered at the MSA level. In Equation (1), the coefficient β denotes the average local fiscal multiplier: it defines

[19]Modifications to existing contracts and de-obligation are observed. Demyanyk et al. (2019) voids contracts where obligations and de-obligations are within 0.5% of each other.

[20]For a further discussion of the construction of this dataset see Demyanyk et al. (2019).

[21]Davis and Haltiwanger (2019) using BDS data study how the young-firm activity shares move with local economic conditions, local house prices, and credit supply.

[22]Note that $\bar{S}$ is a constant that does not vary over MSAs and time. A similar specification is used by Basso and Rachedi (2018) to study the sensitivity of the local fiscal multiplier to the age structure across US states.

the dollar increase in real output following a one dollar increase in federal government spending in an MSA, with the average employment share of small firms. I de-mean the log-share of small firms only for interpretation purposes, but this does not affect the estimation of the firm-size sensitivity γ (see Basso and Rachedi (2018)).[23] The coefficient of interest is γ, which captures the sensitivity of the local fiscal multiplier to the firm size distribution. The interpretation is as follows: when the employment share of small firms increases by 1% above the average, the local fiscal multiplier would be $\beta + \gamma$. If $\gamma > 0$, a larger share of small firms increases the fiscal multiplier.

The challenge in the fiscal literature is that government spending is rarely exogenous, i.e., it varies automatically along the cycle. In this case, military expenditure is potentially endogenous since DOD contracts are notably political. Therefore, I identify government spending shocks following the approach of Nakamura and Steinsson (2014), which exploits the heterogeneous sensitivity of MSA's military procurement to an increase in (aggregate) *federal* military spending. The identification assumption relies on a weaker exogeneity restriction than that of previous studies that use military spending at the national level (Ramey (2011); Burnside et al. (2004)) or state level (Nakamura and Steinsson (2014); Basso and Rachedi (2018); Dupor and Guerrero (2017)). In particular, this empirical strategy assumes that the US as a country does not engage in aggregate military buildups or drawdowns (such as the Iraq War), because a specific MSA (e.g., *San Francisco-Oakland-Berkeley, CA*) is experiencing or is expected to suffer a recession relative to other MSA (e.g., *Champaign-Urbana, IL*). I use a two instruments IV approach, where the first stage estimates:

$$\frac{G_{m,t+l} - G_{m,t-1}}{Y_{m,t-1}} = \alpha_m + \alpha_t + \phi \left(s_m \times \frac{G_{t+l} - G_{t-1}}{Y_{m,t-1}} \right) + \psi Z_{m,t-1} + \epsilon_{m,t} \tag{2}$$

where G_t is the aggregate federal military spending in period t; s_m is MSA's average share of DOD contract $(G_{m,t}/G_t)$ over the relevant period; and $Z_{m,t-1}$ incorporates the instruments for the share of small firms and its interaction with changes in DOD spending. The instrument for local government spending relies on the variation of federal DOD spending, which by construction is orthogonal to the variation in local economic activity that can shape the allocation of federal spending across MSAs (Auerbach et al. (2020a, 2019); Demyanyk et al. (2019)).[24]

The identification of whether an MSA's firm size structure affects the local fiscal multiplier with location

[23]As $\bar{S}$ does not depend on m nor t, the specification is equivalent to $\frac{Y_{m,t+l} - Y_{m,t-1}}{Y_{m,t-1}} = \delta_m + \delta_t + \theta \frac{G_{m,t+l} - G_{m,t-1}}{Y_{m,t-1}} + \gamma \frac{G_{m,t+l} - G_{m,t-1}}{Y_{m,t-1}} \times S_{m,t-1} + \eta S_{m,t-1} + \epsilon_{m,t}$, with $\theta = \beta + \gamma \bar{S}$.

[24]There is a second identification assumption on the exogeneity of the shares s_m: the shares are not correlated with deviations from the short term growth rates. The challenge here is that the cross-sectional variation in s_m may be correlated with some unobserved trends that also affect the outcome of interest. In other words, MSAs with large military spending may be systematically on a different trend path. However, my identifying variation does not come from trends, but deviation from those trends as Equation (1) includes MSA fixed effects with GDP specified in growth rates. Therefore, the fixed effects remove any MSA-specific trend that is correlated with s_m. Appendix A.2 Table 9 shows the weak and generally non-significant correlation between s_m and MSAs' characteristics.

and time fixed effects comes from variation in the share of small firms across MSAs and its changes over time. For instance, the dispersion in the employment share of small firms across MSAs in 2006 ranges from 33.4% to 73.5%, and 76% of MSAs changed their relative ranking by at least 10 positions between 2001 and 2013.[25]

I estimate the sensitivity of the local fiscal multiplier to the employment share of small firms using instrumental variables for both military spending and the share of small firms. The employment share of small firms in the MSA that received the fiscal stimulus will not be exogenous if firms change their location decisions and/or entry or exit decisions because of military spending. To avoid this endogeneity concern, I instrument the employment share of small firms with lagged employment share of new business. Gourio et al. (2016) presents evidence at the state level that shocks to firm entry can affect GDP for as long as 12 years, dying out for longer horizons. For this reason, I use the employment share of new businesses born 20 years before the DOD spending shock takes place as an instrument for the employment share of small firms.

2.3 Results

Table 1 shows that the impact of a local fiscal stimulus is amplified in MSAs with a larger employment share of small firms. Column (1) reports a one-year local multiplier of 1.57 for an MSA with the average employment share of small firms, in line with the cross-sectional multiplier literature (Nakamura and Steinsson (2014); Chodorow-Reich (2019)). The coefficient of interest, γ, is positive and significant, implying that a larger employment share of small firms increases the local fiscal multiplier. In particular, the results indicate that when the employment share of small firms increases by 1% above the mean, the one-year local fiscal multiplier increases from 1.57 to 1.64 (= 1.573 + 0.068). Therefore the marginal effect of increasing the employment share of small firms by 1% on the fiscal multiplier is 4.32% (= 0.068/1.57). Combining the estimated coefficients with the interquartile range of the distribution of the employment share of small firms over the sample period, the local fiscal multiplier varies between 0.95 and 2.15.[26]

The output response at a 2-year horizon indicates an even larger sensitivity. Column (2) shows that the local multiplier increases by 5.34% when the employment share of small firms rises by 1% (from 1.44 to 1.52).[27]

[25] And 25% of MSAs changed their relative ranking by more than 50 positions during the sample period.

[26] Both multipliers are statistically significant at 5% level. The difference in multipliers across the 25^{th} and 75^{th} percentiles is 1.20 and statistically significant at 1% level.

[27] The impact of small firms at larger horizons is still positive but not significant.

Table 1: **The local fiscal multiplier: the role of small firms**

Output response	1-year (1)	2-years (2)
Military contracts (β)	1.573***	1.442***
	(0.369)	(0.380)
Military contracts × Emp share of Small (γ)	0.068**	0.077**
	(0.028)	(0.038)
Emp share of Small (η)	0.101**	0.077
	(0.040)	(0.062)
Obs.	3,784	3,440
MSA and Time FE	Yes	Yes
Cluster SE	MSA	MSA
1st Stage F-stat	18.41	22.78

Note: This table shows estimates of Equation (1). Small firms are defined as those with less than 250 employees. Sample period is 2001-2013 and includes 344 MSAs.***: p<0.01 ;**: p<0.05;*: p<0.1.

Exclusion Restriction. The identification of the firm size sensitivity of local fiscal multipliers hinges on instrumenting the employment share of small firms with a 20-year lag in the employment share of new firms. The implicit exclusion restriction posits that, conditional on MSA and time fixed effects, determinants of cross-sectional variation in firm creation (i.e., startups) have no other long-lasting effect on the size of fiscal multipliers 20 years later. The IV approach would not be valid if the sensitivity to federal government spending shocks - i.e., s_m in Equation (2) - is related to MSA's firm creation 20 years later. Yet, in the data, this correlation is -0.03 (p-value = 0.15, R2 = 0.001). Regarding the relevance of this IV, the first stage coefficient is 0.16*** (p-value < 0.01, R2 = 0.95).

Robustness. Appendix A.4 provides evidence that the sensitivity of the local fiscal multiplier to the employment share of small firms is robust to an array of specifications and time-varying controls. Table 11 shows the OLS results with considerably lower multipliers, explained by attenuation bias and the fiscal foresight problem of government spending shocks. Column (2) considers an alternative normalization that tests that the exploited variation is not driven by the secular trend in the reduction of the share of small firms. Column (3) shows that the estimate for the sensitivity of the fiscal multiplier is biased downward when we do not consider the possible endogeneity of the share of small firms. Are MSAs with larger shares of small firms cyclically more sensitive and therefore driving the results? Columns (4) and (5) show that results are robust to controlling for MSA-specific cyclicality and cyclicality specific to small firms. Table 12 shows that results are not driven by the biggest or smallest MSAs. Table 13 tests that once the IV strategy is implemented, it does not remain a fiscal foresight problem (Column (1)); and MSA's output does not react to future military shocks (placebo test). The baseline specification includes MSA and time-fixed effects that control for time-invariant and aggregate shocks, such as MSA production structure. If time-variant omitted variables remain, controlling for dynamic time-MSA varying factors may reduce the bias due to other confounding factors. Table 13, Columns (2)-(5), shows that controlling for the lagged log share of manufacturing and construction in MSA's value-added, house prices and unemployment rate does not quantitatively nor significantly change the estimated effect of small firms on the local fiscal multiplier. Table 14 shows that results are robust to the definition of small firms and highlights that the sensitivity of the multiplier depends on the overall MSA's firm size distribution. Lastly, Table 15 shows that a higher employment share of small firms also increases the response of earnings, wages and personal income to a fiscal stimulus.

3 Which firms are the most responsive to aggregate fiscal stimulus?

Which firms are the most responsive to fiscal stimulus? Are the indirect effects of government spending different by firm size? I study the heterogeneous behavior of non-contractor small and large firms vis-a-vis a local fiscal stimulus. I focus on firms that **did not receive** a DOD contract to avoid endogeneity concerns of the direct effects associated with the fact that the allocation of government contracts is non-random. For this purpose, I merge 3 datasets: (i) balance sheet information of non-financial private and public firms from the ORBIS database; (ii) firms that were granted DOD contracts from *USAspending.gov*; and (iii) local fiscal stimulus aggregated at the state level. This section estimates γ^{micro} at the firm level and shows that this evidence is consistent with the macro evidence at MSA level: small firms are more responsive to local fiscal stimulus, $\gamma^{micro} > 0$ and this increases the local fiscal multiplier, $\gamma^{MSA} > 0$.

3.1 Data

I build an annual US firm-level panel data set that includes the firm's location and military spending at the state level from 1997-2016. I start with data from ORBIS, a commercial database distributed by Bureau van Dijk, containing basic firm-level balance sheet information with the advantage of including data on small and large private and public firms.[28] I study the behavior of operating revenues, investment, short-term, long-term and total financing for more than 7,600 non-financial firms headquartered in the state where the *local* fiscal stimulus takes place. [29,30] Appendix B.2 presents variable definitions and descriptive statistics for each variable used in the estimation.[31] The local stimulus shock at state level is from Dupor and Guerrero

[28] I drop duplicates and double reporting for the same firm and states with less than 10 firms in the sample period and drop the top and bottom 2% of outliers for each variable.

[29] The ORBIS database does not have information about level of operation in the state. A similar approach is followed by Cohen et al. (2011) to study the response of public corporations in Compustat to seniority-linked government spending shocks headquartered in the congressman state. Kim and Nguyen (2020) use the same approach matching corporations' headquarter in Compustat with population revision census shocks at state level.

[30] I do not exploit the geographic variation of DOD contracts at MSAs level because of data availability. Appendix B.1 shows that Section 2 results are robust to this level of geographic aggregation.

[31] Appendix B.3 shows the descriptive statistics of the variables used in the analysis by state.

(2017), who update the measure of military spending from Nakamura and Steinsson (2014) until 2014.[32] I further extend the military procurement spending until 2016, aggregating the DOD contract level data from *USAspending.gov* to the state level.

The DOD buys goods and services directly from specific firms. This can bias any inference from firm behavior, given the endogeneity and selection concerns relating to which firms received a military contract and when they received them. To deal with this challenge, I *excluded all firms that received at least one DOD contract during the sample period*.[33] The goal in this analysis is to exclude the direct and endogenous effects of DOD contracts on firm' behavior and focus instead on the indirect effects of spending shocks.[34] Table 2 shows that small firms differ from large firms and government contractors. This motivates the study of the differential impacts of fiscal stimulus on these firms. Small firms grow faster than large firms, and contractors are less leveraged and face higher borrowing costs.[35] Appendix B.4 shows that firms that received at least one DOD contract, which were excluded from the sample, were mostly large (76% were listed firms, and only 19% were small firms), produced manufacturing goods (58%) and represented around 10% of all firms in the sample.

Table 2: Small firms are different from large firms and military contractors

	Small	Large	Contractors
Employment	43	1,836	1,965
Log Total Assets	15.32	19.33	19.41
Growth Op. Revenues (%)	11.28	10.75	8.51
Investment	-0.02	0.08	0.07
Leverage	0.52	0.57	0.50
Financial leverage	0.20	0.28	0.22
Borrowing cost (%)	4.82	3.30	2.73

3.2 Firm level econometric specification

I study the average firms' response to local fiscal stimulus, estimating the following:

$$\Delta y_{i,s,t} = \alpha_i + \alpha_t + \beta \frac{G_{s,t} - G_{s,t-2}}{Y_{s,t-2}} + \eta D_{s,t-2} + \theta X_{i,s,t-2} + \epsilon_{i,s,t} \quad (3)$$

where $\Delta y_{i,s,t}$ is the two-year log change of operating revenues and fixed assets for firm i located in state s at time t. Firms' investment is defined as the log change in fixed assets, and firms' operating revenues are net sales plus other operating revenues. $\frac{G_{s,t}-G_{s,t-2}}{Y_{s,t-2}}$ is the local fiscal stimulus normalized by state GDP. To

[32] I also extended Nakamura and Steinsson (2014) data from 2006 to 2016 using *USAspending.gov* database. Results are robust.

