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Article

Price Gap Comparison in Unit Price and Lump Sum Contracts: A Transaction Cost Economic Approach

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Abstract

This study compares two major types of contracts in public procurement, i.e. unit price and lump sum contracts, in terms of the gap between the winner's bid price and owner's estimated price (OEP) in resulted price gap during the tender process, taking the case of government procurement in Indonesia. Using Indonesian e-tendering data of 2018-2021, this study employs an Ordinary Least Square regression to assess whether there is a difference in the price gap between the two types of contracts. This study finds that the average price gap in unit price contract is significantly higher than that of lump sum contracts. With the help of the transaction cost economics approach, this study discussed that the higher average price gap in unit price contracts is related to a lower information cost and lower risk of having a change order for the contract faced by the bidders. While in a lump sum contract, the winner's bid price is closer to OEP because bidders are faced with design risks that require higher information costs and contract adaptation during the execution phase. The study also found that the use of a unit price contract is significantly related to a longer tendering time due to a longer period in evaluating the bid.

Keywords: lump sum; contract; price gap; procurement; tender; transaction cost economics; unit price.

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1. Introduction

In the context of competitive tender in government procurement, efficiency becomes important in line with the New Public Management[1] movement, where the government is encouraged to act like a private in order to gain efficiency advantages (Hood, 1991). In tender, efficiency is often reviewed through a comparison between the winner's bid price and the owner's estimated price (OEP) (Placek et al., 2016; Tas, 2015; Wang et al., 2020), but the extent to which the price gap is relevant as an indicator is an important thing to investigate. It can be misguided if efficiency is only seen from the high price gap between the winner and the government without noticing that the behavior of business actors can differ depending on contractual issues implemented by the government through the type of contract. Several studies have explained the different purposes of using the type of contract. Hyari et al. (2017), Luo & Takahashi (2016), and Mandell & Nilsson (2010) explain that the use of unit price contracts is related to the quantity of work that cannot be ascertained at the beginning of the contract. Hyari et al. (2017) added that, in unit price, there is a discrepancy between the actual and estimated quantities of work poses risks to owners as well as contractors. While, Bajari & Tadelis (2001), Kang (2014), and Mandell & Nilsson (2010) emphasize the purpose of lump sum contracts related to project design. The main goal of this research is to find out to what extent the two main types of contracts (unit price and lump sum contracts) affect the price gap by referring to the Transaction Cost Economics (TCE) approach (Williamson, 1999; 2000). The governance structure or type of contract is a strategy for dealing with risk (Ewerhart & Fieseler, 2003; Luo & Takahashi, 2019; Gransberg & Riemer, 2009). Therefore, the behavior of the government and business actors is not solely opportunistic, but transaction characteristics such as design, information costs, and contract adaptation are thought to be behind it. Thus, it is necessary to observe whether there is a different motive/behavior between the unit price and lump sum contract that can be captured from the difference in price gap.

The research on the relationship between contract type and bid price shows mixed results. Kang (2014) and Luo & Takahashi (2019) found that the winning bid value was lower on tenders using lump sum contracts than the unit price contract. On the other hand, Ewerhart and Fieseler (2003) determined that unit price contracts are preferred over others because they are more economical procurement, allowing for risk sharing between project owners and contractors and reducing renegotiation costs. In addition, Demsetz (1968) and Williamson (1976) revealed that providers tend to provide the lowest bid price when using unit price contracts. These mixed results are one of the foundations of this study.

Nevertheless, when using the perspective of business actors, the bid price and the risks that will be faced are a trade-off. On the characteristics of transactions that, for example, the design is directed, information is not difficult to obtain, and change orders are more flexible, business actors attempt to win at a lower price from OEP compared with the opposite transaction characteristic. The type of contract should reflect that transaction, but

[1] On the New Public Management, government would be likely have some exposure to most of these doctrines: 'hands-on professional management' in the public sector, explicit standards and measures of performance, greater emphasis on output controls, shift to disaggregation of units in the public sector, shift to greater competition in public sector, stress on private sector style of management practice, and stress on greater dicipline and parsimony in resource use (Hood, 1991).

the government does not always understand. Instead, they are mostly oriented towards efficiency.

This study intends to determine the relationship between the unit price and lump sum contract types to the price gap in the tender phase. Currently, many studies have related contract types to the movement of projects and transaction costs. Still, most of these studies highlight aspects that can only be observed during contract execution or even after the project is completed. Meanwhile, empirical proof of the relationship between contract types and price quotations during the implementation of tenders still needs exploration. To answer the research question, this study will compare the effect of contract type on the price gap and the tender time of *e-tenders*[2] in Indonesia.

Williamson (1999, 2000) reveals that contractual relationships are based on transaction costs economics. This has also been supported by a large section of studies showing contractual relationships relating to the movement of transaction costs during contract execution. Bajari & Tadelis (2001) has disclosed the relationship of fixed price contracts and cost-plus contract types to the movement of ex-ante incentives and ex-post transaction fees. Li et al. (2014) reveal that project owners will incur higher contractual transaction costs if using unit price contracts than lump sum contracts and cost-plus contracts because unit price contracts are often used on projects with approximate design and specifications. From the study, the characteristics of the transaction are behind the decisions of the project owner and business actor, which subsequently impact the movement of costs.

Bajari & Tadelis (2001) revealed that an essential aspect of contractual relations is accommodating adaptation, a trade-off between transaction costs due to contract changes and incentives to reduce costs. The selection of contract types is more based on *ex-post* adaptation, which reflects the existence of uncertainty so that it has an impact on design changes that occur after the contract is signed, such as design failures, project site conditions, and the environment that can not be anticipated from the outset as well as regulatory changes (Bajari & Tadelis, 2001). Leśniak & Plebankiewicz (2015) explained that the contract is one of the things that influence the contractor's decision to participate in the tender. Luo & Takahashi (2019) added that contractual arrangements might reflect risks and incentives affecting a contractor's decision to make a tender bid.

Regarding some of the findings linking contract types and bid prices, we argue that using the bid price as an outcome variable in a study does not indicate the actual value obtained. Hence, the value needs to be compared with the initial estimated price. Thus, the price gap in this study is the percentage of the difference between the OEP and the winning bid price. This parameter has been found in studies by Jahren and Ashe (1990), Maharjan (2017), Placek et al. (2016), Tas (2015), and Wang et al. (2020).

