

CEIS Tor Vergata

RESEARCH PAPER SERIES

Vol. 23, Issue 1, No. 592 – February 2025

Firms' Legality and Efficiency: Evidence from Public Procurement

Elisabetta Iossa and Chiara Latour

Firms' Legality and Efficiency: Evidence from Public Procurement*

Elisabetta Iossa[†]

Chiara Latour[‡]

January 30, 2025

Abstract

Do firms with higher legality standards contribute to better procurement outcomes? We address this question in the context of Italian public works procurement, by combining contract-level data on procurement and firm-level data on legality scores, using the Legality Rating System managed by the Italian Antitrust Authority. We find that higher legality scores are positively associated with a significant and economically important improvement in procurement efficiency, measured by shorter time delays and lower extra costs.

Keywords: Cartels, corruption, firm efficiency, legality, procurement.

JEL Codes: H57, K40, L4.

*For useful comments, we thank Francesco Decarolis, Leonardo Giuffrida, Ombretta Main, Vincenzo Mollisi, Gabriele Rovigatti and Giancarlo Spagnolo. We also thank Andrea Fazio, Erminia Florio and Gustavo Piga for providing us with some data.

[†] Autorità Garante della Concorrenza e del Mercato, and University of Rome Tor Vergata (*on leave*). The views expressed in this paper are those of the authors and do not necessarily reflect the views of the Italian Competition Authority. Email: elisabetta.iossa@uniroma2.it.

[‡] University of Stockholm, Department of Economics. Email: chiaralatour@gmail.com

1 Introduction

Countries around the world have enacted numerous laws to regulate business practices and sanction illegal behaviour by companies and their directors. Standards on corporate corruption, antitrust violations and business fraud are examples. Compliance with legal standards promotes ethical behaviour and builds trust, but compliance with legal standards is not just a matter of business ethics.

This paper empirically examines the relationship between a firm’s level of legal compliance and its level of economic efficiency. From a theoretical perspective, higher levels of compliance may be associated with higher levels of economic efficiency, for example because they both stem from better management practices within the organisation. Compliance and efficiency may also be negatively correlated if, for example, compliance requires costly and time-consuming practices that divert resources from productive activities.

To examine the relationship between a company’s level of compliance and its economic efficiency, we use the Legality Rating System, a unique dataset managed by the Autorità Garante della Concorrenza e del Mercato (AGCM)¹, which measures compliance at the company level. Companies based in Italy with a minimum turnover of two million euros can apply to the AGCM to receive a score that reflects the company’s level of compliance with various laws, including antitrust, anti-bribery, health and safety, and the environment. The score can have seven different values.

To measure a firm’s efficiency, we consider its performance in public procurement, which in Italy account for 11.8% of GDP.² We use the dataset managed by the Italian Anti-Corruption Authority (ANAC) on Italian public-works contracts. We proxy firm efficiency using two performance measures commonly used by public procurement researchers: time delays in contract completion and cost overruns relative to the initial project price. We also use the AIDA database (Bureau Van Dijk) to obtain information on firms’ characteristics.

Combining these datasets, we analyse firms’ procurement performance in terms of extra costs and time delays in relation to their legality score. Using a fixed effects OLS regression model, we find that there is a significant and economically relevant relationship between a firm’s legality standards and its performance in procurement contracts. Our results imply

¹Italian Antitrust Authority

²OECD National Accounts Statistics (2020).

that each one-point increase in the legality score is associated with a reduction of at least 1.2 percent and 0.7 percent in average time delays and extra costs, respectively. We test the robustness of our findings by exploring alternative model specifications and changes in the period under consideration.

These results provide convincing evidence that firm efficiency and firm compliance are intrinsically linked, and that the magnitude of this relationship can be significant. To have a simple measure, we combine our OLS coefficients and the number of contracts in the sample with the observed average time delay and extra costs. We find that if all firms in the sample had a minimum legality score equal to the average score, there would be a saving of at least 316,399 days in delay and 99 million euros across all contracts in the sample.

This paper adds to the extensive literature examining the relationship between different forms of legality compliance and economic efficiency. While much focus has been placed on corruption, other dimensions of illegal behavior remain understudied, and the direction of this relationship is still debated.³ In the context of public procurement, for example, some argue that corruption ensures that contracts are awarded to the most efficient and profitable firms because they can afford to pay higher bribes (Liu (1985), Becker (1968)). Others argue that corruption promotes the misallocation of resources by allowing the most well-connected, and not necessarily the most efficient, firms to survive and expand (Colonnelli and Prem (2021)).

A major limitation of the empirical literature on the relationship between legality compliance and economic efficiency is the challenge of obtaining firm-level data on illegal behaviour, which is often undetected and difficult to measure. As a result, most of the previous studies cited above are theoretical models or use corruption indicators at the country level rather than at the firm level. The Legality Rating System provides a unique opportunity to examine this relationship empirically at the firm level, thus addressing this gap in the literature.

A burgeoning literature examines the signalling value of the legality rating system. The

³Some argue that corruption is efficiency enhancing because it acts as a 'grease the wheel' instrument, facilitating the circumvention of bureaucratic constraints, addressing inefficiencies in the provision of public services and navigating through rigid legal frameworks (Leff (1964), Liu (1985) and Lein (1986)). Others argue that it reduces economic performance by acting as a 'sand in the wheel', increasing transaction costs and uncertainty, and leading to inefficient investment and misallocation of factors of production (Murphy et al. (1991), Shleifer and Vishny (1993), Kaufmann and Wei (2000) and Tanzi and Davoodi (1997)).

legality rating reduce banks' screening costs and allow rated firms to benefit from lower borrowing costs. This has led to recent research on the effects of corporate legality on financial performance. Acconcia et al. (2023) shows that certified firms increase their tangible capital expenditure, particularly in areas where it is more difficult for banks to assess firms' creditworthiness. DeBenedetto et al. (2023) finds a positive association between firms' legality and production efficiency in terms of value added. Similarly, Caputo and Pizzi (2019) shows that the use of the legality rating favours the improvement of firms' financial performance. Ginesti et al. (2020) provides evidence that firm-level legality is positively associated with less tax avoidance. Fazio et al. (2024) shows that the legality rating enhances the tender-winning probability of public contracts of small and medium enterprises by almost 13 percentage points. Our study aims to go beyond financial metrics and examine efficiency in the context of contract performance in public procurement.

