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Direct Propagation of a Fiscal Shock: Evidence from Italy's Stability Pact

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Direct Propagation of a Fiscal Shock: Evidence from Italy's Stability Pact

Decio Coviello[♣], Immacolata Marino[♥], Tommaso Nannicini[♠] and Nicola Persico[♦]

Abstract
This paper documents: the channels through which local governments propagate a fiscal shock; and the corresponding reaction by firms in the affected upstream sector (municipal procurement). The shock is provided by an Italian fiscal rule, called *Patto di stabilita' dei comuni*, which was tightened unexpectedly in 2008 and applied only to municipalities with population greater than 5,000. Using a difference-indifference identification strategy, we estimate that this shock led to a 13-20% reduction of infrastructure spending in treated municipalities, or equivalently, an 80% reduction in the average municipality. In contrast, current expenditure was not affected. In the upstream sector, i.e., the infrastructure procurement sector, firms reacted to the demand shock by cutting capital rather than labor. In both cases, then, the capital/investment sector is found to be a pre-eminent channel of direct shock propagation. In addition, the fiscal demand shock is found to propagate disproportionately through those private-sector firms which are most exposed to the shocked sector. This finding suggests that direct shock transmission depends on the higher moments of the exposure distribution, beyond the average sectoral exposure that is represented by the input-output linkages. Using procurement-market data we rule out the possibility that our estimates are attenuated by spillover effects operating through competition in the procurement market.

JEL Classification: D44, D72, D73, H57, H70.

Keywords: fiscal rules; industry dynamics, firm dynamics.

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1 Introduction

This paper documents the channels through which a fiscal shock propagates through local governments, and the corresponding reaction by firms in the affected upstream sector (municipal procurement). The shock is provided by an Italian fiscal rule, called *Patto di stabilita' dei comuni*, which was tightened unexpectedly in 2008 and applied only to municipalities with population greater than 5,000. We study how affected municipalities reacted to this fiscal shock and then how their reaction propagated to the upstream sector (municipal procurement).

We find that affected municipalities reduced infrastructure spending by 13%-20% in the few years following the fiscal shock; current spending (on salaries, e.g.), however, was largely unaffected. These estimates are net of the impact of the 2008 financial crisis on municipal budgets. Thus, we conclude that municipalities indeed reacted to the fiscal shock by cutting capital expenditure disproportionately more than current expenditure

Because municipal infrastructure spending accounts for a very small fraction of national GDP, a shock to this sector is unlikely to reverberate through the larger economy. Therefore our setting is a good laboratory to study the *direct* propagation of the shock to the upstream sector, in isolation of general-equilibrium sectoral effects.

We thus turn to the upstream sector, procurement firms, in order to trace the direct impact of municipal demand reduction on firm-level outcomes. For each firm operating in the municipal procurement sector we leverage a proprietary dataset on procurement winners to create an index of "exposure to treatment." A firm is deemed to be highly exposed if a large fraction of its pre-2009 revenues were earned through procurement in municipalities with population exceeding 5,000. We then compare the outcomes of firms that were more exposed to the fiscal demand shock, with the outcomes of less-exposed firms.

We find that upstream firms which are hit by the demand shock react by cutting capital rather than labor. While labor-protection laws may partly explain this pattern, subcontracting (which is not protected by law) was also spared cuts. We also find that the demand shock causes workers to withdraw money from their severance fund; these payouts represent an additional channel through which firms provide insurance to workers. Finally, the estimated effects of the fiscal demand shock on capital and on severance payments are

stronger in financially more-developed regions.

We interpret these findings through the lens of a crude two-period model of "expectation-driven" adjustment by procurement firms. In the model firms are faced with a demand shock at time t which is expected to worsen at time $t+1$ (this assumption is appropriate in our empirical setting: we document that the impact of our fiscal shock worsened throughout our sample period). The model's implications are consistent with our findings. Since capital is more durable than labor, firms choose to cut capital more sharply early on, and to cut labor more gradually. Also consistent with our findings, in the model the capital cut is larger in size if capital is cheaper.

We believe that these findings can contribute constructively to the fast-evolving literature on the network origins of economic fluctuations. We have documented, in a relatively well-identified way, that firm-level adjustments in the capital investment sector can be a pre-eminent channel of direct shock propagation, above and beyond the sector's relative weight in the factor shares. Though our analysis focuses on a single sector, our findings are consistent with a broader macro-level correlational fact: that the profits' share of output is more procyclical than the labor share. Together with this pre-existing evidence, we believe that our findings make a strong case that adding intertemporal optimization to the theoretical framework of Acemoglu et al. (2012) might significantly improve the framework's ability to match empirical propagation patterns. We leave this theoretical development to future research.

We also explore heterogeneities in the shock response. By computing multipliers separately by exposure levels, we find that the most exposed firms react disproportionately more to the shock. We speculate that this nonlinearity may reflect the fact that highly-exposed firms lack a sizable private-sector order book on which to spread the impact of the fiscal demand shock. Regardless of its causes, the nonlinearity of the estimated multipliers suggests that what matters for shock propagation may not be so much the *average* exposure of one sector to another, as represented for example in input-output sectoral linkages, as much as the *right tail* of the exposure distribution.

Finally, we explore whether our estimates incorporate spillover effects operating through competition in the procurement market. A spillover effect would exist if, after the introduction of the fiscal demand shock, exposed firms were to migrate in search of business to

municipalities not affected by the fiscal demand shock. Such a migration would reduce a firm's "exposure to treatment" while at the same time increasing market competition for non-treated firms; the combined effects would bias downward our estimates of the impact of the fiscal demand shock. We explore the economic magnitude of the migration using the procurement market data. We find that tenders in non-treated municipalities *do not* experience an increase in competition (number of bidders, winning rebate) compared to treated municipalities; nor do we see an increase in the radius in which firms compete (defined as the aerial distance between the tendering municipality and the winner's incorporation place). We conclude that any spillover effects, if they exist, are slight.[1]

The rest of the paper is organized as follows. Section 2 describes the theoretical framework. Section 3 describes the institutional background and the data. Section 4 describes the econometric model. Sections 5-8 contain the results. Section 9 explores possible spillover effects operating through the procurement market. Section 10 concludes.

1.1 Related literature

The theoretical literature on shock propagation goes back at least to Long and Plosser (1983). Key papers in that literature are Horvath (1998) and Dupor (1999), both addressing the possibility of sector-level shocks being amplified to business-cycle size through the propagation mechanisms. Carvalho (2010) and Acemoglu et al. (2012) revived this literature but their theory abstracts away the role of investment. Accordingly, the empirical literature that builds on these more recent papers does not view investment as having a pre-eminent role in the transmission of temporary shocks, beyond whatever weight the investment sector has in the input-output matrix. See Barrot and Sauvagnat (2016) and Baqaee (2017) for recent reviews of this literature.

Grembi et al. (2015) study the impact of an earlier (2001) *Patto di Stabilita'* on municipal public finance. [2] Their identification strategy also relies on the 5,000 population threshold. They ask whether the constraint created by the fiscal rule was binding (it was) and whether municipalities chose to meet the constraint by, at the margin, cutting spending or increasing taxes (the latter). Chiades and Mengotto (2013) study later versions

[1] We attribute this lack of mobility of impacted firms to the localized nature of the infrastructure procurement market, which is probably due to transportation costs (see Bajari et al. 2014).

[2] Notably, investment expenditures were exempted from the *Patto* up to 2004.

of the *Patto di Stabilita'* using the 5,000 population threshold. Their analysis suggests that the *Patto* reduced municipal investment but had no effect on current expenditure, however, their results are not grounded in a formal causal framework. Bonfatti and Forni (2016) use the 5,000 population threshold to demonstrate that the introduction of the *Patto* attenuated the political budget cycle. The key difference with our paper is that our dependent variables include firm-level outcomes.

A somewhat related literature seeks to quantify local fiscal multipliers. Nakamura and Steinsson (2014) use state-level variation in US military procurement spending to estimate state-level fiscal multipliers. Acconcia et al. (2014) seek to estimate the fiscal multiplier in Italian provinces. Suarez Serrato and Wingender (2016) estimate the effect of federal spending on local GDP (fiscal multiplier). The key difference with this literature is that our dependent variables are not local GDP, but rather firm-level outcomes and the details of the transmission mechanism.

Guiso et al. (2005) contribute to the macro-labor literature by showing that a large cross-section of Italian firms do not pass the burden of temporary productivity shocks through to the workers' wages. While our purview is more limited (two sectors only), our shock is arguably more cleanly identified.[3] Our findings are consistent with Guiso et al.'s (2005) view that the firm provides workers with "wage insurance." Furthermore, we document a new channel (the severance fund) through which workers in the procurement sector are also "insured" by their employers. We also show that contractors are similarly "insured."

Ferraz et al. (2015) study the effects of firm-level demand shocks on employment. Identification is achieved by comparing bidders that narrowly won and lost a Brazilian government procurement auction. Ferraz et al. (2015) find that winning an auction causes an immediate increase in employment, and that this effect persists over about two years. Compared to Ferraz et al. (2015), our analysis is less focused on employment (for which we have fewer measures) and more focused on financial outcomes (for which we have a rich set of outcome variables). Cohen and Malloy (2016) use shocks to the political connections of military procurement firms to explore the effects of changes in their revenues on financial

[3]Their identification strategy relies on the time-series properties of the individual firms' value added, and idiosyncratic shocks to value added are identified by using internal instruments. In contrast, our paper relies on variation provided by a *demand* shock generated by the fiscal rule.

outcomes. Although their source of identification is different, their aim is the same as in our paper.

Collard-Wexler (2013) studies demand fluctuations in the ready-mix concrete industry. Demand is proxied by employment in the construction sector. The outcomes of interest are sectoral dynamics (entry and exit) as well as costs of entry and of changing firm size. Collard-Wexler (2013) reports that governments purchase half of all U.S. concrete, primarily for road construction,[4] and so his paper, like ours, studies the infrastructure procurement sector. Compared to Collard-Wexler (2013), our analysis is less focused on market structure and more focused on firm-level financial outcomes (for which we have a rich set of outcome variables).

2 Conceptual framework for firm response

In the following sections we will document that the procurement sector reacted to a demand shock by cutting capital more so than labor. This decrease in the capital-labor ratio was sharper in regions where credit was more accessible. In this section we argue that these findings are consistent with the predictions of a very crude model of shock propagation building on Acemoglu et al. (2012). The model and all the analytical derivations are in Appendix A.

The model, as the empirics, focuses only on the *direct* propagation of the demand shock, and not on the *indirect* effects. This choice is guided by the fact that municipal procurement is a very small fraction of GDP[5] so a sectoral demand shock is unlikely to reverberate through the economy.

Building on Acemoglu et al. (2012), the model assumes that a small competitive sector (such as the municipal procurement sector) operates a Cobb Douglas technology $y = k^{\alpha} l^{1-\alpha}$. Output y is sold at a price p. The prices of capital and labor are determined economy-wide and are unaffected by activity in the sector. Given these assumptions, we get the standard result that capital and labor are utilized at a ratio independent of output price p. Since in this model a demand shock operates through changes in p, it follows that the capital/labor ratio is unaffected by demand shocks.

[4] Collard-Wexler (2013), p. 1009.

[5] Refer to Section 3.

The model is made dynamic in a very simple way: we add a second period, and we make capital durable. In this setting, a demand shock is represented by output prices in the two periods, p_1 and p_2. The firm's problem is:

$$\max_{k,l_1,l_2} p_1 k^\alpha l_1^{1-\alpha} + p_2 k^\alpha l_2^{1-\alpha} - rk - w\left(l_1 + l_2\right),$$

where k represents durable capital and l_t represents period-t labor utilization.

In a steady state where demand is constant we have $p_1 = p_2 = p$. A persistent negative demand shock relative to the steady state p can be modeled as $p_1 = p_2 < p$. It's easy to show that, if $p_1 = p_2$, then again the capital/labor ratio is independent of output prices. Thus a permanent shock has no effect on the capital/labor ratio relative to the steady state (though both capital and labor *levels* will decrease). But if $p_2 < p_1$, that is, the shock in period 1 portends an even worse shock in period 2, then the capital labor ratio drops in period 1 relative to the steady state level. This is because when p_1 contains negative information about p_2 the firm anticipates the bad shock in period 2 by reducing capital more sharply than labor. This asymmetric adjustment reflects the fact that capital is durable wheras labor is purchased on the spot market. Another way of saying this is that the firm uses capital in preference to labor to absorb the negative shock to future profitability. Interestingly, in our data the drop in municipal procurement in 2008 (demand shock) indeed portended worse news: in the years following 2008, aggregate procurement increasingly contracted in line with the assumption that $p_2 < p_1$.

The model also affords an interesting comparative static result: ceteris paribus, the difference between the capital-labor ratio at the steady state and in period 1, becomes larger in absolute value as r decreases. This comparative static result is consistent with the empirical finding that capital adjusted more sharply in regions where credit was more accessible.

Overall, while the goal of this paper is not to provide or test a theoretical model, this section argues that the estimated effects on labor and subcontractors v. capital, and the mediating effect of access to credit, are consistent with those of an "expectation-driven" adjustment by procurement firms to an autocorrelated demand shock.

3 Institutional background and the data

In Italy, municipal administrations provide roads, schools, and municipal buildings. Municipalities are required to outsource this provision to private contractors via public tenders. The average municipality makes 2.7 tenders per year each with an average value (per engineering estimate) of 333,000 euros. The moneys that pay for these public works are partly raised by the municipality, with the balance coming from grants (from the region, the central government, and the EU).

Municipal procurement is a very small fraction of GDP (only 0.2%[6]) Thus a sectoral demand shock is unlikely to reverberate through the economy. In our view, this feature makes the procurement sector an ideal laboratory to study the direct propagation mechanism in isolation.

Appendix B contains information about the data sources and the variables we use.

3.1 Fiscal shock to municipalities

The fiscal shock is based on the *Patto di stabilita' dei Comuni*, a fiscal rule designed to check the growth in municipal public spending. The 2008 *Patto* required zero deficit, and in addition a 20% ceiling on total spending growth (current + capital, year-on-year). Municipalities with population greater than 5,000 were subjected to this fiscal rule.

We date our shock to 2008. While versions of the *Patto* were in place prior to 2008,[7] actual penalties for non-compliance were introduced only in 2008. These penalties include: substantial cuts in central government transfers, and an automatic 30% cut to the salary of mayors and city councillors.[8] Thus a meaningful tightening of the fiscal rule was introduced in 2008. After 2008, municipalities with population exceeding 5,000 will be thought of as "treated." Figure 1 shows the distribution of treated and control municipalities.

3.2 The procurement sector and firm-level data

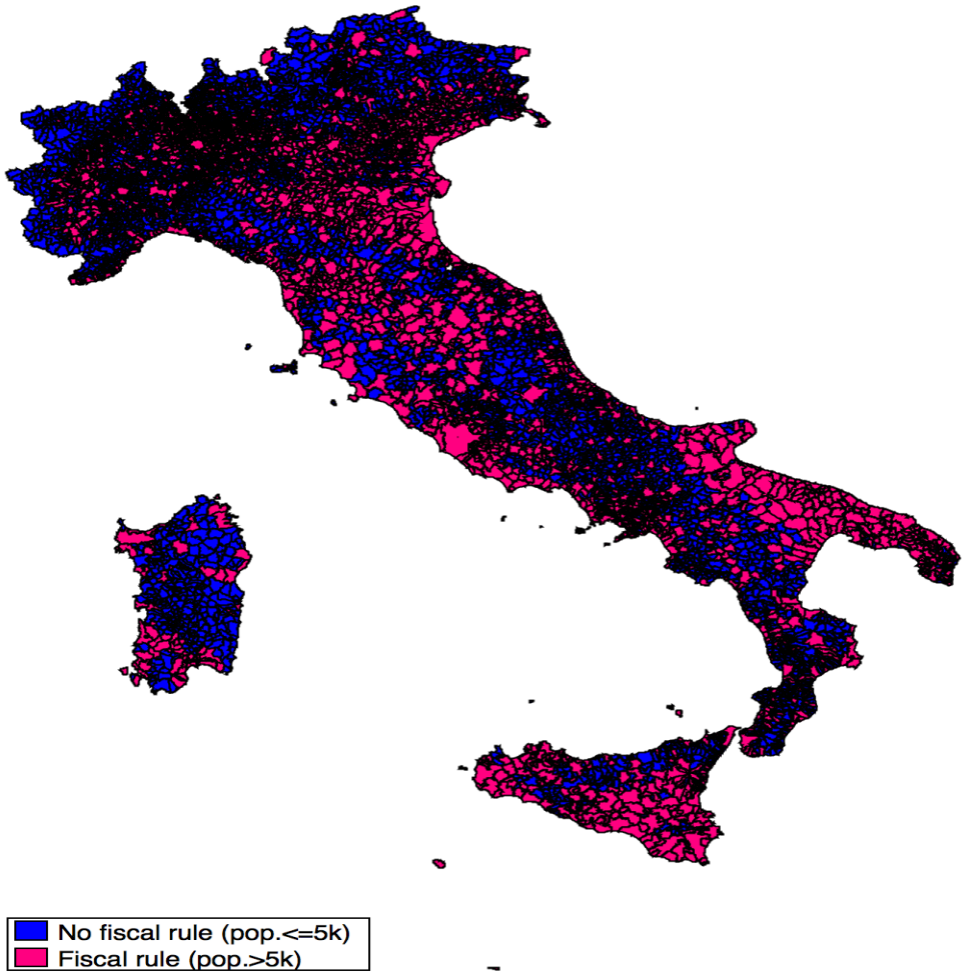
The main source of firm-level data is the AIDA database. This database contains information on all Italian firms that are required to file a balance sheet; the requirement applies

[6]We compute that in 2007 the average municipality devoted 8% of its spending to capital. We also compute that municipal spending equals roughly 2.5% of Italy's GDP.

