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

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Abstract

I study the role of firm size heterogeneity and credit frictions on the transmission mechanism of fiscal policy. This paper shows that the local fiscal multiplier increases with the share of small firms, implying multipliers of 0.95-2.15 in the interquantile range. At micro level, I find positive spillovers for small firms and neutral for large firms. Small firms increase operating revenues, investment and financing relative to large firms after a local fiscal stimulus. I interpret these findings with a two-firm open economy New Keynesian model with the financial accelerator mechanism. The model implies that a higher share of small firms also increases the national fiscal multiplier if monetary policy does not respond aggressively to fiscal shocks.

Keywords: *Fiscal stimulus, Firm size distribution, Financial Accelerator, Spillovers*

JEL classification: E62, E52

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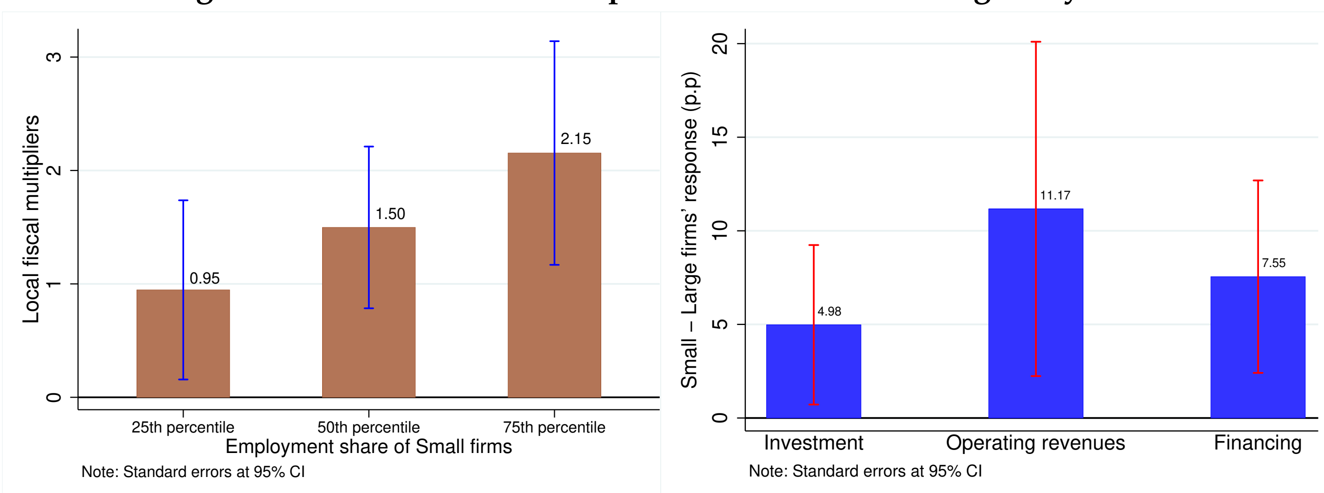
1 Introduction

The central question when evaluating the effects of government spending on GDP, is whether the fiscal multiplier is greater or lower than 1, or equivalently, the direction and strength of fiscal spillovers. I study the role of firm size heterogeneity and credit market imperfections for firms' financing decisions on the size of the fiscal multiplier. Small firms are different from large firms: they are cyclically more sensitive, and exhibit different investment, revenues and financing dynamics along the business cycle (Fort et al., 2013; Dinlersoz et al., 2019); are typically more bank dependent and credit constrained (Beck et al., 2005); and conditional on surviving, grow faster and contribute disproportionately to output growth (Decker et al., 2014). Given this rich heterogeneity across firms: How does firm size heterogeneity affect the fiscal multiplier? Which firms are the most responsive to aggregate fiscal stimulus? Are fiscal spillover heterogeneous by firm size?

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 interquantile range. To explain this fact, I combine local fiscal stimulus with firm level balance sheet information and identifying government contractors, I document positive (within location) fiscal spillovers for small firms and neutral for large firms. Figure 1(b) shows that within 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 their financing by 7.5 p.p relative to large firms in response to an *local* fiscal stimulus. This implies that small firms are more responsive to local fiscal stimulus than large firms.

To interpret this evidence I propose a heterogeneous firm credit channel of fiscal stimulus. I embed the *"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, which reduces credit spreads of small firms, and relaxing borrowing constraints.[1] This boosts borrowing, investment and production; and amplifies endogenously the local fiscal multiplier. 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.

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 US from Equation (1). Data for the share of small firms is from Business Dynamic Statistics. The government spending shock is identified with the cross-sectional variation of military spending across MSAs. 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 state-level military shock. Firm data is from ORBIS. See Equation (5).

I use the model to show that a higher *national* employment share of small firms also increase 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-lineal: it depends on the response of monetary policy to fiscal shocks (Woodford, 2011; Christiano et al., 2011). As the link between credit

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

spread and firms' balance sheet is stronger for small firms, the larger the stabilization role of monetary policy the lower the amplification effects of small firms on the national fiscal multiplier. When monetary policy does not rise the nominal interest rate in response to the inflationary fiscal stimulus, the real interest rate decline crowding-in consumption and investment, improving firms' balance sheet and the value of collateralize assets.[2] The aggregate effects of government spending depends on both, the firm size distribution where the stimulus takes place and monetary policy response.

