

# Firm-Level Effects of Fiscal Rules: Evidence from Italy's Stability Pact\*

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## Abstract

We study the sectoral propagation of a fiscal rule that constrained the expenditure of Italian municipalities. The fiscal rule was tightened in 2008 and applied only to municipalities with population greater than 5,000. Using a difference-in-difference identification strategy, we estimate that affected municipalities chose to reduce infrastructure spending by 60-80% in response to this shock, while leaving current expenditure unchanged. 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 shock propagation beyond its size as a supply link in the input-output matrix. In addition, the fiscal rule shock is found to propagate disproportionately through those private-sector firms which are most exposed to the shocked sector. This finding suggests that shock transmission depends on the higher moments of the exposure distribution, beyond the average sectoral exposure that is represented by the input-output linkages. We use procurement-market data to rule out that our estimates are attenuated by spillover effects operating through competition in the procurement market.

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

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# 1 Introduction

When countries get worried about public debt, they introduce laws restricting government spending. These laws are called “fiscal rules.” Fiscal rules can target different budgetary aggregates (e.g., expenditure, debt, or specific expenditure items) either at the national or at the sub-national government level. More and more countries have at least one fiscal rule: from five in 1990 to eighty in 2012 (see Schaechter et al. 2012).

How does a fiscal rule propagate across the real economy? This paper aims to answer this question in the case of a fiscal rule that constrained the expenditure of Italian municipalities. This fiscal rule, called *Patto di stabilita’ dei comuni*, was tightened in 2008 and applied only to municipalities with population greater than 5,000. We study how municipalities reacted to this rule and then how their reaction propagated to the upstream sector (municipal procurement).

Our inquiry belongs to the literature on the propagation of shocks across sectoral networks (started by Long and Plosser 1983 and recently revived by Acemoglu et al. 2016). This literature posits that shocks propagate across sectors as a function of the intensity with which sectors trade with one another. For example, if the shipbuilding sector is hit by a demand shock, it will transmit the shock to its upstream sectors (labor, capital, and materials) proportionally according to the share of these factors in ship production. However, another perspective (not logically exclusive) is that shipbuilders should react to temporary shocks by adjusting investment more sharply than other production factors. This idea of investment as a pre-eminent propagation channel of temporary shocks has not been taken up by the recent literature on shock propagation, perhaps due to the fact that recent theoretical models of shock propagation do not feature intertemporal decisions. Our findings will show that municipalities adjust to the fiscal rule by cutting capital expenditure rather than current expenditure, and that firms in the upstream sector (infrastructure procurement) then react by cutting capital rather than labor. Thus our findings suggest that the capital sector can be a pre-eminent channel of shock propagation.

We begin by assessing how municipalities react to the shock caused by the fiscal rule. Using a difference-in-difference identification strategy, we estimate that the fiscal rule caused the average municipality to reduce its infrastructure spending by 60-80% depending on the empirical specification, but not to moderate its current spending. We explore the

possibility that this reduction reflected the impact of the financial crisis on municipal budgets but we ultimately discount this possibility. Thus, we conclude that municipalities indeed reacted to the fiscal rule by cutting capital expenditure disproportionately more than current expenditure.

We then turn to the upstream impacted sector, infrastructure firms, in order to trace the impact of municipal demand reduction on firm-level outcomes. For each firm operating in the infrastructure sector we compute an index of “exposure to treatment” as the fraction of the firm’s pre-2009 revenues which were earned in municipalities with population exceeding 5,000. We then compare the outcomes of firms that were more exposed to the fiscal rule, with the outcomes of less-exposed firms.

We find that, in response to the sharp drop in municipal demand, firms do not significantly reduce their employment. Furthermore, we find that the demand drop causes workers to withdraw money from their severance fund, which firms are then required to pay out.<sup>1</sup> This is an additional channel through which firms provide insurance to workers.

In contrast, capital accumulation declines sharply for firms that are highly exposed to the municipal sector. The multiplier for “Capital” equals 121% among the 25% most-exposed firms. This means that a 100% drop in demand was estimated to cause a 121% drop in capital for the top-25% most exposed firms. Notably, no significant drop was estimated for the less-exposed firm quartiles.

The multiplier for the probability of firm exit is significant for the third exposure quartile of firms only, as opposed to the fourth. The third-quartile multiplier for “exit” equals 592% , meaning that a fully-exposed firm is almost six times as likely to exit due to the fiscal rule, compared to a non-exposed firms. This large number must be understood in the context of a baseline exit probability which is small (about 2 percent).

The broad picture, then, is that of relatively small multipliers for most firms, and large capital and exit multipliers for the few most exposed firms. 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 rule. The nonlinearity of the estimated multipliers connects back to models of shock propagation. It indicates that what matters for shock propagation may not be so much the *average* exposure of one sector to another, as much

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<sup>1</sup> Italian labor law entitles workers to request early distribution once during their tenure.

as the *right tail* of the exposure distribution.

These firm-level effects are partly moderated by regional financial development and by firm size. Firms incorporated in more-financially developed regions shrink more when hit by the fiscal rule, perhaps reflecting the disadvantage of relying on external capital during a sectoral crisis.

We interpret the firm-level estimates as the causal effect of a decrease in demand for public infrastructure. A threat to this interpretation is the possibility of spillover effects operating through competition in the procurement market. A spillover effect exists if, after the introduction of the fiscal rule, exposed firms were to migrate in search of business to municipalities not affected by the fiscal rule. Such a migration would reduce a firm’s “exposure to treatment” while at the same time increasing market competition for supposedly non-treated firms; the combined effects would bias downward our estimates of the impact of the fiscal rule. 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.<sup>2</sup>

The rest of the paper is organized as follows. Section 2, describes the institutional background and the data. Section 3 describes the model. Sections 4-6 contain the results. Section 7 explores possible spillover effects operating through the procurement market. Section 8 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. Acemoglu et al. (2016) revived this literature but their theory abstracts away the role of investment. Accordingly, the empirical literature that builds

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<sup>2</sup> 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).

on Acemoglu et al. (2016) 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) for a recent review of this literature. In contrast, our findings suggest that investment plays a pre-eminent role in the transmission of some shocks, and furthermore, that not all firms transmit shocks equally: shock transmission in our data is done disproportionately by those firms that are most exposed to the “shocked” sector.

Grembi et al. (2015) study the impact of an earlier (2001) *Patto di Stabilita'* on municipal public finance.<sup>3</sup> 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 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 are not local public finance outcomes, but rather 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. Corsetti et al. (2014) seek to estimate the fiscal multiplier in Italian provinces. They instrument for municipal spending using judicial injunctions against Mafia-infiltrated municipal councils; these injunctions cause large, unanticipated, temporary contractions in local public spending. 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.

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. Their identification strategy relies on the time-series

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<sup>3</sup>Notably, investment expenditures were exempted from the *Patto* up to 2004.

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 large *demand* shock generated by the fiscal rule. Our findings are consistent with Guiso et al.'s (2005) view that the firm provides workers with wage insurance. In addition our analysis suggests that, within our specific sector, employment is also insured. Furthermore, we identify a new channel (the severance fund) through which workers use the firm as an insurance provider.

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). Interestingly, in our setting employment appears to be rather more resilient to a demand shock compared to the findings in Ferraz et al (2015). This discrepancy may reflect the difference in labor regulations between Brazil and Italy.

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,<sup>4</sup> 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 Institutional background, data, and descriptive evidence

In Italy, the large majority of municipal public infrastructures are provided by municipal administrations. Provision entails the construction and maintenance of roads, schools,

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<sup>4</sup> Collard-Wexler (2013), p. 1009.

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

## 2.1 Demand shock

We want to study the knock-on effect of the fiscal rule on the private sector. Thus, we study the effect of the fiscal rule on the publicly-procured portion of infrastructure expenditure. We can do this because we have data on the universe of municipal tenders for infrastructure during our sample period. The tender data were obtained from a private company which alerts procurement firms of upcoming tenders.

The demand shock is the *Patto di stabilita' dei Comuni*, a fiscal rule designed to check the growth in municipal public spending. Investment expenditures are not exempt from the *Patto* since 2004, i.e., no “golden rule” applies.<sup>5</sup> Throughout our sample period, the *Patto* only applied to municipalities with population greater than 5,000.

While versions of the *Patto* were in place prior to 2008,<sup>6</sup> during our sample period Panel A of Figure 2 reveals a discontinuous impact of the *Patto* in the year 2008. The presence of this discontinuity in 2008 will be supported empirically by means of falsification tests (see Section 4). We ascribe this discontinuity to a meaningful tightening the enforcement of the *Patto*. In 2008, the central government set penalties for non-compliant municipalities: substantial cuts in central government transfers, and an automatic 30% cut to the salary of mayors and city councillors.<sup>7</sup> At that time, the *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 will be thought of as “treated.” Figure 1 shows the distribution of treated and control municipalities. We expect the fiscal rule to cause a drop in procurement in treated municipalities only, and only after 2008.