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[2] The procurement method of goods/services in Indonesia consists of E-purchasing, Direct Procurement, Direct Appointment, Fast Tender, Tender and Selection. E-tender is a selection method to obtain providers of goods/construction works/other services electronically with criteria worth more than IDR 200,000,000 does not meet the criteria for Fast Tender and not in certain circumstances as stipulated in Presidential Regulation Number 16 of 2018 and its amendments.

This research is limited to construction and goods tenders sourced from the Indonesian government budget from 2018 to 2021 using 1-file and 2-files methods[3]. Observation of construction tenders and goods is used because it is the most considerable amount of the national procurement budget. This study was conducted using the OLS multiple regression as a quantitative method. The research reveals that the price gap was significantly greater in unit price than in lump sum contracts. This adds to the empirical finding that the price gap affected by the type of contract reflects the behavior of the agents through the TCE approach. Moreover, this study also contributes to explaining the consequences of tender time arising from the type of contract established.

2. Literature Review

TCE approach can help to explain why governments choose the type of contract and how bidders respond to bid prices. From the government's perspective, contract variation is expected to reflect savings and efficiency objectives. By using the analogy of bounded rationality faced by an individual human being (Simon, 1955; Simon & Barnard, 1947), this study assumes that the Government and business actors are also limited in achieving a high level of rationality due to the need for extensive information access in estimating the risks of contract execution by uncertainties. The government estimates this risk by selecting the appropriate contract to reduce the likelihood of contract failure. The choice of the contract type is determined by the level of certainty or risk associated with changes in costs (Gransberg & Riemer, 2009), as well as the ability of the project owner to calculate the number of goods or work items with certainty (Schexnayder & Richard, 2004). Gransberg & Riemer (2009) have mapped three types of contracts based on the level of risk sharing, namely cost-plus contracts when the project owner is confident and willing to bear all the risks that will arise; the unit price contract that is chosen because the project owner plans to share the risk with the provider; and a lump sum contract that transfers all the risks of contract execution to the provider. . This contract risk mapping affects the behavior of potential bidders in determining their bid price. The high risk in lump sum contracts encourages bidders to settle high prices in anticipation of risk. In contrast, bidders will be more competitive on unit price contracts because they have a high probability of change orders.

Some studies have outlined certain conditions for when to use the unit price and lump sum contracts. Unit price contract has been widely used in construction projects under the tender process (Luo & Takahashi, 2019; Mandell & Nilsson, 2010; Shrestha et al., 2013). A unit price contract is used for work with quantities that are still approximate (Luo & Takahashi, 2016), with few design and technology alternatives (Mandell & Nilsson, 2010). However, there are high potential quantity variations in the contract execution phase (Hyari et al., 2017). On the other hand, a lump sum contract is used when the scope of work has been clear, and the quantity of work has been accurately estimated (Hyari et al., 2017) so that it is not possible to make significant changes to the contract (Bajari & Tadelis, 2001; Kang, 2014; FIDIC, 2017). Lump sum or fixed-price contracts are used when the project is

[3] 1-file and 2-file methods are 1-stage method. 1 file is a method of delivering the entire bid document in 1 folder. While in 2-file, the bidder conveys the administrative and technical bidding documents in folder 1 and the price quote in folder 2. In both 1-file and 2-file methods, the folders are submitted at once.

simple, with a complete design and a low probability of contract change (Bajari & Tadelis, 2001). Kang (2014) argues that the purpose of a lump sum contract is to reduce the cost of design and administration concerning measurement and verification. Thus, the project owner designs some output concepts or images without creating a detailed design. The lump sum contract is considered appropriate to use for construction work that requires innovation and flexibility in replacing or substituting inputs but is applied to projects that are low risk, for example, related geotechnical risks (Mandell & Nilsson, 2010).

Based on the above conditions and with the help of the TCE approach, we argue that there is a transaction cost economizing motive behind the selection of contract types. Unit price contracts are chosen when the government can access information more easily about relevant prices and designs because the price per item and details of the work have been set. In this regard, it is suspected that there is a lower risk of contract changes, so the government is willing to bear the flexibility of change order from the presence of common risk. In contrast, the government chose the lump sum because they considered it easier to hand over the details of the work to the provider because of the difficulty in finding information related to the design details and price per item so that it is better to be output-oriented by leaving the risk of contract adaptation entirely to the provider.

On the business actor's side, the type of contract affects the bidder's behavior in determining the price quote. The risk sharing and potential increased profits from ex-post change orders make bidders on unit price tenders dare to bid much lower than OEP. The high risk and design cost to be borne on the lump sum contract encourages bidders to settle high prices in anticipation of risk. Mandell & Nilsson (2010) revealed that the bidder would incur design costs that are specific to a particular project and have the potential to become 'sunk' costs in a lump sum contract. This will lead to higher total design costs paid by the provider, affecting fewer bidders and higher bid prices. It differs from the unit price contract, where the project owner has designed the project. Nevertheless, bidders estimate ex-post conditions by reducing costs and maximizing profits. This incentive to reduce costs has an adverse effect on noncontractible quality, where the providers tend to ignore the quality of work to engage the lowest possible cost (Hart et al., 1997; Holmstrom & Milgrom, 1991).

The type of contract represents the consequences of transaction costs. Bajari & Tadelis (2001) reveals that the efficiency during the execution of the contract is influenced by the ex-ante of the contract signed by the parties, which implies an influence on the movement of renegotiation costs or transaction costs. In order to reduce the inefficiency of renegotiation at the stage of contract execution, a complete design is needed. The more complete the design, the higher the cost borne by the owner. However, the ex-ante design costs remain more favorable than the disadvantages of inefficient *ex-post* renegotiation (Bajari & Tadelis, 2001).

From this point of view, there are two essential things about the price gap. First, the difference in the price gap between the two contracts can reflect the difference in the amount of risk internalization carried out by bidders in the face of unit price and lump sum contracts. Second, the price gap affected by the type of contract does not necessarily indicate efficiency when looking at the impact on the ex-post contract. Unit price produces a high price gap but also has the potential to increase cost overruns and transaction costs that are higher than the lump sum. It is mentioned by Luo & Takahashi (2016) that unit price would cause a significant difference between the value of the initial contract and the final payment, and Li et al. (2014) who proved that the transaction cost borne by the project owner is higher when

using unit price contract due to the uncertainty before the project is completed. This also resonates with Shrestha & Pradhananga (2010) and Stark (1974), who state that the lowest bid value does not necessarily mean the project's total cost will also be low.

