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Court Efficiency and Procurement Performance*

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Abstract

Disputes over penalties for breaching a contract are often resolved in court. A simple model illustrates how inefficient courts can sway public buyers from enforcing a penalty for late delivery in order to avoid litigation, thereby inducing sellers to delay contract delivery. By using a large dataset on Italian public procurement, we empirically study the effects of court inefficiency on public work performance. Where courts are inefficient, we find the following: public works are delivered with longer delays; delays increase for more valuable contracts; contracts are more often awarded to larger suppliers; and a higher share of the payment is postponed after delivery. Other interpretations receive less support from the data.

Keywords: Court efficiency; delay; enforcement cost; litigation; performance in contract execution; public procurement; time incentives

JEL classification: *H*41; *H*57; *K*41

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I. Introduction

Explicit contracting is a crucial governance instrument for public procurement transactions. Concerns about accountability severely limit civil servants' discretion and, with it, the scope for relational contracting (Kelman, 2002; Spagnolo, 2012). Similarly, reputational considerations based on non-verifiable performance are rarely allowed in public procurement.[1] However, contract enforcement costs can be significant where the law court system is inefficient (Djankov *et al*., 2003). Contracting parties can then choose *ex post* not to exercise their contractual rights to save on enforcement costs. In public procurement, high enforcement costs can therefore imply that buyers are unable to effectively control suppliers' opportunism.

In this paper, we study whether suppliers are more prone to opportunistic behavior in public procurement when courts are less efficient. We specifically focus on suppliers' opportunism with regard to delivery delays. As Lewis and Bajari (2011) stress, delivery time is often an important quality dimension, and delays can have a significant negative impact on end users. We first develop a stylized model in the spirit of the nuisance claim literature (Rosenberg and Shavell, 1985) to organize the data and guide the empirical analysis. The model also helps our understanding of the incentives of the agents (i.e., suppliers and public buyers) involved in the procurement process. The effects of trial duration on procurement delays is *a priori* ambiguous and can depend on "who is suing who" (i.e., on who is the plaintiff and who is the defendant), and on other features specific to the institutional environment such as litigation costs and their distribution. In the Italian case, it is the contractor that must act as a plaintiff because the contracting authority can move first by subtracting the penalty from the contract. Under this assumption, and others chosen to match the institutional setting from which our data originate, we derive testable predictions relevant to the empirical analysis.

We then use a large dataset on public works collected by the Italian Public Procurement Authority (henceforth, AVCP) for the years 2000–2006

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[1] This has been particularly true in Europe, where reputational considerations have typically been seen by legislators as a tool to discriminate against foreign suppliers (e.g., EC Directives 2004/17, 2004/18, 2014/24, and 2014/25); see Butler *et al*. (2013) for further discussion on recent EU regulations.

to empirically investigate this relationship. AVCP maintains a centralized electronic database containing a wide range of detailed information on public procurement – crucial to our analysis and to any anti-corruption activity – that are not even collected in the vast majority of other countries. We merge this dataset with information collected by the Italian Statistics Institute (henceforth, ISTAT) on the duration of civil trials by province for each year. Our focus is Italy, which represents a unique laboratory for studying the costs of an inefficient judiciary among developed countries. Italy is a judicial outlier, twice as slow as any other member of the OECD and characterized by large territorial and time variability in judicial efficiency (Palumbo *et al*., 2013).

Our empirical findings suggest, as predicted by our model, that delays in executing public works are positively associated with the duration of civil trials. This effect is statistically significant, and it is robust to the inclusion of a large set of contract, geographical, and time controls in our regressions. We also find that the association between procurement and court delays is stronger for larger and more complex projects. This is also consistent with our model: as highlighted in the influential paper by Bajari and Tadelis (2001), the more asymmetric information typical of large/complex contracts favors contractors in legal disputes.

Furthermore, we find that where trials take longer, contracts are more often awarded to larger suppliers; this is in line with previous evidence provided by Laeven and Woodruff (2007). We also find that the final amount to be paid upon delivery is larger where the trial duration is longer, a result which suggests that the public buyer attempts to reduce the incentive to delay by increasing the supplier's financial cost.

Finally, we consider different explanations and extensions of our results on delivery delays, including corruption and public buyers' fiscal restraints. We find that our results are robust across model specifications and sample selections.

Our paper relates to three main strands of economic literature. First, we consider recent works on time incentives in public procurement contracts. In particular, Lewis and Bajari (2011) theoretically and empirically investigated an innovative procurement-awarding design adopted by the California Department of Transportation that provides for explicit time incentives. They estimate the benefits, in terms of social welfare, of including project completion time in the auction mechanism. D'Alpaos *et al*. (2013) developed a model in which – if penalties for late delivery are included in the contract – the supplier's choice concerning the execution time can be investigated as a real option (i.e., a put option); in such a setting, the supplier's choice is affected by the volatility of investment costs and by the enforcement of penalty clauses. Lewis and Bajari (2014) investigated how higher penalties for delivery delays can induce greater

effort, but can also increase the agent's risk in performing the contract. Using micro-level data on Minnesota highway construction contracts, these authors find evidence of suppliers' moral hazard in adjusting their effort level during the course of the contract in response to unanticipated productivity shocks. Coviello *et al*. (2018) use data similar to ours, and find that an increase in buyer discretion in selecting potential suppliers need not result in worst procurement performance. We contribute to this literature by studying the interactions between penalties for late contract delivery and their enforcement by local law courts.

Second, we look at a strand of empirical literature on contract enforcement costs. Djankov *et al*. (2003) showed the extent to which these costs are linked to court efficiency in various legal systems. Using the length of a trial in the civil courts as a measure (among others) of judicial efficiency in 109 countries, they investigated how a law court's efficiency depends on different levels of procedural "formalism". Their empirical findings show that the level of such formalism is higher in civil than in common law countries, and is typically associated with longer lasting trials, fewer fair sentences, and more corruption. The same authors emphasize that inefficient judicial enforcement of contractual clauses often gives rise to opportunistic behavior and settlements. A number of papers have evaluated the implications of these findings for economic outcomes. For example, Jappelli *et al*. (2005) investigated the effect of judicial enforcement on credit markets. Testing their model on panel data from Italian provinces, they found that the duration of civil trials and the stock of pending civil trials per inhabitant were negatively correlated with loans granted to local firms, and positively correlated with credit constraint measures. Chemin (2012) empirically studied the effect of judicial reforms implemented in India in 2002 on the performance of small firms. He found that a more expedited disposal of civil suits resulted in fewer breaches of contract, encouraged investments, and facilitated firms' access to finance.[2] We contribute to this literature with empirical evidence on the costs of inefficient courts in terms of delayed execution of public works.

Third, a body of empirical and theoretical literature focuses on the use of relational contracts to escape the adverse effects of weak contracting institutions (Gil and Zanarone, 2015). Closest to ours in this area is the work of Johnson *et al*. (2002), who analyze the role of court efficiency in maintaining trust and reducing transaction costs in private

[2] See also Litschig and Zamboni (2015), who estimated the effect of state judiciary presence on rent extraction (administrative irregularities) by local governments in Brazil; Ponticelli and Alencar (2016), who made an empirical assessment of the extent to which the effects of financial reform in Brazil are dependent upon the quality of court enforcement; and Moretti (2014), who, using Italian data, found that an increase in the availability of credit had a larger effect on firm productivity in provinces with shorter civil trials.

procurement transactions in developing countries. They show that, although the main instruments for governing buyer-supply exchanges are long-term relationships, transaction costs are significantly lower when courts are effective. More recent theoretical papers have also analyzed parties' *ex post* decisions on whether or not to enforce previously signed explicit contractual clauses by weighting the costs and benefits of doing so (Chakravarty and MacLeod, 2009; Doornik, 2010; Iossa and Spagnolo, 2011). We contribute to this body of literature by investigating the possibility that explicit contractual clauses (i.e., penalties for late delivery) cannot, in fact, be enforced by public buyers because of the high costs of seeing these clauses disputed in front of inefficient law courts.

