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MUNICIPAL SOCIALISM OR MUNICIPAL CAPITALISM? THE PERFORMANCE OF LOCAL PUBLIC ENTERPRISES IN ITALY

by Nicola Curci*, Domenico Depalo* and Emilio Vadalà *

Abstract

This paper evaluates the performance of Italian local public enterprises (LPEs) with respect to their private sector counterparts. We address the following questions: i) do LPEs perform worse than (comparable) private firms?; ii) does the performance gap depend on the ownership structure (the share held by the public) or on the market structure (the degree of competition in the sector)?; iii) which are the main determinants of LPEs' performance in terms of productivity (labour v capital)? In addressing these questions, we propose solutions to two pervasive issues in the existing literature on this topic: the identification of an appropriate set of private sector counterparts and the possible endogeneity of the ownership structure. The main findings are as follows: i) LPEs perform less well than private companies by about 8 percent in terms of TFP; ii) although both ownership structure and market structure matter, our results suggest that the ownership structure is more important; and iii) the performance gap of LPEs with respect to private firms seems to be driven by over-capitalization rather than by over-employment. These results suggest that policy measures aimed at privatizing LPEs (totally or, at least, partially) can improve their performance, by reducing the level of public control and promoting cost-benefit analysis for investments.

JEL Classification: L33, L22, H42, C26.
Keywords: local public firm, firm performance, instrumental variables.

Contents

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1 Introduction[1]

In OECD countries public services, especially at local level, are often provided by public enterprises (Saussier and Klien, 2014). For both the policy makers and the citizens, it is important to know whether public enterprises are less efficient than (comparable) private ones: inefficiency of public enterprises can weigh on public finances and reduce the efficiency of the whole economy. Also, public enterprises are an important source of risk for public finances: government bailouts of public enterprises cost, on average, 3 percent of GDP (up to 15 percent in the most extreme cases; IMF, 2016).[2]

The literature on the efficiency of public enterprises with respect to their private sector counterparts is huge. However, the empirical evidence is not clear-cut. Some authors argue that public firms perform less well than private ones (Megginson and Netter, 2001) and that, in mixed public-private enterprises, the performance gap decreases as the private sector's share increases (Monteduro, 2014; Bognetti and Robotti, 2007). Other authors (Martin and Parker, 1997) are more cautious in drawing conclusions, noting that the performance gap depends crucially on the level of competition in the sector of economic activity: public enterprises operating in competitive sectors would show no significant differences in terms of efficiency compared to private enterprises. From the available analyses, it is unclear whether the results are mostly due to the public sector's ownership *per se* or to the competitive environment in which public enterprises operate.

Furthermore, the analyses of the existing literature on this topic are affected by two open issues: one is the appropriate definition of privately owned companies against which to compare public enterprises; the other is that the ownership structure may be endogenous (Megginson and Netter, 2001). In this paper we take a step towards the solution for both issues. We address the first one by building a rich and innovative dataset (with reference to Italian local public enterprises; LPEs henceforth) that allows us to select the private counterparts on the basis of extremely

[1]We would like to thank Guglielmo Barone, Erich Battistin, Paola Fabbri, Silvia Gicomelli, Paolo Liberati, Marco Magnani, Sandro Momigliano, Angelo Pace, Michele Pellizzari, Paolo Sestito and Jeffrey Wooldridge for useful comments. We also thank participants at seminars held at Bank of Italy and Università Roma Tre. The views expressed in this paper are those of the authors and do not imply any responsibility of their institution.

[2]This estimate is based on a survey on fiscal risks and contingent liability realizations covering 80 advanced and emerging markets for the period 1990-2014.

detailed observable characteristics and, as a result, to compare private and public firms that are *observationally* (almost) identical, apart from the public/private owner. Although there is nothing conceptually new in this, the richness of our dataset provides a great advantage over the existing analyses.

To address the possible endogeneity of the ownership structure, a standard approach would be based on *instrumental variable* (IV) methods that rely on a valid instrument that affects the probability of being a public firm, but not the performance of the LPEs. We argue that the quest for a valid instrument in this case is doomed. Therefore, we apply an innovative approach, identifying the parameters of interest by 'non-standard' estimators that exploits the heteroschedasticity in the data to obtain a valid instrument (Lewbel, 2012). For an intuition, consider a control function approach without an instrument: under homoschedasticity, the errors are identical across observations and therefore there is a multi-collinearity between the predicted endogenous and the other covariates; in this case the parameter attached to LPE cannot be identified. Under heteroschedasticity, the errors are $different$ across observations and therefore the issue of multi-collinearity is overcome; in this case the parameter attached to LPE can be estimated. In our analysis there exists a huge heterogeneity across units, thus this method performs particularly well. From a technical point of view, this is the major contribution of this paper.

Our analysis is focused on Italian LPEs. The Italian case is of particular interest for at least three reasons:[3] i) the number of LPEs is quite large (around 8,000, according to recent estimates by the Italian Ministry of Economy and Finance; MEF, 2015), with about 500,000 employees and operating in almost all sectors of the economy (Karantounias and Pinelli, 2016; for an analysis focused on Italian local public services, Bianco and Sestito, 2010); ii) public transfers to LPEs are around 16.5 billion euros per year (1% of GDP; Cottarelli, 2014); iii) in recent years the government has repeatedly intervened to rationalize LPEs, primarily in order to reduce their number and to improve their efficiency, as part of a broader spending review process.[4]

[3] The debate, even theoretical, about the efficiency of LPEs in Italy is very ancient and dates back to the beginning of the twentieth century. See for example Montemartini, 1902.

[4] In Italy several commissioners for spending review have been appointed since 2012. They devoted special attention to LPEs as an important part of the process, increasing public consciouness about their functioning. The legislative process, aiming at increasing LPEs efficiency and reducing their number, was concluded in June 2017. However, effective results are still far away. This delay may be attributed not only to political pressures but also to

In this paper we address three questions: 1) do LPEs perform worse than (comparable) private firms? If so, 2) what is the relative importance of the ownership structure (the share held by the public) and the market structure (the degree of competition in the market)? 3) which are the main drivers of LPEs' performance?

The main results of the paper can be summarized as follows: i) measuring performance in terms of total factor productivity, LPEs perform on average worse than private enterprises by about 8 percent; ii) the performance gap decreases monotonically as the share held by local governments increases; iii) the ownership structure seems to be more important than the market structure in explaining the worse performance of LPEs; iv) for TFP over-capitalization matters more than over-employment.