[7]E.g., Grembi et al. 2015 study the impact of a 2001 version.

[8]Per *Legge* 133/2008, and *Comma* 10, *Articolo* 61 *Decreto Legge* 112/2008.

Figure 1: Italian municipalities with and without fiscal rule



Notes: Municipalities with population measured in 2008. Source: Authors' calculation on National Institute of Statistics (ISTAT) data.

to corporations but not to partnerships. In addition to yearly financial statements, AIDA records the firms' sector (e.g., construction), where the firm is incorporated, and the year of incorporation. AIDA covers both public and privately-owned companies. We deflate financial variables using the KLEMS deflators for output and inputs.

AIDA does not report whether a construction firm operates specifically in the public procurement sector. Since we care about firms that operate in public procurement, we restrict attention to the 7,743 AIDA firms which we can match to winners in the

procurement-market database described in Section 3.3 below.[9]

We start with a sample consisting of the financial information of 4,317 firms AIDA firms that won at least one infrastructure tender before 2009. Before the fiscal demand shock takes effect, corporate revenues equal 3.049 million euros on average, only part of which originate from municipal procurement. Wages equal 395,000 euros. Fixed Assets equal 464,000 euros. About 1% of the firms in our matched sample cease operations every year. See Table 1 for summary statistics.

We supplement this financial information with municipal registry data collected from the Italian Chambers of Commerce. These data are aggregated at the *construction* (as opposed to municipal procurement) sectoral level. They allow us to compute the entry and exit rates in the construction sector,[10] which are proxies for entry and exit in the *municipal procurement* sector and have the advantage that partnerships are included. See Table 1 for summary statistics.

3.3 Procurement-market data

The firm-level dataset is augmented by merging in firm-level procurement-market outcomes. The procurement-market data were obtained from a private company which alerts procurement firms to upcoming tenders. Table 1 reports descriptive statistics of the procurement market.

The average tender attracts 30 bidders. There are 30,788 distinct winners in the database. 28% of all tenders are for municipal roads. On average, 55% of winners are incorporated in the tendering province.

Bids are expressed as a percentage rebate on a *valore stimato*: this is an estimate of the project's cost which is computed by a municipal engineer based on a government-issued price list. The average winning rebate is 17.35% of *valore stimato*.

During our sample period, the law required competitive contests to be anonymous and

[9]Many procurement-market winners are not found among AIDA firms, probably because they are partnerships. To get a sense of how representative our matched data are of the entire sector, we computed the average annual win for the companies we match (2 auctions with average value of 1,000,000 euros) and compare it with the average annual win of the procurement-market winners we do not match (2 auctions with average value of 863,000 euros). We conclude that, as regards financial accounts, our corporation-focused sample is not majorly unrepresentative of the universe of municipal procurement firms.

[10]The entry and exit rates are defined as the number of newly registered (or newly removed from the registers) firms in year t over the total number of registered firms in year $t-1$.

Table 1: Descriptive statistics (pre-fiscal demand shock)

Stats	Mean (1)	St.Dev. (2)	p10 (3)	p50 (4)	p90 (5)	N (6)
	Panel A: Firm data					
Fisc.Rule.Exp.	17.29	23.91	0	8.091	48.03	16,161
Municipal exposure	21.44	25.60	1.477	11.21	59.26	16,161
Value of Procurement Won (in 100,000)	3.892	10.53	0	0	10.90	16,161
Inc. in Fisc.Rule.Mun.	0.827	0.378	0	1	1	16,161
Capital (in 1,000)	464.0	2,464	12.41	110.7	979.2	16,161
Labor (in 1,000)	395.3	1,501	33.99	190.2	775.3	16,161
Number of workers	25.14	88.79	3	12	50	8,591
Exit	1.002	9.962	0	0	0	16,161
O.Services (in 1,000)	1,184	4,872	47.56	404.6	2,409	16,161
Severance Fund (in 1,000)	24.19	74.47	0.797	11.57	50.80	15,558
	Panel B: Municipal data					
Total value of tenders (in 100,000)	9.703	59.82	0	1.878	19.29	30,075
N.Tenders	2.667	7.762	0	1	6	30,075
Avg. value of procurement (in 100,000)	3.338	4.702	0.665	2.126	6.835	19,232
Percent Roads	27.72	35.86	0	7.549	100	19,233
Number of bidders	30.09	26.01	5	23.67	63.33	9,637
Winning rebate (in %)	17.35	8.211	7.960	16.01	28.61	10,697
Winner from the same province	54.57	34.22	9.274	50.87	100	7,346
Entry rate	9.053	8.764	0	8.140	16.67	29,918
Exit rate	7.319	6.446	0	6.818	13.70	29,918
Entry rate, AIDA	0.948	2.479	0	0	2.941	33,730
Exit rate, AIDA	0.0523	0.558	0	0	0	33,730

Notes: *Fisc.Rule.Exp.* represents the exposure to the fiscal demand shock computed as the ratio between the firm's value won in municipalities with fiscal rule and the firm's pre-fiscal demand shock revenues. *Value Proc. Won* is the value of procurement won in a year (in 100,000 euros); *Inc. in Fisc.Rule.Mun.* equal one for firms incorporated in municipality with fiscal rule; *Tot.Rev.* are the total annual revenues (in 1,000 euros); *Sev. Fund* is the firm's total funds accumulated for severance pays (in 1,000 euros); *Capital* are the firm total annual physical assets (in 1,000 euros); *Labor* are the firm total personnel costs (in 1,000 euros); *O.Services* are the firm total costs for outsourced service (in 1,000 euros); *Exit* is the probability of firm exit in a given year. Inputs and outputs are deflated using KLEMS deflators. Source: Statistics pre-fiscal demand shock for procurement companies that won at least one auction before 2009 and observed between 2004 and 2011, for all Italian municipalities.

single-attribute (i.e., technical and quality components of the offers are not evaluated). The tender would specify one of several mechanisms through which the contract could be awarded. The choice of the particular mechanism depends on the *valore stimato* and on some other technical components.[11].

[11]Refer to Coviello et al. (2016).

4 Identification strategy and econometric model

To estimate the causal impact of the fiscal shock we adopt two slightly different versions of a difference-in-difference design.

For municipal-level outcomes (municipal expenditures, Chamber of Commerce data, etc.) the treatment is defined as the municipality being above the 5,000 population threshold after 2008. For each municipal-level outcome we estimate the following econometric model:

$$y_{it} = \alpha + \delta Fisc.Rule_i X Post_t + \beta Fisc.Rule_i + \gamma Post_t + \varepsilon_{it}, \quad (1)$$

where δ is our main coefficient of interest, $Fisc.Rule_i$ is an indicator variable for municipalities with population above the 5,000 inhabitants, $Post_t$ indicates the years after 2008. We then add municipal and time fixed effects, and municipal-level linear trends. Standard errors are clustered at municipal level.

A key identifying assumptions is parallel trends of treated and control municipalities before the treatment. We test whether treated and control municipalities share the same trend in the variables of interest before the fiscal shock (common trend assumption). Furthermore, we bolster our identification strategy in two ways. First, we run a McCrary (2008) density test for the presence of jumps in the distribution of the municipal population around the 5,000 population threshold before the fiscal shock. Second, we repeat our analysis for progressively-tighter sub-samples around the threshold. See Section 5 for details.

Turning to firm-level outcomes, a key identification step is to translate a treatment for municipalities (fiscal shock) into a treatment for firms. We do this by measuring each firm's exposure to procurement from treated municipalities before the *Patto*. Therefore, for firm-level outcomes (capital, etc.) the treatment is the firm's *exposure to the fiscal demand shock*. This is a continuous variable constructed based on pre-2009 data: refer to Section 6.1 for its construction. Construction of this variable relies crucially on matching the procurement-market data with firm-level revenue data (e.g., from AIDA) and is arguably the crucial insight in this paper.

For each firm-level outcome we estimate the following econometric model:

$$y_{it} = \alpha + \delta Fisc.Rule.Exp._i X Post_t + \beta Fisc.Rule.Exp._i + \gamma Post_t + \varepsilon_{it}, \quad (2)$$

where the $Fisc.Rule.Exp.$ variable is the firm's *exposure to the fiscal demand shock* variable defined in Section 3.2. We then add firm-specific and time fixed effects. Standard errors are clustered at firm level.

A required assumption for the causal interpretation of the estimates is a common-trend assumption before the fiscal demand shock. Because the treatment variable is continuous and not binary, the standard test for the common trend assumption needs to be adapted to our environment. In Appendix E we check whether more- and less-exposed firms share the same trend in the firm-level variables before 2009 by regressing each firm-level variable on a linear time trend interacted with the variable "Fiscal Rule Exposure." In a few cases the estimated pre-trend coefficient is significant. For this reason we also provide estimates that allow for firm-specific trends.

The previous models are linear, so the estimated coefficients capture the average effect of the fiscal demand shock across all exposed firms. The following non-parametric specification is designed to highlight whether the fiscal demand shock might disproportionately affect more-exposed firms.

$$\begin{aligned} y_{it} \;=\; & \beta_0 + \beta_1 \mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})_i X Post_t \\ & + \beta_2 \mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})_i X Post_t \\ & + \beta_3 \mathbb{1}(P_{75} < Fisc.Rule)_i X Post_t + \beta_4 \mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})_i \\ & + \beta_5 \mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})_i + \beta_6 \mathbb{1}(P_{75} < Fisc.Rule)_i \\ & + \beta_7 Post_t + \varepsilon_{it} \end{aligned} \tag{3}$$

Treatment is now defined by the quartiles of the distribution of the exposure to the fiscal demand shock before the *Patto* and the reference group is the first quartile. Our preferred specifications will also include firm and year FEs, and firm-specific trends.

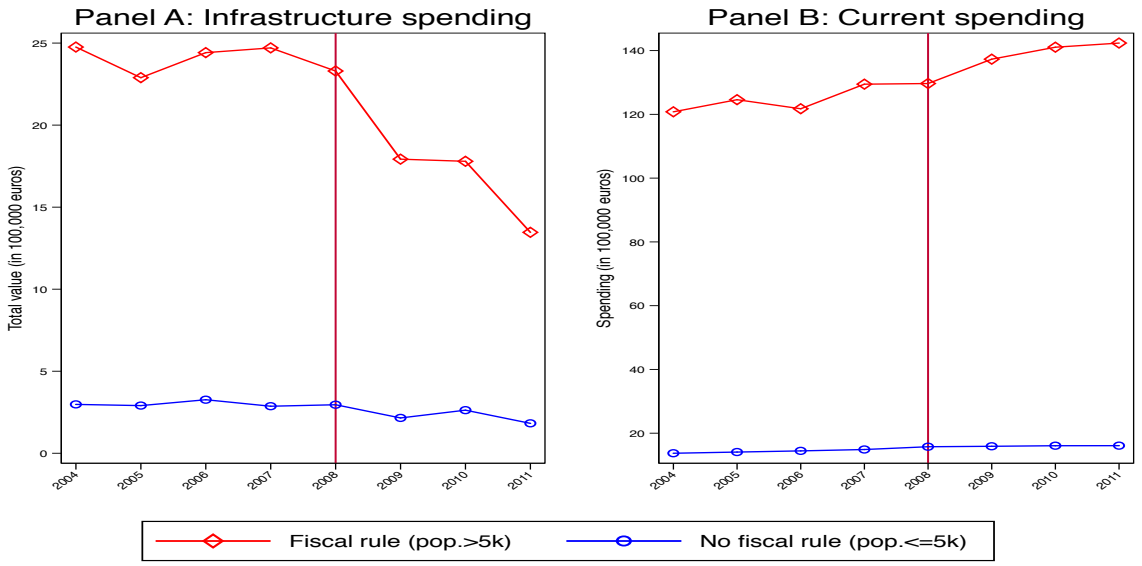
5 Impact of the fiscal shock on municipal spending

In this section we quantify the impact of the fiscal shock on infrastructure spending. Figure 1 shows the distribution of treated and control municipalities. We expect the fiscal shock to cause a drop in procurement in treated municipalities only, and only after 2008.

5.1 Graphical evidence of the impact of the fiscal shock on municipal spending

Panel A of Figure 2 depicts the value of public tenders for infrastructure in treated (red diamonds) and control (blue circles) municipalities. This value appears to drop after 2008, and to drop more sharply in the municipalities that are covered by the fiscal rule.[12,13] In contrast, the fiscal shock appears to have no impact on current spending (Figure 2 panel B). The same pattern is present when we restrict the comparison to municipalities that are closer to the treatment threshold (Figure C.1). Because the fiscal shock appears to have a sharp impact on infrastructure spending but no discernible impact on current spending, in what follows we focus on the fiscal shock's effect on infrastructure spending only.

Figure 2: Fiscal shock associated with drop in infrastructure spending (investment) but not with drop in current spending (consumption)



Notes: Panel A: Average total annual value infrastructure procurement. Panel B: Average total annual value of current spending. The pictures report averages across all Italian municipalities. Diamonds represent fiscal rule municipalities with population above 5,000. Source: Authors' calculation on procurement data (Panel A), and municipal budget data (Panel B) from Italian Ministry of Interior for all municipalities between 2004-2011.

[12]That the drop in spending can happen so quickly is consistent with the procurement law (*D.Lgs* 163/06), whereby 3-year municipal procurement plans are revised on yearly basis.

[13]It makes sense for local administrators to cut investment expenditures because investment is not exempt from the *Patto*, i.e., no "golden rule" applies since 2004. For a discussion of the impact of golden rules, see International Monetary Fund (2014), p. 110.

5.2 Estimates of the impact of the fiscal shock

Now we quantify the impact of the fiscal shock on municipal infrastructure spending by estimating several variants of equation 1. We choose to keep the dependent variable (spending) in levels rather than logs due to the high frequency of zeros for small municipality-year observations.[14] This choice requires guarding against spurious scale effects. Below, we do so in two ways: first, we control for municipal population; in addition, we perform estimates on different populations windows centered around the treatment threshold.

