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# IMF Working Paper

## Does Public Sector Inefficiency Constrain Firm Productivity: Evidence from Italian Provinces

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European Department

# Does Public Sector Inefficiency Constrain Firm Productivity: Evidence from Italian Provinces

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Authorized for distribution by Petya Koeva Brooks

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## Abstract

This paper studies the effect of public sector efficiency on firm productivity using data from more than 400,000 firms across Italy's provinces. Exploiting the large heterogeneity in the efficiency of the public sector across Italian provinces and the intrinsic variation in the dependence of industries on the government, we find that public sector inefficiency significantly reduces the labor productivity of private sector firms. The results suggest that raising public sector efficiency could yield large economic benefits: if the efficiency in all provinces reached the frontier, output per employee for the average firm would increase by 9 percent.

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## I. INTRODUCTION

The provision of high-quality public goods and services in a cost-effective way has often been thought of as one of the key determinants of long-run economic prosperity. Indeed, there is no conclusive evidence that higher public spending per se improves long-run growth (see e.g., Bergh and Henrekson, 2011). There are plenty of examples of both costly policies that deliver few durable benefits (e.g., Hoxby, 2000) and public programs that are both cheap and successful (e.g., Skinner and Steiger, 2007).[2] It is the quality of institutions, broadly understood as both the extent of the government's protection of property rights and the quality of public services, which determines the ultimate ability of the public sector to efficiently provide the goods and services necessary to support productivity and economic growth in a lasting manner.

This paper presents new evidence on the impact of public sector efficiency on economic performance and, in particular, on firm productivity, by studying the case of Italy. A large body of literature has examined the link between the efficiency of the public sector and economic performance across countries. The seminal papers by Knack and Keefer (1995) and Hall and Jones (1999) looked at broad survey-based measures of the quality of institutions; a large literature focusing on property rights institutions was spurred by Acemoglu and others (2001), while a smaller stream of contributions (to which the present paper belongs) studies the role of the government as an efficient and effective provider of services (see, e.g., Evans and Rauch, 1999, and more recently, Angelopoulos and others, 2008; and Oto-Peralias and Romero-Avila, 2012).[3]

Differently from this literature, we examine the effect of government efficiency by focusing on within-country variation. Differences in economic performance across regions within a country tend to be large, persistent and widespread.[4] Studying this subnational heterogeneity is not only interesting per se, but it also helps overcome the methodological issues faced by cross-country studies: cross-country data may not be as easily comparable, sample sizes are small, and measures of public sector efficiency could be correlated with other variables important to productivity and the economic growth process. By analyzing within-country differences instead, we can implicitly control for the role of many formal institutions, thus limiting omitted-variable bias.

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[2] More generally, Rajkumar and Swaroop (2008) show that more public spending on education and health care translates into better education and health outcomes only in countries with high bureaucratic quality and low corruption levels.

[3] Contrary to previous studies, such as Knack and Keefer (1995), Hall and Jones (1999), Dollar and Kraay (2003), and Rodrik and others (2004), which rely on *International Country Risk Guide* or World Bank broad quality of governance indicators, Rauch and Evans (1999) develop an index of bureaucratic quality for 35 countries and show that it correlates positively with long-run growth.

[4] Acemoglu and Dell (2010), Gennaioli and others (2013), and Breinlich and others (2014) document the prevalence and importance of differences in productivity and growth across regions within countries.

We exploit variation in the quality of government service provision across Italian provinces to examine whether public sector inefficiency constrains the productivity of firms. Italy presents a particularly relevant setting to seek the answer to this question. Despite 150 years of common formal institutions since its political unification, there are still large differences in public sector efficiency across Italian regions and provinces. According to the European Commission's European Quality of Governance Index, Italy has the largest variation between its worst and best performing region in terms of quality of governance, of all European economies. Indeed, it takes more than twice the number of days to get a construction permit in Sicily than in Lombardy (World Bank, Doing Business Indicators, 2012). Coincident with this large heterogeneity in the quality of public service provision, there are significant differences in per capita output between the North and South of the country, as well as other measures of labor productivity.

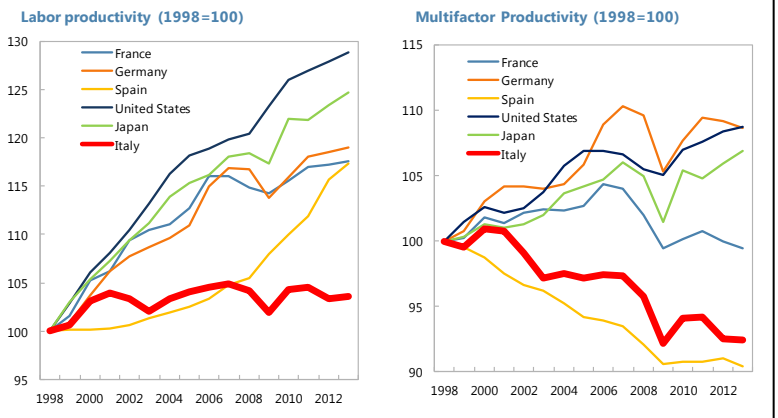
To determine whether there is a causal link between the efficiency of the public sector and firm productivity, this paper exploits the variation in objective measures of government efficiency across Italy's 103 provinces and the variation in the degree of dependence on the government across industries. Under the identifying assumption that the efficiency of government would matter more for firms in industries more dependent on the government, we determine—in a regression framework—whether firms in industries that depend more intensively on government services are more productive in areas with better government. By focusing on the interaction between government efficiency and government dependence, this approach—first pioneered by Rajan and Zingales (1998) and used in the context of studying government efficiency by Pellegrino and Zingales (2014)—allows us to control for all differences across Italy's provinces that affect firms in all industries in a similar manner, thus limiting potential omitted variable bias. We use productivity measures for more than 400,000 firms from the Orbis dataset compiled by Bureau van Dijk in 2007, objective measures of government efficiency computed by Giordano and Tommasino (2013) and government dependence, as captured by Pellegrino and Zingales (2014).

We find that the (in)efficiency of public service provision is an important determinant of firm productivity in Italy. This effect is not only statistically but also economically significant. For example, for a firm in a sector with above median dependence on government, being in a province with above median public efficiency increases output per euro spent on salaries by 11.3 percent. Furthermore, we find that efficiency in the provision of services at national level matters more for productivity than that of services provided by local governments.