There are several reasons why compliance to legality standards and efficiency in public procurement could be related. A culture of compliance within the firm may be associated with better legal and business practices, including the respect of contractual clauses with a firm's own vendors and subcontractors. A firm's reputation of reliability may also incentivize effort in maintaining high-performance standards.⁴ Furthermore, the insights from the rating literature also suggests that stronger financial performance of more compliant firms (as found in Ginesti et al. (2020)) may reduce the risk of negative shocks, such as defaults during the provision of goods and services. Additionally, lowering borrowing costs may enable firms to make productive investments (as found in Acconcia et al. (2023), DeBenedetto et al. (2023)) that improve their performance in procurement contracts.

Finally, we also contribute to the existing literature on the determinants of procurement outcomes, which has already identified the important role played by auction design (Lewis and Bajari (2011)), bid preferences (Marion (2007)), discretion (Coviello et al. (2018)), buyer competence (Decarolis et al. (2020); Buccioli and Camboni (2020)), judicial efficiency (Decarolis et al. (2023)), corruption and organisational efficiency (Bandiera et al. (2009)).

The rest of the paper is organised as follows. Section 2 describes our data. Section 3 discusses our methodology and the two measures of firms' procurement performance used in our analysis. Section 4 presents the results of our empirical analysis, while section 5

⁴Decarolis et al. (2016) documents how a reputation index employed by a large utility company, based on 136 parameters measuring the quality and safety of suppliers' work, led to improved performance.

concludes with some policy implications.

2 Data

We combine the AGCM firm-level dataset on the list of firms with a rating and their rating level with the ANAC contract-level database on public works contracts awarded by Italian public procurers. We focus on the years 2013 to 2021 because the Legality Rating System only came into force in 2013. We describe these two datasets in more detail below.

2.1 The Legality Rating System

The Legality Rating System was introduced into Italian law in 2012. It is a synthetic indicator assigned by AGCM, on request, to companies that meet certain standards of legality. To apply for the rating, companies must be based in Italy, have been registered in the Italian Companies Register for at least two years and have a turnover of at least two million euros in the year preceding the application. The rating ranges from a minimum of one star (*) to a maximum of three stars (***). Once the basic requirements have been met, the applicant receives one star, which can be increased by one "+" for each additional requirement met. Three "+" results in an additional star. In total, there are seven different ratings.⁵

The basic requirements include a clear company record (including the personal records of relevant parties such as CEOs and directors) on preventive and/or restrictive measures, criminal convictions, tax offences, criminal settlements and non-compliance with health and safety regulations at work.⁶ In addition, in the two years prior to applying for the rating, the company must not have been convicted of serious antitrust offences and certain unfair commercial practices, or have received sanctions from ANAC for corruption, transparency and public procurement.

Other requirements that grant additional points include registration on the suppliers' white list, the adoption of a payment traceability system, the implementation of anti-corruption organisational models or various sustainability standards.⁷

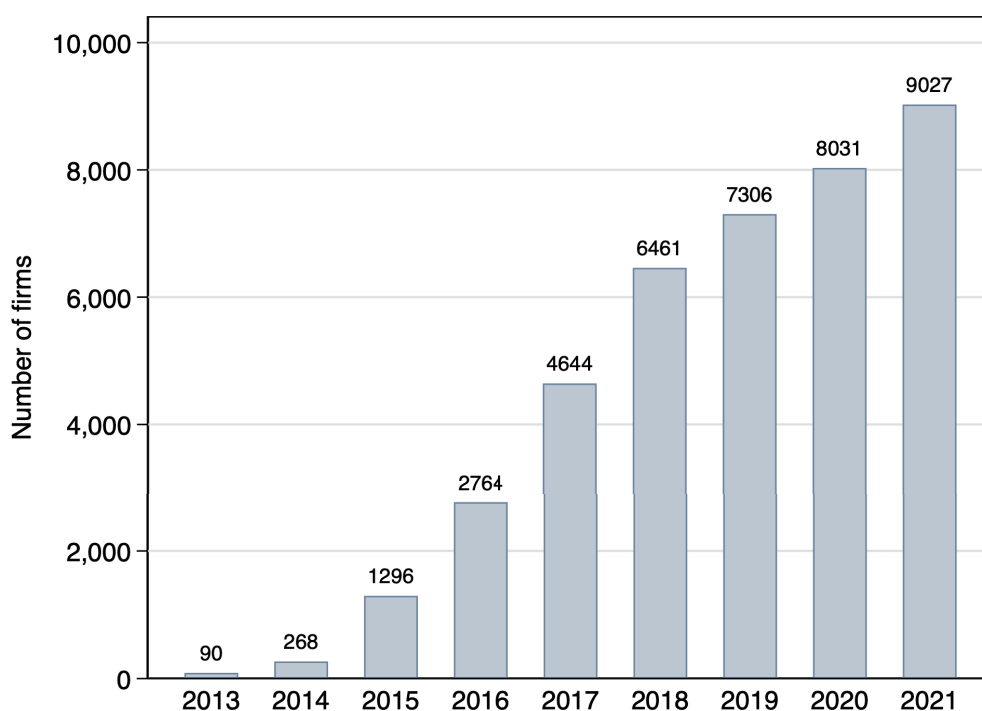
⁵The basic and additional requirements for obtaining the legality rating are listed in Articles 2 and 3 respectively of the "Regolamento attuativo in materia di rating di legalità (AGCM (2020))".

⁶There are some exceptions provided for in Article 2 of the "Regolamento attuativo in materia di rating di legalità (AGCM (2020))".