Table 2: Impact of the fiscal shock on infrastructure spending

Dep. Var.	Total Value of procurement					
Model	OLS	FE	FE	FE	FE	FE-HT
	(1)	(2)	(3)	(4)	(5)	(6)
Fisc.Rule*Post	-6.825***	-6.825***	-7.192***	-6.413***	-5.941***	-5.106***
	(1.170)	(1.170)	(1.818)	(1.073)	(1.696)	(1.656)
Post	-0.793***					
	(0.079)					
Fisc.Rule	21.019***					
	(2.113)					
Population			0.003		0.001	
			(0.004)		(0.004)	
Population^2			-0.0001***		-0.0001***	
			(0.00001)		(0.00001)	
Transfers (in 100k)				0.010**	0.012***	
				(0.004)	(0.003)	
Municipal population	All	All	All	All	All	All
Municipalities	6,015	6,015	6,015	6,015	6,015	6,015
Observations	48,120	48,120	48,120	47,914	47,914	48,120
Mean Y_treat-pre	24.01	24.01	24.01	24.01	24.01	24.01
Eff.Fisc.Rule on Treated (%)	-28.42	-28.42	-29.95	-26.71	-24.74	-21.26
Municipal FE	NO	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	YES	YES	YES
HT Trend	NO	NO	NO	NO	NO	YES

Notes: The table reports estimates of the effects of the fiscal shock on the annual total value of municipal tenders for infrastructures in all Italian municipalities. In each of the rows, *Fisc.Rule* is an indicator variable for municipalities with population above the 5,000 population threshold and *Post* is an indication for the years after 2008. HT Trend denotes regressions that include municipal specific trends. *Population* represents the municipal population in 1,000 inhabitants. *Transfers (in 100k)* represents the transfer to the municipality by central governments (state and region). Mean Y_treat-pre is the sample mean for treated municipalities pre-2009. *Eff.Fisc.Rule on Treated (%)* is the ratio between the estimated coefficient of *Fisc.Rule*Post* and Mean Y_treat-pre. SEs are clustered at municipal level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for all the public works tendered between 2004 and 2011 in Italy.

[14]The 10th percentile of municipal spending is zero in our data, see Table 1 panel B.

The coefficients of *Fisc.Rule*Post* in Table 2, columns 1 and 2 indicate that, regardless of whether municipal- and time-fixed effects are included, the fiscal shock reduced infrastructure spending by roughly 28% of the average pre-2009 spending in the treated municpalities. We then add: time-varying municipal population and its squared term, see column 3; annual transfers from other governments (region and state) to the municipality, see column 4; and then both variables together, see column 5. Controlling for transfers to the municipality is important because these transfers represent an important funding source for infrastructure procurement. The estimated impact of the fiscal shock is robust to the inclusion of these controls.

Although not required (the parallel-trends assumption holds), in column 6 of Table 2 we add municipal-specific linear trends. In this specification the impact of the fiscal shock is somewhat smaller (-21%) and very precisely estimated.

In Table 3 columns 1 and 2 we restrict to the tighter windows around the treatment threshold: (1k-10k) and (3k-7k) windows around the 5k treatment threshold; the estimated effect decreases to 13.25%. Restricting even closer (column 3) does not further decrease the magnitude of the estimate, but statistical significance is lost due to the relatively small number of municipalities (701). We adopt 13.25% as the most conservative bound for our estimate of the effect of the fiscal shock on treated municipalities.[15]

5.3 Testing the identifying assumptions

Parallel trends The estimates rely on a pre-fiscal rule parallel-trend assumption. This assumption is supported visually (see Panel A of Figure 2, and Panels A1 and A2 of Figure C.1 where we restrict the comparison to municipalities that are closer to the treatment threshold) and it is formally tested by checking the statistical significance of the interaction term *Fisc.Rule*Year* in a model where municipal demand for infrastructure is regressed on: a linear trend; the fiscal rule dummy; and the interaction term; in the pre-fiscal rule sample. Column 1 of Table 4 shows that the estimated coefficient of the interaction term is small and not statistically different from zero.[16] Therefore the parallel-trend assumption

[15]This effect corresponds to a roughly 80% drop in the investment of the average (treated and non-treated) municipality.

[16]We find similar evidence when we restrict the sample to the (1k-10k), (3k-7k) and (4k-6k) windows around the 5k treatment threshold; see columns 1, 3, and 5 of Table C.1.

Table 3: Impact of the fiscal shock on infrastructure spending for different windows around the threshold

Dep. Var.	Total Value of procurement		
Model	FE	FE	FE
Municipal population	1k-10k	3k-7k	4k-6k
	(1)	(2)	(3)
Fisc.Rule*Post	-1.574***	-0.936**	-0.891
	(0.306)	(0.441)	(0.613)
Municipalities	3,930	1,497	701
Observations	31,440	11,976	5,608
Municipal FE	YES	YES	YES
Year FE	YES	YES	YES
Mean Y_treat-pre	7.717	7.053	6.526
Eff.Fisc.Rule on Treated (%)	-20.40	-13.27	-13.65

Notes: The table reports estimates of the effects of the fiscal shock on the annual total value of municipal tenders for infrastructures in all Italian municipalities. In each of the rows, *Fisc.Rule* is an indicator variable for municipalities with population above the 5,000 population threshold and *Post* is an indication for the years after 2008. Mean Y_treat-pre is the sample mean for treated municipalities pre-2009. *Eff.Fisc.Rule on Treated (%)* is the ratio between the estimated coefficient of *Fisc.Rule*Post* and Mean Y_treat-pre. SEs are clustered at municipal level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for all the public works tendered between 2004 and 2011 in Italy.

is not rejected.

Anticipation We also test for anticipated effects of the policy. This is important for two reasons. First, to further corroborate the parallel-trend assumption; second, because the central government had previously attempted to restrain municipal spending through a variety of administrative measures. We estimate a model in which the fiscal rule variable is interacted with all year dummies. Column 2 of Table 4 (and columns 2, 4, and 6 of Table C.1 for the smaller windows around the threshold) reports the estimated coefficients on the leads (statistically, zero) and lags (negative and large). These estimates rule out any anticipated effects of the policy, consistent with the parallel-trend assumption. Further, the lack of anticipation effects suggests that any other changes in the *Patto* during our sample period were not effective in restraining municipal investment expenditure.

Sorting around the threshold A further question is whether the estimates are confounded by selection out of treatment by municipalities. In Figure 3 we test for the possibility that municipalities sort below the 5,000 municipal threshold. The figure indi-

Table 4: Check of common-trend and no-anticipation assumptions

Test	Common Trend Assumption	Leads&Lags
Municipal population	All	All
	(1)	(2)
Fisc.Rule*Year	-0.103	
	(0.502)	
Leads		
Fisc.Rule*2005		-1.791
		(1.871)
Fisc.Rule*2006		-0.623
		(2.193)
Fisc.Rule*2007		0.062
		(2.517)
Fisc.Rule*2008		-1.439
		(2.179)
Lags		
Fisc.Rule*2009		-6.005***
		(2.296)
Fisc.Rule*2010		-6.609***
		(2.470)
Fisc.Rule*2011		-10.135***
		(2.537)
Observations	30,075	48,120
Municipalities	6,015	6,015
p-value Leads		0.327
Municipal FE	YES	YES
Year FE	NO	YES

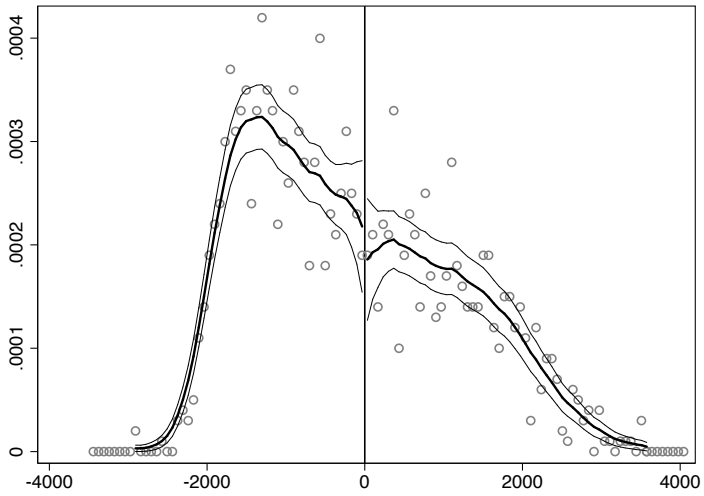
Notes: The table reports estimates of the effects of the fiscal rule on the average annual total value of procurement for public works in all Italian municipalities. In each of the rows, *Fisc.Rule* is an indicator variable for municipalities with population above the fiscal rule population threshold (5,000 inhabitants) and *Post* is an indication for the years after 2008. In column 1 the sample is before the fiscal rule and the regressions include a linear trend as a control. In column 2 *p-value Leads* is the *p-value* for the joint statistical significance of the leads effect of the fiscal rule. SEs are clustered at municipal level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for all the public works tendered between 2004 and 2011 in Italy.

cates no evidence of any statistically significant jump in the distribution of the municipal population around the 5,000 population threshold.[17] Thus we find no evidence of sorting around the threshold, and hence no selection out of treatment.

Placebo thresholds The institutional design of the fiscal rule is expected to generate a discontinuous spending behavior at the 5,000 population threshold, but not at nearby thresholds. To check this prediction, in Table 5 we perform a number of placebo

[17]Results, available on request, are robust to different selections of samples around the threshold.

Figure 3: No sorting around the fiscal-rule population threshold



Notes: Distribution of the municipal population around the threshold in Italian municipalities with population between 3,000 and 7,000 inhabitants in 2007. Circles represent the difference between the municipal population and the 5,000 threshold (vertical line). Circles are average observed values, the bold solid line is a kernel estimate (see McCrary, 2008), and the two thin lines are 95% confidence intervals. Discontinuity estimate, log difference in height, (and standard errors are -.15 (.26), respectively. Source: Statistics for all the public works tendered between 2004 and 2011 in Italy with population between 3,000 and 7,000 inhabitants in 2007.

tests for thresholds below (columns 1-3) and above (columns 5-7) the true threshold. None of these placebo thresholds has a significant effect on spending, consistent with the assumption that the discontinuity is specific to the 5k threshold.

5.4 Is the 2008 financial crisis affecting the estimates?

There is no doubt that the financial crisis impacted financing for public works, and indeed, government transfers to municipalities did drop significantly after 2008. We believe, however, that controlling for transfers from the central government does a good job of controlling for this post-2008 impact. This is because other non-transfers sources of municipal revenues are not especially pro-cyclical (they are based principally on real estate assessments which are very persistent). Indeed, municipal tax revenue *increased more* for larger municipalities after 2008: see Figure 4.[18] This finding suggests that, beyond

[18]The same pattern emerges in Figure C.2, where we plot municipal tax revenue for municipalities with population between 1,000 and 10,000 inhabitants (left picture) and 3,000 and 7,000 inhabitants (right picture).

Table 5: Placebo test: effect only at actual threshold not at simulated thresholds

Dep. Var.	Total value of procurement						
Threshold	3.5k	4k	4.5k	5k	5.5k	6k	6.5k
Municipal population	3k-5k	3k-5k	3k-5k	3k-7k	5k-7k	5k-7k	5k-7k
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Fisc.Rule*Post	0.087						
	(0.399)						
Fisc.Rule*Post		0.304					
		(0.447)					
Fisc.Rule*Post			-0.225				
			(0.615)				
Fisc.Rule*Post				-0.936**			
				(0.441)			
Fisc.Rule*Post					-0.488		
					(0.805)		
Fisc.Rule*Post						-0.530	
						(0.814)	
Fisc.Rule*Post							-1.674
							(1.058)
Observations	7,760	7,760	7,760	11,976	4,216	4,216	4,216
Municipalities	970	970	970	1,497	527	527	527
Mean Y_treat-pre	4.388	4.388	4.388	5.034	6.222	6.222	6.222
St.Dev. Y_treat-pre	8.694	8.694	8.694	9.960	11.85	11.85	11.85
Municipal FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES

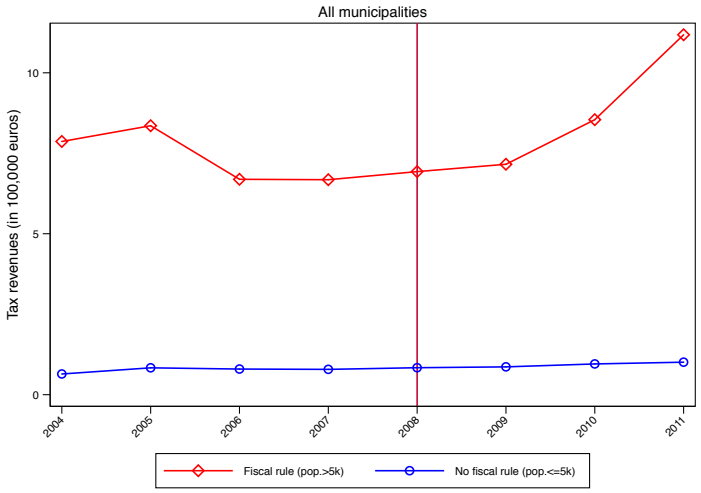
Notes: The table reports estimates of the effects of the fiscal rule on the average annual total value of municipal contests for public works in all Italian municipalities with population between 3,000-7,000 inhabitants. In columns 1,2, and 3; columns 5,6, and 7 *Fisc.Rule* is an indicator variable for municipalities with population above the simulated threshold indicated on top of each column. In column 4, *Fisc.Rule* is an indicator variable for municipalities with population above the 5,000 threshold. In all the regressions *Post* is an indication for the years after 2008. When denoted with YES regressions include municipal and year fixed-effect. Mean Y_treat-pre and St.Dev. Y_treat-pre are the sample mean and standard deviation for treated municipalities pre-2009. SEs are clustered at municipal level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for all the public works tendered between 2004 and 2011 in Italy with population between 3,000 and 7,000.

the drop in central government transfers which we control for, there is no obvious "cash crunch" for municipal incomes.

But the strongest evidence against the crisis as a threat to identification is that the crisis should operate equally as well on placebo thresholds. However, Table 5 shows no effects at placebo thresholds below (columns 1-3) and above (columns 5-7) the true threshold. Only column 4, the true threshold, shows an effect.

Therefore, we conclude that the effect that we are picking up is due to a discontinuity at 5k; that this discontinuity cannot be due to the crisis; and that the global effects of the

Figure 4: No crisis in municipal tax revenues after 2008



Notes: Average total annual value of municipal tax revenues. Diamonds represent municipalities with population above 5,000. Source: Authors' calculation based on municipal financial accounts.

crisis are well-controlled by controlling for central government transfers.[19]

6 Propagation through procurement firms

We seek to estimate the effects of the fiscal demand shock on the performance of firms operating in the infrastructure procurement sector.

6.1 Measuring a firm's exposure to the demand shock

In what follows we stratify firms according to the variable "Fiscal Demand Shock Exposure," a time-invariant variable that is interpreted as "treatment intensity." We are able to construct this variable because of the availability of the proprietary procurement-market data described in Section 3.3.[20] Firms that are more "exposed to the fiscal demand shock" are expected to be more impacted by the fiscal demand shock.

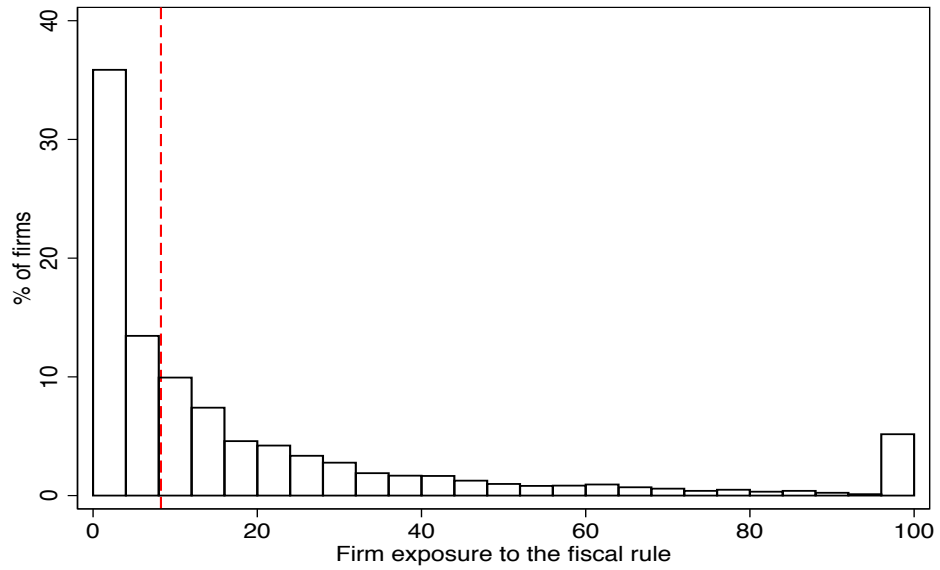
We define a firm's *exposure to the fiscal demand shock* as the fraction of the firm's pre-2009 revenues earned in municipalities with population greater than 5,000. Figure 5

[19]Of note, we do not detect any discontinuity in government transfers around the 5k threshold, when government transfers are put on the left-hand side in equation 1.

