Publicity Requirements in Public Procurement: Evidence from a Regression Discontinuity Design*

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Abstract

We document whether and how publicizing a public procurement auction causally affects entry and the costs of procurement. We run a regression discontinuity design analysis on a large database of Italian procurement auctions. Auctions with a value above the threshold must be publicized in the Regional Official Gazette and two Provincial newspapers. We find that the increased publicity requirement induces more entry and higher winning rebates, which reduces the costs of procurement and rationalizes public spending. The evidence suggests that the number of bidders is the channel through which publicity affects rebates. Increased publicity also selects different winners: it increases the likelihood that the winner hails from outside the region of the public administration and that the winner is a large company. Such companies tend to win repeated auctions gaining market share. Publicity seems to have no adverse effect on the *ex-post* renegotiations of the works, as measured by the percent of works delivered with delay or that are subcontracted. Estimates are robust to alternative measures of publicity, alternative model specifications, different sample selections, to a falsification analysis at simulated thresholds and to the possibility that firms learn about auctions from a web-based for-profit information provider.

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1 Introduction

Policy makers believe that public procurement auctions need to be publicized more. Regulators, both at the national and at the supranational level, have therefore moved to mandate publicity. These regulations typically take the form of enhanced publicity requirements for auctions exceeding a certain value threshold. The EU mandates such advertising requirements, as does the US Federal Government.[1] Lack of publicity is seen as a sign of limited competition, insufficient transparency, and possibly of corruption.[2]

Despite this widespread regulatory intervention, there is, to date, no empirical evidence showing that publicity increases bidder participation, nor that increased participation lowers procurement costs. In fact, the academic literature seemingly casts doubt on the first channel: surprisingly, lowering entry costs (i.e., enlarging potential competition) for bidders is predicted to decrease entry. The data utilized in the literature (e.g., Li and Zheng, 2009; Marmer et al., 2013; Roberts and Sweeting, 2011), it should be stressed, do not feature exogenous variation in potential competition and entry costs, and so their predictions are out-of-sample counterfactuals coming from a structural model.[3]

This paper attempts to provide direct evidence about whether, and how, publicity affects entry and the costs of public procurement, in the context of Italian procurement auctions. This paper identifies the effect of increased publicity, a proxy for the increase in the number of (potential) entrants that are more likely to be informed about upcoming auctions, from a discontinuity in publicity requirements. Auctions with a value (reserve price) that exceeds 500,000 euros, are required by law to be publicized more broadly in the Regional Official Gazette and in two provincial newspapers, while those below the threshold may be publicized only on the notice board in the premises of the public administration. By carefully comparing outcomes in auctions around this

[1] Directive 1159/2000 European Commission. In the U.S., the Federal Acquisition Regulation (5.101) mandates all procurement agencies to publicize the procurement contracts with a value exceeding $25,000 on the Commerce Business Daily, while those with a value below the threshold need only be publicized in a public place, or on any appropriate electronic mean.

[2] The WTO and the OECD recently published two documents describing how publicity increases transparency and accountability, and prevents corruption in procurement. Bandiera et al. (2009) and Ferraz and Finan (2011) document the incidence of corruption on public spending analyzing public procurement data for Italy and Brazil, respectively.

[3] Despite the fact that Li and Zheng (2009) and Marmer et al. (2013) use the same data set, the two papers disagree on whether the costs of procurements are reduced with a reduction of entry costs. Roberts and Sweeting (2011) find the same effect as Marmer et al. (2013), using data on USFS timer auctions. The discrepancy is due to different modelling assumptions.

threshold, we are able to directly identify the causal effect of publicity on entry and the costs of procurement.

Our main finding is that an increase in publicity increases the number of bidders participating in the auctions by 9.3%, and increases the winning rebate by 7%. A back-of- the-envelope calculation suggests that a hypothetical public work with a value of 500,000 euros costs the government about 35,000 euros more if it is publicized at the local level compared to the regional level.[4] This finding seems to lend support to the regulator's view that procurement entities need to be forced to advertise.

The auction mechanism we study is somewhat unconventional. It has some "beauty contest" features whereby the highest bidder does not necessarily win.[5] This mechanism is used in procurement auctions around the world. Decarolis (2011) shows that the specific features of this mechanism raise the theoretical possibility that increased participation in the auction need not result in greater competition. If so, then an increase in publicity need not have any effect on the cost of procurement. However, Conley and Decarolis (2012) show theoretically that in such an auction, increased participation may indeed result in more aggressive bidding.[6] Their theoretical result is consistent with Figure 2 in this paper, which documents a positive and significant relationship between the number of bidders and the rebates submitted by these bidders (i.e., their bidding strategies).[7] Taken together, the theory and the evidence suggest that, despite the fact that the auction mechanism is unconventional, greater participation is good for the auctioneer just as in a conventional auction.[8]

Our empirical results are obtained relying on two building blocks. First, we rule out the possibility of perfect manipulation of an auction's value (reserve price) around the discontinuity threshold, using graphical and statistical tests discussed by McCrary (2008) and Lee (2008). This procedure supports the assumption that the publicity requirements (the treatment) are quasi-experimentally assigned across auctions. Second, the institutional setting is such that no another policy (i.e., a change in the adjudication mechanism) changes around the threshold. If there was

[4]Net of the costs of publicity.

[5]See Section 2 for institutional details.

[6]In their Proposition 3 this outcome is the result of competition among cartels and independent bidders.

[7]We find a similar positive and significant relationship between the number of bidders and the winning rebate (the maximum rebate) in a (small) sub-sample of first-price auctions managed by the municipality and county of Turin from the 2003, which we analyze in Section 6.3.

[8]This is in line with the experimental study of Chang et al. (2013), which shows that this auctions mechanism is a) quite successful at preventing bidder losses; b) the price premium is lower than the theory predicts.

such a change it would confound the estimates of the causal effect of publicity.

Our findings suggest that local procurement authorities do in fact underinvest in publicity limiting the pool of (potential) participants by rising search (entry) costs. This underinvestment may reflect collusive relationships between the auctioneer and some favored bidders, reducing entry and winning rebates, and increasing the costs of procurement.[9] Such collusion has been found in other aspects of Italian procurement auctions (Coviello and Gagliarducci, 2012). Our paper is the first, to our knowledge, to provide empirical support for mandatory publicity as a regulatory tool to increase transparency.

The paper proceeds as follows. In Sections 2 and 3 we present the institutional framework and the data. In Sections 4 and 5 we illustrate the regression discontinuity design analysis and present the evidence.

In Sections 6 we discuss extensions. We look at a variety of auctions' outcomes (i.e., the distribution of the rebates, the identity of the winning firms, the delays in the delivery of the works and the probability that works are subcontracted), and repeat our RDD analysis in a small sub-sample of first-price auctions. Consistent with publicity requirements being important, we find that an increase in the level of publicity shifts the distribution of the bids toward higher rebates. It increases the minimum rebate, the anomaly threshold and the maximum rebate by 8%, 7%, and 7%, respectively. Publicity also increases the number of excluded rebates above the anomaly threshold by 10%.[10] When we look at the effects of publicity on the type of the winner, we find that publicity also increases the probability that the contract is awarded to a firm that hails from outside the region of the public administration by 12%, to a small firm by -9.3% and to the same firm repeatedly by 12.6%. Increased publicity has no effect one *ex-post* renegotiations of the procurement contract, since it has no effects on the probability that works are delivered after the contractual deadline and that are subcontracted. Thus enlarging the pool of potential entrants does not seem to generate any relevant trade-off between price and *ex-post* renegotiations for these public works. Publicity also increases the number of bidders and the winning rebate in a small sub-sample of first-price auctions managed by the municipality and county of Turin.

In Section 7 we assess the robustness of the results. In Section 7.1 we: redefine the treatment

[9] In our data, one standard deviation increase in corruption is associated with a 7.3 % increase in the probability that the call for tender is not published. We measure corruption at provincial level using the Golden Picci (2005) Index. This index measures the differences between the expenses in public infrastructures and the availability of infrastructures. This correlation is not reported but available on request.

[10] The auction mechanism is explained in Section 2.

variable; experiment with different model specifications; select different samples (bandwidths) around the threshold as in Imbens and Kalyanaraman (2011) and include to the baseline model a large number of characteristics of the works and the public administration managing the auction. Estimates are robust and confirm the effects of publicity. In Section 7.2 we show that our results are not driven by random chance or by other thresholds; we find no effects of publicity when we repeat the (falsification) analysis considering four simulated thresholds above and below the true publicity threshold.

In Section 8 we inspect the mechanism of the effects of publicity. Specifically, we test whether or not publicly provided publicity (official publicity) might not matter when privately provided publicity (unofficial publicity) is available on-line and not particularly expensive. We empirically test this possibility by showing that publicly provided publicity causes a substantial increase in privately provided publicity. In addition, we find that there is possibly another channel. We find that after controlling for privately provided publicity, publicly provided publicity significantly increases winning rebates. This evidence, however, is not conclusive since we only control for unofficial publicity provided by one information provider.

In Section 9 we conclude that publicizing the procurement notice increases the overall level of competition reducing the costs of procurement. Publicity also selects different winners, and does not affect the *ex-post* renegotiations of the works.

Related Literature. This paper contributes to two strands of the literature regarding empirical auctions. First, it contributes to the literature that studies the effects of entry costs on entry in auctions (Li and Zheng 2009; Marmer et al. 2013; Roberts and Sweeting 2011). We think of publicity as reducing the search costs to be informed about upcoming auctions (i.e., entry costs) and enlarging the pool of potential participants. We find that exogenously publicizing the procurement notice increases entry and increases the winning rebate, which stands in contrast to the evidence of Li ad Zheng (2009). However, as in Marmer et al. (2013) and Roberts and Sweeting (2011), we find that publicity increases the winning rebate and *selects* winners.

Second, this paper contributes to the literature that looks at the effects of the provision of information by private information providers that collect and sell announcements about forthcoming auctions. Leslie and Zoido (2011) find evidence that the establishment of a for-profit information provider leads to a 2.9% reduction in the price of drug procurement for public hospitals in Buenos Aires, Argentina. However, this paper does not consider the role of government publicity. We

analyze the effects of the two different sources of publicity and find that both are important.

2 Institutional Framework

The applicable procurement law, during our sample period, requires auctions to be sealed-bid and single-attribute (i.e., technical and quality components of the offers are not evaluated).[11] We consider a sample of procurement auctions where participation is open.[12]

The firms participating in the auction bid the price at which they are willing to undertake the project. They submit a percentage reduction (a rebate) with respect to the auction's starting value (the reserve price). The reduction from the original reserve price is the final price paid by the public administration, the cost of procurement. An engineer employed by the municipal administration estimates the value of the project and sets the reserve price, according to a menu of standardized costs for each type of work.

The winner of the auction is determined by a mathematical algorithm illustrated in Figure 1.[13] After a preliminary trimming of the top/bottom 10% of the collected bids, the bids that exceed the average by more than the average deviation (called the "anomaly threshold") are also excluded. The winning rebate is the highest of the non-excluded rebates below the anomaly threshold.[14] This

[11] During the period covered by our 2000-2005 sample, Italian public administrations have to follow *"Legge Merloni"*: *Legge 109/94* and amendments (*"Merloni-bis"* in 1995, *"Merloni-ter"* in 1998, and *"Merloni-quater"* in 2002). Major legislative changes were introduced in 2006, but do not affect our sample. This changes are used in Decarolis (2011) to identify the effects auctions outcomes.

[12] *Pubblico incanto*, and *licitazione privata* are the two auctions formats that by law allow open participation. They are similar except that in the latter, the contracting authority allows all firms satisfying some technical requirements to bid. Call for tenders specify the technical and financial requirements that bidders must satisfy to take part in the auction. Requirements are determined by the law and are mainly based on firms' turnover and do not vary discontinuously with the publicity threshold. For example, if the construction of a road is put out to tender and the contracting authority estimates that the amount of work that has to be done is valued at 600,000 euros, the required category will be 3-OG3, where 3 refers to the size of the works and OG3 to the category "road constructions". Firms certified for 3-OG3 projects are allowed to bid for projects with a reserve price of at most 650,000 euros. In Italy, auctions with an invitation to a limited amount of bidders (i.e., restricted auctions) have to be used for urgent small works. We discard from our analysis the *trattativa privata*, where the contracting authority only *invites* a restricted number of firms, with a minimum of 15, and other restricted auction formats like the *licitazione privata semplificata* and the *appalto concorso*.

[13] This mechanism is not used in two sets of procurement auctions: First, auctions with a reserve price above the European Community threshold that are administrated under the European Community common law, *"Merloni-quater"* in 2002. Second, the municipality of Turin managed to change the procurement law and from 2003 introduced first-price auctions. We discard EU auctions from the data and also consider the results when do not include Turin in the sample.

[14] As for illustration, consider this simple example. In a hypothetical auction, after the trimming of the tails there are three participants placing the following bids (in the form of a rebate over the starting value): 10, 14 and 16. The average bid is thus 13.33. The average difference of the bids above this average bid is 1.12. Thus the "anomaly threshold" is 14.44. It turns out that in this case the winning bid is 14, which is above the average, even if 16% is the highest bidden rebate.

adjudication mechanism is somewhat unconventional. Decarolis (2011) shows that the specific features of this mechanism raise the theoretical possibility that increased participation in the auction need not result in greater competition. If so, then an increase in publicity need not have any effect on the cost of procurement. In Section 6.3, we repeat our RDD analysis in a small subsample of first-price auctions managed by the municipality and the county of Turin after January 2003.

Contractual conditions (e.g., deadlines and possibility of subcontracts) are described in the call for tender. Some terms of the contract (the time of delivery and the cost of the project) might be partially renegotiated in cases of unforeseen or extreme meteorological events.[15] Subcontracting part of the works is permitted by law, but requires the approval of the public administration. We consider whether works are delivered with delay or executed by sub-contractors as measures of the *ex-post* renegotiations of the contract.

The procurement law specifies the requirements on how to publicize the procurement notice. Auctions with a starting value below 500 thousand euros have to be posted on the notice board in the premises of the public administration.[16] Auctions with a starting value between 500 thousand and one million euros have to be published at the regional level, in both the Regional Official Gazette (*BUR*) and at least two newspapers from the province where the public administration is based. Publishing in the BUR costs an average of 200-500 euros, while publishing in Provincial newspapers is proportional to the number of printed copies in each of the 110 Italian provinces and costs around 400 euros. In Table 1 we summarize the publicity requirements, the target population by different publicity requirement, and the costs of publication. Column 3 shows that an increase in publicity requirements from local to regional levels increases the potential readers from 13,000 residents of an average municipality to 3,031,322 residents of an average region.

3 Data and Descriptive Statistics

We analyze a unique database collected by the Italian Authority for the Surveillance of Public Procurement *(A.V.C.P)*. We have access to all the public works with starting values greater or equal to 150,000 euros auctioned in Italy between the years 2000-2005. For each auction, we observe

[15] Floods, storms, earthquakes, landslides, and mistakes of the engineer are the reasons for renegotiations prescribed by the Italian Civil Code.

[16] Procurement entities in Italy are Municipalities, Provincial Administrations, Regions, Hospitals, Mountain Communities, Universities and other public administrations.

the number of bidding firms, the winning rebate, the minimum rebate, the anomaly threshold, the maximum rebate, the number of excluded bidders with a rebate above the anomaly threshold, the starting value, the identity of the winning bidder, the type of the project, the observed level of publicity, the identity of the managers, the date of delivery of the bid, and the type and location of the public administration managing the auction. For a subsample of auctions, we also observe whether the works are executed with interruptions and realized by subcontractors.

3.1 Descriptive Statistics

In Table 2 we present summary statistics for the original sample of auctions. Our original database amounts to 31,610 auctions with open participation. The average number of bidders per auction is 36.1, and the mean winning rebate is 16.3%. The minimum rebate is 8.25%, while the maximum is 20%. The average anomaly threshold is 16.7 % and 9 bids that are above the anomaly threshold are excluded. The winner of the auction is registered outside the region of the public administration about 37.1% of the time.[17] In our sample, 44.4% of the winners are small companies (limited liability contractors), and, on average, the highest fraction of auctions won by the same firm in a year is 34%. 51% of the works are delivered with delay and 60% are completed by a subcontractor.

Most of the calls for tender (92%) are published on the notice board of the public administration, 25% in the Regional Official Gazette, about 18% in the National Official Gazette, and 2% in the European Official Gazette. The advertisement of the tender appeared in an average of 0.24 Provincial newspapers, 0.42 regional newspapers, and 0.61 national newspapers. The average starting value for a public work is 680,000 euros.[18] Column 4 of Table 1 reports the compliance rate to the publicity requirements of an average contract. 50% of the contracts are not respecting one of the regional requirements, suggesting that local procurement authorities underinvest in publicity non complying with the procurement law. In our data, one standard deviation increase in local corruption is associated with a 7.3 % increase in the probability that the call for tender is not published while the law prescribing it must be.[19]

The majority of the public works concern the construction of roads (31%), schools and educa-

[17] This is the case in the subsample of auctions for which we can reconstruct the information on the origin of the winners

[18] Monetary values in 2000 equivalents, using the OECD CPI index.

[19] We measure corruption using the Golden Picci (2005) Index. This index measures the differences between the expenses in public infrastructures and the availability of infrastructures. This correlation is not reported but available on request.

tional buildings (11%), art-related construction (7%), Hospitals (7%), Trains and Airports (1.5%). In 28% of the auctions the required category is either Buildings (i.e., OG1), or Roads and Others (i.e., OG3). The public administrations managing the auctions are mostly municipalities (53% of the sample), health-care public bodies (ASL), and other public bodies or corporations. Public administrations are mostly located in the northern Italy (47%), while 20% are in central Italy and 24% are in the southern Italy, and 6% in the Islands.[20]

In the empirical analysis we focus on a subsample of 17,512 auctions with a starting value between 200,000 and 800,000 euros.[21] We do this for three reasons. First, Table 2 shows that the distribution of the starting value is very right skewed: 80% of the auctions have a starting value below 800,000 euros. Second, we rule out the possible confounding factors generated by the introduction in 2002 of first-price auctions for large works.[22] Third, we avoid the problem of comparing auctions which are close to the minimum level registered by the Italian Authority for the Surveillance of Public Procurement.[23]

4 Regression Discontinuity Design Analysis

Our evidence supports the idea that local procurement authorities do underinvest in publicity. This underinvestment may reflect collusive relationships between the auctioneer and some favoured bidders, which is likely to reduce entry and winning rebates rising the costs of procurement. Such collusion has been found in other aspects of Italian procurement auctions (Coviello and Gagliarducci, 2012) and represents a confounding factor that biases OLS estimate of the effect of publicity on entry and the winning rebate. In this section, we implement a Regression Discontinuity Design (RDD) analysis to estimate the causal effect of publicity.