In Section II, we first briefly detail the institutional features of penalties for late delivery in accordance with the Italian regulations on public procurement. Then, using the nuisance suits literature as a base, we present a simple model that shows how agents might interact in such a setting. In Section III, we describe our dataset, illustrating the cross-sectional variability (across Italian provinces) of delays in the execution of works, as well as the cross-sectional and time-related (i.e., within) variability in the average duration of civil trials. Then, in Section IV, we present our estimation strategy and discuss our results. In Section V, we check whether trial duration interacts with the complexity of the contract and if it is correlated with the size of the winning company and with the proportion of the final payment going to the contracting authority (CA); we also control for alternative explanations for our results and provide further robustness checks. Conclusions are given in Section VI.

II. Equilibrium Delay in Delivering Public Procurement

In this section, we first illustrate how time incentives and other terms are regulated in Italian public procurement for public works. Then we present a simple model that describes the equilibrium delay in completing the contracted works when the public buyer has the choice of whether or not to enforce the agreed penalty for late delivery.

Institutional Setting

In our sample period, the applicable procurement law is Law No. 109/94, which was enacted in Italy in the early 1990s in the immediate aftermath of several corruption scandals in public procurement. This historical context provides us with an understanding of why the law is so strict in the use of scoring auctions and negotiations, and in imposing clauses on price definitions (and revisions).

The contractual terms with which suppliers have to comply in the delivery of public works are specified in the calls for tender, while general

rules are specified by Italian procurement law. Italian procurement law prescribes that time incentive clauses be included in all contracts (in the form of payment deductions/penalties for late delivery), it regulates the lower and upper limits of said penalties (in the range of 0.03–0.1 percent of the contract value for each day of delay), it caps the total amount of penalties that can be exercised (10 percent of the contract value), and it mandates contract resolution and damage action (where possible) if this limit is reached.[3] The contract value is determined by an engineer employed by the CA, according to a price list that enumerates the standardized costs for each type of work; see Decarolis (2014) and Coviello and Mariniello (2014) for details on how the CA determines this price. This value represents the reserve price of the contract, i.e., the maximum price that the CA is willing to pay for a public work before the auction to award the contract takes place.

Italian procurement law indicates three main types of awarding procedures for public works: open procedures, restricted procedures, and negotiations. The standard approach is the open procedure; however, the choice between the three depends on the reserve price of the auction, alongside other technical aspects. In our sample, the winner of the auction is determined by a mathematical algorithm. This auction mechanism is somewhat unconventional in that it includes a number of "beauty contest" features whereby the highest bidder does not necessarily win; this is used with slight modifications in many other countries; see Decarolis (2014) for a discussion. The specific features of the mechanism generate the theoretical possibility that increased participation need not result in greater competition (Albano *et al*., 2006; Decarolis, 2014).

Enforcement of Penalties for Late Delivery

Even though the regulatory environment mentioned above is strict, Italian public procurement law grants public buyers a considerable degree of discretion in exercising their right to enforce penalties for late delivery. These penalties are enforced in the form of payment deductions, which are usually subtracted from payments to the contractor. According to the current procedure, the supplier can request that the penalty be revoked (or only partially implemented) either because of a reason for delay that was outside the supplier's control (e.g., planning errors, adverse weather conditions, contingencies, etc.) or because the fee is "manifestly disproportionate" to the harm done. If the supplier presents a claim on the enforced penalty, the public buyer can assess the claim and decide

[3] Italian procurement law does not allow contractors to penalize suppliers that delivered past works late. Contractual penalties are the only punishment for late delivery.

whether or not to wholly (or partially) accept it. If the public buyer rejects the supplier's claim, thus confirming the penalty enforcement, the supplier can go to court. This solution is often very time consuming due to the typically long duration of civil trials in Italy.

Note that the costs of a dispute in court between a supplier and a public buyer can vary substantially. The buyer's costs are not limited to spending on the resources that are required to defeat the claim; litigation in court means that the works remain inaccessible to end users, and the related social welfare loss can affect the public buyer's reputation and political interests. The longer the court proceedings, the greater the delay to public works and the larger the political cost. However, suppliers can make use of such delays by allocating productive capacity more efficiently. Moreover, their future chances of winning a contract are not damaged because suing is their constitutional right. This asymmetry generates an incentive for public buyers to avoid entering into disputes with suppliers where the law courts are particularly slow. For the supplier to obtain the right to a lawsuit, the sequence of events is as follows. Once the supplier has delivered delayed work, the public buyer can enforce the penalty by subtracting it from the final payment. The supplier can then request that the penalty be reviewed, and if the public buyer rejects the supplier's claim, the supplier can sue him. Thus, in this legal framework, in the resulting trial the supplier would act as the plaintiff and the public buyer as the defendant.

A Simple Model of Equilibrium Delay in Delivery

In the very simple model we present in this section, which encompasses the main features of the Italian institutional public procurement setting, we characterize conditions under which – in equilibrium – suppliers strategically delay the delivery of public contracts and public buyers do not exercise penalties.

We investigate a setting where a public buyer, i.e., a contracting authority (CA), entrusts the execution of a contract to a supplier firm (F). The parties sign a contract specifying the work involved, the timing of the execution, the price Π to be paid to the supplier, and the penalty p for each day of delay.

We assume that CA and F are risk neutral. We also assume that F is capacity constrained and derives a positive value from postponing the contract's execution: $V(d)$ is F's benefit from d days of delay in the delivery of the works. Delaying the contract's execution generates a damage $D(d)$ to CA, with $D(d) > V(d)$. We shall also make the following assumptions of the regularity of the functions $V(d)$ and $D(d)$: $V(0) = 0$, $D(0) = 0$. $V(d)$ and $D(d)$ are continuous and strictly concave.

Figure 1 shows the timing of the game and the actions available to players. Payment occurs once the works are completed, and eventual

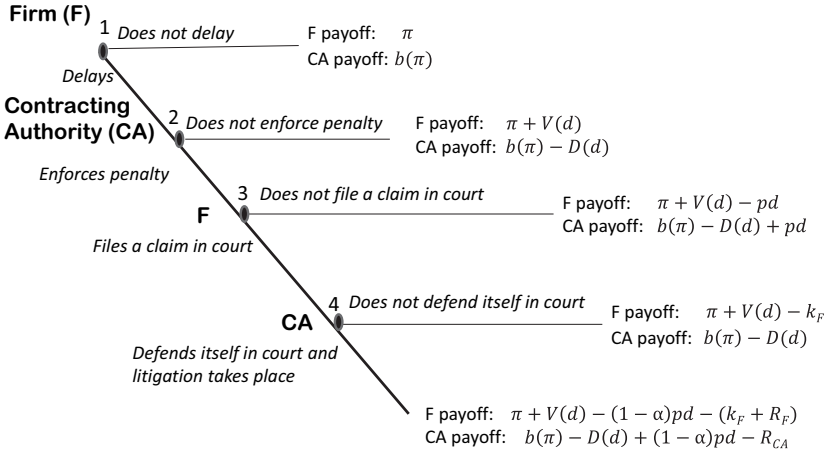

Fig. 1. The game tree

penalties are deducted at that time. In the case where F delays the contract's delivery, CA can enforce the corresponding penalty pd; if it does, F can file a claim in the local courts to recover the penalty. Filing a claim carries a small administrative sunk cost for F, $k_F \geqslant 0$, that we assume to be given and known to both parties involved in the dispute.

If F files a claim and CA withdraws, CA will be damaged by F's delay, losing $D(d)$, and will not pocket the penalty. If F files a claim and CA does not withdraw, the case goes to trial. F expects to recover αpd, where $\alpha \in]0,1[$ is the probability that the judge will decide in favor of F, thereby making a *type 1 error* (i.e., a *false positive*). Indeed, as we are dealing with strategic delays, F can only recover an enforced penalty by inducing the judge to make a type 1 error.[4] If CA defends itself in court, it will incur a cost, $R_{CA} \geqslant 0$, that we assume to be given and known to both parties, and will receive the enforced penalty minus the fraction $(1-\alpha)pd$ that F will recover according to the judge's assessment.[5] If CA goes to court, F will face the legal costs of litigation, $R_F \geqslant 0$, and will expect to partially recover the penalty, αpd, depending on the judge's assessment.[6]

[4] In our setting, a *type 2 error* (i.e., *false negative*) is not present as F files a claim in court only if a strategic delay took place. We thank an anonymous referee for suggesting that we highlight this point.

[5] Note that higher value contracts are usually delivered by larger firms; these often have more information than the CA on the works in question, and can therefore use this information to influence the judge towards a type 1 error.