The paper is organized as follows. Section 2 reviews the relevant existing literature. Section 3 discusses the empirical approach of the analysis; Section 4 presents the data at hand that are analyzed and discussed in Section 5. Section 6 offers some conclusions.

2 Literature review

In this section we briefly review the theoretical and empirical literature comparing the performance of LPEs and private firms.

The theoretical literature has devoloped along three lines of research, all predicting that private firms are expected to perform better than public firms: agency theory, property-rights theory and public-choice theory.

According to agency theory models, managers (the agents) maximize their own utility function rather than that of the owner (the principal). Whilst in private companies, the misalignment of objectives between the agent and the principal may be reduced through several mechanisms, like a more clear statement of objectives or the threats of takeovers and bankruptcies, this is not the case in public firms. Their tasks usually combine economic and social targets and for them threats of takeovers and bankruptcies are very weak. For these reasons, private ownership structure should

the very heterogeneous duties of LPEs. In this paper we aim to provide some policy conclusions that may be useful even for this spending review process. However, we limit ourself to draw conclusions about economic aspects of the issue, disregarding political economy considerations.

lead to higher efficiency and profitability than public one (Monteduro, 2014).

The second line of research argues that in public firms property-rights are more attenuated than in private firms, because it is unclear who has the right to control the managers and the shares are dispersed across many owners (which ultimately are the voters). Weaker incentives to monitor managerial behaviors lead to worse performance of public firms.[5]

In public-choice models, the primary goal of politicians is extracting rents for themselves. Therefore, their aim is related to the political cycle (re-election) rather than to economic efficiency of public firms. Further, much in line with the property-rights models, for individual taxpayers the cost of monitoring public firms would be higher than the benefit in terms of lower taxes or improved efficiency of public expenditure. It follows that none of the taxpayers, taken individually, has any interest in exercising this form of control and public firms' performance is consequently worse than that of private firms (Willner (2001)).

The empirical evidence is less clear-cut. A literature review on this topic faces several challenges given the heterogeneity of the institutional frameworks in which public enterprises operate, the indicators of performance and the empirical methods employed in the analysis. For this reason, we focus only on recent surveys based on western non-transitional economies (Table 1).[6] The most recent review of the existing empirical literature is in Muhlenkamp (2013).

The general finding is that private firms perform better than public firms. Studies differ in the emphasis they give to this result, with some being more cautious when drawing conclusions, others more assertive.

Among studies characterized by more cautious conclusions, there are Martin and Parker (1997), Shirley and Walsh (2000), Villalonga (2000), Willner (2001), Parker (2006), Bel and Warner (2008), Arcas and Bachiller (2010). Even though public firms are (almost) never found to perform better than their private sector counterparts, these authors recognize that this result can be sensitive to the sample of firms under study, the measures of performance investigated and the sector of activity.

[5] The same problem is experienced by private companies with a disperse ownership structure: if individual shareholders incorporate the expectation that they cannot affect alone the managerial behavior, they will loosen their monitoring effort, thereby creating a free-rider situation even in the private sector (Boardman and Vining, 1989).

[6] In the table we report only summary information about the results. The reader should refer to the cited papers for details.

Among studies that are more assertive, the review in Megginson and Netter (2001) and Megginson et al. (2004) argue that private firms perform better than public firms along operational and financial dimensions. Similar conclusions are reached for TFP (Boitani et al., 2013) and profitability (Gupta, 2005).

Studies on Italian data are more recent. All of them assert that public firms are less performing than their private counterparts. Bortolotti et al. (2007) on a sample of firms in 2005 show beneficial effects of privatization in terms of profitability and management efficiency (measured as return on asset and gross operational margins) and a lower number of employees. However, these effects disappear when the analysis is focused on sectors that are more open to competition. Cambini et al. (2011), on a sample of 33 local transportation companies for the years 1993-2002, conclude that transformation of a municipal firm into an autonomous company or into a Limited Liability Company, no matter who are the owners, reduces production costs. The latest study that we are aware of is based on 623 Italian local utilities (Monteduro, 2014). The differences in economic performance between local public firms and an appropriate counterfactual is significantly in favour of the latter and varies with the degree of public shares, especially in terms of profitability.

We conclude this section noting that all the papers reviewed in Table 1 provide their estimates based on OLS technique (although, as emphasized by Bel et al., 2010, simple OLS might miss relevant aspect of the differential between private and public firms). In Section 3 we argue that OLS may provide biased results and that standard techniques may be inaccurate, so we depart from OLS following a different approach.

3 Identification strategy

The aim of our analysis is the comparison of an outcome y between public (subscript G) and private (subscript P) firms, *coeteris paribus*.

We identify a firm as public when the participation share of local governments is greater than zero. Since a firm is either public or private, but not both, we will heavily borrow from the policy evaluation literature to recover what would have been the outcome in the unobservable status.

If *1)* for each treated (public) firm, an *observationally* identical firm exists (common support) and *2)* there are no unobservable characteristics of the firms correlated with both the outcome and the treatment (exogeneity), we can consistently estimate $\mu_G = E[y(G)|x]$ (μ_P) using only the sample of public (private) firms and the difference between the two groups is the effect of being a LPE.[7]

As far as we know, the existing empirical literature in this field heavily relies on (some form of) the exogeneity assumption (usually using OLS; see Section 2). However, this assumption is unlikely to hold in reality. Megginson and Netter (2001) criticize the exogeneity assumption pointing out that "there are generally fundamental reasons why certain firms are government owned and others are privately owned [...]. These factors that determine whether the firm is publicly or privately owned likely also have significant effects on performance. Thus, it is difficult to evaluate the effects of government ownership where the ownership structure is itself endogenous to the system that includes both political and performance goals" (p.332).[8]

Some examples can help to understand why the exogeneity assumption may be violated in this analysis: *i)* enforcement of the regulation for public firms may be looser than for private firms, which would make the OLS biased towards better outcomes of LPEs; *ii)* 'healthy' LPEs are more likely to undergo privatization process, which would make the OLS (after privatization) biased towards worst outcomes of LPEs (the opposite may happen in case of nationalization of private firms); *iii)* LPEs management may take into account social and political objectives, which would make the OLS biased towards worst outcomes of LPEs; *iv)* LPE identifier may be measured with error, in which case the estimates from OLS would be attenuated. These examples make it clear not only that OLS estimates of the treatment indicator is in general biased but also that the direction of the bias is *a priori* unpredictable and that OLS alone is not helpful even for the less ambitious

[7] In order to account for differences between public and private enterprises two main approaches have been suggested in the literature: the first adjusts for differences in the covariates (possibly non parametrically as we do using series estimations suggested in Imbens et al., 2005); the second approach adjusts for differences in the probability of treatment (i.e. propensity score approach suggested by Rosenbaum and Rubin, 1983). In our analysis we exploit the two approaches together, so that the estimator is consistent when either the propensity score or the model for the outcome is consistent (double robustness property; Wooldridge, 2007).