In Section 2 we discussed that auctions with a starting value (i.e., reserve price) exceeding the 500,000 Euros threshold are required, by law, to be publicized on the Regional Official Gazette and two Provincial newspapers. However, auctions with starting values below the 500,000 Euros threshold are only required to be publicized on notice boards of public administrations. This unique feature of the procurement law allows us to estimate the effect of publicity on procurement

[20]For 8% of the sample we have missing information on the geographical location of the public administrations.

[21]The descriptive statistics in the subsample are similar to the full sample. In the estimation tables we report sample averages of the variables of interest.

[22]See Section 2

[23]The Italian Authority for the Surveillance of Public Procurement collects data on auctions with value above 150,000 euros.

using the RDD methodology (Hahn et al. 2001; Imbens and Lemieux, 2008; Lee and Lemieux, 2010).

The central assumptions of RDD are:

1. The enforcing variable (actions starting value in this case) is continuously distributed around the threshold.

2. The probability of being treated (publicized in this case) changes discontinuously at the threshold.

3. In the absence of treatment, the expected outcome (number of bidders and winning bid) changes continuously around the threshold *(continuity assumption)*.

Hahn et al. (2001) show that, depending on additional assumptions, RDD nonparametrically identifies several type of expected treatment effects. Specifically, under the assumptions that (1) for each observation, treatment assignment is some monotone deterministic function of the enforcing variable (the function can be different for different observations); (2) the enforcing variable crossing the discontinuity threshold cannot impact outcomes except through impacting the treatment (i.e., valid exclusion restriction, see Lee and Lemieux, 2010); (3) the random effect of treatment and treatment assignment function are jointly independent of the enforcing variable around the threshold then RDD nonparametrically identifies the local average treatment effect for compliers (LATE) at the threshold.[24]

In this paper we denote with P_i the publicity variable. Specifically, $P_i = 1$ if the auction is publicized on the Regional Official Gazette and two Provincial newspapers, $P_i = 0$ otherwise. Let Y_i be the auction starting value, y_0 be the threshold value, and C_i denote one of the auction outcomes. Then, the LATE of publicity for auctions at the threshold is identified by

$$\lim_{e \downarrow 0} \frac{E(C_i|Y_i = y_0 + e) - E(C_i|Y_i = y_0 - e)}{E(P_i|Y_i = y_0 + e) - E(P_i|Y_i = y_0 - e)}. \tag{1}$$

When the denominator in (1) is exactly one (perfect compliance), the design is said to be *sharp*. If it is less than one, the design is said to be *fuzzy*. In this paper, we have a case of *fuzzy*-RDD as compliance to the publicity law is imperfect (see Section 3.1).

[24]These assumptions allow for endogenous selection into treatment based on anticipated gains from treatment (i.e., non-compliance). At the same time, in view of the *continuity assumption*, the populations on different sides of the threshold (near the threshold) must be identical except for the likelihood of being treated.

Numerator and denominator of equation (1) are usually called the *intention-to-treat* (ITT) effects. As discussed in Lee and Lemieux (2010) they are (1) derived without relying on a valid exclusion restriction; (2) are informative of the average treatment effect (ATE) of being assigned to a higher level of publicity $Z_i = \mathbf{1}\{(Y_i - y_0) \geq 0\}$ on the publicity P_i and on the auctions outcomes C_i. Under the *continuity assumption* of the starting value around the threshold (and of the unobservables), the ITT are unbiased estimates of the average treatment effect (ATE) of publicity requirements on auction outcomes.

4.1 Implementation of the RDD with Regressions

Hahn et al. (2001) recommend to use nonparametric (kernel) local linear regressions when estimating the conditional expectations in (1). However, it is also a common practice to use for estimation parametric linear models augmented with a flexible control function in $g(Y_i - y_0)$ that is typically approximated by a polynomial. The later approach consists in estimating traditional IV-LATE regression model where endogenous variable P_i is instrumented by $Z_i = \mathbf{1}\{(Y_i - y_0) \geq 0\}$, and the first and second stages include the same continuous control functions in $g(Y_i - y_0)$.[25] Van der Klaauw (2002) shows that the parametric approach allows using all the data in the discontinuity sample and absorbing variations coming from auctions that are not close to the publicity threshold using the flexible controls for the starting value, $g(Y_i - y_0)$.

We start presenting parametric linear models augmented with a flexible control function in $g(Y_i - y_0)$ used in Angrist and Lavy (1999) and recently surveyed in Lee and Lemieux (2010).[26] We IV-LATE estimate equation (2) with the method of the two stages least squares.

$$C_i = g(Y_i - y_0) + \beta P_i + \eta X_i + \omega_i. \tag{2}$$

In the first-stage, equation (3), we consider $Z_i = \mathbf{1}\{(Y_i - y_0) \geq 0\}$ as the excluded instrument for P_i

$$P_i = g(Y_i - y) + \gamma Z_i + \eta X_i + \nu_i. \tag{3}$$

[25] See Angrist and Lavy (1999), Lee and Lemieux (2010), and Van der Klaauw (2002).

[26] In Section 7.1 and in the Appendix, we repeat our analysis reporting nonparametric *fuzzy*-RDD estimates based on local linear kernel regressions

Where, $g(Y_i - y_0)$ is approximated with a fourth-order polynomial in $(Y_i - y_0)$, and X_i includes a set of five year dummies.[27,28]

Throughout the paper, we also report OLS estimates of equation (2) considering $P_i = Z_i = \mathbf{1}\{(Y_i - y_0) \geq 0\}$. These estimates are OLS estimates of the *intention-to-treat* effects, which we denote OLS-ITT. Because of the non-compliance with the procurement law, we expect these OLS-ITT to be diluted estimates and representing a lower bound of the true treatment effect (see Angrist, 2005).

5 Empirical Evidence

5.1 Testing for the RDD assumptions

In this section we report graphical evidence on the validity of the *continuity assumption* required by the RDD. We follow Lee (2008) and investigate the behavior of the pre-intervention variables around the threshold. We define our set of pre-intervention variables from the detailed information available in our data. These variables, in principle, should meet the following two conditions: they should not be affected by the publicity law, but they may depend on the same unobservables (e.g., efficiency/corruption of the public administrations with participants) that are likely to affect the auction's outcomes.

In Figure 3 we plot the six pre-intervention variables on $y_i = (Y_i - y_0)$. These estimates are obtained by separate locally-weighted smoothing regressions on the left and right of the cut-off points.[29]

First, in the top-left panel we plot whether or not the public works are schools and educational buildings (i.e., schools, museums, etc.); second in the top-centre we plot the age of the manager

[27] To select the order of the polynomial in $(Y_i - y_0)$ that well approximates $g(Y_i - y_0)$, we implement the Lee and Lemieux (2010, pg. 326) specifications tests. This test is implemented adding a fixed set of bin dummies for the size of the projects to each of the estimated models. The number of the bin dummies is selected to exactly match the number of bins used in the graphical analysis (see next section). For each of the regressions, we jointly test the significance of the bin dummies and report the *p-value* of the tests.The procedure suggests selecting the higher order term of the polynomial approximation of $g(Y_i - y_0)$ until the bin dummies are no longer jointly statistically significant.

[28] In Section 7.1, we present results obtained including different controls in X_i and excluding time effects.

[29] Circles represent sample averages of the dependent variable computed on 20,000 euros brackets of the running variable. The solid line (dashed line) [dotted line] is a least squares running-mean smoothing [local linear regression prediction], separated on either side of the threshold computed on the sample of all auctions with starting value $y \in [2, 8]$ ($[y \in [2.66, 7.34]$, determined using the Imbens and Kalyanaraman, 2011 optimal bandwidth criterion]), in 100,000 euros (2000 equivalents). For presentational reasons, the figure plots averages of the dependent variable with running variable $y \in [4, 6]$. The red vertical line denotes the discontinuity, normalized to zero.

in charge of the auction; third in the top-right we plot the gender of the manager in charge of the auction; fourth, in the bottom-left we plot whether the contracting authority is the municipality; fifth in the bottom-centre we plot whether the public administration is located in the South of Italy and sixth the population of the city of the public administration on $y_i = (Y_i - y_0)$. These variables are likely to be determined before the definition of the publicity levels and before the auction takes place, and hence they can be used as pre-intervention variables. The graphical test for the continuity assumption would suggest a discontinuity if the plots of these indicators against $y_i = (Y_i - y_0)$ showed a jump at the cut-off points. Identification would not be possible in those cases, since auctions assigned to a high theoretical level of publicity $Z_i = 1$ would not be comparable to auctions assigned to a low level of publicity $Z_i = 0$.

Figure 3 shows that 5 of our 6 pre-intervention variables display no significant jumps around the 500,000 threshold. We find, instead, some differences between small and large municipalities: large municipalities are more likely to have small works. This might be in part due to the nature of public works in larger municipalities or to strategic sorting around the threshold. The latter might imply a violation of the continuity assumption (iii) discussed in Section 4.1 and that the underlying identifying assumption of no precise manipulation of the starting value of the auctions is unwarranted (see Lee and Lemieux, 2010). In Section 7.1 we investigate this possible source of bias of our RDD estimates. Specifically, we: a) parametrically test whether or not this jump is statistically different from zero; b) assess the impact of including this covariate on our main estimates.

We further inspect the validity of the continuity assumption looking at the distribution of the starting value around the threshold implementing the McCrary (2008) test. Figure 4 shows that the overall distribution of the auctions' starting value is right skewed and has no significant mass probability around the threshold.[30] Figure 5 implements the graphical version of the McCrary (2008) density test in the subsample of auctions around the discontinuity threshold.[31] Figure 5 suggests that there are no graphical differences (jump) between the two separate estimates of the

[30] Figure A.1, in the Appendix, reports the overall distribution of the auctions' starting value split by Center-South and Northern super-regions. The Figure shows no significant mass probability around the threshold.

[31] This test is constructed in two steps. First, we obtain a very under-smoothed histogram of the starting value's distribution, where the bins of the histogram are defined so that no one histogram bin includes both points to the left and right of the discontinuity point. Second, we run a local linear smoothing of the histogram, where we treat the midpoints of the histogram bins as a regressor, and the normalized counts of the number of observations of the bins are the outcome variable.

density around the threshold.[32] In Panels A and B of Table 3, we report a parametric version of the McCrary (2008) test and statistically test the difference between the two densities around the threshold. The numbers are the point estimates (and standard errors) computed for the discontinuity sample (Panel A), a smaller subsample (Panel B), for each year (columns 1-6), and for each typology of good (rows 1-3). We find no statistical evidence of jumps in the density around the threshold.

This evidence shows that the RDD assumptions are satisfied and that there is no perfect manipulation of the value of the auction (the reserve price that determines exposure to treatment) around the discontinuity. We conclude therefore, that theoretical publicity is quasi-experimentally assigned around the threshold.

5.2 Discontinuity Effects of Publicity on Entry and the Winning Rebate: Graphical Analysis

In this section we repeat the graphical analysis to document the discontinuity effects of publicity on entry and the winning rebate. In Figures 6 and 7, we plot (circles) sample averages of the dependent variable computed on 20,000 euros brackets of the running variable and three non-parametric estimates of the main variables of interest. These estimates are obtained using a separate locally-weighted smoothing regression (continuous lines), local linear regressions (dotted lines) on the left and right of the cut-off points for the discontinuity sample (and for an optional bandwidth determined following Imbens and Kalyanaraman, 2012).[33] Jumps in the plots show the effect of the threshold on the variables of interest, offering a graphical interpretation of the ITTs as defined by equations the numerator and the denominator of (1).

In Figure 6, the box on the left plots the number of bidders on $y_i = (Y_i - y_0)$, while the box on the right pilots the winning rebate on $y_i = (Y_i - y_0)$. We observe a jump in the number of bidders and in the winning rebate at the right of the cut-off point. In particular, If we consider the 20,000 euros interval around the threshold and compute the sample means, we observe a jump by 5.3%

[32] Figures A.2-A.4, in the Appendix, implement the graphical version of the McCrary (2008) density test in the subsample of auctions around the discontinuity threshold split by Center-South and Northern super-regions. The Figures suggest that there are no jumps in the densities of the starting value around the threshold. We further test for the presence of sorting considering two auctions characteristics that are likely to be correlated with collusion/corruption. Specifically, we inspect whether or not *licitazione privata* or urgent works exceptions (discussed in footnote 11) have jumps around the 500,000 threshold. Figure A.5 and Figure A.6 show no systematic sorting around the 500,000 thresholds.

[33] In Section 7.1 we discuss how we computed the optional bandwidth

in the number of bidders and by 11% in the winning rebate at the right of the cut-off point.

In Figure 7, the box on the left plots whether a contract has been published in the Regional Official Journal and two Provincial newspapers on $y_i = (Y_i - y_0)$, while the right box plots whether a contract has been published in the Regional Official Journal on $y_i = (Y_i - y_0)$. As can be seen, the figures show that the actual publicity is uniformly no lower than the theoretical publicity for the discontinuity to the left of the threshold no matter how it is measured. To the right of the threshold, we have problems of compliance with the law on publicity, but these violations are not large enough to violate the monotonicity condition required by the RDD.[34]

The graphical impact of publicity can be computed in two ways. First, by the ratio of the jump of the number of bidders or the winning rebate and the jump of the level of publicity (see equation 1). Second, by the differences in the means of the outcomes around the threshold. Using the two pictures and both methods, we can graphically conclude that the mean impact of publicity on entry and the winning rebate is positive.

To get a sense of the channel through which publicity affects rebates, it is helpful to look again at Figure 2. This figure depicts some key moments of the bids' distribution (including the winning rebate), controlling for the number of bidders. These moments are not significantly different between publicized and non-publicized auctions. This shows that publicity has no effect on the rebates after controlling for the number of bidders.[35] Put differently, the number of bidders is the unique channel through which publicity affects the winning rebate.

5.3 Discontinuity Effects of Publicity on Entry and the Winning Rebate: Regression Analysis

In this section we compute point estimates and standard errors, of the effects of publicity on entry and the winning rebate. Table 4 reports the estimated effects of publicity on the number of bidders and the winning rebate in the sub-sample of auctions (i.e., discontinuity sample) with a starting value between 200,000 and 800,000 euros.[36]

Column 1 reports the OLS-ITT effect of theoretical publicity on the level of publicity observed in the data. As suggested in Imbens and Lemieux (2008) we compute standard errors that are

[34] In Figure 7 all right circles are above left circles. Garibaldi et al. (2013) provide a detailed discussion and an example of violation of the monotonicity condition.

[35] This evidence persists when we consider the subsample of small works with starting value $y \in [350,000; 650,000]$ (right panel of Figure 2).

[36] As discussed in Section 3.1 we focus on a sub-sample of the auctions described in Table 2. In Section 7.1 we repeat the analysis considering several samples/bandwidths around the discontinuity threshold.

robust for the presence of an unknown form of heteroskedasticity.[37] The estimates indicate that an increase from a lower starting value bracket, say $2-5$ hundred thousand euros, to an higher one, say $5-8$ hundred thousand euros, shifts the actual publicity by 0.21 with a standard error of 0.02. These results identify a lack of full treatment compliance due to non-perfect law enforcement.

The non-compliance makes particularly useful the OLS-ITTs estimates. Columns 2 and 4 report the OLS-ITT effects of theoretical publicity (i.e., the publicity requirements determined by the procurement law) on the number of bidders and the winning rebate, respectively. The estimates indicate that an increase in tenders' theoretical publicity from local to regional levels leads to an average increase of 3.34 bidders (relative to a sample average of 37.77), and an average increase in the winning rebate of 1.1 (relative to a sample average of 16.1%). These correspond to an increase in entry by 9.3% and the winning rebate by 7%.

Columns 3 and 5 report the Instrumental Variables Local Average Treatment Effects (henceforth, IV-LATE) estimates of the effect of publicity on the number of bidders and the winning rebate, respectively. The estimates indicate that an increase in tenders' publicity from local to regional levels leads to an average increase of 16 in the number of bidders, and an average increase in the winning rebate of 5.3. These correspond to an increase in entry by 45% and the winning rebate by 33%. Columns 3 and 5 also report that the first-stage F statistic is 185.4, which suggests that the IV-LATE estimates are not affected by the weak instrument problem.[38] Both effects are statistically different from zero at a 5% significance level.[39]

Our evidence suggests that IV-LATE estimates are larger than ITT-OLS estimates. As discussed in Section 4.1, the ITT-OLS are diluted by the non-compliance to the treatment, which is showed in Figure 7.[40] We consider our IV-LATE as the estimates of the true causal effect of publicity for those auctions with a value above the threshold publicized as a result of the publicity law *(compliers)*. On the other hand, we consider OLS-ITTs estimates the lower-bound of (the average) effects of publicity. The latter being, however, statistically significant.

[37] As a robustness check in Section 7.1, we compute robust standard errors clustered at city level.

[38] Marmer et al. (2013b) discuss the problems of weak instruments in *fuzzy*-RD design.

[39] Table A.1 (in Appendix) shows (1) estimates obtained considering 5 different polynomial specifications; (2) results of the Lee and Lemieux (2010, pg. 326) polynomial selection test. Our evidence suggests that (1) results are not sensitive to the choice of a specific order of the polynomial; (2) the polynomial specification of order 4 does not reject the *Lee and Lemieux test* polynomial selection test and approximates well the non-linear relationship between auctions outcomes and the starting value of the projects.

[40] In this application, the non-compliance is not enough to invalidate the monotonicity assumption required by the IV-LATE estimates. Garibaldi et al. (2012) provide a detailed discussion and an example of violation of the monotonicity condition. Moreover, since we have showed robust evidence of no-sorting around the threshold, it is also likely that the exclusion restriction is satisfied in the data.

In our preferred estimates, a back-of- the-envelope calculation suggests that a hypothetical public work with a value of 500,000 euros costs the government about 35,000 euros more if it is publicized at the local level compared to the regional level.[41] Since general procurement represents 10% of GDP, savings from publicity might represent 0.7% of the Italian GDP. This extrapolation leap is based on two stringent assumptions: a) the counterfactual conditional mean function of the winning rebate is sufficiently regular in the sense described in Angrist and Rokkannen (2012); b) there are heterogenous treatment effects such that the IV-LATE estimates can be viewed as weighted average of treatment effects for all the auctions in the sample computed with uniform weights (Lee and Lemieux, 2010). This is equivalent to assuming that the reserve price of the auctions (i.e., the running variable) can be treated as random rather then conditioning on it in estimating the IV-LATE effects (Angrist and Rokkannen, 2012). We conclude that publicity increases entry and significantly reduces the costs of procurement for the public administrations.