[6] In Italian public procurement, if the firm loses its case against penalties for delay, then it has to pay (i) these penalties (but not the penalties for the delay incurred because of the trial),

If F does not delay in the delivery of the works, F and CA will have the respective payoffs $[\Pi, b(\Pi)]$, where Π is the contract's price paid to F, and b is the utility gained by CA from the contract's execution. b is an increasing function of the contract's price Π and also includes some measure of social welfare for the citizens using the public works in question.[7]

If F delays and CA does not react, their respective payoffs will be

$$[\Pi + V(d), b(\Pi) - D(d)].$$

If F delays, CA enforces the penalty, and F does not file a claim in the local courts, the respective payoffs become

$$[\Pi + V(d) - pd, b(\Pi) - D(d) + pd].$$

If F delays, CA enforces the penalty, F files a claim, and CA withdraws rather than defends itself, they will respectively achieve

$$[\Pi + V(d) - k_F, b(\Pi) - D(d)].$$

If F delays, CA enforces the penalty, F files a claim, and CA defends itself in court, the respective payoffs will be

$$[\Pi + V(d) - (1 - \alpha)pd - (k_F + R_F), b(\Pi) - D(d) + (1 - \alpha)pd - R_{CA}].$$

In this setting, we first investigate the simple case where F's costs for filing a claim and defending it in court, $(k_F + R_F)$, and CA's costs for responding, R_{CA}, are both fixed, positive, and commonly known. We assume that α, the probability that the judge will make a type 1 error, is constant.

Equilibrium Delay

As highlighted in Rosenberg and Shavell (1985), in a legal dispute, defeating a claim is more costly than making a claim. This is especially pertinent for complex procurement contracts (i.e., higher value contracts) where the supplier has more information than the buyer (Bajari and Tadelis, 2001). This information advantage can be used by the supplier to reinforce

(ii) its own legal costs for the trial, and (iii) at the judge's discretion, a proportion of the CA's legal costs (see the Italian Code of Civil Procedure, art. 91 and 92). Our simple model abstracts from (iii) because including partial reimbursement would not change our qualitative results (it determines a smaller equilibrium delay if the judge is unlikely to make an error, and a larger one if this probability increases).

[7] Π, the final project payment to F, is a proxy for the size, importance, and cost of the project, and for its complexity given that larger projects tend to be more complex. Alternatively, Π could be assumed to indicate the reserve price as determined by the CA's engineers, as that is also a proxy for the value and the complexity of the project.

the signal when filing a claim in court: "a stronger signal increases the probability that the judge or the jury will favor the fact as represented by its sender" (Cooter and Rubenfeld, 1989, p. 1072).

Moreover, in the Italian public procurement setting, litigation in court further delays the citizens' use of the contracted works until the trial is over. This determines a social welfare loss and, consequently, an additional cost for *CA* when disputing enforceable penalties in court. The longer the trial, the higher the related social loss from the public's inability to access the executed public work.[8] These considerations lead us to assume $R_{CA} > k_F + R_F$.

The expectation of large R_{CA} could make it too costly for *CA* to take *F* to court, preventing *CA* from enforcing the penalty. Specifically, at node 4 in Figure 1, having enforced the penalty, *CA* will *not* go to court after *F* files a claim against the penalty whenever

$$b(\Pi) - D(d) \geqslant b(\Pi) - D(d) + (1 - \alpha)pd - R_{CA},$$

$$R_{CA} \geqslant (1 - \alpha)pd, \text{ or } d \leqslant \frac{R_{CA}}{(1 - \alpha)p}. \tag{1}$$

Condition (1) determines a threshold of delay, $\tilde{d} = R_{CA}/[(1-\alpha)p]$, such that CA will *not* go to court as long as $d \leqslant \tilde{d}$.

If condition (1) is satisfied, *F* has opted for a delay d, and *CA* has enforced the allowable penalty, then *F* does not expect *CA* to fight in court and will file a claim as long as $k_F < \alpha pd$. If, instead, condition (1) is not satisfied, then *F* will expect *CA* to go to court at node 4 (see Figure 1) so that litigation takes place and the relative costs are incurred. Let d' define the optimal choice of d in this case, i.e.,

$$d' = \arg\max_{d} \{\Pi + V(d) - (1 - \alpha)pd - k_F - R_F\}. \tag{2}$$

We can then state the following.

Proposition 1. *There exists a positive number m such that for any* $d' \leqslant \tilde{d} + m$ *there is a pure strategy subgame perfect equilibrium of the game in which F chooses* $d = \tilde{d}$ *and CA does not enforce the penalty.*

Proof: See Online Appendix A. □

Proposition 1 indicates that there are reasonable parameter configurations of this simple model under which it is natural to expect *F* to strategically

[8] Consider public works for the construction of a new kindergarten – if these works are executed with delay, and if *CA* enforces the penalty, *F* files a claim in the local court, and *CA* defends itself in court, end users of the kindergarten will only be able to access the service once the dispute has been resolved. This determines a social welfare loss that can further affect the public buyer's reputation and political interest.

delay delivery and *CA* to not enforce the penalty for the delay. This will generally be the case when the cost of litigation for *CA* is relatively large, undermining the credibility of the threat by *CA* to contest a nuisance suit by *F* with the intention of not paying the penalty.

Crucial thresholds for this equilibrium are $\tilde{d} = R_{CA}/[(1-\alpha)p]$ and $d > k_F/p$; hence on inspection we can already see that this outcome will be more common and that the higher the *CA* legal costs R_{CA}, the lower the penalties for delay p, the higher the courts' precision $(1-\alpha)$, and the lower the fixed cost for *F* of filing a nuisance suit, the longer the equilibrium delays.

We now make this simple scenario more complex in order to consider other important aspects of reality and to develop additional predictions to be tested with our data (see Corollary 1), and to light on *CA*'s choice on p (see Corollary 2). Specifically, in what follows we extend our model to consider the following cases.

(i) *Parties' legal costs increase with court delays,* $R'_{CA}(\gamma) > 0$ *and* $R'_F(\gamma) > 0$, *where* $R_{CA}(\gamma) > k_F + R_F(\gamma)$ *and* (γ) *is the average time to solve a dispute in court.* There is considerable empirical evidence to suggest that judicial systems characterized by lengthy trials tend to be more costly. For example, Palumbo *et al*. (2013), investigating different judicial systems using OECD and EU data, highlighted the positive correlation between trial length and litigants' costs for the trial, with Italy being in the worst position. Although these empirical findings relate to national judicial systems, the same effects could be inferred for courts at the provincial level: lengthy local trials result in higher legal costs. In Italian public procurement, where penalties for delayed delivery are disputed in court, longer trials further delay the end users' access to the public work, increasing the related social welfare loss; this, as well as the institutional setting discussed above, motivates us to focus on the case $R'_{CA}(\gamma) \geqslant R'_F(\gamma)$. This extension allows us to make predictions – empirically tested in Section IV – about the relationship between court efficiency γ and the delay $\tilde{d}$.

(ii) *The probability of a judge making a type 1 error increases with the size/complexity of the contract, i.e.,* $\alpha(\Pi)$ *with* $\alpha'(\Pi) > 0$. As mentioned by Bajari and Tadelis (2001) and broadly acknowledged in the procurement literature, larger value contracts tend to be more complex, and complex contracts are *ceteris paribus* more costly to perform. Furthermore, the importance of the informational advantage of *F* relative to the court tends to increase with larger and/or more complex projects. Accordingly, the larger in value and/or the more complex the project, the higher *F*'s ability to

dispute penalties for delay in court, i.e., to induce a type 1 error.[9] This extension gives us predictions for the quantitative analysis in Section IV on how the equilibrium delay $\tilde{d}$ is affected by the value of the project (i.e., the complexity of the project Π).

(iii) *The daily penalty p is chosen in the interval $\underline{p} \leqslant p \leqslant \overline{p}$.* This case is for the sake of realism: in Italian public procurement, $\underline{p}$ and $\overline{p}$ correspond to 0.03 and 0.1 percent of the contract value, respectively. Note that to endogenize the penalty p, we need to add a decision stage at the beginning of the game in which *CA* defines p.

We can now state the following results.

