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Firm dynamics and Fiscal stimulus

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Dínamica de las empresas y estímulos fiscales

Resumen

Cómo depende la efectividad de estímulos fiscales de la composición de empresas presentes al momento del estímulo? Este paper explora si heterogeneidad en términos de tamaño y edad de las empresas importan para el mecanismo de transmisón de cómo el gasto público afecta al GDP. Los resultados indican que una política fiscal expansiva se ve amplificada en regiones de EEUU con mayor share de empresas jóvenes y pequeñas. Incrementando el share de empresas jóvenes y pequeñas un 1% por encima del promedio el multiplicador fiscal local crece 5.6%, desde 1.60 a 1.69. Propongo un nuevo mecanismo donde los shocks de demand relajan las restricciones de las empresas (restricciones de crédito, construir una base de clientes y aprender el know how de su negocio), aumentando la tasa de superviviencia de estos emprendedores con el consecuente incremento de la productividad y el empleo. Después de un estímulo fiscal las empresas más pequeñas adquieren más capital e impulsan la productivitidad relativo a las más grandes. Estos resultados sugieren que la política fiscal puede promover el emprendedorismo y al mismo tiempo que la heterogeneidad de las empresas moldea la respuesta agregada de la economía ante políticas fiscales expansivas.

Palabras clave: Política fiscal, Distribución de empresas, emprendedor, amplificación

Firm dynamics and Fiscal stimulus

Abstract

How does the effectiveness of fiscal stimulus depend on the composition of firms operating where the stimulus takes place? This paper explores if firm size and age heterogeneity have aggregate implications for the transmission mechanism of government spending. I show that fiscal stimulus gets amplify in US regions with a higher share of young and small firms. Increasing the share of small and young firms by 1% raises the local open economy fiscal multiplier by 5.6%, from 1.60 up to 1.69. I propose a new mechanism where demand shocks loosen firm's constraints, e.g. borrowing constraints, building a customer base or learning by doing, increasing the survival rate of constrained entrepreneurs with the consequential increase in job and productivity

growth. At the firm level, I find that after a fiscal stimulus smaller firms increase capital expenditures and boost productivity relative to larger firms. These findings suggest that fiscal policy can spur entrepreneurship and at the same time that firm heterogeneity shape the aggregate responses of fiscal stimulus.

Keywords: Fiscal Policy, Firm distribution, startups, amplification

Códigos JEL: E23, E32, E62, F33, H32

1 Introduction

How does the effectiveness of fiscal stimulus depend upon firms' size and age distribution? Neoclassical theory mostly ignores the role of firm heterogeneity on the fiscal multiplier and Keynesian theory only allows heterogeneity in the frequency of price adjustment (i.e. nominal rigidities)[1]. In other words, both theories work under a representative firm assumption without frictions. Surprisingly, the firm's distribution where the fiscal stimulus take place has received almost null attention. This paper explores how firm heterogeneity matters for the transmission mechanism of government spending.

Small and young firms contribute disproportionately to job creation, output and productivity growth. There are two well established facts in firm dynamics called "up or out": first, conditional on survival, younger and smaller firms have much higher rates of jobs and productivity growth than more mature firms and second, young firms have a substantially higher exit rate than mature firms (Decker et al. 2014). In other words, firms grow as they age and reach their optimal size. Young firms tend to born small because of financial constraint, uncertainty about demand and other potential constraints: such as limited reputations that leads to challenges in building up a customer base, learning by doing dynamics in the accumulation of specific capital, managerial skills, etc (Foster, Haltiwanger & Syverson 2016). Along this process a higher aggregate demand may help to loosen these constraints increasing job and productivity growth.[2]

I exploit military purchases as identification of government spending shocks at regional level to estimate a geographic local fiscal multiplier - the dollar increase in state GDP caused by a one dollar increase in government spending in that state that varies with the composition of firms. Using regional variation in military procurement across US states as in (Nakamura & Steinsson 2014) I found that government spending shocks get amplify in regions with a higher share of small and young firms. Increasing the share of small and young firms by 1% above the average share across US states raises the *local* fiscal multiplier by 5.6%, from 1.60 up to 1.69. Consistent with recent evidence, I found that employment, wages and labor productivity growth also increased after a

[1] See for example (Baxter & King 1993, Aiyagari, Christiano & Eichenbaum 1992, Barro n.d.) for the neoclassical and (Coenen & Straub 2005, Auerbach & Gorodnichenko 2013, Galí, López-Salido & Vallés 2007) for the new keynesian theory

[2] (Hsieh & Klenow 2014) using micro-level wedges explain the dispersion in average marginal product of capital and labor across firms that leads to misallocation. They show that young firms face barriers to grow indicating that demand or borrowing constraints may distorts marginal products of labor and capital. Loosening these barriers will increase aggregate productivity.

fiscal stimulus[3]. The new empirical fact is that these effects are larger for those states with a higher share of small and young firms. Even though the government tend to buy from large firms, small and young firms tend to benefit the most for the increased in aggregate demand. This highlight the role of indirect effects or spillover of demand shocks. I suggest that the presence of firm-specific wedges in the form of capital and/or productivity distortions are counter-cyclical and therefore these constraints are relaxed after a fiscal stimulus. These wedges tend to be more binding for small and young firms (Hsieh & Klenow 2014, Ottonello & Winberry 2016).