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 metropolitan areas (MSAs) in the US.[3] 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).[4] Military spending is potentially endogenous since military contracts are notably political, and local politician and firms politically connected can affect the allocation of spending (Choi et al., 2020). I use an IV strategy which exploits the heterogeneous sensitivity of MSA' military procurement to an increase in (aggregate) *federal* military spending. For the firm size distribution across MSAs, I use panel data from Business Dynamic Statistics (BDS).[5] The employment share of small firms will not be exogenous if firms in other MSAs changes 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 lagged in firm creation.[6] Results show that increasing the employment share of

[2]The extreme case is the zero lower bound (ZLB).

[3]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.

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

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

[6]Gourio et al. (2016) show that firm entry shocks at 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.

small firms by 1% above the average, increase the local fiscal multiplier by 4.3%, from 1.57 to 1.64.

To identify heterogeneous fiscal spillovers by firm size, its key to recognize that whom and when receive a government contract may be endogenous to firms' decisions.[7] This will bias the estimation of firm level responses.[8] To overcome this endogeneity, I use contract level data from *USAspending.org* to identify the contractors, match them with a firm panel data from ORBIS and exclude all firms that received any military contract during the sample period. Using ORBIS, with more than 7,600 non-financial small and large firms headquartered on the state where the fiscal stimulus takes place, I find that small firms are more responsive to aggregate local fiscal stimulus: their operating revenues, investment and financing increase more than those of large firms.[9,10] The main advantage of ORBIS is that it covers listed, unlisted, small and large firms.[11]

Quantitatively, the proposed heterogeneous credit channel is able to explain up to 20% of the sensitivity of the local fiscal multiplier to the share of small firms documented in the data. Other plausible mechanisms that can be behind the amplification effects and that there are beyond the scope of this paper may be: (i) heterogeneous pricing decisions (i.e. small firms adjust prices less frequently); (ii) different factor intensities in the production process (i.e. small firms use a larger share of non-tradables inputs and sell their products locally); (iii) positive assortative matching between workers and firms credit constraints[12];

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

[8] 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.

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

[10] 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.

[11] In addition to excluding government contractors, my regressions include firm fixed effect to control for unobserved time-invariant heterogeneity at 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.

[12] Flynn et al. (2020) explore empirically the link between heterogeneity of workers marginal propensity to consume (MPC) and the production network at 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.

(iv) Input-Output linkages among firms[13]; and/or (v) local fiscal multipliers may be larger in those MSAs with larger housing supply elasticities because this may support growth.[14]

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).[15] 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 households' 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 aggregate government spending shocks, which lead to an increase in banks' lending. I show that the interaction between firm size and credit market imperfections, amplifies the fiscal multiplier.[16] Auerbach et al. (2020b) show that the interest rate on consumer loans decreases after a fiscal stimulus in a local economy, with a larger reduction for riskier loans. I emphasize that these effects are present at firm level, and are heterogeneous by firm size.

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

[14] 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.

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

[16] 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)).

Third, my paper contributes to the empirical literature that estimates firms' level responses to fiscal stimulus. In the US, the focus has been exclusively on public and typically large firms from Compustat. Hebous and Zimmermann (2021) merge federal government contracts' database with US listed firms in Compustat and show that for those that are financially constraint (proxied by firm size), direct demand shocks increase firm investment in the US. They document null effects on firms that are unconstraint, 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, reporting strong positive spillover among listed 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 on smaller and financially constrained listed firms. Combining administrative data and quasi-natural designs in Brazil and Korea, Ferraz et al. (2015) 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 firms.[17] 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 fiscal spillovers at 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.[18] I contribute to this literature showing that firm heterogeneity amplifies the local fiscal multiplier. Furthermore,

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

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

heterogeneity in firms' financial frictions interacts with monetary policy to determine the national fiscal multiplier. I find that small firms have the largest effect on the national fiscal multiplier when monetary policy does not respond to fiscal shocks.

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 aggregate local fiscal stimulus. Section 4 presents a quantitative model to evaluate the proposed mechanism. Finally, Section 5 concludes.

2 The local fiscal multiplier and the share of small firms

This section presents how 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 metropolitan areas (MSAs) in the US.[19]

2.1 Data

I use annual data on the geographical allocation of the Department of Defense (DOD) procurement contracts for 2000-2013 from Demyanyk et al. (2019) aggregated at metropolitan area level. They collect DD-350 and DD-1057 military procurement forms from USAspending.gov. These forms contain information about the total amount obligated and duration of the contract, and the name and location of the prime contractors.[20] For most of the contracts, information regarding the location where the majority of the work was actually performed is available. Relative to studies that exploit the cross-sectional variation of DOD contracts at state level to estimate state-level fiscal multipliers, this data allows me

[19] 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."

[20] 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.

to reduce endogeneity concerns due to political lobby and omitted variable bias with the inclusion of MSA fixed effects, increasing the cross-sectional dimension from 50 states to 344 MSAs.[21] 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 micro data 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.[22] 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:

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

$Y_{m,t}$ 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 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.[23] 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-

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

[22] 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.

[23] A similar specification is used by Basso and Rachedi (2018) to study the sensitivity of the local fiscal multiplier to the age structure across U.S. states.