6 Extensions

Our results so far have shown a remarkable effect of publicity on entry and the costs of procurement. In this section we study the effect of publicity on a variety of auctions outcomes (i.e., the distribution of the rebates, the identity of the winning firms, the days of delay in the *ex-post* execution of the works and the probability that works are subcontracted) and the effects of publicity on a small sub-sample of first-price auctions.

6.1 Distribution of the Rebates and Excluded Bidders

In this section, we consider whether publicity has an effect on the within auction distribution of the rebates. Despite we do not have individual bids for each auction, our data contains other moments of the rebates: the minimum rebate, the anomaly threshold, the number of rebates excluded because they are above the threshold, and the maximum rebate. These statistics are informative moments on the overall competitiveness of the auction (i.e., the bidding strategies).

In columns 1, 3, 5, 7 of Table 5, we report the OLS-ITT estimates, while in columns 2, 4, 6, 8 we report the IV-LATE estimates of equation (2). We find that an increase in the publicity requirements (publicity) increases the the minimum bid by 8% (36%); the anomaly threshold by 7% (34%); the number of excluded rebates by 10% (47%); and the maximum bid by 7% (35%).

[41] Values are net of the costs of publicity summarized in Table 1.

All the estimated coefficients are statistically significant at the 10-percent level. We conclude that an increase in publicity induces all the bidders to submit more competitive rebates. This induces an increase in the number of bidders who systematically bid above the *ex-ante* unknown anomaly threshold and who are automatically excluded by the awarding mechanism.[42] These results are compatible with some of the theoretical predictions in Conley and Decarolis (2012),[43] and support the idea that publicity enlarges the pool of potential competitors and rises the competitive pressure within each auction, which have an effect on the overall distribution of the rebates. These results suggest that at least these moments of the bidding distribution are monotonically affected by an exogenous increase in the number of potential entrants, which is what would happen in standard auctions with endogenous entry.[44]

6.2 Selection of the Winners and *Ex-post* Renegotiations

In this section, we consider whether the reduction in entry costs (i.e., search costs) from additional publicity increasing the pool of potential participants systematically selects different types of winning firms. From the fiscal identifiers of the winners, we construct indicators of whether or not the firm hails from a different region than the public administration managing the auction, whether or not the winner is a small firm (e.g., a limited liability company), and whether or not the same firm wins repeated auctions gaining market share.

In columns 1, 3, and 5 of Table 6, we report the OLS-ITT estimates, while in columns 2, 4, and 6 we report the IV-LATE second-stage estimates of equation (2). We find that an increase in the level of theoretical publicity (publicity) increases the likelihood that the contract is awarded to a firm coming from outside the region by 12% (50%), decreases the probability of the contract being awarded to a small firm by 11.4% (45%), and increases the likelihood that the same firm wins repeatedly by 13% (54%). Estimated coefficients are statistically different from zero at a 10% significance level. These estimates suggest that publicity systematically selects bigger companies, that hails from a different region and gain market shares winning repeated auctions.

Finally, in columns 7-10 of Table 6, we consider whether the reduction in entry costs (i.e., search costs) from additional publicity increasing the pool of potential participants has an effect on the

[42] Consistent to the auction mechanism on average there are 28% of the bids that are excluded because of the anomaly threshold.

[43] In their Proposition 3 attracting independent bidders, most likely from outside well established regional cartels, has similar theoretical results.

[44] See Marmer et al., (2013) for the case of US procurement auctions.

ex-post renegotiations of the works. So far, we have documented that publicity encourages entry and leads to more aggressive bidding. Aggressive bidding, may have two opposite effects. On the one hand, fierce competition may lead to *ex-post* renegotiations of the contracts, since the winner might not be able to live up to its commitment and therefore delays the execution of the works. On the other end, publicity may attract more efficient firms (larger) from outside the region, that win repeated auctions and do not need to delay the execution of the works to recover the costs. These winners, however, might be tempted to subcontract the works. For a smaller sample of public administrations for which we have the data, we consider whether or not the contract is delivered after the contractual deadline or subcontracted. Our evidence suggests that an increase in the level of publicity has no effects on the *ex-post* renegotiations of the contract.[45]

6.3 First-price auctions

Does publicly matter in more commonplace auctions formats? In this section, we empirically test this possibility by analyzing a small sub-sample of first-price auctions available in our data. We use the auction data collected by the municipality and county of Turin that voluntary switched to first-price auctions starting from January 2003.[46] Within this sub-sample we repeat our RDD analysis.

In Table 7 we report descriptive statistics for the sub-sample of 783 first-price auctions for public works with open participation. The average number of bidders per auction is 26, and the mean winning rebate is 18.6%.[47] In this (small) sub-sample we find a positive and statistically significant correlation between the number of bidders and the winning rebate, as in our main sample. To gain sample size, we run our RDD analysis in the sample of auctions with starting value between 200,000 and 1,000,000 of euros. This is a larger window around the 500,000 euros threshold compared to our baseline window (See Section 3.1).

In Table 7 we present estimation results. Columns 1-3 and 7-9 display the OLS-ITT estimates, and columns 4-6 and 10-12 display the IV-LATE estimates illustrated in Section 4.1. Our estimates indicate that an increase in tenders publicity from local to regional levels leads to an average

[45] We check our main results in this small subsample. When we repeat our RDD analysis on the number of bidders and the winning rebate, we confirm both size and significance of the effects of publicity. Results are not reported but available on request.

[46] Decarolis (2011) explains the details of this reform.

[47] The average number of bidders is is 38% smaller than the average number of bidders in the main sample, while the winning rebate is 12.4% greater than the average winning rebate in our main sample described in Section 3.1.

increase of 8 in the number of bidders, and an average increase in the winning rebate of 5.6. This corresponds to an increase in entry by 34% (not statistically significant) and an increase in the winning rebate by 30%. These effects are comparable in sign and in its magnitude to the one obtained in the main sample. This evidence suggests that an increase in the level of publicity increases entry and the winning rebate also in this small sub-sample of first-price auctions.

7 Sensitivity Analysis and Robustness

7.1 Robustness

In this section we consider at least three possible concerns of the apparently discontinuous relationship between auction outcomes and publicity. First we consider a different specification of the treatment variable publicity. Second we consider a different model specification, sample selection and possible omissions of relevant characteristics of public procurement auctions. We also report regressions-based tests on the pre-treatment variables presented in Section 5.2, to further assess the validity of the continuity assumption.

In Table 8, we repeat the analysis considering as a treatment variable the indicator for whether a call for tender has been published or not in the Regional Official Gazette.[48] The table reports the IV-LATE coefficients (and standard error in parenthesis) considering theoretical publicity as an instrument for publicity on the Official Gazette. The only striking difference in this table as compared to Table 4, is the higher compliance to the publicity requirements.[49] Most of the signs of the estimated coefficients on the number of bidders and auction outcomes have a similar sign and statistical significance as the ones reported in Table 4. However, the point estimates are systemically smaller as the effects are diluted by the larger first-stage estimates. This evidence reinforces the robustness of our results, as they are not driven by the specification of the treatment variable.[50]

[48] See Section 2 for details on publicity requirements.

[49] 48% against 20% in column 1 of Table 4.

[50] In Table A.2 (in Appendix), we report estimates of the effect of each discrete level of treatment on the number of bidders and the winning rebate. We impose two extra (structural) assumptions to estimate a model with two endogenous indicators of publicity (and with one instrument). First, we assume that publicity has three (ordered) levels of publicity: local, provincial and regional; Second, we assume that the new publicity variable is normally distributed. We extend our parametric *fuzzy*-RDD two-step procedure to properly consider the new treatment variables. Our new estimates are obtained implementing the tools developed by Terza (1987), and Vella (1993). In the first-step, we estimate, via maximum likelihood, an ordered probit model using the theoretical level of publicity, determined by the starting value of the projects, as an excluded instrument (and controlling for the fourth order polynomial in the starting value, and year effects), and estimate the ordered probit generalized residuals. From the ordered probit estimates, we calculate the generalized residual for each level of publicity. We denote the generalized

In Table 9, we report 7 different sets of estimates of the effect of theoretical publicity (OLS-ITT) and publicity (IV-LATE) on the number of bidders (Panel A) and the winning rebate (Panel B). The rationale behind this robustness check comes from the fact that our baseline model includes the fourth-order polynomial in the starting value and the year effects only. This specification may be too restrictive or not be sufficiently flexible to absorb all the auctions' characteristics that, so far, are left in the unobservables.

In columns 1-2 of Table 9, we add several observable pre-determined characteristics to the baseline model. We include: The typology of the public works (whether they are roads, cultural buildings, schools, hospitals, rails, bridges, basins and damns, and airports); the administrative nature of the contracting authority (municipality); technical and financial characteristics required by the contracting authority to the bidders (OG1-OG3); 110 provincial dummies; and the resident population of the municipality of the public administration (in 10,000 inhabitants in 2001). In this latter specification, we compute standard errors (in parenthesis) allowing for within-cities correlation of the effect of publicity on the number of bidders (Panel A) and the winning rebate (Panel B), see Donald and Lang (2007). We find that an increase in publicity (theoretical publicity) increases the number of bidders by 36% (7.5%) and the winning rebate by 19.4% (4.1%).[51] These estimates are, in magnitude, slightly smaller than the baseline estimates, but preserve the same sign and statistical significance.[52]

residual ψ and this new variable is used to model unobservables in auctions' outcome equations. The ψs for each publicity level are calculated as follows:$\psi_{li} = \frac{\phi((c_{l-1}-\beta Theo.Pub_i-\delta X_i)-\phi(c_l-\beta Theo.Pub_i-\delta X_i)}{\Phi(c_l-\beta Theo.Pub_i-\delta X_i)-\Phi(c_{l-1}-\beta Theo.Pub_i-\delta X_i)}$, where $l = 1, 2, ..., L$ are publicity levels, c_l are cut-off levels in the ordered probit model and ϕ is the probability density function of the normal distribution. In the second step, we use OLS to estimate a model with two indicators for each discrete level of publicity (i.e., provincial and regional) and include (as a control function) the first-step generalized residuals to take care of endogeneity in publicity (and controlling for the fourth order polynomial in the starting value, and year effects). We compute bootstrapped standard errors correcting them for the presence of the (generated) generalized residuals. Table A.2 reports results for estimates obtained (1) both in the main sample and for the optimal bandwidth sample (computed following Imbens and Kalyanaraman, 2012), (2) by including the generalized residuals as well as by excluding them. Our new evidence suggests that (1) provincial and regional publicly have a positive and significant impact on entry and the winning rebate. The ordered profit estimated cutoffs are 0.900 and 1.073 (0.868, 1.032) for the number of bidders and the winning rebate in the main sample (in the optimal bandwidth sample). The sum of the generalized residuals is approximately zero (0.2) in both samples; (2) regional publicity has the biggest effect; (3) the sum of the effects (i.e., the total effect of publicity) is positive, statistically significant and similar, in magnitude, to the main results.

[51] We find similar evidence focusing on 6,767 auctions for the procurement of roads. We find that an increase in publicity (theoretical publicity) increases the number of bidders by 26% (12%) and the winning rebate by 62% (12%); effects statistically significant at 5% for the winning rebate. Details of this estimates are available upon request.

[52] In Table A.3 (in Appendix) we estimate a model that includes the fourth-order polynomial in the starting value only. Our evidence shows that the estimated coefficients for the number of bidders and the winning rebate are invariant to the inclusion of the time effects.

In columns 3-4 of Table 9, we follow Lee and Lemieux (2010), and we approximate $g(Y-y)$ fitting a model that also includes the interaction term between *Theo. Pub.* and the starting value (Local Linear Regression). The effect of publicity (theoretical publicity) on the number of bidders (Panel A) is 34.4% (7.9%), and on the winning rebate (Panel B) is 15% (3.4%), which are similar in size and significance to the baseline result.[53]

In columns 5-6 of Table 9, we fit the baseline model but we consider all the works with a starting value in the interval $y \in [2.66, 7.34]$, determined using the Imbens and Kalyanaraman (2012) optimal bandwidth criterion.[54] The effect of publicity (theoretical publicity) on the number of bidders (Panel A) is 48% (9%), and on the winning rebate (Panel B) is 34.5% (6.5%), which are similar in size and significance to the baseline result.

In columns 7-8 of Table 9, we change the specification and fit a local linear regression model in the sample selected with the Imbens and Kalyanaraman (2011) optimal bandwidth criterion.[55] The effect of publicity (theoretical publicity) on the number of bidders (Panel A) is 49% (10.5%), and on the winning rebate (Panel B) is 23% (5%), which are similar in size and significance to the baseline result.

In columns 9-10 of Table 9, we estimate the baseline model but we consider all the works with a starting value in the interval $y \in [3.5, 6.5]$, determined by splitting the bandwidth of the original estimation window $y \in [2, 8]$ into two. The effect of publicity (theoretical publicity) on the number of bidders (Panel A) is 55.4% (9.7%), and on the winning rebate (Panel B) is 37% (6.7%). The effects are not significant for the number of bidders but similar in size and sign to the baseline result but with larger standard errors.

In columns 11-12 of Table 9, we change the baseline specification and consider Local Linear regressions in the subsample of works with a starting value in the interval $y \in [3.5, 6.5]$. This sample is obtained by dividing by two the original bandwidth. The effect of publicity (theoretical publicity) on the number of bidders (Panel A) is 43% (8%), and on the winning rebate (Panel B)

[53] Table A.4 (in Appendix) reports the details of the local linear regression estimates.

[54] We compute the optimal bandwidth applying the Imbens and Kalyanaraman (2012) STATA routine to our original sample of auctions with starting value above 150,000 euros and below 1,000,000 of Euros. As discussed in Section 3.1 this sample is larger then the sample with starting values [2,8] used throughout the empirical analysis. This routine is has been programmed by Imbens and Kalyanaraman (2012) and it is downloadable from G. Imbens website.

[55] Table A.5 (in Appendix) reports the estimates of local linear regressions and of the 4^{th} order polynomial and considering rectangular and triangular kernel functions in the main sample and in the optimal bandwidth sample. The effect of publicity are similar in size and significance to the baseline results.

is 29% (5.5%), which are similar in size and significance to the baseline result.[56]

In columns 13-14 of Table 9, we estimate a linear model considering works with a starting value 37,500 euro (7.5%) below and above the 500,000 euros threshold.[57] The effect of publicity (theoretical publicity) on the number of bidders (Panel A) is 47% (9.4%), and on the winning rebate (Panel B) is 24% (5%). These estimates are in a close neighbourhood of the publicity threshold and are similar in size and significance to the baseline result.[58]

This evidence reinforces the robustness of our results, as they are not driven by the specification of the empirical model, sample selection, or possible omissions of relevant characteristics that determine entry and auction outcomes.

In Table 10, we parametrically assess the continuity condition discussed in Section 5.2, and reestimate the baseline model considering 6 pre-intervention variables as outcomes of our main equation. As a matter of fact, the evidence suggests that both publicity and theoretical publicity do not affect the type of works, their location, the public administration that is managing the project, and the identity of the auction manager. We find instead, in column 11, some differences between public administrations with different population size: larger contracts are realized by smaller public administrations. This is in part due to large differences in the frequency of the public works in smaller municipalities. We are somewhat encouraged by the fact that once we add to the regression (column 12) the controls used in columns 1-2 of Table 9 there is no evidence of differences in the size of the public administration managing the contract above and below the threshold. As a final check, we explore the sensitivity of our results to the inclusion of this covariate, which appears not perfectly balanced around the 500,000 Euros threshold. In Table A.7 (in the Appendix) we report the estimates of the effects of publicity on the number of bidders and the winning rebate controlling for the population of the public administration managing the auctions, only (Columns 2 and 6). This pre-treatment characteristic appears to affect in a sizeable and statistically significant way the number of bidders and the winning rebates. The inclusion of

[56] Our local linear regressions (standard errors) for a bandwidth obtained splitting in two the Imbens and Kalyanaraman (2012) optimal bandwidth (i.e., starting values in the range [3.83, 6.17]) are 19.08 (9.32) for the number of bidders and 4.65 (2.39) for the winning rebate.

[57] We consider this estimation window and a model that does not control for the size of the projects following Angrist and Lavy (1999).

[58] Table A.6 (in Appendix) reports reports first-stage F-statistics for (1) for the 4th order polynomial regressions and the local linear regressions; (2) the four different bandwidths presented in the paper. The table shows that our first-stage F-statistics are below 10 in the sub-sample. of works with starting values in the range [4.63, 5.38]. In this sub-sample, the first-stage F-statistics is above 10 when we estimate this model that does not control for the size of the projects.

this variable delivers only slightly larger estimates compared to the baseline estimates (Columns 1 and 5). This result suggests that the estimates reported in Table 4 are likely to be a lower bound of the effects of publicity. In columns 3,4 and 7,8, we report the estimates of the effects of publicity for small ($\leq$ 5,000 inhabitants) and large cities. The effects of publicity are similar in the two sub-samples but are not precisely estimated for small municipalities. This compelling evidence reinforces the robustness of our identification strategy and the validity of the continuity assumption.

7.2 Falsification analysis at simulated thresholds

To assess the robustness of these (local) results around the threshold, we run four placebo tests. We generate four simulated treatments at four different values of the starting value of the auctions: 300,000; 450,000; 550,000 and 700,000 euros. We then use these thresholds to statistically test for the presence of discontinuities in the outcomes. Table A.8, in the Appendix, reports estimates repeating the analysis in two subsamples that do not include the 500,000 euros threshold (i.e., between 200,000 and 499,999 euros; and between 500,001 and 800,000 euros). We reestimate the same baseline specification considering the number of bidders and the winning rebate.[59] We (1) do not find evidence of significant effects in any of the the four simulated thresholds; (2) report evidence of very weak instruments in the IV-LATE estimates (see Marmer et al. 2013b). This evidence reinforces the robustness of our results, as they are not driven by random chance or by other thresholds.

8 The Mechanism of the Effects of Publicity

Does publicly provided publicity (official publicity) matter when privately provided publicity (unofficial publicity) is available on-line and not particularly expensive? In this section, we empirically test this possibility by showing that publicly provided publicity causes a substantial increase in privately provided publicity.