[33] I excluded DOD contractors for the whole sample period, no matter when the contract was granted.

[34] Ferraz et al. (2015), and Lee (2017) exploit randomness in the procurement process in Brazil and Korea to estimate the *direct* effect of government spending on firm behavior. Hebous and Zimmermann (2021) focus on contracts awarded in full and open competition with at least two bidders to control for potential anticipation effects.

[35] We proxy for borrowing costs with financial expenses over total liabilities.

control for other shocks that can occur in the same state, $D_{s,t-2}$ includes state-level controls such as GDP growth and the change in state taxes. $X_{i,s,t-2}$ controls for firm-level characteristics such as the log of total assets and profitability to account for changes in firm growth and creditworthiness, respectively.[36] Finally, I include firm and time-fixed effects. Firm fixed effects control for time-invariant firm-specific trends such as their industry sector (e.g., manufacturing). Time fixed effects control for aggregate (national) shocks common to all firms, such as the stance of monetary policy or federal tax policy. Standard errors are clustered at the state level, allowing the error term to be correlated across firms within a state.

Military spending is subject to endogeneity concerns, as discussed in the previous section, given that politically connected firms can alter the allocation of DOD contracts (Choi et al. (2020)). To address this endogeneity problem, I follow a standard IV approach for the identification of the shock and exclude firms that did receive a contract:

$$\frac{G_{s,t} - G_{s,t-2}}{Y_{s,t-2}} = s_s \times \frac{G_t - G_{t-2}}{Y_{t-2}}$$

where s_s is the average share of national DOD spending received by state s ($G_{s,t}/G_t$) over 1990-1996. Again the instrument relies on the heterogeneous sensitivity of states to aggregate variation of federal DOD contracts, which is exogenous to local economic activity.

To investigate the heterogeneous response of small and large firms to local fiscal stimulus, I include an interaction term between firm size and the government spending shock:

$$\Delta y_{i,s,t} = \alpha_i + \alpha_t + \beta \frac{G_{s,t} - G_{s,t-2}}{Y_{s,t-2}} + \gamma \frac{G_{s,t} - G_{s,t-2}}{Y_{s,t-2}} \times Small_{i,s,t-2} + \eta D_{s,t-2} + \theta X_{i,s,t-2} + \epsilon_{i,s,t} \quad (4)$$

where $Small_{i,s,t-2}$ is a dummy that takes value 1 if a firm has less than 250 employees before the fiscal stimulus (i.e., firm size is predetermined and exogenous at the moment of the shock).

By using firm-level data and including firm fixed effects, regression (3) and (4) allow me to mitigate concerns about reverse causation and unobserved firm-level factors driving firms' responses to fiscal stimulus. However, concerns remain that time-varying omitted variables may bias the estimates. Therefore, I focus on within state-year variation in firms' behavior across small and large firms. I estimate the following regression with state-year ($\alpha_{s,t}$) and firm fixed effects (α_i):

$$\Delta y_{i,s,t} = \alpha_i + \alpha_{s,t} + \gamma \frac{G_{s,t} - G_{s,t-2}}{Y_{s,t-2}} \times Small_{i,s,t-2} + \theta X_{i,s,t-2} + \epsilon_{i,s,t} \quad (5)$$

Note that Equation (5) can only estimate the differential response of small relative to large firms to a *local* fiscal stimulus.

[36] Nakamura and Steinsson (2014) show that the two-year change captures the dynamic effects of government spending on output parsimoniously at the state level.

3.3 Results

Table 3 reports that a local fiscal stimulus increases operating revenues and decreases investment for the average firm, though this evidence is not statistically significant (see columns (1) and (3)).[37] However, when I allow for the response to be heterogeneous by firm size, small firms increase their operating revenues by 10.7 percentage points and investment by 4.8 percentage points relative to large firms in response to a local DOD shock (see columns (2) and (4)). Large firms are barely affected (revenues and investment are negative but not significant). Therefore, among firms that did not receive a DOD contract, there is a differential indirect response to the local fiscal stimulus by firm size. I interpret these findings as evidence of positive indirect effects for small firms and neutral for large firms. This evidence is in line with the aggregate evidence at the MSA level presented in Section 2, which focuses on the employment share of small firms.

Table 3: Heterogeneous Firms' responses to Local Fiscal stimulus

	Operating Revenues growth			Investment (Δ Fixed Assets)		
	(1)	(2)	(3)	(4)	(5)	(6)
ΔG	1.804	-0.990		-1.205	-2.519	
	(2.384)	(2.610)		(2.675)	(2.509)	
$\Delta G \times$ Small (γ)		10.737**	11.168**		4.848**	4.978**
		(4.508)	(4.552)		(2.307)	(2.173)
ΔGDP	0.092	0.085		0.138	0.136	
	(0.185)	(0.181)		(0.129)	(0.129)	
$\Delta Taxes$	-0.128**	-0.129**		-0.087	-0.088	
	(0.058)	(0.059)		(0.059)	(0.058)	
Small	0.055***	0.046***	0.046***	0.019	0.015	0.016
	(0.012)	(0.012)	(0.013)	(0.025)	(0.026)	(0.025)
Total Assets	-0.177***	-0.177***	-0.173***	-0.327***	-0.327***	-0.326***
	(0.007)	(0.008)	(0.007)	(0.008)	(0.008)	(0.007)
Profitability	-0.020	-0.020	-0.021	0.097***	0.097***	0.097***
	(0.013)	(0.013)	(0.013)	(0.019)	(0.019)	(0.019)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	Yes	Yes	No
State × Year FE	No	No	Yes	No	No	Yes
Obs	59,412	59,412	59,412	61,011	61,011	61,011
Cluster SE	State	State	State	State	State	State
Kleibergen-Paap rk Wald F	9.435	4.882	45.64	9.338	4.845	41.88

Note: Data is from ORBIS. Firms that received a DOD contract during the sample period were excluded. Small firms are those with less than 250 employees. The sample period is 1997-2016. ***: p<0.01 ;**: p<0.05;*: p<0.1.

These results are robust to controlling for state-year fixed effects, addressing concerns about time-varying omitted variable bias. Columns (3) and (6) show that small firms increase investment by 5 percentage points *relative* to large firms and operating revenues by 11.2 percentage points. The fact that small firms increase revenues and investment in response to higher government spending suggests that the easing of credit constraints is worth studying as a plausible mechanism.

Robustness. Appendix B.6, B.7 and B.8 show that these results are robust. Table 20 shows that estimates

[37] These results are in line with Cohen et al. (2011) and Kim and Nguyen (2020), who find a reduction of capital expenditures for large public corporations after government spending shocks.

are similar if I include government contractors; however, investment is not statistically significant. Additionally, there may be concerns about sample selection because firms enter and exit the sample over time. Table 21 keeps only those firms that remain in the sample for at least 5 years, and the results are robust.[38]

It is also important to understand whether it is firms' size or financial position that is driving these heterogeneous responses. Tables 22 and 25 in Appendix B.6 test if responses are heterogeneous across firms above and below the median leverage and liquidity position before the stimulus. Results show no differential impact of a local fiscal stimulus across firms' debt or liquidity position. These results are confirmed in Tables 23 and 26 which test for heterogeneous responses across firm size coupled with either firm leverage or firm liquidity interaction terms. The results suggest that the differential impact is only present along the firm size spectrum.[39]

Another concern may be that because the composition of DOD contracts is biased toward manufacturing goods, this specific sector drives the findings. Table 28 shows that results remain the same, even controlling for industry-year fixed effects and time-varying state-level controls (instead of location-year fixed effects). As expected, Table 29 shows that the manufacturing firms grow faster than the non-manufacturing firms. Nevertheless, Table 30 shows that controlling for the differential effect of the manufacturing sector; small firms are still more responsive than large firms to fiscal stimulus.[40]

3.4 Fiscal stimulus and firms' use of external financing

Credit spreads are countercyclical. During booms, firms' balance sheets improve and have better growth opportunities and higher collateral values, all of which lead firms to raise investment and borrowing (Bahaj et al. (2019)).[41] How does the use of external finance of small firms react to fiscal stimulus? This subsection provides evidence that government spending shocks loosens the borrowing constraints of small firms.[42]

I now focus on firms' financing decisions after a local fiscal stimulus occurs. I define financing as the log change in total liabilities and short-term financing as current liabilities with maturity below one year.[43]

[38]Tables 33-36 in Appendix B.8 analyze the heterogeneous effects of fiscal stimulus across firms with less than 100 employees and those with between 100 and 250 employees vis-a-vis large firms. Results are robust.

[39]The results with a triple interaction are shown in Tables 24 and 27. Though not statistically significant, the evidence suggests that low leverage or high liquidity small firms are those that benefit the most from the fiscal stimulus.

[40]Table 31 test if the results are driven for manufacturing small goods producers with a triple interaction term. As little variation is left, standard errors naturally increase. However, the results are qualitatively robust. It's worth noticing that the largest increase in investment is for small manufacturing firms.

[41]Appendix B.5 shows that investment and financial expenses of small firms are more sensitive to aggregate output growth.

[42]Appendix A.3 shows that the survival rate of small firms increased in an MSA that received a fiscal stimulus relative to those that did not, while that of large firms is unaffected. At the same time, housing prices increased in an MSA that receives a fiscal stimulus. Larger values of firms' collateral may reduce information asymmetries between banks and borrowers, allowing for higher leverage. These constraints are particularly relevant for small firms.

[43]There may be concerns about the focus on total liabilities and not directly on total debt or bank loans. The reason for doing this is data availability: the sample size is reduced by half. Nevertheless, Appendix B.6 shows that the results for the reduced sample with a

As a proxy of the interest rate, I construct an implicit borrowing cost variable defined as the change in financial expenses over total liabilities. Table 4 reports the results. Relative to large firms, small businesses increase financing by 7.5 percentage points. Financing decisions for the average non-contractor firm are not statistically affected.[44]

Small firms may face borrowing constraints. Higher aggregate demand can help relax these constraints, reducing borrowers' perceived default risk due to increased firms' cash flows and the value of pledgable collateral. Auerbach et al. (2020a) present evidence that a local fiscal stimulus triggers a countercyclical credit spread. Columns (8) and (9) show that small firms' implicit borrowing costs decrease. This leads to an increase in investment by small firms, endogenously propagating the effects of fiscal stimulus.

Table 4: Fiscal stimulus and firms' use of external finance

	Total financing growth			Short-term financing growth			Δ Finan Exp/Liab.		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ΔG	0.758	-1.265		-0.429	-2.043		0.123	0.245	
	(2.550)	(2.062)		(2.385)	(2.709)		(0.317)	(0.318)	
$\Delta G \times$ Small (γ)		7.302**	7.550**		5.829**	6.800**		-0.619**	-0.670**
		(2.851)	(2.624)		(2.429)	(2.740)		(0.296)	(0.297)
ΔGDP	-0.011	-0.015		0.033	0.030		-0.007	-0.007	
	(0.116)	(0.116)		(0.097)	(0.096)		(0.012)	(0.012)	
$\Delta Taxes$	-0.068	-0.070		-0.034	-0.035		0.015*	0.015*	
	(0.051)	(0.050)		(0.051)	(0.050)		(0.008)	(0.008)	
Small	0.017	0.011	0.010	0.032**	0.074**	0.027**	-0.002	-0.002	-0.002
	(0.015)	(0.017)	(0.017)	(0.013)	(0.031)	(0.013)	(0.002)	(0.002)	(0.002)
Total Assets	-0.204***	-0.204***	-0.203***	-0.186***	0.006***	-0.184***	0.006***	-0.023***	0.006***
	(0.009)	(0.009)	(0.009)	(0.006)	(0.006)	(0.007)	(0.001)	(0.001)	(0.001)
Profitability	0.061***	0.061***	0.060***	0.065***	0.065***	0.065***	-0.001	-0.001	-0.001
	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.001)	(0.001)	(0.001)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
State $\times$ Year FE	No	No	Yes	No	No	Yes	No	No	Yes
Obs	62,054	62,054	62,054	62,054	62,054	62,054	38,916	38,916	38,916
Cluster SE	State	State	State	State	State	State	State	State	State
Kleibergen-Paap rk Wald F	9.265	4.836	43.15	9.265	4.836	43.15	10.460	5.444	43.18

Note: Data is from ORBIS. Firms that received a DOD contract during the sample period were excluded. Small firms are defined as those with less than 250 employees. The sample period is 1997-2016. ***: p<0.01 ;**: p<0.05;*: p<0.1.

This evidence points to a relaxation of borrowing constraints as a mechanism behind the larger real effects of fiscal stimulus on small firms. Given that demand for credit increases after a spending shock, I conjecture that the equilibrium level of credit increases due to a reduction of the borrowers' perceived default risk.[45]

Taking stock of the evidence. Section 2 documents that the local fiscal multiplier increases with the

detailed breakdown of financial debt (total, bank loans, and long-term debt) remain unchanged (responses are quantitatively larger but much less precisely estimated).

[44] Appendix B.7 shows that this evidence is robust if we decompose small firms between those with less than 100 employees and those with between 100 and 250 employees.