Our results shed light on the reasons behind Italy's lagging productivity. One of the key features of the Italian economy has been the stagnant labor productivity since the mid 1990s (see also Pellegrino and Zingales, 2014). Labor productivity, defined as real GDP per hour worked increased a meager 3.5 percent, while TFP fell by a cumulative 7.5 percent since Italy adopted the euro in 1999. As a result, a wide productivity gap has emerged between Italy and most OECD economies (Figure 1). Many hypotheses have been put forth in trying to explain Italy's lack of productivity growth—structural deficiencies related to the sectoral specialization of Italian manufacturing (Ciriaci and Palma, 2008), a business model, which relies predominantly on micro and small firms, and institutional factors, such as cumbersome labor regulations (Daveri and Parisi, 2010), judicial inefficiency (Giacomelli and Menon,

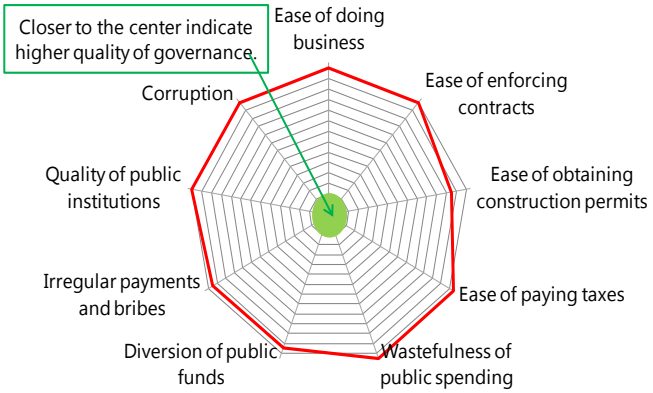
2013, Esposito and others, 2013), and the lack of key factors of production, such as human and entrepreneurship capital and managerial knowhow (e.g., Bandiera and others, 2010; Brasili and Federico, 2008; Bloom and others, 2008). Our findings suggest that Italy's inefficient public sector—one of the lowest ranked among OECD economies (Figure 2) — contributes to the low level of productivity of Italian firms.[5]

**Figure 1. Italy: Evolution of Aggregate Productivity**




Source: Total Economy Database (TED). Labor productivity is measured as GDP per hour worked.

**Figure 2. Italy: Quality of Governance Indicators**
(Italy's rank; 29 OECD countries)




Our study contributes to the small but growing literature on the link between government efficiency and economic performance at the *subnational* level. Such research has been insofar relatively limited because subnational indicators of government efficiency have only recently become available.[6,7] Moreover, most of the available indicators are typically based on surveys and capture the perception of respondents (experts, entrepreneurs, or ordinary citizens). While these studies present interesting evidence, their findings may be biased for several reasons. For example, the evaluation of government performance might depend on expectations: individuals in regions where governments consistently underperform will probably expect less from their public officials (see the discussion in Chong and others, 2014). Furthermore, a number of subnational studies have focused exclusively on the role of

[5] Besides reducing the productivity of existing firms, public sector inefficiency has also been shown to exert a negative effect on firm entry (see Amici and others (2015) for evidence based on Italian municipalities).

[6] See, e.g., Charron and others (2014), which discusses the subregional European Quality of Governance Indicators, and Rodriguez-Pose and di Cataldo (2015), which study the relationship between innovation and regional quality of government.

[7] In the case of Italy, Giacomelli and Tonello (2015) recently computed an objective measure of government performance by making phone calls to Italian municipal offices under the pretense of being entrepreneurs wanting to start a business in the municipality.

property right protection for firm performance rather than the provision of a broader set of public services (see e.g., Lu and others, 2013; Giacomelli and Menon, 2013; Chemin, 2009 and 2013).

To circumvent these shortcomings, we use objective measures of efficiency, computed by Giordano and Tommasino (2013), for five public services (child care, education, health care, civil justice, and waste disposal) provided by different levels of government in the 103 Italian provinces. In computing public sector efficiency for these services, Giordano and Tommasino (2013) follow well-established methods (see e.g., Afonso and others, 2005;[8] Hakkinen and Joumard, 2007; Sutherland and others, 2007; Verhoeven and others, 2007; European Commission, 2008, for cross-country indicators of government efficiency; and Afonso and Scaglioni, 2007, and Barone and Mocetti, 2011 for indicators for Italy's regions and municipalities[9]). Well-functioning education or childcare and a fast and efficient judicial system are likely, for different and obvious reasons, to have a positive impact on firm productivity. Furthermore, our sector-specific efficiency measures can be interpreted as proxies of the overall quality of government actions: the positive correlation between our scores and alternative measures of quality of governance has been documented by Giacomelli and Tonello (2015).

The remainder of this paper is structured as follows. Section 2 describes our data and outlines our empirical strategy. Section 3 presents the main results and discusses the robustness of the findings. Section 4 offers some policy considerations and concludes.

[8]Afonso and others (2005) provide indicators concerning not only specific services, but also general government functions such as promoting economic growth, reducing poverty, and limiting macroeconomic volatility.

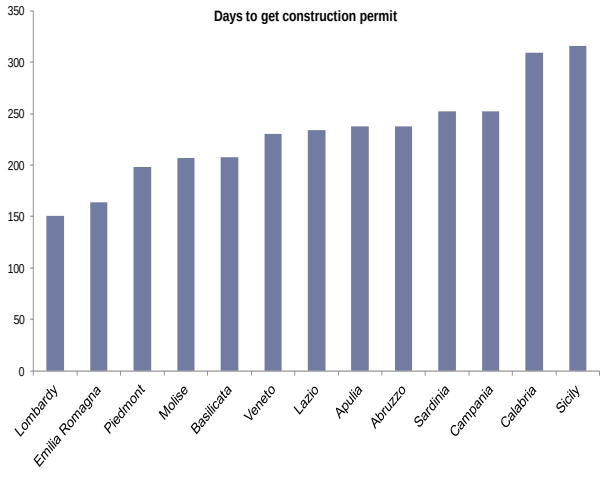
[9] Similar indicators at the subnational level have been computed for a few other countries: see Balaguer-Coll and others (2007) for Spain; Borge and others (2008) for Norway; and Revelli (2010) for the UK.

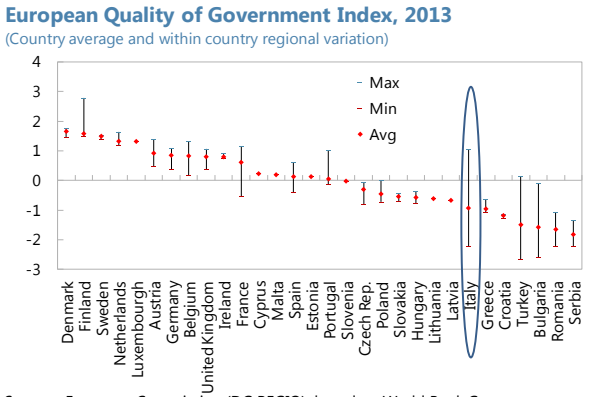
# II. Empirical Strategy, Data and Measurement

## A. Empirical Strategy

Our empirical strategy exploits the large regional disparities in government efficiency across regions and provinces in Italy.[10] The subnational Doing Business survey conducted in 2013 highlights a significant gap between the relatively efficient Center-North and the lagging South. In the Lombardy region, it takes about 150 days to obtain a construction permit; in Sicily firms have to wait more than 300 days to obtain a similar permit. In fact, of all European economies, Italy has the largest variation between its worst and best performing region according to the mostly survey-based European Quality of Governance Index (Figure 3). A similar pattern of geographical variation emerges from Giordano and Tommasino's (2013) objective performance-based public sector efficiency measure at the more disaggregated provincial level (explained in more detail below).