Corollary 1. *(a) If $R'_{CA}(\gamma) \geqslant R'_F(\gamma) \geqslant 0$, then the equilibrium delay $\tilde{d}$ increases with γ. (b) If $\alpha'(\Pi) > 0$, then the equilibrium delay $\tilde{d}$ increases with Π. (c) If (a) and (b) are both simultaneously satisfied, then the effects of γ and Π on $\tilde{d}$ reinforce each other.*

Proof: See Online Appendix A. □

As we might intuitively expect, when court inefficiency increases legal costs, *CA* is even more scared of litigation; this leads *F* to increase the delay without fear of penalty. Similarly, when an increase in project complexity (value) leads to more frequent type 1 errors by the court, it makes imposing penalties less attractive for *CA*, thus leading it to tolerate longer delays. Both these two predictions will find validating evidence in the empirical section (Section IV). The reinforced effect of a project's complexity Π and the inefficiency of the local courts γ on the delay to a contract's execution will be empirically confirmed in Section V.

Corollary 2. *Supposing CA can choose p from a finite interval, it will always choose the highest possible p, as a higher p induces both shorter and less frequent delays.*

Proof: See Online Appendix A. □

III. Data

We merge a dataset on procurement auctions administered by each Italian public administration between 2000 and 2006 with a database containing

[9] Coviello *et al*. (2015) empirically found that faster judges (i.e., lower γ) make fewer mistakes (i.e., lower α). Our dataset, however, does not permit this test; thus, in our simple model, we assume that γ and α are independent. Allowing γ and α to be positively correlated in our model would strengthen our results concerning strategic delays with no enforcement of penalties.

information on the duration of civil trials in Italian courts. The former database is provided by AVCP, which systematically collects data on all procurement auctions for public works with a starting value greater than or equal to 150,000 euros. The latter database is collected by ISTAT.

Our procurement data include information on several dimensions of each procurement contract, including the auction's awarding procedure, the reserve price, and the winning rebate (i.e., the percentage discount from the reserve price offered by the auction's winning firm), the number of bidders, the expected and actual durations of the works, the main category of works involved, and the location and type of the contracting authority (*CA*) awarding the contract. For a subsample of auctions, we also observe the business identity of the winning firm (*F*) and the proportion of the final payment that *CA* pays *F* (on completion) relative to the total amount.

Our sample consists of contracts awarded in 83 provinces.[10] As shown in Table 1, most (about 75.8 percent) of the contracts were awarded by means of an open auction to all-comers, and about 70 percent of the CAs involved were municipal or provincial authorities.[11] The majority of our contracts are for the construction of buildings (about 32.3 percent) or roads and bridges (about 30.4 percent). Table 1 shows that 75 percent of the works have a value below 550,000 euros. As discussed in Bajari and Tadelis (2001), small contracts are easy to design and involve little uncertainty regarding what needs to be produced.

We define the delay in completion of the contracted work (*d* in the simple model in Section II) as the difference between the actual completion of the contracted work and the expected delivery (due) date; the latter is usually calculated by the CA's engineers and is stated in the contract, while the former is recorded once the works have been delivered. In our dataset, the delays in completion averaged around 153 days, with a maximum of 1,578 days. Some works were completed on time, or even in advance (this was true for about 6.72 and 8.74 percent of the sample, respectively), but about 84.54 percent of the works were delivered late.[12] Figure 2 shows provincial variations in the average number of days of delay in the completion of public works. A higher concentration of delays is apparent in central and southern Italy, but the picture also varies considerably among the northern Italian provinces.

[10] We consider provinces from 15 of the 20 Italian regions, because the other five (Val D'Aosta, Trentino Alto-Adige, Friuli Venezia-Giulia, Sicily, and Sardinia) enjoy a greater degree of legislative autonomy and have different rules for public procurement contracts.

[11] Our dataset does not include design and build contracts, which are analyzed in Decarolis and Palumbo (2015).

[12] Similar empirical evidence on delays in the delivery of Italian public procurement contracts has also been found by Decarolis and Palumbo (2015), Coviello *et al*. (2018), Coviello and Mariniello (2014), Decarolis (2014), D'Alpaos *et al*. (2013), and Bucciol *et al*. (2013).

Table 1. *Summary statistics*

Variable	(1) Obs	(2) Mean	(3) SD	(4) Min	(5) P25	(6) P50	(7) P75	(8) Max
Dependent variable								
Delay in completion (days)	40,521	153.339	168.209	−194	30	108	225	1578
Contract characteristics								
Reserve price	40,521	5.824	11.154	1.303	1.998	3.008	5.492	299.805
Awarding procedure								
Open	40,521	0.758	0.428	0	1	1	1	1
Restricted	40,521	0.081	0.273	0	0	0	0	1
Simplified restricted	40,521	0.064	0.245	0	0	0	0	1
Negotiation	40,521	0.097	0.296	0	0	0	0	1
Category of works								
Buildings	40,521	0.323	0.467	0	0	0	1	1
Roads and bridges	40,521	0.304	0.460	0	0	0	1	1
Cultural heritage	40,521	0.065	0.247	0	0	0	0	1
Hydraulic	40,521	0.065	0.247	0	0	0	0	1
Type of CA								
Municipal authorities	40,521	0.548	0.498	0	0	1	1	1
Provincial authorities	40,521	0.151	0.358	0	0	0	0	1
Ministries	40,521	0.042	0.200	0	0	0	0	1
Provincial controls								
Trial duration (days)	40,521	889.389	293.701	205	664	839.5	1063	2221
Population	40,521	11.356	11.598	0.890	3.577	6.430	11.498	40.131

Notes: The reference period is 2000–2006. See Online Appendix B for detailed definitions of variables.
Sources: Auction/project-level variables are from AVCP; province-level variables are from ISTAT.

Our measure of the trial duration (γ in the model in Section II) is calculated by ISTAT annually for each court and represents the average time taken to arrive at a sentence (weighted over the number of pending cases). In provinces with more than one law court we took the average duration. We focus on first instance civil trials (*procedimento civile di cognizione ordinaria di primo grado*) by province and by year from 2000 to 2006. We examine local civil courts because it is these courts that resolve disputes over the execution of public procurement contracts.[13] The average duration of a first instance civil trial in Italy between the

[13] Jappelli *et al*. (2005) use the same measure to examine the relationship between trial duration and banking market performance in the Italian provinces. Note that disputes concerning the awarding phase of public procurement contracts are handled instead by local administrative tribunals.

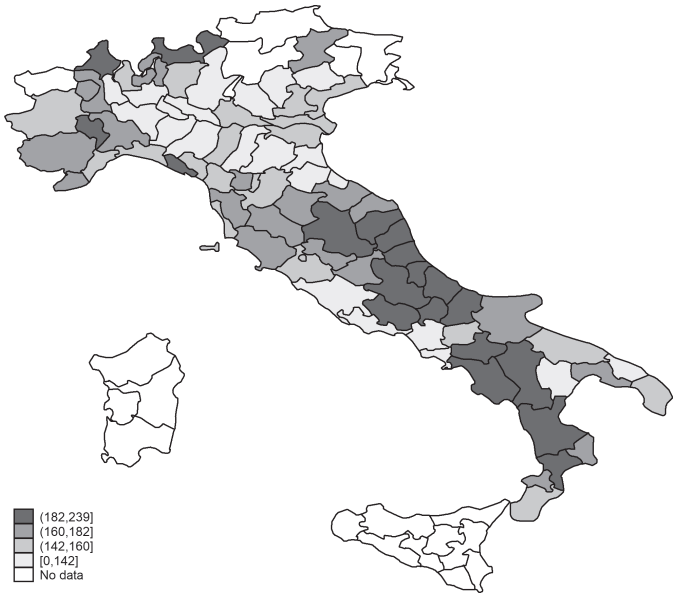

Fig. 2. Delays in completion of works (days) [Colour figure can be viewed at wileyonlinelibrary.com]

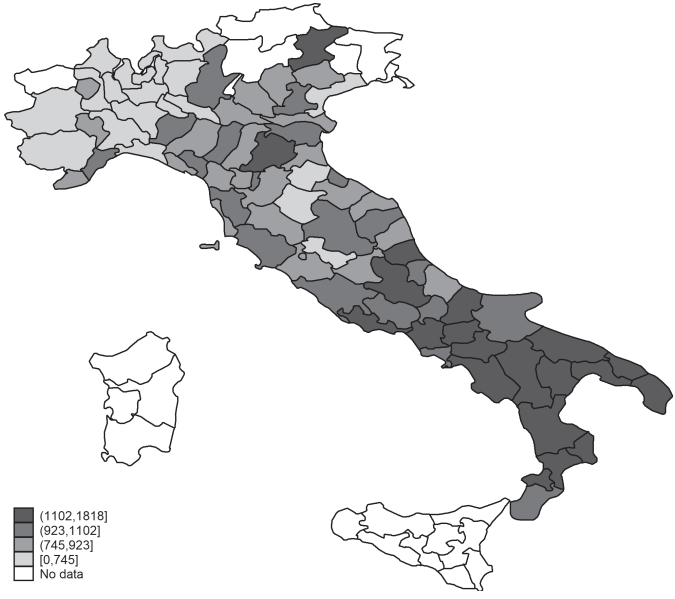

Fig. 3. Trial duration (days) [Colour figure can be viewed at wileyonlinelibrary.com]