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 policy and tax policy. Thus, the only possible confounding factors that may remain need to vary both 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 MSA level.

In Equation (1) the coefficient β denotes the average local fiscal multiplier: it defines 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)).[24] 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 increase 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. varies automatically along the cycle. In this case, military spending 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' 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 national (Ramey (2011); Burnside et al. (2004)) or state level (Nakamura and Steinsson (2014); Basso and Rachedi (2018); Dupor and Guerrero (2017)): the U.S. as a country does not

[24]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 $\theta = \beta + \gamma \bar{S}$.

engage in aggregate military buildups or drawdowns (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 the others (e.g. *Champaign-Urbana, IL*). To address this endogeneity problem, 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 aggregate (federal) DOD spending, which by construction is orthogonal to the variation in the local economic activity that can shape the allocation of federal spending across MSAs (Auerbach et al. (2020a, 2019); Demyanyk et al. (2019)).[25]

The identification of whether an MSA's firm size structure affects the local fiscal multiplier with location and time fixed effects comes from the variation of 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.[26]

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 be-

[25]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, that 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 the share of military spending. Appendix A.2 Table 10 shows the weak and generally non-significant correlation between s_m and MSAs' characteristics.

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

cause 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 state level that shocks to firm entry can have effects on GDP for as long as 12 years, dying out for longer horizons. For this reason, I use the employment share of new businesses that were 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 presents the first empirical fact: local fiscal stimulus gets amplified in MSAs with a larger employment share of small firms. Column (1) reports a one-year local multiplier equal to 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. The interpretation is as follows: 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 inter-quantile range in the distribution of the employment share of small firms over the sample period, the local fiscal multiplier varies between 0.95 and 2.15.[27,28] The first stage F-stat shows that instruments are relevant.

The output response at a 2-year horizon indicates even a larger sensitivity. Column (2) shows that the local multiplier increase by 5.34% when the employment share of small firms by 1% (from 1.44 to 1.52).[29]

[27]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.

[28]Figure 1(a) in the introduction shows the heterogeneity in the one-year local fiscal multipliers.

[29]The impact of small firms at larger horizons are still positive but become 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 $\times$ 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, whatever determines the cross-sectional variation in firm creation (i.e. startups) has 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' 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.3 evidences 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) consider an alternative normalization which tests that the exploited variation is not driven by the secular trend in the reduction of the share of small firms. Column (3) shows the downward bias of not considering the possible endogeneity of the share of small firms. Are MSAs with larger shares of small firms cyclically more sensitive and therefore driven the results? Column (4) and (5) show that results are robust to controlling for MSA specific cyclicality, and small firms specific cyclicality. 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 at play. 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 do not change quantitatively nor significantly the effect of small firms on the local fiscal multiplier. Table 14 shows that results are robust to the definition of small firms, and highlight that the sensitivity of the multiplier depends on the overall MSA's firm size distribution. Lastly, Table 15 shows that the employment share of small firms also increases the response of earnings, wages and personal income.

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 particularly stronger for small firms? Young firms are born small because of borrowing constraints, uncertainty about their own productivity and ramp up period, and limited reputation that leads to challenges of building up a customer base. A natural conjecture is that a higher aggregate demand may help loosening these constraints amplifying the output response. For instance, if this is the case, 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 2 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. Furthermore, the exit rate of small firms decrease by 1%. Conversely, the exit rate of large firms is not statistically affected.

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 firms' collateral may reduce 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 particularly sensitive to variations in house prices. This suggest that a collateral credit channel can be behind the amplification effects of small firms.

Table 2: 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

3 The heterogeneous behaviour of Small and Large firms to fiscal stimulus

Which firms are the most responsive to fiscal stimulus? Are spillover effects heterogeneous by firm size? I study the heterogeneous behavior of 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 whom and when recieved a stimulus. For this purpose, I merge 3 datasets: (i) balance sheet information of non-financial private and public firms from ORBIS database; (ii) firms that were granted DOD contracts from USAspending.gov; and (iii) local fiscal stimulus aggregated at 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 from ORBIS and state military spending from 1997-2016. I use data from ORBIS, a commercial database distributed by Bureau van Dijk, containing basic firm-level balance sheet information with the advantage that it includes data on small and large private and public firms.[30] I study the behavior of operating revenues, investment, short-term, long-term and total financing of more than 7,600 non-financial firms headquartered on the state where the *local* fiscal stimulus takes place.[31,32] Appendix B.2 presents variables definition and descriptive statistics of each variable used in the estimation.[33] The local stimulus shock at state level is from Dupor and Guerrero (2017), who update Nakamura and Steinsson (2014) military spending until 2014.[34] I extend the military procurement spending until 2016 aggregating the DOD contract level data from USAspending.gov at 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 of which firms received a military contract and when. In order to deal with it I *excluded all firms that received at least one DOD contract during the sample period*.[35] The goal here is to exclude the direct and endogeneous effects of DOD contracts on firms' behavior, and focus on spillover

[30] 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.

[31] 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.

[32] 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.

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

[34] As a robustness, I extended Nakamura and Steinsson (2014) data from 2006 to 2016 using USAspending.org database. Results are robust.