At the tender stage, the procedure is adjusted to the type of contract chosen. In the unit price contract, the bidder will bid on each goods item or work component along with a predetermined quantity, where the total bid price refers to the OEP. The total bid price is a combination of the unit price multiplied by the quantity for each type of goods/work. Each unit price is contractually binding (Burnett & Wampler, 2011). Unlike the lump sum contract, the quantity of work is not determined by the project owner but by the participant, who will settle the amount for each item/work based on the design and job description that the project owner has set through a technical expert (Kang, 2014). The use of a unit price contract will have the consequence of a longer tender duration than a lump sum contract. This is because the evaluation of tenders on unit price contracts is carried out in detail by evaluating each item's price for the entire work component (Hyari et al., 2017).

3. Method

3.1 Empirical Model

This empirical study uses a quantitative approach through the Ordinary Least Square (OLS) multiple regression model. The OLS multiple regression approach has been used to estimate the parameters of more than one explanatory variable (Gujarati, 2003). The relationship between the contract type and the price gap is explained through model (1), while model (2) describes the relationship to tender duration. All models are applied to the unit observation of the tender package (i) at the government level of ministries/institutions, provinces, regencies, and cities (g), between the years of 2018-2021 (t). The model includes interaction variables, other explanatory variables for control, fixed effects at the government level (τ_g), year effect (θ_t), and error terms (ε_{igt}). The estimation model of this study uses robust standard error to produce an unbiased error standard within the heteroskedasticity framework (White, 1980).

$$\begin{aligned} pricegap_{igt} = {} & \alpha_0 + \alpha_1\, unitprice_{igt} + \alpha_2\, project_{igt} + \alpha_3 bidder_{igt} + \\ & \alpha_4\, size_{igt} + \alpha_5\, prequalification_{igt} + \alpha_6\, java_{igt} + \\ & \alpha_7\, unitprice \times project_{igt} + \tau_g + \theta_t + \varepsilon_{igt} \end{aligned} \quad (1)$$

$$\begin{aligned} duration_{igt} = {} & \beta_0 + \beta_1\, unitprice_{igt} + \beta_2\, project_{igt} + \beta_3\, bidder_{igt} + \\ & \beta_4\, size_{igt} + \beta_5\, prequalification_{igt} + \beta_6\, personnel_{igt} + \\ & \beta_7\, java_{igt} + \beta_8\, unitprice \times project_{igt} + \tau_g + \theta_t + \varepsilon_{igt} \end{aligned} \quad (2)$$

As mention in model (1), *pricegap* is a dependent variable that is the percentage difference between the OEP and the winning bid price against OEP. The second dependent variable is the duration of the tender implementation, calculated from the time of tender announcement until the winner announcement as used by Hackney et al. (2007) and Wang et al. (2020). Models (1) and (2) use unit price as an independent variable in the form of dummy types of contracts, unit price (=1) and lump sum (=0). In order to see the effect of different types of projects, *project* is included for two types of dummies, namely public goods

type dummy (1=construction work; 0=goods) and construction type dummy (1=building; 0=road). Construction type dummy is included because it is motivated by the study of Hanák et al. (2021), who suggests that there is a need for a comparison study on different construction jobs with certain distinctive features, such as building and road constructions, to show the company's bidding strategy. Based on the characteristics of the project, this study also includes the interaction variable between the project and contract type. It is included because of the alleged additional effect if characteristics of a particular project are also motivated by unit price contracts. Moreover, this interaction is carried out to correct the endogeneity of contract type selection due to selection bias or measurement errors in the data (Bun & Harrison, 2019).

Several tender characteristics were added to reduce omitted variable bias in the estimation model: *bidder*, *size, prequalification,* and *java*. These are the control variables in both models, and *personnel* in the model (2). Variable *bidder* reflects the number of participants in the tender. A large number of bidders will increase the level of competition so that the bid price is getting low (Pavel & Sičáková-Beblavá, 2013; Placek et al., 2016; Soudek & Skuhrovec, 2013; Wang et al., 2020). The success rate of e-reverse tender increases with the rise of monetary value, because the implementing authority emphasizes more careful preparation for potential bidders (Carter et al., 2004). The high risk of losses in large procurement encourages procurement personnel to be more thorough, thus extending the procurement time (Wang et al., 2020). The budget ceiling reflects the size of the budget allocation to obtain public goods, but the value will be corrected in the form of the owner estimate price that is used in the tender process. Therefore, the project size used in this study refers to the OEP. *Personnel* is the number of working group members on each tender which is thought to affect the speed of the tender. This study involves a qualification method as a dummy type between pre-qualification (=1) and post-qualification (=0) to control the work's complexity and the length of time due to the qualification process. *Java* variables were added to control the characteristics and conditions in Java Island, which are suspected of having a higher intensity of development and procurement due to its high demand. Hence, there may be differences in the business climate and market share.

A set of dummy variables is needed to control the distributed populations that may differ over periods (Wooldridge, 2016). Therefore, we included a series of institutional dummy variables in the form of fixed effects (τ_g) to control differences in government-level characteristics that cannot be directly observed, such as factors of political aspiration, work culture, socio-economic and strategic plans in each level of governments. Referring to the study of Placek et al. (2016), the shift in the level of government upwards and downwards will affect the movement of economies of scale. In higher governments, it should be considered that there is an increase in the cost of coordination and harmonization of requirements. On the other hand, at the lower levels of government, they will be faced with the issue of greater heterogeneity of business actors; if the size of contracts varies, the economies of scale are low. Time fixed effect (θ_t) is also added because observations throughout 2018-2021 may be influenced by specific trends or conditions such as macroeconomic trends, political regimes, pandemic periods, business climate developments, and technological developments that can change throughout the observation.