Two mechanisms are proposed to account for the amplification effect of small and young firms on the local fiscal multiplier. First, firm death decrease on average after a spending shock, but decrease even more in states with a higher share of small and young firms. As firm-specific wedges are loosened, the survival rate of firms increase the most for those firms that are key for job and productivity growth dynamics. Second, using firm level data from Compustat, the same regional variation of military procurement as a shock and the headquarter's location of the firms[4], I present suggestive evidence that productivity increase more for smaller firms. My results indicates that firm's average cost decrease by 1.5% and that the average product of labor and capital and TFP increased more for smaller firms in the sample. I interpret this evidence as being consistent with the presence of heterogeneous responses of wedges to demand shocks.[5] Lastly, but not least important, I don't find evidence that heterogeneity in price rigidities (a suggested new keyenesian mechanism) across firms is driving the results.[6]

Related literature. The paper contributes to two literatures[7]. First, on the role of fiscal policy as a stabilization tool, particularly important in the macroeconomic debate after the financial crisis. There is no such a thing as a unique fiscal multiplier: there is no agreement about the transmission mechanism of how the fiscal authority affects GDP with fiscal multipliers estimates ranging from a low 0.5 (crowding-out) to as high as 2 (strong crowding-in) and what is the correct model to interpret the data

[3](Auerbach, Gorodnichenko & Murphy 2019) show that labor productivity is procyclical due to a procyclical labor wedge

[4]The same empirical strategy is used in (Cohen, Coval & Malloy 2011) where the headquarter of the firms is used as the location where the firm operates.

[5]I only explore the firm size distribution in Compustat, given the difficulties to disentangle the incorporation date from the founding date of the company. However firms in the sample tend to be larger and older than the average firm in the economy, I find that even within listed corporations, smaller firms tend to growth faster and improve productivity relative to larger firms.

[6]As small firms are more labor intensive and wages tend to be more sticky than other inputs and prices it may be the case that these firms adjust prices with less frequency and then amplifying the effects of spending shocks. Appendix 6.3 show that this is not the case.

[7]See (Ramey 2016) for a review of the effects of government expenditures on economic activity

(Ramey 2011, Ilzetzki, Mendoza & Végh 2013). This paper shed light on a new channel for the effectiveness of fiscal policy in the new and growing literature about geographic cross-sectional fiscal multipliers that measures the impact of an increase in spending in one region of a monetary union.[8] This empirical strategy has a number of advantages over the tradition of SVAR (Blanchard & Perotti 2002): uses much greater variation in fiscal policies across distinct geographic areas and across time. The most important is that as monetary and tax policy is common to all regions in a monetary union these effects are subsumed by a time fixed effects, allowing to focus on other mechanism of how fiscal stimulus may affect output.[9] However, the disadvantage of this method is that it's not directly comparable with the closed economy multiplier estimated in the SVAR literature. Therefore, in order to give a structural interpretation to the local fiscal multiplier estimated here we will have to model interactions between regions and how the distribution of firms interact between each other (input-output linkages, entry dynamics, home bias in production function, agglomeration of scale, i.e. endogenously determined firms location decision). Future work should go in this direction.

Second, my paper contributes to the literature that links heterogeneous firm sensitivity to aggregate shocks (Fort et al. 2013).[10] The closest papers to this are (Ferraz, Finan & Szerman 2015) and (Lee 2017). (Ferraz, Finan & Szerman 2015) using a quasi-natural design in Brazil estimate that firms that get a procurement contract from the government tend to grow faster and expand the product variety that firms produce. This effects persist over time. They find that young firms are the most benefited of getting this increase in demand, highlighting demand constraints and learning by doing as a mechanisms. (Lee 2017) using procurement data for Korea find similar results where short-term contract from the government have long-term impact in firm growth, specially strong for small, young and financially constraint firms. I present suggestive evidence at firm level using Compustat that small firms increase capital expenditures, average product of labor and capital relative to large firms by about 2%. The increased in productivity presented here is in line with (D'Alessandro, Fella & Melosi 2019) that show that fiscal shocks raises TFP due to learning by doing, accumulating skills via work experience. (Jørgensen & Ravn 2017) finds that TFP also goes up after a fiscal

[8] See (Chodorow-Reich 2019) for a comprehensive review of this literature.

[9] The financial crisis has spurred a large literature with a focus on the ZLB and demand heterogeneity on how an increase in government spending can crowd-in consumption due to financial constraints that generates heterogeneous MPC (Galí, López-Salido & Vallés 2007, Demyanyk, Loutskina & Murphy 2016).

[10] (Ottonello & Winberry 2016) suggest that financial frictions worsen the allocation of capital during recessions. (Ottonello & Winberry 2018) show that financial heterogeneity at firm level play a key role on the investment channel of monetary policy shocks.

shock, with a decreased in inflation through the adoption of new technologies. These last two papers assumes a representative firm and uses aggregate data for the US, with the typical concerns about identification and not isolating the role of monetary policy and taxation. The evidence presented here highlight the role of firm heterogeneity for the increase in TFP in a more natural framework.

Results indicate that firms distribution is key to the design of fiscal packages, calling for a *firm-dependent* fiscal multiplier.[11] At the best of my knowledge there is no empirical or theoretical studies looking at the role of firms constraints on the effectiveness of spending shocks. This a first step in understanding how firm dynamics can share the response to a fiscal shocks, with important policy implications. Active fiscal policy can bolster startups and entrepreneurship stimulating economic activity.[12]

The remainder plan for the paper is as follows. Next section describe my empirical strategy and the estimated equation. Sector 3 presents the results and robustness. Section 4 presents evidence for the proposed mechanisms and firm level evidence of the increase in productivity. Finally, Section 5 concludes.

2 Empirical strategy

This section will show how the local fiscal multiplier depend on the firm size and age distribution. The empirical strategy uses a panel data set of output, government military spending and firm size and age characteristics across U.S. states. To identify how government spending affect output differently according to the share of small and young firms in each state I exploit variation across U.S. states in military buildups or drawdowns and previous employment share of small and young firms. This method identifies an open economy local fiscal multiplier: measures the effect of an increase in spending in one specific region in a monetary union relative to the response of all other U.S. states when the federal government increase spending in that state. This dollar increase is financed by taxing individuals in all U.S. states.

I use annual data on the geographical allocation of military spending for 1977-2006 from (Nakamura & Steinsson 2014). Key for my purpose is that they show that military procurement tend not to be subcontracted to firms in different states from the original

[11] As a parallel of *state-dependent* fiscal multiplier that finds that multipliers tend to be greater in times of recession (Auerbach & Gorodnichenko 2013).