⁷The "white lists" are lists of companies drawn up in each Italian prefecture with the aim of making

Application is free and requires minimal documentation. The rating is valid for two years and can be renewed on request, but can be revoked if the company no longer meets the requirements. Information on rejected applications remains confidential and is not published by AGCM. As companies are well aware of the criteria for obtaining a compliance rating, the number of refusals is low, averaging around 2 per cent per year (AGCM (2022)). The validity of the rating system is ensured by a number of internal and external controls.⁸

Figure 1: Number of firms in possession of the legality rating



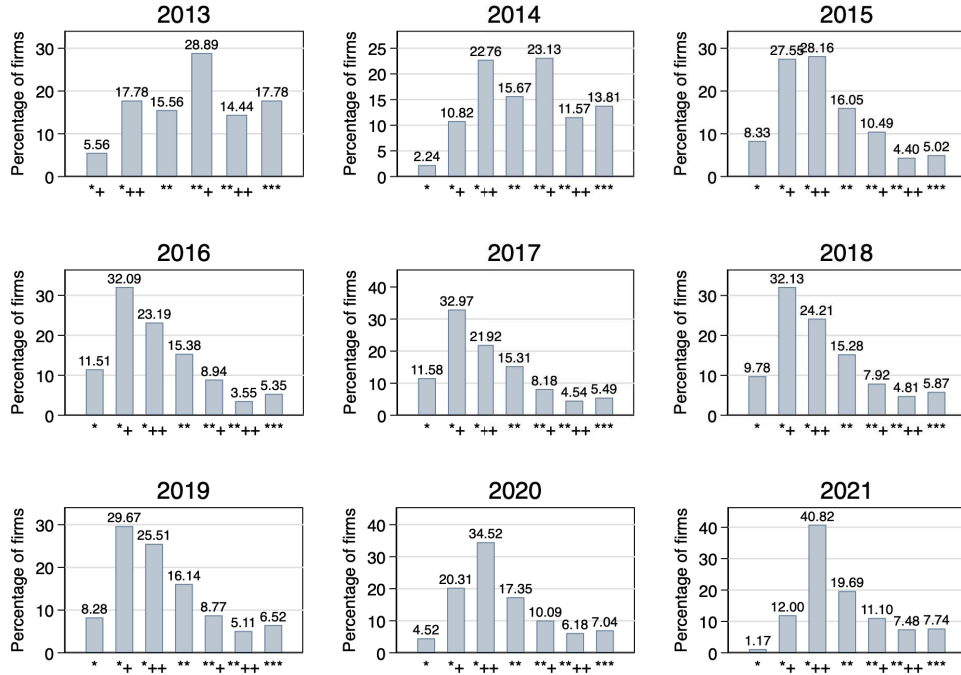
Notes: The figure shows the number of firms in possession of the legality rating per year.

The number of firms with a legality rating has increased progressively since the introduction of anti-mafia controls more effective in sectors considered to be at the highest risk of mafia infiltration. Registration on these lists is mandatory for companies wishing to participate in public tenders.

⁸The AGCM carries out a number of checks to verify the accuracy of the information provided by applicants on the rating form. These checks include consultation of judicial records for any criminal convictions, consultation with the Carabinieri and the Public Prosecutor's Office for pending charges, cross-referencing with the National Anti-Mafia Documentation Database and with the database managed by the National Anti-Corruption Authority (ANAC). In addition, the AGCM collaborates with the Guardia di Finanza to conduct ex-post compliance checks on a sample of around 10 percent of rated companies. Cancellations of ratings as a result of these checks are rare, accounting for less than 1 percent of all assignment and renewal decisions.

tion of the system. While there were only 90 firms in 2013, the number reached 9027 by the end of 2021 (Figure 1). The distribution of scores by year is shown in Figure 2. Since 2016, there has been a steady increase in the percentage of firms receiving high ratings, from 17.8 per cent to 26.4 per cent in 2021. Figure 3 shows the geographical distribution of firms with the legality rating in Italy in 2021. The left panel shows the absolute number of rated firms, while the right panel present the percentage of firms with the rating. There is a substantial difference in the adoption of the legality rating across regions. The regions with the highest concentration of firms, such as Veneto and Emilia-Romagna, are located in the North of Italy, except for Puglia.

Figure 2: Distributions of the legality rating scores

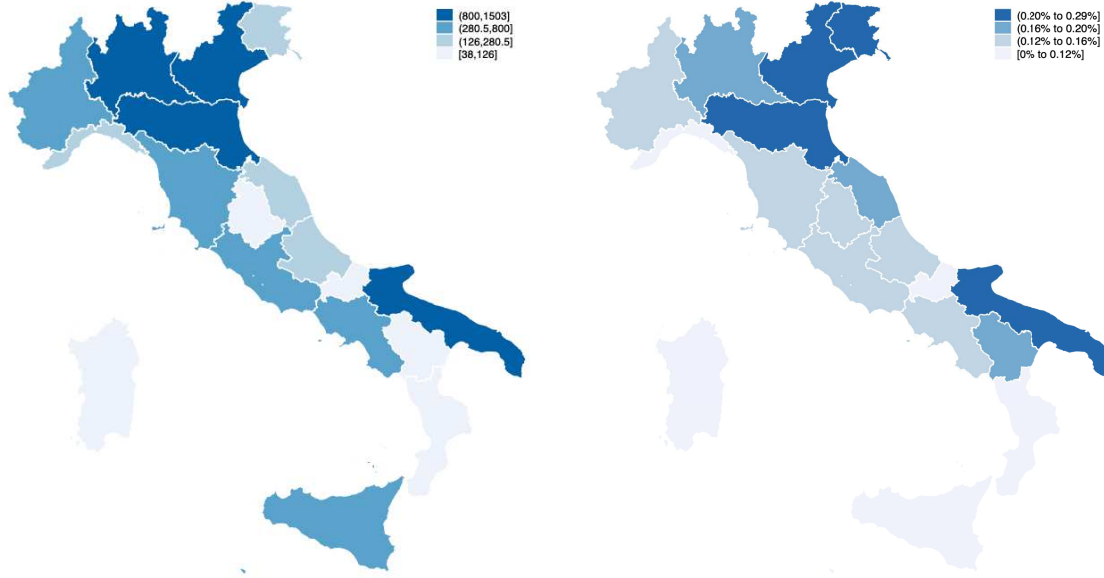


Notes: The distributions of the legality rating scores by year are shown in the Figure.