We build a measure of unofficial publicity by analyzing data from *Telemat*, a private company specialized in searching and reselling web-based information on upcoming procurement auctions in Italy.[60] For each auction, we compute the number of days its call for tender is posted on *Telemat's*

[59] The McCrary (2008) tests around these simulated thresholds show no jumps. We also compute similar estimates for the pre-treatment variables. These results are available upon request.

[60] *Telemat* is a private company operating in Italy since 1987. Every year more than 7,000 new firms join *Telemat*.

web-page before the date of bid delivery. With this measure of unofficial publicity we repeat the analysis illustrated in Section 4.

As in the main analysis, we select a sample of 18,900 auctions for public works with open participation and with a starting value between 200,000 and 800,000 euros.[61] In the 2000-2005 sample, the average winning rebate is 17% and calls for tenders are publicized, on average, for 31 days (standard deviation 15) before the date of bid delivery. In this sample, the distribution of the starting value is very right skewed and does not show any jump around the discontinuity threshold.[62]

Column 1 of Table 11 shows that highly publicized auctions on the right side of the 500,000 Euros discontinuity threshold are more privately publicized. That is, these auctions are published for +13% days longer before the date of bid delivery on *Telemat's* website. We concluded that publicly provided publicity adds to privately provided publicity augmenting the information available for *Telemat* and its subscribers.

In addition, we find that there is possibly another channel: in an oligopolistic market, there is no reason to believe that all bidders purchase privately provided publicity. Indeed, in any oligopolitistic equilibrium, we expect some buyers to be rationed. Such buyers will rely on publicly provided publicity only. This intuition is partially confirmed in column 2 of Table 11. There, we find that after controlling for privately provided publicity, publicly provided publicity significantly increases winning rebates. Specifically, we find that an increase in one standard deviation in unofficial publicity increases the winning rebate by 1.2%. Similar to our main estimates, an increase in official publicity increases the winning rebate by 6%, and both effects are statistically significant. This evidence, however, is not conclusive since we only control for *Telemat* and not all privately provided publicity.

In columns 3-10 of Table 11, we report a set of estimates to assess the robustness of the RDD in this alternative sample. Estimates confirm the robustness of the effects of official publicity to different bandwidth selection around the threshold, different model specifications (columns 3-5)

Its services cover the entire Italian territory. In 2006, *Telemat* was one of the two leaders in a market characterized by 6 large competitors and several small local competitors. *Telemat*'s clients pay a small fee to have access to a website where information on upcoming procurement auctions are posted. The price to join *Telemat* is about 600-800 euros per year.

[61] Since there are no auctions' identifiers that allow to map the two database, we cannot repeat the analysis in the exact sample of auctions collected in the main database. However, the fact that the *Telemat*'s database contains more auctions suggests that the results on the *Telemat*'s sample cannot be biased by *Telemat*'s efficiency in collecting information on the procurement auctions.

[62] This evidence is confirmed by the McCrary (2008) tests available upon request.

and the validity of the RDD assumptions (columns 6-10).

We conclude that publicly provided publicity causes a substantial increase in privately provided publicity informing *Telemat* and its subscribers.

9 Conclusions

We have used a regression discontinuity design to document the extent to which publicizing a public procurement auction (i.e., enlarging the pool of potential participants) influences public procurement through its effects on entry and the costs of procurement, using a large database on Italian auctions. We identify the effects of publicity on outcomes, by comparing auctions around a discontinuity threshold caused by legally-mandated rules on whether an auction must be publicized on the notice board in the premises of the public administration, or in Regional Official Gazettes and Provincial newspapers. The set of auctions with a starting value close to the discontinuity threshold is likely to be similar to each other in both observable and unobservable characteristics, which can be exploited in a quasi-experimental evaluation framework.

We have reported evidence that publicity "improves" the functioning of the auction mechanism and reduces the amount of public funds spent for public procurement, which is reflected in more entry, higher winning rebates, and a distribution of the rebates shifted toward higher bids. Consistent with the theoretical predictions of Conley and Decarolis (2012), we provided evidence that the number of bidders is the channel through which publicity affects rebates.

Increasing publicity also selects winners. We show that publicity increases the likelihood that the winner hails from outside the region of the public administration, increases the probability that the winner is a large company, and increases the number of repeated winners. This causal evidence contributes to the recent literature of selective entry in auctions.

We have considered as well the effect of publicity on two measures of *ex-post* renegotiations of the procurement contracts at our disposal (percent of works delivered with delay and percent of works that are subcontracted), and found no adverse effects. For the highly publicized works, therefore, we did not detect a trade-off between price and *ex-post* renegotiations. Obviously, this conclusion may vary when looking at different types markets.

We have repeated our analysis on a small sub-sample of first-price auctions and found that publicity also increases the number of bidders and the winning rebate in a more common place

auction format.

Our estimates are robust to a large number of model specifications, bandwidth selections, to a falsification analysis at simulated thresholds and to the possibility that firms learn about upcoming auctions from a for-profit information provider.

We observe here that, to the extent that publicity ameliorates collusion, publicity is a relatively convenient anti-collusion policy, in the sense that it does not require any information or oversight on the part of the regulator. In this sense, the findings in this paper contribute, albeit indirectly, to our toolkit for fighting collusion and corruption in procurement auctions.

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Table 1: Publicity: Requirements, Target population, and Costs

Starting Value y (in 100000 euro)	Publicity requirements	Target popluation	Costs of publishing (in euro)	Non-compliance to the law (%)
	EU-Official Journal (GUCE)	738,200,000	Free	
	Italian Official Journal (GURI)		7000-8000	
$y \geq 65.5$	National Newspapers (at least 2)		800	10
	Regional Newspapers (at least 2)		600	
	Italian Official Gazette (GURI)	56,995,744	7000-8000	
$10 \leq y < 65.5$	National Newspapers (at least 2)		800	22.5
	Regional Newspapers (at least 2)		600	
	Regional Official Gazette (BUR)	3,031,322	200-500	
$5 \leq y < 10$	Provincial Newspapers (at least 2)		400	50
$y < 5$	Notice Board	13,000	Free	6.5

Notes. In the table y represent the starting value/reserve price of the auction. To compute the third publicity threshold we considered 65.5 as the value of 5,000,000 of SDR in EURO 2000. The cost of publishing on regional official journals, and of the regional/provincial newspapers are regional and provincial averages. The target population represents the EU and the Italian population at the 2001 census, while the rest are regional and municipal averages at the 2001 census.
Source: Law 109/1994, authors' interviews with national advertisement companies, National Institute of Statistics.

Table 2: Descriptive Statistics

	Mean	St.Dev.	p10	p25	p50	p75	p90	Obs.
Outcomes:								
Minimum Rebate (%)	8.25	6.57	1	3.05	6.98	12	17.7	31,610
Winning Rebate (%)	16.3	8.17	6.03	11	15.3	21.3	28.6	31,610
Anomaly Threshold (T, %)	16.7	8.09	6.67	11.6	15.6	21.7	28.8	31,610
Maximum Rebate (%)	20	8.5	10.1	14.6	18.7	25.9	32.1	31,610
Number of Bidding Firms	36.1	31.2	8	13	27	49	79	31,610
Number of Bidding Firms Excluded with Rebate Above T	9.33	8.97	2	3	6	12	22	31,610
Winner from Outside the Region	.371	.483	0	0	0	1	1	28,025
Max (%) Wins Same Firm	.336	.325	.0455	.0833	.2	.5	1	28,025
Limited Liability Winner	.444	.497	0	0	0	1	1	28,025
Works Interruption	.507	.5	0	0	1	1	1	28,025
Resales/Subcontract	.604	.489	0	0	1	1	1	28,025
Publicity:								
Notice Board	.92	.27	1	1	1	1	1	31,610
Regional Official Gazette	.25	.43	0	0	0	1	1	31,610
Italian Official Gazette	.18	.39	0	0	0	0	1	31,610
European Official Gazette	.02	.13	0	0	0	0	0	31,610
Number of Provincial Newspapers	.24	.72	0	0	0	0	1	31,610
Number of Regional Newspapers	.42	.81	0	0	0	0	2	31,610
Number of National Newspapers	.61	.92	0	0	0	1	2	31,610
Characteristics of the Works:								
Auction Starting Value (in 100000 Euro)	6.8	11	1.7	2.1	3.3	6.5	14	31,610
Roads	.31	.46	0	0	0	1	1	31,610
Education	.11	.31	0	0	0	0	1	31,610
Culture	.071	.26	0	0	0	0	0	31,610
Health and Hydric	.07	.19	0	0	0	0	0	31,610
Trains and Airports	.015	.1	0	0	0	0	0	31,610
Other	.43	.49	0	0	0	1	1	31,610
Tech. Req.: Roads and Others, Buildings	.28	.35	0	0	0	0	1	31,610
The public administration is:								
Municipality	.53	.5	0	0	1	1	1	31,610
North East	.2	.4	0	0	0	0	1	31,610
North West	.27	.44	0	0	0	1	1	31,610
Center	.2	.4	0	0	0	0	1	31,610
South	.24	.43	0	0	0	0	1	31,610
Islands	.06	.23	0	0	0	0	0	31,610
Population	13	35	.2	.55	2	8.3	32	31,610

Notes. All the auctions for public works with value greater or equal to 150,000 euros auctioned in Italy between the years of 2000-2005 with public participation. *Winning Rebate* is the winning bid and is expressed as a percentage reduction form the starting value. The *Anomaly Threshold, T* is the sum of the average bid (not available in the data) and the average deviation of the bids above the average. The winning rebate is the maximum rebate below *T*. R^{min} and R^{Max} the minimum and the maximum rebate. *Number of Bidding Firms Excluded with Rebate Above T* is the number of bidders automatically excluded with a rebate above the anomaly threshold T. *Winner from outside the region* is a dummy for whether the winning firm is registered outside the region of the public administration. *Max % wins same firm* is the highest percentage of auctions assigned to the same firm for each of the years in the sample and for each public administration. *Limited Liability Winner* is a dummy for whether the winning firm is a small company as defined by Art. 2463 of the Civil Code (10,000 euros of minimum corporate capital). *Works interruption* is a dummy for whether the works have been interrupted because of chance occurrences, unavoidable accidents, places unavailabilities or the judicial police. *Resales* is a dummy for whether the public administration authorized subcontractors to realize the works. Notice Board-European Official Gazette are dummies for whether the contract has been published on one or more Official Journals. *Auction Starting Value* is the value/reserve price set by the public administration (in 2000 equivalents). *Tech.Req.* are the technical and financial characteristics required by the contracting authority to the bidders (OGs). In this table we report the sum of the most frequent OG1 and OG3. *Municipality* is a dummy for whether the public administration is a municipality. *Population* is the number of resident inhabitants (in 10,000, year 2001) in the city of the public administration with at least one auction between 2000-2005.

Table 3: Parametric Density Test for the Presence of Sorting of the Auctions Starting Value Around the Threshold

Type of Works	Year of the Auction						All Years
	2000	2001	2002	2003	2004	2005	
	Panel A: Estimation Sample, $y \in [2, 8]$						
Roads	.7	.1	-.89	.14	-.08	-.25	-.22
(se)	(.62)	(.36)	(.45)	(.35)	(.49)	(.65)	(.21)
Education	-.81	-.36	.53	.88	.1	1.33	.13
(se)	(.74)	(1.2)	(1)	(1)	(1)	(.98)	(.44)
Culture	.24	.41	-2.4	.58	-.7	-.67	.3
(se)	(.92)	(1)	(2.1)	(.85)	(1.2)	(1.1)	(.46)
All types	-.3	.1	-.4	-.057	-.34	.011	-.22
(se)	(.25)	(.23)	(.25)	(.2)	(.29)	(.32)	(.12)
	Panel B: Half-Window, $y \in [3.5, 6.5]$						
Roads	.85	-.8	-.3	.057	.37	-.92	-.2
(se)	(1)	(.63)	(.56)	(.53)	(.56)	(1.2)	(.24)
Education	-1.2	.10	-.39	.69	-.60	1.4	-.017
(se)	(.99)	(.79)	(1.1)	(1.6)	(1)	(2.9)	(.48)
Culture	-.41	.22	-1.9	.51	-.41	-.69	.69
(se)	(1.4)	(1.1)	(2.3)	(1.5)	(2.4)	(2.4)	(.65)
All types	-.54	.2	-.49	-.36	-.31	-.28	-.27
(se)	(.38)	(.39)	(.41)	(.34)	(.36)	(.43)	(.15)

Notes. Coefficient (and standard error in parenthesis) of the McCrary (2008) parametric *t-test* for the presence of sorting in the starting value (the running variable of the RDD estimator) around the $y = 500,000$ discontinuity. *Panel A* reports statistics for the main estimation sample with starting values $y \in [2, 8]$, while *Panel B* for the auctions in the "half-window" subsample with starting values $y \in [3.5, 6.5]$.
Source: In Panel A, statistics for the 17,512 public procurements works tendered between 2000 and 2005, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents) included in the estimation sample of Table 4. In Panel B, statistics for the 9,365 public procurements works tendered between 2000 and 2005, with starting value $y \in [3.5, 6.5]$, in 100,000 euros (2000 equivalents) included in the robustness sample of Table 9.

Table 4: Discontinuity Effect of Publicity on Entry and Winning Rebate: Regression Analysis

Dependent variable	Publicity	Number of bidders	Number of bidders	Winning rebate	Winning rebate
Method	OLS-ITT	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE
	(1)	(2)	(3)	(4)	(5)
Mean outcome	0.10	35.77		16.06	
Theo. Publicity	0.209***	3.348**		1.103***	
	(0.020)	(1.632)		(0.399)	
Publicity			16.015**		5.274***
			(7.976)		(2.005)
F-first stage			185.4		185.4
Year effects	yes	yes	yes	yes	yes
4^{th} order poly.	yes	yes	yes	yes	yes
$y \in [2, 8]$	yes	yes	yes	yes	yes
Observations	17,512	17,512	17,512	17,512	17,512

Notes. Coefficient (and SE in parenthesis) of the effect of publicity. In column 1 the *Dep.Var.* is the observed level of publicity (first stage), while the number of bidders in columns 2-3, and the winning rebate in columns 4-5. The first row reports the mean outcome of each dependent variable. *Theo. Publicity* is the theoretical level of publicity determined by the starting value, $y \geq 5$. *Publicity* is the observed level of publicity. *F-first stage* is the first-stage F-statistics for the excluded instrument. All the regressions include the 4^{th} order polynomial in the difference of the starting value from the threshold, and five year indicators. Columns 2 and 4 report OLS-ITT estimates while 3 and 5 report IV-LATE estimates using *Theo. Publicity* as the instrument for *Publicity*. SEs adjusted for heteroskedasticity. Significance at the 10% (*), at the 5% (**), and at the 1% (***).
Source: Statistics for all the public procurements works tendered between 2000 and 2005, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents). The number of observations is smaller than the one of the full sample described in Table 2, because here we restrict the analysis to auctions with starting value $y \in [2, 8]$.

Table 5: Distribution of the Rebates and Number of Excluded Bidders

Dependent variable	Min rebate	Min rebate	Anomaly threshold (T)	Anomaly threshold (T)	N. bidders excluded with bid above T	N. bidders excluded with bid above T	Max rebate rebate	Max rebate rebate
Method	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mean outcome	8.190		16.49		9.102		19.70	
Theo. Publicity	0.624**		1.161***		0.896*		1.436***	
	(0.316)		(0.394)		(0.461)		(0.409)	
Publicity		2.985*		5.555***		4.286*		6.868***
		(1.560)		(1.993)		(2.251)		(2.100)
F-first stage		185.4		185.4		185.4		1185.4
Year effects	yes	yes	yes	yes	yes	yes	yes	yes
4^{th} order poly.	yes	yes	yes	yes	yes	yes	yes	yes
$y \in [2, 8]$	yes	yes	yes	yes	yes	yes	yes	yes
Observations	17,512	17,512	17,512	17,512	17,512	17,512	17,512	17,512

Notes. Coefficient (and SE in parenthesis) of the effect of publicity. In columns 1-2 the *Dep.Var.* is the minimum rebate; in 3-4 the anomaly threshold T (the average rebate plus the average of the bids above the average and below the top 10 % of the distribution of the rebates); in 5-6 the number of bidders with a rebate above the anomaly threshold T, which are authomatically excluded; in 7-8 the maximum rebate. The first row reports the mean outcome of each dependent variable. *Theo. Publicity* is the theoretical level of publicity determined by the starting value, $y \geq 5$. *Publicity* is the observed level of publicity. *F-first stage* is the first-stage F-statistics for the excluded instrument. All the regressions include the 4^{th}-order polynomial in the difference of the starting value from the threshold, and five year indicators. Odd columns report OLS-ITT estimates; even columns the IV-LATE using *Theo. Publicity* as instrument for *Publicity*. SEs adjusted for heteroskedasticity. Significance at the 10% (*), at the 5% (**), and at the 1% (***).
Source: Statistics for the 17,512 public procurements works tendered between 2000 and 2005, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents) included in the estimation sample of Table 4.

Table 6: Type of Winners, Incumbency, and *ex-post* execution of the works

Dependent variable	Winner non-local	Winner non-local	Winner small company	Winner small company	Max (%) wins	Max(%) wins	Works delivered with delay	Works delivered with delay	Resales	Resales
Method	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mean outcome	.34		.44		.35		.54		.64	
Theo. Publicity	0.040*		-0.047*		0.045***		-0.018		0.032	
	(0.024)		(0.025)		(0.016)		(0.031)		(0.027)	
Publicity		0.169		-0.202*		0.190***		-0.076		0.135
		(0.103)		(0.107)		(0.070)		(0.131)		(0.117)
F-first stage		253.5		253.5		253.5		153.7		153.7
Year effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
4^{th} order poly.	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
$y \in [2, 8]$	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	16,606	16,606	16,606	16,606	16,606	16,606	9,994	9,994	9,994	9,994

Notes. Coefficient (and SE in parenthesis) of the effect of publicity. In column 1-2 the *Dep.Var* is an indicator of whether the winner is non-local (coming from outside the region); in 3-4 the winner is a small company (a limited liability company); in 5-6 is the highest percentage of works assigned to the same firm within a year (the market share); in 7-8 an indicator of whether works were interrupted; in 9-10 whether to contract was resold to a subcontractor. The first row reports the mean outcome of each dependent variable. *Theo. Publicity* is the theoretical level of publicity determined by the starting value, $y \geq 5$. *Publicity* is the observed level of publicity. *F-first stage* is the first-stage F-statistics for the excluded instrument. All the regressions include the 4^{th}-order polynomial in the difference of the starting value from the threshold, and five year indicators. Odd columns report OLS-ITT estimates; even columns the IV-LATE using *Theo. Publicity* as instrument for *Publicity*. SEs adjusted for heteroskedasticity. Significance at the 10% (*), at the 5% (**), and at the 1% (***).
Source: Statistics for the public procurements works tendered between 2000 and 2005, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents) included in the estimation sample of Table 4, which have no missing values.

