



Impact of the time limits for the receipt of tenders on the number of bidders: Evidence from Greek public procurement

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Impact of the time limits for the receipt of tenders on the number of bidders: Evidence from public procurement in Greece

Abstract

Purpose – The purpose of this paper is to examine how the period for which a public procurement notice remains open for bidding (Δt) affects the number of bids.

Design/methodology/approach – We investigated data for 2,404 open procurement tenders in Greece for the years 2018 - 2021. Using Δt as our grouping factor, we defined two samples based on the EU time limits for the receipt of tenders. Group 1 ($\Delta t \leq 35$) contains all tenders for which the Contracting Authorities (CAs) have chosen to limit themselves to the minimum number of days allowed by law. Group 2 ($\Delta t > 35$) includes the remaining tenders where CAs have chosen to keep their notices open for periods beyond the existing minimum time limits, as they are encouraged to do by law.

Findings – A Mann–Whitney U test, in combination with graphical analysis, revealed that CAs from Group 2 tend to enjoy more bids per tender, that is, more intense competition.

Social implications – The paper allows decision-makers and legislators understanding the relationship between the time CAs choose to keep their notices open for bidding and the number of bidders in each tender, that is competition, which according to other authors affects the outcomes of public procurement procedures.

Originality/value – The paper fills the research gap regarding the relationship between time for preparation and number of bids in each tender.

Keywords *procurement, tender process, competition*

Paper type Research paper

1. Introduction

Factors found to be influencing the number of bidders have been explored in several studies (Al-Arjani, 2002; Chua and Li, 2000; Estache and Iimi, 2011), with most of them focusing only on public work projects. According to the literature, the number of bids is affected by the project type and size (Al-Arjani, 2002; Estache and Iimi, 2011), the nature of work (Chua and Li, 2000; Estache and Iimi, 2011), social and economic conditions (Chua and Li, 2000), as well as the Contracting Authorities (CAs) themselves (Estache and Iimi, 2011). The importance of these factors is reinforced when we consider that researchers have linked competition (in terms of number of bids) with the risk of collusion and corruption (Estache and Iimi, 2011), the bid price (Shrestha and Pradhananga, 2010), the award-to-expected price ratio (Hanák and Muchová, 2015), and the bidding gaps (Li *et al.*, 2008). Although most authors agree on the main factors affecting the number of bids, what is not yet clear is the impact of the publication period of each notice, that is, the time available to bidders to submit their bids. This paper examines how the period for which a public procurement notice remains open for bidding affects the number of bids. Understanding the links between the time that the CAs choose to keep their notices open for bidding and the number of tenderers may prove to be beneficial for the decision-makers (CAs, governments, lawmakers, bureaucrats, etc.).

To our knowledge, only Chua and Li (2000), attempted to investigate the impact of the factor “time allowed for bid preparation” on the intention of the Economic Operators (EOs) to submit a bid and therefore on the number of bids. Their study found evidence that this factor has a different weight on the EOs’ decision-making process according to the contract type (unit rate, lump sum, and design/built). The difference in the factor weights among contract types indicates that there is indeed an impact of this factor on competition. Nevertheless, further research is needed to examine the links between time and competition. The importance of such research is underscored by the fact that we can observe cases of contests where tenderers have been excluded due to outdated tenders (Authority for the Examination of Preliminary Appeals - Remedies Review Body, 2018, 2019). These tenderers have apparently made a positive decision on whether to bid. In other words, they all had the intention to bid, that is, the evaluation of the factor “time allowed for bid preparation” of Chua and Li (2000) did not prevent them from doing so. However, it could be hypothesized that the same factor affected their ability to submit a bid successfully and, therefore, also affected the final number of bidders and consequently competition.

The purpose of this paper is to examine how the period for which a notice remains open for bidding affects the number of bids. Our approach was inspired by the work of Chua and Li (2000), who were the first to discern the importance of time in public procurement processes, and also by the work of researchers who examined competition among tenderers. Similar to previous designs (Al-Arjani, 2002; Hanák and Muchová, 2015), we will group and compare our cases using statistical methods. Our grouping factor will be the time available for the EOs to prepare and submit their tenders, and the results of the analysis will allow us to answer the main question of the paper:

Q₁: Does the period a contest notice remains open for bidding significantly affect the number of bids?

To do so, we will use data from contests of Greek Contracting Authorities (CAs), for the years 2018 - 2021, following the example of researchers who examined competition among tenderers (Al-Arjani, 2002; Hanák and Muchová, 2015; Li *et al.*, 2008; Shrestha and Pradhananga, 2010). In contrast with previous similar work that used samples to investigate the issue, our approach will focus on all the available contests in those four years, which were published by Greek CAs.

As a Member State (MS) of the European Union (EU), Greece follows the EU public procurement legislation. The examination of the issue in the Greek public procurement market will allow us to also examine the extent of competition in the EU. In particular, we will focus on contests in which, due to their net worth, common deadlines apply in all EU MS, and EOs from any MS have the right to submit their tenders (European Commission, 2014; Hellenic Parliament, 2016). Thus, we will group our cases according to the EU minimum time limits, with the first group containing all the contests in which the CAs decided to give the minimum legal time for the preparation of the bids to their tenderers, and with the second containing the remaining contests where the CAs let their bidders prepare their tenders for a longer period, as they are encouraged to do by law. As a result, this design will allow us to answer the second question of the paper.

Q₂: Are the EU time limits ideal for the development of adequate competition between economic operators?

2. Literature review

Competition is a key principle in public procurement, as it has an important role in the mitigation of the risk of collusion and corruption (Estache and Iimi, 2011). According to Chua and Li (2000), competition in public procurement is reflected in two forms: (1) the number of firms and (2) the competitiveness among them. Many researchers investigated this

concept in public procurement, and, in their works, we can identify two approaches. According to the first approach, competition is examined using data collected from potential bidders (Chua and Li, 2000; Estache and Iimi, 2011), while in the second public data from actual tenderers of contests are used (Al-Arjani, 2002; Hanák and Muchová, 2015; Li *et al.*, 2008; Shrestha and Pradhananga, 2010). As stated by Estache and Iimi (2011), in the second approach, a question of observability arises. The limitation of this research design is that it allows us to observe bids only if the economic operators decide to participate in the process and succeed in all the prequalification procedures. However, even under this restriction, the study of the competition among actual tenderers is worthy, as the observed economic operators are those who will finally affect the characteristics and form the results of each tender (i.e., final value, contract duration, quality). Using the EU terminology,¹ we can redefine the above two approaches as one where the authors look at competition among economic operators and another where they look at competition among tenderers.

Beyond the nature of the collected data, the main difference between the above approaches is the number of economic entities (economic operators or tenderers) they contain. The number of EOs is equal to the number of all potential firms which may place a tender, while the number of tenderers is significantly smaller since entry barriers may apply. Shrestha and Pradhananga (2010) examined public work street projects and estimated the average number of tenderers at each project to be about four. Hanák and Muchová (2015) found this number to be 6.47 for public buildings and facilities and 7.60 for transport infrastructure public work contests. Close to their results is Al-Arjani (2002), who calculated the mean of tenderers to be 7.10 per contest. Nevertheless, regardless of the approach they follow, researchers focus on two areas: (1) the factors that affect competition (Al-Arjani, 2002; Chua and Li, 2000; Estache and Iimi, 2011; Hanák and Muchová, 2015), and (2) its impact on the results of the contests (Hanák and Muchová, 2015; Li *et al.*, 2008; Shrestha and Pradhananga, 2010).

2.1. Competition between economic operators

Previously we noted that the two concepts of competition in public procurement are the number of tenders and the competitiveness among them. As stated by Estache and Iimi (2011), who studied competition in infrastructure procurement, the World Bank (2003) specifies that, during the bidding period, competition is not determined exclusively by the number of bids: the whole process may be considered successful, even with the submission of only one bid, provided that “the bid was satisfactorily advertised and prices are reasonable in comparison to market values”.

Chua and Li (2000), who studied the bidding decision process in three different types of contracts (unit rate, lump sum, and design/built), identified and examined twenty-six factors that may affect competition among economic operators, categorized into three groups: (a) the nature of work, (b) the bidding requirements, and (c) social and economic conditions. They came up with the following which, according to their study, have the greatest impact on the intention of an economic operator to place a tender, and obviously shape the level of competition: (a) the availability of other projects, (b) the availability of qualified staff, (c) the cash flow requirement, (d) the degree of technical difficulty, (e) the identity of owner/consultant, (f) the project timescale and penalty for noncompletion, (g) the size of the project, and (h) the time allowed for bid preparation. Their study is based on the answers to a questionnaire that was distributed to 153 G7 and G8 grade contractors.² Of the above factors, the first two which refer to the category “social and economic conditions”

¹ See article 2 of the 2014/24/EU Directive

² Contractors’ registration system of Singapore based on paid-up and net capital which defines the value thresholds of projects each contractor is allowed to place a tender.

have the greatest impact, as they carried 50% of total key weights in their research. The next 35% comes from factors (c) to (g), which belong to the first group ("nature of work"). Finally, the bidding requirements, and specifically "the time allowed for bid preparation", affect the bid/no-bid decision with the following weight: 11% for the unit rate, 14% for the lump sum, and 16% for the design/built contracts. Similar work has also been pursued by Estache and Iimi (2011) in which, by taking into consideration that economic operators decide to become tenderers according to (a) their endowments, (b) rivals' behavior, and (c) the nature of projects being auctioned, they concluded that competition must be described by the whole decision-making process of economic operators as well as the number of bids.