[12] After the next expansionary fiscal policy economic agents will not be surprised by this new amplification mechanism and then it should be incorporated in the model of how agents forms expectations in order to be model consistent. See (Montes Rojas & Heymann 2018) for a discussion of model consistent and their implications.

recipient: the increase in spending goes to firms located in the state that received the contract. The data cover any procurement of the U.S. Department of Defense above $10,000 up to 1983, and above $25,000 from 1983 on.

The data for the employment share of young and small firms across states is from Business Dynamic Statistics. State output and employment series for states are coming from the Bureau of Economic Analysis (BEA).

2.1 Econometric specification

I estimate the effect of firm heterogeneity on the local fiscal multiplier using the following equation:

$$\frac{y_{s,t} - y_{s,t-2}}{y_{s,t-2}} = \beta \frac{g_{s,t} - g_{s,t-2}}{y_{s,t-2}} + \gamma \frac{g_{s,t} - g_{s,t-2}}{y_{s,t-2}} \times (YS_{s,t-2} - YS) + \eta C_{s,t-2} + \delta_s + \delta_t + \epsilon_{s,t}$$

where $y_{s,t}$ is per capita output for state s in year t, $g_{s,t}$ denotes military spending distributed to state s in year t, $YS_{s,t-2}$ is the log-employment share of young and small firms in state s two years before the shock arrives. The assumption is that the firm size and age distribution is predetermined at the moment of the shock. I define small firms as those with less than 50 employees and young firms as those that were born two years before the shock hit the state. I de-mean the log-share of small and young firms for interpretation purpose, where β is the local fiscal multiplier with the average employment share of small and young firms. The coefficient of interest is γ, which captures the sensitivity of the local fiscal multiplier to the firm distribution. The interpretation is as follows: when the employment share of small and young firms increase by 1% above the average, the local fiscal multiplier would be $\beta + \gamma$. $\eta C_{s,t-2} = \phi YS_{s,t-2} + \theta X_{s,t-2}$ includes the share itself in order to control for the direct effect that small and young firm may have on output and state level controls such as size of the state economy (proxy by level of GDP), industry composition of output (share of manufacturing, services, retail, and construction in total output), unemployment rate and income inequality (top 10% income share). Lastly, I include state and year fixed effects to control for unobserved heterogeneity across states and aggregate shocks, such as national monetary policy and tax policy. Standard errors are robust to heteroskedasticity and to weak instruments[13].

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 military spending is notoriously political. Therefore I identify

[13] I follow (Sun 2018) to overcome the issue of weak instruments issued in (Nakamura & Steinsson 2014).

government spending shocks following the approach of (Nakamura & Steinsson 2014), which exploits the heterogeneous sensitivity of states' military procurement to an increase in (aggregate) *federal* military spending. The identification assumption is as follows: the U.S. as a country does not engage in aggregate military buildups or drawdowns (as the Vietnam War) because a specific state (e.g. *California*) is experiencing or is expected to suffer from sluggish growth relative to the others (e.g. *Ohio*). A common endogeneity concern with military spending is that the US went to war to benefit the domestic economy. With this identification strategy that's not seem to be problematic. In order to invalidate the exogeneity one should have to argue that US went to war to benefit California relative to Ohio. This IV strategy implies a first stage regression in which per capita state military procurement (as a fraction of per capita state GDP) is regressed against the product of per capita national military spending (as a fraction of per capita national GDP) and state fixed effects:

$$\frac{g_{s,t} - g_{s,t-2}}{y_{s,t-2}} = \beta_s \frac{g_t - g_{t-2}}{y_{t-2}} + \theta\ Z_{s,t-2} + \ \eta C_{s,t-2}\ + \delta_s + \ \delta_t + \ \epsilon_{s,t}$$

β_s captures the heterogeneous exposure of each state to a rise in (aggregate) federal military spending. $Z_{s,t-2}$ includes the interaction of changes in government spending and the employment share of young and small firms. Then, we evaluate whether the effects of government spending shocks on output depend on states' firm distribution. Figure 2 and Table 10 in the Appendix shows that we have enough variation on the distribution of the employment share of small and young firms across states and time.

3 Results

Table 1 shows the results. Column (1) is the baseline: increasing the *share of young and small* firms by 1% above the average share across U.S. states raises the local output fiscal multiplier by 5.6%, from 1.60 (β) up to 1.69 ($\beta + \gamma$).

Columns (2) show to (5) shows that what matters is the interaction between small and young characteristic of the firms distribution in order to amplify the fiscal shock. Column (4) indicates that small and old firms, even though positive, are not a significant source of amplification. Lastly, column (5) indicates that those firms that are born large have no effect on the local fiscal multiplier.

Table 1: The Local fiscal multiplier: the role of small and young firms

	(1)	(2)	(3)	(4)	(5)
Military contracts (β)	1.60***	2.35***	1.56***	2.02***	1.66***
	(0.48)	(0.60)	(0.46)	(0.55)	(0.51)
Military contracts × Emp share of Small & Young (γ)	0.09***			0.08***	0.09***
	(0.03)			(0.02)	(0.03)
Military contracts × Emp share of Small		0.17***			
		(0.05)			
Military contracts × Emp share of Young			0.09***		
			(0.02)		
Military contracts × Emp share of Small & Old				0.07	
				(0.04)	
Military contracts × Emp share of Large & Young					-0.01
					(0.01)
Obs.	1,428	1,428	1,428	1,428	1,428
R2	0.41	0.41	0.43	0.40	0.41
State and Time FE	Yes	Yes	Yes	Yes	Yes