[45] Appendix C.1 using the narrative approach of Ramey (2011) to identify government spending news, I present evidence that at the national level, government spending shocks increase business loans and reduce the bank prime loan. Bank loans are the main source of funding for small firms. Results are in line with Melina and Villa (2014) and Olivero et al. (2019).

employment share of small firms, $\gamma^{MSA} > 0$. Quantitatively, increasing the employment share of small firms by 1% above the average implies a 4.32% larger one-year local fiscal multiplier. Furthermore, the survival rate of small firms and local housing prices increase. This evidence suggests small firm constraints may loosen after a government spending shock. Section 3, using firm-level data, shows that, within firms that did not receive a direct military contract, the investment response of small firms is around 5 percentage points larger than that of large firms, $\gamma^{micro} > 0$. At the same time, small firms improve their balance sheets, increasing earnings by more than 11 p.p relative to large firms. This increase in investment and earnings is accompanied by an increase of 7.5 p.p in borrowing and a reduction of borrowing costs. I document positive indirect effects of demand shocks for small firms and neutral for large firms. This evidence is qualitatively consistent with the financial accelerator mechanism. The next section develops a model to quantitatively evaluate how much of the empirical evidence can be explained by this mechanism.

4 The Model

This section develops a framework to interpret and quantify the role of firm size heterogeneity and financial frictions in determining the local fiscal multiplier. I embed the financial accelerator mechanism with endogenous countercyclical credit spread a la Bernanke et al. (1998) in a model of government spending within a monetary union and two firms, small and large, that face a heterogeneous cost of external finance (Nakamura and Steinsson (2014)).[46] The model consists of two regions that belong to a monetary and fiscal union: "home" and the "rest of the union". There are 5 types of agents: households, entrepreneurs (firms), retailers, capital goods producers, and a government with fiscal and monetary authority.

4.1 Entrepreneurs

Firms play the key role in this model, here relabeled as entrepreneurs. There are two types of risk-neutral entrepreneurs, s for small and l for large, who are perfectly competitive and produce two different intermediate outputs. These two types of entrepreneurs differ in the riskiness of their investment projects, leverage, and credit spread. Entrepreneurs have to borrow funds from lenders to finance their capital goods purchases from capital-producing firms. Entrepreneur i of type $j = s, l$ has available net worth, N^i_{jt+1} and

[46] Corsetti et al. (2013) study the transmission mechanism of fiscal policy in a small open economy with a fixed exchange rate in a similar spirit to Nakamura and Steinsson (2014).

finances the difference between its capital expenditures and its net worth by borrowing funds B^i_{jt+1}:

$$B^i_{jt+1} = P_{jkt} K^i_{jt+1} - N^i_{jt+1} \tag{6}$$

K^i_{jt+1} is the capital stock, P_{jkt} is the price of capital expressed in terms of the home final goods, and $\frac{P_{jkt} K^i_{jt+1}}{N^i_{jt+1}}$ is the leverage of entrepreneur i of type $j = s, l$. Entrepreneurs' net worth is defined as the borrowers' liquid assets plus the collateral value of illiquid assets less outstanding obligations. The production function of entrepreneur i in the home region h and type $j = s, l$ exhibits constant returns to scale and is given by:

$$y^i_{hjt} = (L^i_{jt})^{\alpha} (K^i_{jt})^{1-\alpha} \tag{7}$$

Each type of investment project is subject in each period to a random idiosyncratic productivity shock ω^i. This shock comes from a log-normal distribution, $\ln \omega_j \sim F(\frac{-\sigma^2_{\omega,j}}{2}, \sigma^2_{\omega,j})$ and has a different $\sigma^2_{\omega,j}$ for each type of firm $j = s, l$. $E(\omega) = 1$ and $F(\omega)$ is the CDF. The financial friction comes from an asymmetric information problem: the realization of ω^i is private information to the entrepreneur. To learn this value, the lender has to pay a monitoring cost μ^j, which is a fraction of the entrepreneur's remaining assets. The optimal contract between lenders and an entrepreneur specifies a cutoff value for ω, denoted as $\bar{\omega}^i_t$, the value of which is contingent upon the realization of shocks at t. Entrepreneurs with $\omega^i_t \geq \bar{\omega}^i_t$ will pay back their debts $Z^i_t B^i_t$ and retain profits equal to $\omega^i_t R^{K,i}_t P_{kt} K^i_{t-1} - Z^i_t B^i_t$, where Z^i_t is the non-default contract interest rate and $R^{K,i}_t$ is the return on capital. If $\omega^i_t < \bar{\omega}^i_t$ the firm goes bankrupt, it is monitored and lenders keep what is left (1-μ)$\omega^i_t R^{K,i}_t P_{kt} K^i_{t-1}$. The optimal contract implies that solvent firms will not be monitored and specifies the state-contingent rate Z^i_t, which in aggregate terms is linked to $\bar{\omega}_t$ as:[47]

$$\bar{\omega}_t R^K_t P_{k,t-1} K_t = Z_t B_t \tag{8}$$

The timing of events is as follows. At the end of $t-1$, there is a pool of entrepreneurs whose equity is N_t on aggregate. Those firms choose the optimal value of capital K_t and hence the level of borrowing B_t. The ex-post return on capital R^K_t is not known yet, since the government spending shock has not materialized, which will affect $\bar{\omega}_t$. As the cut-off value depends on the existence of aggregate uncertainty (G_t shocks), $\bar{\omega}_t$ is not known, and the risky loan rate Z_t is linked to macroeconomic conditions. Entrepreneurs make their decision based on $E_{t-1}\bar{\omega}_t$ and are subject to the lenders' participation constraint. Formally, entrepreneurs

[47] The index i has dropped because the optimal contract is homogeneous and standardized for all entrepreneurs of the same type. This aggregation is possible due to constant returns to scale of the entrepreneurial production function, i.i.d assumption of ω^i_t as well as the constant number of entrepreneurs in the economy, their risk neutrality, and perfect competitiveness. See Bernanke et al. (1998) for further details.

solve the following optimization problem (E1):

$$\underset{\{K_t, E_{t-1}\bar{\omega}_t\}}{Max} E_{t-1} \int_{\bar{\omega}_t}^{\infty} \Big[\omega R_t^K P_{k,t-1} K_t - Z_t B_t\Big] dF(\omega) = E_{t-1}\Big[1 - \Gamma(\bar{\omega}_t)\Big] R_t^K P_{k,t-1} K_t \tag{9}$$

subject to,

$$R_t(P_{k,t-1}K_t - N_t) = \Big[\Gamma(\bar{\omega}_t) - \mu A(\bar{\omega}_t)\Big] R_t^K P_{k,t-1} K_t \tag{10}$$

where $\Gamma(\bar{\omega}_t) \equiv \bar{\omega}_t \int_{\bar{\omega}_t}^{\infty} f(\omega)d\omega + \int_0^{\bar{\omega}_t} \omega f(\omega) d\omega$ and $A(\bar{\omega}_t) \equiv \int_0^{\bar{\omega}_t} \omega f(\omega) d\omega$. R_t is the risk-free gross interest rate and $R_t(P_{kt-1}K_t - N_t)$ captures the opportunity cost of the lenders (riskless loan). In equilibrium, this must be equal to the return on a risky loan $(\Gamma(\bar{\omega}_t))$ net of monitoring costs $(\mu A(\bar{\omega}_t))$.

When the G_t shock occurs, R_t^K is pinned down jointly with $\bar{\omega}_t$ and Z_t. As lenders are perfectly competitive, $\bar{\omega}_t$ solves the zero-profit condition (Eq. 10). Note that the lenders' zero profit condition (Eq. 10) can be interpreted as an economy-wide loan supply curve of the following form:

$$E_t\Big[\frac{R_{t+1}^K}{R_{t+1}}\Big] = E_t\Big[\frac{1}{\Gamma(\bar{\omega}_{t+1}) - \mu A(\bar{\omega}_{t+1})}\Big(1 - \Big(\frac{P_{kt}K_{t+1}}{N_{t+1}}\Big)^{-1}\Big)\Big] \tag{11}$$

which implies that capital expenditures are proportional to the net worth of entrepreneurs.

The behavior of the demand for capital and the returns to capital depends on the evolution of entrepreneurs' net worth N_{t+1}, which relies on entrepreneurs' earnings, net of interest payments to lenders. In order to endow entrepreneurs with some initial capital, it is assumed that they also work and receive labor income W_t^e. Therefore, total labor input is supplied by households and entrepreneurs, aggregated as follows:

$$L_t = (H_t^e)^{\Omega}(H_t)^{1-\Omega} \tag{12}$$

where the working hours of entrepreneurs H_t^e are normalized to 1 and Ω is the entrepreneurs' share in total labor.[48] Entrepreneurs' consumption is defined as:

$$C_t^e = (1 - \gamma_s)V_t \tag{13}$$

where γ_s is the entrepreneurs' constant probability of surviving to the next period (and $1 - \gamma_s$ the death rate). To keep the number of entrepreneurs constant every period, firms that have defaulted are replaced by new ones.[49] V_t is the aggregate ex-post profit of entrepreneurial firms, equal to the gross return on their

[48]Entrepreneurs supply their unit of labor inelastically, and I assume that $\Omega = 0.01$ and therefore, this modification to the standard production function does not have first-order effects.

[49]Therefore, there is no extensive margin in the model. This is a limitation that matters when mapping the theory to the empirical

capital less debts of the solvent firms and total monitoring costs:

$$V_t = R_t^K P_{k,t-1} K_t - \left(R_t + \frac{\mu \int_0^{\bar{\omega}_t} \omega dF(\omega) R_t^K P_{k,t-1} K_t}{P_{k,t-1} K_t - N_t} \right) (P_{k,t-1} K_t - N_t) \tag{14}$$

The net worth of the entrepreneurs for the next period is then the equity held by entrepreneurs that survive plus labor income of their own work:

$$N_{t+1} = \gamma_s V_t + W_t^e \tag{15}$$

Entrepreneurs sell their output to retailers. There are two different intermediate goods, one produced by a small firm and the other produced by the large firm. These intermediate goods are combined in a CES aggregator to a single wholesale good as follow:

$$Y_{Ht} = [a Y_{Hl,t}^{\rho} + (1-a) Y_{Hs,t}^{\rho}]^{1/\rho} \tag{16}$$

where $Y_{Hl,t} = \int_i y_{h,l,t}^i di$ and $Y_{Hs,t} = \int_i y_{h,s,t}^i di$ and H denotes the home region. The elasticity of substitution between small and large firms goods producer is denoted by ρ and a is the output share of large firms in aggregate output.

From (11), the price of capital differs across firms but optimal portfolio decisions requires:

$$E_t[(R_{H,l,t+1}^K - R_{H,s,t+1}^K) \beta U_{Ct+1} / U_{Ct}] = 0 \tag{17}$$

$$E_t[(R_{F,l,t+1}^K - R_{F,s,t+1}^K) \beta U_{Ct+1}^* / U_{Ct}^*] = 0 \tag{18}$$

where

$$E_t(R_{Hj,t+1}^K) = E_t \left[\frac{(1-\alpha) \dfrac{Y_{Hjt+1}}{X_{t+1} K_{jt+1}} \dfrac{P_{jt}}{P_t} - (1-\delta) \tilde{P}_{jkt+1}}{P_{kt}} \right] \tag{19}$$

where $\dfrac{P_{lt}}{P_t} = a \Big(\dfrac{Y_{Hlt}}{Y_{Ht}} \Big)^{\rho-1}$, $\dfrac{P_{st}}{P_t} = (1-a) \Big(\dfrac{Y_{Hst}}{Y_{Ht}} \Big)^{\rho-1}$ and X_t is the gross mark-up of retail goods over wholesale goods meaning that $1/X_t$ is the relative price of wholesale goods.

Lastly, as labor is immobile across regions, optimal labor decisions require that real wages are equal for both types of firms $j = s, l$ within a region,

$$W_t X_t = \alpha (1 - \Omega) \frac{y_{jt}}{H_{jt}} \quad \text{and} \quad W_t^e X_t = \alpha \Omega \frac{y_{jt}}{H_{jt}^e} \tag{20}$$

results, given that Table 10 shows that the survival rate of small firms increased after a local fiscal stimulus.