Table 7: Discontinuity Effect of Publicity in the Small Sub-sample of First-Price Auctions

Method	OLS-ITT	OLS-ITT	OLS-ITT	IV-LATE	IV-LATE	IV-LATE	OLS-ITT	OLS-ITT	OLS-ITT	IV-LATE	IV-LATE	IV-LATE
Model	Linear	1th	4th	Linear	1th	4th	Linear	1th	4th	Linear	1th	4th
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Number of bidders						Winning rebate					
Avg. outcome	26.13						18.59					
Theo. Publicity	10.656***	2.943	3.754				0.904**	1.246	2.704**			
	(2.173)	(3.604)	(4.723)				(0.437)	(0.848)	(1.146)			
Publicity				14.028***	7.999	7.845				1.190**	3.388	5.651**
				(2.869)	(9.757)	(9.737)				(0.574)	(2.402)	(2.612)
Observations	783	783	783	783	783	783	783	783	783	783	783	783
F-first				348.7	23.22	22.83				348.7	23.22	22.83

Notes. Coefficient (and SE in parenthesis) of the effect of publicity. Columns report as *Dep. Var.*: the number of bidders (columns 1-6); the winning rebate (columns 7-12). *Theo. Publicity* is the theoretical level of publicity determined by the starting value, $y \geq 5$. *Publicity* is the observed level of publicity. *F-first stage* is the first-stage F-statistics for the excluded instrument. Columns 1-3, and 7-9 (4-6, and 10-12) report OLS-ITT estimates (IV-LATE estimates using *Theo. Publicity* as the instrument for *Publicity*). Columns 1, 4, 7 and 10 (2, 5, 8 and 11) [3, 6, 9 and 12] do not control for the difference of the starting value from the threshold (include the linear term) [include the 4^{th}-order polynomial], and year indicators. SEs adjusted for heteroskedasticity. Significance at the 10% (*), at the 5% (**), and at the 1% (***).
Source: Statistics for all the public procurements works tendered between 2003 and 2005, in the Municipality and County of Turin, with starting value $y \in [2, 10]$, in 100,000 euros (2000 equivalents).

Table 8: Publicity in Official Journals

Dependent variable	Publicity on Gazette	Number of bidders	Winning rebate	Min rebate	Anomaly threshold (T)	N. bidders excluded with bid above T	Max rebate	Winner non-local	Winner small company	Max(%) wins	Works delivered with delay	Resales
Method	OLS-ITT	IV-LATE	IV-LATE	IV-LATE	IV-LATE	IV-LATE	IV-LATE	IV-LATE	IV-LATE	IV-LATE	IV-LATE	IV-LATE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Mean outcome		35.77	16.06	8.188	16.49	9.102	19.68	0.342	0.440	0.346	0.541	0.636
Theo. Publicity	0.478***											
	(0.025)											
Publicity on Gazette		7.008**	2.308***	1.306*	2.431***	1.935*	3.006***	0.081	-0.097*	0.091***	-0.036	0.063
		(3.409)	(0.846)	(0.669)	(0.838)	(0.994)	(0.875)	(0.049)	(0.051)	(0.033)	(0.062)	(0.055)
F-first stage		392.3	392.3					409.8	409.8	409.8	246.6	246.6
Year effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
4^{th} order poly.	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
$y \in [2, 8]$	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	17,512	17,512	17,512	17,512	17,512	17,090	17,512	16,606	16,606	16,606	9,994	9,994

Notes. Coefficient (and SE in parenthesis) of the effect of publicity. In column 1 the *Dep.Var.* is the number of bidders, in 2 the winning rebate, in 3 whether the winner is non-local (coming from outside the region); in 4 the winner is a small company (a limited liability company); in 5 is the highest percentage of works assigned to the same firm within a year (the market share); in 7 an indicator of whether works were interrupted; in 9 whether to contract was resold to a subcontractor. The first row reports the mean outcome of each dependent variable. *Theo. Publicity* is the theoretical level of publicity determined by the starting value, $y \geq 5$. *Publicity on Gazette* is an indicator of whether the auction as been published one the Regional Official Gazette of the public administration. *F-first stage* is the first-stage F-statistics for the excluded instrument. All the regressions include the 4^{th}-order polynomial in the difference of the starting value from the threshold, and five year indicators. Odd columns report OLS-ITT estimates; even columns the IV-LATE using *Theo. Publicity* as instrument for *Publicity on Gazette*. SEs adjusted for heteroskedasticity. Significance at the 10% (*), at the 5% (**), and at the 1% (***).
Source: Statistics for the 17,512 public procurements works tendered between 2000 and 2005, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents) included in the estimation sample of Tables 4–6.

Table 9: Model Specifications and Discontinuity Samples

Model	4^{th}-Order poly.	4^{th}-Order poly.	Local linear	Local linear	4^{th}-Order poly.	4^{th}-Order poly.	Local linear	Local linear	4^{th}-Order poly.	4^{th}-Order poly.	Local linear	Local linear	Linear	Linear
	Full-info	Full-info												
($y \in$)	$[2, 8]$	$[2, 8]$	$[2, 8]$	$[2, 8]$	Opt.-Band.	Opt.-Band.	Opt.-Band.	Opt.-Band.	$[3.5, 6.5]$	$[3.5, 6.5]$	$[3.5, 6.5]$	$[3.5, 6.5]$	$[4.63, 6.38]$	$[4.63, 5.38]$
Method	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE	OLS-ITT	Wald
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
						Panel A: N. of bidders								
Mean out.		35.95				35.77				32.60			34	
Theo. Pub.	2.703*		2.834**		3.249*		3.777***		3.146		2.674*		3.201**	
	(1.634)		(1.230)		(1.677)		(1.296)		(1.996)		(1.571)		(1.551)	
Pub.		12.892*		12.385**		17.224*		17.434***		18.053		13.974*		16.259**
		(7.797)		(5.453)		(9.034)		(6.091)		(11.624)		(8.295)		(7.953)
						Panel B: Winning rebate								
Mean out.		16.06				15.88				15.98			16.31	
Theo. Pub.	0.652**		0.551*		1.034**		0.786**		1.056**		0.885**		0.768*	
	(0.283)		(0.298)		(0.417)		(0.316)		(0.510)		(0.392)		(0.400)	
Pub.		3.108**		2.409*		5.480**		3.628**		6.059**		4.626**		3.898*
		(1.411)		(1.325)		(2.306)		(1.494)		(3.074)		(2.116)		(2.068)
F-first stage		188.2		399.8		160.4		366.3		80.66		162.7		147.6
Year effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Obs.	17,512	17,512	17,512	17,512	16,103	16,103	16,103	16,103	9,365	9,365	9,365	9,365	2,207	2,207

Notes. Coefficient (and standard error in parenthesis) of the effect of publicity on the number of bidders *(Panel A)* and the winning rebate *(Panel B)*. The rows denoted with *Mean out.* report the mean outcome of each dependent variable in the different samples. *Theo. Pub.* is the theoretical level of publicity determined by the starting value, $y \geq 5$. *Pub.* is the observed level of publicity. Odd columns report OLS-ITT estimates; even columns the IV-LATE using *Theo. Pub.* as instrument for *Pub.*. *F-first stage* is the first-stage F-statistics for the excluded instrument. Columns 1,2; 5,6 and 9,10 include the 4^{th}-order polynomial in the difference of the starting value from the threshold; columns 3,4; 7,8 and 11,12 include the interaction term between *Theo. Pub.* and the starting value (Local Linear regressions). All the regression include five year indicators. Columns 1-4 consider all the works tendered between 2000 and 2005, with starting value $y \in [2, 8]$; columns 5-8 all the works with starting value in the interval $y \in [2.66, 7.34]$ determined using the Imbens Kalyanaraman (2012) optimal bandwidth criterion. In columns 9-12 the main estimation window is divided by two and $y \in [3.5, 6.5]$. In columns 13,14 are considered works with starting value 37,500 euro (7.5 %) below and above the threshold without controlling for the starting value of the projects, as in Angrist and Lavy (1999). Columns 1,2 include indicators on the nature of the good (*Goods:* roads, culture, education, hospitals, rails, bridges, basins and damns, and airports.) the administrative nature of the contracting authority (*P.A.:* Municipality), technical and financial characteristics required by the contracting authority to the bidders (*Tech.:* OGs), and 110 provincial dummies and the resident population of the municipality of the public administration (in 10,000 inhabitants in 2001) *Geo.*. Columns 1,2 report SEs clustered for the presence of within cities correlation. In columns 3-14, SEs are adjusted for heteroskedasticity. Significance at the 10% (*), at the 5% (**), and at the 1% (***).
Source: Statistics for all the public procurements works tendered between 2000 and 2005, with starting value in 100,000 euros (2000 equivalents). The number of observations is smaller than the one of the full sample described in Table 2 because here we restrict the analysis to auctions with starting value $y \in [2, 8]$, or $y \in [2.66, 7.34]$, or $y \in [3.5, 6.5]$, or $y \in [4.63, 5.38]$ depending on the specification.

Table 10: Sorting and Continuity Conditions: Parametric Tests on Pre-Treatment Variables

Dependent Variable	Education	Education	Age manager	Age manager	Male manager	Male manager	Munic.	Munic.	South	South	Pop.	Pop.
Model		full-info		full-info		full-info		full-info		full-info		full-info
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Mean outcome	0.10		52		0.9		0.56		0.27		10.53	
					Panel A: OLS-ITT							
Theo. Publicity	0.003	0.015	-0.509	-0.327	-0.004	-0.008	0.027	0.035	0.024	0.028	-3.634***	-1.412
	(0.014)	(0.013)	(0.401)	(0.388)	(0.015)	(0.015)	(0.024)	(0.023)	(0.021)	(0.021)	(1.380)	(1.107)
					Panel B: IV-LATE							
Publicity	0.013	0.047	-2.413	-1.587	-0.019	-0.040	0.129	0.167	0.115	0.134	-17.553**	-6.312
	(0.067)	(0.061)	(1.924)	(1.829)	(0.071)	(0.070)	(0.116)	(0.112)	(0.102)	(0.102)	(6.817)	(5.284)
F-first stage	185.4	193.1	184.6	193.7	185.4	193.8	185.4	189.5	185.4	185.1	177.7	188.1
Year effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
4^{th}-order poly.	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
$y \in [2, 8]$	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Goods charact.	no	no	no	yes	no	yes	no	yes	no	yes	no	yes
P.A. charact.	no	yes	no	yes	no	no	no	no	no	no	yes	yes
Tech. charact.	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes
Geo. charact.	no	yes	no	yes	no	yes	no	yes	no	yes	no	no
Observations	17,512	17,512	17,512	17,512	17,512	17,512	17,512	17,512	17,512	17,512	17,512	17,512

Notes. Coefficient (and standard error in parenthesis) of the effect of publicity on the pre-treatment outcomes. The rows denoted with *Mean out.* report the mean outcome of each dependent variable: Whether the good is a public school or a library (columns 1-2); the age of the manager (columns 3-4); his gender (columns 5-6); whether the administration is a municipality (columns 7-8), whether is located in the south (columns 9-10), and (columns 11-12) its resident population (in 10,000 inhabitants in 2001). *Panel A* reports the OLS-ITT estimates; *Panel B* the IV-LATE estimates. The first row reports the mean outcome of each dependent variable. *Theo. Publicity* is the theoretical level of publicity determined by the starting value, $y \geq 5$. *Publicity* is the observed level of publicity. *F-first stage* is the first-stage F-statistics for the excluded instrument. All the regressions include the 4^{th}-order polynomial in the difference of the starting value from the threshold, and five year indicators. Even columns include indicators on the nature of the good (*Goods:* roads, culture, education, hospitals, rails, bridges, basins and damns, airports.) the administrative nature of the contracting authority (*P.A.:* Municipality), technical and financial characteristics required by the contracting authority to the bidders (*Tech.:* OGs), and 110 provincial dummies *Geo.*. SEs adjusted for heteroskedasticity. Significance at the 10% (*), at the 5% (**), and at the 1% (***). Source: Statistics for all the public procurements works tendered between 2000 and 2005, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents). The number of observations is smaller than the one of the full sample described in Table 2 because here we restrict the analysis to auctions with starting value $y \in [2, 8]$.

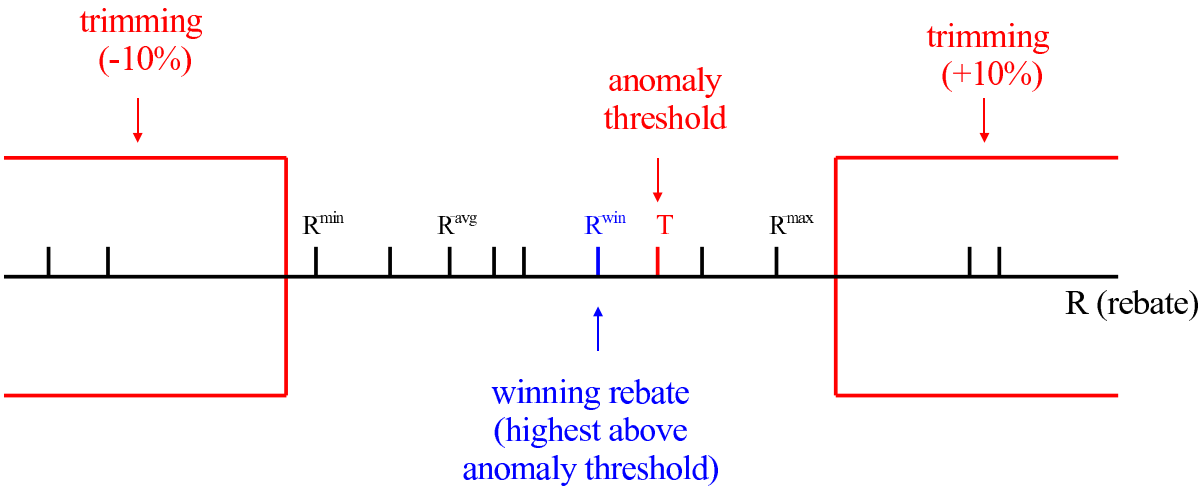
Table 11: Mechanisms of the Effect of Publicity: Evidence from a Large Information Entrepreneur

	Outcomes		Sensitivity Analysis and Pre-treatment Variables							
Dependent variable	Days on *Telemat*	Winning rebate	Winning rebate	Winning rebate	Winning rebate	Municipality	Province	South	Population	Education
Method	OLS-ITT	OLS-ITT	OLS-ITT	OLS-ITT	LLR	OLS-ITT	OLS-ITT	OLS-ITT	OLS-ITT	OLS-ITT
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mean outcome	30.58	17	17	17.3		0.549	0.148	0.227	28.67	0.08
SD outcome	15									
Theo. Publicity	3.992***	0.997**	1.053**	2.162***	1.363***	0.088***	0.004	-0.005	-4.231	-0.006
	(0.607)	(0.418)	(0.418)	(0.571)	(0.440)	(0.021)	(0.014)	(0.018)	(2.696)	(0.011)
Days on *Telemat*		0.014**								
		(0.006)								
Year effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
4^{th} order poly.	yes	yes	yes	yes	no	yes	yes	yes	yes	yes
Window ($y \in$)	$[2, 8]$	$[2, 8]$	$[2, 8]$	$[3.5, 6.5]$	$[3.5, 6.5]$	$[2, 8]$	$[2, 8]$	$[2, 8]$	$[2, 8]$	$[2, 8]$
Observations	18,900	18,900	18,900	8,067	8,067	18,900	18,900	18,900	18,900	18,900

Notes. Coefficient (and SE in parenthesis) of the effect of publicity. Columns report as *Dep.Var.*: The number of days the contract appeared on the *Telemat* website before the official date of bid delivery (column 1); the winning rebate (columns 1, 3-5, 6); whether the administration is a municipality; a provincial administration; whether the works are in the south; the resident population in the city of the public administration (in 10,000 inhabitants in 2001) and the good is a school or an educational building (columns 6-10, respectively). *Theo. Publicity* is the theoretical level of publicity determined by the starting value, $y \geq 5$. Column 2 includes as a regressor *Days on Telemat*. All the columns (but 5) include the 4^{th}-order polynomial in the difference of the starting value from the threshold, and year indicators. Column 5, reports the estimated coefficient of the effect of publicity including the interaction term between *Theo. Publicity* and the starting value (Local Linear regressions). Columns 4, 5 consider the subsample of auctions window with $y \in [3.5, 6.5]$. SEs adjusted for heteroskedasticity. Significance at the 10% (*), at the 5% (**), and at the 1% (***).