**Figure 3. Italy: Regional Variation in Government Efficiency**




Sources: European Commission (DG REGIO), based on World Bank Governance indicator and regional-level survey data.

Similarly, there are substantial regional disparities in firm productivity**.** In our sample, the median firm in the North produces 9½ percent more per euro spent on employees than the median firm in the South, and the median return on assets is 180 bps higher.[11] Even a casual visual inspection reveals those provinces that have higher public sector efficiency also tend to have higher firm level productivity (Figure 4); a finding also confirmed by the positive and relatively tight correlation between the two variables. However, this simple correlation does

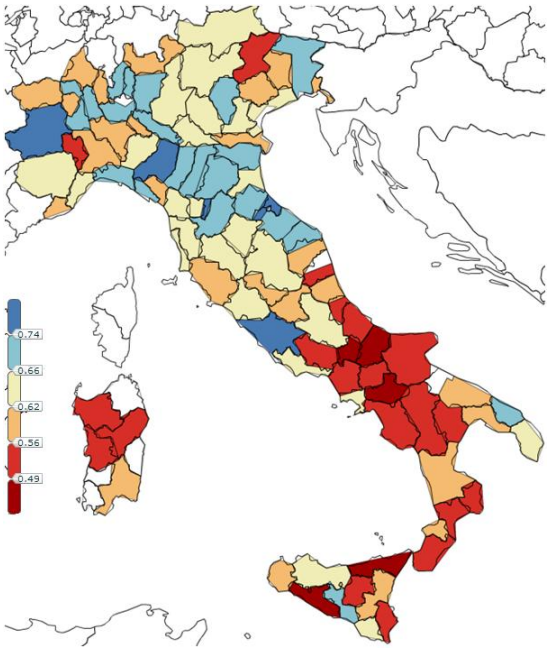
[10] In Italy, a province is an administrative unit between municipalities and regions. Italy is divided into roughly 20 regions, 100 provinces, and 8,100 municipalities.

[11] Regional disparity in per capita GDP is much more pronounced, with real per capita GDP in the north almost double that of the south of Italy. This is largely explained by differences in employment and labor force participation rates. Productivity differentials, as measured by gross value added per euro spent on employees, in national accounts data are of similar magnitude to the ones we uncover in the firm level data.

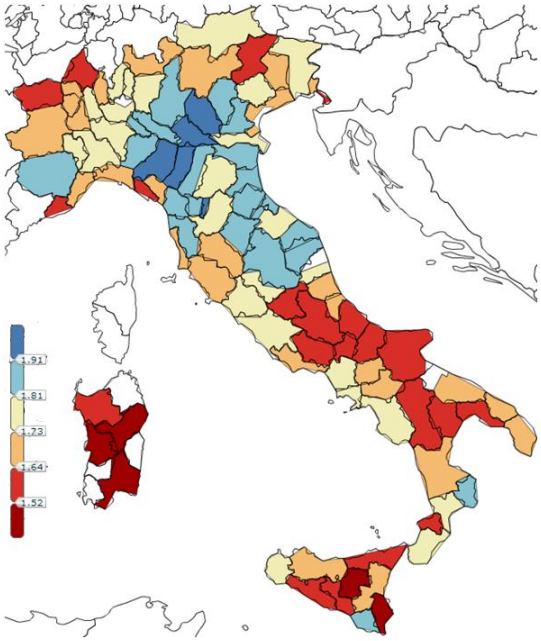
not necessarily imply that public sector efficiency affects firm productivity. Provinces with low public sector efficiency may have different industrial structure, different size composition of firms, and may differ in a host of other ways that affect labor productivity, independently of government efficiency.

**Figure 4. Italy: Public Sector Efficiency and Firm Labor Productivity**

***Public Sector Efficiency***




***Firm Labor Productivity***




Notes: Province-level public sector efficiency is from Giordano and Tommasino (2013). Firm labor productivity is measured as real output per employee cost. The map on the right panel plots the median for each province based on 2007 Orbis data.

In order to establish a causal link between government efficiency and firm productivity, we employ a simple version of the Rajan and Zingales (1998) framework. In particular, our identifying assumption is that productivity of firms in sectors that are more reliant on the government would be more affected by government inefficiency. In other words, the causal effect of government efficiency is captured by the difference, across provinces with different government efficiency, in productivity gaps between firms operating in sectors more or less dependent on the government. The following equation is estimated at the firm level using data from 2007:

$$Y_i = \beta * GovDep_s * GovEff_p + \gamma X_i + \alpha_p + \alpha_s + \varepsilon_i \qquad (1)$$

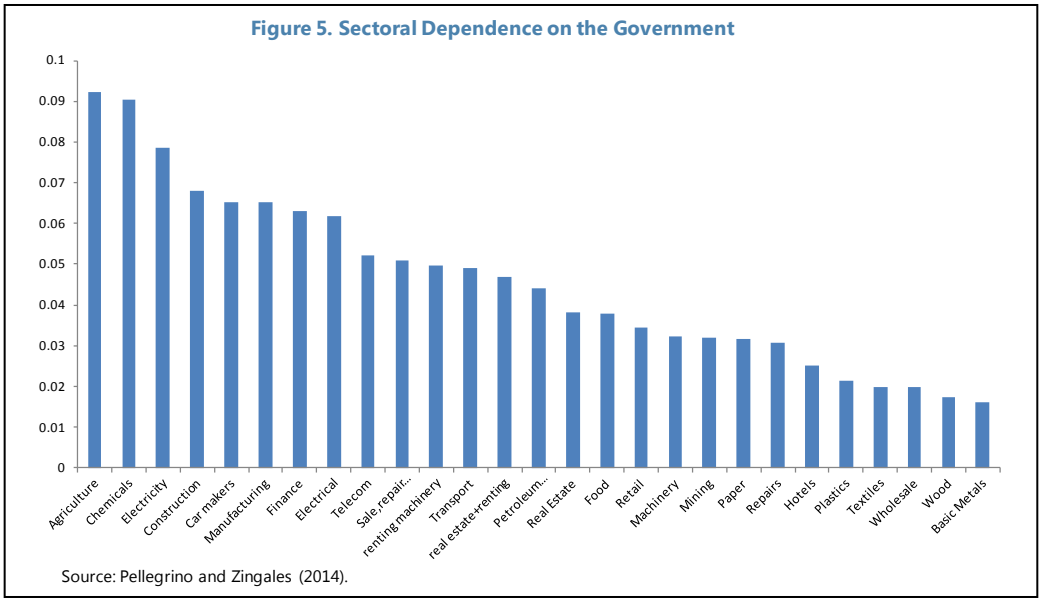
where $Y_i$ is the productivity of firm *i* in sector *s* and province *p*. In the interaction term, $GovDep_s$ measures how dependent firms in sector *s* are on the public sector and $GovEff_p$ how efficient the public sector is in province *p*. $X_i$ contains firm-specific control variables,

namely a set of indicators for firm size.[12] $\alpha_p$ is a set of province fixed effects and $\alpha_s$ a set of sector fixed effects (658 sectors, 4-digit NACE Revision 2 classification). $\varepsilon_i$ is the error term.