[8] Megginson and Netter (2001) criticize also the common support assumptions, emphisizing that "in comparing [public firms] to privately owned firms, it is difficult [...] to determine the appropriate set of comparison firms or benchmarks [...].

goal of defining a lower or an upper bound of the gap.

In standard approaches, consistent estimators of the performance gap in presence of possible endogeneity would rely on a variable Z (an instrument) that explains whether firms go public, while being uncorrelated with the outcome of interest, to implement an instrumental variable (IV) estimator.

Most reliable instruments in several economic problems generally involve a policy change. However, in this setup, even a policy change would not be a good instrument. Indeed, the policy change would be decided by the policy maker and would affect directly itself: the necessary assumption of uncorrelation with the outcome of interest would be violated, making IV estimates inconsistent.[9] This is probably the main reason why the existing literature in this field uses mainly OLS.

In this paper we explore alternative ways to address the endogeneity issue that do not use instruments. To the best of our knowledge, this is the first paper to take this approach in this literature. In particular, following Lewbel (2012), we identify the parameter of interest through higher moments (we refer to it as IV-H) by exploiting the heterogeneity across firms (either within the same public/private group or across groups, as well as conditioning on relevant covariates) in our (large) sample, as confirmed in Section 4. [10]

Addressing endogeneity through higher moments

The aim of the analysis is the estimation of the following model:

$$\begin{aligned} y &= \beta X + \tau LPE + \epsilon_1 \qquad \text{LPE=1 if public enterprise} \\ LPE &= \gamma Z + \epsilon_2 \\ \epsilon_1 &= \alpha_1 U + V_1 \\ \epsilon_2 &= \alpha_2 U + V_2 \end{aligned} \tag{1}$$

[9] Actually, if the condition of exogeneity of the instrument is violated, the IV may be even more biased than the OLS (Card, 1999).

[10] Similar approaches have recently been proposed by Klein and Vella (2010) and Millimet and Tchernis (2013).

In a standard IV setup, U, V_1, and V_2 are unobserved variables that are uncorrelated with the set of exogenous covariates (X) and are uncorrelated with each other, conditioning on X.

Whilst V_1 and V_2 are idiosyncratic errors, U represents unobserved factors that may directly influence both variables (e.g., the health of firms, in the examples above). If the distribution of errors does not depend on X, the relation between errors is captured by the unconditional population regression $\text{argmin}_a \, E[\epsilon_1 - a\,\epsilon_2]^2 = \frac{cov(\epsilon_1,\epsilon_2)}{var(\epsilon_2)}$ (Klein and Vella, 2010). Thus, the endogeneity might be purged adding $a\,\epsilon_2$ as an additional explanatory covariate for y in the main equation. If the idiosyncratic errors are homoscedastic, without an instrument LPE would be a linear combination of the X in the main equation (i.e. multi-collinear), hence identification of τ fails.

However, if one or both of the idiosyncratic errors are heteroschedastic, the additional covariate for the main equation of y would be equal to $a(x_i)\,\epsilon_2$ (where x_i is a particular realization of X), again from the conditional population regression $\text{argmin}_a \, E[\epsilon_{1,i} - a\,\epsilon_{2,i}|X]^2 = \frac{cov(\epsilon_{1,i},\epsilon_{2,i}|X)}{var(\epsilon_{2,i}|X)}$. This quantity is different across observations and it is no longer a linear combination of X (i.e. it is no longer multi-collinear).

Following Lewbel (2012), we identify the parameters of interest by restricting the correlations between the error terms and the covariates. Let Z be a vector of observed exogenous variables, that may also coincide with X. If one or both of the idiosyncratic errors are heteroschedastic, $cov(Z, V_1\,V_2) = 0$ and the common factor U is conditionally independent of Z, Lewbel (2012) shows how to construct instruments that allow to consistently estimate the parameters of interest. The parameters are identified by a 2SLS of y on X and LPE, using as instruments for the latter the interaction between the demeaned covariates and the residuals from a regression of the endogenous on the exogenous covariates, i.e. $z = (x - \overline{X})\,\epsilon_2$ (see also Baum et al., 2012). From the intuition based on the population regression, notice that if we impose heteroschedasticity, whereas the true errors are homoscedastic $a(x_i) = a$, the identification fails. For this reason, the less (more) heteroschedastic the data, the less (more) precise the estimates. In other words, the relevance of the instruments in the approaches that rely on heteroschedasticity is proportional to the degree of heteroschedasticity in the process. An advantage of classical IV method is that the only reason for any relation between the dependent variable and the instrument is the effect of the instrument on

the causal variable of interest (Angrist and Pischke, 2008, p. 128). Without an instrument, ex-ante we loose this clear connection (less technically, we loose a 'story' for the instrument). However, ex-post we can compare the results from the IV-H to those from the OLS to obtain a story based on 'backward-induction'. We follow this approach in the empirical analysis presented in Section 5. The second relevant issue in our empirical strategy has to do with the common support hypothesis (Section 4).

4 Data Description

Common support is needed to perform a meaningful comparison: conditioned on some relevant characteristics, for any treated observation (at least) a conterfactual should be found. In this section, we present our data sources and the strategy implemented to select our sample in order to satisfy this hypothesis. With respect to existing analyses, we achieve the goal by building an extremely detailed dataset, merging data from two different sources: 1) the list of public enterprises compiled by the Ministry of Economy and Finance (MoF, henceforth); 2) firm level information from balance sheets.