Nevertheless, the bidding process may not always be open for every economic operator to submit a tender. Contracting authorities have the option to select different types of procedures including restricted ones (European Commission, 2014), to ensure quality, and avoid time delays and tenderers with little chance of succeeding in the selection process (Estache and Iimi, 2011). To better understand this kind of procedure, we will adopt the definition "candidate" as it is used by the European Commission (2014); "candidate" means an economic operator who has requested an invitation or been invited to participate in a restricted procedure. The candidate can be considered as an intermediate state between the economic operator and the tenderer. This is because, an economic operator who was chosen - after their request- or was invited by a CA as a candidate to participate in a restricted contest, will become a tenderer only if they will decide, given the contest's details, to submit a tender. By examining such types of contests, Estache and Iimi (2011) also recognized the existence of competition among EOs. In these cases of contests, both sides can affect competition which is distinguished by the final number of candidates. Firstly, the bidders themselves, as they will decide whether to participate after evaluating the situation, and secondly the contracting authorities, which have the power to exclude those economic operators who do not meet their requirements before they place bids. While someone could assume that the interference of the authorities at this stage could be catastrophic for the competition, Spagnolo (2012) states that, on average, the minimum number of candidates invited in restricted procedures is similar to the average number of tenderers who intentionally participate in open procedures.

However, even in open procedures, contracting authorities have the power to reduce the number of tenderers. Estache and Iimi (2011) mention that the determining factor through which the above can be achieved is "quality". They simply explain that quality in public procurement refers to any factor, other than the price, the authority considers important for a contract. Thus, in the quality-based selection, we observe that economic operators become self-selective, as the required skills and technology of the project may prevent them from placing tenders. The above requirements of the projects are translated into resources for the firms and, if these resources are not available at the time (i.e., if there are other ongoing projects), they will not place tenders. This situation makes it easier for large firms with plenty of resources to meet the authorities' requirements. Only when low requirements apply, there may be space for low-cost economic operators to place their tenders. As a result, that condition hides the danger of underestimating the true common value of the object, for both the contractor and the authority (Estache and Iimi, 2011).

2.2. Competition between tenderers

In this stage, we focus exclusively on tenderers, whose result during the previous phase on the bid/no-bid decision was positive. Shrestha and Pradhananga (2010) also agreed on the dynamic character of the bidding process, as we have already seen (Chua and Li, 2000; Estache and Iimi, 2011). They studied the whole process from the perspective of public street projects and tried to correlate (a) the contract award cost with the number of bidders and (b) the final cost with the lowest bid price. In their study, they used data from 113 public work projects from 1991 to 2008 with 435 tenderers. Shrestha and Pradhananga

(2010) demonstrated that the bid price and the number of tenderers are inversely proportional and, also, that the lowest bid price is strongly and significantly correlated with the final construction cost.

Al-Arjani (2002), explored how the type and size of maintenance and operation projects influence the number of bidders in Saudi Arabia and, by extension, the willingness of economic operators to place tenders. To do so, he determined four types of projects (building, biomedical, electromechanical, and water - wastewater maintenance projects) and five groups of project size, according to the contracting value. Al-Arjani (2002) applied One Way ANOVA and Bonferroni multiple t-tests to compare the means of bidders for each group and found evidence that the number of tenderers varies according to the characteristics (type and size) of each project. In particular, Al-Arjani's survey on the influence of project type on the number of bidders showed that in all project categories, except the biomedical and water-waste water projects, there appear important differences in the mean of the number of bidders. Regarding his research on project size, he proved an analogous relationship between the average, the minimum, and the maximum number of tenders with the size of the project.

Hanák and Muchová (2015) investigated the impact of competition, by the view of the bids number, on public structure contracts. In their study, they examine two aspects: how the number of tenderers is related to the type of structure and how this number affects the difference between the expected and the award price. The findings on the first question are consistent with the results of Al-Arjani's (2002) study. Particularly, competition in transport infrastructure projects was found to be higher than in public buildings and facilities projects. The second part of their work confirms another previous study. As demonstrated by Shrestha and Pradhananga (2010) and Carr (2005), Hanák and Muchová (2015) also found evidence that competition has a positive impact (negative correlation) on the final project price. The results of their study proved that the award-to-expected price ratio is inversely proportional to the number of tenderers in each contest.

Conceptually similar work has also been carried out by Li et al. (2008), who examined the impacts of the number of tenderers on bid values. They studied the bidding gaps (differences between the second/third lowest and the lowest tender) of 927 contests with more than two tenderers in Utah for the year 1990 and the years 1993-1999. Their results showed that the bid gap decreases when the bidders' number is increased. Specifically, if bidders increase from 3 to 6, they observed a decrease in the difference between the lowest and the immediate lower bid of 2.9% (a decrease from 7.4% to 4.5%). In other words, a higher number of tenders is translated into increased efficiency for the bids, because the probability to lose the contest is higher for the tenderers, and as a result, they squeeze further their bid prices.

2.2.1. Synopsis of literature

The study of the literature revealed that competition in public procurement is an important factor, as it is related to the final result of the process. It is generally accepted that to study competition, we have to agree on the dynamic nature of the public procurement process. Competition is not reflected only in the number of bidders, but also in the intensity between all the potential tenderers, since the time they are characterized as economic operators. As discussed, two categories of studies exist. Those who focused on the competition among economic operators, which results in a bid/no-bid decision, and those who examined competition between tenderers and its influence on the results of the contracts.

Economic operators, during the bid/no-bid decision-making process, evaluate a variety of factors to shape their decision. These factors could belong under any/some/all the following categories: (a) their capabilities, (b) their competitors, and (c) the characteristics of

the tender/contract. For example, we previously discussed that economic operators, before they decide to submit a bid, consider the availability of their resources, the sharpness of the competition, the type of each project, etc. However, there are many cases where not all the potential bidders are welcome. Authorities may themselves take action to reduce the final number of tenderers for reasons such as avoiding time delays and untrustworthy bidders. Even in these cases, we saw that competition remains intact, as the final number of tenderers will not differ significantly compared to the case where the authority has chosen an open procedure. Another category of studies focuses on the results of the competition in public procurement. In this approach, the authors investigated how the final cost of a contract is affected either by the number of tenderers or by the bidding prices. Furthermore, we have also noticed some attempts to combine the above and to find relations between the number of bids and their prices, as well as between the bid prices and the final cost.

The work in this area mainly deals with the study of public work projects, obviously because of their high construction cost. Nevertheless, public works are only a part of the procurement family. Thus, there is a need for further investigation of the area, either as a whole or partially, according to the contract type. Another aspect of competition in public procurement that has received limited attention in the literature is the available time economic operators have to prepare their bids. Previous research typically only investigated the importance of this factor for the bid/no-bid decision in three different types of contests. It revealed that “the time allowed for bid preparation” affects 11% of the decision for the unit rate, 14% for the lump sum, and 16% for the design/built contracts. Yet, as far as we know, no previous research has investigated whether the time available by law or authority is sufficient for bidders to be firstly informed, then prepared, and finally participate.

This question is of particular interest, if we consider: (a) the importance of the number of bids in shaping the outcome of each tender, (b) that public procurement procedures have undergone a digital transformation in recent years, and (c) the fact that the time limits are set by the legislation. More specifically, even in the case of a successful (with one bid) built contract where contractors said that time has the highest (16%) weight on their bid decision, in contrast to the other types where this percentage is lower, could we safely assume that (a) the given time by the legislation was enough for all economic operators to be informed/prepared and (b) more time could not increase the number of bids?

3. Research design

In the real world, a contracting authority at the end of a bidding process will face only some of the potential bidders or, in the worst-case scenario, none of them. As we have already seen in the literature, the reduction of this number is a common characteristic of any procurement procedure. This paper focuses on open procedures with at least one bid to determine the impact of the time available for bidders to submit their bids on their final number.

Let us assume that in the market exist N firms that can fulfill a specific need of a public authority. For our study, as it is focused on an EU member state, the N refers to any firm from any EU country. These firms are all potential contractors, who we call economic operators (EOs). The public procurement cycle begins with the identification of the need by the contracting authority (CA) (Ferwerda *et al.*, 2017). Subsequently, the CA secures the required resources to acquire the need. Then, the CA must decide the type of procurement procedure that will be followed. For the case that we will study, the options of the CA are defined by the European legislation.

With the 2014/24/EU Directive (European Commission, 2014), the EU established the applicable rules on public procurement procedures for all MS. However, a directive is not enforceable from its publication but requires transposition into national law. The country of

our case study, Greece, adopted those rules on 8 August 2016 with Law 4412/2016 (Hellenic Parliament, 2016). From the study of the above legislation (both the Directive and the Greek Law), we can define the following procedures that Greek CA may follow: (a) open procedures, (b) restricted procedures, (c) competitive procedures with negotiation, (d) competitive dialogues, (e) innovation partnerships, (f) negotiated procedures without prior publication and (g) direct awards, or use of other techniques and instruments available in the legislation. To choose a procedure, the CA must determine which of the above fits best in the specific case according to the estimated value, the characteristics of the need, the legislation as well as the time available to complete the process.