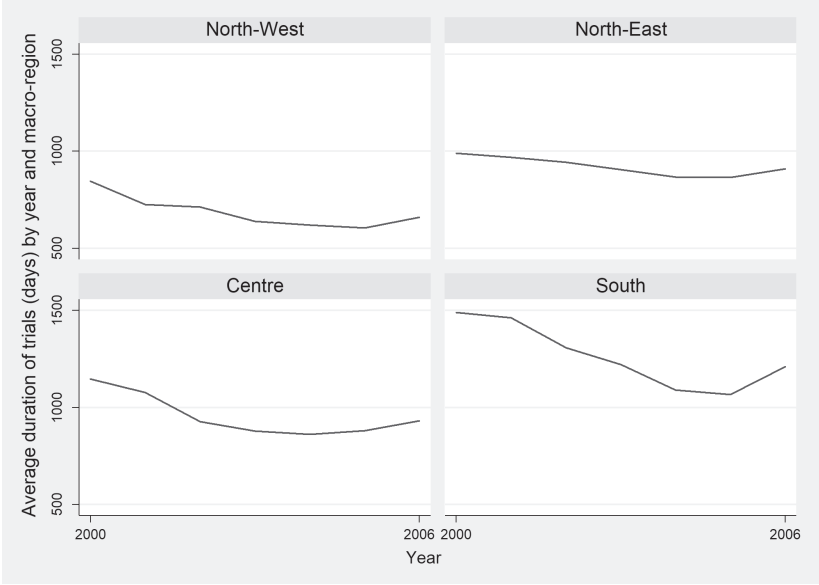

Fig. 4. Trial duration (days) by year and macro-regions [Colour figure can be viewed at wileyonlinelibrary.com]

years 2000 and 2006 was 911 days, with a minimum of 205 days and a maximum of 2,221 (for our sample, the mean was 889 and the standard deviation was about 294 days). The figures show variations across the provinces (see Figure 3) and over time (see Figure 4). These cross-sectional and over-time variations (i.e., within variation) lie at the heart of our strategy to identify the relationship between trial duration and delays in the completion of public works within the framework of a fixed effects (FE) model.

Figures 2 and 3 suggest that there is a positive correlation between the average delay in the completion of public works and the average trial duration across Italian provinces (during our sample period). This is confirmed in the scatter plot in Figure 5, which shows a positive correlation when we consider the province-year averages.

IV. Empirical Analysis

We want to test whether trial duration affects delays in the completion of public works. We consider project-level data and estimate different versions of the following specification:

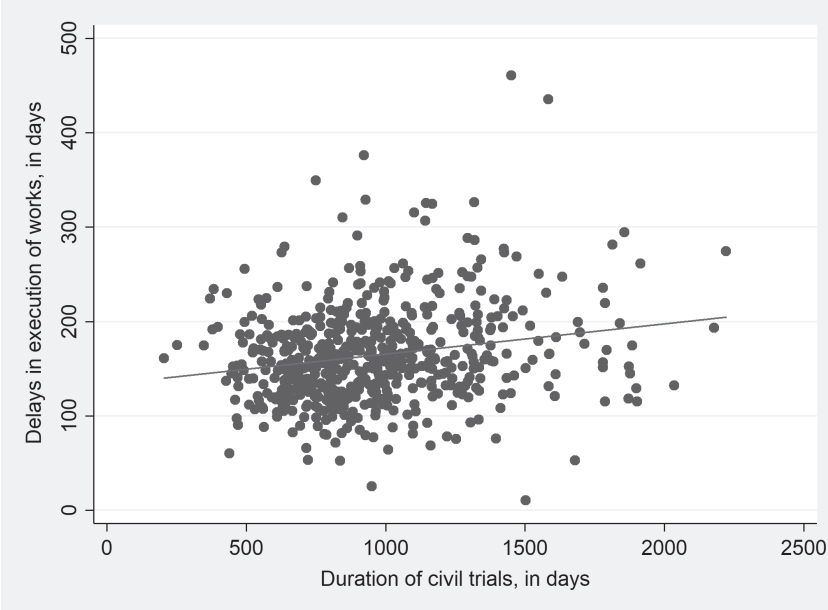

Fig. 5. Delays in completion of works plotted against trial duration [Colour figure can be viewed at wileyonlinelibrary.com]

$$Delay_{ipt} = \alpha + \beta_1 J_{pt} + \beta_2 X_i + \beta_3 Q_{pt} + \beta_4 T_t + \beta_5 P_p + \epsilon_{ipt}, \qquad (3)$$

where J is the value of the average trial duration in the province p taken at the beginning of the works (year t) for each project. X is a set of variables including: (i) the characteristics of the project (e.g., the reserve price and the main category of works, which are proxies for the project's size or complexity, and the type of work involved); (ii) the characteristics of the auction (e.g., entry method); and (iii) the type of CA awarding the contract. Q includes the province population (time-varying), T represents year dummy variables, and P represents province FE. Our estimates are identified provided that there is enough within-province variation in the trial duration. In alternative specifications, we experiment with the inclusion of CA FE.[14]

[14] Our dataset does not allow us to calculate the distance between the winning firm and the court, as we do not have information on the exact locations of the firms. In Italy, however, the density of courts is rather uniform across the country. In Online Appendix B we provide details on the definitions of the variables.

Main Results

Table 2 reports estimates on the relationship between the delay in the delivery of contracted works and the average trial duration in the law courts of the province in which the CA operates. In Columns 1–4, we control for province FE, and in Columns 5–8 for CA FE. The latter model (i.e., after including CA FE) appears to fit the data better, which suggests that variability in the completion time of works correlates strongly with local factors that are not observable to the econometrician. These might include the personal attitudes of CA managers (or other CA staff) towards the more or less strict enforcement of penalties for a contract, all else being equal.

In Columns 1, 3, 5, and 7 in Table 2, we present linear models for the trial duration which turn out not to be statistically significant. In Columns 2, 4, 6, and 8, when we add the quadratic term into the trial duration, the effect of court delay is statistically significant. This suggests that the effect of trial duration on delays in the delivery of works is positive and decreasing. The non-linear effect indicates that, for extremely lengthy trials, the supplier's perception of the law court's inefficiency is less affected by the delay than is the case for trials which have a shorter duration. Indeed, the high level of court inefficiency results in firms waiting a very long time to (partially) recover the penalty; this can make the option of delaying and filing a claim – once the penalty has been enforced – less attractive to the firm.[15] Our estimates suggest that a one standard deviation increase in the trial duration (computed at the average trial duration) is associated with an increase of about 3 percent in the province FE models and 4.8 percent in the *CA* FE models of delays in the completion of works.[16]

Our empirical model also includes the reserve price of the auctions expressed in 100,000s of euros (year 2000 equivalents), which correspond to Π in the model illustrated in Section II and are a proxy for the complexity and/or size of the works involved (see Bajari *et al*., 2009 for a discussion on the role of the reserve price in procurement auctions). We introduce the reserve price either as a single term (Columns 1, 2, 5, and 6), or as a single and a squared term (Columns 3, 4, 7, and 8) in

[15] Discounting could also make *CA* and *F*'s legal costs concave (i.e., R_{CA} and R_F respectively in the model). We thank an anonymous referee for this suggestion.

[16] This percentage is computed as follows: Percentage increase over the mean value $= [(\beta_{Duration} * SD_{Duration} + 2 * \beta_{Duration^2} * SD_{Duration} * MEAN_{Duration})/MEAN_{Delay}] * 100 = [7.417/153.3] * 100 = 4.84$. Note that, based on the results in Column 8 of Table 2, a one standard deviation increase in the trial duration, computed at the 25th (75th) percentile of its distribution, induces an increase relative to the mean value of delays in the completion of works of about 8 percent (2.5 percent).