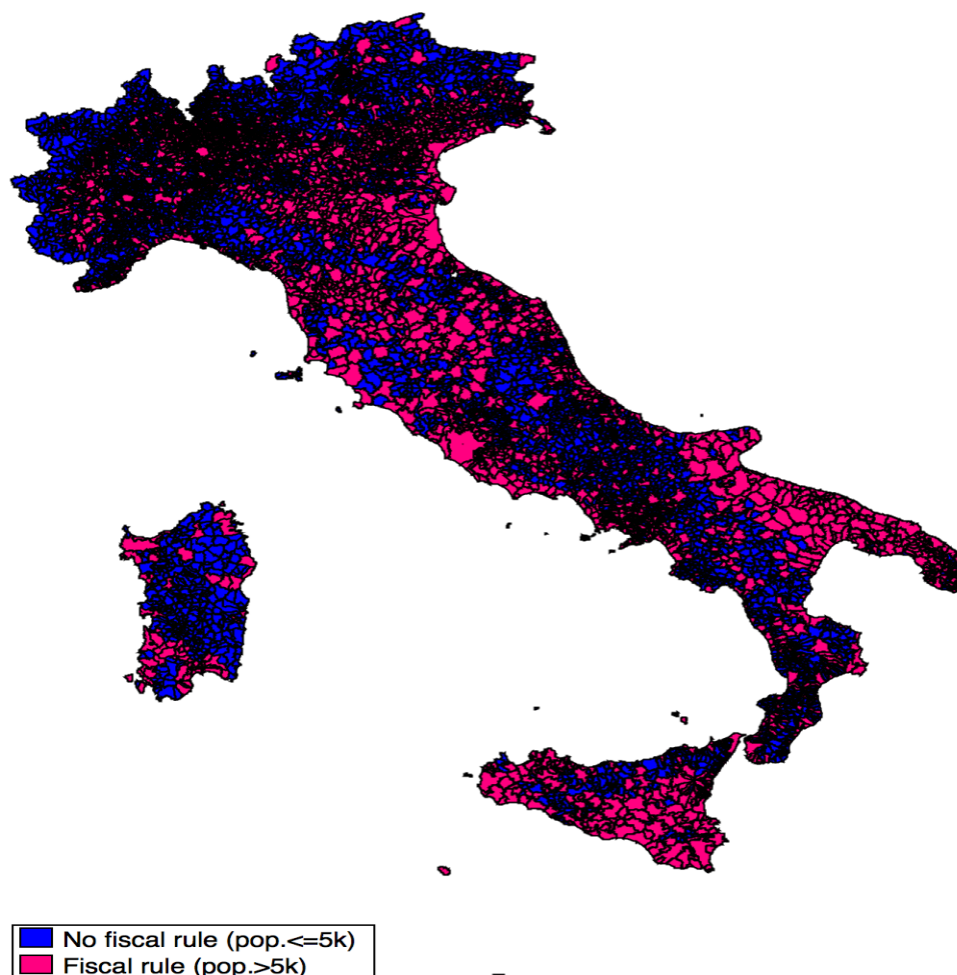
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<sup>5</sup>The so-called golden rule exempts public investment from spending cuts. For a discussion of the impact of the golden rule, see International Monetary Fund (2014), p. 110.

<sup>6</sup>E.g., Grembi et al. 2015 study the impact of a 2001 version.

<sup>7</sup>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.

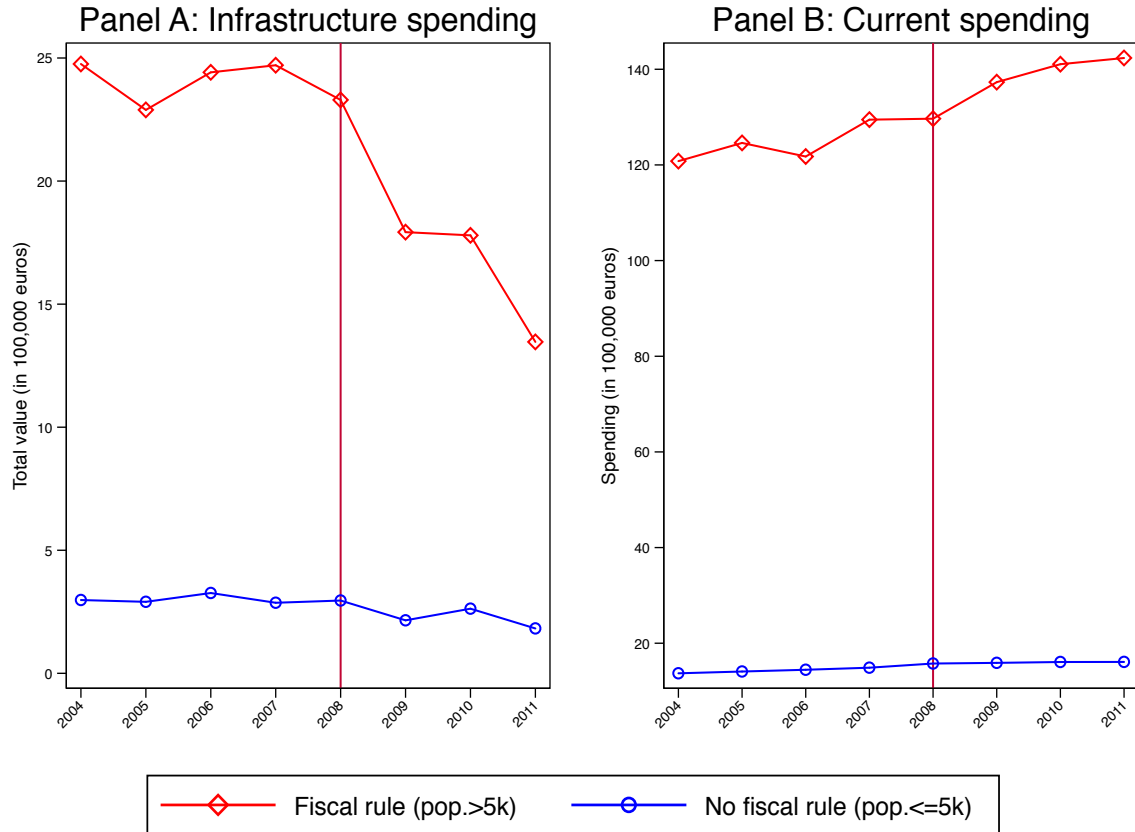
Panel A of Figure 2 depicts the value of public tenders for infrastructure in the average municipality. This value appears to drop after 2008, and to drop more sharply in the municipalities that are covered by the fiscal rule.<sup>8</sup> In contrast, the fiscal rule appears to have no impact on current spending (Figure 2 panel B). Because the fiscal rule appears to have a sharp impact on infrastructure spending but no discernible impact on current spending, in what follows we focus on the fiscal rule's effect on infrastructure spending

<sup>8</sup>According to the procurement law (*D.Lgs* 163/06), municipal procurement is usually planned every three years, but municipalities can adjust plans on yearly basis.



only.

Figure 2: Fiscal rule 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.

## 2.2 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 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 2.3 below.<sup>9</sup>

Before the fiscal rule takes effect, corporate revenues equal 3.049 million euros on average, only part of which originate from municipal procurement. Wages equal 395,000 euros. Profitability (EBITDA/Tot.Revenues) equals 8.8%. 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 define a firm's *exposure to the fiscal rule* as the fraction of the firm's pre-2009 revenues earned in municipalities with population greater than 5,000.<sup>10</sup> Figure 3 plots the frequency of firms by exposure to the fiscal rule. 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 4 reports the Kaplan-Meier estimate of the cumulative hazard of exiting within our post-2008 time window as a function of firm exposure to the fiscal rule. The sample is split according to whether a firm's exposure exceeds the median. The figure suggests that more-exposed firms tend to have a higher probability of exit.

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 (or exit) rate in the sector, 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  $t - 1$ .

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<sup>9</sup> 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.

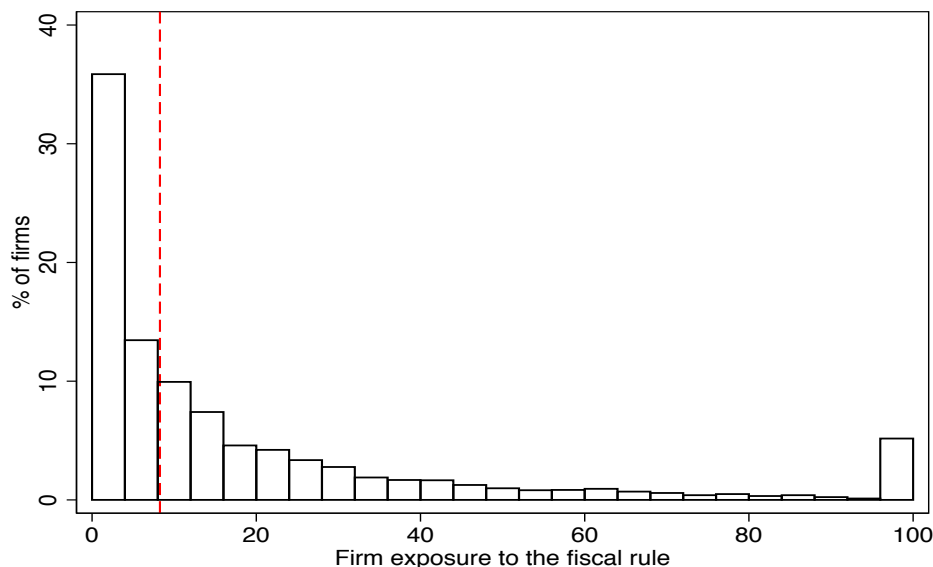
<sup>10</sup>This variable is constructed based on the procurement-market data described in Section 2.3 below. It can only be computed for the 4,317 companies that won at least one auction before the fiscal rule.