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

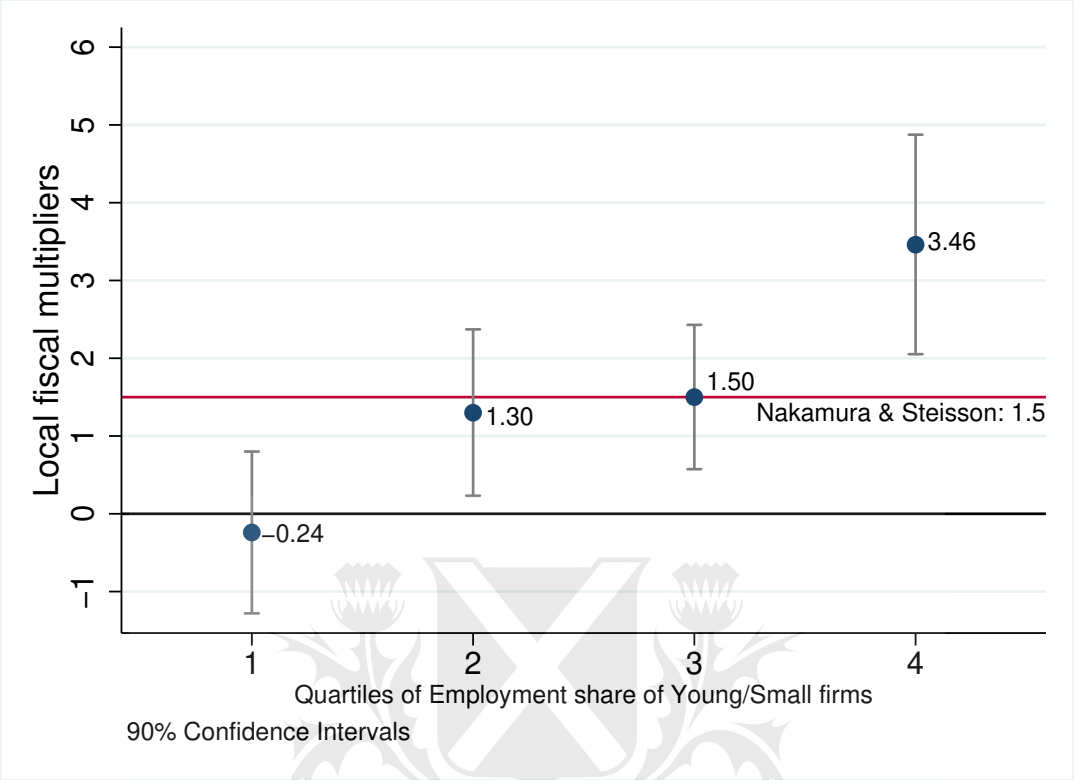
State controls: Industry composition, Top 10% income share, unemployment rate and size of the state GDP. Small business are those with less than 50 employees. Young business are those less than 2 years old

In order to interpret the results I grouped observations along quantiles of the firm size and age distribution and run the same empirical specification in order to see how sensitive is the local fiscal multiplier to the employment share of small and young firms. Figure 1 indicates that the multiplier is not statistically different from 0 when the share of small and young firms is in the bottom 25% of the distribution and can be as high as 3.5 for the top 25%. The multipliers for the middle of the distribution of small and young firms are not much different from the unconditional local multipliers estimated by (Nakamura & Steinsson 2014).

3.1 Employment and labor productivity responses

The literature focus mostly on employment responses given that exist more reliable data. Table 2 shows that the same pattern discussed before applies for employment. Column (1) indicates that employment increase 1.22% for the average state in terms of the share of small and young firms, but increase up to 1.25 (2.5%) if this share increase by 1% above the average across US states. This response corresponds with the extensive margin of employment, consistent with (Blanchard & Galí 2010, Shimer 2009). In line with the literature, I find that wages increase after a spending shock, increasing more when the share of small and young firms is higher (5.8%). Interestingly, for labor productivity (defined as output over employment) only the interaction term is significant (for the average state there is no robust evidence that the product per

Figure 1: Interpreting results



worker increase). That labor productivity increase after positive demand shocks point to a strong increase in capital utilization and/or labor effort and/or alleviation of firm constraints (Nekarda & Ramey 2011, D'Alessandro, Fella & Melosi 2019, Jørgensen & Ravn 2017). I will come back to this when discussing the firm level evidence. Lastly, we observe that there is an increase in firm entry, consistent with procyclical firm entry documented in the literature. Therefore, new firms contribute to the increase in job creation and productivity growth.

Table 2: Employment, wages, labor productivity and firm entry responses

Dependent variable	Employment (1)	Wages (2)	Labor Prod. (3)	Firm entry (4)
Military contracts (β)	1.22***	1.04***	0.49	2.40***
	(0.20)	(0.32)	(0.30)	(0.78)
Military contracts × Emp share of Young-Small (γ)	0.03***	0.06***	0.05***	0.06**
	(0.01)	(0.01)	(0.02)	(0.03)
Obs.	1,428	1,428	1,428	1,428
R2	0.55	0.57	0.63	0.55
State and Time FE	Yes	Yes	Yes	Yes

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

State controls: Industry composition; Top 10% income share, unemployment rate and size of the state

3.2 Reverse causality concerns

Does future output or government procurement growth affect the current share of young and small business? In other words, my identification assumption is that the employment share of young and small business is predetermined two years before the shock arrives. Thus if there is anticipation effects such that government spending affects in advance to the distribution of firms my identification strategy would be invalid.

In order to address this question I run the following regressions:

$$YS_{i,t} = \beta_1 \Delta y_{i,t+1} + \beta_2 \Delta y_{i,t+2} + \delta_i + \delta_t + \epsilon_{i,t}$$

$$YS_{i,t} = \alpha_1 \Delta g_{i,t+1} + \alpha_2 \Delta g_{i,t+2} + \delta_i + \delta_t + \epsilon_{i,t}$$

where $YS_{i,t}$ is the employment share of young and small business for state i in year t, $\Delta y_{i,t+k}$ is future output growth, $k = 1, 2$, $\Delta g_{i,t+k}$ is future government procurement growth, $k = 1, 2$ and δ_i,δ_t are state and time fixed effects.