4.2 Capital Producers

Entrepreneurs use capital from production but do not permanently own it. They purchase it from perfectly competitive capital producers at the end of time $t-1$, use it in production, and re-sell the non-depreciated part $(1-\delta)K_t$ at time t. Capital is firm-type specific for $j = s, l$. Capital producers purchase investment goods, $I_{j,t}$ and old capital $K_{j,t}$ to produce new capital goods $K_{j,t+1}$ that will be sold to entrepreneurs j solving (C1):

$$\underset{\{K_{jt}, I_{jt}\}}{Max} E_0 \sum_{t=0}^{\infty} [P_{jkt} K_{jt+1} - I_{jt} - \tilde{P}_{jkt} K_{jt}] \tag{21}$$

subject to,

$$K_{jt+1} = \phi_j\Big(\frac{I_{jt}}{K_{jt}}\Big) K_{jt} + (1-\delta) K_{jt} \tag{22}$$

where the adjustment cost is an increasing and concave function $(\phi'(.) \geq 0, \phi''(.) \leq 0, \phi(0) = 0)$ and $\tilde{P}_{jkt}$ is the price of previously-installed capital.[50] The link between the price of capital and investment is due to capital adjustment costs. Optimality conditions require that the price of a unit of capital in terms of the home goods is given by,

$$P_{jkt} = \left[\phi_j'\Big(\frac{I_{jt}}{K_{jt}}\Big)\right]^{-1} \tag{23}$$

$$\tilde{P}_{jkt} = \Big[(1-\delta) + \phi_j\Big(\frac{I_{jt}}{K_{jt}}\Big) - \phi_j'\Big(\frac{I_{jt}}{K_{jt}}\Big) \frac{I_{jt}}{K_{jt}}\Big] P_{jkt} \tag{24}$$

4.3 Retailers

To match the average local fiscal multiplier, the literature introduces nominal rigidities (Nakamura and Steinsson, 2014). To simplify the financial contract between lenders and entrepreneurs while still allowing for monopolistic competition and price rigidities, I assume the existence of a monopolistically competitive retail sector subject to a price-setting decision à la Calvo. Specifically, there is a continuum of retailers who buy output from entrepreneurs/producers in a competitive market and costlessly differentiate them into varieties of final outputs. Let $Y_t(z)$ be the quantity of output sold by retailer z, measured in units of wholesale goods, and let $P_t(z)$ be the nominal price. The total final usable good, Y_t^f is the following composite: $Y_t^f = \left[\int_0^1 Y_t(z)^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}}$, where $\theta > 0$ is the elasticity of substitution across different varieties of final output. Lastly, the demand for retailer z is $Y_t(z) = \left(\frac{P_t(z)}{P_t}\right)^{-\theta} Y_t^f$. Final output can be either transformed into a single type of consumer good, invested or consumed by the government or used up in monitoring costs. As these retailers have market power and therefore make non-zero profits, profits are returned to households

[50] Pancrazi et al. (2016) show that the approximation of the previously installed capital with the newly installed capital has first-order equilibrium distortions when $\delta > 0$. I follow their suggested correction.

in a lump-sum form.

Retailers have a probability $1-\epsilon$ of changing their price each period. Let P_t^* denote the price set by retailers who can change their price optimally at t and $Y_t(z)^*$ is the demand at that price. Retailers choose to maximize their expected discounted profits:

$$\sum_{k=0}^{\infty} \epsilon^k E_{t-1}\Big[\beta \frac{U_{c,t+k}}{U_{c,t}} \frac{P_t^* - P_{t+k}/X_{t+k}}{P_{t+k}} Y_{t+k}^*(z)\Big] \tag{25}$$

Retailers set their optimal prices so that in expectation, discounted marginal revenue equals discounted marginal cost, given the constraint that the nominal price is fixed with probability ϵ. This optimization problem yields a standard home and foreign Phillips curve.

4.4 Households

The home region has a continuum of household types indexed by x. Households decide to consume home and foreign goods, supply labor, and invest their savings in a financial intermediary that pays the risk-free interest rate. A household's type specifies the type of labor provided by that household. Home households of type x solve the following problem (H1),

$$\underset{\{C_{t+j}, H_{t+j}(x), D_{t+j}\}}{Max} E_t \sum_{j=0}^{\infty} \beta^j U(C_{t+j}, H_{t+j}(x)) \tag{26}$$

subject to,

$$P_t C_t + D_{t+1}(x) = W_t^n(x) H_t(x) + R_t D_t(x) - T_t + \Pi_t \tag{27}$$

D_{t+1} are deposits at a financial intermediary,[51] R_t^n is the nominal risk-free interest rate, P_t is a price index that gives a consumer the minimum price of a unit of the composite consumption good C_t, W_t^n is the wage rate received for working H_t hours by household type x, T_t are lump-sum taxes collected by the federal fiscal authority and Π_t are profits from home intermediate producers.

Optimal choice between current and future consumption gives the Euler equation:

$$\beta \frac{U_{c,t+1}}{U_{c,t}} = E_t \frac{P_{t+1}}{P_t} \frac{1}{R_{t+1}^n} \tag{28}$$

[51] In equilibrium, household deposits at intermediaries are equal to total loanable funds supplied to entrepreneurs: $D_{t+1} = B_{t+1}$.

The optimal intra-temporal decision between current consumption and current labor supply gives,

$$\frac{U_{H,t}}{U_{c,t}} = \frac{W_t^n}{P_t} \tag{29}$$

Households optimally choose to minimize the cost of attaining the level of the composite consumption good given by,

$$C_t = \left[\phi_H^{1/\eta} C_{Ht}^{\frac{\eta-1}{\eta}} + \phi_F^{1/\eta} C_{Ft}^{\frac{\eta-1}{\eta}}\right] \tag{30}$$

ϕ_H and ϕ_F denote households' relative preference for home and foreign goods. I normalize and set these preferences by setting $\phi_H + \phi_F = 1$. C_{Ht} and C_{Ft} are consumption of composites home and foreign goods and $\eta > 0$ is the elasticity of substitution between home and foreign goods.

$$C_{Ht} = \left[\int_0^1 c_{ht}(z)^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}} \quad \text{and} \quad C_{Ft} = \left[\int_0^1 c_{ft}(z)^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}} \tag{31}$$

$\theta > 0$ is the elasticity of substitution across different varieties. $c_{ht}(z)$ and $c_{ft}(z)$ denote the consumption variety z of home and foreign-produced goods, respectively. Goods markets are completely integrated across regions, and therefore home and foreign consumers face the same prices.

Households minimize the cost of buying the consumption basket C_t. These optimal decisions imply demand curves for home and foreign goods, and for each of the differentiated products of the form:

$$C_{Ht} = \phi_H C_t \Big(\frac{P_{Ht}}{P_t}\Big)^{-\eta} \quad \text{and} \quad C_{Ft} = \phi_F C_t \Big(\frac{P_{Ft}}{P_t}\Big)^{-\eta} \tag{32}$$

$$c_{ht}(z) = C_{Ht} \Big(\frac{p_{ht}(z)}{P_{Ht}}\Big)^{-\theta} \quad \text{and} \quad c_{ft}(z) = C_{Ft} \Big(\frac{p_{ft}(z)}{P_{Ft}}\Big)^{-\theta} \tag{33}$$

where

$$P_{Ht} = \left[\int_0^1 p_{ht}(z)^{1-\theta} dz\right]^{\frac{1}{1-\theta}} \quad \text{and} \quad P_{Ft} = \left[\int_0^1 p_{ft}(z)^{1-\theta} dz\right]^{\frac{1}{1-\theta}} \tag{34}$$

and

$$P_t = \left[\phi_H P_{Ht}^{1-\eta} + \phi_F P_{Ft}^{1-\eta}\right]^{\frac{1}{1-\eta}} \tag{35}$$

The problem of the foreign household is defined analogously.

4.5 The Government

There is a federal government that runs a balanced budget, purchasing goods and collecting lump-sum taxes in both home and foreign regions such that,

$$nP_{Ht}G_{Ht} + (1-n)P_{Ft}G_{Ft} = T_t \tag{36}$$

where n is the relative size of the home region, P_{Ht} is the home relative price of home goods and G_{Ht} is the per capita government purchases of home consumption goods. Lump-sum taxes are defined as $T_t = nT_{Ht} + (1-n)T_{Ft}$. I assume that government demand mimic the private demand for differentiated goods:

$$g_{ht}(z) = G_{Ht}\Big(\frac{p_{ht}(z)}{P_{Ht}}\Big)^{-\theta} \qquad \text{and} \qquad g_{ft}(z) = G_{Ft}\Big(\frac{p_{ft}(z)}{P_{Ft}}\Big)^{-\theta} \tag{37}$$

The policy experiment consists in an increase in government spending in the home region financed with an increase in federal lump-sum taxes (Farhi and Werning (2016)).

The Monetary authority follows a standard Taylor rule for the country's nominal interest rate (in linearised form),

$$\hat{R}^n_t = (1-\rho_R)(\phi_\pi\hat{\pi}_t + \phi_Y\hat{Y}_t) + \rho_R\hat{R}_{t-1} \tag{38}$$

where ρ_R denotes the degree of interest rate smoothing, ϕ_π is the response to the weighted average deviation of national inflation from target and ϕ_Y is the reaction to (the weighted average) national output gap. Lastly, $\hat{\pi}_t = n\hat{\pi}_{Ht} + (1-n)\hat{\pi}_{Ft}$ and $\hat{Y}_t = n\hat{Y}_{Ht} + (1-n)\hat{Y}_{Ft}$, where variables with a hat ($\wedge$) are expressed as deviations of steady state values.

4.6 Equilibrium

Definition. Given $F_j(\omega)$, a competitive equilibrium is a sequence of allocations and price functions, $\{C_{it}, C^e_{it}, H_{ijt}, D_{it}, W_{it}, Y_{ijt}, K_{ij,t+1}, B_{ijt}, P_{kijt}, R^K_{ij,t+1}, R^n_{t+1}, P_{i,t}, G_{it}, T_t, \bar{\omega}_{ijt}\}^\infty_{t=0}$, for $i = H, F$ and $j = s, l$ such that:

1. Households solve $H1$ for $i = H, F$;

2. Entrepreneur j solves $E1$ for $i = H, F$;

3. Capital producers solve $C1$ for $i = H, F$;

4. Government satisfies budget constraint: $nP_{Ht}G_{Ht} + (1-n)P_{Ft}G_{Ft} = T_t$;

5. Goods markets clears: $Y_t = nY_{Ht} + (1-n)Y_{Ft}$; $Y_{it} = C_{it} + I_{it} + G_{it}$,
   $C_t = [n(C_{it} + C^e_{it}) + (1-n)(C^*_{it} + C^{e*}_{it}]$; $I_t = [nI_{it} + (1-n)I^*_{it}]$

6. And bond market clears: $\sum_j (Q_{ijt}K_{ij,t+1} - N_{ij,t+1}) = \sum_j B_{ij,t+1} = D_{it+1}$

4.7 Calibration

I consider the utility function from Greenwood et al. (1988) (i.e. GHH preferences), where consumption and labor are complements. Nakamura and Steinsson (2014) point out that these preferences help to match the average local fiscal multiplier within this framework:

$$U(C_t, H_t) = \frac{(C_t - \chi H_t^{1+\nu^{-1}}/(1+\nu^{-1}))^{1-\sigma^{-1}}}{1-\sigma^{-1}} \tag{39}$$

Table 5 summarizes the parametrization of the model. A period in the model corresponds to a quarter. Using BDS and ORBIS, I choose parameter values to match cross-sectional moments of US local economies and heterogeneity by firm size. For the rest of the parameters I follow Nakamura and Steinsson (2014) and Bernanke et al. (1998). I set $\sigma = 1$ and $\nu = 1$, which capture the Frisch-elasticity. The subjective discount factor β is set to match an annual nominal interest rate of 2%. The elasticity of substitution across varieties is $\theta = 7$, and the substitution between home and foreign goods is $\eta = 2$. The frequency of price change is set to $\epsilon = 0.75$, which implies that retailers change prices once a year on average. The labor share is set to $\alpha = 0.65$, and therefore the capital share is 0.35. The quarterly depreciation rate is $\delta = 0.02$. The home bias for the average MSA is set to $\phi_H = 0.66$ from Dupor et al. (2018) who use the Commodity Flow Survey (CFS) for 2012. The size of the average MSA is $n = 1\%$ calibrated from BEA.

Regarding the policy parameters, the persistence of the government spending shock is set to 0.95, following Basso and Rachedi (2018) which estimates an AR(1) process with state-level data from 1967 to 2015. The conduct of the monetary policy is calibrated using the estimated Taylor rule by Nakamura and Steinsson (2014).[52]

Using BDS, I set the average employment share of small firms across MSAs over the sample period equal to 46% and the average exit rate (i) for small and large firms to 7% and 1% on average, respectively. I calibrate the (ii) credit spread of small and large firms from ORBIS at 3% and 1%, respectively. Leverage

[52] I set the response of monetary policy to the output gap equal to zero, $\phi_Y = 0$, to make a counterfactual exercise clear. See Section 5 for more details.

(iii) is calibrated to match the average ratio of assets to liabilities for small and large firms in ORBIS, 2.08 and 2.32, respectively (see Table (2)). I follow Bernanke et al. (1998) and calibrate the entrepreneurial labor share equal to 0.01 (iv). Lastly, using (i)-(iv) I solve for steady state values for σ_{ω_j}, $\bar{\omega}_j$, μ_j and γ_{sj} for $j = s, l$. The heterogeneous capital adjustment costs are calibrated such that the dispersion in firm-level investment matches ORBIS data: 18.69 vs. 14.34 for small firms and 4.37 vs. 4.27 for large firms. I choose an elasticity of substitution between goods produced by small and large produced equal to 0.5.[53]

Table 5: Calibration

		Target/Source	All	
Discount factor	β	2% i^n	0.995	
Elast. of substitution between home and foreign goods	η	NS14′	2	
Elast. of substitution across varieties	θ	NS14′	7	
Calvo parameter	ϵ	NS14′	0.75	
Labor share	α		0.65	
Depreciation	δ		0.02	
Relative size of avg. MSA	n	BEA	0.01	
Home bias	ϕ_H	Dupor et al, 19′	0.66	
Taylor rule	$(\phi_\pi, \phi_Y, \phi_R)$	NS14′	(1.5,0,0.8)	
Gov. Spending, Shock persistence	$(G/Y, \delta)$	Basso&Rachedi, 20′	(0.20,0.95)	
Financial Accelerator & **Firm size**		Target/Source	Small	Large
Emp. share		BDS	46%	54%
Steady-state risk spread (annual)(^{m})	R^K/R	ORBIS	3%	1%
Business failure (annual) (^{m})	$F(\bar{\omega})$	BDS	7%	1%
Leverage ratio (^{m})	B/N	ORBIS	0.52	0.57
Entrepreneurial Labor share (^{m})	Ω	BGG99′	0.01	0.01
Capital Adjustment Cost	ϕ	$(\sigma^I_s, \sigma^I_l)ORBIS$	0.10	0.50
Standard error of idiosyncratic shock*	σ_ω		0.300	0.197
Threshold value of idiosyncratic shock*	$\bar{\omega}$		0.457	0.568
Monitoring cost*	μ		0.091	0.134
Survival rate of entrepreneurs*	γ_s		0.979	0.988
Elast. of risk premium wrt leverage	ν	Deduced at SS	0.045	0.025
Elast. of substitution between small and large	ρ		0.50	

4.8 Results

This section compares γ^{micro} and γ^{MSA} estimated in Sections 2 and 3 with the same objects estimated using model generated data.