3.1. Time limits in the EU legislation

Each option of the CA means different time available for the EOs to be informed, prepare, and decide whether to place a bid or not. More specifically, the applicable time limits for each procedure, that is the minimum number of days a CA is obligated to keep (at least) a notice open from the time that this notice will be sent to the official journal of the EU until the end of the bidding period, are presented below (European Commission, 2014):

- i. Open procedure:
 - a. 35 days from the date on which the contract notice was sent.
 - b. 30 days from the date on which the contract notice was sent where the CA accepts that tenders may be submitted by electronic means
 - c. 15 days where contracting authorities have published a prior information notice or where a state of urgency duly substantiated by the contracting authority renders impracticable the time limit of 35 days
- ii. Restricted procedure
 - a. 30 days for receipt of requests to participate, from the date on which the contract notice was sent
 - b. 30 days from the date on which the invitation to tender was sent
 - c. 15 days from the date on which the contract notice was sent or 10 days from the date on which the invitation to tender was sent, where a state of urgency duly substantiated by the contracting authority renders impracticable the time limit of 30 days
 - d. 10 days where contracting authorities have published a prior information notice and only if it was sent between 35 days and 12 months before the date on which the contract notice was sent.
- iii. Competitive procedure with negotiation
 - a. 30 days for receipt of requests from the date on which the contract notice was sent
 - b. 30 days for receipt of initial tenders from the date on which the invitation was sent
- iv. Competitive dialogue: 30 days from the date on which the contract notice was sent
- v. Innovation partnership: 30 days from the date on which the contract notice was sent.

The remaining options, which are the negotiated procedures without prior publication and the direct awards, are used only under particular conditions, as they do not require previous publication of the contract notice and there is no need for time limits.

However, those limits are applicable only when the net estimated value of the contract exceeds or is equal to the thresholds which were specified in the 2014/24/EU Directive, and according to the European Commission (2018) change regularly, almost every 2 years. For contests with a net value lower than the thresholds, the CA should apply national law, where according to the OECD (2010 cited in Molander, 2014) variations exist even between the thresholds of similar EU countries. Molander (2014) stated that the establishment of both EU and national thresholds should be based on empirical studies. However, there is little

emphasis on such studies in their preparation, due to the difficulty of including them in discussions of public procurement regulations, as they focus on more core reforms. In our study, which focuses on the period from January 2018 to December 2021, the applicable thresholds are presented in Table I:

Table_I

From all the procedures, we will focus on the open ones, as it is the only case for which data are available not only for the EOs, who were chosen by the CA to participate (as in the case of restricted procedures), but for every tenderer. It is important here to clarify that the above time limits, let us call them $\Delta t_{\min}$, are the minimum days a CA is obligated to keep a contract notice public before the end of the bidding period (t_c), *without this meaning that it should not exceed them. Instead, CAs are encouraged by the legislation to consider factors such as the complexity and time required by suppliers to prepare their tenders, in order to set time limits higher than the minimums provided for under the Directive 2014/24/EU.*

3.2. The importance of available time in shaping the number of bidders

After the time (t_p) that the notice is sent to the Official Journal of the European Union, the EOs according to the legislation have a period $\Delta t = t_p - t_c \geq \Delta t_{\min}$ to place their bids (b). As we mentioned previously, the final number of bids will range from zero to a few tens. From the N EOs who can fulfill the specific need of the CA (suppose they all constitute the set E), it is expected that not everyone will be informed about the publication of the notice in the Official Journal of the European Union. This may be due to various reasons such as access to information issues, low interest, lack of time, etc. To overcome problems related to information, the legislature has enacted the further publication of the notice beyond the official journal, also in other means such as the Official Gazette of the Government, official national public procurement sites, and in the national and local press (Hellenic Parliament, 2016). However, it is expected that only some of the N firms will eventually know about the publication of the announcement. Thus, we define our first subset $I \subseteq E$ which contains the firms, namely economic operators, who were informed. Subsequently, by following the process which we described in the previous section, the EOs of the set I will or will not place a tender. Let $T \subseteq I$ contain the economic operators who finally became tenderers. From what we have said so far, we can define two more subsets; $I' = E - I$, which contains all the economic operators who could not reach the information of the publication of the notice and the $T' = I - T$ which includes all the economic operators who had access to the information but, for any reason did not to submit a tender.

Graph 1: Subsets of EOs based on their abilities, information, and their choices

Graph_1

From the above, two reasonable questions arise:

- i) Would all the elements of the subset I' have decided not to bid, if they had been informed?
- ii) Have all the elements of the subset T' decided not to bid?

On the first question, when a CA publishes a contract notice, it follows the publication rules, which are specified by law in terms of means of publication. However, there is another element that enables the contracting authority to influence the procedure. This element is time. The CA is obliged to comply with the EU time limits for the minimum publication period and when fixing the time limits for the receipt of tenders and requests to participate, it is required by law to take into account the complexity of each contract and the time required to draw up tenders (European Commission, 2014), in order to give more time to EOs if deemed necessary. It can therefore be assumed that, if the EOs had more time available to be

informed, it is possible among them to exist some EOs who would have decided to bid. On the second question, it is sufficient to refer to the provision of the relevant legislation on the submission of outdated tenders and also to authorities' decisions e.g., Decision A9/2019 (Authority for the Examination of Preliminary Appeals - Remedies Review Body, 2019). This decision concerns an economic operator who decided to bid but did not manage to deliver its offer on time. From the above, we conclude that the period for the receipt of tenders is a critical variable for the process, as it seems to be related to competition.

3.3. Data and Methodology

To answer the research questions (Q_1 and Q_2), we used as our source the platform opentender.eu³ and we focused on public procurement data for the years 2018 – 2021 in Greece. We selected this platform because it provides processed metadata, collected from different sources and linked, which are uniformly structured, type formatted, and cleaned from nonsensical values. Furthermore, the final dataset is the result of merging cases from different stages of the process derived from different sources (Hrubý *et al.*, 2018) (e.g., notices data merged with contract data).

From our sample (Opentender, 2022):

- i. We excluded all cases with a value tender_size=BELOW_THE_THRESHOLD. The remaining cases refer to contests with a net value above the thresholds irrespective of authority and type.
- ii. In contracts with more than one contractor, we left only one case, deleting those which included the rest, as each row of the CSV file (cases) represents one lot (contractor). Contracts with multiple contractors are repeated in multiple rows with all other data being the same except the details of each separate lot.
- iii. We excluded all cases with a value tender_procedureType other than OPEN.
- iv. From the remaining cases, we also cleared those without bids. The lack of interest for those notices could also be related to other factors than the time we examine.
- v. We defined the Δt variable by subtracting the date “tender_bidDeadline” from the date “tender_publications_firstCallForTenderDate”
- vi. We categorized the cases according to the variable Δt as follows:
 - a. Group 1: $\Delta t \leq 35$
 - b. Group 2: $\Delta t > 35$

We assume that Group 1 contains all the contests for which the contracting authorities have chosen to limit themselves to the minimum number of days allowed by law, including cases where the publication period may be less than 35 days, while Group 2 includes competitions with publication period exceeding the minimum time limits, as the CAs are encouraged to do by the legislation. Thus, we came up with 2404 cases categorized into two groups.

Graph 2: Allocation of supply types in each group.

Graph_2

Graph 2 reports a similarity of the two groups in terms of the types of supplies they contain, which indicates that Δt is not significantly affected by the supply type. For each case, we will examine whether the number of tenderers is affected by the length of the publication period. The number of tenderers is a variable equal to the number of bids (lot_bidsCount variable) as each tenderer is allowed to place a unique bid in each contest

3 The platform opentender.eu is part of the DIGIWHIST project

and, as we have already stated, this number is also an indicator of competition in the market (Chua and Li, 2000; Estache and Iimi, 2011).

To decide which **statistical** method, we will use to compare the two groups, we tested both for normality. The result of the test is that the distribution of the variable Number of bids (lot_bidsCount) among groups does not follow the normal distribution, as we can see in Graph 3 below:

Graph 3: Normal Q-Q plots per group

Graph_3

Because the two groups do not follow the normal distribution, to compare them, we will use nonparametric procedures. To choose which test we will apply, we examined the nature of our variables. In our case, the outcome, that is, the dependent variable lot_bidsCount is ordinal, the independent variable Groups is dichotomous and the two samples (Group 1 and 2) are unpaired. Neely et al. (2003), stated that when all the above apply, to compare the two groups, we should choose the **Wilcoxon Mann-Whitney U test** (Mann and Whitney, 1949; Wilcoxon, 1945). However, the **Wilcoxon Mann-Whitney U test** demands equality of variances of the treatment groups, especially in the case of large samples (Zimmerman, 2010). Therefore, to use it we must first examine our groups for homoscedasticity. A Levene's test of Equality of Variances (Levene, 1960) showed that we do not have sufficient evidence to say that the variance between the two groups is significantly different, $F(1,2402) = 1.6463$, $p=0.1966 > 0.05$. That is, the two groups have equal variances.