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

effects of spending shocks.[36] Table 3 shows that small firms are different 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.[37] Appendix B.4 shows that firms that received a DOD contract and were excluded from the sample, were mostly large (76% were listed firms and only 19% were small firms), produced manufacturing goods (58%) and represent around 10% of total firms in the sample.

Table 3: 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:

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

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. In order to control for other shocks that can occur in the same state, $D_{s,t-2}$ include state level controls such as GDP growth

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

[37] Proxy by financial expenses over total liabilities.

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.[38] 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 state level, allowing the error term to be correlated across firms within a state.

Military spending is subject to endogeneity concerns as discussed in previous section given that firms politically connected 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, 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 firms before the fiscal stimulus have less than 250 employees (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) allows me to mitigate concerns about reverse causation and unobserved firm-level factors

[38] Nakamura and Steinsson (2014) show that the two-year change captures the dynamic effects of government spending on output in a parsimonious way.

driving firms' responses to fiscal stimulus. However, the concerns about estimates being potentially biased by time-varying omitted variables remains. I therefore 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):

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

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

3.3 Results

Table 4 reports that for the average firm, a local fiscal stimulus increases operating revenues and decreases investment, though evidence is not statistically significant (see columns (1) and (3)).[39] However, when I take into account the heterogeneous response 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 (negative but not significant). Therefore, within firms that did not receive a DOD contract, there is a differential response to local fiscal stimulus by firm size. I interpret these findings as evidence of *positive spillovers* for small firms and neutral for large firms. This evidence is in line with the aggregate evidence at MSA level presented in Section 2, which focuses on the share of small-firms activity.

These results are robust to controlling for state-year fixed effects, which address concerns about time-varying omitted variable bias. Column (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 increases both revenues and invest-

[39] 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.

Table 4: 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. Sample period is 1997-2016. ***: p<0.01 ;**: p<0.05;*: p<0.1.

ment in response to higher government spending, reflects that easing credit constraints are 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 results are similar if I include government contractors, with the exception that investment in this case is not statistically significant. There may be concerns about sample selection of firms that entry and exit my sample. Table 21 keeps only those firms that remain in the sample for at least 5 years and results are robust.[40]

An important question to answer is the following: Is it firms' size or firms' financial position that drives heterogeneous firms' responses? Tables 22 and 25 Appendix B.6 test if responses are heterogeneous across firms above and below the median leverage and liq-

[40]Tables 33-36 in Appendix B.8 analyzes 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.

uidity position before the stimulus. Results show that there is no differential impact of local fiscal stimulus across firms' debt or liquidity position. These results are confirmed when Tables 23 and 26 test for heterogeneous responses including firm size coupled with either firm leverage or firm liquidity interaction terms. Results show that there is a differential impact of local fiscal stimulus only across firm size.[41]

Another concern may be that as the composition effect of DOD contracts is bias to manufacturing goods, the effects are driven by this specific sector. 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 evidence that even controlling for the differential effect of the manufacturing sector, small firms still are more responsive than large firms to fiscal stimulus (both quantitatively and statistically).[42]

3.4 Fiscal stimulus and firms' use of external financing

Credit spreads are countercyclical. During booms firms' balance sheets improve, have better growth opportunities and higher collateral values, all of which leads firms to raise investment and borrowing (Bahaj et al. (2019)).[43] How does the use of external financing of small firms react to fiscal stimulus? This subsection provides evidence that expansionary government spending loosens borrowing constraints of small firms.

I focus now on firms' financing decisions after a local fiscal stimulus takes place. I

[41] The results with a triple interaction is shown in Tables 24 and 27. Tough not statistically significant, the evidence suggest that low leverage or high liquid small firms are those that benefit the most from the fiscal stimulus.

[42] 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, results are qualitative robust. It's worth to notice that the largest increase in investment is for small manufacturing firms.

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

define financing as the log change in total liabilities and short-term financing as current liabilities with maturity below one year.[44] 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 5 reports the results. Relative to large firms, small businesses increase financing by 7.5 percentage points. Financing decisions for the average firm that did not receive a DOD contract are not statistically affected.[45]

Small firms may face borrowing constraints. A higher aggregate demand can help relaxing these constraints, reducing borrowers' perceived default risk due to an increase in 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. Column (8) and (9) show that the implicit borrowing costs decrease for small firms. This leads to an increase in investment by small firms, endogenously propagating the effects of fiscal stimulus.

This evidence points to a relaxation of borrowing constraint 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 here that the equilibrium level of credit increases due to a reduction of the borrowers' perceived default risk.[46]

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

[44] There may be concerns about the focus on total liabilities and not directly on total debt or bank loans. The reason of doing this is data availability: sample size is reduced by half. Nevertheless, Appendix B.6 shows that the results for the reduced sample with detailed breakdown of financial debt (total, bank loans and long-term debt) remain unchanged (responses are quantitatively larger but much less precisely estimated).

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

[46] 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 of small firms. Appendix C.2 shows that these results are robust to using Survey of Professional Forecast errors. Results are in line with Melina and Villa (2014) and Olivero et al. (2019).