Table 1: Descriptive statistics (pre-fiscal rule)

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
Tot.Revenues (in 1,000)	3,049	11,341	216.1	1,364	6,068	16,161
EBITDA/Tot.Revenues (in %)	8.728	11.34	2.329	7.286	17.53	15,735
Severance Fund (in 1,000)	24.19	74.47	0.797	11.57	50.80	15,558
S.T.Acc.Rec.+Cash (in 1,000)	1,765	10,797	116.6	665.5	3,274	15,945
L.-T.Acc.Rec. (in 1,000)	1,628	6,972	0	242.9	3,061	15,945
Debt (in 1,000)	3,355	13,966	194.1	1,073	6,205	16,161
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 rule computed as the ratio between the firm's value won in municipalities with fiscal rule and the firm's pre-fiscal rule 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); *EBITDA/Tot.Rev.* is the ratio between the earning before taxes (EBITDA) and the total revenues (in %); *S.T.Acc.Rec.+Cash* (*L.T.Acc.Rec.*) are the short term (the long-term account receivables (*Residui*)) accounts receivable plus the cash; *Debt* are the firm total debt (in 1,000 euros); *Sev. Fund* is the firm's total funds accumulated for severance pays (in 1,000 euros); *TFP* is the firm's total facto productivity measured using the Olley and Pakes (1996) procedure; *Capital* are the firm total annual physical assets (in 1,000 euros); *Labor* are the firm total personnel costs (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 rule for procurement companies that won at least one auction before 2009 and observed between 2004 and 2011, for all Italian municipalities.

Figure 3: Heterogeneity in firm exposure to the fiscal rule



Notes: A firm's exposure to the fiscal rule 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.

These ratios proxy for entry and exit in the municipal procurement sector, and they have the advantage that partnerships are included. See Table 1 for summary statistics.

### 2.3 Procurement-market data

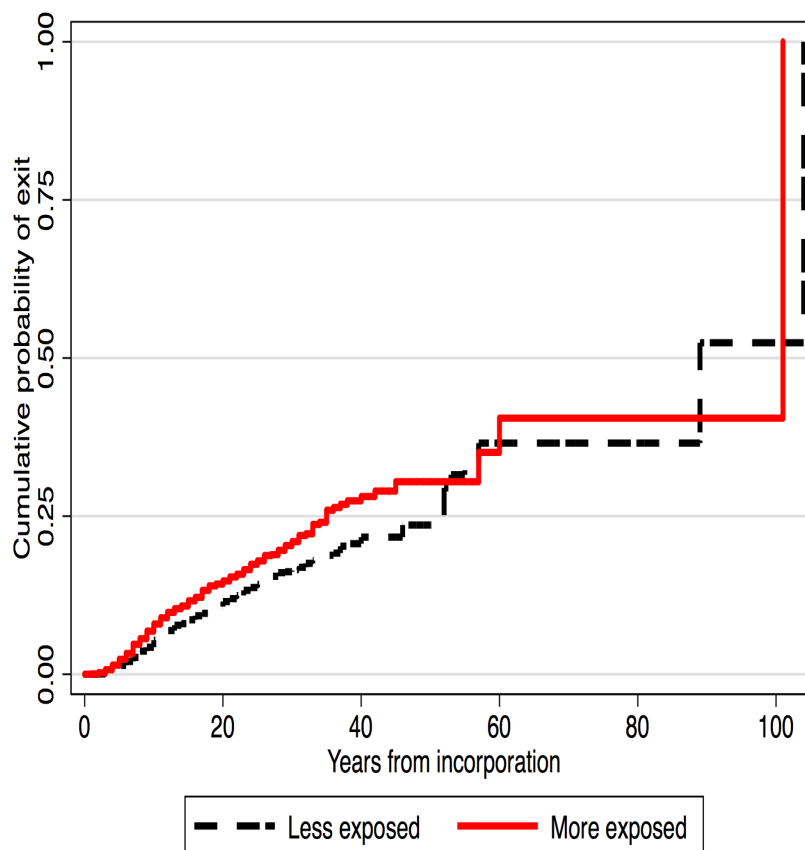
The procurement-market data were obtained from a private company which alerts procurement firms to upcoming tenders. Table 1 reports descriptive statistics of the procurement market.

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 single-attribute (i.e., technical and quality components of the offers are not evaluated).

Figure 4: Kaplan-Meier estimate of the cumulative hazard of exit for firm “more” and “less” exposed to the fiscal rule



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

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.<sup>11</sup>

### 3 Identification strategy and econometric model

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

<sup>11</sup>Refer to Coviello et al. (2016).

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:

$$y_{it} = \alpha + \delta \text{Fisc.Rule}_i X \text{Post}_t + \beta \text{Fisc.Rule}_i + \gamma \text{Post}_t + \varepsilon_{it}, \quad (1)$$

where  $\delta$  is our main coefficient of interest,  $\text{Fisc.Rule}_i$  is an indicator variable for municipalities with population above the 5,000 inhabitants,  $\text{Post}_t$  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.

This difference-in-difference design relies on two assumptions that we test in the data. First, we test whether treated and control municipalities share the same trend in the variables of interest before the fiscal rule (common trend assumption). Second, 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 rule. Under these two assumptions OLS estimate of  $\delta$  captures the causal effect of the fiscal rule on municipal outcomes. See Section 4 for empirical evidence supporting these assumptions.

Turning to firm-level outcomes, a key identification step is to translate a treatment for municipalities (fiscal rule) 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 rule*. This is a continuous variable constructed based on pre-2009 data: refer back to Section 2.2 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 it is possibly the crucial insight in this paper.

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

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

where the  $\text{Fisc.Rule.Exp}$  variable is the firm’s *exposure to the fiscal rule* variable defined in Section 2.2. We then add firm-specific and time fixed effects. Standard errors are clustered at firm level.

Since this specification compares more- and less-exposed firms, it is important to check

whether these two firm groups share the same trend in the dependent variables before 2009. See Section 5 for a discussion of the empirical evidence on the common trend assumption.

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

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

Treatment is now defined by the quartiles of the distribution of the exposure to the fiscal rule 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.

## 4 Impact of the fiscal rule on infrastructure spending

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 rule reduced demand for infrastructure by -79.5% on average. 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 rule is robust to the inclusion of these controls. In column 6 of Table 2 we add municipal-specific linear trends. In this specification the impact of the fiscal rule is somewhat smaller (-59.5%) and very precisely estimated. This is our preferred specification.

These estimates rely on a pre-fiscal rule parallel-trend assumption. This assumption is supported visually (see Panel A of Figure 2) and is formally tested by checking the

Table 2: Impact of the fiscal rule on infrastructure spending

Dep. Var.	Total Value of procurement					
Model	OLS (1)	FE (2)	FE (3)	FE (4)	FE (5)	FE-HT (6)
Fisc.Rule*Post	-6.825*** (1.170)	-6.825*** (1.170)	-7.192*** (1.818)	-6.413*** (1.073)	-5.941*** (1.696)	-5.106*** (1.656)
Post	-0.793*** (0.079)					
Fisc.Rule	21.019*** (2.113)					
Population			0.003 (0.004)		0.001 (0.004)	
Population <sup>2</sup>			-0.0001*** (0.00001)		-0.0001*** (0.00001)	
Transfers (in 100k)				0.010** (0.004)	0.012*** (0.003)	
Sample	All	All	All	All	All	All
Observations	48,120	48,120	48,120	47,914	47,914	48,120
Municipalities	6,015	6,015	6,015	6,015	6,015	6,015
Mean Y	8.589					
St.Dev. Y	52.26					
St.Dev. Y_btw	44.25					
St.Dev. Y_wth	27.82					
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 rule on the average 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 simulated 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). St.Dev. Y\_btw (\_wth) are the between and within standard deviations of the dependent variable. 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.