[20]This variable is only computed for the 4,317 companies that won at least one auction before the fiscal demand shock.

plots the frequency of firms by exposure to the fiscal demand shock. The median firm's exposure is just 8%; 21% of firm revenues comes from municipal procurement; 83% of these companies are incorporated in treated municipalities. Thus corporations that operate in the municipal procurement sector are revenue-diversified.

Figure 5: Heterogeneity in firm exposure to the fiscal demand shock



Notes: A firm's exposure to the fiscal demand shock is defined as the value of procurement won by a firm in municipalities with population greater than 5,000, as a percentage of the firm's total revenues, before 2009. The sample median is 8% (vertical dashed line) and the standard deviation is 24%. Source: Authors' calculation on public works data and AIDA data.

How large of an effect on balance sheets should we expect exposure to the fiscal demand shock to have? Here is a back-of-the-envelope calculation. To fix ideas, let's say that the fiscal demand shock decreased infrastructure procurement by 20% in a treated municipality – consistent with the estimates from Section 5. The average firm has a 17% exposure to the fiscal demand shock, which implies that after the fiscal demand shock this firm's size should drop by 3.4% (the result of 20%*17%). A comparison firm with one more standard deviation of exposure to the fiscal demand shock has an exposure of 41%, which implies that after the fiscal demand shock this firm's size would drop by by 8.2%. Therefore, we should expect one additional standard deviation of exposure to the fiscal demand shock to decrease firm size by 4.8%. If capital and labor scaled one-to-one with firm size, we would expect both to decrease by that same amount.

6.2 Effect of the demand shock on capital and labor

Exposure to the fiscal demand shock appears to reduce physical assets accumulation. Based on Table 6, column 2, one standard deviation of exposure to the fiscal demand shock decreases physical assets (i.e., capital) by 18.4%. This is computed by multiplying $23.91 * (-4.504) = -108$, corresponding to a drop of 108 thousand euros, or 18.4% of average physical assets. Thus physical capital shrinks more than the 4.8% which we computed should be the average effect on firm size.

In contrast, human capital appears to hold steady in the face of the revenue shock. Columns 5 and 8 of Table 6 show no significant impact of exposure to the fiscal demand shock on two different measures of employment: wages (col. 5) and number of workers (col. 8). Thus, firms appear to be providing workers with a form of insurance.

Construction firms rely heavily on outsourced services. These include: subcontractors (for example, a school builder might hire a subcontractor to plant a garden); and also professional services such as lawyers, accountants, etc. Table 6 column 11 indicates that, like labor, outsourced services are not impacted by the fiscal demand shock. This similarity is interesting because outsourced services are not covered by employment-protection law. To the extent that outsourced services are labor-intensive, this finding suggests that perhaps labor-protection laws are not primarily responsible for the differential impact between capital and labor. Consistent with this observation, in our model the differential impact between capital and labor arises from expectations, not labor-protection laws.

Furthermore, Table 6 column 14 shows that the fiscal demand shock causes workers to withdraw money from their severance fund, which firms are then required to pay out. One standard deviation of exposure to the fiscal demand shock decreases severance fund assets by 6.9%.[21] These payouts represent an additional channel through which firms provide insurance to workers.

Overall, our findings support the hypothesis that procurement firms react to a demand shock by sharply adjusting capital, and not by adjusting labor or subcontractors. This finding is perfectly consistent with the macro view that investment is procyclical, as well as with the findings of Guiso et al. (2005) on Italian firms.[22]

[21] $23.91 * (0.078) = 1.86$, corresponding to a drop of 1.8 thousand euros, or 6.9% of severance funds assets.

[22] Guiso et al (2005) show that a large cross-section of Italian firms do not pass the burden of temporary

productivity shocks through to their employee's wages (nothing is said about the employment level).

Table 6: Effect of the fiscal demand shock on capital and labor

Dep.Var	Capital	Capital	Capital	Labor	Labor	Labor	N.Workers	N.Workers	N.Workers	O.Services	O.Services	O.Services	Sev. Fund	Sev. Fund	Sev. Fund
Method	OLS	FE	FE-HT	OLS	FE	FE-HT	OLS	FE	FE-HT	OLS	FE	FE-HT	OLS	FE	FE-HT
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Fisc.Rule.Exp.XPost	-4.067***	-4.504***	-1.491***	0.239	0.012	0.447***	0.069*	-0.016	-0.031	2.920	1.947	0.832	-0.056***	-0.078***	-0.024**
	(0.694)	(0.597)	(0.298)	(0.326)	(0.204)	(0.160)	(0.037)	(0.019)	(0.043)	(1.805)	(1.471)	(1.173)	(0.015)	(0.013)	(0.011)
Fisc.Rule.Exp.	-6.656***			-5.446***			-0.335***			-17.404***			-0.332***		
	(0.609)			(0.612)			(0.048)			(1.970)			(0.032)		
Post	371.035***			6.408			-1.643			-100.628			8.323***		
	(45.677)			(18.419)			(1.876)			(88.409)			(0.708)		
N.Firms	4,317	4,317	4,317	4,317	4,317	4,317	4,095	4,095	4,095	4,317	4,317	4,317	4,305	4,305	4,305
Observations	27,764	27,764	27,764	27,764	27,764	27,764	16,135	16,135	16,135	27,764	27,764	27,764	26,471	26,471	26,471
Company FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Mean Y	584.4	584.4	584.4	397.2	397.2	397.2	24.63	24.63	24.63	1156	1156	1156	27.09	27.09	27.09
St.Dev.Fisc.Rule	23.91	23.91	23.91	23.91	23.91	23.91	23.91	23.91	23.91	23.91	23.91	23.91	23.91	23.91	23.91
Eff.Fisc.Rule.Exp. (%)	-16.64	-18.43	-6.101	1.441	0.0751	2.691	6.706	-1.568	-3.018	6.039	4.026	1.721	-4.917	-6.885	-2.120

Notes: The table reports estimates of the effects of exposure to the fiscal demand shock on firms capital accumulation and labor: *Capital* are the firm total annual physical assets (in 1,000 euros); *Labor* are the firm total personnel costs (in 1,000 euros); *O.Services* are the firm total costs for outsourced services (in 1,000 euros); *Sev. Fund* is the firm's total funds accumulated for severance pays (in 1,000 euros). Financial variables are deflated using KLEMS deflators.*Fisc.Rule.Exp.* represents the exposure to the fiscal demand shock computed as the ratio between the firm's value won in municipalities hit by the demand shock and the firm's pre-demand shock revenues. In each of the rows, *Post* is an indication for the years after 2008. Odd (even) columns report OLS (FE) [FE-HT] estimates (with firm and year fixed effects) [firm-specific linear trends]. Mean Y is the sample mean for each dep.var. *Eff.Fisc.Rule.Exp (%)* is the ratio between the estimated coefficient of *Fisc.Rule.Exp.*Post**St.Dev.Fisc.Rule and Mean Y. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for procurement companies that won at least one auction before 2009 and observed between 2004 and 2011.

Some of the variables discussed above show a pre-trend: these are "Capital," "Labor," and "Severance Funds," see Table E.1. Controlling for the pre-trend changes the estimates' size but not the main message of this section, which is that capital is more responsive than labor to the demand shock: compare columns 3, 6, 9 in Table 6.[23]

A possible threat to the identification of firm-level effects is that firms which, before 2008, procured for larger municipalities might be exposed to a different-sized shock. In this case the variable "pre-2008 exposure" would not fully summarize the size of the shock experienced by a firm. To address this concern, in Appendix G we study the effects of the fiscal demand shock for firm incorporated in municipalities that are smaller and that are closer to the threshold. We find comparable evidence when we restrict the sample only to firms incorporated in municipalities with population between 1k and 10k, and then between 3k and 7k.

6.3 Informational content of the fiscal demand shock

In our theoretical framework (Section 2), a demand shock affects the capital-labor ratio only if it portends worse news for the future, that is, if $p_2 < p_1$. In this section we document that, indeed, in the years following 2008, aggregate procurement increasingly contracted, in line with the assumption that $p_2 < p_1$.

The first evidence that the shock in 2008 portended worse news for the future is in Table 4. Column 2 of this table indicates that the fiscal demand shock became more impactful in each year following 2008.

The same time pattern emerges from Table 7. No significant impact of the fiscal demand shock is detected on Revenues because revenues are the most lagging indicator: they are recognized only after the procurement contract is carried out and payment is received[24]. The second-most lagging indicator is Accounts Receivable, because receivables are due after the work is performed, but before payment is received. In Column 5, Accounts Receivable show a negative (7.8%[25]) and significant effect of the fiscal demand shock. And

[23] Because accounting for pre-trends has an impact on the magnitude of the estimated coefficients, in Section 8 we will allow for firm-specific trends.

[24] Typically, payments are received several years after the procurement contract is awarded. Proper accounting practices would require the firm to mention any newly-won procurement contract in the notes to their financial accounts, but these are not available in AIDA.

[25] $23.91 * (5.917) = 141.47$, corresponding to a drop of 141 thousand euros, or 7.8%.

finally, the largest effect is documented on the variable that has no lag at all: 66.7% of the value of procurement won, Column 8.[26] This variable has no lag at all because we compute it based on procurement contracts awarded in each year.

Table 7: Effect of the fiscal demand shock on revenues

Dep.Var.	Tot.Rev.	Tot.Rev.	Tot.Rev.	A.Rec.	A.Rec.	A.Rec.	Val.Proc. Won	Val.Proc. Won	Val.Proc Won
Method	OLS	FE	FE-HT	OLS	FE	FE-HT	OLS	FE	FE-HT
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Fisc.Rule.Exp.XPost	4.824	3.231	3.498	-4.504**	-5.917***	-3.797**	-0.094***	-0.088***	-0.067***
	(3.559)	(2.375)	(2.212)	(1.964)	(1.956)	(1.739)	(0.006)	(0.006)	(0.013)
Fisc.Rule.Exp.	-43.382***			-19.684***			0.105***		
	(4.543)			(2.866)			(0.005)		
Post	-155.451			527.363***			-0.133		
	(196.851)			(106.735)			(0.116)		
N.Firms	4,317	4,317	4,317	4,302	4,302	4,302	4,317	4,317	4,317
Observations	27,764	27,764	27,764	27,520	27,520	27,520	27,764	27,764	27,764
Company FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Mean Y	3001	3001	3001	1806	1806	1806	3.166	3.166	3.166
St.Dev.Fisc.Rule	23.91	23.91	23.91	23.91	23.91	23.91	23.91	23.91	23.91
Eff.Fisc.Rule.Exp. (%)	3.844	2.575	2.787	-5.962	-7.832	-5.027	-70.65	-66.68	-50.84

Notes: The table reports estimates of the effects of exposure to the fiscal rule on firm operations: *Tot.Rev.* are the total annual revenues (in 1,000 euros); *A.Rec.* are the accounts receivable *(Residui)*; *Val.Proc.Won* is the value of procurement won in a year (in 100,000 euros); *Fisc.Rule.Exp.* represents the exposure to the fiscal demand shock computed as the ratio between the firm's value won in municipalities hit by the demand shock and the firm's pre-demand shock revenues. In each of the rows, *Post* is an indication for the years after 2008. Cols. 1,4,7 (2,5,8) [3,6,9] report OLS (FE) [FE-HT] estimates (with firm and year fixed effects) [firm-specific linear trends]. *Eff.Fisc.Rule.Exp. (%)* is the percent effect of one standard deviation increase of exposure to the fiscal demand shock. SEs are clustered at firm level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for procurement companies that won at least one auction before 2009 and observed between 2004 and 2011.

Although not required (the parallel-trends assumption holds for "Total Revenues," "Accounts Receivable" and "Value of Procurement Won," see Table E.1), in columns 3, 6, 9 of Table 7 we add firm-specific trends. The evidence from these specifications is comparable in sign and magnitude to the baseline evidence. In Appendix G we study the effects of the fiscal demand shock on the revenues of firm incorporated in municipalities that are smaller and that are closer to the threshold. We find comparable evidence when we restrict the sample only to firms incorporated in municipalities with population between 1k and 10k, and then between 3k and 7k.

[26] A one-standard-deviation increase in firm exposure to the fiscal demand shock, when multiplied by the coefficient in Table 7 column 2, yields $23.91 * (-0.088) = -2.1$, corresponding to a drop of 210 thousand euros in annual value of procurement won, or 66.7% of the average value of municipal infrastructure procurement won.

Overall, the available evidence supports the notion that the demand shock in 2008 portended worse news for the future.

6.4 Heterogenous response by financial development

Our theoretical framework (Section 2) affords an interesting comparative static result: ceteris paribus, the difference between the capital-labor ratio at the steady state and in period 1, becomes larger in absolute value as the price of capital decreases.

Guiso et al. (2004) construct an indicator of the financial development of Italian regions. Their indicator captures the availability of consumer credit and is shown to correlate with a variety of firm-level outcomes, including firm birth and firm growth. In Table D.1 we interact our measure of exposure with Guiso et al.'s (2004) "Normalized measure of financial development." Our estimates indicate that the effects of the fiscal demand shock are generally stronger in financially more-developed regions, particularly the decrease in: physical capital accumulation; and severance fund. Interestingly, the point estimate suggests an unfavorable effect on firm exit, though the estimate is not statistically different from zero. In sum, firms incorporated in highly-financially developed regions shrink more when hit by the fiscal demand shock. In our model, this effect reflects a drop in the capital level targeted by firms, and not a credit crunch.

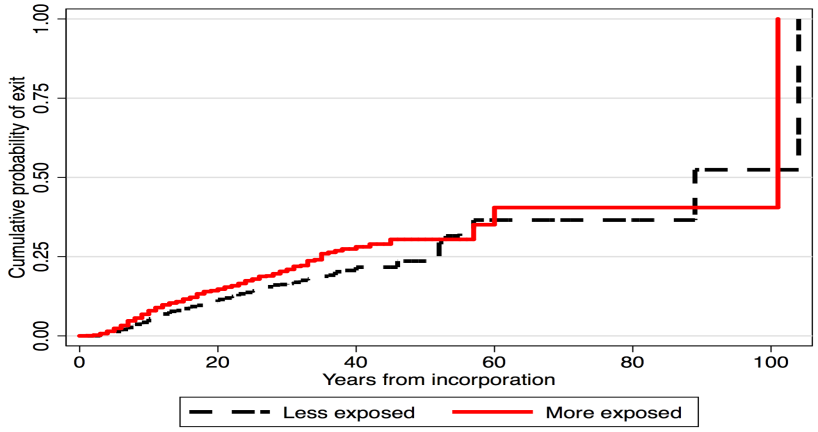
7 Effect of fiscal demand shock on birth-death dynamics

This section explores the impact of the fiscal demand shock on birth-death dynamics in the infrastructure procurement sector. Overall, we find that firm dynamics are impacted by the fiscal demand shock in the way one would expect: firms that are more exposed to the fiscal demand shock are more likely to exit, and less likely to enter. Nevertheless, when evaluated in relation to the stock of active firms, these effects are small. One way of interpreting this observation is that the firm-level effects that were found in the previous sections are not caused by a composition effect (entry/exit).

Our analysis bifurcates as a function of how treatment is defined. If, as in our preferred empirical specification, we define treatment as *exposure to the fiscal demand shock*, then

Figure 6 reports the Kaplan-Meier estimate of the cumulative hazard of exiting within our post-2008 time window as a function of treatment. The sample is split according to whether a firm's exposure exceeds the median. The figure suggests that treated firms tend to have a higher probability of exit.

Figure 6: Kaplan-Meier estimate of the cumulative hazard of exit for firm "more" and "less" exposed to the fiscal demand shock



Notes: More (Less) exposed firms are firms with exposure to the fiscal demand shock computed as the ratio between the firm's value won in municipalities hit by the fiscal demand shock and the firm's pre-demand shock revenues above (below) the median. Source: Statistics for procurement companies that won at least one auction before 2009 and observed between 2004 and 2011.

Consistent with Figure 6, Table 8 reports point estimates of the impact of the exposure to the fiscal demand shock. Multiplying the estimate in col. 2 by a standard deviation in exposure to *Fisc.Rule* yields 0.014*24=0.34, that is, a 0.34 percentage points increase in the exit rate of corporations who operate in the municipal procurement sector. After dividing by the 2.14% average exit rate, we get a 15.9% increase in the exit probability relative to its baseline.[27]

A different definition of treatment can be helpful if we want to know about the dynamics of *all* firms including partnerships. In this case it is expedient to define a firm to be "treated by the fiscal demand shock" if it is incorporated in a fiscal rule-municipality. The advantage of using this definition is that we can leverage the Chambers of Commerce data, which also covers partnerships (these data were discussed in Section 3.2; see Table 1 for

[27]We cannot provide results on the effect of *Fisc.Rule* on the entry rate in Table 8 because the definition of exposure to treatment limits the sample to corporations that existed before the fiscal demand shock hit.