Table 1. Data Statistics by Contract Type

	Unit Price (=1)					Lump sum (=0)				
	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max
Price Gap (%)	44,391	12.42	9.98	0	49.99	14,906	6.70	8.32	0	50
Tender Duration (days)	44,391	29.36	14.47	16	110.9	14,906	23.51	8.58	16	106.5
Number of Bidders	44,391	8.94	9.96	1	155	14,906	5.47	5.55	1	87
Winner Price (Million IDR)	44,391	4,039	19,114	106.4	1,129,000	14,906	3,803	19,415	107.2	549,609
Size (Million IDR)	44,391	4,684	21,042	200	1,182,982	14,906	3,972	19,989	200	597,085
Qualification Method (1= Pre, 0=Post)	44,391	0.0019	0.04	0	1	14,906	0.0033	0.06	0	1
Public Goods Type (1=Construction; 0=Goods)	44,391	0.85	0.36	0	1	14,906	0.23	0.42	0	1
Construction Type (1=Building; 0=Road)	24,634	0.45	0.50	0	1	2,494	0.43	0.49	0	1
Procurement Personnel	44,391	4.32	1.43	3	11	14,906	4.13	1.43	3	11
Java (1= Java, 0=Non Java)	44,391	0.57	0.49	0	1	14,906	0.54	0.49	0	1

3.2 Data

This research uses cross-sectional pooled data of national tenders from 2018 until 2021 from the Electronic Procurement System managed by the National Public Procurement Agency (NPPA) of Indonesia. The observation unit was carried out on the 1-file and 2-files e-tender package of goods and construction in 576 ministries/institutions,

provincial, regency, and city Governments in Indonesia. In one fiscal year, the average total budget procurement through providers was equivalent to IDR 396.8 trillion (USD 25.5 billion)[4], and the average percentage of the e-tender method was 81.2% of the budget value (LKPP, 2022). This research examines 44,391 tender packages using unit price and lump sum contracts in construction work and goods. These two public goods were chosen because they are the most frequent value and packages found within the historical data. Based on the number of packages, the average proportion of construction and goods on e-tender ranges from 51-62% and 16-23% respectively. Based on the total procurement budget, the annual budgets for construction and goods tenders are equivalent to IDR 322 trillion (USD 20,66 billion), thus dominating the average annual e-tender budgets by 78%-90%.

The data processing is carried out by first identifying the appropriate data based on procurement regulations. Besides the incomplete data, data that do not meet the criteria are also not used for observations. These criteria include the tender duration, which refers to the provisions at each tender stage that can be achieved no earlier than 16 days. Hence, tender with less than 16 days is not used. Observation is limited to the 1-file and 2-files submission methods. The 2-stage method[5] is not used because the data is less representative. The tender is carried out with an odd number of members, or at least three people in a working group, so the data with an even number violates the regulation and is not used in this observation.

Based on data, 69% of tenders were construction works, and 75% used unit price contracts. The price gap and tender duration data significantly differ in the unit price and the lump sum contract[6]. In more detail, Tables 1 and 2 describe statistical data by contract type and public goods type. The average percentage of price gap in a unit price contract is higher than in a lump sum contract, but the tender duration is shorter in the lump sum contract. In terms of duration, there are six to seven different tender days between unit price contracts and lump sum, as well as between construction and goods.

The average winner price is 4.3% lower than the average OEP on the lump sum contract and 13.8% lower than the OEP on the unit price contract. Regarding public goods type, the percentage of average winner price against OEP is lower in construction, equivalent to 94.5% of OEP in goods and 86.5% of OEP in construction works. Another finding is that lump sum contracts are more widely used in goods, whereas unit price contracts are more in construction. From the average number of bidders, it can be known that more companies are involved in construction tender and unit price contracts. This indicates that the construction sector market in Indonesia is more competitive than the goods sector. The qualification method is an indicator of work complexity in this study as regulated in Presidential Regulation 16 of 2018 and NPPA of Indonesia Regulation 9 of 2018. Tables 1 and 2 show that most observations use the post-qualification method, which means that it is classified as non-complex work. Regarding the number of personnel involved in the procurement working group, it shows an average value that does not differ, which ranges from three to five people in the working group.

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[4] The assumption used in this paper is 1 USD equivalent to 15.587 Indonesia Rupiah (IDR).
[5] The 2-stage document submission method is divided into two stages. Stage 1 is a submission for administrative and technical bids. Stage 2 is a submission for revisions of technical bidding documents and price quotes. The proposal in stage 2 is carried out if the participant passes the administrative and technical evaluation in stage 1.
[6] Based on the t-test at a statistical significance level of 1%.

Table 2. Data Statistics by Public Goods Type

	Construction (=1) N=41,070				Goods (=0) N=18,227			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Price Efficiency (%)	12.67	9.76	0	49.99	7.20	9.14	0	50
Tender Duration (days)	29.92	14.84	16	110.9	23.30	8.07	16	85.1
Contract Type (1=Unit Price; 0=Lump sum)	0.92	0.28	0	1	0.37	0.48	0	1
Number of Bidders	9.22	10.23	1	155	5.48	5.35	1	82
Winner Price (Million IDR)	4,351	21,174	119.9	1,129,000	3,142	13,669	106.4	538,208
Size (Million IDR)	5,030	23,109	200	1,183,000	3,324	14,145	200	597,085
Qualification Method (1= Pre, 0=Post)	0.0030	0.05	0	1	0.0004	0.02	0	1
Procurement Personnel	4.37	1.45	3	11	4.05	1.38	3	11
Java (1= Java, 0=Non Java)	0.55	0.50	0	1	0.59	0.49	2	2

In order to explore studies related to the specificity of the type of work on the construction works, data processing is carried out by identifying the name of the tender package which is classified as a group of building or road works. The building work group includes tender packages relating to buildings, dormitories, offices, schools, campuses, houses of worship, markets, settlements, health services, official houses, stations, toilets and building renovations. The road works group includes pedestrian, sidewalk, road, and bridge work. Based on this, 27,128 observations were obtained, namely 45.2% of building construction packages and 54.8% of road construction packages with descriptive statistics as shown in Table 3. The average percentage of price gap between buildings and roads is almost the same, namely 11.97% - 11.98%. On road works, it takes an average tender time of four days longer than in building work. The unit price contract is more widely used than the lump sum contract in both types of work. The average winning bid price shows a slight difference where the building work is 88% of the OEP and the road is 86.5% of the OEP. In addition, most of the building and road work tender packages that occurred in 2018-2021 are classified as non-complex where the construction sector market is more interested in participating in building work tenders than road works.