Having a legality rating confers several benefits to the company. In a survey carried out by AGCM in 2021, rated companies reported benefits in terms of improved reputation, better access to government funding and bank loans, and the possibility of obtaining additional points in public tenders (AGCM (2022)).⁹

⁹In 2016, the new Public Procurement Code introduced a preferential scoring system for legality rating holders in the evaluation of tenders and a 30% reduction in the amount of the required guarantee

Figure 3: Distribution of firms with the legality rating across Italian regions



Notes: On the left, the map displays the absolute number of firms with the legality rating in 2021. On the right, the map displays the ratio between the number of firms with the legality rating over the number of active business in each region.

2.2 Public procurement contracts

The procurement database we use in our study is managed by ANAC and provides detailed data on all public procurement contracts awarded since 2000 with a project value of more than 40,000 euros.¹⁰ The ANAC database contains information on all relevant contract characteristics, the identity of the winning firms (fiscal code) and post-contract details, which allow us to construct two measures of firm performance: time delays and extra costs. These indicators are widely recognised in the economic literature as crucial indicators of efficiency in public procurement.¹¹ We focus on post-contract performance rather than bidding offers, such as rebates, which may not accurately reflect true efficiency. For example, Decarolis (2014), in the context of Italian procurement, finds that half of the cost savings from lower winning prices are lost due to ex post renegotiation. We focus on the procurement of works, where time delays and cost overruns are common and constitute

(see Articles 93 and 95 of the Public Procurement Code). However, the frequency of the use of the legality rating in public procurement remains unclear.

¹⁰<https://dati.anticorruzione.it/opendata>

¹¹See, for example, Decarolis et al. (2020); Decarolis et al. (2023); Lewis and Bajari (2011); Mohamed et al. (2011); Iimi (2013); Bajari et al. (2014), and Jung et al. (2019).

key performance indicators compared to the public procurement of goods and services. In fact, several factors, such as the inherent complexity and uncertainty associated with the procurement of works, contribute to a higher likelihood of cost delays and time overruns.

We exclude from the dataset "framework agreements", which allow the contracting authority to buy directly from pre-selected suppliers on pre-established terms for a given period, and contracts awarded by competitive dialogue, which are limited to "particularly complex works" and are very rare. To avoid dealing with contracts awarded to several companies, we keep only those contracts awarded to a single company.

We group the remaining contracts into three categories of awarding procedure: competitive procedure, negotiated procedure, and direct awards. As they are used for different types of contracts and are characterised by significant differences in the discretionary powers of the contracting authority, we use them as a control in our analysis. We also use the selection criterion as a control: contracts can be awarded on the basis of the lowest price or the most economically advantageous tender. While the former involves awarding the contract to the firm offering the lowest price, the latter involves more discretion as it allows for a range of non-price parameters.

In the ANAC database, there is often a lack of post-contractual information because the contracting authorities do not always report this information after the end of the contract. Thus, we construct two different datasets of contracts, one for which we know the date when the work was completed (*Time Performance Subsample*) and the other one for which we know the final price paid by the contracting authority at the end of the work (*Cost Performance Subsample*).

Summary statistics of the resulting subsamples are shown in table 2. Each subsample contains more than 80,000 contracts, and they are balanced in terms of average contract value, which is about 250,000 euros, contract duration, which is about 140 days, the percentage of rated firms, which is about 0.6%, and their average score, which is 3.9 (i.e. almost **+).

2.3 Firm's level data

We obtained financial information on about 70 percent of the companies in our contract samples through balance sheet data from the AIDA database managed by Bureau Van Dijk. Table 2 presents the summary statistics for firms in our sample, comparing firms

Table 1: Summary statistics

	(1)	(2)	(3)	(4)
Time Performance Subsample	N	Mean	SD	Median
Contract value	81909	252218.8	644977.3	134252
Original length	81909	143.6	144.8	92
Delay (days)	81909	63.4	120.3	20
Rating	81909	.06	.23	0
Score	4628	3.88	1.4	4
Cost Performance Subsample				
Contract value	88535	246635.4	708275.2	130601
Original length	88535	140.7	158.4	90
Cost Overrun (euro)	88535	46377.8	168444.2	18784.6
Rating	88535	.06	.23	0
Score	5021	3.89	1.4	4

Notes: Summary statistics of the main variables used in our regression analysis are shown in this table. We used two different dataset. The Time Performance Subsample (top panel) is a sample of contracts for which the delay variable was available and the Cost Performance Subsample (bottom panel) is a sample of contracts for which the cost overrun variable was available.

with and without the legality rating. Firms with the rating are larger than firms without the rating, exhibiting higher revenues and number of employees. Firms with the rating are more experienced, with 26 years of experience, compared to around 21 years for firms without.

3 Methodology

We begin our analysis by examining the correlation between the legality rating and the firms' characteristics summarized in Table 2 above. Specifically, we use a logistic regression model to estimate the relationship between the likelihood of having the legality rating and these characteristics. Additionally, for firms with the rating, we use a linear regression model to explore how these characteristics are associated with the specific score.