The coefficient $\beta$ captures the effect of higher public sector efficiency on firm performance. The 600+ sector fixed effects control for any differences in productivity that may exist across sectors, including those deriving from cyclical factors, such as, demand for output in the sector, and structural sectoral characteristics, such as technology and input requirements, R&D intensity, etc. The biggest advantage of our specification is that it allows to control for all institutional and geographical factors that affect the productivity of all firms in the province equally (such as, for example, factor endowments, attitude towards work, climate, degree of civil engagement, trust, etc.) through the province fixed effects. To account for the potential correlation of firm outcomes located in the same province, standard errors are clustered at the province level.

## B. Measuring Firm Dependence on the Public Sector

A key input for this empirical strategy is the dependence of firms in different industries on the public sector**.** We rely on a new indicator, developed by Pellegrino and Zingales (2014), which proxies government dependence by the frequency of news about a certain sector mentioning the government. More specifically, the authors calculate for 21 sectors the percentage of news containing words like "government," "regulation" in total sector news in Factiva over the period 2000–12. The measure is admittedly imperfect but understandably so given the difficulty of accurately measuring the use of public sector services by industries. Figure 5 depicts the degree of government dependence according to this measure. Not surprisingly, sectors such as agriculture, electricity and construction are ranked as some of the most dependent on government. As a robustness check, we construct an alternative measure of government dependence, using the share of a sector's output sold to the




[12] A large literature has documented that large firms are more productive (e.g., Idson and Oi, 1999).

government according to the economy-wide input-output matrix (see e.g., Barone and Cingano, 2011). Our findings, based on this measure, are discussed in section III in greater detail.

### C. Measuring Public Sector Efficiency at the Province Level

The microeconomic literature proposes several ways to measure the efficiency of a productive unit. In this paper, we use public sector efficiency indicators estimated by Giordano and Tommasino (2013). Their measure relies on the concept of technical efficiency, which compares actual and potential performance. To estimate the potential performance of a province, or the "production frontier," for observed input-output pairs, parametric and non-parametric approaches have been used in the literature. In this paper, we use the Giordano and Tommasino (2013) baseline measure of public-sector efficiency, obtained applying the commonly used nonparametric Data Envelopment Analysis (DEA) method.[13]

Efficiency is calculated for five key public services in 103 Italian provinces: education, civil justice, health, child care and waste collection. Of the five public services, two (education and civil justice) are the responsibility of the central government, one (health) is within the remit of the regional governments, while the remaining two (child care and waste collection) are administered by the municipal governments. Data refer to 2007 or the closest year for which good quality information is available, and are taken from different sources.[14] For the health sector, we consider data spanning over a longer time period, assuming that it takes time for public spending to influence outcomes in this sector. Table 1 details the input and output variables used to calculate efficiency in each category.

**Table 1. Italy: Inputs and Outputs Used to Construct Provincial Public Efficiency Indicators**

| Category | Input | Output | Controls |
|---|---|---|---|
| Health care | Public health expenditure per capita (age weighted), average 1985–2007 | Change in life expectancy between 1981–83 and 2003–05 | GDP growth |
| Education | Number of teachers per student (2005–06) | INValSI test scores of 6$^{th}$ and 9$^{th}$ graders (2005-06) | Adult education |
| Civil justice | Number of judges per 1,000 new trials in 2006 | Average length of trial in 2006 | n.a. |
| Child care | Public expenditure on child care in 2007 | Number of children in day care in 2007 | Quality of service |
| Waste disposal | Public expenditure on waste disposal in 2006 | Tons of waste collected and % recycled in 2006 | n.a. |

Source: Giordano and Tommasino (2013).

[13] For a full description of the methodology, data and estimation strategy, see Giordano and Tommasino (2013). They compute measures of public efficiency using both deterministic and stochastic parametric techniques. These alternative methodologies deliver indicators of provincial government efficiency which are very similar to the baseline used in our study.

[14] Main sources are the Ministries of Health, Education, and Interior, INValSI (the national institute responsible to evaluate the Italian educational system), Consiglio Superiore della Magistratura (the magistrates' governing body), and the Government's Environmental Protection Agency.

Table 2 summarizes the efficiency indicators aggregated at the region and macro-region levels. Higher values mean higher efficiency. The score would be one for a province that was the most efficient in the country in each category. Similarly to the subnational Doing Business survey and the European Quality of Governance index, there is a north-south gap in the efficiency of the public sector. Geographical differences in efficiency are generally more pronounced in sectors where the service is delivered by local authorities. Furthermore, and interestingly, the correlation between efficiency scores is stronger between sectors provided by the same level of government, suggesting that efficiency in the provision of a specific service may be a good proxy for the overall efficiency of the government level providing that service.[15]

The $GovEff$ score used in equation (1) is a simple average across the five categories.