Table 2. *Main estimation results*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Trial duration	0.00182	0.06142*	0.00161	0.06166**	0.00939	0.08274***	0.00863	0.08655***
	(0.007)	(0.033)	(0.007)	(0.030)	(0.007)	(0.030)	(0.007)	(0.030)
Trial duration^2		−0.00003*		−0.00003**		−0.00003**		−0.00003***
		(0.000)		(0.000)		(0.000)		(0.000)
Reserve price	2.83227***	2.83373***	6.35360***	6.35523***	2.95800***	2.96120***	6.73345***	6.73922***
	(0.299)	(0.299)	(0.410)	(0.410)	(0.269)	(0.269)	(0.318)	(0.318)
Reserve price^2			−0.02779***	−0.02779***			−0.03080***	−0.03082***
			(0.002)	(0.002)			(0.002)	(0.002)
Type of CA FE	×	×	×	×				
Category of works FE	×	×	×	×	×	×	×	×
Awarding procedure FE	×	×	×	×	×	×	×	×
Province FE	×	×	×	×				
CA FE					×	×	×	×
Year FE	×	×	×	×	×	×	×	×
Province-year control	×	×	×	×	×	×	×	×
Observations	40,521	40,521	40,521	40,521	40,521	40,521	40,521	40,521
R^2	0.103	0.103	0.124	0.124	0.369	0.369	0.385	0.386
Mean outcome	153.3	153.3	153.3	153.3	153.3	153.3	153.3	153.3
t-test [b(Trial) + b(Trial)^2 = 0]		3.44*		4.09**		7.40***		8.26***
Effect + SD at mean Trial		4.621		4.591		7.354		7.417

Notes: Ordinary least-squares (OLS) estimates. The dependent variable is the delay in the completion of works (days). Coefficients (standard errors). Standard errors clustered at province (CA) level in Columns 1–4 (5–8). Significance levels: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$. See Online Appendix B for detailed definitions of the variables. Province-year control means that a variable with a province-year dimension has been added (e.g., population of the province). Mean outcome is the mean value of the dependent variable. t-test reports the t-statistics for the sum of the coefficients Trial duration and (Trial duration)^2 different from zero. Effect + SD at mean Trial represents the change in the dependent variable associated with an increase of one standard deviation in the trial duration from the mean value of its distribution.

order to take into account possible non-linear effects. The reserve price turns out to be positively and significantly correlated with the delay in the completion of the works. An increase of one standard deviation in the reserve price (about 1.1 million euros) is associated with an increase of about 20 percent in the average delay in completing the works (or about 1.8 percent if we consider a 100,000 euro increase in the reserve price). When we also introduce the squared term of the reserve price, our results show that the effect on delays is still positive and statistically significant, but its marginal effect is lower when the reserve price is higher. A positive, declining relationship between the complexity of a project and the delays in the delivery of the works can be explained by the supplier's evaluation of the benefit it derives from delaying the works: the execution of more complex projects is more uncertain, so delays caused by unforeseen factors are more likely to arise.

V. Extensions and Robustness Checks

In this section, we investigate the possible mechanics of how inefficient law courts affect performance in public works contracts. We also consider alternative explanations of our findings and perform several robustness checks. In particular, we test whether trial duration interacts with the complexity of the contract and whether it is correlated with the type of company winning the contract, as well as with the proportion of the CA's final payment. We then test whether the relationship between inefficient enforcement by local courts and late delivery of contracted works is compatible with other explanations, such as corruption or the financial constraints of the CA. Finally, we present further robustness checks. For each of these robustness checks, we report the main estimation results in Tables 3 and 4; we also refer to the full set of results that are reported in Online Appendix C.

Contract Complexity and Trial Duration

First, we check whether there are any heterogeneous effects of trial duration for different levels of project complexity. According to our model, if the supplier firm takes advantage of such features, we would expect to see longer delays for more complex projects in provinces where the average trial duration is longer (see Corollary 1(c)). We thus add the interaction term between the reserve price for the contract and the trial duration to our main empirical specification. The estimates in Column 1 of Table 3 (Table C2 in the Online Appendix) show that the greater the complexity of the works involved in a project, the greater the effect of the trial duration on delays.

Winning Firms' Characteristics and Trial Duration

Here we test whether law court inefficiency systematically selects different types of winning supplier firms. Longer trials imply an increase in litigation costs. These litigation costs will be higher for smaller firms than for larger enterprises; the latter typically have their own legal offices, meaning that the burden of legal costs is easier to sustain. We thus expect to see that in provinces where trials last longer, large firms are more likely to bid for contracts than small firms; consequently they have a higher chance of winning those contracts.

Due to data limitations, we focus on proxies for the size of the supplier firm. Specifically, we consider two types of business entities: one-man businesses as a proxy for micro-sized (small) firms, and joint-stock companies (JSCs) as a proxy for large firms.[17] We refer only to these two business entities for two reasons: first, for other types of suppliers the correlation with the supplier's size is less clear; and second, JSCs and one-man businesses had much the same probability of winning a contract in the period observed (according to our dataset, they won about 11.4 and 10.7 percent of the contracts, respectively).[18]

The results of our estimates in Columns 2 and 3 of Table 3 (see also Tables C3 and C4 in the Online Appendix) show that JSCs are more likely to win contracts in provinces where trials in law courts last longer, whereas the effects are not significant for one-man businesses.[19] In particular, JSCs have a 1.5 percent higher predicted probability of winning in provinces in the 75th percentile of the trial duration distribution than they do in provinces in the 25th percentile of the same distribution (in all, about a 15 percent higher probability of winning than the mean).

Final Payments and Trial Duration

We next test whether or not the CA strategically uses the final payment amount as a proportion of the total amount paid to the supplier firm for the execution of the works. In the subsample of contracts for which

[17] A similar strategy is described in Moretti and Valbonesi (2015), which also uses the type of business entity as a proxy for the size of the firms participating in the Italian procurement market.

[18] As for the other types of business entities, we see that limited partnerships (SAS) win about 6 percent of the contracts, general partnerships (SNC) about 9 percent, and limited-liability companies (SRL) about 49 percent. The remaining contracts are won by temporary consortia and cooperative firms.

[19] Note that we cannot fully disentangle whether this result is driven by a change of bidding strategy (holding the set of bidders fixed; see Table C15 in the Online Appendix) or by different types of bidders entering the auctions. This is because we do not have information on the name of each bidder that participates in the auction.

Table 3. *Extensions and alternative explanations*

Dependent variable	(1) Delays	(2) Large firm	(3) Small firm	(4) Final payment (share)	(5) Delays	(6) Delays	(7) Delays
Trial duration	0.05486	0.00090*	−0.00041	0.00005*	0.06328*	0.09907**	0.10390***
	(0.035)	(0.000)	(0.000)	(0.000)	(0.033)	(0.040)	(0.040)
Trial duration^2	−0.00003**	−0.00000*	0.00000	−0.00000*	−0.00002*	−0.00004**	−0.00004**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Reserve price	1.30111*	0.02932***	−0.02864***	−0.00179***	2.83011***	4.01244***	4.01423***
	(0.709)	(0.002)	(0.005)	(0.000)	(0.304)	(0.658)	(0.658)
Reserve price^2		−0.00010***	0.00011***	0.00001***			
		(0.000)	(0.000)	(0.000)			
Reserve price*Trial dur.	0.00175**						
	(0.001)						
Corruption*Trial dur.					−0.00571		
					(0.006)		
(M.Pop.<5k)*(P.2000)						−9.57785	
						(11.614)	
P.2000						−19.10122***	−24.81025***
						(5.507)	(6.234)
P.2000*(M.Pop.)							0.00007
							(0.000)
P.2000*(Pop.)^2							−0.00000
							(0.000)
P.2000*(Pop.)^3							0.00000
							(0.000)
Days from election						0.00111	0.00112
						(0.002)	(0.002)