Table_II

As long as the homoscedasticity criterion is also met, the two groups are made comparable through the **Wilcoxon Mann-Whitney U test**. According to this test, the null hypothesis assumes that the two groups come from the same distribution. While the test compares each case of the one group with each case of the other, we reject the null hypothesis if the cases of the one group are significantly larger than those of the other. However, the Mann-Whitney U test does not specify which of the two groups is the largest (Nachar, 2008). To examine the direction of the test, we use descriptive statistics and graphical methods as we have already seen in similar work (Hanák and Muchová, 2015). All the above will be conducted using the **R Statistical Software** (R Core Team, 2022) as suggested by Erceg-Hurn and Miroseovich (2008). The test's hypotheses are as follows:

H_0 : The two groups (Group 1 and 2) come from the same population.

H_1 : The two groups (Group 1 and 2) come from different populations.

In our study, the acceptance of the null hypothesis would mean that the grouping variable does not affect the characteristics of the samples, that is the period a contest remains public and open for bids has no impact on their number. However, if the null hypothesis is rejected, we could state that time affects the number of the tenderers and further, if we observe a direction in the second group, we could also state that the EU legislation's time limits are not enough for all potential tenderers to prepare their bids.

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4. Results

4.1. Descriptive statistics

Table_III

The mean of the number of bids or tenderers between the contests of our sample is 3.35 bids, while the median is 2 bids. These results are of particular importance because they reveal the intensity of competition (in terms of the number of bids) among the contests in our sample.

Table_IV

Graph 4: Histogram of notices by publication period

Graph_4

From the analysis of the publication period (Δt), we observe a mean of 37.83 days and a median of 35 days, while the highest frequency belongs to 35 days, which is equal to the lower limit in the legislation. That probably means that several CAs (46.42%) keep their notices open for bidding for fewer days than the lower number specified in the law, with some of them (2.54%) even fewer than the 15-day period that applies in exceptional cases only. That observation will become more important if we reject our null hypothesis and show that the bidding period affects the number of tenderers. From Table IV and Graph 4, we notice that CAs not only avoid keeping their notices open for as long as possible but, also, the increase of the contests' number close to the limits reveals an effort not to exceed them. As a result, we may assume that a number of contests, remained open for a period less than the minimum time limits. A conclusion here is that even the CAs which intend to strictly apply the legal time limits act against the competition, as they involuntary do not follow the deadlines of the legislation that the EU established to protect it.

4.2. Samples comparison

4.2.1. Descriptive statistics

Table_V

Both the groups have different mean and median values. That being so, to find the direction of the comparison, that is, which team contains on average the highest number of bids in its tenders, we can use both the medians and the means.

4.2.2. Mann-Whitney U test

The results of the Mann-Whitney U test are presented below.

Table_VI

```
Wilcoxon rank sum test with continuity correction

data: lot_bidsCount by group
W = 608128, p-value = 1.261e-10
alternative hypothesis: true location shift is not equal to 0
```

The Wilcoxon Mann-Whitney U test results indicate that there is a significant effect of Groups on the number of bids ($W = 608128$, $p = 1.261 \times 10^{-10}$). Therefore, the two groups do not come from the same population and H_0 can be rejected. In particular, we can state that the publication period significantly affects the number of tenderers.

Graph 5: Boxplot of number of bids per group

Graph_5

The direction of the results can be identified from Graph 5. Given that the two groups come from different populations, comparing their **medians** can also reveal the direction, that is which group tends to have more bids per contest. Group 1 ($\Delta t \leq 35$) **median** is 2 bids, lower than Group 2 ($\Delta t > 35$) **median** which is 3 bids. Furthermore, the same is observed and in their means. Group 1 ($\Delta t \leq 35$) mean is 3.1 bids, lower than Group 2 ($\Delta t > 35$) mean which is 3.67 bids. Consequently, Group 2 enjoys more intense competition. This conclusion casts doubt on the effectiveness of the time limits set by EU legislation in terms of developing competition. Therefore, the question here is what should be the time limits for the CAs to enjoy the maximum benefit from the development of competition? A suggestion for the optimal duration of the time limits follows from the Graph 6. In this graph, we observe an increase in the number of bids for contests whose bidding period is in the 40–47-day range, compared to those whose bidding period is in the 31–37-day range. This would make sense for a corresponding increase in minimum time limits (i.e., from 35 to 41 days), as competition would thus become more intense.

Graph 6: Boxplots of bids per publication period

Graph_6

4.3. Robustness checks

4.3.1. Evaluation of the results for additional values of the grouping factor

Our analysis showed that contests belonging to the second group and having longer bidding periods tend to receive more bids. However, the selection of the value of the grouping factor was based on the highest of the time limits of the European legislation, that of the open procedure (see Section 3.1). This raises questions as to the nature of the results for various values of Δt . Hence, we repeated our analysis for each value of Δt between 15 days (which according to the legislation is the minimum possible duration of any notice) and 60 days. The results are presented in the table of Appendix A. In this table, for every value of d we provide the results of the Levene's test for each group ($\Delta t \leq d$ and $\Delta t > d$) and where the homoscedasticity criterion is met, that is the variances of the two groups are equal making them comparable, the results of the Wilcoxon Mann-Whitney U test.

With the exception of the two cases of 39 and 40 days where the Levene's test detected unequal variances, and therefore the Wilcoxon Mann-Whitney U test could not be applied, we observe that the test results remain the same as the 35-day case we analyzed, up to the 52-day value. The two groups do not come from the same population, that is the grouping factor significantly affects the number of bids. If we now focus on the mean and median bid values of each group, we will also notice that the contests of the groups with the lower bidding periods tend to receive less bids than those of the other. However, the same does not apply to cases where the grouping factor takes values over 52 days. In those cases, the grouping factor does not affect the number of bids. As the value of d is increased, we observe that the mean and the median of the number of bids of the group with the longer bidding periods, is constantly decreasing until the median equals that of the other group, while the mean becomes smaller.

A possible explanation for the above arises from the current legislation, according to which CAs should take into account factors such as the complexity and time required by suppliers to prepare their offers, in order to set time limits higher than the minimum are provided for in it. Therefore, if we take as granted that the CAs apply the above exhortation, we may state that when d takes values of 52 and above, and the second group tends to contain contests with longer and longer publication periods, the complexity and not the bidding period is the main factor affecting the number of bids. After all, this is to be expected, since as the complexity and value of the contracts increases, fewer and fewer EOs are able to cope with the demands of each notice. To conclude, with the exception of particularly complex tenders where the CAs decided to give almost double the number of days to the EOs to prepare, we can state that the bidding period significantly and positively affects the number of bids.

4.3.2. Robust Rank-Order Distributional Test

In our analysis we use the Wilcoxon Mann-Whitney U test, which assumes equality of variances. If the homoscedasticity criterion is not met (as it happens in the cases of 39 and 40 days in the table of Appendix A) then the Wilcoxon Mann-Whitney U test cannot be used. Instead, in that case a robust rank order test can be used (Kasuya, 2001). Such a test is a modification of the Wilcoxon Mann-Whitney U test, the Fligner–Policello test (Fligner and Policello, 1981). This test was proposed in comparing the medians of the two groups; however, it can also be used to test the hypothesis that the two samples come from the same distribution without the assumption of the equality of variances (Fong and Huang, 2018). Therefore, to fill in the analysis gaps identified at 39 and 40 days, where the Levene’s test detected unequal variances, and to evaluate our results of the application of the Wilcoxon Mann-Whitney U test, we additionally applied the Fligner–Policello test for every value of d in the table of the Appendix A.

The results of the Fligner–Policello test are mostly the same as those of the Wilcoxon Mann-Whitney U test. First of all, they fill the gap of the later for the 39 and 40 days where the Levene’s test detected unequal variances, proving that even in those cases the bidding period significantly affects the number of bids. Furthermore, as the Fligner–Policello test showed that this also holds for all cases from 15 to 50 days, and not for those cases where the variable d in the table of Appendix A takes values above 50 days, the conclusion reached earlier is strengthened. Both the Wilcoxon Mann-Whitney U test and the Fligner–Policello test results imply the same: With the exception of highly complex tenders, the tendering period has a significant and positive effect on the number of bids. Regarding the importance of this exception, it is worth mentioning that in our analysis, the tenders with a publication period of more than 51 days are 150, which corresponds to 6.2% of the sample.

5. Discussion

The results presented in this paper have contributed to the identification of another factor that significantly affects the intensity of competition in public procurement beyond the project type and size, the nature of work, social and economic conditions, the CAs, etc. The publication or bidding period of each notice proved to be important for the economic operators. Our study showed that this factor affects not only the intention of the EOs to become tenderers as Chua and Li (2000) suggested, but also their ability to successfully place their bids. In the literature, it is also stated that the number of tenderers is inversely proportional to the bid price (Shrestha and Pradhananga, 2010) as well as the award-to-expected price ratio (Hanák and Muchová, 2015) and the bidding gaps (Li *et al.*, 2008). We could now claim that all the above are also inversely proportional to the time the EOs have available, as it significantly affects the number of tenderers. However, the above does not apply to complex contests, where the number of possible bidders who can meet the requirements is in fact limited.