**Table 2. Italy: Public Sector Efficiency Indicators (Output-Oriented DEA)**

| Region [1/] | Health | Education | Judicial system | Daycare | Waste disposal | Average |
|---|---|---|---|---|---|---|
| Valle d'Aosta | 0.77 | 0.92 | 0.30 | 0.17 | 0.70 | 0.57 |
| Piemonte | 0.76 | 0.91 | 0.43 | 0.45 | 0.65 | 0.64 |
| Liguria | 0.74 | 0.87 | 0.23 | 0.44 | 0.87 | 0.63 |
| Lombardia | 0.87 | 0.89 | 0.32 | 0.38 | 0.76 | 0.64 |
| Trentino Alto Adige | 0.89 | 0.84 | 0.34 | 0.38 | 0.63 | 0.62 |
| Veneto | 0.88 | 0.89 | 0.24 | 0.37 | 0.72 | 0.62 |
| Friuli Venezia Giulia | 0.82 | 0.95 | 0.31 | 0.33 | 0.70 | 0.62 |
| Emilia Romagna | 0.72 | 0.92 | 0.23 | 0.71 | 0.87 | 0.69 |
| Toscana | 0.72 | 0.90 | 0.23 | 0.49 | 0.89 | 0.65 |
| Umbria | 0.69 | 0.88 | 0.25 | 0.50 | 0.76 | 0.61 |
| Marche | 0.74 | 0.91 | 0.21 | 0.41 | 0.82 | 0.62 |
| Lazio | 0.69 | 0.87 | 0.22 | 0.52 | 0.84 | 0.63 |
| Abruzzo | 0.66 | 0.89 | 0.21 | 0.35 | 0.75 | 0.57 |
| Molise | 0.62 | 0.84 | 0.21 | 0.11 | 0.56 | 0.47 |
| Campania | 0.70 | 0.83 | 0.21 | 0.27 | 0.65 | 0.53 |
| Puglia | 0.78 | 0.82 | 0.15 | 0.34 | 0.78 | 0.57 |
| Basilicata | 0.69 | 0.81 | 0.14 | 0.38 | 0.58 | 0.52 |
| Calabria | 0.68 | 0.81 | 0.17 | 0.33 | 0.74 | 0.55 |
| Sicilia | 0.67 | 0.82 | 0.18 | 0.40 | 0.74 | 0.56 |
| Sardegna | 0.70 | 0.82 | 0.16 | 0.29 | 0.77 | 0.55 |
| ITALIA | 0.75 | 0.87 | 0.24 | 0.42 | 0.76 | 0.59 |
| North-west | 0.79 | 0.90 | 0.32 | 0.36 | 0.75 | 0.62 |
| North-east | 0.83 | 0.90 | 0.28 | 0.45 | 0.73 | 0.64 |
| Centre | 0.71 | 0.89 | 0.23 | 0.48 | 0.83 | 0.63 |
| South | 0.69 | 0.83 | 0.18 | 0.31 | 0.70 | 0.54 |

Source: Giordano and Tommasino (2011)
1/ Regional values are obtained as simple averages of provincial values.

[15] For example, while efficiency in day care is positively correlated with that of waste disposal (with coefficient 0.31) it is slightly negatively correlated with efficiency in the judicial system. Also, there is a much larger correlation between efficiency in education and civil justice than between education and waste disposal (0.26 and 0.06, respectively).

## D. Measuring Firm Productivity

Firm data are from the Orbis database by Bureau van Dijk. It includes all companies required to submit accounts with the Italian Chamber of Commerce. It thus captures a very significant portion of the micro, small, and medium enterprises, which constitute the bulk of economic activity in Italy, but are rarely represented in other commonly-used firm-level datasets.[16] The coverage in the Orbis database is high: the firms included in the database account for roughly 70 percent of the gross value added, and 75 percent of the total wage bill of Italy's nonfinancial corporations. The raw dataset contains balance sheets, income statements, geographical information, and industrial classification for about 650,000 firms in 2007. Missing variables and data cleaning reduce the sample to about 450,000 firms.

We use several indicators to measure firm-level productivity**:** (i) the ratio of operating revenue to costs of employees; (ii) the ratio of gross value added to cost of employees; (iii) operating revenue per worker; (iv) gross value added per worker; (v) operating revenue; and (vi) return on assets (defined as EBIT over total assets). Our preferred measures of labor productivity are the ratios to costs of employees for two reasons: (i) firms often do not report the number of employees, hence using the costs of employees increases the sample size; and (ii) by controlling for difference in wage levels across firms, we partially account for variations in the skill level of workers. Measures (i)–(v) are expressed in logs in the regressions. Measure (v) only indirectly captures productivity and relies on the stylized fact that large firms are more productive. Output (operating revenue), gross value added and cost of employees are converted in real terms using the relevant industry specific deflators (at the 2-digit NACE 2 level) from ISTAT, and the top and bottom 2 percent of values of our dependent variables were excluded so as to avoid distortions from extreme outliers. Table 3 reports summary statistics for the different productivity measures.

**Table 3. Italy: Measures of Firm Productivity—Summary Statistics, 2007**

| | All regions | | | | North West | North East | Center | South |
|---|---|---|---|---|---|---|---|---|
| | N Obs | Mean | Median | StDev | Median | | | |
| Operating Revenue/Costs of employees | 400,310 | 13.13 | 6.04 | 23.90 | 6.04 | 6.29 | 6.16 | 5.70 |
| GVA/Costs of Employees | 360,736 | 2.07 | 1.49 | 2.13 | 1.49 | 1.51 | 1.48 | 1.47 |
| Operating Revenue/Worker (000s) | 216,328 | 316 | 193 | 357 | 218 | 216 | 181 | 147 |
| GVA/Worker (000s) | 204,822 | 59 | 50 | 41 | 57 | 55 | 47 | 40 |
| Log Operating Revenue | 452,323 | 13.44 | 13.45 | 1.55 | 13.69 | 13.75 | 13.27 | 13.07 |
| Return on Assets | 474,511 | 0.04 | 0.04 | 0.12 | 0.05 | 0.05 | 0.04 | 0.03 |

Note: The reported summary statistics are based on data excluding the top and bottom 2 percent so as to avoid distortions from extreme outliers. Return on assets is defined as earnings before interest and tax over total assets. All variables (operating revenue, gross value added and costs of employees) are deflated using the relevant industry specific deflator at the NACE 2-digit sector level from ISTAT.

[16] In 2012, more than 99.9 percent of businesses employed fewer than 50 people. These businesses accounted for 70 percent of value added and 54 percent of overall employment in Italy (ISTAT, 2014).

# III. RESULTS

## A. Baseline

We find strong evidence that public sector efficiency raises firm productivity. To build the intuition for our empirical strategy, Table 4 reports the coefficient on our government efficiency measure, when it is included linearly in equation (1), i.e., without the interaction with sectoral government dependence.[17] Columns 1 and 4 contain the estimated coefficient for output per euro spent on employees and gross value added per euro spent on employees for all firms in our sample. Columns 2 and 5 are based only on firms in construction— one of the most government dependent sectors, while columns 3 and 6 include only firms in the basic metals industry, one of the least dependent sector on the government. As expected, firm productivity tends to be higher on average in provinces with more efficient public spending (columns 1 and 4). However, the positive correlation is much larger for firms in construction than for those in basic metals sector, a pattern we would expect if indeed there was a causal relationship between public sector efficiency and firm productivity.

**Table 4. Italy: Correlation between Public Sector Efficiency and Firm Productivity**

| | Output per employee cost | | | Gross Value added per employee cost | | |
|---|---|---|---|---|---|---|
| | All | Construction | Basic Metals | All | Construction | Basic Metals |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Government Efficiency | 0.713 *** | 1.345 *** | 0.466 * | 0.133 *** | 0.434 *** | 0.073 |
| | [0.102] | [0.283] | [0.267] | [0.042] | [0.118] | [0.075] |
| r2 | 0.23 | 0.03 | 0.02 | 0.08 | 0.02 | 0.02 |
| N | 438,087 | 67,183 | 23,208 | 393,492 | 61,150 | 22,011 |

Note: All regressions include firm class size dummies. Columns (1) and (4) control for industry fixed effects at the 4 digit NACE Rev 2 level. Standard errors are corrected for heteroskedasticity and clustered at the province level.