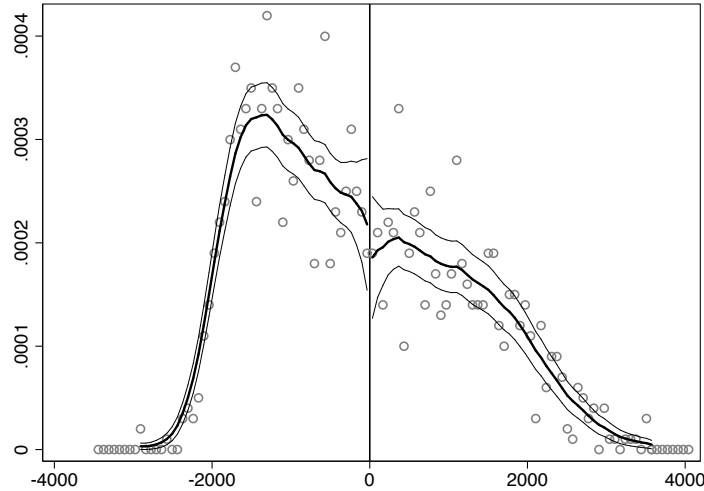
statistical significance of the interaction term *Fisc.Rule\*Year* in a model where municipal demand for infrastructure is regressed on: a linear trend; the fiscal rule dummy; and the interaction term; in the pre-fiscal rule sample. Column 1 of Table 3 shows that the estimated coefficient of the interaction term is small and not statistically different from zero. Therefore the parallel-trend assumption is not rejected.



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 the 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 3 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.

A further question is whether the estimates are confounded by selection out of treatment by municipalities. In Figure 5 we test for the possibility that municipalities sort below the 5,000 municipal threshold. The figure indicates no evidence of any statistically significant jump in the distribution of the municipal population around the 5,000 population threshold.<sup>12</sup> Thus we find no evidence of no sorting around the threshold, and hence no selection out of treatment.

Figure 5: 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.

<sup>12</sup>Results, available on request, are robust to different selections of samples around the threshold.

Table 3: Check of common-trend and no-anticipation assumptions

Test	Common Trend Assumption	Leads&Lags
Municipalities	All (1)	All (2)
Fisc.Rule*Year	-0.103 (0.502)	
<i>Leads</i>		
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)
<i>Lags</i>		
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
<i>p-value</i> 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.

The institutional design of the fiscal rule is expected to generate a discontinuous spending behavior at the 5,000 population threshold. Does this discontinuity exist in the data? Given our econometric specification, the estimated coefficient of the *Fisc.Rule* could reflect a fiscal shock that: (a) happens after 2008 and; (b) whose impact is increasing in

population size. If so, then our estimates might erroneously be attributing to the 5,000 threshold an heterogeneous – but smooth around the threshold – time-varying effect. To address this concern we now compare municipalities that are relatively close to the threshold: those with population between 3,000 and 7,000. For this sample, Figure B.1 panel A shows that, as in the full sample, infrastructure spending drops more sharply above the 5,000 threshold, while panel B shows no sharper drop in current spending.<sup>13</sup> Table 4 shows that in this restricted sample: the drop in the infrastructure spending remains negative and statistically significant at the actual threshold (column 4); and there is no statistically significant effect at placebo thresholds located either below the threshold (columns 1-3) or above the threshold (columns 5-7). These findings suggest that there is indeed a discontinuity in infrastructure spending at the 5,000 population threshold.<sup>14</sup>

Table 4 (column 4) shows that the effect of the fiscal rule (-20%) is smaller in the restricted than in the total sample. This smaller estimate indicates that the effects of fiscal rule are heterogeneous by population size, as one might expect. Treatment heterogeneity is not a concern because ultimately we are interested in the *average treatment effect*: the aggregate impact of the fiscal rule on the entire procurement sector.

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<sup>13</sup> Even non-fiscal rule municipalities experience a drop of infrastructure spending after 2008. We attribute this drop to a decrease in central government transfers to municipalities. In our regressions we control for total transfers to municipalities.

<sup>14</sup> Table B.1 further the common-trend assumption is satisfied (column 1); and that there are no anticipated effects of the policy in this restricted sample (column 2).

Table 4: Placebo test: effect only at actual threshold not at simulated thresholds

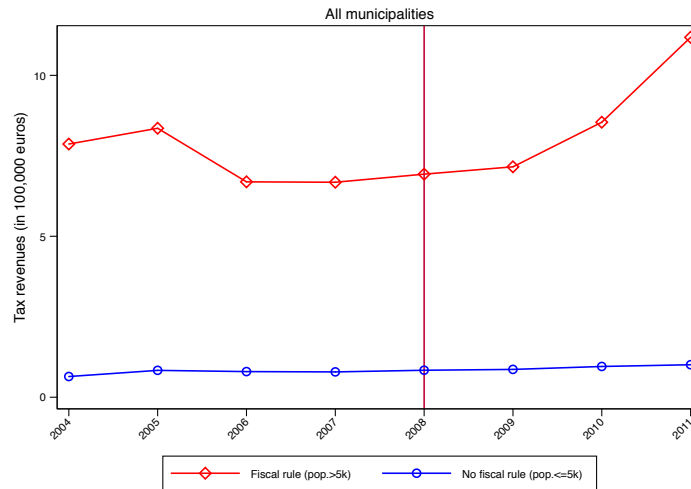
Dep. Var.	Total value of procurement						
	3.5k Municipalities (sample)	4k 3k-5k	4.5k 3k-5k	5k 3k-7k	5.5k 5k-7k	6k 5k-7k	6.5k 5k-7k
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Fisc.Rule*Post	0.087 (0.399)						
Fisc.Rule*Post		0.304 (0.447)					
Fisc.Rule*Post			-0.225 (0.615)				
Fisc.Rule*Post				-0.936** (0.441)			
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 outcome	4.388	4.388	4.388	5.034	6.222	6.222	6.222
St. Dev.	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. 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.

A final question relates to the interpretation of the demand shock. We have established that there is a demand shock which hits after 2008 and is discontinuous at the 5,000 population threshold. We interpret this shock as being caused by the fiscal rule. Alternatively, one could imagine that the shock might reflect the 2008 financial crisis reducing municipal tax revenues, thereby causing the drop in spending. We believe this interpretation is not warranted because we verify that municipal tax revenue *increased more* for larger

municipalities after 2008: see Figure 6.<sup>15</sup> This finding goes against the hypothesis that the differential drop in infrastructure spending in municipalities with population above 5,000 was driven by a differential drop in municipal tax revenues in these municipalities.<sup>16</sup>

Figure 6: 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.

## 5 Performance of procurement firms

We seek to estimate the effects of the fiscal rule on the performance of firms operating in the infrastructure procurement sector. We start with a sample consisting of all AIDA firms that won at least one infrastructure tender before 2009, as discussed in Section 2.2. This dataset contains the financial information of 4,317 firms. The dataset is then augmented by merging in firm-level procurement-market outcomes from the procurement-market database. The merged dataset allows us to compute the variable which we have called *exposure to the fiscal rule* (fraction of a firm's pre-2009 revenues which originated from a municipality with population greater than 5,000).

<sup>15</sup>Figure B.2 plots municipal tax revenue for municipalities with population between 3,000 and 7,000.

<sup>16</sup> Of course the financial crisis did hit Italy in 2008, and it probably did impact municipal infrastructure spending through reduced central government transfers. This is why in our specification we control directly for government transfers.

We stratify firms according to the variable “Fiscal Rule Exposure,” a time-invariant variable that is interpreted as “treatment intensity.” Firms that are more “exposed to the fiscal rule” are expected to be more impacted by the fiscal rule. Refer to Section 3 for the empirical specification.

How large of an effect on balance sheets should we expect exposure to the fiscal rule to have? Here is a back-of-the-envelope calculation. To fix ideas, let’s say that the fiscal rule decreased infrastructure procurement by 70% in a treated municipality – a mid-range value of the estimates from Section 4. The median firm has an 8% exposure to the fiscal rule, which implies that after the fiscal rule is introduced this firm’s revenues should drop by 5.6% (the result of  $70\% \times 8\%$ ). A comparison firm with one more standard deviation of exposure to the fiscal rule has an exposure of 32%, which implies that after the fiscal rule is introduced this firm’s revenues would drop by 22.4%. Therefore, we should expect one additional standard deviation of exposure to the fiscal rule to decrease revenues by 16.8%. This back of the envelope calculation is in the ballpark of the estimated effects in Sections 5.1 - 5.3 below.

## 5.1 Capital accumulation and labor

Exposure to the fiscal rule appears to shrink physical assets accumulation. Based on Table 5, column 2 one standard deviation of exposure to the fiscal rule 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.

Whereas physical capital shrinks roughly proportional to revenues, human capital appears to hold steady in the face of the revenue shock. Columns 4 and 6 of Table 5 show no significant impact of exposure to the fiscal rule on two different measures of employment: wages (col. 4) and number of workers (col. 6). Thus, firms appear to be providing workers with a form of insurance.

Furthermore, Table 5 column 8 shows that the fiscal rule 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 rule decreases severance fund assets by 6.9%.<sup>17</sup> These

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<sup>17</sup>  $23.91 * (0.078) = 1.86$ , corresponding to a drop of 1.8 thousand euros, or 6.9% of severance funds assets.

payouts represent an additional channel through which firms provide insurance to workers.