We estimate the following general equation:

$$Legality\ Rating_{jt} = \gamma_r + \delta_t + \theta_s + \beta X_{jt} + \epsilon_{jt}, \quad (1)$$

where $LegalityRating_{jt}$ is either a dummy for having the legality rating or the legality

Table 2: Firms characteristics

	(1)	(2)	(3)	(4)
Firms without the rating	N	Mean	SD	Median
Revenues	23738	14107	253000	2149
Number of employees	23738	62	785	15
Added Value	23738	55447	31674	50170
Employee returns	23738	5.51	5.26	4
Experience	23738	21	14	18
Age of the board	23738	54	9	54
Salaries	23738	2024	31419	361
Firms with the rating				
Revenues	3067	16883	69592	5379
Number of employees	3067	89	549	31
Added Value	3067	63738	28930	57830
Employee returns	3067	5.68	5.95	4.59
Experience	3067	26	15	25
Age of the board	3067	54	7	54
Salaries	3067	2631	10975	913

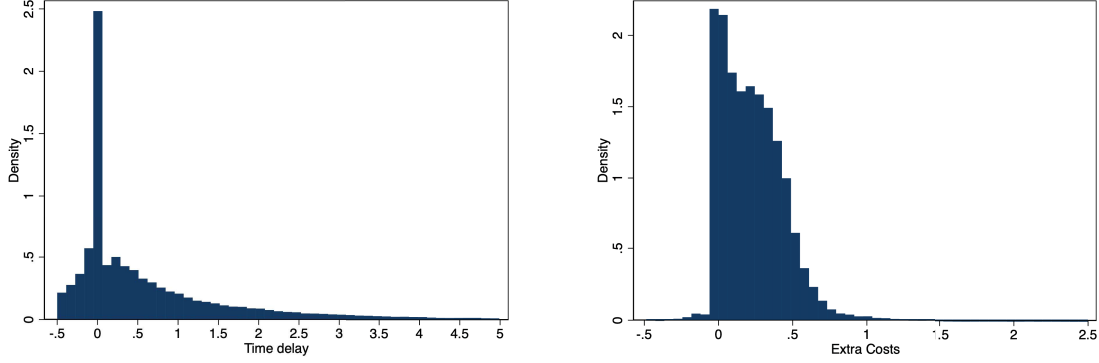
Notes: Summary statistics of the main variables used in our regression analysis are shown in this table. Salaries and revenues are expressed in thousand euros.

rating score for firm j at time t . We converted each score into a numeral value ranging from 1 to 7. γ_r , δ_t , and θ_s are region, year and sector fixed effects, respectively. X_{jt} is a vector of characteristics of firm j at time t that includes the number of employees, years of experience, added value, age of the board, and the logarithms of revenues and salaries.

We then use an OLS fixed effect regression model to test a potential correlation between legality compliance and firms' efficiency. As measures of the firms' performance, we use the delay in contract completion (*time delays*) and the cost overrun over the initial project's price (*extra costs*). Time delay is measured as the ratio between the number of days of delay in delivering the work and the original contractual length. Following Decarolis et al. (2023) this delay ratio is bounded within the interval $[-0.5, 5]$ to remove possible outliers. The distribution is plotted in the left panel of Figure 4. The mean time delay of 0.61 indicates that the company, on average, takes 61% longer than the original contractual length to complete the work. Extra cost is the difference between the final price of the project and the original price (cost overrun) over the original price. As for time delays, we follow Decarolis et al. (2023) and we keep values of extra costs within the interval $[-0.5, 2.5]$.¹² Its distribution is plotted in the right panel of Figure 4. The mean extra

¹²Outliers are often attributed to errors in reporting or data entry, rather than being indicative of

Figure 4: Distribution of time delays and extra costs



Notes: On the left, the figure displays the distribution of our measure of time delay expressed as the ratio between the number of days of delay and the original contractual length. On the right, the figure displays the distribution of our measure of extra costs expressed as the ratio between the cost overruns paid by the contracting authority and the original contractual value.

cost of 0.22 indicates that the contracting authority incurs an additional 22% beyond the original contractual price.

We estimate separate OLS regressions for each of the two performance measures.

$$Performance_{itk}^p = \delta_t + k_k + \gamma_r + \beta_1 Legality\ Rating_j + \theta X_i + \epsilon_{itk} \quad (2)$$

In the equations above, $p = \{T, C\}$ indicates whether the dependent variable is time delay or extra cost, i is the contract, t is the awarding date, and k is the procurement category.¹³ δ_t , k_k and γ_r are year, procurement category and region fixed effects. The fixed effects are used to control for contract heterogeneity. Our main explanatory variable is *Legality Rating_j*, which is the legality rating' score. We alternatively infer 0 to firms without the rating or keep them as missing values.

X_i is a list of controls that include the contract value and original contractual length as a proxy of the job's complexity, the awarding procedure, the selection criterion and a dummy for special and ordinary sectors. Summary statistics of the main variables included in the regressions are provided in Table 2. We use the *Time Performance Subsample* when the dependent variable is time delay and the *Cost Performance Subsample* when the

actual cases of delays or extra costs.

¹³We use the OG and OS codes to categorize public works.

dependent variable is extra cost.

4 Results

Table 3 presents the results of the two regressions examining the correlation between the firm characteristics and the legality rating. Column 1 presents the results of the logit model, where the dependent variable is a dummy for whether the firm has the legality rating. Column 2 presents the results when the dependent variable is the legality score. The direction of the correlation is the same in both models. As expected from the statistics described in Table 2, there is a negative and significant correlation between turnover and salaries and the legality rating. However, there is a negative and significant correlation between the number of employees and the rating. The experience is significant and positive only for the likelihood of having the rating.

The results from the OLS regressions are shown in Table 4. The coefficients suggest that there is a statistically significant and negative correlation between our measures of firm performance and the legality rating score. In Columns 1 and 3, we only include firms which obtained the legality rating in the sample, whereas in Columns 2 and 4, firms without a legality rating are assigned a value of 0. Columns 1 and 2 imply that higher rating scores are associated with lower time delays: one point increase in the legality rating score is correlated with a 0.0208 and 0.00855 percentage points decrease in time delays, that is a reduction of 3.4% and 1.4% of the average time delay.¹⁴

Consequently, this practice likely underestimates the correlation between legality ratings and efficiency indicators.

Similar results are valid for our second measure of firms' performance: extra costs. Columns 3 and 4 imply similar results in terms of magnitude: for one point increase in the legality rating score, we find 0.00827 and 0.00260 percentage points decrease in extra costs, that is a reduction of 3.6% and 1.1% of the average extra cost.