During the design of our research, we came up with two subsets of potential bidders who did not place any bids. In the first subset, (I'), belong those economic operators who did not reach the information that a notice was published, while the second one (T') Includes those economic operators who had access to the information but, for some reason, they did not submit a tender. As we proved that more time available for bidders increases their number, for the first group, we could assume that it contains economic operators who would have decided to place a bid, if they had more time to reach the information that the notice was published. However, further research is needed to clarify the connection between competition and the degree of information of potential bidders. Concerning the second group (T'), we can state that it definitely contains economic operators who found the time they had available inadequate to prepare and place their bids. The latter is also confirmed by the cases where tenderers were excluded due to overdue bids. Therefore, a conclusion here is that CAs should consider time limits as minima, just as they are defined in the legislation, and not as maxima or restrictive.

In our results, we observed that many CAs (46.4% of contests) keep their notices open for bidding for less than 35 days. According to the legislation, this is acceptable only in two cases:

- i. When the CA accepts that tenders may be submitted by electronic means, where the minimum time limit is 30 days and
- ii. When the authorities have published a prior information notice or if a state of urgency duly substantiated by the contracting authority renders impracticable the time limit of 35 days where, in this case, the minimum time limit can be reduced to 15 days.

Even if we assume that the all the 881 contests between 30 and 35 days belong to the first category, and all the 1269 contests between 15 and 35 days (52.8%) belong in the second category, which is considered unlikely as the 2014/24/EU Directive (European Commission, 2014) clarifies that the state of urgency should be brought about by events unforeseeable by and not attributable to the contracting, there is still a remaining 2.5% of contests, where the CAs kept their notices open for less than 15 days which is the minimum time limit available in exceptional situations of open procedures. Furthermore, the descriptive statistics also revealed that the median bidding period for the contests of our sample is 35 days. Considering all the above, this period should not be equated with the median, because (a) there should not exist contests where tenderers had less than 15 days available to place their bids, (b) the exceptional situations where time limits can be shortened to 15 days constitute a minority, and (c) most contests should be open for at least 30 or 35 days.

Another issue our design allowed us to examine, is whether the EU time limits are ideal for the development of adequate competition between economic operators, which is Q_2 . To answer this, first, we have to make clear that the EU defines in its Directives those time limits as the minimum and urges CAs to publish their notices as long as possible. However, our results proved that the reality differs. Less than the half of them (44.7% of the cases) made use of the ability to maintain their notices open for a longer period and took advantage of the growth of competition since, as we have proven, more time available for the bidders implies more bids. Thus, to adequately answer Q_2 , we will distinguish two scenarios:

The CAs comply with the time limits of the legislation.

In this scenario, there are no tenders with a bidding period of fewer than 15 days. The cases with a bidding period of at least 15 days constitute a minority, as they refer to exceptional situations of open procedures and most contests remain open for bidding for a period higher than the minimum time limits of 30 and 35 days as urged by the legislation. Given the above, we may assume that the majority of contests belong to Group 2 ($\Delta t > 35$) of

our research. In this group, we observed a mean of 3.67 bids and a median of 3 bids and we could state, answering Q₁, that the EU time limits seem ideal for the development of adequate competition between economic operators, as the above values are greater from the counterparts of 3.1 and 2 bids of Group 1.

The CAs do not comply with the time limits of the legislation.

This scenario agrees with the results of our research. In fact, there are several deviations from the law, as we have already mentioned. The CAs, either knowingly or unknowingly, do not give to the EOs the available time they are entitled to. As a result, there are too many cases of contests (46.4%) with a bidding period lower than 35 days with some of them (2.5%) even lower than 15 days. Definitely, there should be contests with a bidding period between 30 and 35 days which are the minimum time limits of the EU legislation, as well as contests with a bidding period between 15 and 29 days. However, their number, according to the urges of the EU and the legislation, would not justify a 46.4%. This situation prevents a number of possible tenderers to place their bids. As we have showed, the contests of our sample which remained open for less than 35 days, tend to have a smaller number of bids. In our analysis, these contests were Group 1 ($\Delta t \leq 35$), for which the mean is 3.1 bids.

In this scenario, we cannot answer Q₂ with certainty, as the legal time limits are not applied by all the CAs in their notices. However, we can evaluate their impact on competition based on how CAs perceive and use them. Our analysis shows that CAs actually perceive minimum time limits as ceilings for their notices and in fact instead of favoring the competition they act as a brake. Therefore, a suggestion for legislators could be to take advantage of this fact and modify the minimum time limits in such a way as to push the contracting authorities to publish their notices for periods within Group 2, as suggested in section 4.2.2. That group contains competitions with a bidding period that exceeds 35 days, where we observed the existence of more intense competition.

To conclude, the answer to Q₂ is negative in the present situation, as the minimum time limits of the European legislation are considered ineffective for the development of adequate competition between economic operators. However, this is not due to their duration, but to the way the CAs perceive them. To deal with this situation, the EU has two options; either to “teach” the CAs that they should seek the greatest possible duration of publication (as far as possible from the minimum time limits), always considering the characteristics of each tender, or to modify the minimum time limits, as we stated above. A problem here, is that any increase in limits is associated with additional administrative costs for CAs, which makes this option, albeit more immediate, less feasible.

The key strength of our design is that it is based on contests of an EU Member state, which according to their net value, in terms of their execution, are subject to EU law. That means that these contests are published in the Official Journal of the European Union, and any EO from any member state is allowed to place a tender. Thus, for the first part of our work, the findings of how Δt affects competition could be generalized at the level of the European Union. As for the second part, the opinion that the EU minimum time limits favor the development of competition stands only under the assumption that the CAs of each Member State perceive the minimum time limits as described in the legislation, which is not the case for Greece. The limitation here is that we cannot generalize our opinion that the time limits are inadequate due to the way the CAs perceive them, as this situation might only be encountered in the case of Greece. We may only assume that an analogous situation exists in other EU Member States with similar characteristics (political, economic, social, etc.) to Greece. However, further research is necessary to explore if the behavior of the Greek CAs is the exception or the rule.

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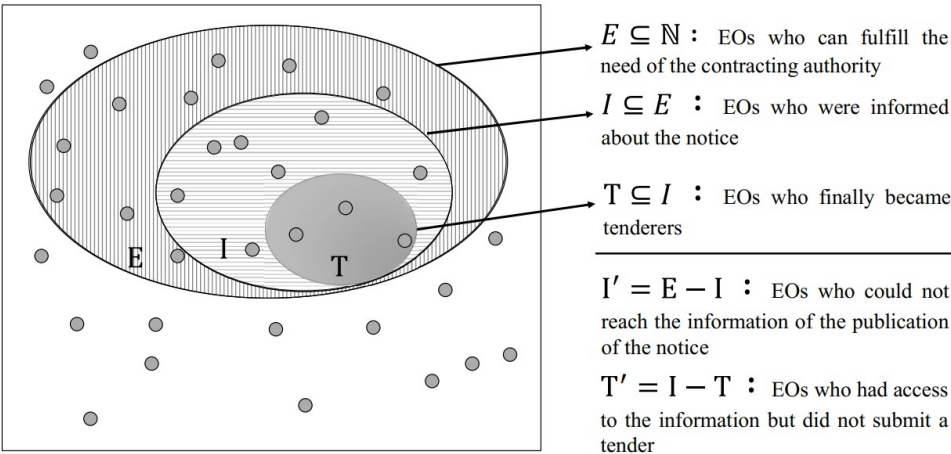
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Appendix_A

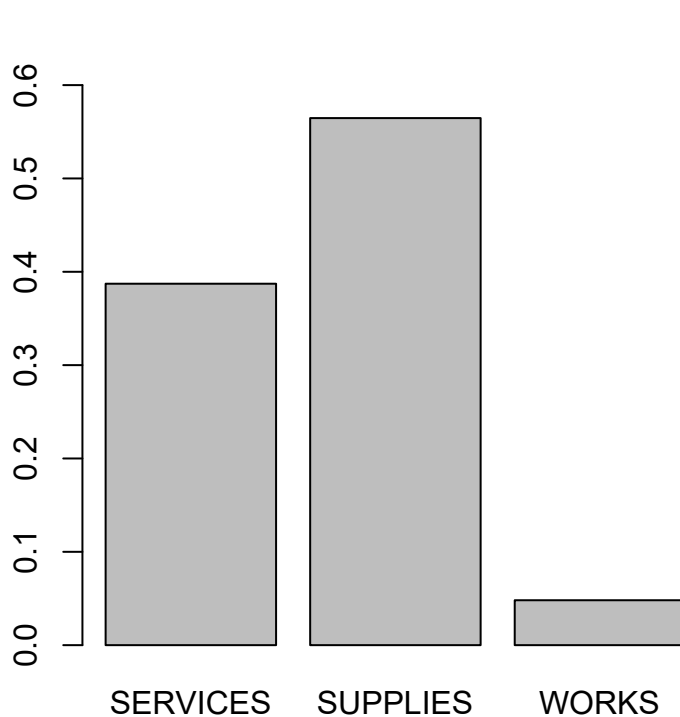
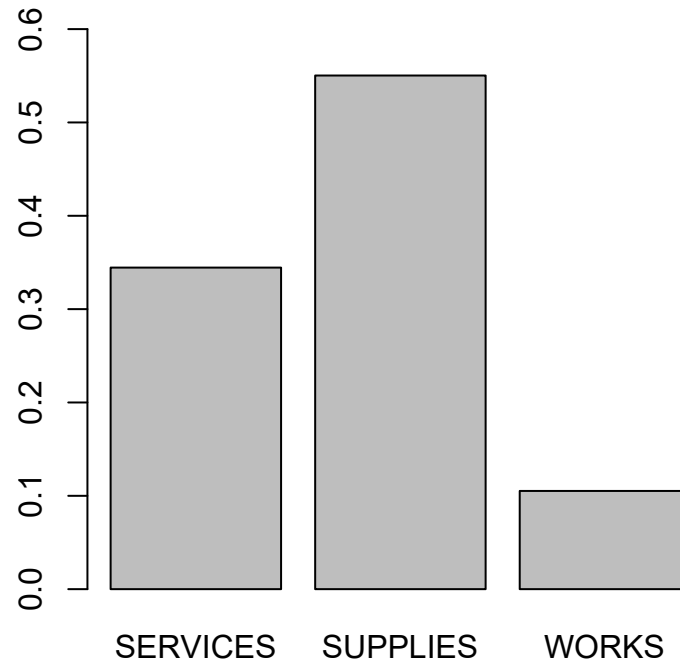
Table I: EU thresholds for public contracts from 1 January 2018 to 31 December 2021
(source: European Commission, 2018; 2019)