First, using the average calibration for the employment share of small firms (46%) between 2000 and 2013, I study the differential response in investment between small and large firms γ^{micro} to a federally financed increase in government spending in the home region G_H relative to the differential response of small and large firms in the foreign region, as estimated in Equation (5). Table 6 shows that the model generates a differential response of 3.14% versus almost 5% in the data (column (6) in Table 3). This implies that the model can account for about 2/3 of the heterogeneous investment response between small and large firms. The financial accelerator mechanism quantitatively matches the differential response of investment documented in the data reasonably well.

Can the model quantitatively match the effect of the employment share of small firms on the local fiscal

[53] The higher this elasticity of substitution, the higher the heterogeneous response of small vs. large firms. Sensitivity analysis shows that the baseline results are not significantly affected.

multiplier, γ^{MSA}? I estimate Equation (1) used in Section 2 with model generated data:

$$\frac{Y_{m,t+1} - Y_{m,t-1}}{Y_{m,t-1}} = \beta \frac{G_{m,t+1} - G_{m,t-1}}{Y_{m,t-1}} + \gamma^{MSA} \frac{G_{m,t+1} - G_{m,t-1}}{Y_{m,t-1}} \times (S_{m,t-1} - \bar{S}) + \eta S_{m,t-1} + \delta_m + \delta_t + \epsilon_{m,t}$$

β is the local fiscal multiplier an MSA with the average employment share of small firms. Given that the model is symmetric (i.e. it has the same share of small firms in both regions) I estimate β with the above equation using the average employment share of small firms. Table 6 shows that β is equal to 1.70, which, although a slight overestimates, is not too far from the size of the one-year average local fiscal multiplier of 1.57 found in Section 2. Quantitatively, the model does a good job matching the average local fiscal multiplier. However, this is not new; this is a feature of Nakamura and Steinsson (2014) model, which I follow.

As the model is symmetric and does not have a heterogeneous share of small firms (S_m) and government spending (G_m) across regions, I compute γ^{MSA} as the average difference in βs of two regressions. These βs differ in the employment share of small firms by 1% across the range of S_m and G_m observed in the data.[54] Table 6 shows that γ^{MSA} = 0.010 from the model-generated results versus 0.068 in the data. The model's results imply that increasing the employment share of small firms by 1%, increases the local fiscal multiplier by 0.59%, versus 4.32% in the empirical results. The model can account for 14% (=(0.59/4.32)×100) of the sensitivity of the local fiscal multiplier to the share of small firms.[55]

Table 6: Local fiscal multipliers: the role of small firms

		Data	Model
Difference in Investment response (γ^{micro})		4.978	3.142
Investment: Ratio of Model-Data explained		**63.1**%	
Average Local Output Fiscal Multiplier	β	1.573	1.705
Sensitivity wrt Small firms	γ^{MSA}	0.068	0.010
Δ Local Multiplier of 1% increase in Share of Small	γ/β	4.32%	0.59%
Local Fiscal Multiplier: Ratio of Model-Data explained		**13.7**%	
[Min; Max]		[10.3%; 17.1%]	

5 Small firms and the national fiscal multiplier

Policymakers and the fiscal literature focus on national multipliers. Even though I have not estimated the effects of the employment share of small firms on the national multiplier, the model can produce such a multiplier given that it accounts for general equilibrium effects. I use the model to ask: Does a larger share of small firms increase the national aggregate fiscal multiplier? In other words, is $\gamma_{nat} > 0$?

[54]Specifically, γ^{MSA} = Mean($\beta_{g,s+1} - \beta_{g,s}$), with $g = G^{min}, .., G^{max}$ and $s = S^{min}, .., S^{max}$.

[55]And between 10-17% of sensitivity across all simulations.

Using model-generated data from the baseline calibration, I run the following regression aggregating output and the employment share of small firms across regions: $Z_t^{nat} = nZ_t^H + (1-n)Z_t^F$, with $Z = Y, G, S$. Next, I calculate how national output changes in response to a symmetric government spending shock in both, home and foreign regions, and how this impact changes with the employment share of small firms.

$$\frac{Y_{t+1}^{nat} - Y_{t-1}^{nat}}{Y_{t-1}^{nat}} = \beta_{nat} \frac{G_{t+1}^{nat} - G_{t-1}^{nat}}{Y_{t-1}^{nat}} + \gamma^{nat} \frac{G_{t+1}^{nat} - G_{t-1}^{nat}}{Y_{t-1}^{nat}} \times (S_{t-1}^{nat} - \bar{S}^{nat}) + \eta S_{t-1}^{nat} + \epsilon_t$$

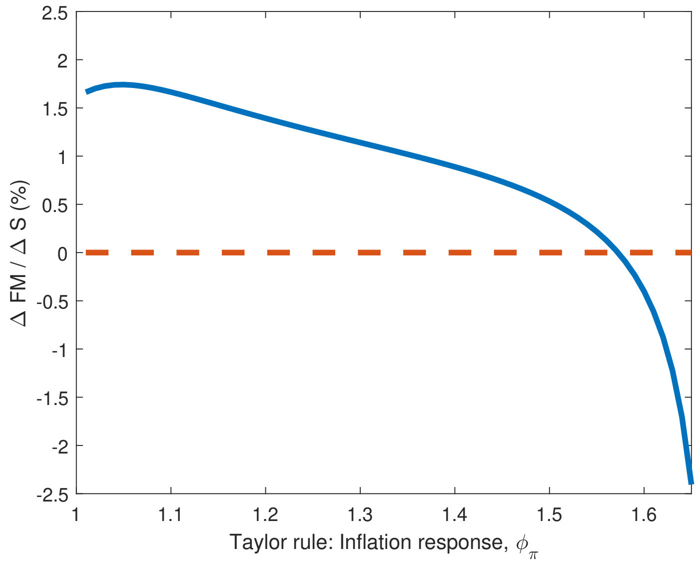
As before, β^{nat} is the national fiscal multiplier in an economy with the average national employment share of small firms. To compute the effect of the share of small firms on the national fiscal multiplier, I change the share of small firms by 1% and therefore define $\gamma^{nat} = \beta_{\bar{S}+1}^{nat} - \beta_{\bar{S}}^{nat}$. Table 7 presents the results: β^{nat} is 0.277 and increases with the share of small firms, $\gamma^{nat} = 0.003$. This implies that increasing the employment share of small firms by 1%, rises the national fiscal multiplier by 1.08%.

Table 7: National fiscal multipliers: the role of small firms

		Model
National Fiscal Multiplier	β^{nat}	0.277
Sensitivity wrt Small firms	γ^{nat}	0.003
Δ National Multiplier of 1% increase in Share of Small	γ/β	1.08%

National policies such as the common monetary policy and federal tax policy affect the size of the national fiscal multiplier. The consensus in the literature is that more accommodative monetary policies increase the national fiscal multiplier. The extreme case is the zero lower bound, where the fiscal multiplier can be significantly large (Christiano et al., 2011). Intuitively, this result is because when the central bank does not increase the nominal interest rate after a fiscal stimulus, inflation goes up and the real interest rate goes down, crowding-in consumption and investment. Next, I use the model to explore how the employment share of small firms interacts with monetary policy in determining the national fiscal multiplier. Figure 2 shows that the relationship between the share of small firms and the national multiplier is non-linear: it depends on how aggressive monetary policy reacts to fiscal shocks ($\gamma^{nat} = f(\phi_\pi)$). The larger the stabilization role of monetary policy (ϕ_π), the smaller the role of the financial accelerator. Therefore, a larger stabilizing role of the monetary authority decreases the impact that small firms have on the national fiscal multiplier. The model predicts that the amplification effects of small firms on the *national* fiscal multiplier are larger at the ZLB.

Figure 2: National fiscal multipliers, Small firms and Monetary policy



6 Conclusions

The results presented here imply that the composition of firms where a fiscal stimulus takes place is key to designing fiscal packages to stabilize the economy. Specifically, this paper presents evidence of a firm size-dependent multiplier where the heterogeneous behavior of small and large firms shapes the effectiveness of the fiscal stimulus. The fiscal multiplier increases with the share of small firms in the economy. A financial accelerator channel of fiscal stimulus is emphasized, where the aggregate effects of government spending depend on the distribution of financial constraints that firms face, which can vary over time. The propagation of government spending shocks through the interaction of firm heterogeneity and credit markets restricts the class of models able to match the empirical evidence presented here. Lastly, I show that the indirect effects of a demand shock can be sizable for small firms.

Further research is needed to improve our understanding of the links between firms and households decisions for the amplification of fiscal stimulus. Recent contributions bring the complex network structure between consumption and production into the transmission mechanism of fiscal policy (Patterson et al. (2019); Bouakez et al. (2020)).

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A Appendix: MSA Evidence

A.1 MSA level data - Summary Statistics

Table 8: *Summary statistics*

Variable	Mean	SD	p25	p50	p75
GDP growth (%), $(Y_{m,t+1} - Y_{m,t-1})/Y_{m,t-1}$	3.42	6.44	-0.25	3.33	6.69
DOD spending growth (%), $(G_{m,t+1} - G_{m,t-1})/Y_{m,t-1}$	0.24	1.78	-0.07	0.04	0.28
Ratio DOD spending over GDP (%), $G_{m,t}/Y_{m,t}$	1.37	2.68	0.15	0.46	1.44
Shift Share ($s_m = G_m/G$)	0.29	0.98	0.01	0.03	0.17
Employment share of Small250 (Emp $<$ 250) (%)	46.27	6.56	41.85	45.35	49.87
Employment share of Small100 (Emp $<$ 100) (%)	37.77	6.06	33.64	36.70	41.08
Employment share of firm entry (%)	3.72	1.52	2.68	3.38	4.40

Note: This table reports summary statistics for core variables of interest used in this study. The data covers 344 MSAs.

A.2 MSA - Discussion of s_m

Table 9: Military spending shares (s_m) and MSAs' characteristics

	s_m (1)	s_m (2)	s_m (3)	s_m (4)	s_m (5)	s_m (6)	s_m (7)
Coef. of Variation GDP growth	-0.001*** (0.000)						-0.001*** (0.000)
Log Emp Share of Small firms (S_m)		-1.325*** (0.265)					-1.425*** (0.245)
Log Emp Share of new firms (S_m^{new})			-0.023 (0.085)				0.229*** (0.081)
Log House Prices				0.902*** (0.308)			0.916** (0.359)
Log per capita Personal Income					2.069*** (0.672)		0.573*** (0.173)
Unemployment rate						-0.046 (0.028)	0.008 (0.007)
Constant	0.294*** (0.054)	5.360*** (1.054)	0.319*** (0.119)	-4.396*** (1.552)	-19.79*** (6.477)	0.565** (0.226)	-4.901** (2.052)
Obs.	344	344	344	344	344	328	319
R2	0.001	0.032	0.000	0.059	0.131	0.008	0.244

A.3 Results at MSA level - The local fiscal stimulus and firms' constraints.

The local fiscal multiplier increases with the employment share of small firms. Does the higher aggregate demand induced by the fiscal stimulus loosen firm-level constraints? Is this effect particularly stronger for small firms? Young firms are typically smaller because of borrowing constraints, uncertainty about their productivity and ramp-up period, and limited reputation, which leads to challenges of building a customer base. A natural conjecture is that higher aggregate demand may help loosen these constraints amplifying the output response. For instance, if this mechanism is at play, the survival rate of credit-constrained firms should increase as the financial wedge relaxes due to a countercyclical credit spread (Kiyotaki and Moore

(1997)). Table 10 shows that the exit rate decreases by 0.94% in MSAs hit by a fiscal stimulus relative to MSAs that did not receive the stimulus. For small firms, the exit rate decreases by 1% but is not statistically affected for large firms.

Why does the survival rate of small firms increase when a fiscal stimulus occurs? Column (4) shows that housing prices increase by 1.25% in an MSA that receives a fiscal stimulus. Larger values of collateral for firms may temper information asymmetries between banks and borrowers, allowing for higher leverage. These constraints are particularly relevant for small firms (Gertler and Gilchrist (1994)). Adelino et al. (2015) and Bahaj et al. (2019) present evidence that housing is the main collateral value of small and young firms, and therefore they are susceptible to variations in house prices. This suggests that a collateral credit channel may be driving the amplification effects of small firms.