Assigning a score of zero to firms without a legality rating poses two main challenges. First, firms with a turnover of less than 2 million euros or that haven't been registered in

¹⁴The larger coefficients in Columns 1 and 3 likely result from assigning zero to unrated firms. This group includes both firms failing the legality rating criteria and those that would potentially receive a positive score. Consequently, this leads to an underestimation of the association between the legality rating and the indicators of efficiency.

Table 3: Correlation between firms characteristics and the legality rating

VARIABLES	(1) Legality rating	(2) Legality score
Turnover	0.522*** (0.0477)	0.105* (0.0553)
Added value	-0.302*** (0.0759)	0.0933 (0.0795)
Number of employees	-0.499*** (0.101)	-0.257** (0.126)
Salaries	0.633*** (0.0970)	0.594*** (0.128)
Employee returns	0.00422 (0.00521)	0.0167*** (0.00551)
Experience	0.00368** (0.00165)	0.00193 (0.00206)
Age of the board	-0.00169 (0.00253)	-0.00795** (0.00328)
Observations	26,597	3,055
R-squared	0.2072	0.186
SE	Robust	Robust
Year-FE	YES	YES
Region-FE	YES	YES
Sector-FE	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: The results from the estimation of equation ADD REF are shown in this Table. The dependent variable in Column 1 is a dummy for whether the firm has the legality rating. The dependent variable in Column 2 is the legality rating score. In Column 2 we include only the firms with ratings.

Table 4: Baseline estimates: Time Delay and Extra Costs

VARIABLES	(1) Time Delay - Rated Firms	(2) Time Delay - All firms	(3) Extra Costs - Rated firms	(4) Extra Costs - All firms
Legality Rating	-0.0208** (0.00941)	-0.00855** (0.00359)	-0.00827*** (0.00186)	-0.00260*** (0.000674)
Constant	0.724** (0.346)	1.074*** (0.0551)	0.0612 (0.0423)	0.122*** (0.00853)
Observations	4,628	76,942	5,021	83,165
R-squared	0.086	0.080	0.200	0.171
SE	Robust	Robust	Robust	Robust
Year-FE	YES	YES	YES	YES
Region-FE	YES	YES	YES	YES
Procur Category-FE	YES	YES	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: The results from the OLS regressions are shown in the table. The dependent variable 'time delay' is the ratio between the days of delay in completing the contract and the original contractual length. The dependent variable 'extra costs' is the ratio between the extra cost paid by the contracting authority and the original contractual value. All the regressions include as controls the contract value, the original contract length, a dummy for ordinary and special sectors, the awarding procedure, the selection criterion, and several fixed effects illustrated in the table. Each column refers to a different independent variable. *Legality Rating* represent the legality rating score. In Columns 1 and 3 we include in the regressions only the firms with ratings. In Column 2 and Column 4, we assign 0 to firms without the rating. Column 1 and 2 refers to the *Time Performance Subsample* and Column 3 and 4 to the *Cost Performance Subsample*.

the Italian Companies' register for a minimum of two years are ineligible to apply for a rating, which automatically exclude small and new businesses. Second, some firms may not have applied due to lack of knowledge or incentive. There could also be confounding factors influencing both the legality rating and efficiency. Two major concerns are that larger and more experienced firms obtain greater rating and are associated with better procurement performance. Therefore, there could be a firm size and experience effect affecting our results. ¹⁵

To mitigate this concern, in columns 2 and 4 of table 5 we restrict our sample to firms with at least two years of activity and a turnover of more than 1.4 million, which reflects the turnover threshold of the firms that received the legality rating. ¹⁶ Additionally, we restrict the sample to the contracts awarded between 2016 and 2021, because the new

¹⁵We found a positive correlation between the legality score and the firms' turnover, experience, and the geographical location of firms.

¹⁶The requirement for firms to receive the legality rating is a minimum turnover of 2 million euros in the year prior to application. However, as the legality rating is valid for two years, even firms with a rating may have a lower turnover in the year before the contract is awarded. To account for this, we calculated the average turnover in the two years prior to the contract award and set the threshold at €1.4 million based on our dataset, which represents the minimum average turnover of the rated companies.

Public Procurement Code introduced in 2016 incentivized the adoption of the legality rating by allowing the contracting authorities to award additional points to the economic offers of rated firms. We believe that this made it more likely that the firms that did not apply for the legality rating were either those that were not interested in public contracts or those that could not meet the basic requirements.

We also include firm turnover and years of activity as a control to show that the observed relationship between legality and efficiency is not driven by firm size or experience.

Table 5: Alternative specification with firms' turnovers and experience

VARIABLES	(1) Time Delay - Rated Firms	(2) Time Delay - All Firms	(3) Extra Costs - Rated Firms	(4) Extra Costs - All Firms
Legality Rating	-0.0184* (0.0108)	-0.00738** (0.000737)	-0.00788*** (0.00201)	-0.00125* (0.000737)
Turnover	-1.13e-10 (2.19e-10)	-0 (0)	-1.16e-10*** (0)	-0*** (0)
Experience	-0.00140 (0.00127)	0.000284 (0.000508)	-0.000378* (0.000214)	-0.000602*** (9.07e-05)
Constant	0.522 (0.360)	0.956*** (0.0780)	0.0754 (0.0563)	0.160*** (0.0124)
Observations	3,864	24,384	4,582	24,968
R-squared	0.091	0.087	0.207	0.184
SE	Robust	Robust	Robust	Robust
Year-FE	YES	YES	YES	YES
Region-FE	YES	YES	YES	YES
Procur Category-FE	YES	YES	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: The results from the OLS regressions are shown in the table. The dependent variable 'time delay' is the ratio between the days of delay in completing the contract and the original contractual length. The dependent variable 'extra costs' is the ratio between the extra cost paid by the contracting authority and the original contractual value. All the regressions include as controls the contract value, the original contract length, dummy for ordinary and special sectors, the awarding procedure, the selection criterion and several fixed effects illustrated in the table. *Legality Rating* represent the legality rating score. In Column 1 and 3 we include in the regressions only the firms with rating. In Column 2 and Column 4 we assign 0 to firms without the rating and restrict the sample to the period 2016-2021. *Turnover* is the average turnover of the firms in the last two years and *Experience* is the years of the experience of the firms. Column 1 and 2 refers to the *Time Performance Subsample* and Column 3 and 4 to the *Cost Performance Subsample*.