The list of public shareholdings is published yearly by MoF on the basis of direct reporting from public institutions that have shareholdings in any firm, irrespective of the amount of shares effectively owned.[11] While in principle this list should contain all firms that have (at least) one public shareholder, it cannot be considered exhaustive. From 2011 to 2012, the number of firms in which public entities have shareholdings increased from 7,320 to 8,119.[12] The vintage used in this paper is that of 2012. On average, in 2012 there were about four shareholders for each public firm reported in the MoF list, as there are many cases of shareholdings owned by different public

[11] In 2009, Law 191 provided a mandatory obligation for all public entities (both central and local) to report data about their shareholdings to MoF on a yearly basis. Since 2011, MoF made available the lists of shareholdings (MEF, 2014).

[12] The increase in number of public shareholders denotes a stronger compliance especially by local governments to the legal obligation of reporting their shareholdings. However, the compliance rate remains below 100%, in particular for smaller local governments. MEF (2014) estimates that in the 2012 release the compliance rate was 100% for social security institutes, fiscal agencies, universities, regions and the biggest municipalities (those with more than 250,000 inhabitants); almost 100% for provinces; about 70% for ministries and Prime Minister offices; 90% for medium size municipalities (those with more than 50,000 and less than 250,000 inhabitants); 50% for smaller municipalities and 60% for other central government offices.

institutions.

About 93% of shareholdings reported in the 2012 list are LPEs, i.e. having only local governments as public shareholders. In what follows, we restrict our attention only to them, because: 1) shareholdings of Central Government and other public entities are likely to be larger, more strictly monitored and under the scrutiny of public opinion through mass-media news; 2) LPEs are the target of the recent policy intervention (Section 1).[13] After this selection, we remain with 7,691 LPEs.

In addition to shareholders, the MoF dataset contains LPEs identification data. However, it lacks comprehensive information on balance sheets items. Then we need to integrate these data from other sources. The largest existing database on the Italian balance sheets is provided by Cerved Group:[14] it contains balance sheets of about 750,000 (public and private) firms. Besides balance sheet data, Cerved provides additional data on profitability, namely returns on equity, on investments and on assets (see Section 5). Given the administrative nature of Cerved dataset, standard problems of sample data like unit- and item-nonresponse, as well as measurement errors in key variables, in principle, are not an issue in our case.

Table 2 reports the results of the merge between the MoF list and Cerved information for years 2009-2012.[15] In each year, we recovered balance sheets for about 60% of the (active and inactive) LPEs. Excluding firms that are exempt by law from the requirement of transmitting their balance sheets to the Company Register (more than 1,600 per year; see first row of Table 2), the matching rate between the two datasets is as large as 92%, which is remarkably high. After the merge, the dataset contains identification and balance sheet information for about 5,000 LPEs by year.

Cerved data are used also for the selection of private sector counterparts.[16] This selection is

[13] Our results are not affected by keeping into the dataset all the public firms.

[14] Since 1994, Cerved Group collects data from the Company Register held by the Chambers of Commerce to which, by law, each company has to transmit its balance sheet at least on a yearly basis, usually between April and November of the following year. There are some exceptions to this legal requirement, like, among others, consortia that provide goods and services only to their members, holding companies, and companies operating in banking and financial sectors. Not exempted companies are fined, should they fail to transmit their balance sheet. Therefore, Cerved dataset may be considered exhaustive of the entire population of Italian firms.

[15] In principle, one can extract balance sheet information also for years before 2009. However, we restrict our attention to 2009-2012 balance sheets because in this short time span it is likely that firms have not changed their ownership status.

[16] Notice that, because of the already mentioned under-reporting of LPEs to the MoF list, we mis-classify some LPEs as private firms. However, on the one hand we think that this mis-classification reguards only a tiny fraction

conducted on the basis of branch of activity (6-digit NACE code), region, statutory form and size of the firms. Table 3 reports the steps we followed in selecting the sample. From the original Cerved data, we initially dropped some LPEs with very rare statutory forms: we drop statutory forms with less than 15 records, thus removing about 40 LPEs and 7,600-8,200 private firms per year. The main selection is driven by NACE codes. We removed more than 250,000 private firms with NACE codes not corresponding to any of the remaining LPEs. Finally, considering all possible combinations of legal forms and NACE codes, we drop firms in those cells where either private or public enterprises are absent (other 80,000-100,000 firms, depending on years). We remain with a unique dataset of about 390,000 balance sheets per year, of which 1.2% refers to LPEs (Table 4). This selection procedure ensures by construction that the common support hypothesis is satisfied.

Another distinctive feature of this paper is the sectoral classification of LPEs. In our analysis, we classify firms according to the Spending Review Commissioner's 2014 Report (Cottarelli, 2014).[17] LPEs are divided into four groups, based on their NACE codes: 1) the 'Network industries' are public enterprises that provide network public goods, including those operating as natural monopolists and in sectors with market failures (electricity, water, gas, local public transportation, refuse pickup etc.) and are generally subject to quite a strict regulatory system that dictates operating rules, often imposing prices and margins; 2) LPEs in 'Other services' provide other public services of general interest for local communities and are normally financed by fiscal revenues (eg. infrastructures, care for infants or elderly etc.); 3) LPEs that provide 'Services to the PA' generally furnish goods and services almost exclusively to the owner public institution and were constituted in order to outsource previously in-house produced goods and services (eg. real estate managing, holding companies, computer services, other administrative services etc.); 4) the 'Competitive sectors' collect all other LPEs that operate in a competitive, market-disciplined environment (eg. shops, drugstores, storage and activities supporting public transportations, touristic

of total firms; on the other hand, if LPEs have a worst performance than private firms (as found in the most of the literature reviewed in Section 2), the mis-classification negatively impacts on the performance of the private firms as a whole and the estimated differential would be a 'lower bound' of the true differential.

[17] In 2014 the Parliament adopted a Government decree aiming at reducing the number of LPEs and improving their economic efficiency. The Spending Review Commissioner was in charge of proposing measures to fulfill the pledge: in August 2014 a report about the current status of LPEs in Italy was published, using, among others, the same dataset from MoF we use in this work.

activities etc.). In Table 5 we show the distribution of LPEs by sector of activity. The largest group (about 37% of the sample) is that with LPEs operating in competitive sectors. Slightly less than 30% of LPEs provide other public services of general interest and about 20% operate in network industries. Finally, less than 10 per cent act as main furnishers of Public Administrations. Private firms in our sample are less unevenly distributed across the four main categories if we exclude the group of 'other services' where private firms are much less present.