Table 3 suggest that this is not the case: future output growth and future government procurement does not predict current firm distribution in terms of size and age.

3.3 Robustness

My causal interpretation of the firm sensitivity of local fiscal multipliers hinges on instrumenting the current employment share of young and small firms with a 2-year lagged share. The implicit exclusion restriction is that, conditional on state and time fixed effects, whatever determines the cross-sectional variation in lagged employment share of young and small firms has no other long lasting effect on the size of fiscal multipliers 2 years later. The IV approach would not be valid if the sensitivity to

Table 3: Reverse causality concerns

Dependent variable	YS_t			
	(1)	(2)	(3)	(4)
Output growth$_{i,t+1}$ (β_1)	0.01	0.37		
	(0.38)	(0.32)		
Output growth$_{i,t+2}$ (β_2)		-0.82		
		(0.70)		
Military Contract growth$_{i,t+1}$ (α_1)			-1.87	-3.39
			(1.81)	(2.05)
Military Contract growth$_{i,t+2}$ (α_2)				-1.97
				(2.01)
Obs.	1,479	1,428	1,479	1,428
R2	0.72	0.72	0.72	0.72
State and Time FE	Yes	Yes	Yes	Yes

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

current federal government shocks is related to past states' firm distribution. In fact, in the data the correlation between states' firm distribution and sensitivity to federal government shocks is 0.03 and not significant. Thus, the geographical distribution of military spending is not related to firm distribution, therefore there is not enough evidence that my identification approach is invalid.

The sensitivity of the local fiscal multipliers to the employment share of young and small firms could be affected by alternative sources of heterogeneity across states that can confound the effects of firm heterogeneity. The estimates could be bias if the exclusion restrictions of the IV approach are violated, which would happen in case there exist potential confounding factors which are highly correlated with both changes (across states and over time) in the lagged firm distribution and in current government spending. It can be the case that what matters for the local multiplier is the industry composition and not the firm age and size. Appendix 6.3 shows that however there is a correlation between firm size-age and the industry where that firms belong, γ is still positive and significant and approximately of the same magnitude after controlling for industry composition. The positive effect of the employment share of young and small business is robust to other confounding explanations that have been explored in the literature, such as income inequality (Brinca et al. 2016), households financial distress and debt (Demyanyk, Loutskina & Murphy 2016), demographics (Basso & Rachedi 2018), excess capacity, interest rate and oil prices.

4 Inspecting the Mechanism

The higher the employment share of small and young firms the larger is the local fiscal multiplier. This section presents suggestive evidence that a demand shock affect post-entry dynamics, mostly for those firms that are growing to reach their optimal scale of operations. I show that the exit rate of small and young firms decrease after a spending shock increasing job creation, job growth and labor productivity. I interpret these results as wedges at firm level getting relaxed. The key is the counter-cyclicality of these frictions, allowing those firms that were constraint before the increase in aggregate demand and binding constraints to grow.

4.1 Post-entry dynamics: "up or out"

It's not surprising that when aggregate demand increase less firm go out of business. Table 4 indicates that spending shocks increase survival rate (lower firm death) and is relatively stronger where there is a higher share of small and young firms. Columns (4) to (6) show that although I don't have enough power to see a direct decrease in firm death of small and young firms, this firm death decrease more in states with a higher share of these types of firms.

Table 4: Fiscal stimulus increase survival rate (lower firm death)

Dependent variable	All			Age 2 & Small		
Firm death	(1)	(2)	(3)	(4)	(5)	(6)
Military contracts (β)	-2.32**	-2.49**	-1.66*	-1.89	-2.07	-1.31
	(1.17)	(1.03)	(0.99)	(1.46)	(1.52)	(1.50)
Military contracts × Emp share of Young-Small (γ)		-0.14***			-0.15***	
		(0.03)			(0.04)	
Military contracts × Number share of Young-Small (γ)			-0.26***			-0.30***
			(0.04)			(0.06)
Obs	1,428	1,428	1,428	1,325	1,325	1,325
R2	0.49	0.46	0.46	0.62	0.61	0.60
State and Time FE	Yes	Yes	Yes	Yes	Yes	Yes

***: p<0.01 ;**: p<0.05;*: p<0.1. State controls: Industry composition; Top 10% income share, unemployment rate and size of the state

After documenting that firm death decrease, I ask the following question, conditional on surviving: who is creating more and/or destructing less employment? Table 5 indicates the ones that are creating more jobs are those with higher share of small and young firms. Similarly, job destruction decrease the higher is the employment share of small and young firms.

Table 5: Who is creating more and/or destructing less employment?

Dependent variable	Job creation rate		Job destruction rate	
	All	Continuers	All	Continuers
	(1)	(2)	(3)	(4)
Military contracts (β)	1.42	2.05	-0.58	-0.69
	(0.99)	(1.18)	(1.17)	(1.34)
Military contracts × Emp. share of Young-Small (γ)	0.12***	0.14***	-0.09**	-0.13***
	(0.03)	(0.04)	(0.04)	(0.04)
Obs.	1,428	1,428	1,428	1,428
R2	0.42	0.51	0.62	0.62
State and Time FE	Yes	Yes	Yes	Yes

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

State controls: Industry composition; Top 10% income share, unemployment rate and size of the state (GDP)

4.2 Firm level evidence

Small and young firms amplify fiscal stimulus. But, does it mean that these firms actually sell more and hire more workers than large and mature firms? This section provide an answer to this question using US Compustat firms, an extensively used database. I focus on the responses of public corporations headquartered in the state that received the fiscal stimulus. The approach is similar to (Cohen, Coval & Malloy 2011). A limitation of using this data is that does not allow me to explore the age effect highlighted previously. However I explore the role of firm size distribution and if relatively smaller firms react differently than larger firms. The balance sheet information allows me to investigate the heterogeneous responses of these firms in terms of productivity and financial variables.