Table 3. Data Statistics by Construction Type

	Building (=1) N=12,266				Road (=0) N=14,862			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Price Efficiency (%)	11.98	8.69	0	47.64	11.97	10.09	0	49.99
Tender Duration (days)	26.55	11.61	16	109.9	30.32	14.91	16	110.6
Contract Type (1=Unit Price; 0=Lump sum)	0.857	0.35	0	1	0.95	0.218	0	1
Number of Bidders	9.69	10.36	1	125	7.35	7.43	1	86
Winner Price (Million IDR)	3,519	16,745	132	549,609	5,243	16,753	119.9	756,898
Size (Million IDR)	3,997	18,081	200.7	556,228	6,061	19,069	200	799,258
Qualification Method (1= Pre, 0=Post)	0.00367	0.0605	0	1	0.00161	0.0402	0	1
Procurement Personnel	4.23	1.40	3	11	4.37	1.43	3	11
Java (1= Java, 0=Non Java)	0.53	0.50	0	1	0.54	0.50	0	1

4. Results, Analysis, and Discussions

In this section, we will cover the results as follows. First, a result explanation of regression estimation from the relationship between the selection of unit price and lump sum contract to the price gap. Second, the consequence of the tender time of both types of contracts. Third, a specific explanation of estimation results from the effect of contract type to price gap dan tender duration in construction work observation. Fourth, we show robustness tests of the relationship of contract types to price gaps and tender duration on several subsamples based on public goods type, government level, and procurement size segmentation.

Table 4. Estimation Results of the Price Gap Model in Public Goods Tender

	Price Gap (%)			
	(1)	(2)	(3)	(4)
Unitprice (1=unit price; 0=lump sum)	5.699***	2.213***	1.890***	2.019***
	(0.083)	(0.088)	(0.127)	(0.128)
Public Goods (1=construction; 0=goods)		2.303***	1.786***	2.616***
		(0.090)	(0.125)	(0.130)
Bidder		0.566***	0.565***	0.536***
		(0.008)	(0.008)	(0.009)
Size (Million IDR)		-0.0000155***	-0.0000157***	-0.0000122***
		(0.000)	(0.000)	(0.000)
Prequalification (1=pre; 0=post)		-2.808***	-2.660***	-2.892***
		(0.600)	(0.604)	(0.569)
Java (1=java; 0=non java)		3.135***	3.141***	3.871***
		(0.067)	(0.067)	(0.079)
Unitprice X Public Goods			0.759***	0.418**
			(0.170)	(0.170)
Government fixed effect	no	no	no	yes
Year effect	no	no	no	yes
R-square	0.062	0.389	0.390	0.406
Observation	59,297	59,297	59,297	59,297

Note: statistical significance levels of 10% (*), 5% (**), and 1% (***), robust standard errors are written in parentheses.

4.1 The Effect of Contract Type on Price Gap in Public Goods Tender

Based on Table 4, all regression results show a consistent positive relationship between the unit price and price gap. The value of the effect is significantly based on robust standard error. Assuming other factors are constant, using unit price contracts contribute to the price gap by 2% higher than lump sum contracts by controlling work and tender characteristics. This means the bid price on the unit price contract is lower than the lump sum contract. These results are in line with Demsetz (1968), Ewerhart & Fieseler (2003), and Williamson (1976). The interaction between the type of contract and the type of work exerts an additional positive and significant influence on the price gap by 0.4%. Therefore, the difference in price gap between the construction work with a unit price contract and the

goods that uses a lump sum contract is 5% as the sum of the coefficients α_1, α_2, and α_7. This calculation refers to Wooldridge (2016).

The results also show the relationship between the control variable and the price gap. Construction works achieve a higher price gap than goods. This is consistent with Tas (2012), who argues that the degree of competition in construction works is higher than in goods due to the more significant number of bidders. The coefficient of the number of bidders variable shows a positive relationship; where the number of bidders is getting higher, the bid price is getting lower (Pavel & Sičáková-Beblavá, 2013; Placek et al., 2016; Soudek & Skuhrovec, 2013; Wang et al., 2020), and thus, the difference in value to OEP is also getting higher. The size of procurement did not have a meaningful effect on decreasing participation because the higher demand for public goods leads to a lower bid price. This is in line with Carter et al. (2004) and Tas (2012), who revealed that tenders with an enormous procurement size would attract business actors to participate in tenders.

The influence of *Prequalification* variables as the indicator of work complexity shows a negative relationship to price gap, which is statistically and economically significant. The price gap difference between complex and simple work is 2.9%. This is because as the complexity of the work increases, the uncertainty becomes higher (Williamson et al., 1975). This, then, will require innovation that is often risky and resulting an increase in the cost of designing a project (Mandell & Nilsson, 2010). Subsequently, it can reduce the company's willingness to participate in tender with complex works. Against the high market intensity background, procurement located on Java Island strongly influenced the bid price gap of 3.9%.

4.2 The Effect of Contract Type on Tender Duration in Public Goods Tender

Table 5, as the estimation result of tender duration, shows that the influence exerted by the unit price contract is positive on the longer tender period than the lump sum contract. This is due to the detailed evaluation process for each item on the work component of the unit price contract, where the arithmetic correction of the unit price contract requires a recalculation of the total bid value. Whilst, in the lump sum contract, the evaluation is carried out by adjusting the output of the work listed in the Output and Price List[7] to the work's details without changing the offer's total value. The Output and Price List for the lump sum contract are not more detailed than the Quantity and Price List on the unit price contract.

In the baseline model (column 1), the difference in tender duration between the unit price contract and the lump sum contract is almost six days. However, when added with other variables, the difference in the tender period between the unit price and the lump sum contract is reduced to almost half a day. The results of the interaction variable also show a negative relationship to the speed of tender. In construction procurement using the unit price contract, the tender period must take almost seven days longer than procuring goods with the lump sum contract. This is due to the combination of longer construction work tenders (in comparison to goods tenders) and the application of a unit price contract for construction works.

[7] Output and Price List is a term for construction work that uses a lump sum contract, while in the unit price contract or the goods procurement using Quantity and Price List terms.

Table 5. Estimation Results of the Tender Duration Models in Public Goods Tender

	Duration (days)			
	(1)	(2)	(3)	(4)
Unitprice	5.849***	1.952***	0.453***	0.441***
(1=unit price; 0=lump sum)	(0.098)	(0.108)	(0.130)	(0.133)
Public Goods		3.843***	1.450***	2.383***
(1=construction; 0=goods)		(0.107)	(0.183)	(0.196)
Bidder		0.333***	0.329***	0.301***
		(0.009)	(0.009)	(0.010)
Size		0.0000791***	0.0000782***	0.0000654***
(Million IDR)		(0.000)	(0.000)	(0.000)
Prequalification		17.43***	18.11***	19.47***
(1=pre; 0=post)		(2.438)	(2.424)	(2.336)
Personnel		1.274***	1.268***	1.058***
		(0.039)	(0.039)	(0.037)
Java		2.873***	2.897***	1.751***
(1=java; 0=non java)		(0.103)	(0.103)	(0.112)
Unitprice X Public Goods			3.520***	4.041***
			(0.223)	(0.229)
Government fixed effect	no	no	no	yes
Year effect	no	no	no	yes
R-square	0.0354	0.176	0.178	0.194
Observation	59,297	59,297	59,297	59,297

Note: statistical significance levels of 10% (*), 5% (**), and 1% (***), robust standard errors are written in parentheses.