Table 5 reports the results from estimating our baseline specification in equation (1), presenting the estimated coefficients on the interaction between public sector efficiency and government dependence for various measures of firm productivity. Across all measures of productivity, the estimated coefficient is positive and statistically significantly different from zero, implying that public sector inefficiency holds back labor productivity.[18]

[17] More specifically, we estimate: $Y_i = \beta * GovEff_p + \gamma X_i + \alpha_s + \varepsilon_i$.

[18] The drag on productivity from the inefficient provision of public goods adds to the disadvantages faced by firms in relatively inefficient regions. Limited geographical differentiation in nominal public sector wages and downward private sector wage rigidity due to competition with the public sector and a centralized wage bargaining system prevent firms from adjusting wages to fully accommodate the lower labor productivity.

**Table 5. Italy: Effect of Public Sector Efficiency on Firm Productivity**

| | Output per employee cost | GVA per employee cost | Output per worker | GVA per worker | Log Output | ROA |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| GovEff*GovDependence | 17.864 *** | 8.061 *** | 15.862 *** | 5.908 *** | 6.361 | 0.342 ** |
| | [4.540] | [1.268] | [4.231] | [1.443] | [4.171] | [0.164] |
| r2 | 0.23 | 0.08 | 0.27 | 0.17 | 0.33 | 0.04 |
| N | 404,536 | 364,019 | 224,460 | 206,812 | 455,101 | 479,417 |

Note: All regressions include province and industry fixed effects, and control for firm size category. Robust standard errors clustered at the province level.

The economic magnitude of the impact of government efficiency on productivity is nontrivial. A firm in the electrical equipment sector (which is just below the upper quartile of dependence on the public sector) in a province in the upper quartile of public efficiency produces 13 percent more output per euro spent on salaries than the same firm in a province in the lower quartile of public efficiency. The equivalent figure for gross value added per euro spent on salaries is 5.8 percent, for output is 4.5 percent, output per worker 11 percent, and value added per worker 4.2 percent. Finally, its return on assets is 25 bps higher than the equivalent firm in a province with public sector efficiency at the 25$^{th}$ percentile.

Table 6 reports a simplified version of the results, obtained by estimating equation (1) with dependence on government and public sector efficiency coded as dummies taking the value of one if the sector/province is above the median government dependence and public sector efficiency respectively. For a firm operating in a sector characterized by above median dependence on government, being in a province with above median public efficiency increases output per euro spent on salaries by 11.3 percent. Being in above median province in terms of public efficiency, also raises gross value added per euro spent on employees, output and return on asset by 4.3 percent, 8.6 percent, and 50 bps respectively for the average firm in a sector with above median government dependence.

**Table 6. Italy: Effect of Public Sector Efficiency on Firm Productivity: Alternative presentation**

| | Output per employee cost | GVA per employee cost | Output per worker | GVA per worker | Log Output | ROA |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| GovEff*GovDep | 0.113 *** | 0.043 *** | 0.126 *** | 0.057 *** | 0.086 *** | 0.005 *** |
| Indicator | [0.041] | [0.016] | [0.039] | [0.016] | [0.027] | [0.001] |
| r2 | 0.21 | 0.05 | 0.26 | 0.15 | 0.22 | 0.04 |
| N | 396,484 | 357,105 | 220,975 | 203,767 | 445,283 | 468,955 |

Note: All regressions include province and industry fixed effects, and control for firm size category. Robust standard errors clustered at the province level.

## B. Robustness

The results are robust to several modifications of the baseline empirical approach (Table 7). In the baseline estimation, we use firm level data from 2007, which most closely matches the time for which public sector efficiency is measured at the province level. Using firm data from 2008, 2009, or 2010 does not alter the findings (public sector efficiency is still measured in 2007, a reasonable assumption in the absence of major reforms of the public administration). In fact, the significance of the results for output in levels is stronger (Panel A–C).

Results are generally robust to an alternative measure of dependence on government based on the percent of sectoral output sold to the public sector (Panel D). In order to preserve the exogeneity of the government dependence measure, we use the input-output table for Germany to calculate the share of output sold to the private sector. In the spirit of Rajan and Zingales (1998), we chose a country where the public sector is fairly efficient.

We find similar effects if we consider average measures of public sector efficiency at the regional level, which might help reduce potential measurement error if firms' inputs and/or interactions with the government are not restricted to the province but to the broader region where the firm is located (Panel E).

The findings are also robust to an alternative proxy for government quality. Instead of public sector efficiency, we use the *effectiveness* of government as captured in the European Quality of Governance Index at the region level (see Figure 3). This index, available for 2010 and 2013, is based on a large survey of citizens' perception of the quality, impartiality and level of corruption of three public services (education, health, and law enforcement), combined with the World Bank Doing Business Indicators (see Charron and others, 2014, for details about the index). In Panel F, we replicate our cross-sectional specification (equation 1) with data for 2010, but we replace the provincial public sector efficiency score with the regional quality of governance index. In Panel G, we take advantage of the time series dimension of the data, and examine whether firm productivity rose relatively more in regions where quality of governance improved relatively more between 2010 and 2013.[19] Both in the cross-section and in the time-series, we find evidence that government ineffectiveness constrains firm productivity. The time series findings make a particularly compelling case for the causal impact of government effectiveness on firm productivity.

Orbis provides a unique database to study Italy's firms, but its representativeness of certain types of firm (such as smaller or younger firms or firms in the service sector) may be an issue. Indeed, while the database contains virtually all of the establishments classified as large, only about 10 percent of the small and medium enterprises are included in the data. As a robustness check, we follow Gal (2013) and apply re-sampling weights, based on the number of enterprises in each (industry-size) class cell, which essentially scale-up the

[19] In particular we estimate: $Y_{it} = \beta * GovEff_{rt} * GovDep_s + \delta * GovEff_{rt} + \alpha_t + \alpha_i + \varepsilon_{it}$ where $\alpha_t$ are year fixed effects while $\alpha_i$ are firm fixed effects, which subsume the sector and province fixed effects in equation 1.

number of Orbis observations in each cell so that they match the number in the population.[20] The weighted regression yield even stronger estimates of the effect of public sector efficiency on firm productivity (Panel E).

The results are also not affected by a number of additional robustness checks such as the inclusion of more firm-level controls (leverage, share of tangible assets in total assets, firm age; results available upon request), and controlling for firm size X 4-digit sector fixed effects (resulting in about 3,300 sector-firm-size categories) (Panel F).