Table 10: Fiscal stimulus increases survival rate of Small firms

Dependent variable	Exit rate All (1)	Exit rate Small (2)	Exit rate Large (3)	Housing Prices (4)
Military contracts (β)	-0.936*	-1.006**	0.727	1.251*
	(0.495)	(0.441)	(1.720)	(0.681)
Obs.	3,784	3,784	3,784	3,652
MSA and Time FE	Yes	Yes	Yes	Yes
SD Cluster	MSA	MSA	MSA	MSA
1st Stage F-stat	6.742	6.742	6.742	7.791

Note: 1-year response. ***: p<0.01 ;**: p<0.05;*: p<0.1

A.4 Results at MSA level - Robustness

Table 11: The local fiscal multiplier: Robustness

Output response	OLS (1)	$(S_{m,t-1} - \bar{S}_t)$ (2)	No IV Share Small (3)	MSA specific Cyclicality (4)	National specific Cyclicality (5)
Military contracts (β)	0.213***	1.689***	1.476***	1.334***	1.640***
	(0.079)	(0.425)	(0.405)	(0.263)	(0.359)
Military contracts × Emp share of Small (γ)	0.007	0.076**	0.048**	0.046**	0.073***
	(0.004)	(0.035)	(0.024)	(0.022)	(0.025)
Emp share of Small (η)	0.123***	0.010**	0.106***	0.027	0.081
	(0.037)	(0.040)	(0.039)	(0.040)	(0.054)
Lag GDP growth				0.432**	
				(0.184)	
Lag GDP growth × Emp share of Small				0.000	0.003
				(0.001)	(0.008)
Obs.	3,748	3,748	3,748	3,440	3,440
MSA and Time FE	Yes	Yes	Yes	Yes	Yes
Cluster SE	MSA	MSA	MSA	MSA	MSA
1st Stage F-stat		15.88	20.70	17.58	17.49

Note: Sample period is 2001-2013 and includes 344 MSAs. ***: p<0.01 ;**: p<0.05;*: p<0.1.

Table 12: The local fiscal multiplier: Robustness - Outliers

Output response	Dropping Largest MSAs (3%) (1)	Dropping Smallest MSAs (3%) (2)	Dropping Both (6%) (3)	Dropping 10% (4)
Military contracts (β)	1.433***	1.663***	1.524***	1.504***
	(0.319)	(0.418)	(0.362)	(0.339)
Military contracts × Emp share of Small (γ)	0.063**	0.079***	0.073***	0.071***
	(0.026)	(0.030)	(0.027)	(0.024)
Emp share of Small (η)	0.101**	0.120***	0.119***	0.124***
	(0.039)	(0.041)	(0.041)	(0.041)
Obs.	3,663	3,663	3,542	3,388
#MSAs	333	333	322	308
MSA and Time FE	Yes	Yes	Yes	Yes
Cluster SE	MSA	MSA	MSA	MSA
1st Stage F-stat	20.53	15.40	17.38	19.30

Note: Sample period is 2001-2013 and includes. ***: p<0.01 ;**: p<0.05;*: p<0.1.

Table 13: The local fiscal multiplier: Robustness adding MSAs' time-varying controls

Output response	Lagged GDP growth (1)	Control Unemp. rate (2)	Control Share Manuf. (3)	Control Share Constr. (4)	Control House Prices (5)
Military contracts (β)	0.002	1.463***	1.446***	1.404***	1.506***
	(0.195)	(0.333)	(0.315)	(0.321)	(0.378)
Military contracts × Emp share of Small (γ)	0.020	0.078***	0.063**	0.071***	0.070**
	(0.021)	(0.024)	(0.027)	(0.026)	(0.028)
Emp share of Small (η)	0.074***	0.108**	0.099**	0.106**	0.103**
	(0.025)	(0.042)	(0.040)	(0.043)	(0.040)
Control ($X_{m,t-1}$)		-0.001	-0.016	0.017	-0.002*
		(0.002)	(0.019)	(0.017)	(0.014)
Obs.	3,440	3,608	3,734	3,327	3,674
MSA and Time FE	Yes	Yes	Yes	Yes	Yes
Cluster SE	MSA	MSA	MSA	MSA	MSA
1st Stage F-stat	17.18	22.26	38.20	31.09	17.07

Note: Sample period is 2001-2013 and includes 344 MSAs. ***: p<0.01 ;**: p<0.05;*: p<0.1.

Table 14: The local fiscal multiplier: Robustness - Definitions of Small firms

Output response	Small $<$ 50 (1)	Small $<$ 100 (2)	Young $<$ 5 (3)	Large $>$ 1000 (4)
Military contracts (β)	1.460***	1.519***	1.201***	1.065***
	(0.379)	(0.364)	(0.257)	(0.388)
Military contracts × Emp share of Small (γ)	0.042**	0.053**	0.029***	-0.052†
	(0.019)	(0.022)	(0.009)	(0.032)
Emp share of $Small_{50}$	0.125***			
	(0.041)			
Emp share of $Small_{100}$		0.102**		
		(0.043)		
Emp share of $Young_5$			-0.017	
			(0.013)	
Emp share of $Large_{1000}$				-0.009
				(0.041)
Obs.	3,748	3,748	3,748	3,748
MSA and Time FE	Yes	Yes	Yes	Yes
Cluster SE	MSA	MSA	MSA	MSA
1st Stage F-stat	15.78	17.10	7.89	6.46

Note: Sample period is 2001-2013 and includes 344 MSAs. ***: p<0.01 ;**: p<0.05;*: p<0.1.

Table 15: The local fiscal multiplier: Impact on other outcome variables

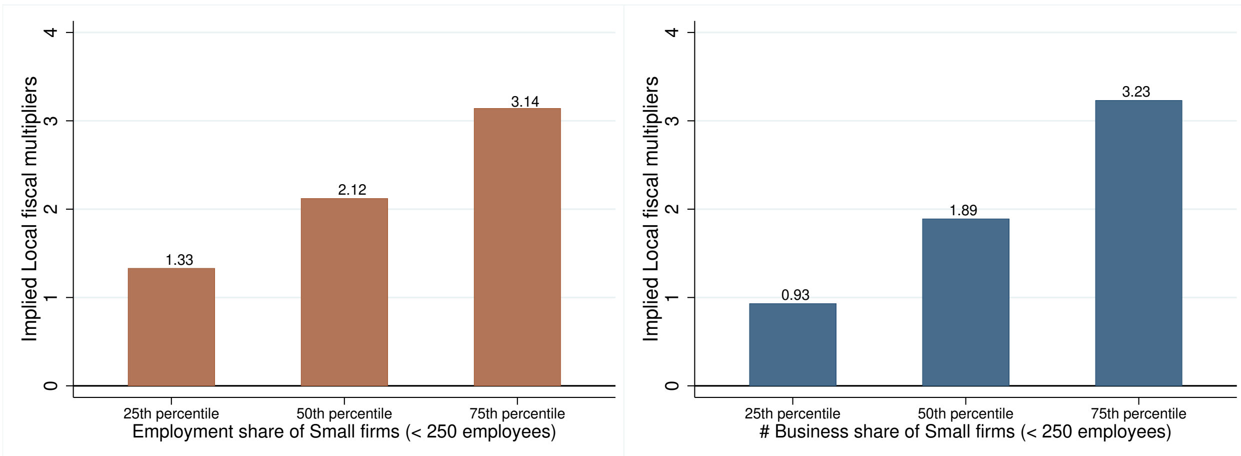
Response of	Earnings (1)	Wages (2)	Personal Income (3)	Unempl rate (4)	Dividends, Int. & rent (5)
Military contracts (β)	2.154***	1.934***	1.058***	-2.113**	0.691**
	(0.440)	(0.404)	(0.258)	(0.834)	(0.321)
Military contracts × Emp share of Small (γ)	0.078**	0.096***	0.036*	-0.019	0.044
	(0.033)	(0.025)	(0.020)	(0.076)	(0.033)
Emp share of Small (η)	0.105**	0.075**	0.045	0.179	-0.078
	(0.040)	(0.038)	(0.028)	(0.160)	(0.048)
Obs.	3,748	3,748	3,748	3,608	3,748
MSA and Time FE	Yes	Yes	Yes	Yes	Yes
Cluster SE	MSA	MSA	MSA	MSA	MSA
1st Stage F-stat	18.41	18.41	18.41	21.83	18.41

Note: Sample period is 2001-2013 and includes 344 MSAs. ***: p<0.01 ;**: p<0.05;*: p<0.1.

B Appendix: Robustness Micro level evidence

B.1 Results at State level

Figure 3: Aggregate effects of firm heterogeneity - State level Evidence



Note: The figure display the sensitivity of the local fiscal multiplier to the firm size distribution at state level. Sample period is 1977-2014. Data for the share of small business is from Business Dynamic Statistics. The government spending shock is identified with the cross-sectional variation of DoD spending across US states from Dupor and Guerrero (2017).

Table 16: The local fiscal multiplier: the role of small business

Dependent variable	Output		Earnings	
	(1)	(2)	(3)	(4)
Military contracts (β)	2.260***	2.126***	1.713***	1.600***
	(0.559)	(0.512)	(0.393)	(0.381)
Military contracts × Emp share of Small (γ)	0.190**		0.092**	
	(0.074)		(0.042)	
Military contracts × # Business share of Small (γ)		4.398***		1.589**
		(1.026)		(0.712)
Emp share of Small (η)	-0.153**		-0.115**	
	(0.075)		(0.056)	
#Business share of Small (η)		-3.918		-0.346
		(2.417)		(1.733)
Obs.	1,759	1,800	1,759	1,800
R2	0.285	0.258	0.526	0.522
State and Time FE	Yes	Yes	Yes	Yes

***: p<0.01 ;**: p<0.05;*: p<0.1

B.2 Firm level data - ORBIS

Table 17: Descriptive Statistics: ORBIS 1997-2016 - 7,635 firms & 62,054 obs.

Variable	Definition	Obs.	Mean	Median	SD	p25	p75
ΔOp. Revenues	Log change in operating turnover	59,596	0.161	0.095	0.560	-0.088	0.343
Investment	Log change in fixed assets	61,111	0.150	0.055	0.679	-0.152	0.383
ΔFinancing	Log change in total financing, defined as current liabilities (Loans+Creditors+Other current liab) + long-term liabilities (Long term financial debts + other long term liab. and provisions))	62,054	0.167	0.078	0.555	-0.137	0.397
ΔST-Financing	Log change in short-term debt (with maturity less or equal than a year)	62,054	0.159	0.104	0.570	-0.154	0.421
$\Delta \frac{FinExp}{Liab_{-2}}$	Change in all financial expenses such as interest charges, write-off financial assets over total liabilities	38,916	0.002	0.000	0.055	-0.014	0.016
Total Assets$_{-2}$	Log of total assets	62,054	18.422	18.457	2.438	16.739	20.144
Profitability$_{-2}$	EBIT (Gross profit-Other operating expenses) over total assets	62,054	-0.119	0.048	0.807	-0.072	0.103
Small	Dummy equal to 1 if Employment is less than 250	62,054	0.307	0.000	0.461	0.000	1.000
Small$_{100}$	Dummy equal to 1 if Employment is less than 100	62,054	0.189	0.000	0.391	0.000	0.000
Medium$_{100-250}$	Dummy equal to 1 if Employment is less than 250 & more than 100	62,054	0.129	0.000	0.336	0.000	0.000
ΔG	Military Procurement growth over State GDP	62,054	0.001	0.000	0.005	-0.001	0.002
ΔGDP	State GDP growth	62,054	0.050	0.046	0.049	0.021	0.083
$\Delta Taxes$	State Total Tax Collection growth	62,054	0.043	0.058	0.086	-0.001	0.095

B.3 ORBIS: Descriptive Statistics by State (mean)

State	Obs.	ΔOp.Revenues	Investment	ΔFinancing	ΔST-Financing	$\Delta \frac{FinExp}{Finan_{-2}}$	Small
AL	309	0.046	0.043	0.060	0.048	0.001	0.078
AR	332	0.091	0.118	0.103	0.072	-0.002	0.045
AZ	902	0.216	0.157	0.187	0.179	-0.001	0.274
CA	10,277	0.201	0.186	0.195	0.190	0.003	0.374
CO	2,171	0.228	0.197	0.249	0.233	0.003	0.428
CT	1,235	0.114	0.141	0.131	0.145	0.002	0.320
DE	604	0.169	0.150	0.197	0.204	0.003	0.409
FL	3,193	0.166	0.146	0.184	0.182	0.003	0.398
GA	1,669	0.124	0.120	0.138	0.137	0.001	0.199
HI	122	0.048	0.020	0.070	0.096	-0.004	0.418
IA	318	0.047	0.098	0.102	0.095	0.005	0.292
ID	169	0.244	0.147	0.163	0.129	0.007	0.414
IL	2,392	0.102	0.102	0.113	0.104	0.000	0.153
IN	691	0.118	0.149	0.113	0.115	-0.001	0.168
KS	484	0.100	0.072	0.124	0.101	-0.002	0.306
KY	396	0.103	0.110	0.127	0.079	0.000	0.159
LA	396	0.166	0.152	0.196	0.170	-0.001	0.237
MA	2,812	0.203	0.197	0.187	0.172	0.004	0.387
MD	1,000	0.203	0.211	0.178	0.205	0.006	0.390
MI	946	0.075	0.082	0.098	0.110	0.004	0.173
MN	1,570	0.143	0.130	0.133	0.123	0.003	0.356
MO	912	0.106	0.133	0.146	0.122	0.002	0.094
MS	142	0.104	0.130	0.147	0.130	0.003	0.169
NC	1,249	0.134	0.111	0.131	0.128	0.003	0.231
NE	155	0.120	0.186	0.228	0.185	0.009	0.174
NH	195	0.101	0.093	0.125	0.107	0.002	0.385
NJ	2,884	0.141	0.112	0.137	0.136	0.004	0.408
NV	1,127	0.235	0.210	0.244	0.289	0.007	0.468
NY	4,861	0.140	0.128	0.147	0.141	0.003	0.329
OH	2,140	0.072	0.072	0.095	0.073	0.002	0.137
OK	638	0.250	0.221	0.255	0.191	0.001	0.324
OR	587	0.102	0.083	0.096	0.095	0.000	0.291
PA	2,349	0.160	0.151	0.158	0.156	0.002	0.256
RI	208	0.128	0.100	0.158	0.108	0.009	0.308
SC	285	0.104	0.072	0.088	0.098	0.003	0.140
TN	927	0.159	0.168	0.174	0.164	0.002	0.109
TX	7,051	0.181	0.168	0.197	0.182	0.001	0.300
UT	566	0.210	0.148	0.176	0.184	0.006	0.484
VA	1,623	0.161	0.170	0.151	0.133	0.002	0.197
VT	111	0.124	0.117	0.150	0.115	0.008	0.369
WA	1,162	0.225	0.203	0.227	0.194	0.004	0.325
WI	894	0.105	0.092	0.097	0.096	0.000	0.122