Period	Authority	Works	Supplies	Services		
				Social and specific services	Subsidized services	All other services
1 January 2018 to 31 December 2019	Central government authorities		144.000€		221.000€	144.000€
	Sub-central contracting authorities	5.548.000€	221.000€	750.000€	221.000€	
1 January 2020 to 31 December 2021	Central government authorities		139.000€		214.000€	139.000€
	Sub-central contracting authorities	5.350.000€	214.000€	750.000€	214.000€	

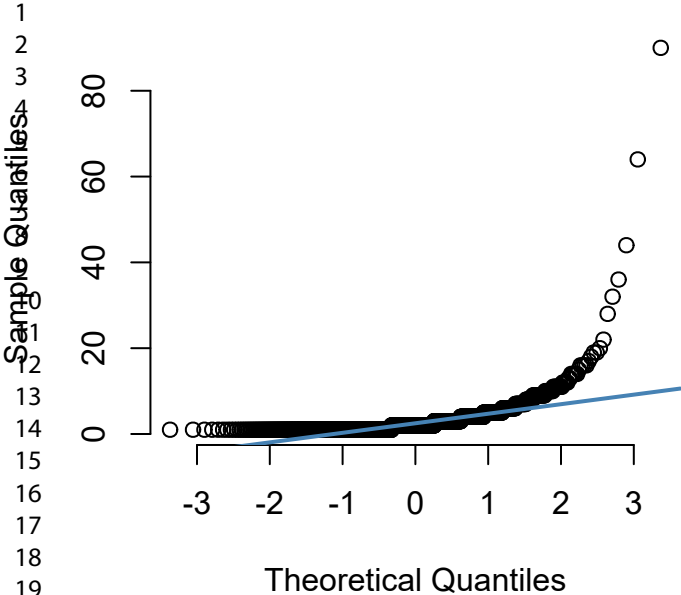


Graph 1: Subsets of EOs based on their abilities, information, and their choices

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$\Delta t \leq 35$  **$\Delta t > 35$** 

Normal Q-Q Plot, $\Delta t \leq 35$



Normal Q-Q Plot, $\Delta t > 35$

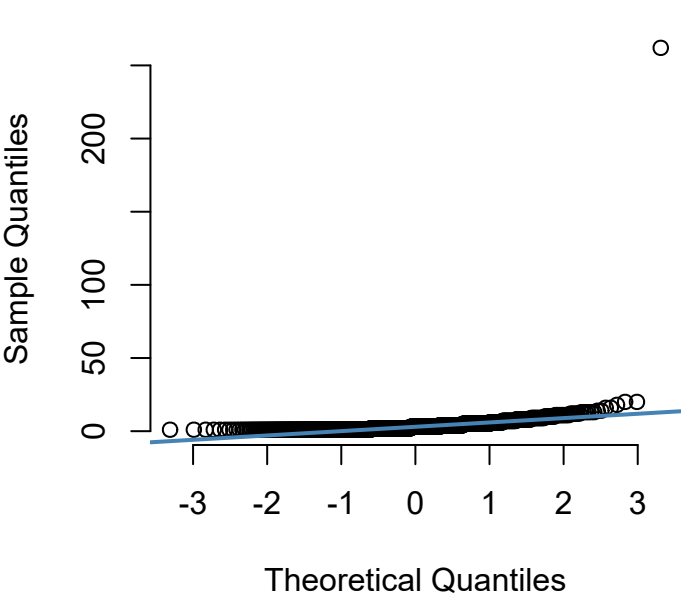


Table II: Levene's Test for Homogeneity of Variance (center = median)

	Df	F value	Pr(>F)
group	1	1.6463	0.1996
	2402		

Table III: Descriptive statistics of the variable lot_bidsCount (Number of bids)

Variable	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
lot_bidsCount	2404	3.35	6.45	2	2.61	1.48	1	262	261	8.56	1091.69	0.13

Table IV: Descriptive statistics of the variable Δt (Period of publication)

Variable	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
Δt	2404	37.83	25.63	35	35.44	5.93	1	592	591	12.04	195.72	0.52

Notices by publication period

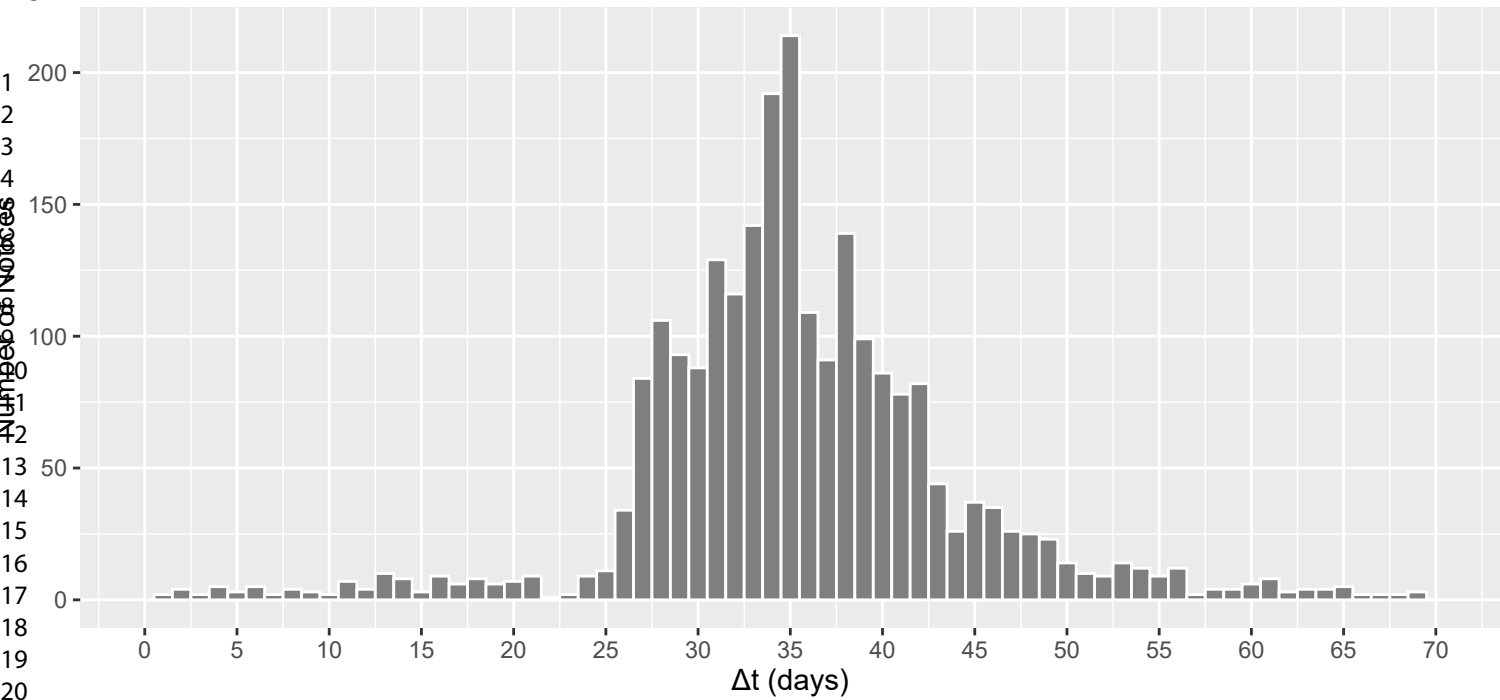


Table V: Descriptive statistics of the variable lot_bidsCount (Number of bids) in the two samples (Group1 $\Delta t \leq 35$ and Group2 $\Delta t > 35$)

Variable	Group	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
lot_bidsCount	$\Delta t \leq 35$	1330	3.1	4.33	2	2.36	1.48	1	90	89	10.04	160.35	0.12
	$\Delta t > 35$	1074	3.67	8.35	3	2.96	2.97	1	262	261	27.65	850.87	0.25