Table 8: Exit

Dep.Var.	Exit	Exit	Exit
Model	OLS	FE	FE-HT
	(1)	(2)	(3)
Fisc.Rule.Exp.XPost	0.002	0.014*	0.001
	(0.008)	(0.008)	(0.009)
Fisc.Rule.Exp.	0.007*		
	(0.003)		
Post	2.682***		
	(0.229)		
N.Firms	4,317	4,317	4,317
Observations	27,764	27,764	27,764
Company FE	No	Yes	Yes
Year FE	No	Yes	Yes
Mean Y	2.139	2.139	2.139
St.Dev.Fisc.Rule	23.91	23.91	23.91
Eff.Exposure (%)	1.862	16.08	0.986

Notes: The table reports estimates of the effects of the fiscal demand shock on firm exit defined as the probability of exit in a given year. *Fisc.Rule.Exp.* represents the exposure to the fiscal demand shock computed as the ratio between the firm's value won in municipalities hit by the fiscal demand shock and the firm's pre-demand shock revenues. In each of the rows, *Post* is an indication for the years after 2008. Col. 1 (2) [3] reports OLS (FE) [FE-HT] estimates (with firm and year fixed effects) [firm-specific linear trends]. Mean Y is the sample mean for each dep.var. *Eff.Fisc.Rule on Treated (%)* is the ratio between the estimated coefficient of *Fisc.Rule.Exp.*Post**St.Dev.Fisc.Rule and Mean Y. SEs are clustered at firm level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for procurement companies that won at least one auction before 2009 and observed between 2004 and 2011.

summary statistics.) The disadvantage is that this definition less accurately proxies for treatment: a firm can be incorporated in a fiscal rule-municipality and yet do most of its business in non-fiscal rule municipalities. Another disadvantage is that the Chambers of Commerce data is aggregated at the municipal and sectoral levels (thus, all firms in the construction industry are lumped together).

Using this second definition of "treated firm," Table 9 column 2, panel A, indicates that the fiscal demand shock had a negative effect on the entry rate in the construction

Table 9: Firm dynamics

Dep.Var.	Entry Rate		Exit Rate		Entry Rate		Exit Rate	
Data	Municipal		Municipal		AIDA		AIDA	
Model	OLS	FE	OLS	FE	OLS	FE	OLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Baseline Model							
Fisc.Rule*Post	-0.769***	-0.770***	0.091	0.079	-0.195***	-0.196***	0.487***	0.488***
	(0.125)	(0.125)	(0.096)	(0.095)	(0.034)	(0.035)	(0.027)	(0.027)
Post	-2.178***		0.064		-0.101***		0.505***	
	(0.112)		(0.085)		(0.029)		(0.019)	
Fisc.Rule	0.598***		0.652***		0.651***		0.038***	
	(0.100)		(0.067)		(0.031)		(0.005)	
	Panel B: Municipal Specific Time Trends							
Fisc.Rule*Post		-0.508**		0.148		-0.181***		0.199***
		(0.242)		(0.189)		(0.068)		(0.023)
Municipalities		6,002		6,002		6,002		6,002
Observations	47,892	47,892	47,892	47,892	47,892	47,892	47,892	47,892
Mean Y_treat-pre	9.459		7.655		1.166		0.0671	
St.Dev. Y_treat-pre	3.986		3.332		1.476		0.302	
Municipal FE	NO	YES	NO	YES	NO	YES	NO	YES
Year FE	NO	YES	NO	YES	NO	YES	NO	YES

Notes: The table reports estimates of the effects of the fiscal demand shock on measures of firms dynamics: *Entry (Exit) Rate* is defined as the number of new (cancelled) firms in year t over the number of active firms in year t-1, in every municipality. *Entry (Exit) Rate AIDA* is the defined as the number of new (death) firms in year t, in the AIDA database, over the number of active firms in year t-1. In each of the rows, *Fisc.Rule* is an indicator variable for municipalities with population above the fiscal rule population threshold (5,000 inhabitants) and *Post* is an indication for the years after 2008. Odd (even) columns report OLS (FE) estimates (with municipal and year fixed effects). Mean Y_treat-pre and St.Dev. Y_treat-pre are the sample mean and standard deviation for treated municipalities pre-2009. SEs are clustered at municipal level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for all the Italian municipalities between 2004 and 2011.

sector equal to -0.77 percentage points. After dividing by the baseline entry rate of 9.5%, we get a 8.1% decrease in the entry probability relative to its baseline. Table 9 column 4, panel A, confirms a positive, though not statistically significant effect on the exit rate from that sector. Finally, columns 5-8 in Table 9, panel A, revert to AIDA firms, this time to an enlarged sample containing all construction firms. For comparability with the Chambers of Commerce data, we aggregate firms at the municipal level. The resulting dataset is comparable to the Chambers of Commerce dataset except for it does not include partnerships.[28]

[28]The comparability only goes so far. Table 9 indicates that the exit rate in our AIDA construction-sector sample is 0.7%, much lower than the exit rate in the Chambers of Commerce data (7%). This disparity cannot be due to sector specification, which is the same in the two samples: therefore, the high exit rate in the the Chambers of Commerce data must be due to the presence of partnerships. It is possible

After dividing by the baseline entry and exit rates, we estimate that both the birth rate (-17%) and the death rate (+697%) are significantly impacted by the fiscal demand shock with the expected sign.[29] Overall, it appears that firm dynamics are impacted by the fiscal demand shock in the way one would expect: firms that are exposed to the fiscal demand shock are more likely to exit, and less likely to enter. We note that, when evaluated in relation to the stock of active firms, these effects are small because the underlying flows of entry and exit are themselves small.

8 Multipliers by exposure quartile

The previous section's estimates of the effect of the fiscal demand shock were based on a linear model: in this section we explore whether the effects of the fiscal demand shock are nonlinear in the "exposure" variable. In addition, in this section we translate the estimated coefficients into multipliers, because multipliers are the standard measure of fiscal policy impact.

We now describe how we compute the multipliers. Start from the coefficients of interest in model (3), i.e., the coefficients $\beta_1 - \beta_3$. The coefficient β_3, in Table F.1 for example, captures how much more capital adjusts to the fiscal shock in the most exposed quartile (quartile 4) of firms, compared to the least exposed firms (the omitted quartile 1). Suppose we want to compute the multiplier for capital expenditure for quartile-4 firms. Average exposure in quartile 4 is 55.85 ; average exposure in quartile 1 is 0.32. Therefore, the estimated coefficient $\hat{\beta}_3 = -98$ reflects how much capital decreases due to an exposure differential of $55.8 - 0.32 = 55.5$. Accordingly, an exposure differential of 100 results in a capital adjustment of $\hat{\beta}_3 \cdot \frac{100}{55.53} = -177.21$. Thus, capital in a fully-exposed firm decreases by 177,210 euros compared to a non-exposed firm, equal to a 85% of the average capital among the most-exposed quartile of firms (207,000 euros). Furthermore, the fiscal shock reduced municipal expenditures by approximately 20% (refer to Table 2); accordingly, the effect of a 100% decrease in municipal expenditure (the fiscal multiplier) can be imputed by $85\% \cdot (100/20) = 425\%$.

that partnerships exit more readily than corporations, perhaps because they lack limited liability.

[29] After controlling for municipal-specific trends, the two estimates of the fiscal demand shock's impact drop to -15% and +284% respectively, see Table 9 (Panel B).

The estimates for all the other outcomes are reported in Appendix F. In light of the findings discussed in Appendix E, all our estimates include firm-specific trends.[30] In general the estimated coefficients (see Table F.1), when statistically significant, increase in absolute value as exposure increases; see "Capital" , and "Exit". Thus, we find that effects are systematically stronger for more-exposed firms. The one exception to this finding is "Exit," where firms are most likely to exit in the 50-75% quartile. The economic significance of the nonlinearity is probably even stronger than the estimates suggest because more-exposed firms are on average smaller than less-exposed firms. The multipliers for the fourth quartile of firms are as follows: 425% for capital. The third-quartile multiplier for "exit" equals 2100%, meaning that a fully-exposed firm is almost twenty-one times as likely to exit due to the fiscal demand shock, compared to non-exposed firms. This large number must be understood in the context of a baseline exit probability which is small (about 2 percent).

9 Checking for treatment spillovers in the procurement market

We have documented that the fiscal demand shock had a measurable impact on the demand for public works and on firm-level outcomes. In this section we explore whether we might be underestimating the magnitude of firm-level effects due to treatment spillovers in the procurement market. We are concerned about the possibility that firms which did business in municipalities that are subject to the fiscal demand shock might, after 2008, start bidding more often in municipalities that were not hit by the fiscal demand shock. If that were so, then pre-fiscal demand shock exposure, the variable we use to capture treatment intensity, might not be a good proxy for actual treatment take-up. Presumably, this would mean that our results under-estimate the true impact of the fiscal demand shock on firms.

To explore the economic significance of any spillovers, we leverage the procurement market data. Table 10 presents two specifications, both based on municipal-level averages:

[30]Not allowing for firm-specific trends results in estimates that are generally larger; compare estimates in the present section with those in Tables F.3 and F.4. In Tables G.3 and G.4 we repeat the analysis for firm incorporated in municipalities that are smaller and that are closer to the threshold. We find comparable evidence when we restrict the sample only to firms incorporated in municipalities with population between 1k and 10k, and then between 3k and 7k.

Table 10: Checking for treatment spillovers in the procurement market

Dep. Var.	N.Tenders		Avg.Value of procurement		Perc.Roads		N.Bidders		Winning Rebate		Winner from the same province	
Model	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Panel A: Baseline Model											
Fisc.Rule*Post	-1.705***	-1.705***	0.807***	0.827***	0.352	0.593	4.845***	3.242**	1.349***	1.300***	2.038	1.847
	(0.182)	(0.182)	(0.252)	(0.247)	(0.987)	(1.046)	(1.385)	(1.615)	(0.334)	(0.362)	(1.408)	(1.670)
Post	-0.532***		1.310***		-1.839***		5.162***		2.912***		6.019***	
	(0.019)		(0.133)		(0.713)		(0.927)		(0.255)		(1.057)	
Fisc.Rule	4.310***		1.623***		0.512		7.915***		1.547***		-17.312***	
	(0.278)		(0.084)		(0.555)		(0.637)		(0.237)		(0.913)	
	Panel B: Municipal specific time trends											
Fisc.Rule*Post		-0.579***		0.262		-1.795		1.399		0.668		3.115
		(0.157)		(0.417)		(2.176)		(2.964)		(0.659)		(3.877)
Municipalities		6,015		5,970		5,970		4,276		4,726		3,896
Observations	48,120	48,120	26,722	26,722	26,724	26,724	13,520	13,520	16,310	16,310	11,277	11,277
Mean Y_treat-pre	5.601		4.274		28.02		33.46		18.03		47.51	
St.Dev. Y_treat-pre	12.99		5.667		32.43		26.24		7.961		32.37	
Municipal FE	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Year FE	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES

Notes: The table reports estimates of the effects of the fiscal demand shock on on municipal procurement outcomes: *N.Tenders* is the number of tenders in a municipality in a year; *Avg.Value of procurement* is the average value of tenders in a municipality in a year computed using the engineers' estimates of the value of the works; *Roads* is the fraction of roads' tenders; *N.Bidders* is the number of competitors submitting an offer; *Winning-Rebate* is the winning offer, which represents the percentage discount over the engineer's estimate of the value of the works. In each of the rows, *Fisc.Rule* is an indicator variable for municipalities with population above the fiscal rule population threshold (5,000 inhabitants) and *Post* is an indication for the years after 2008. Odd (even) columns report OLS (FE) estimates (with municipal and year fixed effects). Mean Y_treat-pre and St.Dev. Y_treat-pre are the sample mean and standard deviation for treated municipalities pre-2009. SEs are clustered at municipal level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for all the public works tendered between 2004 and 2011 in Italy.

without (panel A) and with (panel B) controls for municipal-level trends. Columns 1-4 confirm the large impact of the fiscal demand shock on the demand for public works. Columns 5, 6 look at the percentage of tender value which is road construction – a proxy for demand composition effects. The estimates suggest that shifts in demand composition, if any, are negligible. Columns 7-10 are informative about spillover effects. The estimates in panel A go against the notion that firms move away from municipalities that are hit by the fiscal demand shock, because contests held by municipalities hit by the fiscal demand shock tend to have slightly *more* bidders and slightly *higher* winning rebates after 2008. Panel B cols 7-10, however, casts doubt of the statistical significance of the coefficients measured in Panel A. Furthermore, we detect no effects on the firms' radius of operation: columns 11-12 (Panels A and B) show no statistically significant change in whether the winning firm is from the same province as the tendering municipality.

Overall, we read the evidence as not supporting the notion that there was significant selection out of treatment. We thus conclude that downward biases in the estimated firm-level effects of the fiscal demand shock, if any, are slight.

10 Conclusions

This paper has documented, in a relatively well-identified way, the channels through which a fiscal shock propagates through the public sector and onto the private sector. We have shown that two different types of organizations: local governments and procurement firms, both use capital investment as the primary channel of shock absorption.

We add to the existing literature in two separate dimensions. First, we provide evidence on *the channels* (investment or current expenditures) through which local governments choose to propagate a fiscal-rule shock. To our knowledge this was a gap in the literature, and a significant one because fiscal rules are increasingly salient. Second, as regards firm-level behavior: we study a small sector which is hit by a tightly-focused sectoral shock, and we observe the impacted firms before and after the shock. This combination of features allows us to zoom in on the *direct* propagation behavior, in isolation from general-equilibrium sectoral spillovers; this focus on direct propagation is new, to our knowledge, in the literature.

We believe that our findings on direct propagation can contribute constructively to

the fast-evolving literature on the network origins of economic fluctuations. Though our analysis focuses on just two sectors, our findings are consistent with a broader macro-level correlational fact: that the profits' share of output is more procyclical than the labor share. Together with this pre-existing evidence, we believe that our findings make a strong case for the distinctiveness of capital as a shock-propagating channel in the theoretical framework of Acemoglu et al. (2012). What is unique, from a theoretical perspective, about capital as a propagation channel? In this paper we have tentatively attributed capital's pre-eminent role to its intertemporal durability, but the evidence on this mechanism is not conclusive and we leave this inquiry to future research.

We further found that, within the procurement sector, shocks are propagated disproportionately by those firms which are most exposed to the shocked sector. This is intuitive if we believe that business organizations are spurred to make changes by crises. Nevertheless, this finding suggests that direct shock transmission may not depend so much on *average sectoral* exposure to the shocked sector, as much as on the *fraction of highly exposed firms*. This suggests that higher moments of the exposure distribution may matter for direct shock transmission, in addition to the average sectoral exposure that is represented by the input-output linkages.

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For Online Publication Appendix

A Analytical appendix

A.1 One-period model (Acemoglu et at. 2012)

Following model by Acemoglu et al. (2012, p. 1984-87). Small competitive sector (such as the municipal procurement sector) operates a Cobb Douglas technology

$$y = k^{\alpha} l^{1-\alpha}.$$

Firm solves:

$$\max pk^{\alpha} l^{1-\alpha} - rk - wl,$$

where r and w are factor prices determined economy-wide and are unaffected by production in the sector. Firm's foc's require:

$$\begin{aligned} p\left(1-\alpha\right) k^{\alpha} l^{-\alpha} - w &= 0 \\ p\alpha k^{\alpha-1} l^{1-\alpha} - r &= 0 \end{aligned}$$

so

$$\frac{wl}{rk} = \frac{p\left(1-\alpha\right)\left(k\right)^{\alpha}\left(l\right)^{1-\alpha}}{p\alpha\left(k\right)^{\alpha}\left(l\right)^{1-\alpha}} = \frac{\left(1-\alpha\right)}{\alpha}$$

independent of p. Now consider a demand shock to demand that causes p to change to p' (this shock could be micro-founded in a demand system such as the one on page 1984 of Acemoglu et al. 2012). Then factor utilization l and k, will change, but since by assumption w and r are unaffected by the shock, l and k must change in the exact same proportion. Hence if p changes to p' the resulting capital-labor ratio is unaffected:

$$\frac{k'}{k} = \frac{l'}{l}.$$

It follows that $\frac{k'-k}{k} = \frac{l'-l}{l}$ and thus elasticities to the demand shock (the multipliers) are the same for capital and labor.