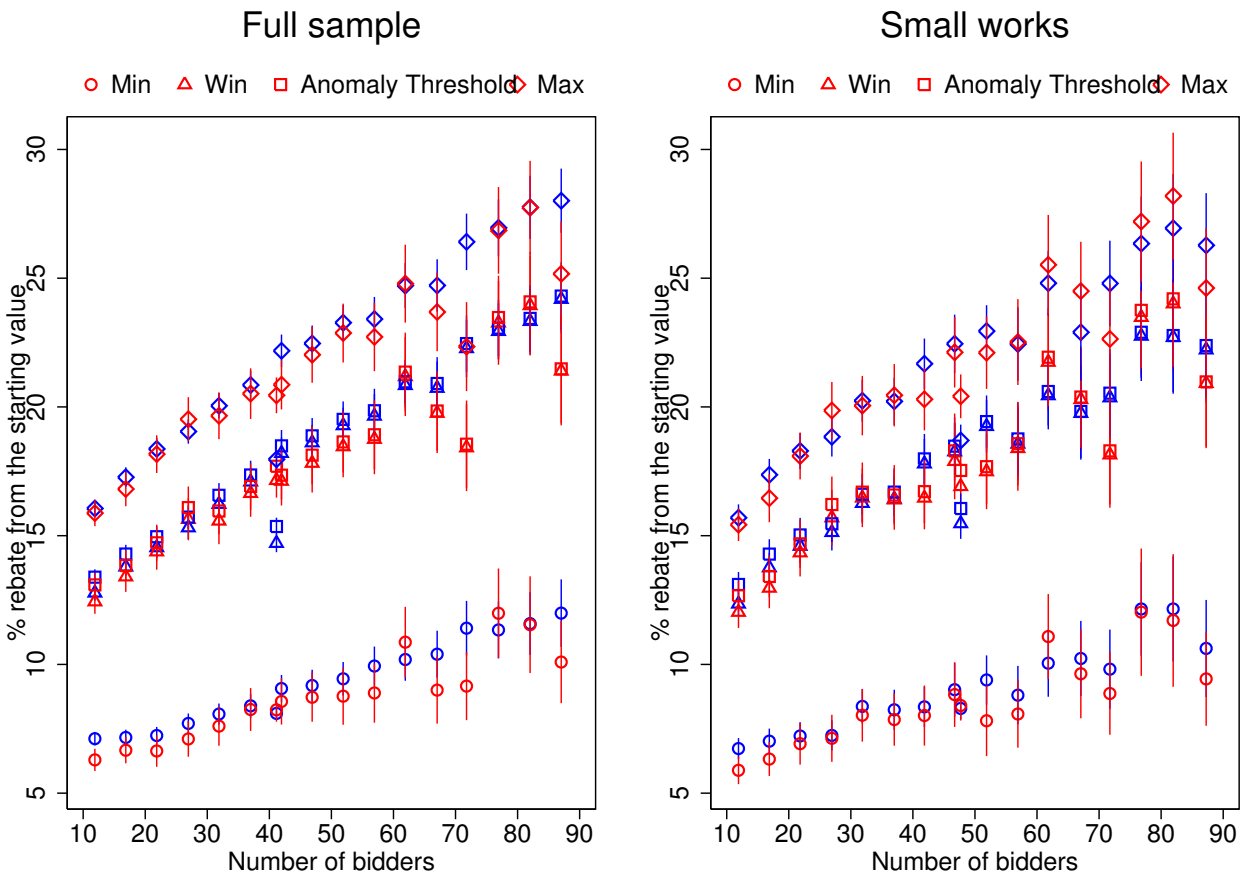
Source: Statistics for *Telemat* all the public procurements works tendered between 2000 and 2005, with starting value in 100,000 euros (2000 equivalents).

Figure 1: The Awarding Mechanism



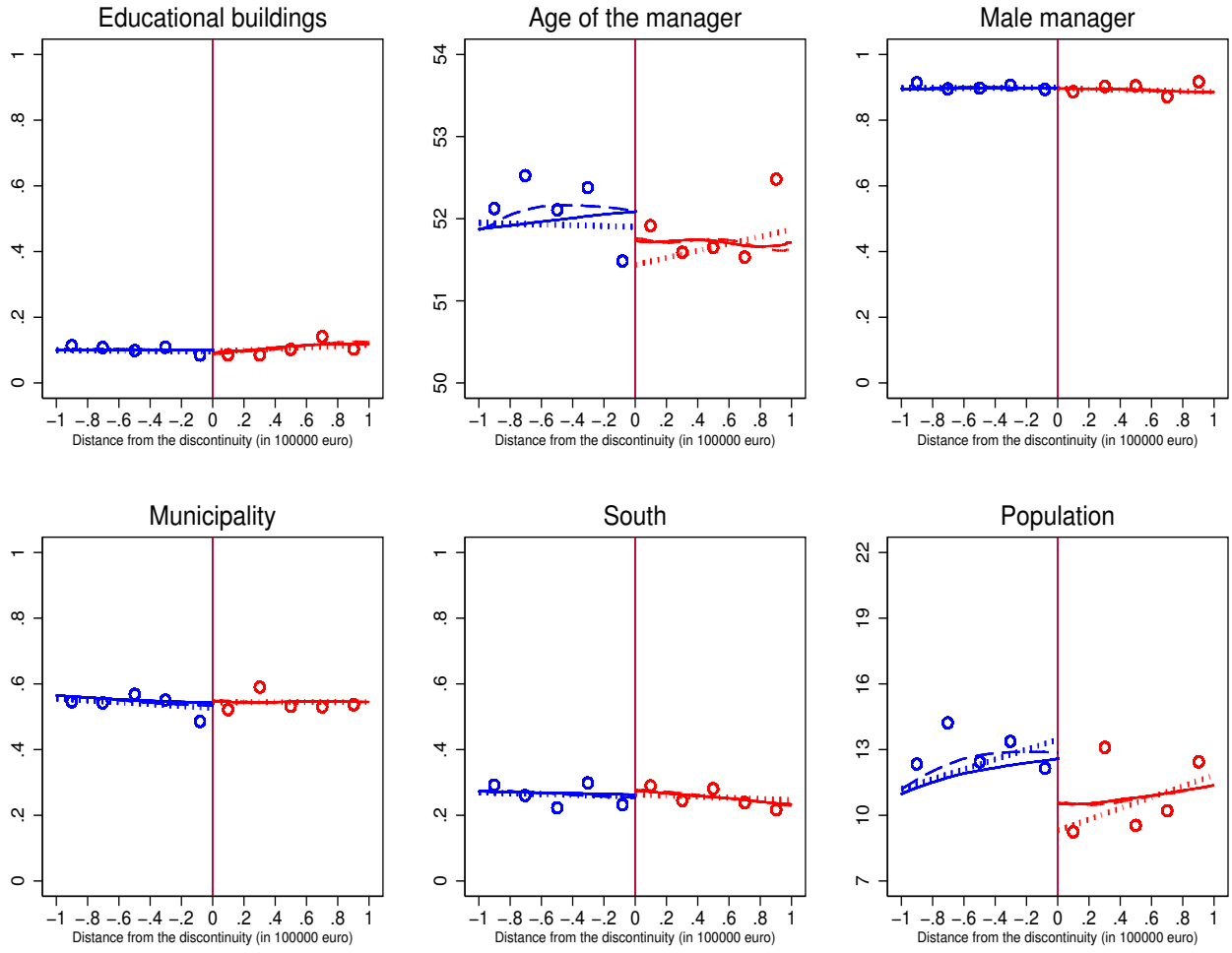
Notes. R^{avg} is the average rebate, expressed as a percentage reduction form the starting value. T, is the anomaly threshold obtained as the sum of R^{avg} and the average deviation of the bids above R^{avg}. R^{win} is the winning rebate and is the max rebate below T. R^{min} and R^{Max} the minimum and the maximum rebate, respectively.

Figure 2: Rebates, Number of Bidders and Publicity Requirements



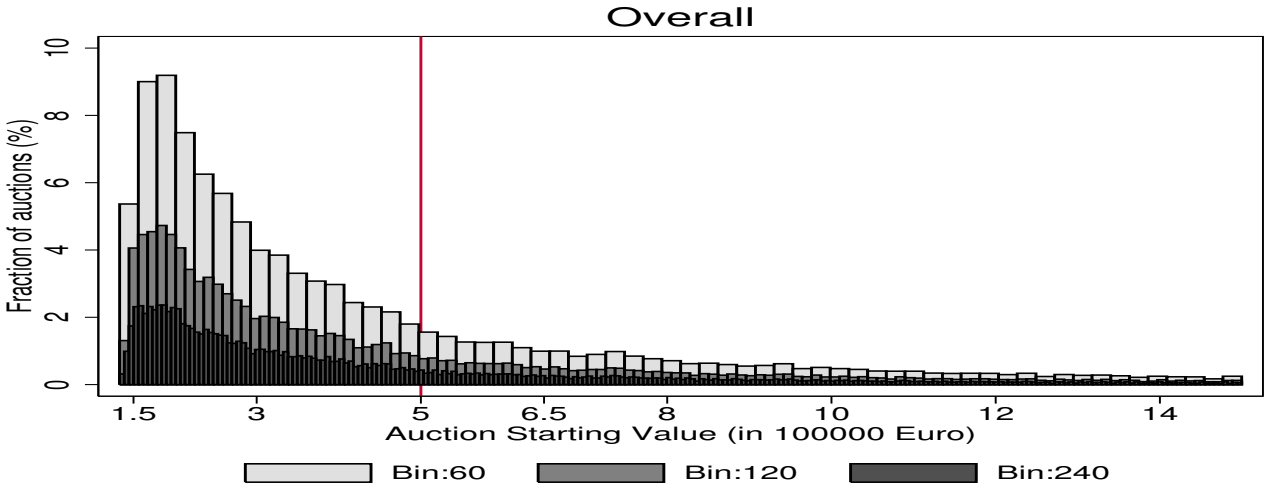
Notes. Distribution of the rebates conditional on the number of bidders participating to the auction at different levels of publicity: local (in red) or regional (in blue). Circles denote the minimum rebate; triangles the winning rebate; squares the anomaly threshold; diamonds the maximum rebate. Vertical lines denote the 95 % confidence intervals.
Source: Statistics for the 17,512 public procurements works (on the right, small works) tendered between 2000 and 2005, with starting value $y \in [2, 8]$ ($y \in [3.5, 6.5]$ right panel), in 100,000 euros (2000 equivalents) included in the estimation sample of Table 4.

Figure 3: Discontinuity Effect of Publicity on Pre-Treatment Variables: Graphical Analysis (Continuity Conditions)



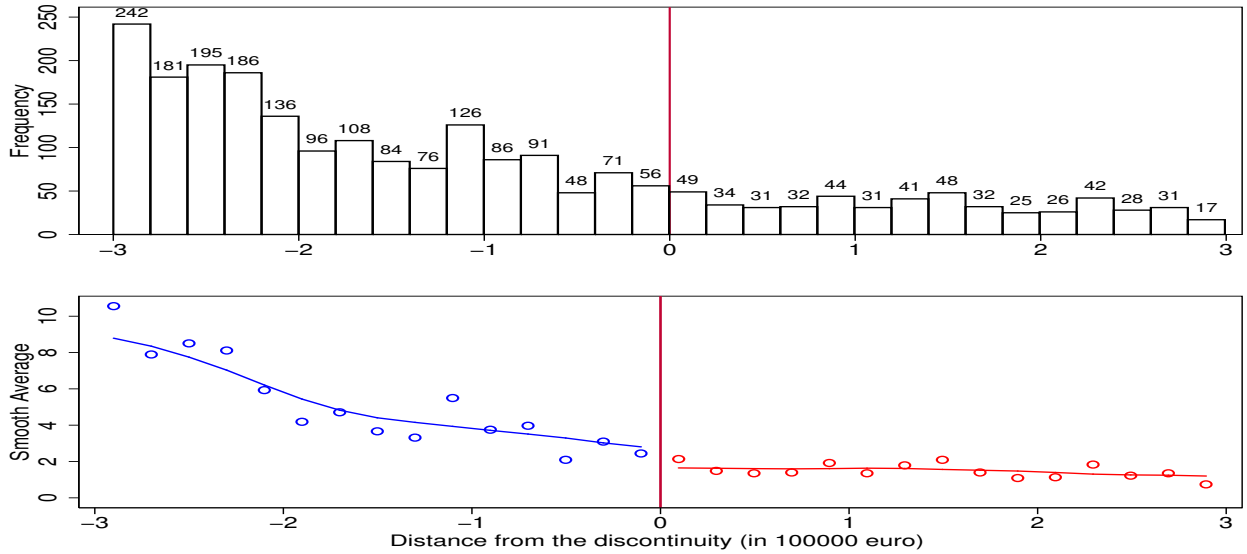
Notes. Circles represent sample averages of the dependent variable computed on 20,000 euros brackets of the running variable. The solid line (dashed line) [dotted line] is a least squares running-mean smoothing [local linear regression prediction], separated on either side of the threshold and computed on the sample of all auctions with starting value $y \in [2, 8]$ ($[y \in [2.66, 7.34]$, determined using the Imbens and Kalyanaraman, 2011 optimal bandwidth criterion]), in 100,000 euros (2000 equivalents). For presentational reasons, the figure plots averages of the dependent variable with running variable $y \in [4, 6]$. The red vertical line denotes the discontinuity, normalized to zero.
Source: Statistics for the 17,512 public procurements works tendered between 2000 and 2005, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents) included in the estimation sample of Table 4.

Figure 4: Overall distribution of the Auctions Starting Value



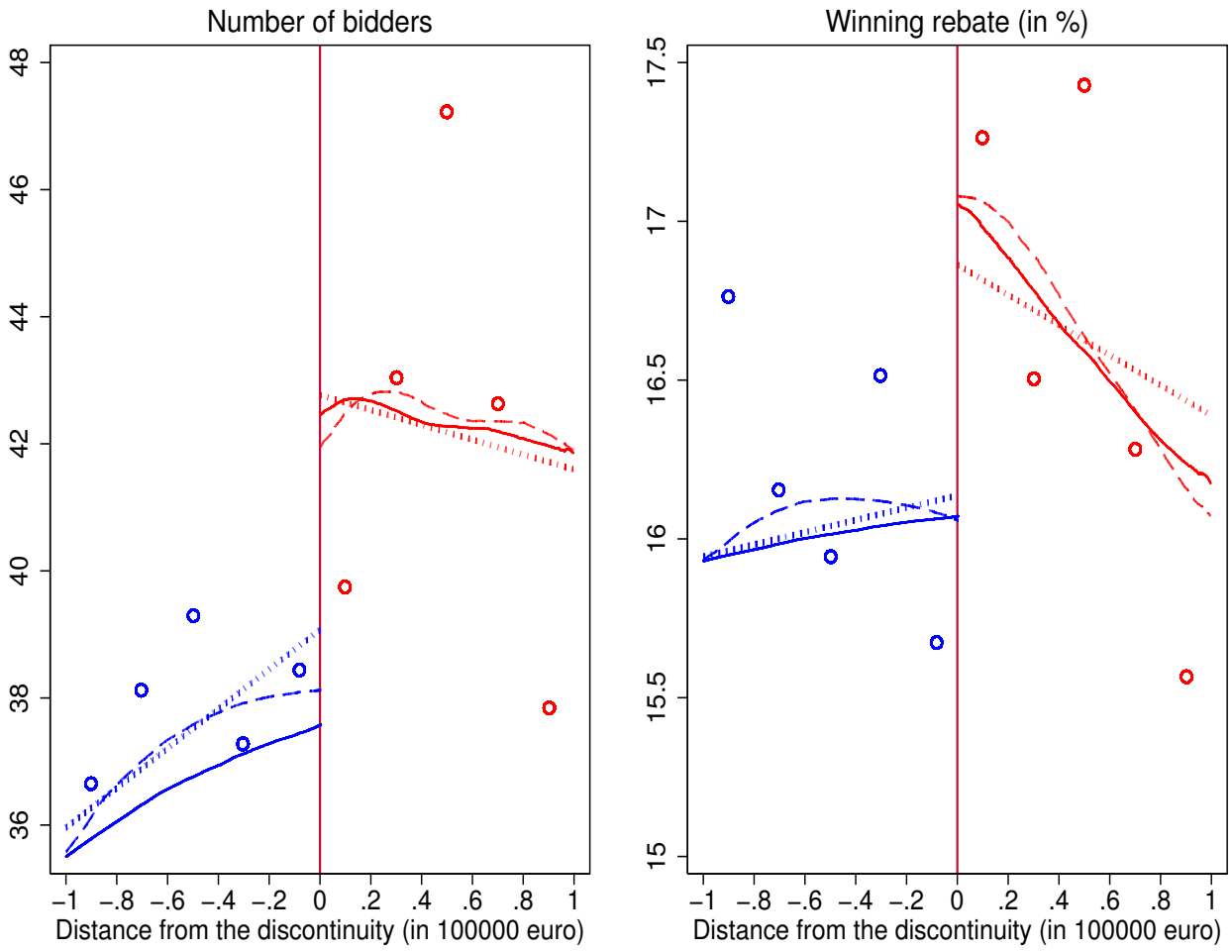
Notes. The (red) vertical line denotes the 500,000 euros discontinuity.
Source: Statistics for the 31,610 public procurements works tendered between 2000 and 2005, with starting value $y \in [1.5, 20]$, in 100,000 euros (2000 equivalents) of Table 2.

Figure 5: Density of the Auctions Starting Value Around the Threshold



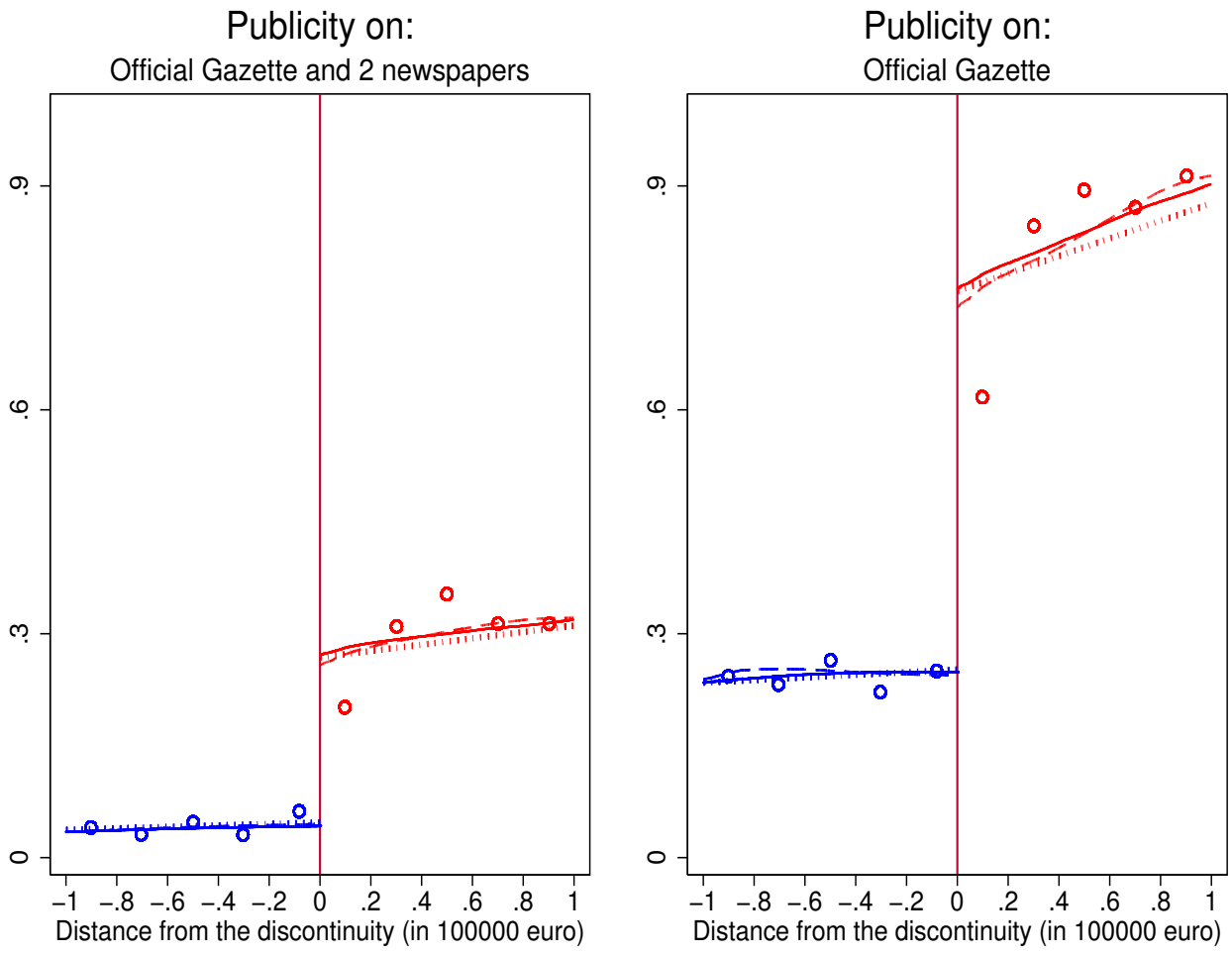
Notes. Circles represent sample averages of the dependent variable computed on 20,000 euros brackets of the running variable. The solid line is a least squares running-mean smoothing, separate on either side of the threshold. The (red) vertical line denotes the discontinuity, normalized to zero.
Source: Statistics for the 2,293 public procurements works tendered in year 2000, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents) included in the estimation sample of Table 4.