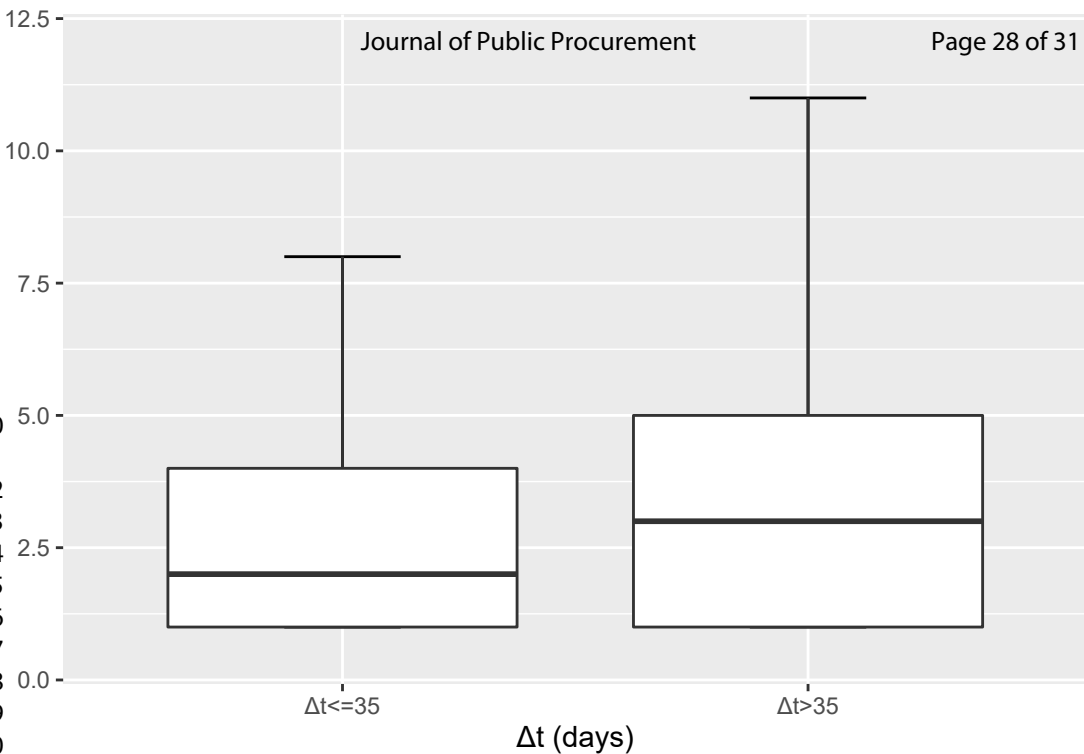
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Table VI: Mann-Whitney U test Descriptive Statistics

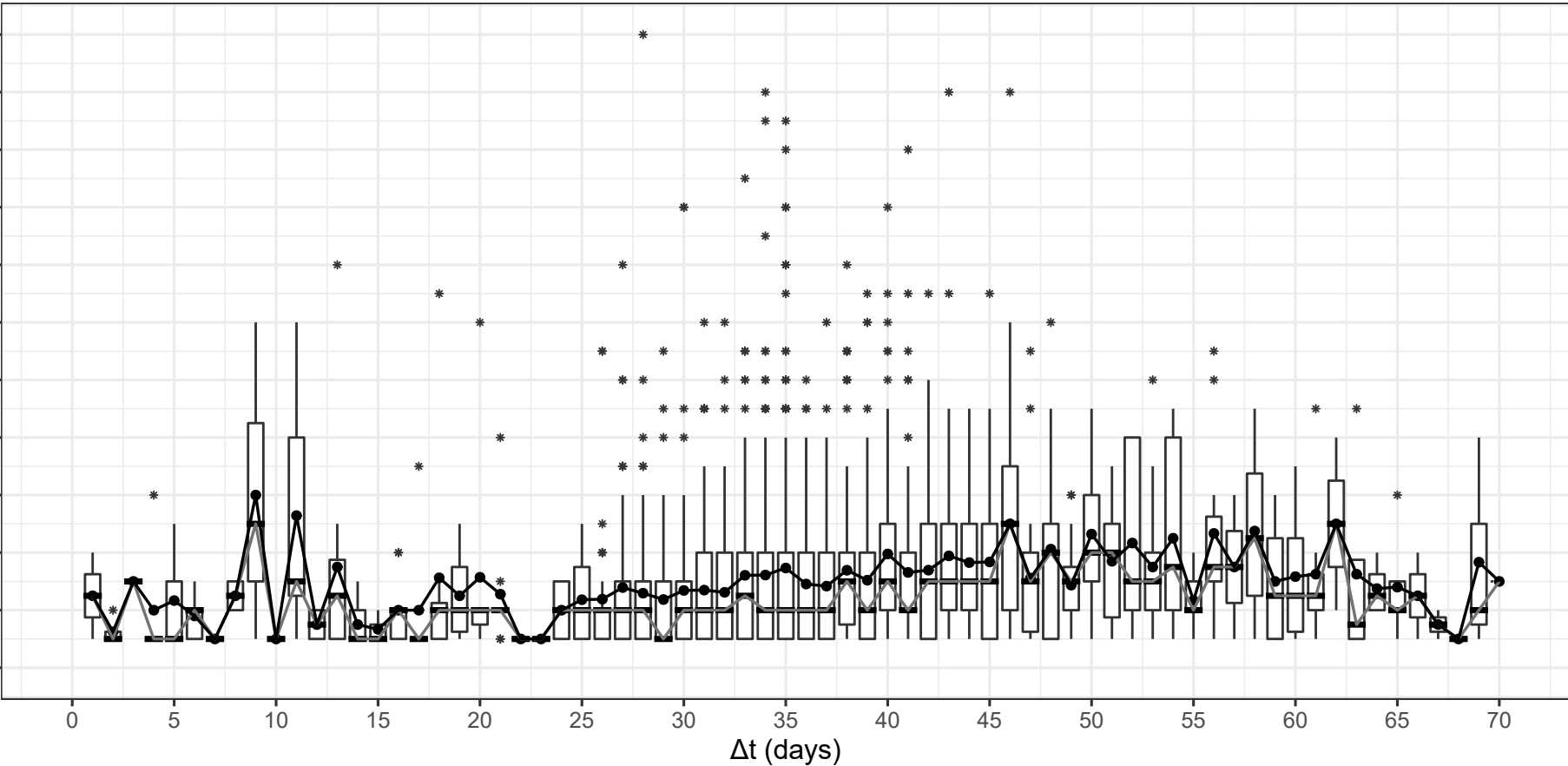
	N	Percentiles		
		25th	50th (Median)	75th
Number of bids	2404	1.00	2.00	4.00
Groups	2404	.0000	.0000	1.0000

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Appendix A - Levene's test, Mann Whitney U test, and Robust Rank-Order Distributional test results for different values of the grouping factor (d)