Table 3. *Continued*

Dependent variable	(1) Delays	(2) Large firm	(3) Small firm	(4) Final payment (share)	(5) Delays	(6) Delays	(7) Delays
Category of works FE	×	×	×	×	×	×	×
Awarding procedure FE	×	×	×	×	×	×	×
Type of CA	×	×	×	×	×		
CA FE						×	×
Province FE	×	×	×	×	×		
Year FE	×	×	×	×	×		
Province-year control	×	×	×	×	×	×	×
Observations	40,521	19,920	19,876	28,175	40,071	22,197	22,197
R^2	0.104			0.070	0.103	0.335	0.335
Mean outcome	153.3	0.108	0.115	0.060	153.5	159.2	159.2
Effect + SD at mean Trial	4.748			0.005	4.630	7.997	8.278

Notes: OLS estimates (Probit estimates in Columns 2 and 3). Coefficients (standard errors). Standard errors are clustered at province (CA) level in Columns 1–5 (Columns 6 and 7). Estimates in Columns 6 and 7 are limited to projects awarded by municipal governments. Significance levels: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$. See Online Appendix B for detailed definitions of the variables. Province-year control means that a variable with a province-year dimension has been added (e.g., population of the province). Mean outcome is the mean value of the dependent variable. Effect + SD at mean Trial represents the change in the dependent variable associated with an increase of one standard deviation in the trial duration from the mean value of its distribution.

we observe this information, we see that this proportion averages around 6 percent of the total value of the contract, with a standard deviation of about 11 percent. According to Italian law on procurement, the final balance is only payable to the supplier firm after the contract has been completed and all necessary tests have been conducted to confirm the proper execution of the works. This final payment should not exceed 10 percent of the total payment. In our setting, CAs can use this final payment as a means to deter firms from delaying the execution of works. Therefore, final payments can act as a "stick" to supplier firms when there is weak enforcement by courts.

The estimates in Column 4 of Table 3 (see also Table C5 in the Online Appendix) show a positive (and statistically significant) correlation between trial duration and the proportion of the final payment for each contract, i.e., CAs tend to make up for weak external enforcement (due to long and costly civil trials) with an instrument of their own (proportionally larger final payments) to deter supplier firms from delaying.

Alternative Explanations for the Late Delivery of Works

We now explore whether other factors, such as corruption or the CA's financial constraints, can explain our empirical findings.

Corruption. One possible concern with our findings is the fact that trial duration is probably correlated with the overall quality of the local socio-institutional environment. In particular, the positive relationship between trial duration and the late delivery of public works could be affected by corruption. In turn, the level of corruption can be correlated with the case load in courts and with the time taken to arrive at a sentence (i.e., to enforce the law).

To test this alternative hypothesis, we include the proxy for corruption in public procurement proposed by Golden and Picci (2005) as a regressor. This indicator is computed at the provincial level for Italy and measures the level of corruption in public works. It is calculated as the difference between the amount actually spent on completing public infrastructure in a given province and the estimated monetary cost of the existing physical infrastructure. Golden and Picci (2005) show that a greater difference between the two coincides with a larger amount of money being wasted due to corruption. Because this indicator does not vary with time,[20] we add it to our model through an interaction with the variable that measures trial duration. The estimates in Column 5 of Table 3 (see also Table C6

[20] Golden and Picci (2005) do not calculate a time-varying variable; however, corruption is likely to move slowly over time.

in the Online Appendix) show that the effect of trial duration on the late delivery of public works changes very little when the corruption indicator is included in the model.

Municipalities: Financial Constraints and Electoral Cycle. Another possible explanation to consider for the late delivery of public works is some sort of exchange between the contracting parties. The CA can approve the supplier firm's delays in the completion of works and waive the penalty (which benefits the supplier firm) in exchange for delayed payments (which benefit the budget-constrained CA). In a recent paper, Grembi *et al*. (2016) analyze the effect of an unexpected relaxation of the municipal authorities' budgetary constraints on the outcome of their policies, and find that it causes higher deficits. We follow Grembi *et al*. (2016) and explore whether the relaxation of the local stability pact for municipalities (i.e., the CAs) with a population of fewer than 5,000 in 2001 has an effect on delays in the delivery of public works.[21] To test this possibility, we focus on a subsample of contracts awarded by municipal authorities.

We use two different proxies for the CA's budget constraints: (a) in Column 6 of Table 3, through the interaction between a dummy variable for municipalities with a population of fewer than 5,000, and a dummy variable representing the treated period (from 2001 onwards, after the stability pact was relaxed); and (b) in Column 7, using a third-order polynomial of the population, which interacts with the post-2000 dummy variable. We include in our model specification both a linear term of the population and a third-order polynomial (as in a standard regression discontinuity design) to capture any potential non-linearity for municipalities of different sizes. Our estimates suggest that these proxies for the CA's budget constraints have no effect on the late completion of public works, while the positive relationship between trial duration and late completion remains statistically significant.

In addition to municipal budget characteristics, there can be political factors in the municipalities that could influence the late delivery of public works. To control for a political budget cycle, we include in our model specification a variable that measures the number of days between the expected end of the works and the next round of elections in the municipality. This variable can be a proxy for the incentives of politicians near the end of the electoral term. Our estimates from Columns 6 and 7

[21] In 1999, to comply with the EU Stability and Growth Pact, the Italian government introduced a cap on the deficit of all municipalities. In 2001, the government relaxed this fiscal rule only for municipalities with a population below 5,000 because it was thought to be too restrictive given the small size of these municipalities. See Grembi *et al*. (2016) for further details.

of Table 3 (see also Table C7 in the Online Appendix) suggest that the coefficient of the timing of municipal elections is not statistically different from zero.

Other Robustness Checks

In this section, we first report four different robustness checks on our main estimated relationship between trial duration and delays in the delivery of public works, and we later inspect the relationship between trial duration and other procurement outcomes.

A primary concern is with the supply and demand for justice. A recent study on litigation in labor courts in France (Fraisse *et al.*, 2015) shows that an increase in the density of lawyers is likely to lead to a reduction in legal fees due to greater competition. This in turn has an influence on the decision to litigate and file a case in court. To allow for this source of heterogeneity, we added a variable indicating the density of lawyers in the population to our model specification.

The estimates reported in Column 1 of Table 4 (Table C8 in the Online Appendix) confirm our main results on the effects of court delay. In Column 2 of Table 4 (Table C9 in the Online Appendix), we repeat these estimates by instrumenting the current trial duration with the seven-year lagged number of judges and staff operating in the courts, and we find that the effects of trial duration on delays in the delivering of public works are positive and statistically significant as our baseline estimates. The rationale behind the use of these instruments is that they are a proxy for the supply of justice; in Italy, variations in the number of judges (and staff) are largely determined by the legal process managing the turnover of judges and staff within courts, and not by either the duration of public works or trial duration.[22] The diagnostic tests for these instruments show that the p-value of the Hansen J-test statistics for instrument validity is always greater than 5 percent, and that the first-stage F-statistics for the relevance of the instruments is greater than 10 in most of the specifications. From these findings, we conclude that the lagged numbers of judges and staff operating in the courts are valid instruments for trial duration.

A further concern is the inclusion of additional project-level controls. So far, we have used the value of the project (reserve price) and the project's main category of work as proxies for the project's complexity. An additional measure of project complexity used in the public procurement

[22] The sign of the two-stage least-squares (2SLS) estimates of the effects of trial duration on procurement outcomes is determined by the intention-to-treat (ITT) ratio. In our data, our instruments have a negative sign on trial duration (ITT1), as well as a negative sign on the delays in the delivery of works (ITT2). ITT estimates are not reported here but are available on request.

literature is the expected (contractual) duration of the works, which is estimated by the CA's engineers. When we include this variable in our model specification, our main results do not change (Column 3 of Table 4; see also Table C10 in the Online Appendix).