Our findings are consistent with Guiso et al. (2005), who 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). Our findings are consistent with the view that firms insure their employees' wages, and in addition they suggest that the employment level is similarly preserved – at least for firms that do not close down. Furthermore, we identify an additional channel (the severance fund) through which workers use the firm as an insurance provider.

Table 5: Capital and labor

Dep.Var.	Capital	Capital	Labor	Labor	N.Workers	N.Workers	Sev.Fund	Sev.Fund
Model	OLS	FE	OLS	FE	OLS	FE	OLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fisc.Rule.Exp.XPost	-4.067*** (0.694)	-4.504*** (0.597)	0.239 (0.326)	0.012 (0.204)	0.069* (0.037)	-0.016 (0.019)	-0.056*** (0.015)	-0.078*** (0.013)
Fisc.Rule.Exp.	-6.656*** (0.609)		-5.446*** (0.612)		-0.335*** (0.048)		-0.332*** (0.032)	
Post	371.035*** (45.677)		6.408 (18.419)		-1.643 (1.876)		8.323*** (0.708)	
N. Firms		4,317		4,317		4,095		4,305
Observations	27,764	27,764	27,764	27,764	16,135	16,135	26,471	26,471
Company FE	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Mean Y	584.4		397.2		24.63		27.09	
St.Dev. Y	3209		1690		107.3		82.94	
St.Dev. Y_btw	3139		1655		88.33		75.82	
St.Dev. Y_wth	923.3		292.5		23.73		19.77	
St.Dev.Fisc.Rule	23.91		23.91		23.91		23.91	

Notes: The table reports estimates of the effects of exposure to the fiscal rule 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); *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 rule computed as the ratio between the firm's value won in municipalities with fiscal rule and the firm's pre-fiscal rule revenues. In each of the rows, *Post* is an indication for the years after 2008. Odd (even) columns report OLS (FE) estimates (with firm and year fixed effects). St.Dev. Y\_btw (\_wth) are the between and within standard deviations of the dependent variable. 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.

## 5.2 Birth-death dynamics

This section explores the impact of the fiscal rule on birth-death dynamics in the infrastructure procurement sector. 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 rule* then Figure 4 on page 12 has already provided a first rough cut. In Table 6, we present point estimates of the impact of the exposure to the fiscal rule. 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 decrease 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.<sup>18</sup>

If we want to know about the dynamics of *all* firms including partnerships, then it is expedient to define a firm to be “treated by the fiscal rule” if it is incorporated in a fiscal rule-municipality. The advantage of this definition is that we can leverage the Chambers of Commerce data, which also covers partnerships (these data were discussed in Section 2.2; see Table 1 for summary statistics.) The disadvantage of this definition is that it 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 7 column 2, panel A, indicates that the fiscal rule had a negative effect on the entry rate in the construction sector equal to -0.77 percentage points. After dividing by the baseline entry rate of 8%, we get a 9.4% decrease in the entry probability relative to its baseline. Table 7 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 7, 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.<sup>19</sup>

After dividing by the baseline entry and exit rates, we estimate that both the birth

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<sup>18</sup>We cannot provide results on the effect of *Fisc.Rule* on the entry rate in Table 6 because the definition



Table 6: Firm exit

Dep.Var.	Exit	Exit
Model	OLS	FE
	(1)	(2)
Fisc.Rule.Exp.XPost	0.002 (0.008)	0.014* (0.008)
Fisc.Rule.Exp.	0.007* (0.003)	
Post	2.682*** (0.229)	
N.Firms		4,317
Observations	27,764	27,764
Company FE	No	Yes
Year FE	No	Yes
Mean	2.139	
St.Dev. Y	14.47	
St.Dev. Y_btw	8.982	
St.Dev. Y_wth	12.99	
St. Dev. <i>Fisc.Rule</i>	23.91	

Notes: The table reports estimates of the effects of the fiscal rule on firm exit defined as the probability of exit in a given year. *Fisc.Rule.Exp.* represents the exposure to the fiscal rule computed as the ratio between the firm's value won in municipalities with the fiscal rule and the firm's pre-fiscal rule revenues. In each of the rows, *Post* is an indication for the years after 2008. Odd (even) columns report OLS (FE) estimates (with firm and year fixed effects). St.Dev. Y\_btw (-wth) are the between and within standard deviations of the dependent variable. 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.

rate (-21%) and the death rate (+161%) are significantly impacted by the fiscal rule with the expected sign.<sup>20</sup> Overall, it appears that firm dynamics are impacted by the fiscal rule in the way one would expect: firms that are exposed to the fiscal rule 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.

of exposure to treatment limits the sample to corporations that existed before the fiscal rule was adopted.

<sup>19</sup> The comparability only goes so far. Table 7 indicates that the exit rate in our AIDA construction-sector sample is 0.3%, 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 that partnerships exit more readily than corporations, perhaps because they lack limited liability.

<sup>20</sup> After controlling for municipal-specific trends, the two estimates of the fiscal rule's impact drop to -20% and +66% respectively, see Table 7 (Panel B).

Table 7: Impact of the fiscal rule on firm dynamics

Dep.Var.	Entry Rate		Exit Rate		Entry Rate AIDA		Exit Rate AIDA	
	OLS (1)	FE (2)	OLS (3)	FE (4)	OLS (5)	FE (6)	OLS (7)	FE (8)
Panel A: Baseline Model								
Fisc.Rule*Post	-0.769*** (0.125)	-0.770*** (0.125)	0.091 (0.096)	0.079 (0.095)	-0.195*** (0.034)	-0.196*** (0.035)	0.487*** (0.027)	0.488*** (0.027)
Post	-2.178*** (0.112)		0.064 (0.085)		-0.101*** (0.029)		0.505*** (0.019)	
Fisc.Rule	0.598*** (0.100)		0.652*** (0.067)		0.651*** (0.031)		0.038*** (0.005)	
Panel B: Municipal Specific Time Trends								
Fisc.Rule*Post		-0.508** (0.242)		0.148 (0.189)		-0.181*** (0.068)		0.199*** (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	8.143		7.354		0.934		0.303	
St.Dev. Y	8.570		6.385		2.306		1.266	
St.Dev. Y_btw	3.613		3.055		1.071		0.503	
St.Dev. Y_wth	7.786		5.816		2.042		1.176	
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 rule 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). St.Dev. Y\_btw (\_wth) are the between and within standard deviations of the dependent variable. 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.

### 5.3 Heterogenous response by financial development and firm size

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

C.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 rule 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 rule. This effect may reflect the disadvantage of relying on external capital during a sectoral crisis.

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

In sum, larger firms shrink more when hit by the fiscal rule, and moreover they seem to translate some of the fiscal rule shock onto their employees’ wages. We cannot establish that they also terminate workers in response to the fiscal rule, at least at conventional levels of statistical significance. This last result may reflect the fact that larger firms do not terminate workers, or that the “number of workers” variable is frequently missing from the AIDA data.

## 5.4 Heterogeneous trends

A required assumption for the causal interpretation of the estimated coefficients is a common-trend assumption before the introduction of the fiscal rule. This is necessary because the key coefficient  $\delta$  in specification (2) is estimated off of the comparison between more- and less-exposed firms. In Appendix D 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.” A large estimated effect would suggest that more-exposed firms have a large pre-2009 time trend, compared to less-exposed firms. This test is performed in the even columns in Table D.1 in Appendix D. The majority of the estimated coefficients are not significantly different from zero. But some pre-trend coefficients are significantly different from zero.

Therefore, in Table D.2 we re-estimate the baseline model (2) allowing for firm-specific trends. For the variables that show a pre-trend, the new estimates have the same sign but, generally, smaller magnitude. The one exception is “Labor” which, after controlling for pre-trends becomes statistically significant. Our takeaway from this analysis is that accounting for pre-trends has an impact on the magnitude of the estimated coefficients. So, in the next Section 6 we will allow for firm-specific trends.<sup>21</sup>

## 6 Multipliers by exposure quartile

The previous section’s estimates of the effect of the fiscal rule was based on a linear model: the estimated coefficients captured the average effect of the fiscal rule across all exposed firms. In this section we explore whether the effects of the fiscal rule are nonlinear in the “exposure” variable, by estimating model (3). 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  $\beta_3$ , in Table E.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 the 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 70% (refer to Table 2); accordingly, the effect of a 100% decrease in municipal expenditure (the fiscal multiplier) can be imputed by  $85\% \cdot (100/70) = 121\%$ .

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<sup>21</sup>In Appendix F we find comparable evidence when we restrict the sample only to firms incorporated in municipalities with population below 10,000, and only in municipalities with population between 3,000 and 7,000.

The estimates are reported in Appendix E. In light of the findings in Section 5.4, all our estimates include firm-specific trends.<sup>22</sup> In general the estimated coefficients (see Table E.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: 121% for capital. The third-quartile multiplier for “exit” equals 592% , meaning that a fully-exposed firm is almost six times as likely to exit due to the fiscal rule, 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).