d	Group 1 $\Delta t \leq d$					Group 2 $\Delta t > d$					Levene's test		Number of bids (b)		Robust Rank-Order Distributional Test	
	n	$\bar{b}$	μ_b	μ_v	$\bar{v}$	n	$\bar{b}$	μ_b	μ_v	$\bar{v}$	F value	Pr(>F)	W	p value	z	p value
15	64	2.63	2	1,516,389.87 €	487,700.00 €	2340	3.37	2	2,608,976.50 €	555,260.93 €	0.288582	0.591180*	60733.00	0.008074336790239**	-2,26938279458	0,023245057558***
16	73	2.55	2	1,508,186.42 €	497,927.50 €	2331	3.38	2	2,613,226.01 €	551,639.70 €	0.483019	0.487125*	68377.50	0.003343567844454**	-2,56419827635	0,010341444916***
17	79	2.51	1	1,532,310.21 €	499,840.00 €	2325	3.38	2	2,614,430.31 €	550,448.68 €	0.523393	0.469468*	72082.00	0.000837146870983**	-2,89166520200	0,003832060657***
18	87	2.56	2	1,630,983.68 €	525,884.00 €	2317	3.38	2	2,614,689.82 €	549,905.00 €	0.480354	0.488329*	79595.50	0.000624837507079**	-2,96582711940	0,003018701261***
19	93	2.56	2	1,606,299.69 €	546,668.00 €	2311	3.39	2	2,618,403.91 €	549,143.62 €	0.572220	0.449452*	85695.00	0.000668471156555**	-2,95731460449	0,003103313069***
20	100	2.60	2	1,582,403.14 €	570,159.58 €	2304	3.39	2	2,621,282.66 €	548,387.17 €	0.584072	0.444796*	92363.00	0.000565701409103**	-3,00628287249	0,002644628500***
21	109	2.60	2	1,604,317.05 €	582,423.00 €	2295	3.39	2	2,623,641.74 €	547,599.73 €	0.766332	0.381442*	101181.00	0.000535931434190**	-3,05483942151	0,002251810516***
22	110	2.58	2	1,595,433.03 €	586,214.67 €	2294	3.39	2	2,624,524.13 €	547,289.87 €	0.787321	0.375000*	101465.00	0.000365620327472**	-3,14660137712	0,001651799881***
23	112	2.55	2	1,589,353.11 €	602,860.67 €	2292	3.39	2	2,625,764.10 €	546,287.81 €	0.829701	0.362450*	102030.00	0.000166830930524**	-3,32892344426	0,000871823648***
24	121	2.51	2	1,596,809.61 €	615,715.00 €	2283	3.40	2	2,629,715.76 €	545,400.00 €	1.118927	0.290256*	109749.00	0.000091646342157**	-3,51990690823	0,000431698288***
25	132	2.50	2	1,516,286.81 €	607,857.50 €	2272	3.40	2	2,639,615.64 €	545,497.81 €	1.344290	0.246394*	120083.00	0.000077420386503**	-3,56842130631	0,000359138685***
26	166	2.48	2	1,481,460.89 €	546,668.00 €	2238	3.42	2	2,660,330.76 €	549,143.62 €	1.797917	0.180091*	146745.50	0.000003525102205**	-4,19788803876	0,000026941576***
27	250	2.58	2	1,509,082.77 €	497,490.00 €	2154	3.44	2	2,704,843.27 €	556,630.10 €	2.955010	0.085741*	226515.50	0.000024440590525**	-3,82193900948	0,000132406442***
28	356	2.76	2	1,546,701.57 €	499,525.00 €	2048	3.46	2	2,762,279.66 €	559,800.00 €	2.155253	0.142214*	304304.50	0.000000318391396**	-4,53991093270	0,000005627800***
29	449	2.74	2	1,479,543.18 €	500,000.00 €	1955	3.50	2	2,837,837.99 €	561,894.00 €	2.440908	0.118340*	357806.00	0.000000000356705**	-5,49007108295	0,000000040177***
30	537	2.97	2	1,480,895.61 €	498,650.00 €	1867	3.46	2	2,901,123.51 €	569,000.00 €	0.725119	0.394555*	410598.00	0.000000000052606**	-5,71322348325	0,000000011086***
31	666	2.92	2	1,804,592.38 €	495,818.40 €	1738	3.52	2	2,876,015.32 €	575,000.00 €	1.754512	0.185437*	475831.00	0.000000000004144**	-6,00572855233	0,000000001905***
32	782	2.87	2	1,705,432.02 €	491,725.00 €	1622	3.59	3	3,003,774.49 €	583,822.00 €	2.869817	0.090385*	515771.50	0.000000000000025**	-6,57144193272	0,000000000050***
33	924	2.93	2	1,801,411.92 €	499,562.50 €	1480	3.62	3	3,068,681.88 €	584,068.45 €	3.429958	0.064146*	572011.50	0.0000000000004372**	-5,91602952615	0,000000003298***
34	1116	3.01	2	1,812,138.32 €	517,910.00 €	1288	3.66	3	3,251,729.68 €	583,185.00 €	2.827132	0.092814*	607742.00	0.000000000019917**	-5,67829418956	0,000000013604***
35	1330	3.10	2	1,764,379.97 €	517,019.66 €	1074	3.67	3	3,578,097.46 €	596,943.25 €	1.646318	0.199585*	608128.00	0.000000000126088**	-5,42076295409	0,000000059345***
36	1439	3.08	2	1,791,290.57 €	518,210.20 €	965	3.76	3	3,738,684.24 €	612,841.38 €	2.100651	0.147367*	582242.50	0.000000000005508**	-5,82884246737	0,000000005581***
37	1530	3.07	2	1,806,228.93 €	518,210.20 €	874	3.85	3	3,919,983.02 €	640,000.00 €	2.865510	0.090627*	551843.50	0.000000000000253**	-6,21163361579	0,000000000524***
38	1669	3.10	2	1,841,398.52 €	518,060.10 €	735	3.94	3	4,252,556.05 €	647,778.69 €	3.473068	0.062497*	511073.50	0.000000000022015**	-5,66530740680	0,000000014676***
39	1768	3.09	2	1,884,087.40 €	518,210.20 €	636	4.08	3	4,517,184.17 €	665,012.51 €	4.612928	0.031832			-5,88700681407	0,000000003933***
40	1854	3.13	2	1,900,399.30 €	519,294.06 €	550	4.10	3	4,881,100.75 €	681,014.00 €	4.512637	0.033747			-4,90580080565	0,000000930469***
41	1932	3.27	2	1,897,561.34 €	526,457.92 €	472	3.69	3	5,385,074.29 €	715,264.72 €	0.059229	0.807739*	380509.50	0.000000010355375**	-4,76596226162	0,000001879544***
42	2014	3.28	2	1,953,395.83 €	530,503.00 €	390	3.75	3	5,788,580.40 €	700,000.00 €	0.088483	0.766141*	324587.50	0.000000025250648**	-4,63836483850	0,000003511765***
43	2058	3.29	2	1,953,669.34 €	529,034.00 €	346	3.73	3	6,292,824.00 €	826,027.75 €	0.053471	0.817150*	296235.50	0.000000282012792**	-4,25110719256	0,000021271632***
44	2084	3.30	2	1,993,472.05 €	526,960.56 €	320	3.74	3	6,379,335.26 €	871,289.00 €	0.074206	0.785331*	279343.00	0.000001584380515**	-3,96292224898	0,000074037899***
45	2121	3.30	2	2,011,631.93 €	526,960.56 €	283	3.75	3	6,765,161.71 €	889,670.05 €	0.034210	0.853276*	250576.50	0.000003587078367**	-3,87444742002	0,000106866913***
46	2156	3.33	2	2,020,643.55 €	529,920.00 €	248	3.57	3	7,350,047.62 €	880,000.00 €	0.051716	0.820124*	230101.50	0.000223667991337**	-3,11951634224	0,001811482119***
47	2182	3.33	2	2,067,571.20 €	529,232.00 €	222	3.62	3	7,499,113.02 €	896,226.77 €	0.014245	0.905007*	206269.50	0.000183215736439**	-3,14526382522	0,001659371142***
48	2207	3.34	2	2,404,228.07 €	530,361.85 €	197	3.56	3	4,507,422.63 €	881,766.55 €	0.043973	0.833921*	188271.50	0.001374565760052**	-2,71831922719	0,006561449916***
49	2230	3.33	2	2,396,842.45 €	530,503.00 €	174	3.65	3	4,894,459.74 €	899,000.00 €	0.000097	0.992156*	166351.00	0.001292965444451**	-2,69584430950	0,007021047448***
50	2244	3.34	2	2,398,631.22 €	531,720.00 €	160	3.56	3	5,101,019.66 €	907,470.00 €	0.003399	0.953512*	158422.50	0.010730439002817**	-2,14046479726	0,032317222780***
51	2254	3.34	2	2,397,197.44 €	532,642.00 €	150	3.55	3	5,314,246.11 €	907,470.00 €	0.002459	0.960451*	150569.50	0.021276645118311**	-1,94115979460	0,052238898133
52	2263	3.35	2	2,391,648.04 €	532,485.00 €	141	3.50	3	5,578,539.71 €	917,000.00 €	0.006497	0.935765*	144204.00	0.049127804716420**	-1,65609266103	0,097703055351

53	2277	3.35	2	2,384,506.71 €	533,555.58 €	127	3.50	3	6,051,259.21 €	967,103.54 €	0.000151	0.990193*	131961.50	0.088831518173289	-1,41329535945	0,157568897888
54	2289	3.35	2	2,382,266.11 €	536,574.51 €	115	3.40	3	6,428,434.46 €	967,103.54 €	0.005707	0.939789*	123635.00	0.259591171628237	-0,93403032099	0,350288252603
55	2298	3.35	2	2,398,179.43 €	536,765.96 €	106	3.49	3	6,448,502.26 €	907,470.00 €	0.002652	0.958936*	112996.50	0.196495153397951	-1,05098790064	0,293264146888
56	2310	3.36	2	2,415,086.42 €	540,000.00 €	94	3.34	2	6,581,816.50 €	899,000.00 €	0.000227	0.987973*	105235.50	0.604135407261271	-0,41967861834	0,674720246990
57	2312	3.36	2	2,414,202.19 €	539,662.50 €	92	3.34	2	6,651,010.44 €	899,500.00 €	0.001014	0.974598*	103127.00	0.612409891821329	-0,41245883315	0,680003148413
58	2316	3.36	2	2,416,103.34 €	540,000.00 €	88	3.27	2	6,803,469.01 €	897,613.39 €	0.014015	0.905773*	100154.00	0.778849840786097	-0,23065518322	0,817582693294
59	2320	3.36	2	2,417,830.69 €	540,000.00 €	84	3.29	2	6,975,723.71 €	888,113.39 €	0.014493	0.904186*	95559.00	0.757563264274838	-0,25539189179	0,798420432616
60	2326	3.36	2	2,412,796.00 €	540,000.00 €	78	3.29	2	7,494,146.10 €	903,235.00 €	0.011105	0.916083*	89114.50	0.785598263831510	-0,22564357795	0,821478644497

* Levene’s test significance is greater than 0.05: The null hypothesis of the test that the groups have equal variances is not rejected.
** Mann Whitney U test significance is lower than 0.05: The null hypothesis of the test that the two groups come from the same population is rejected.
*** Robust Rank-Order Distributional test significance is lower than 0.05: The null hypothesis of the test that the medians of the two groups are the same is rejected.