The addition of the number of participants, the size of the procurement, and the work complexity variable show that these three variables positively affect the tender duration. On the coefficient of *Bidder*, the more competitive a tender is, the longer the tender process. The results of this study show that adding three bidders can increase the tender time by almost one day. On the other hand, procurement size was found to have a positive effect even though the effect is small at the tender stage. Carter et al. (2004) revealed that a larger procurement size would extend the procurement time due to the more thorough and adequate preparation to reduce the risks. Thus, the impact of the procurement size can be observed better at the

preparation stage rather than the tender stage. Nonetheless, this can be a note for further studies.

The complexity of the work has the most considerable influence on the tender time, which is almost twenty days longer than a simple project. In order to process the complex work, the procurement working group must evaluate the qualifications related to the credibility, performance, and assets of the company before the company makes an offer that will prolong the procurement process (Wang et al., 2020). In addition, procurement working groups needed to provide more extended time for bidders to prepare their bids on complex work.

This study shows that the tender time on the island of Java is almost two days longer than tenders outside of Java. This can be motivated by certain conditions and characteristics on the island of Java that can prolong the tender time, for example: the characteristics of procurement personnel, location, geographical and climatic factors on the island of Java. The relationship between the number of members of the procurement working group and the tender duration shows an interesting finding where the more employees assigned to the procurement working group, the longer the tender process will take. In addition to showing inefficient conditions, this also indicates an issue regarding the effectiveness and competence of procurement personnel. Implementing a decentralized procurement system causes high variations regarding the level of competence of procurement implementers. Inefficiencies in decentralized procurement due to human resource factors have been stated by Tanzi (1995), who maintains that there are imperfections in the provision of services at the local level that can limit the benefits obtained from procurement due to the poorly trained human resources in local governments. This is in line with Guccio et al. (2014), who argued that reliable implementers influence procurement efficiency.

4.3 Estimation Result in Building and Road Tender

The estimation results in Table 6 show that the relationship of contract types to price gap and tender duration remains consistent in building and road tenders. This consistent direction of relationships also occurs in the variables of the number of bidders, the size of procurement, the complexity of the work, and procurement personnel whose value is significant at a confidence level of 99%. Table 6 column (2) shows that building works will result in a lower price gap than road works. The negative influence of the building works still appears even though they implemented a unit price type of contract. This can be seen from the value of the interaction coefficient, which indicates the additional negative influence of this. Nonetheless, the total price gap obtained on building works with the unit price contract is not greater than the price gap of road works using unit price contracts.

The difference in price gap for the combination of contract type and work type is calculated from the coefficient value of *unitprice*, *building*, and interaction variables referenced by Wooldridge (2016). The estimation results show that using lump sum contracts in building works tends to increase the bid price closer to the OEP. This is due to higher complexity or uncertainty factors in the building works and the risk coverage that the provider will entirely bear if using a lump sum contract. Therefore, the bidder will compensate through a higher bid value.

Table 6. Estimation Results in Building and Road Tender

	Price Gap (%)		Duration (days)	
	(1)	(2)	(3)	(4)
Unitprice (1=unit price; 0=lump sum)	3.969***	2.319***	4.244***	4.595***
	(0.171)	(0.237)	(0.221)	(0.336)
Construction Type (1=building; 0=road)		-0.327		-1.934***
		(0.269)		(0.415)
Bidder		0.562***		0.225***
		(0.010)		(0.013)
Size (Million IDR)		-0.0000165***		0.000121***
		(0.0000028)		(0.000020)
Prequalification (1=pre; 0=post)		-2.523***		12.72***
		(0.866)		(4.508)
Personnel				0.843***
				(0.055)
Java (1=java; 0=non java)		3.906***		3.669***
		(0.104)		(0.164)
Unitprice X Construction Type		-1.116***		-2.467***
		(0.283)		(0.436)
Government fixed effect	no	yes	no	yes
Year effect	no	yes	no	yes
R-square	0.015	0.429	0.008	0.181
observation	27,128	27,128	27,128	27,128

Note: statistical significance levels of 10% (*), 5% (**), and 1% (***), robust standard errors are written in parentheses.

The results of the tender duration model show that building works using lump sum contracts produce the fastest tender times. On the other hand, road works using unit price contracts are the longest compared to other combinations. Although building work is considered to have many types of works and a high level of customization, as mentioned by Haronian and Sacks (2018), the results showed that building works have a better time tender compared to road works. This requires further exploration on the critical points of differences, such as in technical and price offerings in building and road constructions, including the methods of carrying out the works, the period of execution of the works, the

list of leading equipment, managerial personnel, construction safety plans, the list of subcontractors, and the list of outputs/quantity prices.

4.4 Robustness Test

There are some concerns about the result estimates. There is a procurement size segmentation in goods and construction where the fact is that the number of tenders is not equal between segments. In addition, there is also a significant difference in the number of tenders at each level of government. These issues raise concerns about whether controlling public goods type and government level are sufficient to estimate nationwide data. To anticipate this issue, robustness tests were conducted on several subsamples based on public goods type, government level, and procurement size segmentation. The government level is divided into ministries/institutions, provinces, and combined regencies & cities. Based on the sizes, the procurement of goods will be separated into small and non-small businesses under Presidential Regulation 16 of 2018, which is applicable during the observation period. The procurement values at a maximum IDR 2.5 billion (USD 160,390) are reserved and designed for small businesses, except for work packages with technical capabilities that small businesses cannot meet. Construction works are divided into three subsamples according to the Circular Letter of the Minister of Public Works and Public Housing Number 14 of 2018. The OEP of up to IDR 10 billion (641,560 USD) for small business qualifications, above IDR 10 billion to IDR 100 billion (USD 6.4 million) for medium business qualifications, and above IDR 100 billion for large business qualifications.