[20] This method of resampling implicitly assumes that firms in ORBIS within a specific industry and industry class size cell are representative of the true population within that cell. However, we cannot correct for potential selection bias from differential propensity of reporting by firms based on other characteristics (e.g., profitability, age, etc.) and our findings should be interpreted in light of this analytical shortcoming.

## Table 7. Italy: Effect of Public Efficiency of Firm Productivity: Robustness

| | Output per employee cost | GVA per employee cost | Output per worker | GVA per worker | Log Output | ROA |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | | | Panel A. Data from 2008 | | | |
| GovEff*GovDep | 15.355 *** | 7.680 *** | 15.438 *** | 5.242 ** | 6.947 ** | 0.31 |
| | [3.278] | [1.068] | [4.280] | [2.323] | [2.984] | [0.191] |
| r2 | 0.22 | 0.07 | 0.25 | 0.16 | 0.33 | 0.04 |
| N | 424,056 | 376,702 | 327,024 | 296,481 | 476,798 | 500,593 |
| | | | Panel B. Data from 2009 | | | |
| GovEff*GovDep | 15.280 *** | 8.277 *** | 16.187 *** | 8.872 *** | 9.837 *** | 0.910 *** |
| | [3.405] | [1.291] | [4.791] | [2.355] | [3.655] | [0.172] |
| r2 | 0.22 | 0.08 | 0.24 | 0.15 | 0.33 | 0.03 |
| N | 427,842 | 377,457 | 268,459 | 241,804 | 485,530 | 511,395 |
| | | | Panel C. Data from 2010 | | | |
| GovEff*GovDep | 14.307 *** | 5.870 *** | 16.064 *** | 7.561 *** | 8.090 ** | 0.472 ** |
| | [3.252] | [1.055] | [4.067] | [1.785] | [3.246] | [0.200] |
| r2 | 0.21 | 0.07 | 0.26 | 0.18 | 0.33 | 0.03 |
| N | 438,195 | 386,139 | 205,722 | 186,242 | 500,032 | 526,827 |
| | | | Panel D. Alternative Measure of Government Dependence | | | |
| GovEff*Share of Sales to Gov | 0.006 ** | 0.001 | 0.008 *** | 0.001 | 0.009 *** | 0.001 *** |
| | [0.002] | [0.001] | [0.002] | [0.001] | [0.003] | [0.000] |
| r2 | 0.24 | 0.08 | 0.29 | 0.18 | 0.35 | 0.04 |
| N | 433808 | 389811 | 239000 | 219928 | 488562 | 513434 |
| | | | Panel E. Regional Measure of Government Efficiency (2010) | | | |
| Reg GovEff*GovDep | 23.605 *** | 9.755 *** | 32.281 *** | 14.094 *** | 21.047 *** | 1.058 *** |
| | [5.774] | [2.473] | [7.604] | [3.099] | [5.619] | [0.304] |
| r2 | 0.21 | 0.07 | 0.26 | 0.18 | 0.33 | 0.03 |
| N | 438195 | 386139 | 205722 | 186242 | 500032 | 526827 |
| | | | Panel F. Alternative Measure of Government Efficiency: Quality of Governance (2010) | | | |
| Reg Quality Gov*GovDep | 1.965 *** | 0.823 *** | 2.891 *** | 1.366 *** | 1.804 *** | 0.067 *** |
| | [0.313] | [0.174] | [0.335] | [0.183] | [0.219] | [0.022] |
| r2 | 0.21 | 0.07 | 0.26 | 0.18 | 0.33 | 0.03 |
| N | 438195 | 386139 | 205722 | 186242 | 500032 | 526827 |
| | | | Panel G. Times Series Evidence: Quality of Governance (2010, 2013) | | | |
| Reg Quality Gov*GovDep | 1.204 *** | 2.279 *** | 4.027 *** | 4.334 *** | 3.125 *** | 0.245 *** |
| | [0.465] | [0.373] | [0.937] | [0.887] | [0.662] | [0.083] |
| r2 | 0.92 | 0.88 | 0.95 | 0.92 | 0.93 | 0.8 |
| N | 794858 | 697262 | 570204 | 504660 | 898991 | 937748 |
| | | | Panel H. Weighted Regression | | | |
| GovEff*GovDep | 27.282 *** | 11.174 *** | 25.136 *** | 10.137 *** | 12.567 ** | 0.857 *** |
| | [6.476] | [2.134] | [5.613] | [1.674] | [5.068] | [0.199] |
| r2 | 0.21 | 0.05 | 0.26 | 0.15 | 0.22 | 0.04 |
| N | 396,484 | 357,105 | 220,975 | 203,767 | 445,283 | 468,955 |
| | | | Panel I. Industry X Firm Size Fixed Effects | | | |
| GovEff*GovDep | 18.012 *** | 8.160 *** | 16.414 *** | 6.608 *** | 6.459 | 0.363 ** |
| | [4.443] | [1.288] | [4.309] | [1.457] | [4.242] | [0.161] |
| r2 | 0.24 | 0.08 | 0.28 | 0.18 | 0.34 | 0.04 |
| N | 404,536 | 364,019 | 224,460 | 206,812 | 455,101 | 479,417 |

Note: All regressions (except in Panel G) include province and industry fixed effects, and control for firm size category. Regressions in Panel G include data from 2010 and 2013, and include firm and year fixed effects, as well as the regional quality of government index,which varies by region and year. Standard errors in panel G are clustered at the firm level. In the rest of the panels, standard errors are clustered at the province level.

## IV. GOVERNMENT INEFFICIENCY, FIRM TYPE, AND LEVEL OF GOVERNMENT

The effects of public sector efficiency on productivity are stronger for certain types of firms. Table 8 reports estimates obtained using equation (1) for the subsamples of firms incorporated before and after 2005; as well as micro, small, medium, and large firms. The effects of public inefficiency are larger for young firms. This finding is intuitive since young firms are more likely to interact with the public sector to obtain permits and certifications. With regards to firm size, public sector inefficiency seems to be a bigger constraint for the smallest firms (micro establishments with less than 10 employees), and the largest firms (establishments with more than 250 workers). This finding is consistent with the importance of the public sector for young firms, as well as for very large firms, which tend to be more heavily regulated (for example, many labor laws apply only for firms with more than 15 employees).