Figure 6: Discontinuity Effect of Publicity on Entry and Winning Rebate: Graphical Analysis (Intention-to-Treatment)



Notes. On the left the number of bidders, while on the right the winning rebates expressed as a percent reduction from the starting value of the auction. Circles represent sample averages of the dependent variable computed on 20,000 euros brackets of the running variable. The solid line (dashed line) [dotted line] is a least squares running-mean smoothing [local linear regression prediction], separated on either side of the threshold and computed on the sample of all auctions with starting value $y \in [2, 8]$ ($[y \in [2.66, 7.34]$, determined using the Imbens and Kalyanaraman, 2011 optimal bandwidth criterion]), in 100,000 euros (2000 equivalents). For presentational reasons, the figure plots averages of the dependent variable with running variable $y \in [4, 6]$. The red vertical line denotes the discontinuity, normalized to zero.
Source: Statistics for the 17,512 public procurements works tendered between 2000 and 2005, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents) included in the estimation sample of Table 4.

Figure 7: Discontinuity Effect on Publicity: Graphical Analysis (Intention-to-Treatment)



Notes. Circles represent sample averages of the dependent variable computed on 20,000 euros brackets of the running variable. The solid line (dashed line) [dotted line] is a least squares running-mean smoothing [local linear regression prediction], separated on either side of the threshold and computed on the sample of all auctions with starting value $y \in [2, 8]$ ($[y \in [2.66, 7.34]$, determined using the Imbens and Kalyanaraman, 2011 optimal bandwidth criterion]), in 100,000 euros (2000 equivalents). For presentational reasons, the figure plots averages of the dependent variable with running variable $y \in [4, 6]$. The red vertical line denotes the discontinuity, normalized to zero.
Source: Statistics for the 17,512 public procurements works tendered between 2000 and 2005, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents) included in the estimation sample of Table 4.

Appendix

Table A.1: Sensitivity of the Results to Different Polynomial Approximations of $g(Y_i - y_0)$

Method	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE
$g(Y_i - y_0)$	linear	linear	quadratic	quadratic	cubic	cubic	quartic	quartic	quintic	quintic
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Panel A: Number of bidders									
Theor. Publicity	2.022*		2.688**		2.284		3.348**		3.343**	
	(1.106)		(1.256)		(1.496)		(1.631)		(1.631)	
Publicity		8.127*		11.786**		10.430		16.015**		15.985**
		(4.458)		(5.584)		(6.860)		(7.976)		(7.971)
Lee-Lemieux test		0.001		0.025		0.013		0.207		0.204
	Panel B: Winning rebate									
Theor. Publicity	0.579**		0.487		0.819**		1.103***		1.100***	
	(0.278)		(0.301)		(0.376)		(0.399)		(0.399)	
Publicity		2.328**		2.137		3.738**		5.274***		5.258***
		(1.126)		(1.340)		(1.745)		(2.005)		(2.002)
Lee-Lemieux test		0.001		0.001		0.658		0.857		0.950
Observations	17,512	17,512	17,512	17,512	17,512	17,512	17,512	17,512	17,512	17,512

Notes. Coefficient (and SE in parenthesis) of the effect of publicity. In *Panel A* the dependent variable is the number of bidders, in *Panel B* the winning rebate. Columns 1 and 2 control for the difference of the starting value from the threshold *(linear)*; columns 3 and 4 add the squared term *(quadratic)*, columns 5 and 6 add the cubic term *(cubic)*, columns 7 and 8 control add the quartic term *(quartic)*, columns 9 and 10 add the quintic term *(quintic)*. *Theo. Publicity* is the theoretical level of publicity determined by the starting value, $y \geq 5$. *Publicity* is the observed level of publicity. *F-first stage* is the first-stage F-statistics for the excluded instrument. *Lee-Lemieux test* is the *p-value* of the test for the joint significance of the bin dummies. Odd columns report OLS-ITT estimates while even columns IV-LATE estimates using *Theo. Publicity* as the instrument for *Publicity*. SEs adjusted for heteroskedasticity. Significance at the 10% (*), at the 5% (**), and at the 1% (***).
Source: Statistics for all the public procurements works tendered between 2000 and 2005, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents).

Table A.2: Discontinuity Effect of Publicity on Entry and Winning Rebate: Two Levels of Treatment

Estimation Method	One Step (1)	Two Step (2)	One step (3)	Two Step (4)
	Panel A: Full Sample, $y \in [2, 8]$			
	Number of Bidders		Winning Rebate	
Mean Outcome	35.77		16.06	
Provincial Publicity	1.893*	6.507***	-1.259***	0.385
	(1.127)	(1.709)	(0.309)	(0.404)
Regional Publicity	5.566***	8.720***	0.504***	1.627***
	(0.690)	(1.102)	(0.172)	(0.241)
Generalized Residuals		-4.771***		-1.699***
		(1.256)		(0.264)
Prov. + Reg. Pub	7.458	15.23	-0.755	2.012
H_0 :Prov. + Reg. Pub=0	0.001	0.001	0.046	0.001
Observations	17,512	17,512	17,512	17,512
	Panel B: Optimal Bandwidth, $y \in [2.66, 7.34]$			
	Number of Bidders		Winning Rebate	
Mean Outcome	32.59		15.82	
Provincial Publicity	1.766	7.965***	-1.180***	0.791*
	(1.294)	(1.804)	(0.335)	(0.471)
Regional Publicity	5.501***	10.101***	0.724***	2.187***
	(0.759)	(1.002)	(0.190)	(0.307)
Generalized Residuals		-6.556***		-2.084***
		(1.242)		(0.343)
Prov. + Reg. Pub	7.266	18.07	-0.456	2.978
H_0 :Prov. + Reg. Pub=0	0.001	0.001	0.272	0.001
Observations	16,103	16,103	16,103	16,103

Notes. Coefficient (and SE in parenthesis) of the effects of Regional and Provincial publicity. In columns 1-2 the dependent variable is the number of bidders; in columns 3-4 the winning rebate. For each panel, the first row reports the mean outcome of each dependent variable. *Provincial Publicity* and *Regional Publicity* are indicators of the observed level of publicity at provincial and regional levels. All the regressions include the 4^{th} order polynomial in the difference of the starting value from the threshold, and five year indicators. Columns 1, and 3 report One Step OLS estimates while 2 and 4 the Two Step OLS estimates controlling for the first-step generalized residuals. *Generalized Residuals*, are obtained substituting the first-step estimated coefficients in this formula: $\psi_{li} = \frac{\phi((c_{l-1} - \beta Theo.Pub_i - \delta X_i) - \phi(c_l - \beta Theo.Pub_i - \delta X_i)}{\Phi(c_l - \beta Theo.Pub_i - \delta X_i) - \Phi(c_{l-1} - \beta Theo.Pub_i - \delta X_i)}$, where $l = 1, 2, ..., L$ are publicity levels, c_l are cutoff levels and ϕ is the probability density function of the normal distribution. All the estimates use *Theo. Publicity* as the instrument for *Publicity* in the first-stage ordered probit. *Theo. Publicity* is the theoretical level of publicity determined by the starting value, $y \geq 5$. *Prov. + Reg. Pub* is the sum of the effects of the two levels of publicity. H_0 :*Prov. + Reg. Pub=0* is the *p-vaule* of the test of statistical significance of the sum. SEs adjusted for heteroskedasticity doing 150 bootstrap replications. Significance at the 10% (*), at the 5% (**), and at the 1% (***).

Source: Statistics for all the public procurements works tendered between 2000 and 2005, with starting value $y \in [2, 8]$ ($y \in [2.66, 7.34]$ in the optimal bandwidth sample in Panel B), in 100,000 euros.

Table A.3: Trend Analysis

Dependent variable	Publicity	Publicity	Number of bidders	Number of bidders	Number of bidders	Number of bidders	Winning rebate	Winning rebate	Winning rebate	Winning rebate rebate
Method	OLS-ITT	OLS-ITT	OLS-ITT	OLS-ITT	IV-LATE	IV-LATE	OLS-ITT	OLS-ITT	IV-LATE	IV-LATE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Theo. Publicity	0.211***	0.209***	3.378**	3.348**			1.106***	1.103***		
	(0.020)	(0.020)	(1.655)	(1.631)			(0.401)	(0.399)		
Publicity					16.043**	16.015**			5.251***	5.274***
					(8.028)	(7.976)			(1.998)	(2.005)
F-first stage					187.3	185.4			187.3	185.4
Year effects	no	yes	no	yes	no	yes	no	yes	no	yes
4^{th} order poly.	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
$y \in [2, 8]$	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	17,512	17,512	17,512	17,512	17,512	17,512	17,512	17,512	17,512	17,512

Notes. Coefficient (and SE in parenthesis) of the effect of publicity. In columns 1-2 the *Dep.Var.* is the observed level of publicity (first stage), while the number of bidders in columns 3-6, and the winning rebate in columns 7-10. *Theo. Publicity* is the theoretical level of publicity determined by the starting value, $y \geq 5$. *Publicity* is the observed level of publicity. *F-first stage* is the first-stage F-statistics for the excluded instrument. Columns 3,4 and 7,8 report OLS-ITT estimates while 5,6 and 9,10 report IV-LATE estimates using *Theo. Publicity* as the instrument for *Publicity*. All the regressions include the 4^{th} order polynomial in the difference of the starting value from the threshold. Odd columns do not include five year indicators (i.e., year effects). SEs adjusted for heteroskedasticity. Significance at the 10% (*), at the 5% (**), and at the 1% (***).
Source: Statistics for all the public procurements works tendered between 2000 and 2005, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents). The number of observations is smaller than the one of the full sample because here we restrict the analysis to auctions with starting value $y \in [2, 8]$.

Table A.4: Discontinuity Effect of Publicity on Entry and Winning Rebate: Local Linear (Rectangular) Kernel Regression Analysis

Dependent variable	Publicity	Number of bidders	Number of bidders	Winning rebate	Winning rebate
Method	OLS-ITT	OLS-ITT	IV-LATE	OLS-ITT	IV-LATE
	(1)	(2)	(3)	(4)	(5)
Mean outcome	0.10	35.77		16.06	
Theo. Publicity	0.229***	2.834**		0.551*	
	(0.015)	(1.230)		(0.298)	
Publicity			12.385**		2.409*
			(5.453)		(1.325)
F-first stage			399.8		399.8
Year effects	yes	yes	yes	yes	yes
Local Linear	yes	yes	yes	yes	yes
$y \in [2, 8]$	yes	yes	yes	yes	yes
Observations	17,512	17,512	17,512	17,512	17,512

Notes. Coefficient (and SE in parenthesis) of the effect of publicity. In column 1 the *Dep.Var.* is the observed level of publicity (first stage), while the number of bidders in columns 2-3, and the winning rebate in columns 4-5. The first row reports the mean outcome of each dependent variable. *Theo. Publicity* is the theoretical level of publicity determined by the starting value, $y \geq 5$. *Publicity* is the observed level of publicity. *F-first stage* is the first-stage F-statistics for the excluded instrument. All the regressions include the starting value from the threshold, its interaction term with *Theo.Publicity*, and five year indicators. Columns 2 and 4 report OLS-ITT estimates while 3 and 5 report IV-LATE estimates using *Theo. Publicity* as the instrument for *Publicity*. SEs adjusted for heteroskedasticity. Significance at the 10% (*), at the 5% (**), and at the 1% (***).
Source: Statistics for all the public procurements works tendered between 2000 and 2005, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents).

Table A.5: Alternative Kernel Functions

Model	4-th	4-th	LLR	LLR	4-th	4-th	LLR	LLR
Kernel	Rectangular	Triangular	Rectangular	Triangular	Rectangular	Triangular	Rectangular	Triangular
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Full sample, $y \in [2, 8]$							
	Number of bidders				Winning rebate			
Mean Outcome	35.77				16.06			
Publicity	16.015**	16.990*	12.385**	13.967**	5.274***	6.772***	2.409*	3.977***
	(7.976)	(8.675)	(5.453)	(6.124)	(2.005)	(2.275)	(1.325)	(1.534)
Observations	17,512	17,512	17,512	17,512	17,512	17,512	17,512	17,512
	Panel B: Optimal bandwidth, $y \in [2.66, 7.34]$							
	Number of bidders				Winning rebate			
Mean Outcome	32.59				15.82			
Publicity	17.224*	15.462	17.434***	16.571**	5.480**	6.158**	3.628**	4.411**
	(9.034)	(9.856)	(6.091)	(6.987)	(2.306)	(2.596)	(1.494)	(1.769)
Observations	16,103	16,103	16,103	16,103	16,103	16,103	16,103	16,103

Notes. Coefficient (and SE in parenthesis) of the effect of publicity on the number of bidders (Columns 1-4) and the winning rebate (Columns 5-8). Columns 1,2, and 5,6 report 4^{th} order polynomial regression. They include the 4^{th} order polynomial regressions in the difference of the starting value from the threshold. Columns 3,4, and 7,8 report local liner regressions (LLR). They include the difference of the starting value from the threshold and its interaction term with *Theo.Publicity*. *Theo. Publicity* is the theoretical level of publicity determined by the starting value, $y \geq 5$. Odd (even) columns report rectangular (triangle) kernels estimates. *Publicity* is the observed level of publicity instrumented with *Theo. Publicity*. All the regressions include five year indicators. SEs adjusted for heteroskedasticity. Significance at the 10% (*), at the 5% (**), and at the 1% (***).
Source: Statistics for all the public procurements works tendered between 2000 and 2005. Panel A (Panel B) reports estimates for auctions with starting value $y \in [2, 8]$ ($y \in [2.66, 7.34]$ in the optimal bandwidth sample), in 100,000 euros (2000 equivalents).

Table A.6: First-Stage Estimates

Model	4th-poly	4th-poly	4th-poly	4th-poly	LLR	LLR	LLR	LLR	Linear
Bandwidth	[2-8]	[2.66, 7.34]	[3.5-6.5]	[4.63-5.38]	[2-8]	[2.66, 7.34]	[3.5-6.5]	[4.63-5.38]	[4.63-5.38]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Theo. Publicity	0.209***	0.189***	0.174***	0.099**	0.229***	0.217***	0.191***	0.074**	0.197***
	(0.020)	(0.019)	(0.023)	(0.040)	(0.015)	(0.015)	(0.018)	(0.032)	(0.018)
F-first stage	107.1	98.67	59.02	5.943	222.3	215.0	116.0	5.288	123.4
Observations	17,512	16,103	9,365	2,207	17,512	16,103	9,365	2,207	2,207

Notes. Coefficient (and SE in parenthesis) of the effect of *Theo. Publicity* on the observed level of publicity. *Theo. Publicity* is the theoretical level of publicity determined by the starting value, $y \geq 5$. In columns 1-4, the regressions include the 4^{th} order polynomial in the difference of the starting value from the threshold, and five year indicators. In columns 5-8, the regressions include the starting value from the threshold, its interaction term with Theo.Publicity, and five year indicators (local linear regressions, LLR). *F-first stage* is the first-stage F-statistics for the excluded instrument. Columns 1 and 5 consider all the public procurements works tendered between 2000 and 2005, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents). Columns 2 and 6 procurement works with starting value $y \in [2.66, 7.34]$ (Optimal bandwidth), Columns 3 and 7 procurement works with starting value $y \in [3.5, 6.5]$ (Half original bandwidth), Columns 4 and 8 procurement works with starting value $y \in [4.63, 5.38]$. Column 9 considers a model that does not control for the starting value of the auctions. SEs adjusted for heteroskedasticity. Significance at the 10% (*), at the 5% (**), and at the 1% (***).
Source: Statistics for all the public procurements works tendered between 2000 and 2005.

Table A.7: Effects of Publicity in Small and Large Cities

Model	base	population	small	large	base	population	small	large
Method	IV-LATE	IV-LATE	IV-LATE	IV-LATE	IV-LATE	IV-LATE	IV-LATE	IV-LATE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Number of bidders				Winning rebate			
Publicity	16.015**	18.962**	17.183	16.318*	5.274***	6.279***	5.442	5.296**
	(7.976)	(8.276)	(16.886)	(9.039)	(2.005)	(2.079)	(4.185)	(2.275)
Population		0.105***				0.044***		
		(0.012)				(0.002)		
Observations	17,152	17,152	3,936	13,216	17,152	17,152	3,936	13,216

Notes. Coefficient (and SE in parenthesis) of the effect of publicity. In columns 1-4 (5-8), the *Dep.Var.* is the number of bidders (winning rebate). In columns 1 and 5 we report the baseline estimates. Columns 2, and 6 include the resident population of the municipality of the public administration (in 10,000 inhabitants in 2001). In columns 3,4 and 7,8 we report the estimates of publicity for small and large cities. *Publicity* is the observed level of publicity. *Theo. Publicity*, which is the theoretical level of publicity determined by the starting value, $y \geq 5$. IV-LATE estimates using *Theo. Publicity* as the instrument for *Publicity*. All the regressions include the 4^{th} order polynomial in the difference of the starting value from the threshold, and five year indicators. SEs adjusted for heteroskedasticity. Significance at the 10% (*), at the 5% (**), and at the 1% (***).