To conclude this section, we present some descriptive statistics about the main variables of interest for our analysis (see Table 6). On average, public firms show higher TFP, due to compositional effect, and lower profitability (as measured by ROE, ROI and ROA) than private firms. Differences between the two groups remain broadly stable across quantiles. As the relevance of the instruments in our approach is proportional to the degree of heteroschedasticity in the data (see Section 3), it is worth emphasizing that standard deviation is a non-negligible fraction of the mean for each variable. This ensures the validity of our empirical strategy.

5 Empirical Analysis

In this section we present the results of the analysis. We evaluate *1)* whether LPEs perform worse than private (comparable) enterprises; *2)* how important the ownership structure (the share held by the public) v the market structure (the degree of competition in the sector) are in explaining the result; and *3)* which the main determinants of LPEs' performance are in terms of production factors (labour v capital).

Definition of the outcome

A preliminary issue to be addressed is to find the most appropriate measure of performance. Several alternatives have been proposed in the literature, which can be classified in two groups referring to either operational efficiency or profitability (see Section 2). As for operational efficiency (for short, simply efficiency) there exists a wide range of indicators: the most common and the one we use

in our analysis, is the total factor productivity (TFP),[18] which probably offers the most complete representation of the phenomenon.[19] As for profitability, we recur to standard measures used in the literature: the return on assets (ROA), equity (ROE) and investments (ROI).

We control for a rich set of covariates: dummies for region, sector of activity – based on 365 different 4 digit NACE code –, statutory form, year and (appropriate) polynomials of (log of) cost per employee, number of employees, capital, sales.[20]

Throughout this section our working hypothesis is that, being identical apart from the owner (public/private), the two groups of firms are expected to have the same performance. Therefore, all our analyses are about testing this null hypothesis. To take into account the heteroschedasticity and the panel structure of the data, standard errors are robust to heteroschedasticity and clustered at firms/year level (Cameron et al., 2011).

In Section 3 we noticed that the direction of the bias of the OLS is *a priori* unpredictable, therefore it must be judged on the basis of the actual results. This exercise is meaningful only if IV is consistent for the parameters of interest. To this aim, as a preliminary analysis, we successfully test that conditions of the estimator by Lewbel (2012) are satisfied, in particular that heteroschedasticity is a feature of the regressions for all the outcomes (with the only exception of the immaterial component of capital).

A comparison between (double robust) OLS and IV-H estimates suggests that the two estimators are indeed different. More formally, the Hausman (1978) test rejects the OLS as inconsistent, thus supporting our decision to abandon the exogeneity assumption. This result confirms the skepticism of Megginson and Netter (2001) about the existing literature based on the assumption of exogeneity. For the sake of brevity, in what follows we focus only on IV regressions and only emphasize the most interesting differences between the two estimators.[21]

[18] The estimate of the TFP is based on the method in Levinsohn and Petrin (2003) using the data described in Section 4 (similar results are obtained using the method in Wooldridge (2009)).

[19] We also check the robustness of our results against possible alternative definitions of efficiency used in the literature (Feng et al., 2004). The differences, all available on our internet website, are minor and economically negligible.

[20] The expression 'appropriate' means that, for example, we do not control for a polynomial in sales when estimating an output with respect to sales.

[21] All the results commented but not shown in the paper are available on our internet website.

Main results

We organize the discussion by answering the three questions raised at the beginning of the section. Our estimates show that, in terms of TFP, LPEs are less efficient than private firms by about 8% (Table 7; col. 1). OLS estimates (Table 8) are in general biased towards worse outcomes, with an estimated efficiency gap of LPEs of about 10%. Although the difference between the IV-H and OLS estimates might appear relatively small in terms of TFP, when it comes to identify the main drivers behind this gap the two estimators tell us a very different story. Below we will discuss this point more in details.

In an attempt to understand the extent to which the result depends on the public ownership of LPEs (the ownership structure) or on the fact that LPEs mainly operate in less competitive sectors (the market structure), we replicate our analysis over different subsamples. As for the ownership structure, we split the sample in four subsamples that reflect decreasing public ownership: total ownership (100% of shares), majority share ($> 50\%$), influential power (that we conventionally define as a public share larger than 30%) and minority ($< 30\%$).[22] For the market structure, we exploit the aggregation of NACE codes proposed by Cottarelli (2014) (Section 4).

When we look at the ownership structure (Table 7; cols. 2–5), we find that indeed it matters for the performance of LPEs. Our subsample estimates show that the larger the share held by Local Government, the higher the performance gap: LPEs that are 100% owned by Local Government are less efficient than their private sector counterparts by 15%, about 9 percentage points more than those for which the share of Local Government is low (less than 30%).

However, even the market structure matters. When we focus only on competitive sectors (Table 7; col. 6), i.e. sectors in which the LPEs produce for the market and face with the competition of private enterprises, the efficiency gap of LPEs with respect to private firms vanishes. In contrast, in all other sectors (Table 7; cols. 7–9), characterized by a lower level of competition (or no competition at all), LPEs show an efficiency gap which ranges from 17 (services to PA and other services of general interest) to 20% (network industries).

[22] We have also checked our results using other thresholds, namely 25% and 33.3%, which are relevant quorum for passing/discussing resolutions in the Italian legislation.

In order to understand which between the ownership and market structure is more important in determining the worse performance of LPEs, we run a regression over subsamples identified by each possible combination of the two categorical variables measuring ownership and market structures (Table 9). If the market structure were relatively more important than the ownership structure, then no significant differences between LPEs and private firms should be estimated for competitive sectors, no matter the share held by the Local Government (Table 9; row 1). In contrast, if a significantly negative coefficient were estimated when the share held by the Local Government increases, the ownership structure would be relatively more important than the market structure. Our results show that a significant negative gap for LPEs is found also for competitive sectors as soon as the share held by the public is larger than 30%; the gap increases with the share held by the public, reaching the peak of 13% for enterprises totally owned by Local Governments.

Although the efficiency gap for LPEs operating in competitive sectors is remarkably smaller than in other sectors, these results suggest that the ownership structure is more important than the market structure in explaining the performance of LPEs with respect to their private sector counterparts.

The final relevant question we try to answer is about the determinants of the LPEs inefficiency. We focus our attention on labour (L), and its cost, and on capital (K).