Table 5: **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 × 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. Sample period is 1997-2016. ***: p<0.01 ;**: p<0.05;*: p<0.1.

year local fiscal multiplier. Furthermore, the survival rate of small firms and local housing prices increase. This evidence leads to conjecture that 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 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 spillovers for small firms and neutral for large firms. This evidence is qualitatively consistent with the financial accelerator mechanism. 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 the role of firm size heterogeneity and financial frictions on 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 heterogeneous cost of external finance (Nakamura and Steinsson (2014)).[47] 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 a fiscal and monetary authority.

4.1 Entrepreneurs

The key role in this model is played by firms, 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 spreads. Entrepreneurs have to borrow funds from lenders in order to finance their purchases of capital goods from capital producing firms. Entrepreneur i of type $j = s, l$ has available net worth, N^i_{jt+1} and to finance the difference between its capital expenditures and its net worth, the entrepreneur needs to borrow 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 collateral value of illiquid assets less

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

outstanding obligations. The production function of entrepreneur i in the home region h and type $j = s, l$ is constant return to scale and 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: it is assumed that the realization of ω^i is private information to the entrepreneur. In order 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 it 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:[48]

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

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

[48]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.

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 subject to the lenders' participation constraint. Formally, entrepreneurs 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 ($A\mu(\bar{\omega}_t)$).

The moment the G_t shock arrives, 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 (10). Note that the lenders' zero profit condition (Eq. 10) can be interpreted as an economy-wide loan supply curve of the following form:

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

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

The behavior of the demand for capital and return of 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 income W_t^e. Total labor input is supplied by households and entrepreneurs, aggregated in the following form:

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

where the working hours of entrepreneurs H_t^e are normalized to 1 and Ω is the entrepreneurs' share in total labor.[49] 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. V_t is the aggregate ex-post profit of entrepreneurial firms, equal to the gross return on their 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:

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

[49]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.

where $Y_{Hl,t} = \int_i y^i_{h,l,t} di$ and $Y_{Hs,t} = \int_i y^i_{h,s,t} di$ 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:

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

$$E_t[(R^K_{F,l,t+1} - R^K_{F,s,t+1})\beta U^*_{Ct+1}/U^*_{Ct}] = 0 \tag{18}$$

where

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

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 and X_t is the gross mark-up of retail goods over wholesale goods and $1/X_t$ is then the relative price of wholesale goods.

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

$$W_t X_t = \alpha(1-\Omega)\frac{y_{jt}}{H_{jt}} \qquad \text{and} \qquad W^e_t X_t = \alpha\Omega\frac{y_{jt}}{H^e_{jt}} \tag{20}$$

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 undepreciated part $(1-\delta)K_t$ at time t. Capital is firm-type specific, $j = s, l$. 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 capital 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,

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

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

4.3 Retailers

To match the average local fiscal multiplier the literature introduce nominal rigidities (Nakamura and Steinsson, 2014). In order to simplify the financial contract between lenders and entrepreneurs but allow 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 output. 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,

[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.

Y_t^f is the following composite: $Y_t^f = \left[\int_0^1 Y_t(z)^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}}$, $\theta > 0$ is the elasticity of substitution across different varieties. 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 consumption 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 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 are able to 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, to 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 supplied by that household. Home households of type x solves 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 lastly Π_t are profits from home intermediate producers.

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

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

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 as $\phi_H + \phi_F = 1$. 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.

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

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

$\theta > 0$ 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

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

and

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

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,

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

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:

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

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 (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 a variable with a hat ($\wedge$) is 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 budget constraint: $nP_{Ht}G_{Ht} + (1-n)P_{Ft}G_{Ft} = T_t$;

5. Goods markets clears: $Y_t = nY_{Ht} + (1-n)Y_{Ft}$; $\quad Y_{it} = C_{it} + I_{it} + G_{it}$,

   $C_t = [n(C_{it} + C^e_{it}) + (1-n)(C^*_{it} + C^{e*}_{it}]$; $\quad I_t = [nI_{it} + (1-n)I^*_{it}]$

6. 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 matching 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 6 summarizes the parametrization of the model. A period in the model corresponds to a quarter. I choose parameter values to match cross-sectional moments of US local economies and heterogeneity by firm size using BDS and ORBIS. 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 such that it matches 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 equal 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.

In terms of the policy parameters, the persistence of the government spending shock is set to 0.95, following Basso and Rachedi (2018) which estimate an AR(1) process with state level data until 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. From ORBIS, I calibrate the (ii) credit spread of small and large firms at 3% and 1%, respectively. Leverage (iii) is calibrated to match ORBIS ratio of assets to liabilities for small and large firms, 2.08 and 2.32 respectively (see Table (3)). 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 small and large produced goods equal to 0.5.

Table 6: 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	

[52] I set the response of monetary policy to the output gap equal to zero, $\phi_Y = 0$, in order to make a counterfactual exercise clear. Please see Section 4.9.

4.8 Results

This section compares γ^{micro} and γ^{MSA} estimated in Sections 2 and 3 with the 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 7 shows that the model generates a differential response of 3.14% versus almost 5% in the data (column (6) in Table 4). This implies that the model can account for about 2/3 of the heterogeneous response of investment between small and large firms. The financial accelerator mechanism matches quantitatively well the differential response of investment documented in the data.