In order to see the response of the average firm to the fiscal stimulus, I estimate the following equation for the sample period 1963-2008:

$$\Delta y_{i,s,t-2} = \beta \frac{G_{s,t} - G_{s,t-2}}{Y_{s,t-2}} + \eta C_{i,t-2} + \delta_i + \delta_t + \epsilon_{i,s,t}$$

where $\Delta y_{i,s,t-2}$ is the two-year change in y = Sales and Employment for firm i in state s. The parameter β captures the effect of the aggregate fiscal shock in state s (normalized to be 1% of state GDP) on the average firm with headquarter in state s. δ_i and δ_t are firm and time fixed effects controlling for aggregate shocks and unobserved time invariant firm heterogeneity (for example, probability of getting a government contract).[14] Lastly, $\eta C_{i,t-2}$ are firm level control before the shock arrive such as em-

[14] Results are robust to the inclusion of industry-year fixed effects that controls for industry specific demand shocks. Results are available upon request.

ployment leverage, liquidity and total assets. I cluster the standard errors at state-year level.

To see if there is heterogeneous responses to the fiscal stimulus across the firm size distribution I estimate:

$$\Delta y_{i,s,t-2} = \sum_{q=1}^{5} \beta_q \frac{G_{s,t} - G_{s,t-2}}{Y_{s,t-2}} \times I^{emp}_{Pq,t-2} + \eta C_{i,t-2} + I^{emp}_{Pq,t-2} + \delta_i + \delta_t + \epsilon_{i,s,t}$$

where now β_q is the response of firms in quantile $q = 1, 2, 3, 4, 5$ of the employment distribution of firms two years the shock arrives. The assumption is that the number of employees at the firm was predetermined at the moment of the shock. Table 6 shows the results.

Table 6: Average and heterogeneous firm level responses to fiscal stimulus

Dependent variable	Sales		Employment	
	(1)	(2)	(3)	(4)
Military contracts	1.68		1.76**	
	(1.05)		(0.75)	
Military contracts $\times$ I^{emp}_{P20}		4.06**		4.89***
		(1.73)		(1.27)
Military contracts $\times$ I^{emp}_{P40}		3.15**		3.30***
		(1.24)		(1.00)
Military contracts $\times$ I^{emp}_{P60}		0.57		1.77**
		(1.07)		(0.83)
Military contracts $\times$ I^{emp}_{P80}		0.92		1.30*
		(1.03)		(0.77)
Military contracts $\times$ I^{emp}_{P100}		1.09		-0.05
		(1.02)		(0.84)
Firm controls	Yes	Yes	Yes	Yes
Firm and Time FE	Yes	Yes	Yes	Yes
Obs	147,496	147,496	144,006	144,006
R2	0.06	0.06	0.11	0.09

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

Results indicate that sales and employment goes up when government spending increases (though not significant for sales). Column (2) and (4) shows a vast heterogeneity: small firms creates more employment and sells more than large firms. The differences between the bottom 20% and the top 20% of the employment distribution is about 3-5%. Then, even listed corporations in US there are heterogeneous responses along the firm size distribution to fiscal stimulus.

Notwithstanding the composition of military purchases is not representative of the product space and these purchases tend to be concentrated in very large firms. In an attempt to take care of this Table 7 decompose the effects in direct versus indirect effects, controlling for the industries and firms that are more probable of getting a contract. Firms included in the direct effects are basically military industries. I defined these industries at 4-digit NAICs level using (Nekarda & Ramey 2011) which compute the share of shipments to the government in the Census of Manufacturing.[15]

Table 7: Direct vs Indirect effects

	Direct				**Indirect**			
Dependent variable	Sales		Employment		Sales		Employment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Military contracts	2.89		4.04**		1.54		1.50**	
	(1.95)		(1.82)		(1.06)		(0.72)	
Military contracts $\times$ I^{emp}_{P20}		5.33*		4.12		3.93**		4.95***
		(2.83)		(2.53)		(1.84)		(1.28)
Military contracts $\times$ I^{emp}_{P40}		4.45*		5.40**		2.87**		2.78***
		(2.58)		(2.43)		(1.25)		(0.96)
Military contracts $\times$ I^{emp}_{P60}		-1.37		0.14		0.77		1.84**
		(2.45)		(2.27)		(1.25)		(0.86)
Military contracts $\times$ I^{emp}_{P80}		-0.26		3.38*		1.05		0.95
		(2.18)		(2.03)		(1.05)		(0.73)
Military contracts $\times$ I^{emp}_{P100}		5.81**		2.71		0.70		-0.28
		(2.47)		(2.12)		(0.98)		(0.79)
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm and Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	14,976	14,976	14,653	14,653	132,520	132,520	129,353	129,353
R2	0.08	0.08	0.12	0.10	0.06	0.06	0.11	0.11

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

Notice that the direct effects almost double indirect effects. regarding the direct effects, large firms in line with the evidence that are these firms the ones that are probably getting the government contracts, are selling on average more than everyone else in the sample (almost 6%). Smaller firms are also increasing sales (still not highly significant), probably because Input-Output linkages. The indirect effects results shows that smaller firms response more to aggregate spending shocks that may relax firm's

[15] For example firms in the Guided missiles and space vehicles (3761), Ammunition, except for small arms (3483), Ordnance and accessories (3489), Aircraft and missile equipment (3728), etc etc are included in the group of firms that are directly affected by a government spending shock. As this paper only include Manufacturing industries until 1992 and the composition of military purchase had change in the direction of construction and services I use (Auerbach, Gorodnichenko & Murphy 2019) top 5 sectors that received demand from DoD, including Construction (21), Miscellaneous professional, scientific, and technical services (5412), Computer systems design and related services (5415) and Computer and electronic products (334).

constraints.

It's easy to imagine that listed firms don't operate only in the state where they locate their headquarters. We should expect that fiscal stimulus have higher effects that have a higher concentration of operations at the state where they are located. Table 8 restrict the sample to those firms that have more than 90% of operations at headquarter's state.[16] Results show that the magnitudes of the effects are considerable larger and that same pattern across the firm size distribution emerges. Therefore, results suggest that there is an heterogeneous response to fiscal stimulus across the firm size distribution. Next we investigate the causes of this.