As for labour (measured as the number of employees normalized with respect to sales as in Feng et al., 2004), overall the difference between the two groups is not statistically significant (Table 7; row 2); for some sectors (services to PA and competitive sectors) the coefficients are significant in statistical terms, however the difference is negligible. This implies that there is no efficiency loss due to the number of employees, no matter the sub-sample.

Following a large literature that estimates the wage gap between the public and the private sector workers, we also investigate the average cost per employee (Table 7; row 3). The cost per employee in the LPEs is higher than in private firms by about 2,500 euros (about 6.5%); the largest differential (about 5,000 euros) is estimated for firms operating in network industries, probably the sector least subject to competition. An important caveat is that we cannot distinguish between skilled and unskilled workers, thus we are not able, at this stage, to conclude that this difference is

a wage premium or rather that it is due to the higher incidence of skilled workers for the LPEs.[23] The size of this gap is comparable to that estimated for the Italian public sector workers with respect to their private sector counterparts (Depalo et al., 2015).

Continuing with the investigation of the main determinants of the TFP gap, we now turn to capital. We focus only on material capital (over sales, to provide an easier and more direct comparison with respect to labour indicators; other definitions do not affect our conclusions), because as mentioned before for immaterial capital not all statistical assumptions for the validity of the IV-H estimator are satisfied.

Our estimates show that the amount of (material) capital is larger in LPEs than in private firms: the overall coefficient is slightly less than 1, implying a difference in capital endowment by 10% of the unconditional mean (Table 7; row 4). When the share held by the public is lower than 30%, the difference between LPEs and private firms is not statistically significant. Furthermore, the gap is statistically significant only for firms operating in network industries.

From these results, the efficiency gap of LPEs in terms of TFP seems to be due to 'over-capitalization'; we do not find instead significant evidence of 'over-employment'.[24]

This conclusion might be at odds with prior expectations. Indeed, one may think that if politicians maximizes the probability of re-election, they would influence the LPEs decisions in the direction of a larger-than-needed employment size. However, it should be considered that Italian LPEs are not completely free in the recruitment of staff, but they are subject to some restrictions similar to those applied to other public entities (this is especially true for LPEs classified as general government in official statistics). In this institutional framework, an alternative way to maximize the probability of re-election for politicians can rely on pushing expenditures, including those devoted to capital accumulation (Sole Olle, 2003).

In this respect, it is worth emphasizing that IV-H and OLS tell us a different story about the

[23] At the end of this section, when a more complete set of results is available, we will argue in favour of a wage premium (at least to some extent).

[24] The differences that we have estimated so far in terms of labour or capital are *all other things equal*. Even though we use a semi-parametric approach based on series estimation of continuous covariates (Imbens et al., 2005; Newey, 1994), it may be the case that we do not fully control for the possible non-linearities between capital and labour. For this reason we have also used as dependent variable the capital-labour ratio (K/L) and indeed the results confirm that LPEs are over-capitalized with respect to private counterparts but they do not show over-employment.

determinants of the LPEs inefficiency gap. OLS estimates are coherent with the over-employment prevalence in the explanation of the TFP results (based on the significance of parameters; Table 8). In this respect, our analysis is an improvement in the literature, as the use of a consistent estimator not only returns more precise estimates but also prevents misleading conclusions and policy implications.

The results for profitability are broadly consistent with those for TFP. Focusing on ROE (Table 7; row 7), we find that: *1)* LPEs are less profitable than otherwise equal private firms by about 2.4 percentage points; *2)* the larger the share held by the public the higher is the profitability gap of LPEs. However, a distinctive difference with respect to the results for TFP is that LPEs operating in competitive sectors are less profitable than private firms, even though to a lesser extent than LPEs operating in other sectors. Since the difference in terms of TFP was not significant for competitive firms, the profitability gap may depends on differences in the cost of production factors and/or in sale prices. Even if we do not have direct information on the latter, it is reasonable to assume that in competitive sectors sale prices are not (much) different across firms. At the same time, no gap in productivity was estimated for LPEs operating in competitive sectors. This seems to suggest that the gap estimated for the cost of labour force should reflect, at least partially, a wage premium and can explain the profitability gap of LPEs operating in competitive sectors.

6 Conclusion

In OECD countries public services, especially at local level, are often provided by public enterprises (Saussier and Klien, 2014). Therefore, the efficiency of LPEs is important for the overall efficiency of the economy and the sustainability of public finances.

The empirical evidence on the relative efficiency of public enterprises is not clear-cut and is affected by two open issues, namely the definition of an appropriate counterfactual sample and the endogeneity of the ownership structure (Megginson and Netter, 2001). In this paper we take a step towards the solution for both issues. On the one hand, we are able to build a very detailed dataset that allows us to compare firms that are observationally equivalent, apart from the ownership

indicator, thus making possible the definition of the appropriate set of comparison firms. On the other hand, we address the possible endogeneity of the ownership using a recent estimator proposed by Lewbel (2012). As a contribution to this estimator we propose a method for the selection of the best set of instruments that reduces the possible finite sample bias of the estimator.

Although we focus on Italy, which represents a particularly interesting case to analyze for several reasons, the approach we have followed in this paper may be easily adapted to other countries. We find that the performance of Italian LPEs, measured in terms of total factor productivity, is on average lower than that of private enterprises by about 8%; the performance gap decreases monotonically as the share held by local government increases. Although the efficiency gap for LPEs operating in competitive sectors is remarkably smaller than in other sectors, our results show that the ownership structure is more important than the market structure in explaining the performance of LPEs with respect to their private sector counterparts. The performance gap measured in term of TFP seems to be determined more by over-capitalization than by over-employment of LPEs: in this respect, our analysis is an improvement in the literature, as the use of a consistent estimator not only returns more precise estimates but also prevents misleading conclusions.

Our results imply that policy measures aimed at privatizing LPEs (totally or, at least, partially) can improve their performance, by reducing the level of public control and promoting cost-benefit analysis for investments.