The model in the robustness test adds size segmentation as control variables at the government level subsample, while in subsamples based on procurement size, a government-fixed effect is added. The results in Table 7 showed that the relationship of contract types to price gap and tender time remained consistent and significant at 1% in almost all subsamples, except in the provinces and combined regencies & cities subsamples, which stated that there was no significance in the tender duration model. This is possible because of the different conditions and characteristics when procuring goods in provinces, regencies, and cities, so the relationship of contract types to the tender duration cannot be described through this research model. Nevertheless, in general, the estimation results can be concluded as robust.

Table 7 shows that the positive effect of unit price contracts is higher on construction works than on goods. In addition, this study concludes that the positive influence of unit price contracts on price gap is more significant in the larger procurement size, which is more commonly found in ministry/institution-level agencies.

The smallest effect of contract type on the tender duration is found in goods procurement from small business qualifications. Conversely, at a larger size of procurements, the effect of unit price contracts on tender duration is higher. This can be seen in goods tenders with non-small qualifications and construction works tenders with large qualifications. In addition, ministries/institutions carry out the longest tenders with unit price contracts compared to subsample provinces and combined regencies & cities.

Table 7. Robustness Test Results

	Goods					**Construction**					
	Small	Non-Small	Ministry	Province	Regency&City	Small	Medium	Large	Ministry	Province	Regency&City
Price_Eff (%)											
Unitprice (1=unit price; 0=lump sum)	1.723***	2.631***	3.184***	0.797***	1.129***	2.467***	3.866***	4.970***	4.371***	3.884***	1.386***
	(0.138)	(0.274)	(0.226)	(0.238)	(0.179)	(0.116)	(0.561)	(1.434)	(0.241)	(0.227)	(0.152)
control: *bidder, size, prequalification, java*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-square	0.292	0.287	0.248	0.360	0.311	0.420	0.459	0.578	0.457	0.443	0.415
Duration (days)											
Unitprice (1=unit price; 0=lump sum)	0.604***	1.454***	1.882***	0.32	0.0651	3.951***	7.325***	12.78**	9.689***	6.920***	0.651***
	(0.131)	(0.337)	(0.231)	(0.256)	(0.174)	(0.192)	(1.33)	(5.832)	(0.481)	(0.351)	(0.226)
control: *bidder, size, prequalification, personnel, java*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-square	0.0323	0.0736	0.0548	0.0365	0.0314	0.122	0.272	0.312	0.266	0.118	0.0537
control: size segmentation	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Government fixed effect	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No	No
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	14,873	3,354	6,632	4,670	6,925	37,201	3,673	196	7,479	7,940	25,651

Note: statistical significance levels of 10% (*), 5% (**), and 1% (***), robust standard errors are written in parentheses.

4.5 Discussion

This research revealed that the price gap was significantly greater in the unit price contract than in the lump sum contract. This indicates that business actors in unit price contracts tend to reduce the bid price much lower than those in lump sum contracts. Several potential explanations can be explored using a transaction cost economic approach related to the issue of uncertainty risk and the work complexity faced by business actors when operating contracts.

We argue that the provider responds to offer a high bid price close to OEP in a lump sum contract because it comes from the reason why government chooses lump sum for contract governance. First, the high information costs when the government (as project owner) faces a high obstacle in obtaining information, so it will be more efficient if it is handed over to the provider. Second, the high risk of change orders due to the output-based design. In the lump sum work, the project owner seeks to anticipate various changes that may arise due to the uncertainty of detailed design, so it prefers to leave the risk to the provider—for example, a lump sum contract on a design-build project. Gultom (2019) shows that design-build projects indicate a motive to reduce transaction costs through a smaller frequency of change orders than in design-bid-build projects. In the design-build project, the owner only compiles the concept design, while the provider compiles the detailed design. Therefore, the provider is more flexible in replacing or substituting the input of work (Mandell & Nilsson, 2010). In addition, the project owner can encourage innovation through lump sum contracts (Mandell & Nilsson, 2010).

The argument is also consistent with observational data used in this study which show that, on average, more complex works (through prequalification method indicator) are found in tenders with lump sum contracts, both on the observation of building works, road works as well as construction and goods as a whole. This shows that the project owner is most likely faced the potentially high transaction costs, so they use lump sum contracts to reduce these risks. Taking into account the risks, uncertainties and limitations of future change orders, the price bid on the lump sum contract project will be closer to the OEP in order to compensate information costs, design costs, work input change costs, as well as other transaction costs which will arise after the contract is signed.

Unlike the lump sum contract, the unit price contract is input-oriented and needs to identify the details of specific items of goods or work as a basis contractual, while the quantity of work is still uncertain. This indicates a lower cost of information on unit price contracts, so the government is willing to bear it. With the estimated quantity of work, the project owner allows for higher change order flexibility referring to work details that have been set. Li et al. (2014) explained that given the uncertainty in this unit price contract, it is likely that many changes will be proposed. The project owner must support either directly or through any architect-engineer and requires costs to measure and determine the actual amount of work completed so that post-contract transaction costs are high. Bidders have not considered this when drawing up bid prices on projects with unit price contracts, so bid prices tend to be low.

On the other hand, in conditions of high information costs and low risk of the change order, or vice versa, a unit price or lump sum contract may be selectable by the project owner. Nonetheless, the selection of this contract type also needs to consider that using complex

governance structures (types of contracts) to regulate simple contractual relationships tends to incur unnecessary costs (Williamson, 1979).

5. Conclussion and Recommendation

This research revealed that in the tender process, unit price contracts produce higher price gap than lump sum contracts, which means that the winning bid's value is lower on unit price contracts. These findings are not aligned with the study of Kang (2014) and Luo and Takahashi (2019) but are in line with the study of Demsetz (1968), Ewerhart & Fieseler (2003), and Williamson (1976). The difference in price gap in the two types of contracts indicates the differences in transaction cost minimization between these two contracts. Unit price contracts tend to have a higher price gap because the bidder can find information about relevant prices easier, thus facing a lower information cost. Moreover, they have the opportunity of flexible change orders, which means low risk to be covered. On the other hand, bidders in lump sum contracts will internalize the high information cost, risks, uncertainties and limitations of change orders at the execution stage into a price quote so that the price does not differ much from OEP. That led to a smaller price gap in lump sum contracts.

Therefore, from the government's perspective, unit price contracts are more suitable to be placed on working conditions with lower information costs and change order risks. Conversely, the high information cost and change order risk will be reduced when the government uses a lump sum contract.