**Table 8. Italy: Firm Type and the Effect of Public Sector on Productivity**

| | All | Young | Old | Micro | Small | Medium | Large |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | | Panel A. Output per employee cost | | | |
| GovEff*GovDep | 17.864 *** | 24.352 *** | 16.004 *** | 20.289 *** | 11.138 ** | 10.873 ** | 39.422 *** |
| | [4.540] | [7.363] | [3.782] | [5.239] | [4.387] | [4.733] | [12.317] |
| r2 | 0.23 | 0.18 | 0.21 | 0.19 | 0.3 | 0.41 | 0.57 |
| N | 404,536 | 84,161 | 345,782 | 277,013 | 106,076 | 18,420 | 3,027 |
| | | | | Panel B. GVA per employee cost | | | |
| GovEff*GovDep | 8.061 *** | 11.659 *** | 7.643 *** | 9.678 *** | 3.610 ** | 6.517 *** | 23.122 *** |
| | [1.268] | [3.114] | [1.288] | [1.650] | [1.459] | [1.972] | [6.365] |
| r2 | 0.08 | 0.07 | 0.07 | 0.05 | 0.1 | 0.17 | 0.38 |
| N | 364,019 | 69,351 | 311,415 | 243,686 | 99,806 | 17,591 | 2,936 |

Note: Young companies are defined as those incorporated since 2005. Micro firms are those with 1-9 wokers, Small with 10-49 workers, Medium with 50-249 workers, and Large are firms with more than 250 workers. All regressions include province and industry fixed effects, and control for firm size category. Robust standard errors clustered at the province level.

There is evidence that the efficiency of both central and local governments matters for firms. As mentioned above, three of the services included in our average public sector efficiency variable are provided by regional or local governments (health, child care, and waste collection). Education is a central government responsibility and civil justice is provided by the judiciary, an independent centrally managed branch of power. We calculate the average efficiency scores for services provided by the central and regional/local governments and interact these separately with the dependence of industries on the public sector. The results from estimating the modified version of equation (1) are in Table 9and point to a sizeable effect of government efficiency at both central and local levels, with the effects of improving the efficiency of education and justice in some cases up to twice as large as the effects of improving decentralized services.

**Table 9. Italy: Level of Government and the Effect of Public Sector Efficiency on Productivity**

| | Output per employee cost | GVA per employee cost |
|---|---|---|
| Local GovEff*GovDependence | 7.350 ** | 3.924 *** |
| | [2.969] | [1.070] |
| Central GovEff*GovDependence | 18.099 *** | 5.906 ** |
| | [5.070] | [2.318] |
| r2 | 0.23 | 0.08 |
| N | 404,536 | 364,019 |

Note: Locally provided services include child care, waste collection and health. Centrally provided services include education and civil justice. All regressions include province and industry fixed effects, and control for firm size category. Robust standard errors clustered at the province level.

## V. Conclusions

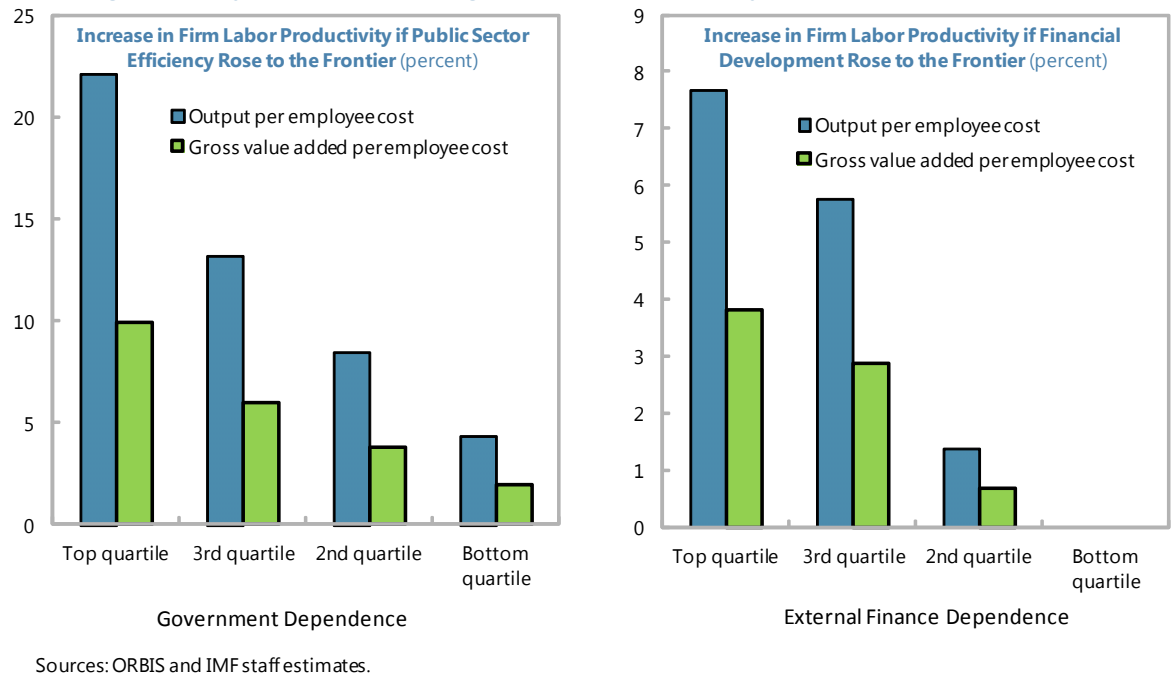
This paper provides empirical evidence on the impact of public sector inefficiency on firm productivity for the case of Italy. The analysis suggests that public sector inefficiency at the provincial level hurts firm productivity using a rich dataset containing information for about 450,000 Italian firms.

The quantitative estimates suggest that Italy could realize significant macroeconomic productivity gains if public sector efficiency improved from currently low levels: if public sector efficiency rose to the frontier in all provinces, firm productivity, measured as output per euro spent on salaries, could increase by up to 22 percent in the sectors that depend the most on the public sector, while gross value added per employee costs could rise from 2 to 10 percent. For the average firm, output would expand by 3 percent.

The impact of increasing public sector efficiency could be potentially much more sizable than that of other interventions suggested by existing empirical literature. For example, several studies have documented the importance of local financial development for growth and productivity in Italy (see, among others, Guiso, Sapienza and Zingales, 2004; D'Alfonso, 2004; and Barra, Destefanis, Lavadera, 2013). We compare the gains from raising public sector efficiency to those of raising local financial development by estimating equation (1) with government dependence replaced by a measure of dependence on external finance and government efficiency by financial development. We then compute the increase in firm labor productivity if financial development in all provinces were to rise to the level of the most

financially developed province.[21] Figure 6 presents the findings for both public sector efficiency and financial development. The dividends from raising public sector efficiency appear to be substantially larger.

**Figure 6. Italy: Gains from Raising Public Sector Efficiency and Financial Development**




Sources: ORBIS and IMF staff estimates.

[21] A sector's dependence on external finance is from Tong and Wei (2011), which build on the methodology first developed by Rajan and Zingales (1998). Specifically, financial dependence of a sector is constructed as the difference of the capital expenditures of the sector and its cash flow as a share of its total capital expenditures in the 1990–2006 period in the U.S. financial development at the province level is proxied by the log of outstanding credit per capita.

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