B.4 DOD Contractors

Table 18: *Descriptive Statistics: DOD Contractors*

Obs	13,762 (12.12%)	
Firms	847 (7.2%)	
Share of Small (< 100)	9.7%	
Share of SME (< 250)	18.9%	
Share of Listed	75.9%	
Manufacturing (20-39)	57.8%	
Services (70-89)	19.6%	
Trans., Commun., Electric, Gas, And Sanitary Ss (40-49)	10.6%	
Wholesale (50-51)	4.7%	
Retail (52-59)	3.9%	
Mining (1-9)	1.8%	
	Mean	Median
Employment	6,240.5	1,965
Profitability ($EBIT/TA_{-2}$)	-0.001	0.071
Log Total Assets	19.23	19.31
Leverage	0.56	0.50
Financial Exp/Liab$_2$ (%)	4.25	2.73

B.5 Cyclicallity of Small versus Large firms

Table 19: *Cyclicality of Firm's Investment and Financial Expenses*

Firm size	Investment	Financial Expenses
Small	0.043*** (0.002)	-0.083*** (0.024)
Large	0.019*** (0.001)	-0.070*** (0.013)
All	0.028*** (0.001)	-0.074*** (0.012)

Note: This table shows the linear combination of β_1 and β_2 coefficients of the following regression: $y_{it} - y_{i,t-1} = \alpha + \beta_1 \Delta GDP^{agg}_{t,t-1} + \beta_2 \Delta GDP^{agg}_{t,t-1} Small_{i,t-1} + Small_{i,t-1} + \theta X_{i,t-1} + \psi \Delta GDP^{agg}_{t-1,t-2} + \epsilon_{it}$, with $y =$ Investment and $(\frac{Finan.Exp}{Liab})$. Standard errors in parenthesis.***: p<0.01 ;**: p<0.05;*: p<0.1.

B.6 Robustness: Firm level results

Table 20: Robustness: Including Government Contractors

	Op. Revenues growth (1)	Investment (Δ Fixed Assets) (2)	Total Financing growth (3)
$\Delta G \times$ Small (γ)	11.230***	3.809	8.044***
	(2.924)	(2.722)	(2.615)
Small	0.047***	0.015	0.003
	(0.012)	(0.022)	(0.016)
Log Total Assets	-0.172***	-0.321***	-0.200***
	(0.007)	(0.007)	(0.010)
Profitability	-0.010	0.140***	0.074***
	(0.014)	(0.018)	(0.008)
Firm FE	Yes	Yes	Yes
State × Year FE	Yes	Yes	Yes
Obs	70,708	72,343	73,556
Cluster SE	State	State	State
Kleibergen-Paap rk Wald F	42.94	42.50	44.02

Table 21: Sample Selection - Firms that were in the sample for more than 5 years

	Op. Revenues growth (1)	Investment (Δ Fixed Assets) (2)	Total Financing growth (3)
$\Delta G \times$ Small (γ)	11.311**	6.520**	9.009**
	(4.487)	(2.525)	(3.404)
Small	0.043***	0.006	-0.005
	(0.012)	(0.031)	(0.019)
Log Total Assets	-0.162***	-0.305***	-0.194***
	(0.005)	(0.008)	(0.010)
Profitability	-0.033	0.163***	0.086***
	(0.020)	(0.023)	(0.011)
Firm FE	Yes	Yes	Yes
State × Year FE	Yes	Yes	Yes
Obs	49,270	50,185	50,687
Cluster SE	State	State	State
Kleibergen-Paap rk Wald F	38.84	38.64	39.75

Table 22: Firm's size or firm's leverage?

	Op. Revenues growth (1)	Investment (Δ Fixed Assets) (2)	Total Financing growth (3)
$\Delta G \times$ High Leverage (γ)	1.703	1.322	-2.821
	(1.321)	(3.154)	(1.712)
DHigh Leverage	-0.028***	-0.085***	-0.399***
	(0.008)	(0.007)	(0.014)
Small	0.052***	0.016	0.004
	(0.012)	(0.023)	(0.011)
Log Total Assets	-0.179***	-0.340***	-0.240***
	(0.008)	(0.009)	(0.006)
Profitability	-0.045***	0.138***	0.042***
	(0.013)	(0.024)	(0.008)
Firm FE	Yes	Yes	Yes
State × Year FE	Yes	Yes	Yes
Obs	59,234	60,826	61,778
Cluster SE	State	State	State
Kleibergen-Paap rk Wald F	40.69	40.48	40.77

Table 23: Firm's size or firm's leverage?

	Op. Revenues growth (1)	Investment (Δ Fixed Assets) (2)	Total Financing growth (3)
ΔG × High Leverage	2.115	1.591	-2.596
	(1.334)	(3.106)	(1.774)
ΔG × Small (γ)	10.114**	5.729**	5.277**
	(4.578)	(2.164)	(2.561)
DHigh Leverage	-0.028***	-0.085***	-0.399***
	(0.008)	(0.007)	(0.013)
Small	0.043***	0.012	-0.000
	(0.013)	(0.024)	(0.012)
Log Total Assets	-0.180***	-0.340***	-0.240***
	(0.008)	(0.009)	(0.006)
Profitability	-0.045***	0.138***	0.042***
	(0.013)	(0.024)	(0.008)
Firm FE	Yes	Yes	Yes
State × Year FE	Yes	Yes	Yes
Obs	59,234	60,826	61,778
Cluster SE	State	State	State
Kleibergen-Paap rk Wald F	21.02	20.99	21.67

Table 24: Firm's size or firm's leverage?

	Op. Revenues growth (1)	Investment (Δ Fixed Assets) (2)	Total Financing growth (3)
ΔG × High Leverage	3.637**	2.892	-1.896
	(1.366)	(3.684)	(1.531)
ΔG × Small (γ)	12.156***	8.364***	5.336**
	(3.554)	(2.985)	(2.380)
ΔG × Small × High Leverage	-4.412	-6.607	0.125
	(4.244)	(5.414)	(4.068)
High Leverage	-0.012	-0.094***	-0.371***
	(0.007)	(0.009)	(0.013)
Small	0.064***	0.000	0.033**
	(0.014)	(0.024)	(0.013)
High Leverage × Small	-0.053***	0.030	-0.085***
	(0.019)	(0.023)	(0.019)
Log Total Assets	-0.181***	-0.340***	-0.243***
	(0.008)	(0.009)	(0.006)
Profitability	-0.047***	0.139***	0.039***
	(0.013)	(0.024)	(0.008)
Firm FE	Yes	Yes	Yes
State × Year FE	Yes	Yes	Yes
Obs	59,234	60,826	61,778
Cluster SE	State	State	State
Kleibergen-Paap rk Wald F	14.18	14.10	14.45

Table 25: Firm's size or firm's liquidity?

	Op. Revenues growth (1)	Investment (Δ Fixed Assets) (2)	Total Financing growth (3)
ΔG $\times$ Low Liquidity (γ)	-3.016**	0.791	-1.937
	(1.289)	(2.777)	(2.303)
DLow Liquidity	-0.048***	-0.219***	-0.144***
	(0.006)	(0.015)	(0.012)
Small	0.052***	0.014	0.014
	(0.012)	(0.025)	(0.015)
Log Total Assets	-0.172***	-0.320***	-0.200***
	(0.008)	(0.007)	(0.009)
Profitability	-0.020	0.095***	0.058***
	(0.013)	(0.020)	(0.007)
Firm FE	Yes	Yes	Yes
State $\times$ Year FE	Yes	Yes	Yes
Obs	58,598	60,164	61,167
Cluster SE	State	State	State
Kleibergen-Paap rk Wald F	41.32	41.30	41.58

Table 26: Firm's size or firm's liquidity?

	Op. Revenues growth (1)	Investment (Δ Fixed Assets) (2)	Total Financing growth (3)
ΔG $\times$ Low Liquidity	-2.086	1.236	-1.206
	(1.362)	(2.297)	(2.313)
ΔG $\times$ Small (γ)	10.691**	4.381*	7.056***
	(4.774)	(2.257)	(2.468)
DLow Liquidity	-0.048***	-0.219***	-0.144***
	(0.006)	(0.015)	(0.012)
Small	0.043***	0.011	0.008
	(0.013)	(0.025)	(0.016)
Log Total Assets	-0.172***	-0.321***	-0.200***
	(0.008)	(0.007)	(0.009)
Profitability	-0.020	0.095***	0.058***
	(0.013)	(0.020)	(0.007)
Firm FE	Yes	Yes	Yes
State $\times$ Year FE	Yes	Yes	Yes
Obs	58,598	60,164	61,167
Cluster SE	State	State	State
Kleibergen-Paap rk Wald F	21.29	21.52	22.11

Table 27: Firm's size or firm's liquidity?

	Op. Revenues growth (1)	Investment (Δ Fixed Assets) (2)	Total Financing growth (3)
$\Delta G \times$ Low Liquidity	1.596	4.041	0.526
	(2.220)	(3.937)	(2.768)
$\Delta G \times$ Small (γ)	17.314***	8.747	9.827**
	(6.174)	(5.393)	(3.789)
$\Delta G \times$ Small $\times$ Low Liquidity	-13.531**	-8.777	-5.753
	(5.053)	(9.271)	(4.821)
Low Liquidity	-0.038***	-0.201***	-0.137***
	(0.006)	(0.010)	(0.009)
Small	0.058***	0.035	0.017
	(0.017)	(0.031)	(0.023)
Low Liquidity $\times$ Small	-0.035*	-0.058**	-0.021
	(0.019)	(0.026)	(0.021)
Log Total Assets	-0.173***	-0.322***	-0.200***
	(0.008)	(0.007)	(0.009)
Profitability	-0.021	0.095***	0.058***
	(0.013)	(0.020)	(0.007)
Firm FE	Yes	Yes	Yes
State $\times$ Year FE	Yes	Yes	Yes
Obs	58,598	60,164	61,167
Cluster SE	State	State	State
Kleibergen-Paap rk Wald F	14.74	14.22	14.35

Table 28: Controlling for Industry $\times$ Year fixed effects

	Op. Revenues growth	Investment (Δ Fixed Assets)	Total Financing growth
$\Delta G \times$ Small (γ)	10.860**	6.317**	8.233**
	(4.635)	(2.534)	(3.220)
ΔGDP	0.177	0.009	-0.129
	(0.150)	(0.120)	(0.113)
$\Delta Taxes$	-0.083*	-0.002	-0.004
	(0.042)	(0.046)	(0.041)
Small	0.042***	-0.001	0.005
	(0.012)	(0.027)	(0.017)
Log Total Assets	-0.170***	-0.329***	-0.205***
	(0.007)	(0.007)	(0.011)
Profitability	-0.023	0.092***	0.058***
	(0.014)	(0.019)	(0.007)
Firm FE	Yes	Yes	Yes
Industry $\times$ Year FE	Yes	Yes	Yes
Obs	59,343	60,945	61,985
Cluster SE	State	State	State
Kleibergen-Paap rk Wald F	42.50	42.10	43.33

Table 29: Firm's size or Manufacturing Industries?

	Op. Revenues growth (1)	Investment (Δ Fixed Assets) (2)	Total Financing growth (3)
$\Delta G \times$ Manufacturing (γ)	6.491***	8.902**	6.189**
	(2.015)	(4.285)	(2.569)
Small	0.055***	0.020	0.016
	(0.012)	(0.025)	(0.015)
Log Total Assets	-0.173***	-0.326***	-0.203***
	(0.007)	(0.007)	(0.009)
Profitability	-0.021	0.096***	0.060***
	(0.014)	(0.019)	(0.008)
Firm FE	Yes	Yes	Yes
State $\times$ Year FE	Yes	Yes	Yes
Obs	59,411	60,010	62,054
Cluster SE	State	State	State
Kleibergen-Paap rk Wald F	44.57	44.65	45.16

Table 30: Firm's size or Manufacturing Industries?

	Op. Revenues growth (1)	Investment (Δ Fixed Assets) (2)	Total Financing growth (3)
$\Delta G \times$ Manufacturing	5.878***	8.610**	5.696**
	(1.792)	(4.237)	(2.575)
$\Delta G \times$ Small (γ)	10.716**	4.218*	7.041**
	(4.446)	(2.187)	(2.667)
Small	0.047***	0.016	0.010
	(0.013)	(0.025)	(0.017)
Log Total Assets	-0.173***	-0.326***	-0.203***
	(0.007)	(0.007)	(0.009)
Profitability	-0.021	0.096***	0.060***
	(0.013)	(0.019)	(0.008)
Firm FE	Yes	Yes	Yes
State $\times$ Year FE	Yes	Yes	Yes
Obs	59,411	60,010	62,054
Cluster SE	State	State	State
Kleibergen-Paap rk Wald F	20.54	20.45	20.93

Table 31: Firm's size or Manufacturing Industries?