## 7 Checking for treatment spillovers in the procurement market

We have documented that the fiscal rule had a robust impact on the demand for public works, but a comparatively muted impact 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 rule might, after 2008, start bidding more often in municipalities that were not hit by the fiscal rule. If that were so, then pre-fiscal rule 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 rule on firms.

To explore the economic significance of any spillovers, we leverage the procurement market data. Table 8 presents two specifications, both based on municipal-level averages: without (panel A) and with (panel B) controls for municipal-level trends. Columns 1-4 confirm the large impact of the fiscal rule on the demand for public works. Columns 5, 6 look at the percentage of tender value which is road construction – a proxy for demand

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<sup>22</sup>Not allowing for firm-specific trends results in estimates that are generally larger; compare estimates in the present section with those in Table E.2.

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 rule, because contests held by municipalities hit by the fiscal rule 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 rule, if any, are slight.

Table 8: 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	
	OLS (1)	FE (2)	OLS (3)	FE (4)	OLS (5)	FE (6)	OLS (7)	FE (8)	OLS (9)	FE (10)	OLS (11)	FE (12)
Panel A: Baseline Model												
Fisc.Rule*Post	-1.705*** (0.182)	-1.705*** (0.182)	0.807*** (0.252)	0.827*** (0.247)	0.352 (0.987)	0.593 (1.046)	4.845*** (1.385)	3.242** (1.615)	1.349*** (0.334)	1.300*** (0.362)	2.038 (1.408)	1.847 (1.670)
Post			1.310*** (0.133)		-1.839*** (0.713)		5.162*** (0.927)		2.912*** (0.255)		6.019*** (1.057)	
Fisc.Rule			1.623*** (0.084)		0.512 (0.555)		7.915*** (0.637)		1.547*** (0.237)		-17.312*** (0.913)	
Panel B: Municipal specific time trends												
Fisc.Rule*Post		-0.579*** (0.157)		0.262 (0.417)		-1.795 (2.176)		1.399 (2.964)		0.668 (0.659)		3.115 (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	2.264		3.841		27.26		32.34		18.59		57.30	
St.Dev. Y	6.902		6.696		36		30.95		9.260		35.19	
St.Dev. Y_btw	5.957		4.718		24.22		23.11		7.716		28.69	
St.Dev. Y_wth	3.488		5.601		30.50		23.48		6.140		25.12	
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 rule 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). St.Dev. Y\_btw (\_wth) are the between and within standard deviations of the dependent variable. 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.

## 8 Conclusions

This paper has quantified the propagation of a fiscal rule designed to constrain the spending of Italian municipalities. We found that in response to this shock to the municipal government sector, municipalities reduced infrastructure spending by 60-80% in the following few years; current spending, however, was largely unaffected. In the upstream private sector, i.e., the infrastructure procurement sector, firms reacted to the demand shock by cutting capital rather than labor.

In general, these findings indicate that the capital/investment sector can be a pre-eminent channel of shock propagation, playing a much larger role than its relative contribution to the factor shares. This makes sense from an intertemporal smoothing perspective: cutting investment rather than consumption would be the dynamically optimal response to a transitory shock. Nevertheless, this point has not so far been noted in the empirical propagation literature, and it suggests that shocks which are seen as temporary may be transmitted through different channels compared to permanent ones.

A second key finding is that the propagation of shocks in the private sector is disproportionately mediated by those firms who 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 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 shock transmission, in addition to the average sectoral exposure that is represented by the input-output linkages.

What general lessons from a policy perspective? We find that a fiscal rule on (local) government disproportionately propagates through the investment channel, both in the public sector (municipalities) and then in turn in the private sector (procurement firms). This effect is probably intuitive, and first-order, to policy makers. In fact, policy makers sometimes enact “golden rules,” i.e., fiscal rules that expressly exempt investment, precisely in order to prevent the disproportionate propagation of a fiscal rule through the investment channel. But golden rules have drawbacks: they distort the government’s consumption/investment patterns, and they may be gameable by governments. So it is interesting that, without a golden rule, our paper documents that a very sizable cut in public



investment expenditures is absorbed quite well by the infrastructure sector as a whole because most procurement firms are revenue-diversified. So the general lesson is that golden rules may not be needed when most procurement-sector firms are revenue-diversified, as is the case in Figure 3.

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# For Online Publication Appendix

## A Variables, Descriptions, and Sources

Variable	Description	Source
<b>Municipalities</b>		
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 tender. 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 <i>Unioncamere</i> .
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 <i>Unioncamere</i> .
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: <i>Totale spese correnti (conto capitale), impegni</i>
Population	Is the municipal population.	National Institute of Statistics (ISTAT).
<b>Firm balance-sheet</b>		
Exit	Probability of exit in a given year obtained with the year fo last official submission of the balance-sheet.	AIDA. Variable: <i>Anno ultimo bilancio</i> .
Severance Fund	Is the firm's total funds accumulated for severance pays (in 1000 euros).	AIDA. Variable: <i>Fondo di trattamento fine rapporto lavoro</i> .
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: <i>Totale Immobilizzazioni Materiali</i> .
Labor	Total annual personnel costs (in 1000 euros).	AIDA. Variable: <i>Totale salari e stipendi</i> .
N.Workers	Number of workers.	AIDA. Variable: <i>Dipendenti</i> .
Tot.Rev.	Are the total annual revenues (in 1000 euros).	AIDA. Variable: <i>Ricavi, vendite, e prestazioni</i>
$\frac{EBITDA}{Tot.Rev.}$	Ratio between earnings before tax and the total annual revenues multiplied by 100.	AIDA. Variable: <i>risultato operativo+totammesval</i>
S.T.Acc.Rec.+Cash	Are the cash and the short term accounts receivables (in 1000 euros).	AIDA. Variable: <i>Attivo Circolante-Rimanenze</i> .
L.T.Acc.Rec.	Are the firm total annual amount of non-completed works (in 1000 euros).	AIDA. Variable: <i>Totale rimanenze</i> .
Debt	Are the firm annual total debt (in 1000 euros).	AIDA. Variable: <i>Totale debiti</i> .

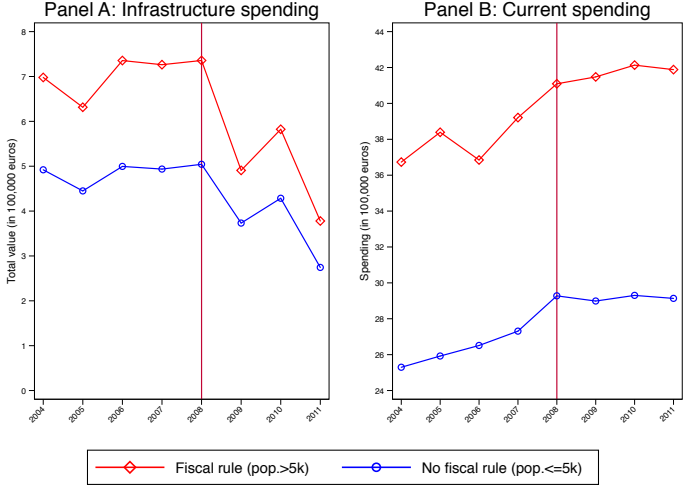
## B Additional tables and figures

Table B.1: Check of common-trend and no-anticipation assumptions around the threshold

Test	Common Trend Leads&Lags Assumption	
	3k-7k (1)	3k-7k (2)
Fisc.Rule*Year	0.097 (0.172)	
<i>Leads</i>		
Fisc.Rule*2005		-0.193 (0.645)
Fisc.Rule*2006		0.302 (0.756)
Fisc.Rule*2007		0.269 (0.752)
Fisc.Rule*2008		0.256 (0.788)
<i>Lags</i>		
Fisc.Rule*2009		-0.884 (0.769)
Fisc.Rule*2010		-0.520 (0.858)
Fisc.Rule*2011		-1.023 (0.696)
Observations	7,485	11,976
Municipalities	1,497	1,497
<i>p-value</i> Leads		0.852
Municipal FE	YES	YES
Year FE	NO	YES

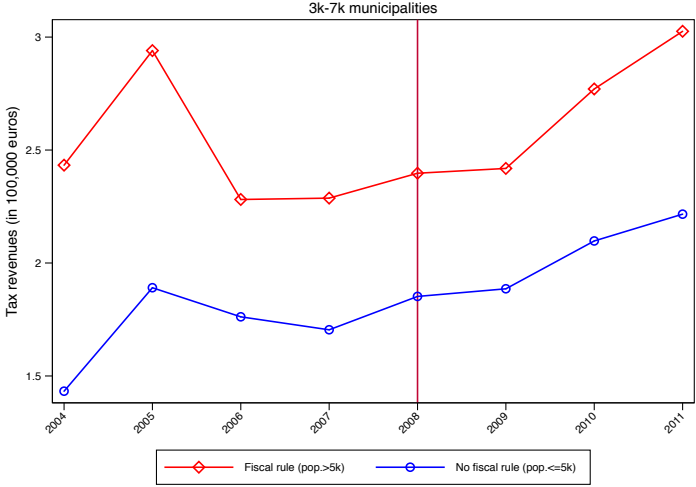
Notes: The table reports estimates of the effects of the fiscal rule on the average annual total value of procurement for public works in all Italian municipalities. In each of the rows, *Fisc.Rule* is an indicator variable for municipalities with population above the fiscal rule population threshold (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 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 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 with population between 3,000 and 7,000.