Table 8: Geographic concentration and fiscal stimulus

Dependent variable	Sales		Employment	
	(1)	(2)	(3)	(4)
Military contracts	37.01*		31.97**	
	(21.91)		(16.02)	
Military contracts $\times$ I^{emp}_{P50}		38.69*		34.78**
		(22.75)		(16.47)
Military contracts $\times$ I^{emp}_{P100}		34.56		27.45
		(21.75)		(16.84)
Firm controls	Yes	Yes	Yes	Yes
Firm and Time FE	Yes	Yes	Yes	Yes
Obs	3,358	3,358	3,456	3,456

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

Does the spending shock helps firms to increase productivity? Table 9 shows that smaller firms incorporate more capital (and employment), increase labor productivity (defined as value added over number of workers, in line with the aggregate results of Table 2) and the average product of capital (defined as value added over stock of capital) by about 2-3%. At the same time, we observe that the average cost (cost of goods sold over sales) of smaller firms decrease after a fiscal shock.

This firm level evidence is in line with the recent papers that highlight the increase in aggregate TFP after spending shocks using SVAR empirical strategies (D'Alessandro, Fella & Melosi 2019, Jørgensen & Ravn 2017). These results indicate that the interaction between demand shocks and supply responses may be an important driver of the aggregate effects of fiscal stimulus. This paper explicitly consider the role of firm heterogeneity on the transmission channel of fiscal shocks.

[16] I use (Garcia & Norli 2012) from 1994 to 2008 track where the firms operates reading Form 10-K.

Table 9: Fiscal stimulus and firm's productivity

Dependent variable	Capital Exp. $CAPX_{i,t}/A_{i,t-2}$		Avr. Cost $cogs_{i,t}/sale_{i,t}$		Avr. Labor Prod. $VA_{i,t}/emp_{i,t}$		Avr. Capital Prod. $VA_{i,t}/Capital_{i,t}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Military contracts	0.44		-0.34		0.49**		1.66*	
	(0.28)		(0.29)		(0.22)		(0.87)	
Military contracts $\times$ I^{emp}_{P20}		1.40***		-1.33**		1.86***		3.63**
		(0.45)		(0.63)		(0.52)		(1.66)
Military contracts $\times$ I^{emp}_{P40}		1.00**		-1.40***		0.68***		3.43**
		(0.40)		(0.47)		(0.26)		(1.68)
Military contracts $\times$ I^{emp}_{P60}		0.55**		-0.56*		0.84***		1.40
		(0.27)		(0.33)		(0.28)		(1.30)
Military contracts $\times$ I^{emp}_{P80}		0.29		0.08		0.36		2.04*
		(0.30)		(0.29)		(0.24)		(1.07)
Military contracts $\times$ I^{emp}_{P100}		-0.30		0.51**		-0.23*		-0.48
		(0.21)		(0.24)		(0.13)		(1.09)
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm and Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	137,640	137,640	147,440	147,440	117,654	117,654	86,445	86,445
R2	0.03	0.02	0.00	0.00	0.06	0.02	0.01	0.00

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

5 Conclusion

Does firm heterogeneity have aggregate implications for the transmission mechanisms of fiscal stimulus? There is a well established fact in firm dynamics called "up or out": conditional on survival, young and small firms tend to grow as they age, having a higher rate of job creation and productivity growth. At the same time the exit rate of young and small firms is considerable larger than mature and large firms. This paper proposed a novel amplification mechanism of fiscal stimulus incorporating facts from the life-cycle of the firms. I show that fiscal stimulus in a monetary union get amplify the larger the employment share of small and young firms. Quantitatively, results indicates that the local fiscal multiplier goes from 1.60 for the state with the average share of small and young firms to 1.69 if this share increase 1% above average across U.S. states. Suggestive evidence shows that this effects is explained by a higher survival rate of young and small firms. Consequently this lower firm death, job creation and labor productivity increase the most for this group of firms. In other words, aggregate spending shocks relax firms constraint such as borrowing constraints and/or allow firms to learn about demand and own productivity deepening the the costumer base. This leads to an increase in productivity of firms that are in the process of growing. Therefore, post-entry dynamics of firms is an important determinant of the local fiscal multiplier. A better understanding of how positive demand shocks can

loosen these constraints should guide future research.

This paper has a number of limitations. First, does not provide a structural interpretation of results and can not provide an answer of how firm heterogeneity affect the closed economy fiscal multiplier. Future work is needed in this direction in order to explicitly deal with firm dynamics, supply frictions and amplification from loosening firm's constraints. In the firm level dimension, even though this paper provides an aggregate answer at least for open economy local fiscal multiplier. However, in order to improve our understanding of how different firms react to fiscal stimulus we need firm level analysis, decomposing the overall effect in direct versus indirect effects at firm level. The direct effect can be estimated linking procurement contract with firm level outcomes, as in (Ferraz, Finan & Szerman 2015, Lee 2017). The indirect aggregate effect would be the difference between overall and direct effects. Preliminary results suggest that indirect effects are key once we are consistent with the life-cycle of firms.