	Op. Revenues growth (1)	Investment (Δ Fixed Assets) (2)	Total Financing growth (3)
$\Delta G \times$ Manufacturing	7.401**	5.141*	5.056**
	(1.587)	(2.418)	(2.121)
$\Delta G \times$ Small (γ)	13.514***	-7.435	5.638
	(4.951)	(6.856)	(4.428)
$\Delta G \times$ Small $\times$ Manufacturing	-5.959	18.582*	1.637
	(5.318)	(10.067)	(6.240)
Small	0.073***	0.070**	0.030
	(0.018)	(0.026)	(0.020)
Small $\times$ Manufacturing	-0.047**	-0.091**	-0.034
	(0.022)	(0.037)	(0.024)
Log Total Assets	-0.173***	-0.325***	-0.203***
	(0.007)	(0.007)	(0.009)
Profitability	-0.021	0.095***	0.060***
	(0.013)	(0.019)	(0.008)
Firm FE	Yes	Yes	Yes
State $\times$ Year FE	Yes	Yes	Yes
Obs	59,411	60,010	62,054
Cluster SE	State	State	State
Kleibergen-Paap rk Wald F	13.98	14.05	14.56

B.7 Robustness from ORBIS - Loans and Long-term debt

Table 32: Fiscal stimulus and Firm's use of external finance

	Total debt growth	Long-term debt growth	Short-term debt growth	Δ Fin.Exp/Debt
	(1)	(2)	(3)	(4)
$\Delta G \times$ Small	18.848***	10.386*	8.981†	-0.677
	(6.824)	(5.923)	(5.397)	(1.403)
Small	-0.016	0.001	0.015	-0.003
	(0.036)	(0.030)	(0.043)	(0.005)
Total Assets	-0.250***	-0.263***	-0.137***	0.015***
	(0.014)	(0.016)	(0.012)	(0.003)
Profitability	0.078***	0.045***	0.062***	-0.010***
	(0.017)	(0.015)	(0.017)	(0.003)
Firm FE	Yes	Yes	Yes	Yes
State × Year FE	Yes	Yes	Yes	Yes
Obs	35,076	46,946	37,852	23,377
Cluster SE	State	State	State	State
Kleibergen-Paap rk Wald F	48.44	44.22	46.57	49.76

Note: Data is from ORBIS. Direct contractors that received a DOD contracts during sample period were excluded. Small firms are defined as those with less than 250 employees. Sample period is 1997-2016. ***: $p<0.01$;**: $p<0.05$;*: $p<0.1$;†: $p<0.15$

B.8 Robustness from ORBIS - Small and Medium firms

Table 33: Heterogeneous Firms' responses to Fiscal stimulus

	Operating Revenues growth		Investment (Δ Fixed Assets)		Working capital growth	
	(1)	(2)	(3)	(4)	(5)	(6)
ΔG	1.804	-1.631	-1.202	-3.275	0.594	-0.954
	(2.392)	(2.753)	(2.657)	(2.370)	(5.189)	(5.618)
$\Delta G \times$ Small$_{100}$		11.078**		1.195		12.702**
		(4.309)		(4.098)		(5.585)
$\Delta G \times$ Medium$_{100-249}$		13.041***		12.601***		-2.337
		(3.997)		(3.224)		(7.599)
ΔGDP	0.084	0.076	0.136	0.130	-0.126	-0.129
	(0.183)	(0.179)	(0.129)	(0.130)	(0.199)	(0.198)
$\Delta Taxes$	-0.125**	-0.127**	-0.086	-0.090	-0.190	-0.191
	(0.059)	(0.061)	(0.059)	(0.059)	(0.139)	(0.137)
Small$_{100}$	0.114***	0.102***	0.033	0.030	-0.007	-0.017
	(0.028)	(0.027)	(0.043)	(0.045)	(0.033)	(0.033)
Medium$_{100-249}$	0.097***	0.088***	0.036	0.027	0.014	0.016
	(0.013)	(0.014)	(0.023)	(0.024)	(0.035)	(0.033)
Total Assets	-0.169***	-0.170***	-0.325***	-0.326***	-0.217***	-0.217***
	(0.007)	(0.007)	(0.008)	(0.008)	(0.028)	(0.028)
Profitability	-0.021	-0.021	0.097***	0.097***	0.075***	0.074***
	(0.013)	(0.013)	(0.019)	(0.019)	(0.010)	(0.10)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	59,412	59,412	61,011	61,011	55,069	55,069
Cluster SE	State	State	State	State	State	State
Kleibergen-Paap rk Wald F	9.420	3.292	9.321	3.280	9.286	3.276

Note: Data from ORBIS. Small and Medium firms are defined as those with less than 100 and 250 employees. Sample period is 1997-2016. ***: p<0.01 ;**: p<0.05;*: p<0.1.

Table 34: Heterogeneous Firms' responses to Fiscal stimulus

	Operating Revenues growth	Investment	Working capital growth
	(1)	(2)	(3)
$\Delta G \times$ Small$_{100}$	11.773**	1.727	11.494*
	(4.474)	(3.949)	(6.668)
$\Delta G \times$ Medium$_{100-249}$	12.847***	12.461***	-1.724
	(3.883)	(3.310)	(7.753)
Small$_{100}$	0.104***	0.024	-0.021
	(0.027)	(0.046)	(0.032)
Medium$_{100-249}$	0.090***	0.028	0.020
	(0.014)	(0.022)	(0.033)
Total Assets	-0.166***	-0.325***	-0.216***
	(0.007)	(0.008)	(0.028)
Profitability	-0.022	0.096***	0.073***
	(0.013)	(0.019)	(0.009)
Firm FE	Yes	Yes	Yes
State $\times$ Year FE	Yes	Yes	Yes
Obs	59,412	61,011	55,069
Cluster SE	State	State	State
Kleibergen-Paap rk Wald F	22.89	23.05	24.52

Note: Data from ORBIS. Small and Medium firms are defined as those with less than 100 and 250 employees. Sample period is 1997-2016. ***: p<0.01 ;**: p<0.05;*: p<0.1.

Table 35: Fiscal stimulus and Firm's use of external finance

	Total financing growth		Short-term financing growth		Δ Finan Exp/Liab	
	(1)	(2)	(3)	(4)	(5)	(6)
ΔG	0.774	-1.860	-0.441	-2.279	0.115	0.252
	(2.545)	(2.005)	(2.383)	(2.704)	(0.312)	(0.302)
$\Delta G \times$ Small$_{100}$		8.691**		6.884***		-0.731
		(3.782)		(2.420)		(0.606)
$\Delta G \times$ Medium$_{100-250}$		8.778**		5.314**		-0.535
		(3.273)		(2.329)		(0.627)
ΔGDP	-0.011	-0.017	0.028	0.024	-0.008	-0.007
	(0.117)	(0.116)	(0.097)	(0.096)	(0.012)	(0.012)
$\Delta Taxes$	-0.068	-0.071	-0.032	-0.034	0.015*	0.015*
	(0.051)	(0.050)	(0.050)	(0.050)	(0.008)	(0.008)
Small$_{100}$	0.025	0.017	0.081**	0.074**	-0.000	0.001
	(0.033)	(0.036)	(0.031)	(0.031)	(0.002)	(0.003)
Medium$_{100-250}$	0.008	0.002	0.057***	0.054***	0.001	0.002
	(0.020)	(0.022)	(0.017)	(0.017)	(0.002)	(0.002)
Total Assets	-0.203***	-0.204***	-0.180***	-0.181***	0.006***	0.006***
	(0.011)	(0.011)	(0.007)	(0.007)	(0.001)	(0.001)
Profitability	0.061***	0.061***	0.064***	0.064***	-0.002	-0.001
	(0.008)	(0.008)	(0.007)	(0.007)	(0.001)	(0.001)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	62,054	62,054	62,054	62,054	38,916	38,916
Cluster SE	State	State	State	State	State	State
Kleibergen-Paap rk Wald F	9.248	3.279	9.248	3.279	10.460	5.444

Note: Data from ORBIS. Small and Medium firms are defined as those with less than 100 and 250 employees. Sample period is 1997-2016. ***: p<0.01 ;**: p<0.05;*: p<0.1.

Table 36: Fiscal stimulus and Firm's use of external finance

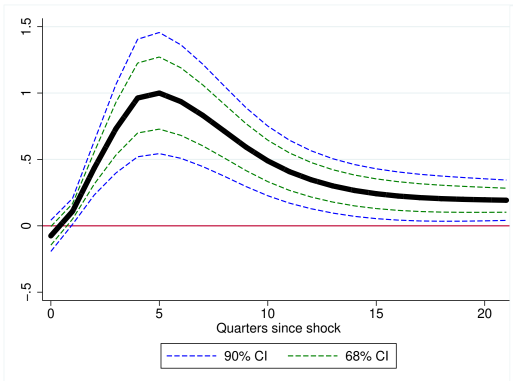
	Total financing growth (1)	Short-term financing growth (2)	Δ Finan Exp/Liab (3)
$\Delta G \times \text{Small}_{100}$	9.198**	7.938***	-0.407
	(3.694)	(2.685)	(0.679)
$\Delta G \times \text{Medium}_{100-250}$	8.721**	6.236**	-0.590
	(3.241)	(2.599)	(0.424)
Small_{100}	0.014	0.072**	0.002
	(0.036)	(0.031)	(0.003)
$\text{Medium}_{100-250}$	0.003	0.054***	0.002*
	(0.021)	(0.017)	(0.001)
Total Assets	-0.203***	-0.179***	0.005***
	(0.011)	(0.007)	(0.001)
Profitability	0.060***	0.064***	-0.001
	(0.008)	(0.007)	(0.001)
Firm FE	Yes	Yes	Yes
State $\times$ Year FE	Yes	Yes	Yes
Obs	62,054	62,054	38,220
Cluster SE	State	State	State
Kleibergen-Paap rk Wald F	23.80	23.80	20.39

Note: Data from ORBIS. Small and Medium firms are defined as those with less than 100 and 250 employees. Sample period is 1997-2016. ***: p<0.01 ;**: p<0.05;*: p<0.1.

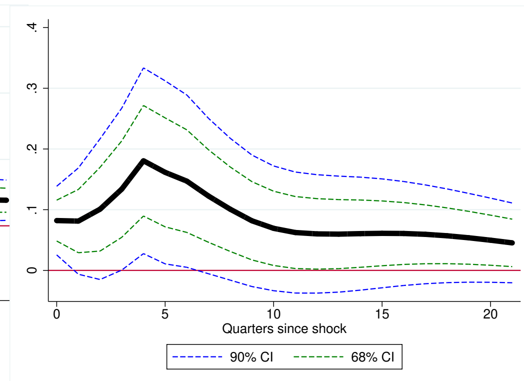
C Appendix: Aggregate Fiscal stimulus and Credit spreads

C.1 Appendix: SVAR - Defense News shocks and Credit markets

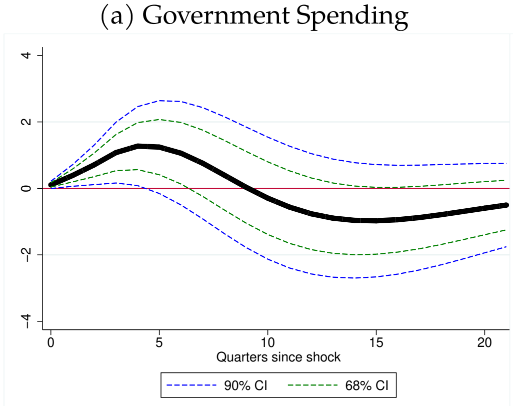
Figure 4: IRF to a (Ramey) Defense News Shock: 1948Q1 - 2008Q4



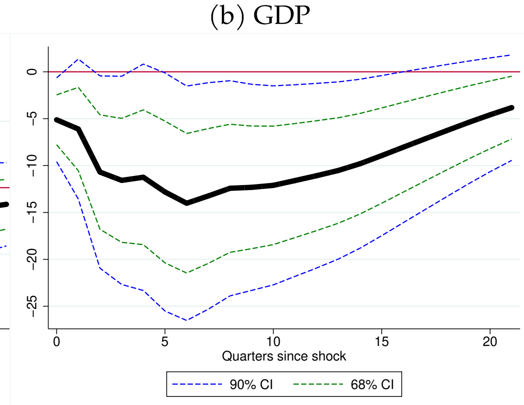
(a) Government Spending



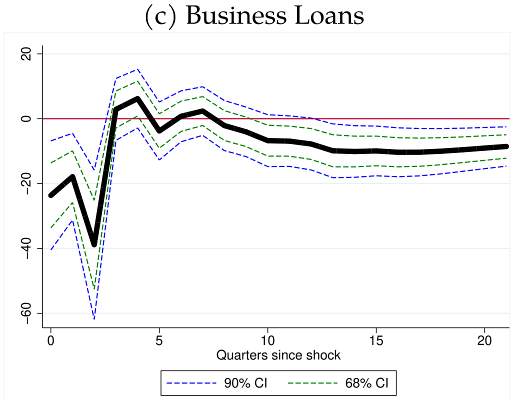
(b) GDP



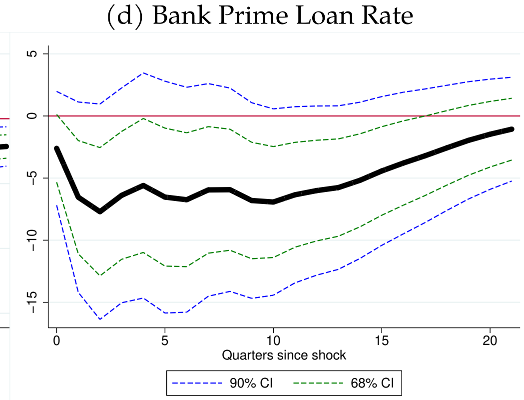
(c) Business Loans



(d) Bank Prime Loan Rate



(e) Real BAA Bond rate



(f) 3-month T-Bill rate