Can the model quantitatively match the effect of the employment share of small firms on the local fiscal 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 for the MSA that has the average employment share of small firms. Given that the model is symmetric, i.e. has the same share of small firms in both regions, I estimate β running the above equation using the average employment share of small firms. Table 7 shows that β is equal to 1.70, which overestimates but is not too far from the size of the one-year average local fiscal multiplier of 1.57 found in Section 2. The model can match quantitatively well 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 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.[53] Table 7 shows that γ^{MSA} = 0.010 versus 0.068 in the data, implying 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.[54]

Table 7: 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%]	

4.9 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 multiplier given that it accounts for general equilibrium effects. I use the model to ask the following question: Does a larger share of small firms also increase the national aggregate fiscal multiplier? In other words, is $\gamma_{nat} > 0$?

With model generated data using 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 $Z = Y, G, S$. I calculate how national output changes in response to a symmetric government spending shock in both, home and foreign regions;

[53] Specifically, γ^{MSA} = Mean($\beta_{g,s+1} - \beta_{g,s}$), with $g = G^{min}, .., G^{max}$ and $s = S^{min}, .., S^{max}$.
[54] And between 10-17% of sensitivity across all simulations.

and how this statistic changes with the employment share of small firms.

$$\frac{Y^{nat}_{t+1} - Y^{nat}_{t-1}}{Y^{nat}_{t-1}} = \beta_{nat}\frac{G^{nat}_{t+1} - G^{nat}_{t-1}}{Y^{nat}_{t-1}} + \gamma^{nat}\frac{G^{nat}_{t+1} - G^{nat}_{t-1}}{Y^{nat}_{t-1}} \times (S^{nat}_{t-1} - \bar{S}^{nat}) + \eta S^{nat}_{t-1} + \epsilon_t$$

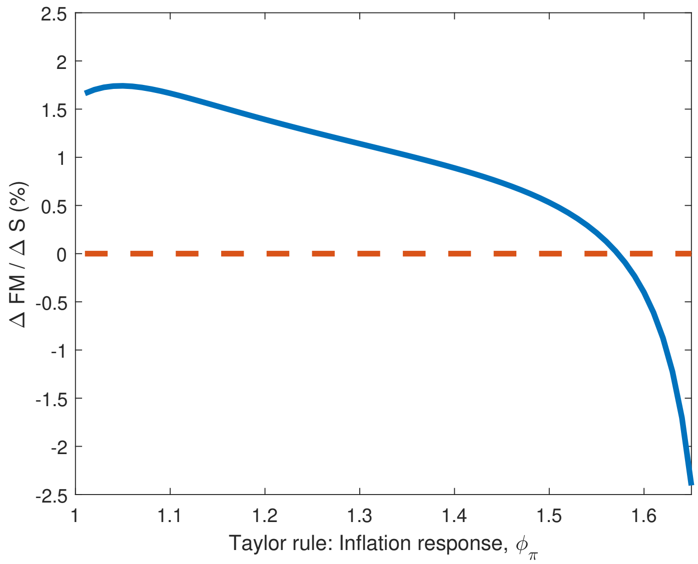
As before, β^{nat} is the national fiscal multiplier in an economy with the average national employment share of small firms. To compute the effect of the share of small firms on the national fiscal multiplier, I change the share of small firms by 1% and therefore define $\gamma^{nat} = \beta^{nat}_{\bar{S}+1} - \beta^{nat}_{\bar{S}}$. Table 8 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 8: 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 agreement 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). The reason for this result is that if 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 ask: How does the employment share of small firms interact with the stance of monetary policy for the national fiscal multiplier? Figure 2 shows that the relationship between the share of small firms and the national multiplier is non-lineal: 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, and therefore, the role of small firms 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



5 Conclusions

How does the effectiveness of fiscal stimulus depend on the composition of firms where the stimulus takes place? The composition of firms where the fiscal stimulus takes place is key to the design of fiscal packages aiming to stabilize the economy. This paper presents evidence of a firm size-dependent multiplier where the heterogeneous behaviour of small and large firms shapes the effectiveness of 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 depends 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, restrict the class of models able to match the empirical evidence presented here. Lastly, I show that the spillover effects of demand shocks can be sizable on 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 9: *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 10: 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***						-0.001***
	(0.000)						(0.000)
Log Emp Share of Small firms (S_m)		-1.325***					-1.425***
		(0.265)					(0.245)
Log Emp Share of new firms (S_m^{new})			-0.023				0.229***
			(0.085)				(0.081)
Log House Prices				0.902***			0.916**
				(0.308)			(0.359)
Log per capita Personal Income					2.069***		0.573***
					(0.672)		(0.173)
Unemployment rate						-0.046	0.008
						(0.028)	(0.007)
Constant	0.294***	5.360***	0.319***	-4.396***	-19.79***	0.565**	-4.901**
	(0.054)	(1.054)	(0.119)	(1.552)	(6.477)	(0.226)	(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 - Robustness

Table 11: The local fiscal multiplier: Robustness

Output response	OLS	$(S_{m,t-1} - \bar{S}_t)$	No IV Share Small	MSA specific Cyclicality	National specific Cyclicality
	(1)	(2)	(3)	(4)	(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%)	Dropping Smallest MSAs (3%)	Dropping Both (6%)	Dropping 10%
	(1)	(2)	(3)	(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 $\times$ 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 $\times$ 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