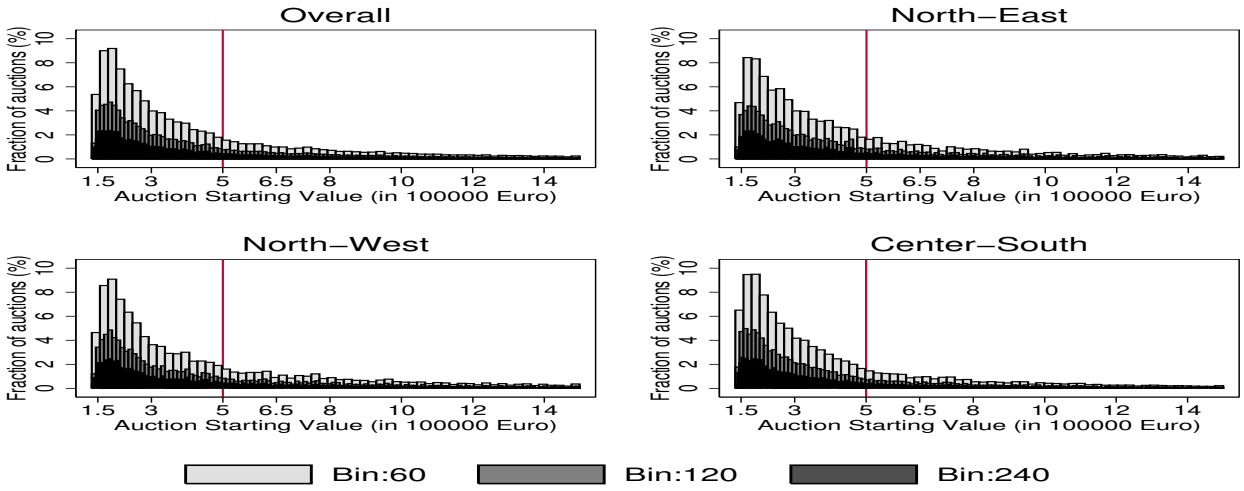
Source: Statistics for all the public procurements works tendered between 2000 and 2005, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents).

Table A.8: Falsification Exercise at Simulated Thresholds

Dependent variable	Threshold at $y \geq 3$		Threshold at $y \geq 4.5$		Threshold at $y \geq 5.5$		Threshold at $y \geq 7$	
	Number of bidders	Winning rebate	Number of bidders	Winning rebate	Number of bidders	Winning rebate	Number of bidders	Winning rebate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Panel A: OLS-ITT				
Theo. Pub.	-0.339	-0.432	-0.015	0.648	3.065	0.187	5.339	-0.273
	(1.496)	(0.398)	(2.207)	(0.556)	(3.417)	(0.736)	(4.213)	(0.812)
				Panel B: IV-LATE				
Publicity	34.935	44.529	3.007	-132.627	-909.835	-55.433	473.519	-24.185
	(152.465)	(65.669)	(450.447)	(489.675)	(12,272.621)	(762.223)	(2,449.163)	(135.280)
F-first stage	0.722	0.722	0.089	0.089	0.005	0.005	0.044	0.044
Year effects	yes	yes	yes	yes	yes	yes	yes	yes
4^{th} order poly.	yes	yes	yes	yes	yes	yes	yes	yes
$y \in [2, 5)$	yes	yes	yes	yes	yes	yes	no	no
$y \in (5, 8]$	no	no	no	no	no	no	yes	yes
Observations	13,727	13,727	13,727	13,727	3,785	3,785	3,785	3,785

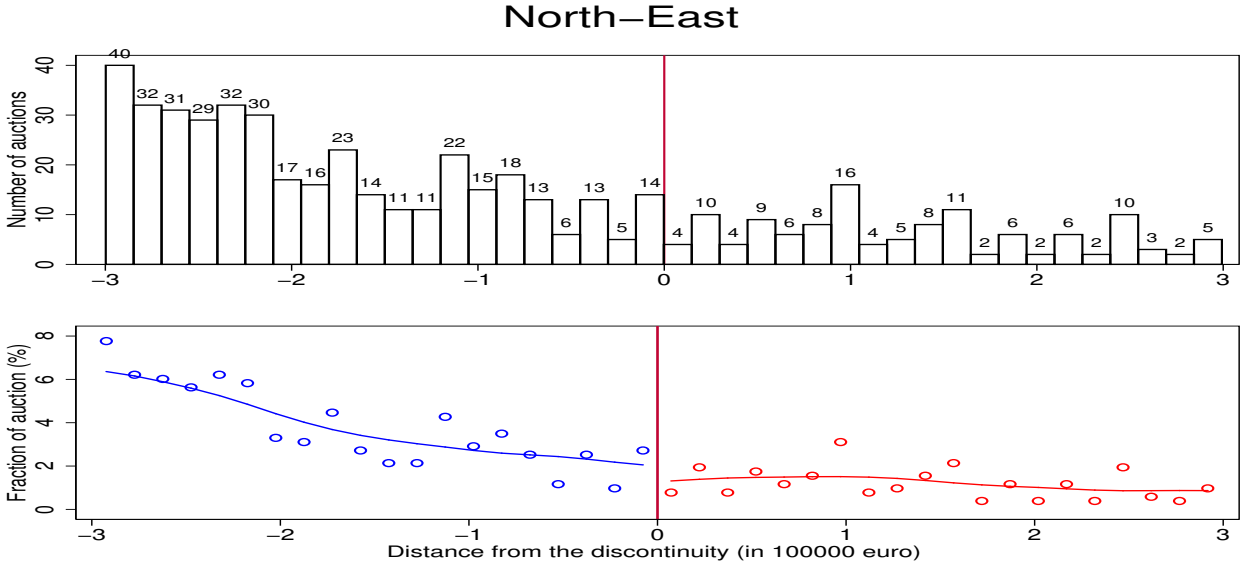
Notes. Coefficient (and standard error in parenthesis) of the effect of publicity on the number of bidders (odd columns); the winning rebate (even columns). *Panel A* reports the OLS-ITT estimates; *Panel B* the IV-LATE estimates the using *Theo. Publicity* as instrument for *Publicity*. *Theo. Pub.* is the theoretical level of publicity determined by the starting value ($y \geq 3$ in columns 1 and 2; $y \geq 4.5$ in columns 3 and 4; $y \geq 5.5$ in columns 5 and 6 and $y \geq 7$ in columns 7 and 8), *Publicity* is the observed level of publicity. *F-first stage* is the first-stage F-statistics for the excluded instrument. All the regressions include the 4^{th} order polynomial in the difference of the starting value from the simulated thresholds, and five-year indicators. SEs adjusted for heteroskedasticity. Significance at the 10% (*), at the 5% (**), and at the 1% (***).
Source: Statistics for the 17,512 public procurements works tendered between 2000 and 2005, with starting value $y \in [2, 5)$, in 100,000 euros (2000 equivalents) in columns 1–4; and with starting value $y \in (5, 8]$, in 100,000 euros (2000 equivalents) in columns 4–8. The number of observations is smaller than the one of the full sample described in Table 2 because here we restrict the analysis to the same estimation sample of Table 4.

Figure A.1: Overall distribution of the Auctions Starting Value, by Macro-Areas



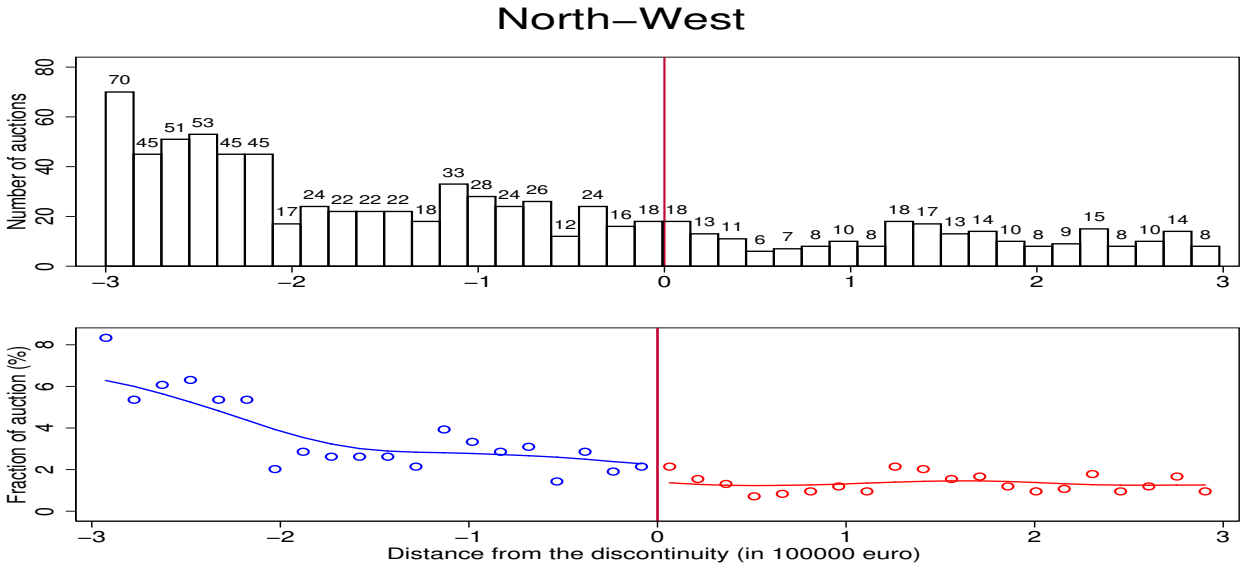
Notes. The (red) vertical line denotes the 500,000 euros discontinuity.
Source: Statistics for the 31,610 public procurements works tendered between 2000 and 2005, with starting value $y \in [1.5, 20]$, in 100,000 euros (2000 equivalents).

Figure A.2: Density of the Auctions Starting Value Around the Threshold



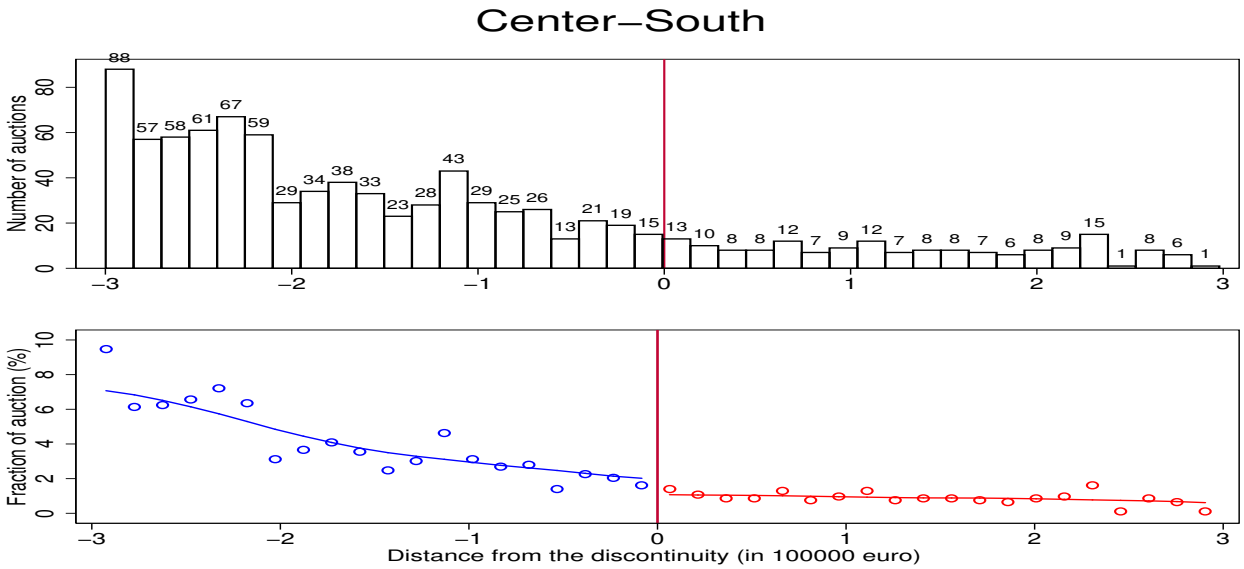
Notes. Circles represent sample averages of the dependent variable computed on 20,000 euros brackets of the running variable. The solid line is a least squares running-mean smoothing, separate on either side of the threshold. The (red) vertical line denotes the discontinuity, normalized to zero.
Source: Statistics for public procurements works tendered in year 2000, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents) included in the estimation sample.

Figure A.3: Density of the Auctions Starting Value Around the Threshold



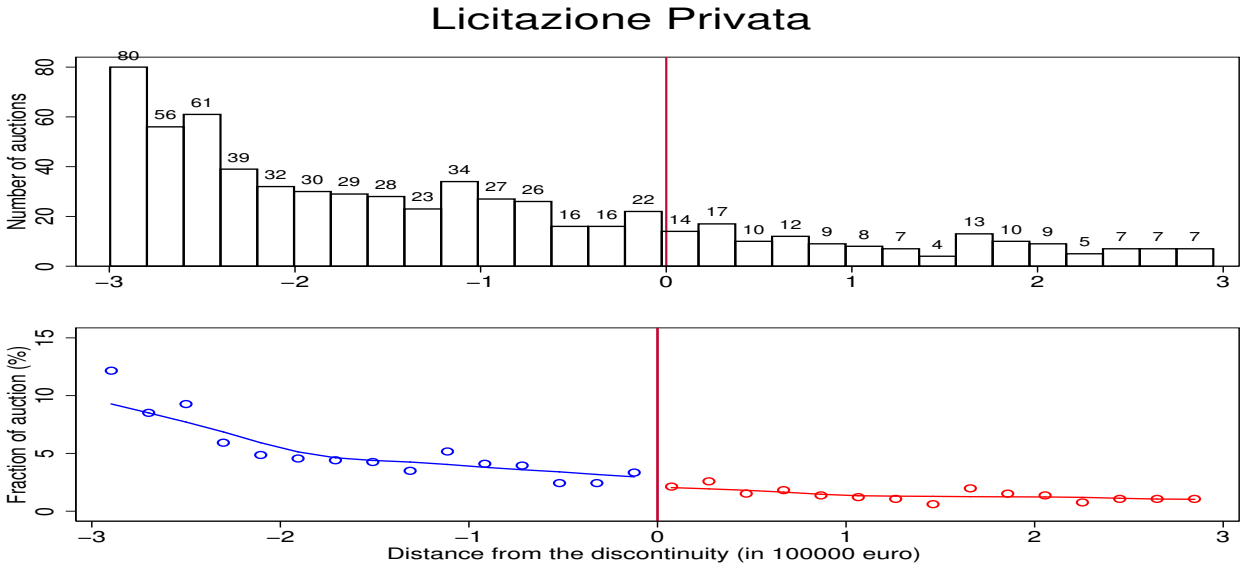
Notes. Circles represent sample averages of the dependent variable computed on 20,000 euros brackets of the running variable. The solid line is a least squares running-mean smoothing, separate on either side of the threshold. The (red) vertical line denotes the discontinuity, normalized to zero.
Source: Statistics for public procurements works tendered in year 2000, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents) included in the estimation sample.

Figure A.4: Density of the Auctions Starting Value Around the Threshold



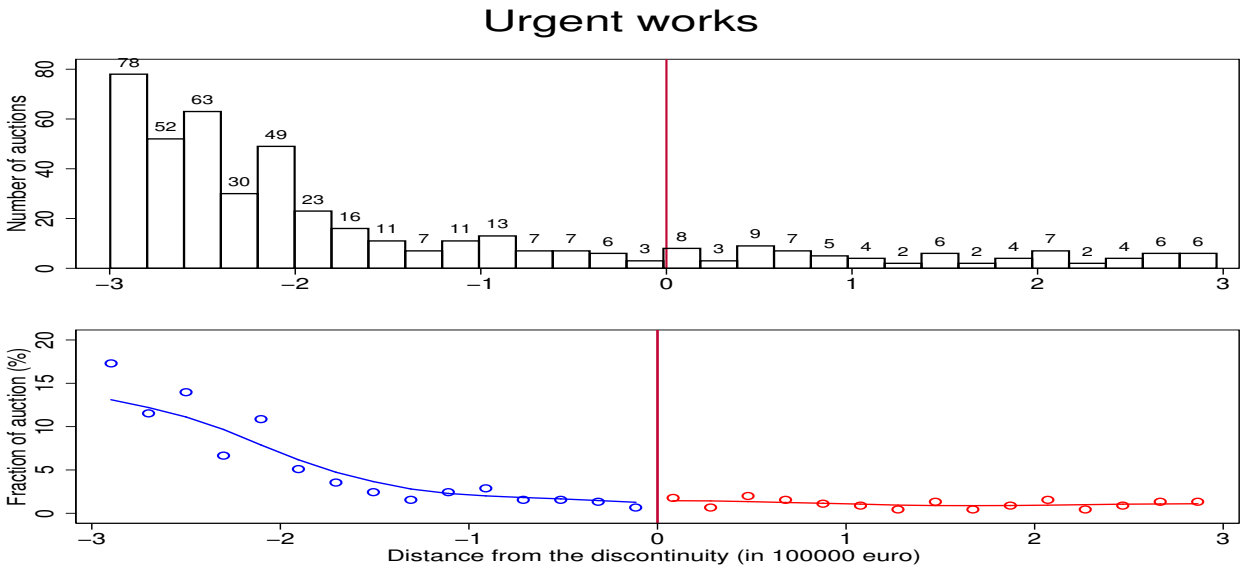
Notes. Circles represent sample averages of the dependent variable computed on 20,000 euros brackets of the running variable. The solid line is a least squares running-mean smoothing, separate on either side of the threshold. The (red) vertical line denotes the discontinuity, normalized to zero.
Source: Statistics for public procurements works tendered in year 2000, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents) included in the estimation sample.

Figure A.5: Density of the Auctions Starting Value Around the Threshold



Notes. Circles represent sample averages of the dependent variable computed on 20,000 euros brackets of the running variable. The solid line is a least squares running-mean smoothing, separate on either side of the threshold. The (red) vertical line denotes the discontinuity, normalized to zero.
Source: Statistics for public procurements works tendered in year 2000, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents) included in the estimation sample.

Figure A.6: Density of the Auctions Starting Value Around the Threshold



Notes. Circles represent sample averages of the dependent variable computed on 20,000 euros brackets of the running variable. The solid line is a least squares running-mean smoothing, separate on either side of the threshold. The (red) vertical line denotes the discontinuity, normalized to zero.
Source: Statistics for public procurements works tendered in year 2000, with starting value $y \in [2, 8]$, in 100,000 euros (2000 equivalents) not included in the estimation sample.