Figure B.1: Fiscal rule associated with drop in infrastructure spending (investment) but not with drop in current spending (consumption), around the threshold



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 3,000 and 7,000 inhabitants.

Figure B.2: Tax revenues in 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 3,000 and 7,000 inhabitants.

## **C Heterogenous response by financial development and firm size**

In Table C.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 rule 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 C.1 panel B we interact our measure of exposure with a firm's size (average yearly revenue before the fiscal rule 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 C.1: Financial development, firm size and responses to the fiscal rule

Dep.Var.	Capital	Labor	N.Workers	Sev. Fund	Exit
Model	FE (1)	FE (2)	FE (3)	FE (4)	FE (5)
Panel A: Financial Development					
Fisc.Rule.Exp.XPostXFin.Dev.	-11.3696*** (3.833)	-1.5410 (1.370)	-0.1226 (0.129)	-0.2616*** (0.080)	0.0408 (0.050)
N.Firms	3,515	3,515	3,336	3,504	3,515
Observations	22,654	22,654	13,312	21,616	22,654
Mean Y	606.2	413.2	25.44	28.06	2.159
St. Dev. Y	3488	1851	117.3	89.90	14.53
St.Dev.Fisc.Rule.Exp.	22.85	22.85	22.85	22.85	22.85
St.Dev.Fin.Dev	0.207	0.207	0.207	0.207	0.207
Panel B: Size of the Firm					
Fisc.Rule.Exp.XPostXTot.Rev.	-0.0040 (0.015)	-0.0062* (0.003)	-0.0002 (0.001)	-0.0001 (0.001)	-0.0000 (0.001)
N.Firms	4,317	4,317	4,095	4,305	4,317
Observations	27,764	27,764	16,135	26,471	27,764
Mean Y	606.2	413.2	25.44	28.06	2.159
St.Dev. Y	3488	1851	117.3	89.90	14.53
St.Dev.Fisc.Rule.Exp.	22.85	22.85	22.85	22.85	22.85
St. Dev. Tot.Rev.	1362	1362	1362	1362	1362
Company FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Notes: The table reports estimates of the effects of exposure to the fiscal rule 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); *Exit* is defined as the probability of exit in a given year. Inputs and outputs are deflated using KLEMS deflators. In Panel A, *Fisc.Rule.Exp.XPostXFin.Dev.* is a triple interaction term between the exposure to the fiscal rule computed as the ratio between the firm's value won in municipalities with fiscal rule and the firm's pre-fiscal rule 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.* In Panel B, *Fisc.Rule.Exp.XPostXTot.Rev.* is an interaction term between the exposure to the fiscal rule computed as the ratio between the firm's value won in municipalities with fiscal rule and the firm's pre-fiscal rule revenues, the dummy post, and the indicator for pre-fiscal rule average annual total revenues of the firm. In each column the model includes interaction terms between *Fisc.Rule*, *Post*, and *Tot.Rev.*. 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.



## D Pre-fiscal rule differences and dynamics of exposed firms

In this Appendix we first examine 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 ( $\delta$  in specification (2) ) because that specification includes firm-level fixed effects.

We also check whether more- and less-exposed firms share the same trend in the firm-level variables before 2009. This is necessary because the key coefficient  $\delta$  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.”

Table D.1: Pre-fiscal rule differences and trends of exposed firms.

	Capital	Capital	Labor	Labor	N.Workers	N.Workers	Sev. Fund	Sev. Fund	Exit	Exit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Fisc.Rule.Exp.	-6.7754*** (0.603)		-5.4876*** (0.619)		-0.3229*** (0.048)		-0.3341*** (0.032)		0.0058* (0.004)	
Fisc.Rule*Year		-1.3173*** (0.171)		-0.1232* (0.067)		0.0056 (0.007)		-0.0102** (0.005)		0.0059 (0.004)
N. Firms		4,297		4,297		3,694		4,273		4,297
Observations	16,161	16,161	16,161	16,161	8,591	8,591	15,558	15,558	16,161	16,161
Company FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean	464		395.3		25.14		24.19		1.002	
St.Dev.	2464		1501		88.79		74.47		9.962	
St.Dev.Fisc.Rule	23.91		23.91		23.91		23.91		23.91	

Notes: The table reports estimates of the effects of exposure to the fiscal rule on firm 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). *Exit* is defined as the probability of exit in a given year. Financial variables are deflated using KLEMS deflators. *Fisc.Rule* represents the exposure to the fiscal rule 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 rule revenues. Odd columns include time effects. Even columns report the estimate of the interaction term *Fisc.RuleXYear* and include firm and time effects. The sample is before the fiscal rule. 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.

Table D.2: Firms capital, labor and exit controlling for firm-specific trends

Dep.Var.	Capital	Labor	N.Workers	Sev.Fund	Exit
Model	FE-HT	FE-HT	FE-HT	FE-HT	FE-HT
	(1)	(2)	(3)	(4)	(5)
Fisc.Rule.Exp.XPost	-1.491*** (0.298)	0.447*** (0.160)	-0.031 (0.043)	-0.024** (0.011)	0.001 (0.010)
N.Firms	4,317	4,317	4,095	4,305	4,317
Observations	27,764	27,764	16,135	26,471	27,764
Company FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Mean Y	584.4	397.2	24.63	27.09	2.139
St.Dev. Y	9.801	13181	8040	14615	13.01
St.Dev.Fisc.Rule	23.91	23.91	23.91	23.91	23.91

Notes: The table reports estimates of the effects of exposure to the fiscal rule 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). Financial variables are deflated using KLEMS deflators. *Fisc.Rule.Exp.* represents the exposure to the fiscal rule computed as the ratio between the firm's value won in municipalities with fiscal rule and the firm's pre-fiscal rule 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. St.Dev. Y\_btw (\_wth) are the between and within standard deviations of the dependent variable. 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 Non-linear effects of exposure to the fiscal rule controlling for firm-specific trends

Table E.1: Firms capital, labor and exit. Non-parametric model controlling for firm-specific trends.

Dep.Var. Model	Capital FE-HT (1)	Labor FE-HT (2)	N.Workers FE-HT (3)	Sev.Fund. FE-HT (4)	Exit FE-HT (5)
$\mathbb{1}(P_{25} < \text{Fisc.Rule.Exp.} \leq P_{50})XPost$	13.377 (37.844)	-7.706 (18.492)	3.462 (5.134)	0.451 (1.143)	1.013 (0.710)
$\mathbb{1}(P_{50} < \text{Fisc.Rule.Exp.} \leq P_{75})XPost$	-20.420 (40.829)	-6.346 (17.696)	0.436 (1.486)	-0.371 (1.391)	1.274* (0.743)
$\mathbb{1}(P_{75} < \text{Fisc.Rule})XPost$	-98.008*** (28.433)	19.433 (16.626)	-0.645 (1.573)	-1.697** (0.832)	0.921 (0.745)
N.Firms	4,317	4,317	4,095	4,305	4,317
Observations	27,764	27,764	16,135	26,471	27,764
Company FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Mean Y	584.4	397.2	24.63	27.09	2.139
St.Dev.Y	3209	1690	107.3	82.94	14.47

Notes: The table reports estimates of the effects of exposure to the fiscal rule 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). Financial variables are deflated using KLEMS deflators.  $\mathbb{1}(P_{25} < \text{Fisc.Rule.Exp.} \leq P_{50})XPost$  ( $\mathbb{1}(P_{50} < \text{Fisc.Rule.Exp.} \leq P_{75})XPost$ ) [ $\mathbb{1}(P_{75} < \text{Fisc.Rule})XPost$ ] is an indicator for the 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 rule and the firm's pre-fiscal rule 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 E.2: Firms capital, labor and exit. Non-parametric model.