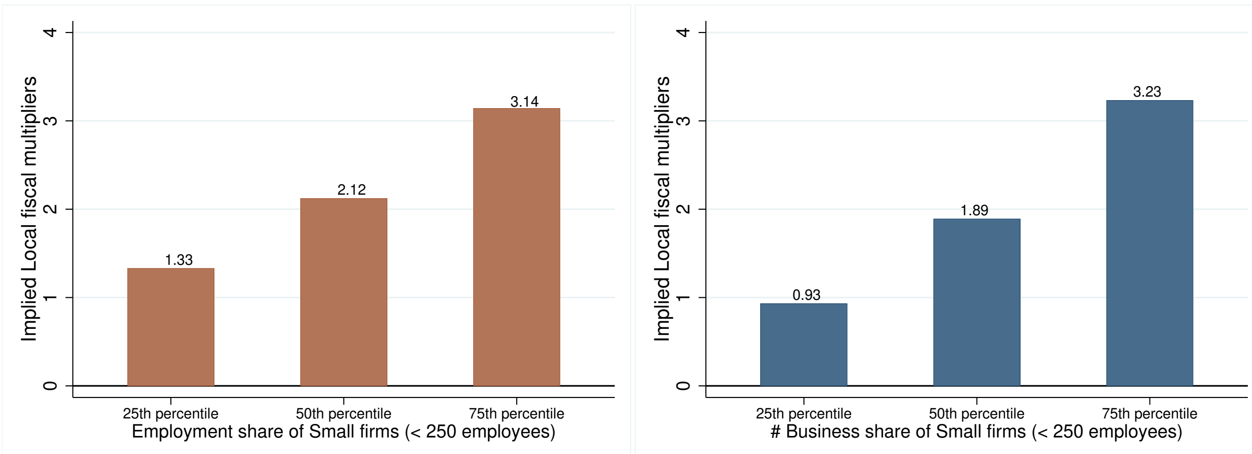
Response of	Earnings (1)	Wages (2)	Personal Income (3)	Unempl rate (4)	Dividends, Int. & rent (5)
Military contracts (β)	2.154***	1.934***	1.058***	-2.113**	0.691**
	(0.440)	(0.404)	(0.258)	(0.834)	(0.321)
Military contracts $\times$ Emp share of Small (γ)	0.078**	0.096***	0.036*	-0.019	0.044
	(0.033)	(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 $\times$ Emp share of Small (γ)	0.190**		0.092**	
	(0.074)		(0.042)	
Military contracts $\times$ # 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 $\times$ 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 $\times$ 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)
ΔG × 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)
$\Delta G \times$ High Leverage	3.637**	2.892	-1.896
	(1.366)	(3.684)	(1.531)
$\Delta G \times$ Small (γ)	12.156***	8.364***	5.336**
	(3.554)	(2.985)	(2.380)
$\Delta G \times$ Small $\times$ 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 $\times$ 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 $\times$ 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)
$\Delta G \times$ 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)
$\Delta G \times$ Low Liquidity	-2.086	1.236	-1.206
	(1.362)	(2.297)	(2.313)
$\Delta G \times$ 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
ΔG × 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 × 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)
ΔG × 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 × 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 (1)	Long-term debt growth (2)	Short-term debt growth (3)	Δ Fin.Exp/Debt (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 (1)	Investment (2)	Working capital growth (3)
$\Delta G \times \text{Small}_{100}$	11.773**	1.727	11.494*
	(4.474)	(3.949)	(6.668)
$\Delta G \times \text{Medium}_{100-249}$	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)
$\text{Medium}_{100-249}$	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

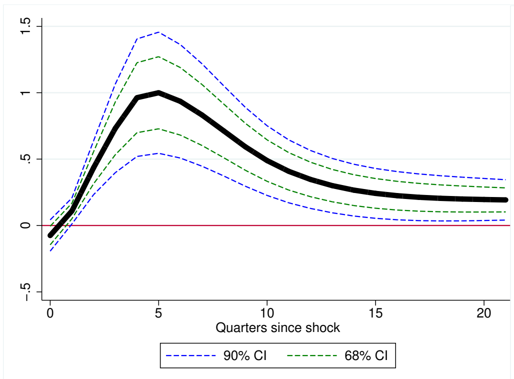
	Total financing growth	Short-term financing growth	Δ Finan Exp/Liab
	(1)	(2)	(3)
$\Delta G \times \text{Small}_{100}$	9.198**	7.938***	-0.407
	(3.694)	(2.685)	(0.679)
$\Delta G \times \text{Medium}_{100-250}$	8.721**	6.236**	-0.590
	(3.241)	(2.599)	(0.424)
Small_{100}	0.014	0.072**	0.002
	(0.036)	(0.031)	(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.