We next consider the average trial duration in the province from time T_0 to T_{-2}, where T_0 refers to either the median year between the date of award and the date of expected delivery, or the year of the expected delivery. This is because we have so far measured the trial duration at the beginning of the works and thus assumed that the supplier firm decides whether or not to delay (as well as the duration of the eventual delay) by taking into account the average trial duration in the province observed in the year the contract is awarded. One might argue that the supplier firm does not necessarily decide to delay at the beginning of the execution of the works, but rather it might make the decision at any time over the course of the contract, or indeed just before the date of expected delivery, when the province's average trial duration could differ from that observed at the beginning of the works (especially for longer contracts). One might also argue that the supplier firm does not necessarily have a clear perception of the actual trial duration at any time in a province. In our data, we cannot observe when the supplier begins to slow down the execution of the works, as we do not have information on the intermediate timetables of the projects or on the relative assessment of intermediate goals. This robustness check is a first attempt to take into account this data limitation. Our estimation results show that the trial duration has a positive and decreasing effect on the delay to delivery of the works when we take as the reference year of the trial duration the median date of the expected life of the project (Column 4 of Table 4; see also Table C11 in the Online Appendix) or the date of expected delivery (Column 5 of Table 4; see also Table C12 in the Online Appendix).[23]

Another possible concern arises when we consider the fact that there are provinces with more than one court. In our dataset, 31 of the 83 provinces that we examine have more than one civil court. In such cases, the court in which the trial is to take place is chosen according to the territorial boundaries of the courts within the province. So far, we have considered average trial duration within the province as a measure for the delays of trials. To deal with the possible measurement error generated by considering these averages, we exclude the contracts procured by those municipalities located within provinces containing more than one court

[23] Because we consider two lagged years and we do not have information about the trial duration prior to 2000, projects that were expected to end before 2002 are not included in the sample.

Table 4. *Further robustness checks*

Dependent variable	(1) Delays	(2) Delays	(3) Delays	(4) Delays	(5) Delays	(6) Delays	(7) Win rebate	(8) Cost overrun
Trial duration	0.06166**	0.24629**	0.06132**			0.06339*	−0.00160	0.00017
	(0.030)	(0.108)	(0.030)			(0.032)	(0.002)	(0.000)
Trial duration^2	−0.00003**	−0.00009**	−0.00003**			−0.00003**	0.00000	−0.00000
	(0.000)	(0.000)	(0.000)			(0.000)	(0.000)	(0.000)
Reserve price	6.35548***	6.35552***	6.11610***	6.26588***	6.85128***	6.38673***	0.14985***	0.11618***
	(0.410)	(0.405)	(0.402)	(0.423)	(0.448)	(0.361)	(0.010)	(0.004)
Reserve price^2	−0.02779***	−0.02779***	−0.02676***	−0.02801***	−0.03075***	−0.02828***	−0.00057***	−0.00080***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.000)	(0.000)
Lawyer density	0.00415	0.00424						
	(0.008)	(0.009)						
Expected duration			0.01922					
			(0.013)					
(Av. lags)Trial duration				0.15501***	0.17828***			
				(0.052)	(0.055)			
(Av. lags)Trial duration^2				−0.00008***	−0.00009***			
				(0.000)	(0.000)			

Table 4. *Continued*

Dependent variable	(1) Delays	(2) Delays	(3) Delays	(4) Delays	(5) Delays	(6) Delays	(7) Win rebate	(8) Cost overrun
Category of works FE	×	×	×	×	×	×	×	×
Awarding procedure FE	×	×	×	×	×	×	×	×
Type of CA	×	×	×	×	×	×	×	×
Province FE	×	×	×	×	×	×	×	×
Year FE	×	×	×	×	×	×	×	×
Province-year control	×	×	×	×	×	×	×	×
Observations	40,521	40,521	40,521	33,053	35,088	30,128	40,521	27,299
R^2	0.124	0.100	0.124	0.124	0.128	0.127	0.490	0.360
Mean outcome	153.3	153.3	153.3	149.4	154.1	149.0	14.90	0.468
Effect + SD at mean Trial	4.593	26.55	4.570	6.162	6.511	3.441	−0.296	0.022
Hansen J (p-value)		0.148						
Cragg–Donald Wald F-statistic		385.91						

Notes: OLS estimates (two-stage least-squares in Column 2). Coefficients (standard errors). Standard errors are clustered at province level. Significance levels: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$. In Column 2, Trial duration (and its squared values) is instrumented with the seven-year lagged values of the number of judges and staff (and their squared values) in the courts operating within the jurisdiction of the court of appeal. See Online Appendix B for detailed definitions of the variables. Province-year control means that a variable with a province-year dimension has been added (e.g., population of the province). Mean outcome is the mean value of the dependent variable. Effect + SD at mean Trial represents the change in the dependent variable associated with an increase of one standard deviation in the trial duration from the mean value of its distribution. The table reports the Sargan–Hansen test of overidentifying restrictions, and the Cragg–Donald Wald F-statistic (for two endogenous variables) denoting the minimum eigenvalue of the joint first-stage F-statistic matrix.

from our sample. Column 6 of Table 4 (see also Table C13 in the Online Appendix) confirms our main findings.[24]

To understand the broader impact of trial duration, we next inspect its relationship with procurement outcomes that might represent extra procurement costs. First, we look at whether or not firms submit higher rebates (to increase their probability of winning the contract) when the trial duration is longer, given that (where the court is inefficient) they could delay the execution of work and recover their profits. The evidence reported in Column 7 of Table 4 (see also Table C14 in the Online Appendix) shows that there is a statistically non-significant relationship between the trial duration and the winning bid.[25] Second, we explore the relationship between trial duration and cost overrun (i.e., extra costs accumulated during the execution of the works). Note that although, on average, time and cost overrun are positively associated (Table C17 in the Online Appendix), estimation results in Column 8 of Table 4 (see also Table C16 in the Online Appendix) indicate that trial duration does not have a statistically significant effect on cost overrun.

In Online Appendix D, we provide several additional robustness checks for the model specification, estimation method, and alternative regression outcomes.

VI. Conclusion

Contracts are an effective deterrent of opportunistic behavior only insofar as they are credibly and effectively enforced. In this paper, we investigated theoretically and empirically how the quality of enforcement of contractual obligations by local courts affects suppliers' performance in public procurement contracts in Italy, where considerable variation can be found in both variables under the same legislation. Following Djankov *et al.*

[24] Another possible confounding factor of our estimates is that during our period of analysis, arbitrations (i.e., alternative dispute resolutions) were allowed by law. The presence of arbitrators can generate a bias in our results. However, according to the AVCP Annual Reports (available at http://www.avcp.it), only a few cases were resolved through arbitrations. Moreover, the presence of an alternative dispute resolution mechanism should reduce the importance of the role played by regular courts. If this is the case, then our estimates can represent a lower bound of the real effect of court delays. This is because parties could use arbitrators prior to going to court, thereby reducing the importance of the role played by courts.

[25] To better understand this zero effect, we have also inspected the relationship between trial duration and the number of bidders. As a first approximation, this relationship would tell us whether or not there are differences between the bidders. The evidence from Table C15 in the Online Appendix suggests that the set of bidders is somewhat constant, as we find no effect on the number of bidders. However, a lack of data on the exact identity of each of the bidders means that our estimates are not informative of whether or not trial duration changes bidding strategies or selective entry in auctions.

(2003) and Jappelli *et al*. (2005), among others, we use a measure of the average trial duration as a proxy for the inefficiency of enforcement by local law courts. Using data on the late delivery of contracted works obtained from a large public procurement database, we investigated such contract breaches, relating them to the competence of the local court.

To guide the empirical analysis, we built a stylized model of how the contract enforcement phase affects suppliers' strategic delay in executing a public procurement work. As we discussed, the effects of trial duration on procurement outcomes can be ambiguous depending on the specific features of the institutional environment, such as who the plaintiff is and who the defendant is, and how the legal costs are distributed. In our model the sequence of play and other assumptions closely follow the institutional setting we investigated empirically, which leads us to precise predictions relevant to our data.

The empirical analysis suggests that, as predicted by our model, public works are delivered with longer delays in provinces where the local courts are less efficient, and that the marginal effect decreases when delays become very long. The effect of court inefficiency on delays to public contracts is greater for higher-value contracts (i.e., more complex projects), which is also consistent with the model's implications, as it suggests that the greater information advantage typical of suppliers managing larger-scale works allows them to behave more opportunistically when court delays are larger.

We also find that, where local courts are inefficient, public procurement contracts are more commonly awarded to large firms. An explanation for this finding, consistent with our simple theoretical model, could be that these firms have their own legal offices and thus incur lower (marginal) costs than smaller suppliers when they face litigation in court. Moreover, where courts are less efficient, we find that buyers offer proportionally larger final payments, most likely as a "stick" to reduce the benefit that the supplier can gain from strategically delaying the delivery of the works.

Taken together, our results suggest that court efficiency does have an effect on procurement performance. These contract enforcement institutions are crucial not only for financial contractors and for the performance of the private sector, but also to ensure the quality of provision of basic public goods.

Supporting Information

The following supporting information can be found in the online version of this article at the publisher's web site.

Online Appendix

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