The resulting samples are much smaller than the previous ones but our findings remain valid. The new regressions' results are displayed in Table 5. The coefficients are slightly smaller but still statistically significant. Columns 1 and 2 suggest that a one-point increase in the legality rating score corresponds to a reduction of 0.0184 and 0.00738 percentage points in time delays, respectively. These reductions correspond to 3% and 1.2% of the average time delay. Columns 3 and 4 suggest that a one-point increase in the legality rating

score corresponds to a reduction of 0.00788 and 0.00125 percentage points in extra costs, respectively. These reductions correspond to 3.4% and 0.5% of the average extra cost. In addition, the firms' revenues and experience appear to impact the firms' performance in terms of extra costs but not in terms of time delays.

Procurement inefficiencies are very costly to society; for example, motorway repairs generate significant externalities for commuters by increasing traffic (Lewis and Bajari (2011)). To get an idea of the magnitude of our results, we consider what would happen if we used them to infer the effect of raising the level of legality compliance of all firms in our sample to the average legality rating. We use the following formula:

$$Time\ Delays = \hat{\beta} \times Average\ Rating\ Score \times Average\ Contract\ Length \times N \quad (3)$$

$$Extra\ Costs = \hat{\beta} \times Average\ Rating \times Average\ Contract\ Value \times N \quad (4)$$

where $\hat{\beta}$ corresponds to the coefficients reported in column 2 and 4 of Table 4, the average contract length and value are those in Table 4 and N is the number of contracts in the sample.

Using the results for the full sample (Column 2 and 4 of Table 4), we find that, if all firms in the sample had a minimum legality score rating equal to the average legality score equal to 3.88 (approximately two stars), there would be a significant reduction in extra costs, amounting to an average of 2488 euros per contract, or approximately 207 million euros in total across all contracts. Furthermore, this would imply a saving of 4.76 days in execution time per contract, corresponding to approximately 366,561 days across all the contracts in the sample.

Considering the results from the restricted sample (Column 2 and 4 of Table 5), the reduction in extra costs amounts instead to an average of 1196 euros per contract or 99 million euros in total across all contracts. In terms of time delays, it would imply a saving of 4.11 days per contract or 316,399 days across all contracts.

5 Conclusions

The relationship between legality compliance and firm efficiency has been relatively understudied. This paper provides some novel insights by combining a dataset of Italian

public contracts with the list of firms with the AGCM legality rating. The results of the OLS analysis suggest that there is a significant and economically relevant relationship between legality and efficiency. On average, each point increase in the legality score is associated with a reduction of at least 1.2 percent and 0.7 percent in the average time delay and extra costs, respectively. Applying our estimate to the full sample of contracts, we find that if all firms in the sample had a minimum legality score equal to the average score, there would be a saving of at least 316,399 days and 99 million euro across all contracts in the sample.

Previous research has demonstrated the effectiveness of reputation mechanisms based on past performance in public procurement, showing an increase in the average performance of firms after their introduction. By highlighting the positive relationship between legality compliance and efficiency, our paper shows that the Italian rating system can serve as a signalling device to identify more efficient firms. In this respect, our results also provide an efficiency rationale for giving preferential treatment in tenders to those firms with a higher rating, a practice already implemented in some procurement tenders.

Further research is needed to understand the direction of causality between firms' legality compliance and economic efficiency.¹⁷ Legality could be a driver of efficiency: firms with a higher standard of legality could expect greater economic rents and thus be inclined to invest more in innovative technologies that increase efficiency. Conversely, efficiency may drive legality: illegal acts can damage a firm's reputation and generate negative publicity, so the opportunity cost of not being legal is higher for more efficient firms (Baucus and Baucus (1997)). Finally, a third factor may be the driver of both legality and efficiency. For example, firms with better governance or longer seniority may make greater investments, leading to greater firm efficiency, and follow better management practices, leading to greater compliance with legality. The common driver could also be a factor external to the firm, such as the quality of the judicial system, which affects legality by increasing the likelihood that an illegal act will be detected (Becker (1968)) and efficiency through the role that courts play in enforcing contracts (Decarolis et al. (2023)). Understanding the direction of causality, if any, is an interesting area for future research.

¹⁷For a recent attempt in this direction, subsequent to the present paper, see Pizzo (2024).

References

- Acconcia, A., M. Alfano, A. Baraldi, and C. Cantabene (2023). Public certification, information asymmetry, and investment. Working paper. University of Naples Federico II.
- AGCM (2020). Regolamento attuativo in materia di rating di legalità. Autorità garante della concorrenza e del mercato. Rome, Italy. <https://www.agcm.it/>.
- AGCM (2022). Relazione annuale sull'attività svolta nel 2021. Autorità garante della concorrenza e del mercato. Rome, Italy. <https://www.agcm.it>.
- Bajari, P., S. Houghton, and S. Tadelis (2014). Bidding for incomplete contracts: An empirical analysis of adaptation costs. *American Economic Review* 104(4), 1288–1319.
- Bandiera, O., A. Prat, and T. Valletti (2009). Active and passive waste in government spending: Evidence from a policy experiment. *American Economic Review* 99(4), 1278–1308.
- Baucus, M. S. and D. A. Baucus (1997). Paying the piper: An empirical examination of longer-term financial consequences of illegal corporate behavior. *The Academy of Management Journal* 40(1), 129–151.
- Becker, G. S. (1968). Crime and punishment: An economic approach. *Journal of Political Economy* 76(2), 169–217.
- Buccioli, A. and P. Camboni, R Paola Valbonesi (2020). Purchasing medical devices: The role of buyer competence and discretion. *Journal of Health Economics* 74.
- Caputo, F. and S. Pizzi (2019). Ethical firms and web reporting: Empirical evidence about the voluntary adoption of the italian "legality rating". *International Journal of Business and Management* 14(1).
- Colonnelli, E. and M. Prem (2021). Corruption and firms. *The Review of Economic Studies* 89(2), 695–732.
- Coviello, D., L. Moretti, G. Spagnolo, and P. Valbonesi (2018). Court efficiency and procurement performance. *The Scandinavian Journal of Economics* 120(3), 826–85.