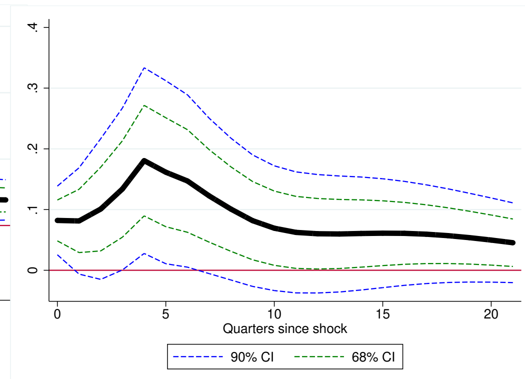
C Appendix: Aggregate Fiscal stimulus and Credit spreads

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

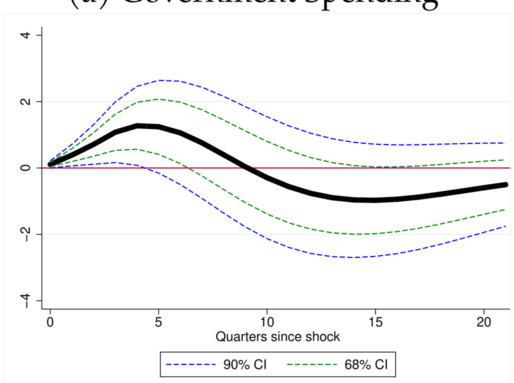
Figure 4: IRF to a (Ramey) Defense News Shock: 1948Q1 - 2008Q4



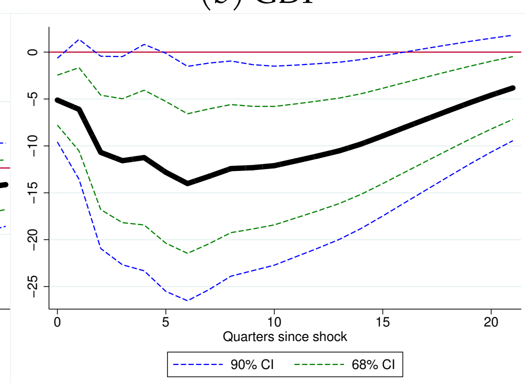
(a) Government Spending



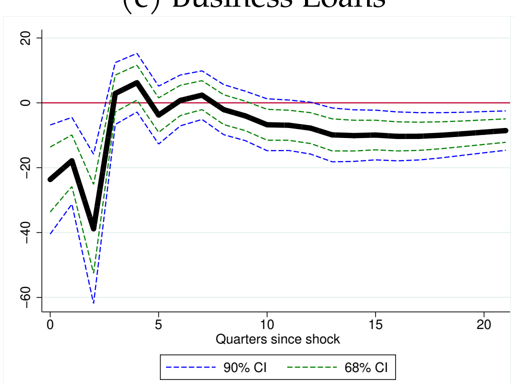
(b) GDP



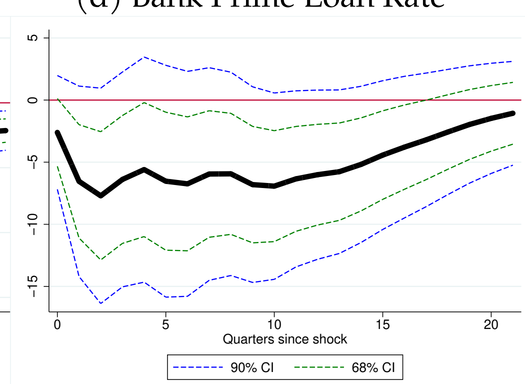
(c) Business Loans



(d) Bank Prime Loan Rate



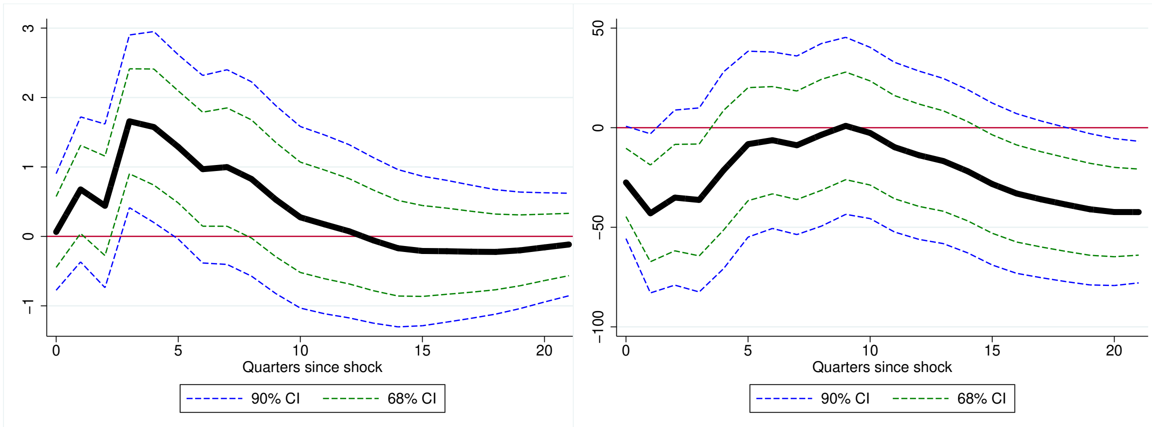
(e) Real BAA Bond rate



(f) 3-month T-Bill rate

C.2 Appendix: SVAR - SPF shock and Credit markets

Figure 5: IRF of a SPF errors shock: 1966Q3-2007Q4



(a) House Prices (b) Bank loan rate

Note: SVAR includes SPF errors, log real per capita Gov. spending, Taxes, GDP, log real House prices and bank loan rate. Standard errors come from 500 Montecarlo simulations (linear and quadratic trends and 4 lags are included).