Dep.Var.	Capital	Capital	Labor	Labor	N.Workers	N.Workers	Sev.	Sev.	Exit	Exit
Model	OLS	FE	OLS	FE	OLS	FE	Fund	Fund	OLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\mathbb{1}(P_{25} < \textit{Fisc.Rule.Exp.} \leq P_{50})XPost$	-45.885 (92.578)	-76.221 (83.612)	3.709 (49.602)	-1.268 (29.625)	2.358 (5.031)	0.190 (2.205)	3.475* (1.856)	1.118 (1.725)	-0.610 (0.514)	-0.305 (0.551)
$\mathbb{1}(P_{50} < \textit{Fisc.Rule.Exp.} \leq P_{75})XPost$	-100.105 (126.206)	-210.817*** (79.408)	-26.077 (40.387)	-34.856** (17.395)	0.785 (2.178)	-1.409 (1.123)	-0.328 (1.290)	-2.861** (1.313)	-0.158 (0.533)	0.278 (0.574)
$\mathbb{1}(P_{75} < \textit{Fisc.Rule})XPost$	-320.461*** (75.015)	-351.274*** (65.093)	-18.792 (40.040)	-12.234 (16.646)	2.123 (2.218)	-1.034 (1.118)	-3.657*** (1.160)	-4.982*** (1.190)	-0.205 (0.552)	0.701 (0.588)
$\mathbb{1}(P_{25} < \textit{Fisc.Rule.Exp.} \leq P_{50})$	14.339 (62.086)		40.127 (86.103)		2.472 (5.935)		3.006 (4.412)		0.295 (0.198)	
$\mathbb{1}(P_{50} < \textit{Fisc.Rule.Exp.} \leq P_{75})$	-39.512 (123.351)		-162.685*** (46.633)		-11.507*** (3.060)		-8.908*** (2.685)		0.373* (0.203)	
$\mathbb{1}(P_{75} < \textit{Fisc.Rule})$	-391.222*** (47.717)		-323.772*** (44.368)		-19.230*** (2.978)		-19.527*** (2.544)		0.636*** (0.227)	
Post	407.299*** (73.926)		16.803 (39.659)		-2.019 (2.104)		7.163*** (1.066)		2.966*** (0.366)	
N. Firms		4,317		4,317		4,095		4,305		4,317
Observations	27,764	27,764	27,764	27,764	16,135	16,135	26,471	26,471	27,764	27,764
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	584.4		397.2		24.63		27.09		2.139	
St. Dev. Y	3209		1690		107.3		82.94		14.47	

Notes: The table reports estimates of the effects of exposure to the fiscal rule 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). Financial variables are deflated using KLEMS deflators.  $\mathbb{1}(P_{25} < \textit{Fisc.Rule.Exp.} \leq P_{50})XPost$  [ $\mathbb{1}(P_{50} < \textit{Fisc.Rule.Exp.} \leq P_{75})XPost$ ] [ $\mathbb{1}(P_{75} < \textit{Fisc.Rule})XPost$ ] is an indicator for the 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 rule and the firm's pre-fiscal rule 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.

## F Robustness checks

Table F.1: Firms capital, labor and exit controlling for firm-specific trends. Firms incorporated in municipalities with less than 10k population.

Model	Capital		Labor		N.Workers		Sev. Fund		Exit	
	FE (1)	FE-HT (2)	FE (3)	FE-HT (4)	FE (5)	FE-HT (6)	FE (7)	FE-HT (8)	FE (9)	FE-HT (10)
Fisc.Rule.Exp.XPost	-4.470*** (0.721)	-1.238*** (0.385)	0.020 (0.148)	0.454** (0.188)	-0.039** (0.016)	-0.033 (0.024)	-0.076*** (0.018)	-0.014 (0.016)	-0.001 (0.013)	0.022* (0.013)
N.Firms	1,380	1,380	1,380	1,380	1,335	1,335	1,377	1,377	1,380	1,380
Observations	9,001	9,001	9,001	9,001	5,424	5,424	8,703	8,703	9,001	9,001
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	627.5		357.6		20.54		25.87		1.422	
St.Dev.Fisc.Rule	19.87		19.87		19.87		19.87		19.87	

Notes: The table reports estimates of the effects of exposure to the fiscal rule 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). Financial variables are deflated using KLEMS deflators. *Fisc.Rule.Exp.* represents the exposure to the fiscal rule computed as the ratio between the firm's value won in municipalities with fiscal rule and the firm's pre-fiscal rule 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. St.Dev. Y\_btw (\_wth) are the between and within standard deviations of the dependent variable. 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 less than 10k population.

Table F.2: Firms capital, labor and exit controlling for firm-specific trends.  
Firms incorporated in municipalities with population between 3k-7k

Model	Capital		Labor		N.Workers		Sev. Fund		Exit	
	FE (1)	FE-HT (2)	FE (3)	FE-HT (4)	FE (5)	FE-HT (6)	FE (7)	FE-HT (8)	FE (9)	FE-HT (10)
Fisc.Rule.Exp.XPost	-5.964*** (1.407)	-1.589** (0.774)	-0.082 (0.212)	0.549*** (0.197)	-0.075** (0.029)	-0.060 (0.042)	-0.095*** (0.031)	-0.025 (0.025)	-0.012 (0.018)	0.039** (0.019)
N.Firms	609	609	609	609	587	587	607	607	609	609
Observations	3,965	3,965	3,965	3,965	2,384	2,384	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		25.85		1.387	
St.Dev.Fisc.Rule	20.27		20.27		20.27		20.27		20.27	

Notes: The table reports estimates of the effects of exposure to the fiscal rule 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). Financial variables are deflated using KLEMS deflators. *Fisc.Rule.Exp.* represents the exposure to the fiscal rule computed as the ratio between the firm's value won in municipalities with fiscal rule and the firm's pre-fiscal rule 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. St.Dev. *Y\_btw* (*\_wth*) are the between and within standard deviations of the dependent variable. 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 3,000 and 7,000 inhabitants.

Table F.3: Firms capital, labor and exit. Non-parametric model controlling for firm-specific trends. Firms incorporated in municipalities with less than 10k population.

Dep.Var. Model	Capital FE-HT (1)	Labor FE-HT (2)	N.Workers FE-HT (3)	Sev.Fund. FE-HT (4)	Exit FE-HT (5)
$\mathbb{1}(P_{25} < \text{Fisc.Rule.Exp.} \leq P_{50})XPost$	41.954 (36.593)	-3.813 (16.531)	0.041 (1.053)	0.182 (1.523)	1.320 (0.852)
$\mathbb{1}(P_{50} < \text{Fisc.Rule.Exp.} \leq P_{75})XPost$	-53.615 (54.606)	5.924 (17.234)	1.482 (1.115)	-0.487 (1.549)	0.420 (0.793)
$\mathbb{1}(P_{75} < \text{Fisc.Rule})XPost$	-79.598** (31.125)	29.108* (16.239)	-1.745 (1.344)	-0.406 (1.414)	2.773** (1.400)
N.Firms	1,380	1,380	1,335	1,377	1,380
Observations	9,001	9,001	5,424	8,703	9,001
Company FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Mean Y	627.5	357.6	20.54	25.87	1.422
St.Dev.Y	1735	619.1	30.38	46.57	11.84

Notes: The table reports estimates of the effects of exposure to the fiscal rule 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). Financial variables are deflated using KLEMS deflators.  $\mathbb{1}(P_{25} < \text{Fisc.Rule.Exp.} \leq P_{50})XPost$  ( $\mathbb{1}(P_{50} < \text{Fisc.Rule.Exp.} \leq P_{75})XPost$ ) [ $\mathbb{1}(P_{75} < \text{Fisc.Rule})XPost$ ] is an indicator for the 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 rule and the firm's pre-fiscal rule 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 and are incorporated in municipalities with less than 10k population.



Table F.4: Firms capital, labor and exit. Non-parametric model controlling for firm-specific trends. Firms incorporated in municipalities with population between 3k-7k

Dep.Var. Model	Capital FE-HT (1)	Labor FE-HT (2)	N.Workers FE-HT (3)	Sev.Fund. FE-HT (4)	Exit FE-HT (5)
$\mathbb{1}(P_{25} < \textit{Fisc.Rule.Exp.} \leq P_{50})XPost$	-4.004 (69.936)	4.217 (15.121)	1.244 (0.969)	-0.450 (2.343)	1.653 (1.270)
$\mathbb{1}(P_{50} < \textit{Fisc.Rule.Exp.} \leq P_{75})XPost$	-175.786 (111.424)	9.432 (14.588)	2.407* (1.332)	-1.747 (2.489)	1.715 (1.347)
$\mathbb{1}(P_{75} < \textit{Fisc.Rule})XPost$	-139.102** (63.911)	41.319*** (15.040)	-1.876 (1.813)	-1.302 (2.362)	5.010** (2.343)
N.Firms	609	609	587	607	609
Observations	3,965	3,965	2,384	3,818	3,965
Company FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Mean Y	707.8	353	20.43	25.85	1.387
St.Dev.Y	2046	531.2	25.47	40.88	11.70

Notes: The table reports estimates of the effects of exposure to the fiscal rule 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). Financial variables are deflated using KLEMS deflators.  $\mathbb{1}(P_{25} < \textit{Fisc.Rule.Exp.} \leq P_{50})XPost$  ( $\mathbb{1}(P_{50} < \textit{Fisc.Rule.Exp.} \leq P_{75})XPost$ ) [ $\mathbb{1}(P_{75} < \textit{Fisc.Rule})XPost$ ] 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 rule and the firm's pre-fiscal rule 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 and are incorporated in municipalities with population between 3,000 and 7,000 inhabitants.