- DeBenedetto, M., M. Giuranno, C. Mastromarco, D. Ravenda, and P. Toma (2023). Legality rating and corporate efficiency: evidence from a conditional nonparametric frontier analysis. *Empirical Economics*.
- Decarolis, F. (2014). Awarding price, contract performance, and bids screening: Evidence from procurement auctions. *American Economic Journal: Applied Economics* 6(1), 08–32.
- Decarolis, F., L. M. Giuffrida, E. Iossa, V. Mollisi, and G. Spagnolo (2020). Bureaucratic Competence and Procurement Outcomes. *The Journal of Law, Economics, and Organization* 36(3), 537–597.
- Decarolis, F., G. Mattera, and C. Menon (2023). Do local court inefficiencies delay public works? evidence from italian municipalities. *OECD Regional Development Papers*.
- Decarolis, F., G. Spagnolo, and R. Pacini (2016). Past Performance and Procurement Outcomes. NBER Working Papers 22814.
- Fazio, A., E. Florio, and G. Piga (2024). SMEs performance in public procurement and the italian legality rating. Working paper.
- Ginesti, G., L. V. Ballestra, and R. Macchioni (2020). Exploring the impact of firm-level legality on tax avoidance. *European Management Review* 17(2), 499–514.
- Iimi, A. (2013). Testing low-balling strategy in rural road procurement. *Review of Industrial Organization* 43(3), 243–261.
- Jung, H., G. Kosmopoulou, C. Lamarche, and R. Sicotte (2019). Strategic bidding and contract renegotiation. *International Economic Review* 60(2), 801–820.
- Kaufmann, D. and S.-J. Wei (2000). Does “grease money” speed up the wheels of commerce? IMF Working Paper.
- Leff, N. H. (1964). Economic development through bureaucratic corruption. *American Behavioral Scientist* 8(3), 8–14.
- Lein, D. (1986). A note on competitive bribery game. *Economics Letters* 22(4), 37– 341.
- Lewis, G. and P. Bajari (2011). Procurement Contracting With Time Incentives: Theory and Evidence. *The Quarterly Journal of Economics* 126(3), 1173–1211.

- Liu, F. T. (1985). An equilibrium queuing model of bribery. *Journal of Political Economy* 93(4), 760–781.
- Marion, J. (2007). Are bid preferences benign? the effect of small business subsidies in highway procurement auctions. *Journal of Public Economics* 91(7), 1591–1624.
- Mohamed, K. A., S. S. Khoury, and S. M. Hafez (2011). Contractor’s decision for bid profit reduction within opportunistic bidding behavior of claims recovery. *International Journal of Project Management* 29(1), 93–107.
- Murphy, K., A. Shleifer, and R. Vishny (1991). The allocation of talent: Implications for growth. *Quarterly Journal of Economics* 106, 599–617.
- Pizzo, C. (2024). Public procurement: Evidence from the italian legality rating. Working paper.
- Shleifer, A. and R. W. Vishny (1993). Corruption. *The Quarterly Journal of Economics* 108(3), 599–617.
- Tanzi, V. and H. Davoodi (1997). Corruption, public investment, and growth. IMF Working Paper (97/139).

RECENT PUBLICATIONS BY *CEIS Tor Vergata*

Green Ambiguity

Marco Carli

CEIS Research Paper, 591 February 2025

Who Decides Matters: Female Representation and Academic Career Advancement

Marianna Brunetti, Annalisa Fabretti and Mariangela Zoli

CEIS Research Paper, 590 December 2024

Multivariate Rough Volatility

Ranieri Dugo, Giacomo Giorgio and Paolo Pigato

CEIS Research Paper, 589 December 2024

With a Little Help from Nurseries. Childcare Services and Mothers' Employment in Italy

Chiara Puccioni and Daniela Vuri

CEIS Research Paper, 588 December 2024

SMEs Performance in Public Procurement and the Italian Legality Rating

Andrea Fazio, Erminia Florio and Gustavo Piga

CEIS Research Paper, 587 December 2024

A Reinforcement Learning Algorithm For Option Hedging

Federico Giorgi, Stefano Herzel and Paolo Pigato

CEIS Research Paper, 586 December 2024

The Long-Run Effects of R&D Subsidies on High-Tech Start-Ups: Insights From Italy

Christoph Koenig, Letizia Borgomeo and Martina Miotto

CEIS Research Paper, 585 October 2024

With a Little Help From the Crowd: Estimating Election Fraud with Forensic Methods

Christoph Koenig

CEIS Research Paper, 584 October 2024

Biases and Nudges in the Circular Economy: A Review

Luca Congiu, Enrico Botta and Mariangela Zoli

CEIS Research Paper, 583 October 2024

Energy Shocks, Pandemics and the Macroeconomy

Luisa Corrado, Stefano Grassi, Aldo Paolillo and Francesco Ravazzolo

CEIS Research Paper, 582 August 2024

DISTRIBUTION

Our publications are available online at www.ceistorvergata.it

DISCLAIMER

The opinions expressed in these publications are the authors' alone and therefore do not necessarily reflect the opinions of the supporters, staff, or boards of CEIS Tor Vergata.

COPYRIGHT

Copyright © 2025 by authors. All rights reserved. No part of this publication may be reproduced in any manner whatsoever without written permission except in the case of brief passages quoted in critical articles and reviews.

MEDIA INQUIRIES AND INFORMATION

For media inquiries, please contact Barbara Piazzzi at +39 06 72595652/01 or by e-mail at piazzzi@ceis.uniroma2.it. Our web site, www.ceistorvergata.it, contains more information about Center's events, publications, and staff.

DEVELOPMENT AND SUPPORT

For information about contributing to CEIS Tor Vergata, please contact at +39 06 72595601 or by e-mail at segr.ceis@economia.uniroma2.it