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Table 1: Literature Review

Paper	Period	# Studies	Measure	Sector	Stance	Country
Martin and Parker (1997)	68–95	64	Various	Various	Cautious	Various
Shirley and Walsh (2000)	70–78	52	Various (mainly Cost + TFP)	Various	Cautious	Various
Villalonga (2000)	65–97	153	Mainly Profitability	Various	Cautious	Various (focus Spain)
Willner (2001)	70–98	68	Cost	Various	Cautious	Various
Megginson and Netter (2001)	89–01	10	Various	Various	Assertive	Various
Megginson et al. (2004)	77–00	-	Various	Utilities	Assertive	Various
Gupta (2005)	90–00	-	Mainly Profitability	Various	Assertive	India
Bortolotti et al. (2007)	2005	–	Profitability	Utilities+Transport	(Almost) Assertive	Italy
Bel and Warner (2008)	65–07	35	Production + Cost	Waste+Water	Cautious	Various
Arcas and Bachiller (2010)	92–07	28	Various	Various (focus: Size)	Cautious	Various
Cambini et al. (2011)	93-02	33	Cost	Transport	Assertive	Italy
Boitani et al. (2013)	97–06	77	TFP	Transport	Assertive	Europe
Monteduro (2014)	2014	–	Mainly Profitability	Utilities	Assertive	Italy

Table 2: Merging of (2012) Mof's list of LPEs and CERVED archives

	2010	2011	2012	
legal forms not obliged to deposit bs	1698	1663	1608	1606
financial activities	130	130	132	131
holding companies	96	89	81	88
no NACE code	113	103	87	82
purely not matched	619	501	412	431
matched but inactive	494	588	697	731
matched and active	4541	4617	4674	4622

Table 3: Selecting firms from the original CERVED's archives

	2010	2011	2012	
initial CERVED balance sheets	737335	748589	754611	743642
drop LPEs with rare legal forms	45	34	34	39
drop private with legal forms rare among LPEs	8160	8119	7933	7578
drop private with NACE codes not present among LPEs	251184	257739	257108	253657
drop firms in cells without both private and LPEs	81421	93690	98073	97749
final selection (both private and LPEs)	396570	389041	391497	384658

Table 4: Number of firms by year

Year	Private	Public	Total
2010	384540	4501	389041
2011	386943	4554	391497
2012	380164	4494	384658
Total	1151647	13549	1165196

Table 5: Number of firms by Cottarelli (2014) classification

Sector of activity	2010		2011		2012	
	Private	Public	Private	Public	Private	Public
Competitive sectors	114569	1667	114014	1688	114928	1670
Services to PA	134146	395	135264	406	132812	398
Network ind.	119489	1010	120414	1038	115100	1016
Other services (gen.interest)	7929	1311	9481	1309	10378	1301
Not classified	8407	118	7770	113	6946	109
Total	384540	4501	386943	4554	380164	4494

Table 6: Descriptive statistics

Variable	Private firms					Public firms				
	mean	sd	p10	p50	p90	mean	sd	p10	p50	p90
TFP	4.1	0.7	3.4	4.1	4.9	4.6	0.9	3.7	4.6	5.6
Cost L	37.9	5.4	30.8	38.2	44.4	45.5	6.3	37.7	45.9	52.6
L (*)	10.3	757.2	1.1	6.1	15.2	22.1	227.8	1.2	6.1	20.2
K (*)	7944.7	170671.5	12.9	196.7	13230.0	12998.2	207715.7	9.9	280.7	8768.9
Imm. K (*)	623.4	19828.3	2.2	29.1	500.0	1084.0	17928.9	2.1	32.9	758.8
ROE	4.2	18.5	-19.0	3.2	28.6	3.1	15.5	-14.1	1.7	22.1
ROI	4.4	9.9	-4.3	2.8	15.4	3.6	9.0	-4.4	2.6	13.0
ROA	4.3	8.3	-3.5	2.7	14.6	3.2	7.1	-3.8	2.1	11.0

Note: Variables denoted with * are divided by sales and multiplied by 1,000.

Table 7: Performance of LPEs using IV-H

Variable	All	Public share (%)				Sector			
	1	2	3	4	5	6	7	8	9
		100	> 50	> 30	< 30	Competitive Sector	Service to PA	Network ind.	Other serv.gen.int.
1-TFP	-0.080 ***	-0.153 ***	-0.138 ***	-0.128 ***	-0.068 ***	0.002	-0.167 ***	-0.206 ***	-0.173 ***
2-L	0.001	0.001	0.001	0.001	-0.001	0.008 **	-0.003 ***	-0.001	-0.000
3-Cost L	2.494 ***	2.673 ***	3.252 ***	3.170 ***	4.205 ***	3.137 ***	-0.364	5.006 ***	1.546 ***
4-K	0.937 ***	0.690 ***	1.107 ***	1.076 ***	0.474	0.228	-2.026	1.445 ***	0.228
5-Immat. K	-0.008	-0.015	-0.009	-0.010	0.007	0.093 ***	0.825 ***	-0.134 **	-0.014
6-K/L	36.185 ***	26.385 **	80.189 ***	85.717 ***	75.531 ***	8.216	375.200 ***	39.405 ***	6.858
7-ROE	-2.385 ***	-3.058 ***	-2.925 ***	-2.881 ***	-2.690 ***	-1.787 **	-3.177 ***	-2.598 ***	-2.585 ***
8-ROI	-2.775 ***	-3.388 ***	-2.889 ***	-2.880 ***	-1.814 ***	-2.503 ***	-3.464 ***	-3.312 ***	-2.246 ***
9-ROA	-1.299 ***	-2.446 ***	-2.137 ***	-1.996 ***	-1.586 ***	-0.591	-1.853 ***	-1.324 ***	-1.705 ***

Notes: Variables denoted with * (**) [***] indicate statistical significance at the 10 (5) [1] percent level.

Table 8: Performance of public firms - OLS

Variable	All	Public share (%)				Sector			
	1	2	3	4	5	6	7	8	9
		100	> 50	> 30	< 30	Competitive Sector	Service to PA	Network ind.	Other serv.gen.int.
1-TFP	-0.099***	-0.203***	-0.172***	-0.163***	-0.077***	0.009	-0.271	-0.227***	-0.089
2-L	0.014***	0.008	0.003	0.005	-0.001	0.024*	-0.004**	0.026	-0.000
3-Cost L	3.122***	3.185***	3.823***	3.755***	5.058***	3.752***	0.074	4.934***	1.211***
4-K	1.046	2.516	2.610***	2.395***	7.650**	1.669**	-3.038	2.687	0.294
5-Immat. K	-0.026	-0.015	0.014	0.020	0.818	0.071	1.250	-0.255	-0.072
6-K/L	121.047***	132.159***	156.646***	152.496***	157.242***	90.987**	314.398	52.129**	98.135*
7-ROE	-2.091***	-2.419***	-2.721***	-2.602***	-2.264***	-1.118	-3.857	-3.449***	-0.923
8-ROI	-2.594***	-3.168***	-2.949***	-2.909***	-1.382***	-2.949***	-3.177**	-2.720***	-1.569**
9-ROA	-1.124***	-2.039***	-1.966***	-1.843***	-1.126***	-0.339	-2.240**	-1.424***	-1.220**

Notes: Variables denoted with * (**) [***] indicate statistical significance at the 10 (5) [1] percent level.