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6 Appendix

6.1 Descriptive statistics

Figure 2: Distribution of the Employment share of Young and Small business

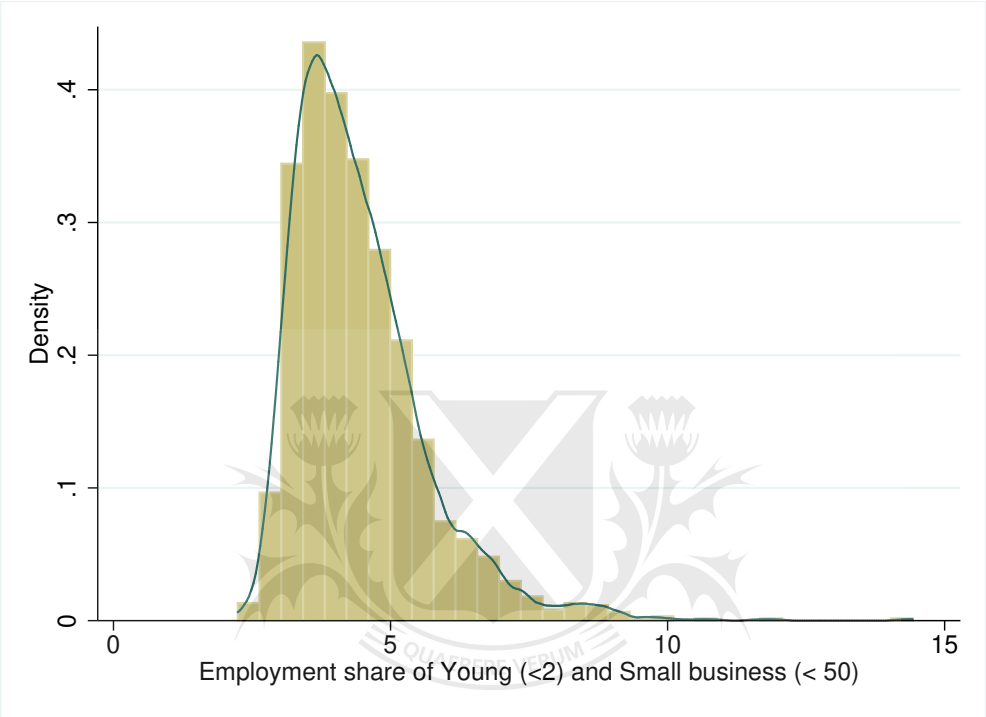

Table 10: Descriptive statistics: 1977 - 2006

	SD	Mean	p50	p25	p75
Emp. share of Small & Young	1.20	4.43	4.19	3.59	4.49
Firm share of Small & Young	2.35	11.46	10.93	9.86	12.51
Emp. share of Small	6.17	44.56	43.12	40.28	47.77
Firm share of Small	0.89	95.26	95.15	94.63	95.79
Emp. share of Young	1.58	6.08	5.75	5.01	6.75
Firm share of Young	2.56	11.97	11.45	10.20	13.15
Gov. Spending growth	0.71	0.02	0.01	-0.23	0.26
GDP growth	5.72	2.94	3.15	0.03	6.16
Employment growth	3.61	1.87	2.16	-0.35	4.20

6.2 Robustness: confounding factors

6.2.1 At state level

$$\frac{y_{i,t}-y_{i,t-2}}{y_{i,t-2}} = \beta \frac{g_{i,t}-g_{i,t-2}}{y_{i,t-2}} + \gamma \frac{g_{i,t}-g_{i,t-2}}{y_{i,t-2}} \times (YS_{i,t-2}-YS) + \psi \frac{g_{i,t}-g_{i,t-2}}{y_{i,t-2}} \times (Z_{i,t-2}-\bar{Z}) + \eta C_{i,t-2} + \delta_i + \delta_t + \epsilon_{i,t}$$

where $\eta C_{i,t-2} = \phi YS_{i,t-2} + \omega Z_{i,t-2} + \theta X_{i,t-2}$

Output	Share Constr. (1)	Share Manuf. (2)	Share Retail (3)	Share Services (4)	Unempl. rate (5)	Top 10% Income share (6)	Household's Finan. stress (7)
				$(Z_{i,t-2}-Z)$			
Military contracts (β)	1.54***	3.08***	2.33**	0.86*	1.50***	1.05**	1.31***
	(0.49)	(0.73)	(0.99)	(0.47)	(0.47)	(0.49)	(0.65)
Military contracts × Emp share of Young-Small (γ)	0.09**	0.07***	0.13***	0.06***	0.09***	0.05***	0.09***
	(0.03)	(0.02)	(0.06)	(0.02)	(0.02)	(0.02)	(0.02)
Military contracts × $(Z_{i,t-2}-Z)$	0.00	-0.04***	-0.24***	-0.06**	0.01	-0.19***	-0.11*
	(0.02)	(0.01)	(0.05)	(0.03)	(0.02)	(0.07)	(0.07)
Obs.	1,428	1,428	1,428	1,428	1,428	1,428	1,276
R2	0.42	0.35	0.18	0.38	0.42	0.36	0.49
State and Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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

$X_{i,t-2}$: Industry composition; Top 10% income share, unemployment rate and size of the state (GDP)

6.2.2 At national level

Output	with Excess Capacity controls (1)	with Oil price controls (2)	with real int. rate controls (3)	with Federal debt controls (4)	with Household's debt controls (5)
Military contracts (β)	1.47***	1.56***	0.79**	0.73*	1.19***
	(0.41)	(0.47)	(0.35)	(0.38)	(0.42)
Military contracts × Emp share of Young-Small (γ)	0.08***	0.10***	0.08***	0.07***	0.09***
	(0.02)	(0.03)	(0.01)	(0.02)	(0.02)
Obs.	1,428	1,428	1,428	1,428	1,428
R2	0.11	0.08	0.37	0.37	0.19
State and Time FE	Yes	Yes	Yes	Yes	Yes

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

6.3 Price rigidities

Dependent variables: CPI			
	(1)	(2)	(3)
Military contracts (β)	-0.07	-0.04	-0.10
	(0.25)	(0.17)	(0.14)
Military contracts × Emp share of Small & Young (γ)	0.00		
	(0.00)		
Military contracts × Emp share of Small		0.00	
		(0.01)	
Military contracts × Emp share of Young			0.00
			(0.00)
Obs.	1,361	1,361	1,361
R2	0.41	0.41	0.43
State and Time FE	Yes	Yes	Yes

***: p<0.01 ;**: p<0.05;*: p<0.1.
State controls: Industry composition, Top 10% income share, unemployment rate and size of the state GDP. Small business are those with less than 50 employees. Young business are those less than 2 years old