A.2 Two period model

Same as above except two periods. We assume that capital is perfectly durable (no depreciation) and that the discount factor is one. We are going to compare two scenarios: one where $p_1 = p_2 = p$, i.e., there is no shock in period 1, or if there is a shock it does not portend anything negative for period 2. The second scenario is one where p_1 is bad news for p_2. So $p_1 > p_2$. It makes sense to presume also that $p_1 < p$, that is, that there is

a shock in period 1; this further assumption is consistent with, but not required for, the analysis that follows.

In neither of these scenarios will the firm want to increase its capital in period 2, so for simplicity in our modeling we assume that all the capital k that the firm will ever want is purchased in period 2. The firm's problem is now:

$$\max p_1 k^\alpha l_1^{1-\alpha} + p_2 k^\alpha l_2^{1-\alpha} - rk - w(l_1 + l_2)$$
$$\max k^\alpha \left(p_1 l_1^{1-\alpha} + p_2 l_2^{1-\alpha}\right) - rk - w(l_1 + l_2)$$

Focs

$$\begin{aligned} \alpha k^{\alpha-1}\left(p_1 l_1^{1-\alpha} + p_2 l_2^{1-\alpha}\right) - r &= 0 \\ k^\alpha (1-\alpha)\left(p_1 l_1^{-\alpha}\right) - w &= 0 \\ k^\alpha (1-\alpha)\left(p_2 l_2^{-\alpha}\right) - w &= 0 \end{aligned}$$

$$\begin{aligned} \alpha k^\alpha\left(p_1 l_1^{1-\alpha} + p_2 l_2^{1-\alpha}\right) - rk &= 0 \\ k^\alpha (1-\alpha)\left(p_1 l_1^{1-\alpha}\right) - w l_1 &= 0 \\ k^\alpha (1-\alpha)\left(p_2 l_2^{1-\alpha}\right) - w l_2 &= 0 \end{aligned}$$

From this we have

$$\begin{aligned} \frac{\left(p_1 l_1^{1-\alpha}\right)}{\left(p_2 l_2^{1-\alpha}\right)} &= \frac{l_1}{l_2} \\ \frac{p_1}{p_2} &= \left(\frac{l_1}{l_2}\right)^\alpha \end{aligned} \tag{4}$$

$$\begin{aligned} \alpha k^\alpha\left(p_1 l_1^{1-\alpha} + p_2 l_2^{1-\alpha}\right) - rk &= 0 \\ k^\alpha (1-\alpha)\left(p_1 l_1^{1-\alpha} + p_2 l_2^{1-\alpha}\right) - w(l_1 + l_2) &= 0 \end{aligned}$$

$$\frac{\alpha k^\alpha\left(p_1 l_1^{1-\alpha} + p_2 l_2^{1-\alpha}\right)}{k^\alpha (1-\alpha)\left(p_1 l_1^{1-\alpha} + p_2 l_2^{1-\alpha}\right)} = \frac{rk}{w(l_1 + l_2)} = \frac{\alpha}{(1-\alpha)} \tag{5}$$

Imagine that we start from $p_1 = p_2 = p$. Then from (4) we get $l_1 = l_2$ and then from (5):

$$\frac{k}{l_1} = \frac{2\alpha w}{r(1-\alpha)}. \tag{6}$$

Now the case where p_1 is bad news for p_2. If $p_1' > p_2'$ then from (4) we get $l_1' > l_2'$ and then from (5):

$$\frac{\alpha}{(1-\alpha)} = \frac{rk'}{w(l_1' + l_2')} = \frac{rk'}{wl_1'\left(1 + \frac{l_2'}{l_1'}\right)} = \frac{rk'}{wl_1'\left(1 + \left(\frac{p_2'}{p_1'}\right)^{1/\alpha}\right)},$$

where the last equality follows from (4). Since $p_1' > p_2'$ we get

$$\frac{k'}{l_1'} = \left(1 + \left(\frac{p_2'}{p_1'}\right)^{1/\alpha}\right) \frac{\alpha w}{r\left(1-\alpha\right)} < \frac{2\alpha w}{r\left(1-\alpha\right)} = \frac{k}{l_1}. \tag{7}$$

In other words, when p_1 contains negative information about p_2 the capital/labor ratio is lower in period 1 compared to the case where no such negative information exists. This is because when p_1 contains negative information about p_2 the firm anticipates the bad shock in period 2 by adjusting capital more negatively than labor. This over-reaction on capital is caused by the fact that capital is durable wheras labor is purchased on the spot market. Another way of saying this is that the firm uses capital in preference to labor to absorb the negative shock to future profitability.

Interestingly, ceteris paribus the magnitude of the "excess capital adjustment," that is, the difference between $\frac{k'}{l_1'}$ and$\frac{k}{l_1}$ equals, by (7):

$$\begin{aligned} \frac{k'}{l_1'} - \frac{k}{l_1} &= \left(1 + \left(\frac{p_2'}{p_1'}\right)^{1/\alpha}\right) \frac{\alpha w}{r\left(1-\alpha\right)} - 2\frac{\alpha w}{r\left(1-\alpha\right)} \\ &= \left[\left(\frac{p_2'}{p_1'}\right)^{1/\alpha} - 1\right] \frac{\alpha w}{r\left(1-\alpha\right)}. \end{aligned}$$

This quantity is negative and it becomes larger in absolute value as r decreases. In this sense, when capital is cheaper the "excess capital adjustment" effect is more pronounced.

B Variables, Descriptions, and Sources

Variable	Description	Source
Municipalities		
Total value of procurement	Is the annual total value of municipal contests for public works.	Information provider
N.Tenders	Is the number of tenders in a municipality in a year.	Information provider
Avg. value of procurement	Is the average value of the contests tendered in a municipality in a year computed using the engineers' estimates of the value of the contest.	Information provider
Percent Roads	Is the fraction of roads' contests	Information provider
Winning rebate	Is the offer that won the procurement, which represents the percentage discount over the engineer's estimate of the value of the tander. A higher offers represents lower municipal procurement costs.	Information provider
Winner from the same province	Is the value won by firms from the same province of the municipality running the contest over the value of contests by year and municipality.	Authors' calculation on Information provider data
Entry (Exit) rate, construction	Is defined as the number of new (cancelled) firms in year t over the number of active firms in year t-1, in every municipality.	Authors' calculation on Official Registry Data from *Unioncamere.*
Entry (Exit) rate, AIDA	Is the defined as the number of new (death) firms in year t, in the AIDA database, over the number of active firms in year t-1, in every municipality.	Authors' calculation on AIDA data and Official Registry Data from *Unioncamere.*
Transfers	Are the annual transfers to the municipality by the central governments (state and region).	Italian Ministry of Interior.
Tax revenues	Are the annual tax revenues of the municipality.	Italian Ministry of Interior.
Total Current (Capital) Spending	Is the annual total current (capital) spendings of the municipality.	Italian Ministry of Interior. Variable:*Totale spese correnti (conto capitale), impegni*
Population	Is the municipal population.	National Institute of Statistics (ISTAT).
Firm balance-sheet		
Exit	Probability of exit in a given year obtained with the year fo last official submission of the balance-sheet.	AIDA. Variable: *Anno ultimo bilancio.*
Severance Fund	Is the firm's total funds accumulated for severance pays (in 1000 euros).	AIDA. Variable: *Fondo di trattamento fine rapporto lavoro.*
Tot.Value	Is the value of contests won in a year (in 100,000 euros).	Authors' calculation on Information provider data
Capital	Total annual physical assets (in 1000 euros).	AIDA. Variable: *Totale Immobilizzazioni Materiali.*
Labor	Total annual personnel costs (in 1000 euros).	AIDA. Variable: *Totale salari e stipendi.*
N.Workers	Number of workers.	AIDA. Variable: *Dipendenti.*
O.Services	Are the firm total costs for outsourced services (in 1,000 euros)	AIDA. Variable: *Servizi*
Tot.Rev.	Are the total annual revenues (in 1000 euros).	AIDA. Variable: *Ricavi,vendite,e prestazioni*
A.Receivable	Are the firm total annual amount of non-completed works (in 1000 euros).	AIDA. Variable: *Totale rimanenze.*

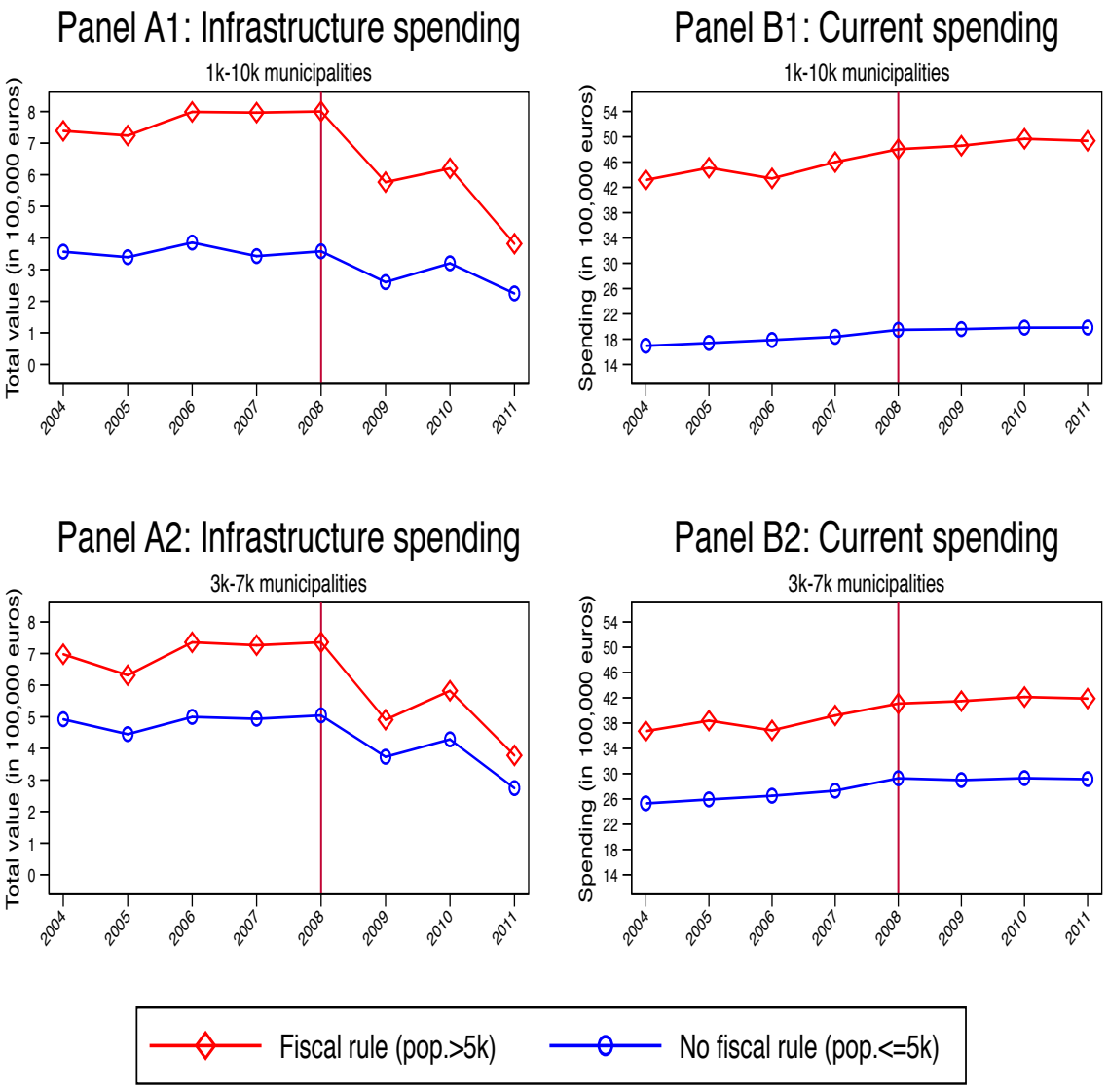
C Additional tables and figures

Table C.1: Check of common-trend and no-anticipation assumptions in smaller municipalieties around the threshold

Test	Common Trend Assumption	Leads&Lags	Common Trend Assumption	Leads&Lags	Common Trend Assumption	Leads&Lags
Municipalities	1k-10k	1k-10k	3k-7k	3k-7k	4k-6k	4k-6k
	(1)	(2)	(3)	(4)	(5)	(6)
Fisc.Rule*Year	0.189		0.097		-0.241	
	(0.129)		(0.172)		(0.213)	
Leads						
Fisc.Rule*2005		0.027		-0.193		-0.327
		(0.428)		(0.645)		(0.906)
Fisc.Rule*2006		0.311		0.302		0.846
		(0.492)		(0.756)		(1.087)
Fisc.Rule*2007		0.717		0.269		-0.561
		(0.550)		(0.752)		(0.985)
Fisc.Rule*2008		0.602		0.256		-1.089
		(0.580)		(0.788)		(0.977)
Fisc.Rule*2009		-0.658		-0.884		-1.343
		(0.554)		(0.769)		(1.161)
Fisc.Rule*2010		-0.818		-0.520		-0.834
		(0.573)		(0.858)		(1.176)
Fisc.Rule*2011		-2.252***		-1.023		-1.174
		(0.460)		(0.696)		(0.803)
Observations	19,650	31,440	7,485	11,976	3,505	5,608
Municipalities	3,930	3,930	1,497	1,497	701	701
p-value Leads		0.561		0.852		0.382
Municipal FE	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	NO	YES	NO	YES

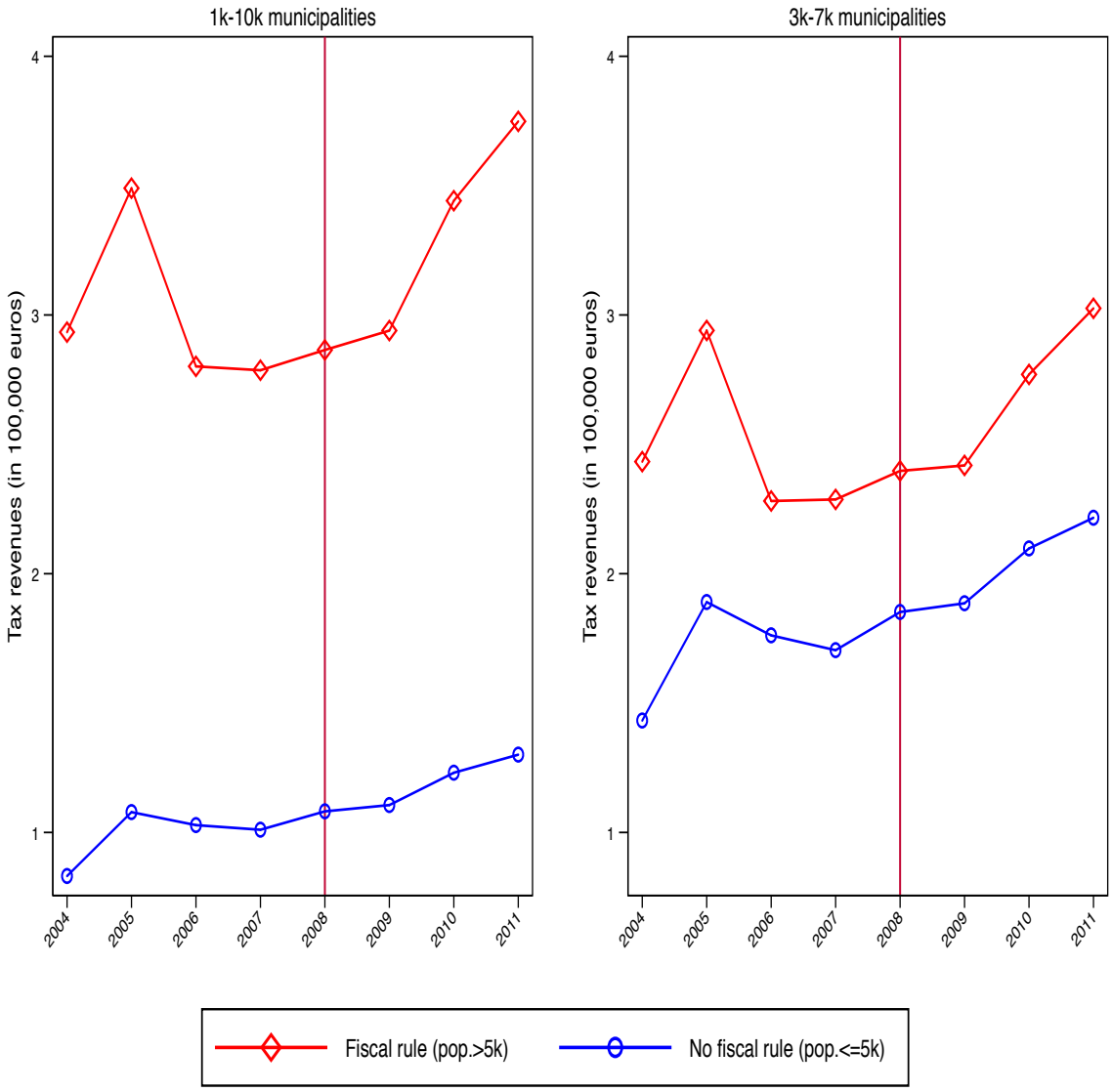
Notes: The table reports estimates of the effects of the fiscal demand shock on the average annual total value of procurement for public works in all Italian municipalities. In each of the rows, *Fisc.Rule* is an indicator variable for municipalities with population above the fiscal rule population threshold (5,000 inhabitants) and *Post* is an indication for the years after 2008. In column 1 the sample is before the fiscal demand shock and the regression includes a linear trend as a control. In column 2 *p-value Leads* is the *p-value* for the joint statistical significance of the leads effect of the fiscal demand shock. SEs are clustered at municipal level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for all the public works tendered between 2004 and 2011 in Italy with population between 1,000 and 10,000 (cols. 1 and 2); 3,000 and 7,000 (cols. 3 and 4); 4,000 and 6,000 (cols. 5 and 6) .