Table 9: TFP gap of LPEs by sector and public share

	Public share (%)				
Sector	100	> 50	> 30	< 30	All
Competitive sectors	-0.129 ***	-0.063 ***	-0.044 **	-0.028	0.002
Services to PA	-0.174 ***	-0.123 ***	-0.103 ***	-0.083 ***	-0.167 ***
Network ind.	-0.151 ***	-0.108 ***	-0.101 ***	-0.093 ***	-0.206 ***
Other services	-0.208 ***	-0.170 ***	-0.157 ***	-0.058 **	-0.173 ***
All	-0.153 ***	-0.138 ***	-0.128 ***	-0.068 ***	-0.080 ***

Notes: Variables denoted with * (**) [***] indicate statistical significance at the 10 (5) [1] percent level.

Table 10: Performance of public firms. Robustness checks related to methodology. For each method we report the corresponding reference, e.g. 'IV(Lewbel (2012))' is IV method proposed by Lewbel (2012). 'IV(Belloni et al.)' relies on Belloni et al. (2012, 2014). 'IV(new)' is our proposal to select instruments.

Method	TFP	Cost L	L	K (mat.)	K (imm.)	K/Empl.
IV (Lewbel (2012))	-0.080 ***	2.494 ***	0.001	0.937 ***	-0.008	36.185 ***
IV (Belloni et al.)	-0.074 **	2.498 ***	0.001	0.939 ***	-0.009	45.616 ***
IV (new)	-0.074 **	2.345 ***	0.002 *	0.915 ***	-0.013	50.547 ***
	ROE	ROI	ROA			
IV (Lewbel (2012))	-2.385 ***	-2.775 ***	-1.299 ***			
IV (Belloni et al.)	-2.367 ***	-2.733 ***	-1.299 ***			
IV (new)	-2.486 ***	-2.679 ***	-1.475 ***			

Notes: Variables denoted with * (**) [***] indicate statistical significance at the 10 (5) [1] percent level.

A Robustness checks

In Section 5 we already considered several robustness checks concerning the sample, e.g. splitting it by sector or by the share of ownership held by the public. Since the estimator we employed is rather new in applied research, in this section we focus on robustness checks in order to support the legitimacy of the estimator in this particular application. Also, we propose a technical innovation to the estimator that allows to select the set of instrument that minimizes the finite sample bias (Bekker, 1994).

First of all, we want to exclude that the estimator is biased toward results that are not in the data (type I error; this may be seen as the statistical size of the estimator). We check this by doing a 'placebo' test (focusing only on the TFP, to save time): we drop all public firms from our sample and we randomly flag 'some' private firms as public. If the type I error of the estimator is negligible, the coefficient measuring the performance gap between 'false' LPEs and private firms should be zero: the new sample is made of firms that belong to the same group (the private sector), therefore no differences are expected, even though we renamed some of them as public. The exercise supports that the type I error of the estimator is not relevant: over 250 random draws, both the mean and the median of the estimated coefficients are equal to zero, while the standard deviation is larger.

Continuing with possible issues related to the estimator we used, concerns may arise for the instruments. The primary reason why we used the estimator proposed by Lewbel (2012) was that we did not have any suitable instrument in our data. We now are in the paradoxical situation that we have a large number of instruments. As well known, in finite samples when the number of instruments increases there exists a bias in TSLS estimators of the form $\text{Bias}_{TSLS} = \frac{(I-2)\,\sigma_{\epsilon_1\,\epsilon_2}}{N(\gamma' Z' Z \gamma)^{-1}}$, which, among other things, increases with the weakness of the instruments ($\gamma \to 0$), with the number of instruments (I) and with the strength of the endogeneity ($\sigma_{\epsilon_1\,\epsilon_2}$), but decreases as sample size increases (Bekker, 1994; Flores-Lagunes, 2007). To address this issue we follow two different approaches for the selection of instruments when using the estimator in Lewbel (2012).

The first approach, which relies on Belloni et al. (2014), works well under the so called 'sparsity' condition and it is a two steps method:[25] in the first step it selects one set of control variables

[25] Intuitively, under sparsity there exist approximations to the true functions that require only a small number

that are useful for predicting the *mean* of the endogenous variable and one set for the outcome of interest, using *LASSO* (Least Absolute Shrinkage and Selection Operator) regression;[26] in the second step it estimates the parameter of interest using the covariates and instruments selected in the first step. More recent proposals are all based on the same idea but involve more refined methodologies, notably *Post-LASSO* (Belloni et al., 2012).

Notice, however, that the estimator we used is based on the second moment and not on the conditional mean. Therefore, a natural departure from the method in Belloni et al. (2014), with validity confined specifically to this (or similar) estimator, would consider the second rather than the first moment. More precisely, we suggest to follow the two step approaches outlined in Belloni et al. (2014), where we select instruments among those built as in Lewbel (2012) that are the best approximation to the *square* of first step residuals. These are the instruments that have a larger impact on the heteroschedasticity and thus those that make the estimator working better.

In Table 10 we report the results from both selection procedures, where 'IV Belloni et al.' is based on the first moment, whereas 'IV new' is our new proposal. The results with either subsets of instruments is indistinguishable from those presented in Table 7. This suggests that the sample size is sufficiently large and therefore the small sample bias in this application is negligible. In order to support this conclusion, we run a Montecarlo simulation with a small size (100 observations) and a large number of covariates (30). According to the simulation results (on our website), the IV with instruments built as in the Lewbel (2012) suffers from small sample bias in the same direction of the OLS (as expected from Bound et al., 1995), therefore some selection of instruments is required. Among these methods, our proposal performs slightly better than that in Belloni et al. (2014), because we select instruments that better explain the heteroscedasticity and maximize the performance of the estimator.

of non-zero coefficients to make the approximation errors relative small. See Belloni et al. (2014, 2012) for formal definitions.

[26] To save time (in the spirit of a robustness check), the results we present are based on the F-statistic.