Figure C.1: Fiscal demand shock associated with drop in infrastructure spending (investment) but not with drop in current spending (consumption), in smaller municipalities



Notes: Average total annual value of budgeted public works in Italian municipalities around the threshold. Diamonds represent fiscal rule municipalities with population above 5,000 inhabitants. Source: Authors' calculation on procurement data for all municipalities between 2004-2011, and also for municipalities with population between 1,000 and 10,000 inhabitants (Panel A1 and B1) and 3,000 and 7,000 inhabitants (Panel A2 and B2).

Figure C.2: Tax revenues in smaller fiscal rule and non-fiscal rule municipalities



Notes: Average total annual value of municipal tax revenues. Diamonds represent fiscal rule municipalities with population above 5,000 inhabitants. Source: Authors' calculation on procurement data for all municipalities between 2004-2011, and with population between 1,000 and 10,000 inhabitants (left picture) and 3,000 and 7,000 inhabitants (right picture).

D Heterogenous response by financial development and firm size

In Table D.1 panel A we interact our measure of exposure with Guiso et al.'s (2004) "Normalized measure of financial development." Our estimates indicate that the effects of the fiscal demand shock are generally stronger in financially more-developed regions, particularly the decrease in: physical capital; and severance fund.

A similar story applies to larger firms. In Table D.1 panel B we interact our measure of exposure with a firm's size (average yearly revenue before the fiscal demand shock took effect). The estimates indicate that for large firms we see a decrease in wages, though not in the number of employees and physical capital.

Table D.1: Financial development and responses to the fiscal demand shock

Dep.Var.	Capital	Labor	N.Workers	O.Services	Sev. Fund	Exit
Model	FE	FE	FE	FE	FE	
	(1)	(2)	(3)	(4)	(5)	(6)
Fisc.Rule.Exp.XPostXFin.Dev.	-11.3696***	-1.5410	-0.1226	-1.8837	-0.2616***	0.0408
	(3.833)	(1.370)	(0.129)	(7.357)	(0.080)	(0.050)
N.Firms	3,515	3,515	3,336	3,515	3,504	3,515
Observations	22,654	22,654	13,312	22,654	21,616	22,654
Mean Y	606.2	413.2	25.44	1242	28.06	2.159
St.Dev.Fisc.Rule.Exp.	22.85	22.85	22.85	22.85	22.85	22.85
St.Dev.Fin.Dev	0.207	0.207	0.207	0.207	0.207	0.207
Company FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table reports estimates of the effects of exposure to the fiscal demand shock on firms capital and labor. *Capital* are the firm total annual physical assets (in 1,000 euros); *Labor* are the firm total personnel costs (in 1,000 euros); *O.Services* are the firm total costs for outsourced services (in 1,000 euros); *Sev. Fund* is the firm's total funds accumulated for severance pays (in 1,000 euros); *Exit* is defined as the probability of exit in a given year. Inputs and outputs are deflated using KLEMS deflators. *Fisc.Rule.Exp.XPostXFin.Dev.* is a triple interaction term between the exposure to the fiscal demand shock computed as the ratio between the firm's value won in municipalities hit by the fiscal demand shock and the firm's pre-demand shock revenues, the dummy post, and the Guiso et al. (2004) indicator for financial development of the region of incorporation of the firm. In each column the model includes interaction terms between *Fisc.Rule*, *Post*, and *Fin.Dev.* SEs are clustered at firm level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for procurement companies that won at least one auction before 2009 and observed between 2004 and 2011.

E Pre-fiscal demand shock differences and dynamics of exposed firms

In this Appendix we first examine whether more- and less-exposed firms share the same trend in the firm-level variables before 2009. This is necessary because the key coefficient δ in specification (2) is estimated off of the comparison between more- and less-exposed firms. We explore this "common trend" assumption by regressing each firm-level variable on a linear time trend interacted with the variable "Fiscal Rule Exposure." A large estimated effect would suggest that more-exposed firms have a large pre-2009 time trend, compared to less-exposed firms. The test is performed in the even columns of the tables in this section. The coefficients that are significantly different from zero are generally small in magnitude: "Capital" -6%; "Labor Costs", and "Severance Fund."

We also check whether more-exposed firms are different from less-exposed firms. This is done by regressing firm-level variables on the "exposure" variable. In general, we find that more-exposed firms are smaller; the estimated coefficients are displayed in the odd columns in the tables in this section. This variation in levels, while interesting, does not affect our estimated coefficient (δ in specification (2)) because that specification includes firm-level fixed effects.

Table E.1: Pre-fiscal demand shock trends of exposed firms.

Dep.Var.	Capital	Labor	N.Workers	O.Services	Sev. Fund	Exit	Tot.Rev.	A.Receivable	Val.Proc. Won
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Fisc.Rule*Year	-1.3173***	-0.1232*	0.0056	0.1169	-0.0102**	0.0059	-0.4782	-1.1083	-0.0081
	(0.171)	(0.067)	(0.007)	(0.269)	(0.005)	(0.004)	(0.637)	(1.056)	(0.006)
N.Firms	4,297	4,297	3,694	4,297	4,273	4,297	4,297	4,282	4,297
Observations	16,161	16,161	8,591	16,161	15,558	16,161	16,161	15,945	16,161
Method	FE	FE	FE	FE	FE	FE	FE	FE	FE
Company FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean	464	395.3	25.14	1184	24.19	1.002	3049	1628	3.892
St.Dev.Fisc.Rule	23.91	23.91	23.91	23.91	23.91	23.91	23.91	23.91	23.91
Effect Fisc.Rule.Exp (%)	-6.787	-0.745	0.533	0.236	-1.005	14.17	-0.375	-1.627	-4.968

Notes: The table reports estimates of the effects of exposure to the fiscal demand shock on firm capital, labor and revenues pre-fiscal demand shock: *Capital* are the firm total annual physical assets (in 1,000 euros); *Labor* are the firm total personnel costs (in 1,000 euros); *Sev. Fund* is the firm's total funds accumulated for severance pays (in 1,000 euros). *O.Services* are the firm total costs for outsourced services (in 1,000 euros). Financial variables are deflated using KLEMS deflators. *Fisc.Rule* represents the exposure to the fiscal demand shock before the *Patto*, and it is computed as the ratio between the firm's value won in municipalities with fiscal rule and the firm's pre-fiscal demand shock revenues. *Fisc.Rule*Year* is the interaction of the exposure to the fiscal rule to the linear trend. All the columns include firm and time effects. *Effect Fisc.Rule.Exp (%)* is the % effect of the fiscal demand shock. The sample is before the fiscal demand shock. SEs are clustered at firm level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for procurement companies that won at least one auction before 2009 and observed between 2004 and 2009.

F Non-linear effects of exposure to the fiscal demand shock controlling for firm-specific trends

Table F.1: Effect of the demand shock on capital and labor. Non-parametric model controlling for firm-specific trends.

Dep.Var.	Capital	Labor	N.Workers	O.Services	Sev. Fund	Exit
Model	FE-HT	FE-HT	FE-HT	FE-HT	FE-HT	FE-HT
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})XPost$	13.377	-7.706	3.462	34.145	0.451	1.013
	(37.844)	(18.492)	(5.134)	(158.860)	(1.143)	(0.710)
$\mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})XPost$	-20.420	-6.346	0.436	-64.934	-0.371	1.274*
	(40.829)	(17.696)	(1.486)	(113.271)	(1.391)	(0.743)
$\mathbb{1}(P_{75} < Fisc.Rule)XPost$	-98.008***	19.433	-0.645	28.722	-1.697**	0.921
	(28.433)	(16.626)	(1.573)	(110.001)	(0.832)	(0.745)
N.Firms	4,317	4,317	4,095	4,317	4,305	4,317
Observations	27,764	27,764	16,135	27,764	26,471	27,764
Company FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean Y	584.4	397.2	24.63	1156	27.09	2.139
St.Dev.Fisc.Rule	23.91	23.91	23.91	23.91	23.91	23.91

Notes: The table reports estimates of the effects of exposure to the fiscal demand shock on firms capital and labor: *Capital* are the firm total annual physical assets (in 1,000 euros); *Labor* are the firm total personnel costs (in 1,000 euros); *Sev. Fund* is the firm's total funds accumulated for severance pays (in 1,000 euros); *O.Services* are the firm total costs for outsourced services (in 1,000 euros). Financial variables are deflated using KLEMS deflators. $\mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})XPost$ ($\mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})XPost$) [$\mathbb{1}(P_{75} < Fisc.Rule)XPost$] is an indicator for the companies companies in the second (third) [forth] quartile of the distribution of the fiscal rule exposure computed as the ratio between the firm's value won in municipalities with fiscal demand shock and the firm's pre-fiscal demand shock revenues. In each of the rows, *Post* is an indicator for the years after 2008. All the regressions include firm, year fixed effects and firm-specific linear trends. SEs are clustered at firm level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for procurement companies that won at least one auction before 2009 and observed between 2004 and 2011.

Table F.2: Effect of the demand shock on revenues. Non-parametric model controlling for firm-specific trends.

VARIABLES	Tot.Rev. FE-HT (1)	A.Receivable FE-HT (2)	Val.Proc. Won FE-HT (3)
$\mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})XPost$	185.962	-89.828	0.199
	(307.624)	(215.464)	(0.422)
$\mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})XPost$	-28.918	-126.748	-1.728***
	(279.837)	(229.288)	(0.524)
$\mathbb{1}(P_{75} < Fisc.Rule)XPost$	253.263	-289.292	-4.221***
	(267.041)	(179.412)	(0.771)
N.Firms	4,317	4,302	4,317
Observations	27,764	27,520	27,764
Company FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Mean Y	3001	1806	3.166
St.Dev.Fisc.Rule	23.91	23.91	23.91

Notes: The table reports estimates of the effects of exposure to the fiscal demand shock on firms revenues: *Tot.Rev.* are the total annual revenues (in 1,000 euros); *A.Receivable* are the account receivables *(Residui)*; *Value Proc. Won* is the value of procurement won in a year (in 100,000 euros). $\mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})XPost$ ($\mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})XPost$) [$\mathbb{1}(P_{75} < Fisc.Rule)XPost$] is an indicator for the companies companies in the second (third) [forth] quartile of the distribution of the fiscal demand shock exposure computed as the ratio between the firm's value won in municipalities with fiscal rule and the firm's pre-fiscal demand shock revenues. In each of the rows, *Post* is an indicator for the years after 2008. All the regressions include firm, year fixed effects and firm-specific linear trends. SEs are clustered at firm level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for procurement companies that won at least one auction before 2009 and observed between 2004 and 2011.

Table F.3: Effect of the demand shock on capital and labor. Non-parametric model.

Dep.Var.	Capital	Capital	Labor	Labor	N.Workers	N.Workers	O.Services	O.Services	Sev. Fund	Sev. Fund	Exit	Exit
Model	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})XPost$	-45.885	-76.221	3.709	-1.268	2.358	0.190	-28.224	12.687	3.475*	1.118	-0.610	-0.305
	(92.578)	(83.612)	(49.602)	(29.625)	(5.031)	(2.205)	(238.954)	(161.902)	(1.856)	(1.725)	(0.514)	(0.551)
$\mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})XPost$	-100.105	-210.817***	-26.077	-34.856**	0.785	-1.409	-141.763	-137.302	-0.328	-2.861**	-0.158	0.278
	(126.206)	(79.408)	(40.387)	(17.395)	(2.178)	(1.123)	(190.347)	(99.957)	(1.290)	(1.313)	(0.533)	(0.574)
$\mathbb{1}(P_{75} < Fisc.Rule)XPost$	-320.461***	-351.274***	-18.792	-12.234	2.123	-1.034	49.044	83.247	-3.657***	-4.982***	-0.205	0.701
	(75.015)	(65.093)	(40.040)	(16.646)	(2.218)	(1.118)	(198.518)	(112.699)	(1.160)	(1.190)	(0.552)	(0.588)
$\mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})$	14.339		40.127		2.472		196.992		3.006		0.295	
	(62.086)		(86.103)		(5.935)		(278.387)		(4.412)		(0.198)	
$\mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})$	-39.512		-162.685***		-11.507***		-442.269***		-8.908***		0.373*	
	(123.351)		(46.633)		(3.060)		(160.044)		(2.685)		(0.203)	
$\mathbb{1}(P_{75} < Fisc.Rule)$	-391.222***		-323.772***		-19.230***		-986.058***		-19.527***		0.636***	
	(47.717)		(44.368)		(2.978)		(149.553)		(2.544)		(0.227)	
Post	407.299***		16.803		-2.019		-27.920		7.163***		2.966***	
	(73.926)		(39.659)		(2.104)		(188.611)		(1.066)		(0.366)	
N. Firms		4,317		4,317		4,095		4,317		4,305		4,317
Observations	27,764	27,764	27,764	27,764	16,135	16,135	27,764	27,764	26,471	26,471	27,764	27,764
Company FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Mean Y	584.4		397.2		24.63		1156		27.09		2.139	
St.Dev.Fisc.Rule	23.91		23.91		23.91		23.91		23.91		23.91	

Notes: The table reports estimates of the effects of exposure to the fiscal demand shock on firms capital and labor: *Capital* are the firm total annual physical assets (in 1,000 euros); *Labor* are the firm total personnel costs (in 1,000 euros); *Sev. Fund* is the firm's total funds accumulated for severance pays (in 1,000 euros); *O.Services* are the firm total costs for outsourced services (in 1,000 euros). Financial variables are deflated using KLEMS deflators. $\mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})XPost$ ($\mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})XPost$) [$\mathbb{1}(P_{75} < Fisc.Rule)XPost$] is an indicator for the companies companies in the second (third) [forth] quartile of the distribution of the fiscal demand shock exposure computed as the ratio between the firm's value won in municipalities with fiscal rule and the firm's pre-fiscal demand shock revenues. In each of the columns, *Post* is an indicator for the years after 2008. Odd (even) columns report OLS (FE) estimates (with firm and year fixed effects). SEs are clustered at firm level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for procurement companies that won at least one auction before 2009 and observed between 2004 and 2011.

Table F.4: Effect of the demand shock on revenues. Non-parametric model.

Dep.Var.	Tot.Rev.	Tot.Rev.	A.Receivable	A.Receivable	Val.Proc. Won	Val.Proc. Won
Method	OLS	FE	OLS	FE	OLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})XPost$	-163.431	-187.385	552.106*	479.566*	-0.573**	-0.465**
	(524.155)	(317.225)	(284.151)	(280.649)	(0.232)	(0.222)
$\mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})XPost$	-320.544	-363.318	185.509	-1.617	-2.220***	-2.136***
	(479.472)	(258.414)	(189.255)	(180.517)	(0.251)	(0.240)
$\mathbb{1}(P_{75} < Fisc.Rule)XPost$	-51.659	17.055	-105.442	-180.443	-5.521***	-5.290***
	(479.873)	(261.078)	(180.009)	(151.551)	(0.317)	(0.311)
$\mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})$	108.416		811.342**		1.162***	
	(637.527)		(377.459)		(0.189)	
$\mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})$	-1,202.313***		-369.094*		3.394***	
	(376.177)		(219.512)		(0.188)	
$\mathbb{1}(P_{75} < Fisc.Rule)$	-2,640.281***		-823.335***		6.680***	
	(351.142)		(241.491)		(0.284)	
Post	33.841		277.283*		0.288*	
	(475.645)		(147.790)		(0.152)	
N.Firms		4,317		4,302		4,317
Observations	27,764	27,764	27,520	27,520	27,764	27,764
Company FE	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes
Mean Y	3001		1806		3.166	
St.Dev.Fisc.Rule	23.91		23.91		23.91	

Notes: The table reports estimates of the effects of exposure to the fiscal demand shock on firms revenues: *Tot.Rev.* are the total annual revenues (in 1,000 euros); *A.Receivable* are the account receivables *(Residui)*; *Value Proc. Won* is the value of procurement won in a year (in 100,000 euros). Financial variables are deflated using KLEMS deflators. $\mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})XPost$ ($\mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})XPost$) [$\mathbb{1}(P_{75} < Fisc.Rule)XPost$] is an indicator for the companies companies in the second (third) [forth] quartile of the distribution of the fiscal demand shock exposure computed as the ratio between the firm's value won in municipalities with fiscal rule and the firm's pre-fiscal demand shock revenues. In each of the columns, *Post* is an indicator for the years after 2008. Odd (even) columns report OLS (FE) estimates (with firm and year fixed effects). SEs are clustered at firm level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for procurement companies that won at least one auction before 2009 and observed between 2004 and 2011.

G Firm-level effects of the fiscal demand shock for firm incorporated in smaller municipalities

Table G.1: Effect of the demand shock on capital and labor. Firms incorporated in smaller municipalities.

Dep.Var.	Capital	Capital	Labor	Labor	N.Workers	N.Workers	O.Services	O.Services	Sev. Fund	Sev. Fund	Exit	Exit
Model	FE	FE-HT	FE	FE-HT	FE	FE-HT	FE	FE-HT	FE	FE-HT	FE	FE-HT
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Sample: Firms incorporated in 1k-10k Municipalities												
Fisc.Rule.Exp.XPost	-4.504***	-1.199***	0.014	0.393**	-0.038**	-0.031	1.404*	0.916	-0.069***	-0.014	0.001	0.022*
	(0.737)	(0.390)	(0.145)	(0.172)	(0.016)	(0.024)	(0.770)	(1.166)	(0.018)	(0.016)	(0.013)	(0.013)
N.Firms	1,316	1,316	1,316	1,316	1,272	1,272	1,316	1,316	1,313	1,313	1,316	1,316
Observations	8,596	8,596	8,596	8,596	5,152	5,152	8,596	8,596	8,303	8,303	8,596	8,596
Company FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Mean Y	610.6		341.3		19.60		962.1		24.83		1.396	
St.Dev.Fisc.Rule	20.20		20.20		20.20		20.20		20.20		20.20	
Eff.Fisc.Rule.Exp. (%)	-14.90	-3.969	0.0850	2.328	-3.876	-3.241	2.948	1.923	-5.644	-1.156	2.057	32.13
Sample: Firms incorporated in 3k-7k Municipalities												
Fisc.Rule.Exp.XPost	-5.964***	-1.589**	-0.082	0.549***	-0.075**	-0.060	1.839	2.565	-0.095***	-0.025	-0.012	0.039**
	(1.407)	(0.774)	(0.212)	(0.197)	(0.029)	(0.042)	(1.469)	(2.412)	(0.031)	(0.025)	(0.018)	(0.019)
N.Firms	609	609	609	609	587	587	609	609	607	607	609	609
Observations	3,965	3,965	3,965	3,965	2,384	2,384	3,965	3,965	3,818	3,818	3,965	3,965
Company FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes		
Year FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes		
Mean Y	707.8		353		20.43		999.4		25.85		1.387	
St.Dev.Fisc.Rule	20.27		20.27		20.27		20.27		20.27		20.27	
Eff.Fisc.Rule.Exp. (%)	-17.08	-4.553	-0.469	3.153	-7.406	-6.001	3.730	5.204	-7.427	-1.928	-17.72	56.87

Notes: The table reports estimates of the effects of exposure to the fiscal demand shock on firms capital and labor: *Capital* are the firm total annual physical assets (in 1,000 euros); *Labor* are the firm total personnel costs (in 1,000 euros); *Sev. Fund* is the firm's total funds accumulated for severance pays (in 1,000 euros); *O.Services* are the firm total costs for outsourced services (in 1,000 euros). Financial variables are deflated using KLEMS deflators. *Fisc.Rule.Exp.* represents the exposure to the fiscal demand shock computed as the ratio between the firm's value won in municipalities with fiscal rule and the firm's pre-fiscal demand shock revenues. In each of the rows, *Post* is an indication for the years after 2008. All the regressions include firm, year fixed effects and firm-specific linear trends (even columns). *Effect Fisc.Rule.Exp (%)* is the % effect of the fiscal demand shock. SEs are clustered at firm level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for procurement companies that won at least one auction before 2009 and observed between 2004 and 2011 and are incorporated in municipalities with population between 1k-10k.

Table G.2: Effect of the demand shock on revenues. Firms incorporated in smaller municipalities.

Dep.Var.	Tot.Rev.	Tot.Rev.	A.Receivable	A.Receivable	Val.Proc. Won	Val.Proc. Won
Method	FE	FE-HT	FE	FE-HT	FE	FE-HT
	(1)	(2)	(3)	(4)	(5)	(6)
	Sample: Firms incorporated in 1k-10k Municipalities					
Fisc.Rule.Exp.XPost	0.437	1.067	-4.823***	-3.189	-0.080***	-0.071***
	(2.309)	(2.474)	(1.811)	(2.296)	(0.009)	(0.023)
N.Firms	1,316	1,316	1,315	1,315	1,316	1,316
Observations	8,596	8,596	8,540	8,540	8,596	8,596
Company FE	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes
Mean Y	2713	2713	1559	1559	2.922	2.922
St.Dev.Fisc.Rule	20.20	20.20	20.20	20.20	20.20	20.20
Eff.Fisc.Rule.Exp. (%)	0.325	0.795	-6.250	-4.132	-55.50	-48.78
	Sample: Firms incorporated in 3k-7k Municipalities					
Fisc.Rule.Exp.XPost	1.711	4.919	-6.704**	-5.630	-0.071***	-0.059*
	(4.216)	(4.568)	(3.065)	(4.305)	(0.012)	(0.033)
N.Firms	609	609	609	609	609	609
Observations	3,965	3,965	3,942	3,942	3,965	3,965
Company FE	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes
Mean Y	2785	2785	1674	1674	2.845	2.845
St.Dev.Fisc.Rule	20.27	20.27	20.27	20.27	20.27	20.27
Eff.Fisc.Rule.Exp. (%)	1.246	3.580	-8.120	-6.819	-50.57	-42.23

Notes: The table reports estimates of the effects of exposure to the fiscal demand shock on firms revenues: *Tot.Rev.* are the total annual revenues (in 1,000 euros); *A.Receivable* are the account receivables *(Residui)*; *Value Proc. Won* is the value of procurement won in a year (in 100,000 euros). Financial variables are deflated using KLEMS deflators. *Fisc.Rule.Exp.* represents the exposure to the fiscal demand shock computed as the ratio between the firm's value won in municipalities with fiscal rule and the firm's pre-fiscal demand shock revenues. In each of the rows, *Post* is an indication for the years after 2008. All the regressions include firm, year fixed effects and firm-specific linear trends (even columns). *Effect Fisc.Rule.Exp (%)* is the % effect of the fiscal demand shock. SEs are clustered at firm level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for procurement companies that won at least one auction before 2009 and observed between 2004 and 2011 and are incorporated in municipalities with population between 1k-10k.

Table G.3: Effect of the demand shock on capital and labor. Non-parametric model. Firms incorporated in in smaller municipalities.

Dep.Var.	Capital	Capital	Labor	Labor	N.Wrks	N.Wrks	O.Ser.	O.Serv.	Sev. Fund	Sev. Fund	Exit	Exit
Method	FE	FE-HT	FE	FE-HT	FE	FE-HT	FE	FE-HT	FE	FE-HT	FE	FE-HT
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
					Sample: Firms incorporated in 1k-10k Municipalities							
$\mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})XPost$	-8.340	50.015	2.865	-6.705	0.248	0.112	-14.037	-16.329	1.373	0.244	-0.045	1.277
	(88.737)	(38.294)	(14.047)	(14.446)	(0.791)	(1.032)	(56.331)	(68.665)	(1.752)	(1.581)	(0.740)	(0.870)
$\mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})XPost$	-220.036***	-70.590	-14.305	0.505	-0.071	1.568	-70.985	-77.770	-1.948	-0.739	-0.321	0.600
	(82.148)	(54.844)	(16.861)	(15.441)	(0.948)	(1.118)	(68.763)	(82.781)	(1.890)	(1.607)	(0.743)	(0.810)
$\mathbb{1}(P_{75} < Fisc.Rule)XPost$	-302.529***	-78.226**	-3.046	24.333*	-1.255	-1.360	42.647	35.229	-3.669**	-0.396	0.820	2.753*
	(72.256)	(32.506)	(12.699)	(14.225)	(0.878)	(1.236)	(58.525)	(74.290)	(1.677)	(1.463)	(0.998)	(1.411)
N.Firms	1,316	1,316	1,316	1,316	1,272	1,272	1,316	1,316	1,313	1,313	1,316	1,316
Observations	8,596	8,596	8,596	8,596	5,152	5,152	8,596	8,596	8,303	8,303	8,596	8,596
Company FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean Y	610.6	610.6	341.3	341.3	19.60	19.60	962.1	962.1	24.83	24.83	1.396	1.396
St.Dev.Fisc.Rule	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20
					Sample: Firms incorporated in 3k-7k Municipalities							
$\mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})XPost$	-4.004	-4.004	4.217	4.217	1.244	1.244	116.751	116.751	-0.450	-0.450	1.653	1.653
	(69.936)	(69.936)	(15.121)	(15.121)	(0.969)	(0.969)	(113.617)	(113.617)	(2.343)	(2.343)	(1.270)	(1.270)
$\mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})XPost$	-175.786	-175.786	9.432	9.432	2.407*	2.407*	-28.270	-28.270	-1.747	-1.747	1.715	1.715
	(111.424)	(111.424)	(14.588)	(14.588)	(1.332)	(1.332)	(141.158)	(141.158)	(2.489)	(2.489)	(1.347)	(1.347)
$\mathbb{1}(P_{75} < Fisc.Rule)XPost$	-139.102**	-139.102**	41.319***	41.319***	-1.876	-1.876	181.220	181.220	-1.302	-1.302	5.010**	5.010**
	(63.911)	(63.911)	(15.040)	(15.040)	(1.813)	(1.813)	(137.277)	(137.277)	(2.362)	(2.362)	(2.343)	(2.343)
N.Firms	609	609	609	609	587	587	609	609	607	607	609	609
Observations	3,965	3,965	3,965	3,965	2,384	2,384	3,965	3,965	3,818	3,818	3,965	3,965
Company FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean Y	707.8	707.8	353	353	20.43	20.43	999.4	999.4	25.85	25.85	1.387	1.387
St.Dev.Fisc.Rule	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27

Notes: The table reports estimates of the effects of exposure to the fiscal demand shock on firms capital and labor: *Capital* are the firm total annual physical assets (in 1,000 euros); *Labor* are the firm total personnel costs (in 1,000 euros); *N.Wrks* is the number of workers. *Sev. Fund* is the firm's total funds accumulated for severance pays (in 1,000 euros); *O.Serv.* are the firm total costs for outsourced services (in 1,000 euros). Financial variables are deflated using KLEMS deflators. $\mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})XPost$ ($\mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})XPost$) [$\mathbb{1}(P_{75} < Fisc.Rule)XPost$] is an indicator for the companies companies in the second (third) [forth] quartile of the distribution of the fiscal demand shock exposure computed as the ratio between the firm's value won in municipalities with fiscal rule and the firm's pre-fiscal demand shock revenues. In each of the rows, *Post* is an indicator for the years after 2008. All the regressions include firm, year fixed effects and firm-specific linear trends (even columns). SEs are clustered at firm level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for procurement companies that won at least one auction before 2009 and observed between 2004 and 2011 and are incorporated in municipalities with population between 1k-10k (3k-7k).

Table G.4: Effect of the demand shock on revenues. Non-parametric model. Firms incorporated in smaller municipalities.

Dep.Var.	Tot.Rev.	Tot.Rev.	A.Receivable	A.Receivable	Val.Proc. Won	Val.Proc. Won
Method	FE	FE-HT	FE	FE-HT	FE	FE-HT
	(1)	(2)	(3)	(4)	(5)	(6)
	Sample: Firms incorporated in 1k-10k Municipalities					
$\mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})XPost$	-80.700	-80.700	-185.382	-185.382	-0.121	-0.121
	(250.521)	(250.521)	(244.232)	(244.232)	(0.597)	(0.597)
$\mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})XPost$	-62.659	-62.659	-196.035	-196.035	-1.454	-1.454
	(267.916)	(267.916)	(218.005)	(218.005)	(0.981)	(0.981)
$\mathbb{1}(P_{75} < Fisc.Rule)XPost$	65.973	65.973	-300.047	-300.047	-5.102***	-5.102***
	(235.735)	(235.735)	(215.060)	(215.060)	(1.311)	(1.311)
Observations	8,596	8,596	8,540	8,540	8,596	8,596
Number of id	1,316	1,316	1,315	1,315	1,316	1,316
Company FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean Y	2713	2713	1559	1559	2.922	2.922
St.Dev.Fisc.Rule	20.20	20.20	20.20	20.20	20.20	20.20
	Sample: Firms incorporated in 3k-7k Municipalities					
$\mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})XPost$	40.839	40.839	-45.188	-45.188	-0.706	-0.706
	(447.088)	(447.088)	(459.919)	(459.919)	(0.660)	(0.660)
$\mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})XPost$	130.808	130.808	-176.786	-176.786	-1.813	-1.813
	(463.760)	(463.760)	(356.353)	(356.353)	(1.410)	(1.410)
$\mathbb{1}(P_{75} < Fisc.Rule)XPost$	497.780	497.780	-485.088	-485.088	-3.870**	-3.870**
	(416.928)	(416.928)	(368.555)	(368.555)	(1.798)	(1.798)
Observations	3,965	3,965	3,942	3,942	3,965	3,965
Number of id	609	609	609	609	609	609
Company FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean Y	2785	2785	1674	1674	2.845	2.845
St.Dev.Fisc.Rule	20.27	20.27	20.27	20.27	20.27	20.27

Notes: The table reports estimates of the effects of exposure to the fiscal demand shock on firms revenues: *Tot.Rev.* are the total annual revenues (in 1,000 euros); *A.Receivable* are the account receivables *(Residui)*; *Value Proc. Won* is the value of procurement won in a year (in 100,000 euros). Financial variables are deflated using KLEMS deflators. $\mathbb{1}(P_{25} < Fisc.Rule.Exp. \leq P_{50})XPost$ ($\mathbb{1}(P_{50} < Fisc.Rule.Exp. \leq P_{75})XPost$) [$\mathbb{1}(P_{75} < Fisc.Rule)XPost$] is an indicator for the companies companies in the second (third) [forth] quartile of the distribution of the fiscal demand shock exposure computed as the ratio between the firm's value won in municipalities with fiscal rule and the firm's pre-fiscal demand shock revenues. In each of the rows, *Post* is an indicator for the years after 2008. All the regressions include firm, year fixed effects and firm-specific linear trends (even columns). SEs are clustered at firm level. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for procurement companies that won at least one auction before 2009 and observed between 2004 and 2011 and are incorporated in municipalities with population between 1k-10k (3k-7k).