By interacting contract types with procurement types, the price gap is higher in construction works with unit price contracts than in other combinations. In specific observational data, namely building and road construction, using unit price contracts on road works correlates with the lower bid price of the OEP, while using lump sum contracts in building works affects bidders to bid closer to the OEP. In addition, this study also shows the consequences of choosing a contract type where the tender duration is shorter on the lump sum contract than the unit price contract. The robustness test results strengthen the consistency of the main findings. These results also show that the effect of unit price contracts on the price gap and tender duration is getting high as the procurement size increases.

This study concludes that the price gap represents the response of business actors to the characteristics of transactions through the type of contract set by the government. Therefore, the change order policy should distinguish between the unit price and the lump sum contract. Especially in Indonesia, where the provisions of change order value are still the same value limit between the unit price contracts and lump sum contracts, even though there are different perspectives in responding to each type of contract so that it can affect the price gap as found in this study. The observations of this study are limited only at the tender stage.

Therefore, for future studies, further research needs to be made regarding the planning phase, preparation stages, and contract executions. Lastly, the research methods used in this study are limited to showing correlations between contract type and tender efficiency. This is mainly due to the endogeneity issue in the research model, namely the

selection of non-random contract types by the project owner. This is an opportunity for further developments in empirical studies.

References

Bajari, P., & Tadelis, S. (2001). Incentives versus Transaction Costs: A Theory of Procurement Contracts. *The RAND Journal of Economics*, *32*(3), 387. https://doi.org/10.2307/2696361

Bun, M. J. G., & Harrison, T. D. (2019). OLS and IV estimation of regression models including endogenous interaction terms. *Econometric Reviews*, *38*(7), 814–827. https://doi.org/10.1080/07474938.2018.1427486

Burnett, J. E., & Wampler, B. M. (2011). Unit Price Contracts: A Practical Framework for Determining Competitive Bid Prices. *Journal of Applied Business Research (JABR)*, *14*(3), 63. https://doi.org/10.19030/jabr.v14i3.5704

Carter, C. R., Kaufmann, L., Beall, S., Carter, P. L., Hendrick, T. E., & Petersen, K. J. (2004). Reverse auctions—grounded theory from the buyer and supplier perspective. *Transportation Research Part E: Logistics and Transportation Review*, *40*(3), 229–254. https://doi.org/10.1016/j.tre.2003.08.004

Demsetz, H. (1968). Why Regulate Utilities? *Journal of Law and Economics*, *11*(1), 55–65.

Ewerhart, C., & Fieseler, K. (2003). Procurement Auctions and Unit-Price Contracts. *The RAND Journal of Economics*, *34*(3), 569–580.

Federation Internationale des Ingenieurs Conseils (FIDIC). (2017). *FIDIC conditions of contract for construction: for building and engineering works designed by the employer* (Second). FIDIC.

Gransberg, D. D., & Riemer, C. (2009). Impact of Inaccurate Engineer's Estimated Quantities on Unit Price Contracts. *Journal of Construction Engineering and Management*, *135*(11), 1138–1145. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000084

Guccio, C., Pignataro, G., & Rizzo, I. (2014). Evaluating the efficiency of public procurement contracts for cultural heritage conservation works in Italy. *Journal of Cultural Economics*, *38*(1), 43–70. https://doi.org/10.1007/s10824-012-9194-2

Gujarati, D. N. (2003). *Basic Econometrics: Vol. 4th edition*. McGraw Hill.

Gultom, Y. M. L. (2019). Transaction Costs and Efficiency in Design-Build Contracting: Empirical Evidence from the Transportation Infrastructure Sector in Oregon. *Public Performance and Management Review*, *42*(5), 1230–1258. https://doi.org/10.1080/15309576.2019.1572020

Hackney, R., Jones, S., & Lösch, A. (2007). Towards an e-Government efficiency agenda: the impact of information and communication behaviour on e-Reverse auctions in public sector procurement. *European Journal of Information Systems*, *16*(2), 178–191. https://doi.org/10.1057/palgrave.ejis.3000677

Hanák, T., Drozdová, A., & Marović, I. (2021). Bidding strategy in construction public procurement: A Contractor's perspective. *Buildings*, *11*(2), 1–14. https://doi.org/10.3390/buildings11020047

Haronian, E., & Sacks, R. (2018). A specialized information schema for production planning and control of road construction. In *eWork and eBusiness in Architecture,*

Engineering and Construction (pp. 257–264). CRC Press. https://doi.org/10.1201/9780429506215-32

Hart, O., Shleifer, A., & Vishny, R. W. (1997). The Proper Scope of Government: Theory and an Application to Prisons. *The Quarterly Journal of Economics*, *112*(4), 1127–1161. https://doi.org/10.1162/003355300555448

Holmstrom, B., & Milgrom, P. (1991). Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design. *Journal of Law, Economics, & Organization*, *7*(Special Issue), 24–52. https://www.jstor.org/stable/764957

Hood, C. (1991). A Public Management for All Seasons? *Public Administration*, *69*(1), 3–19. https://doi.org/10.1111/j.1467-9299.1991.tb00779.x

Hyari, K. H., Shatarat, N., & Khalafallah, A. (2017). Handling Risks of Quantity Variations in Unit-Price Contracts. *Journal of Construction Engineering and Management*, *143*(10), 1–10. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001393

Jahren, C. T., & Ashe, A. M. (1990). Predictors of Cost-Overrun Rates. *Journal of Construction Engineering and Management*, *116*(3), 548–552. https://doi.org/10.1061/(ASCE)0733-9364(1990)116:3(548)

Kang, H. (2014). *The Effect of Lump Sum Contracts on Bidding Behavior and Procurement Costs in Public Highway Construction*. The University of Wisconsin.

Leśniak, A., & Plebankiewicz, E. (2015). Modeling the Decision-Making Process Concerning Participation in Construction Bidding. *Journal of Management in Engineering*, *31*(2). https://doi.org/10.1061/(ASCE)ME.1943-5479.0000237

Li, H., Arditi, D., & Wang, Z. (2014). Transaction costs incurred by construction owners. *Engineering, Construction and Architectural Management*, *21*(4), 444–458. https://doi.org/10.1108/ECAM-07-2013-0064

LKPP. (2022). *Profil Pengadaan Barang/Jasa Pemerintah Tahun Anggaran 2021*.

Luo, Y., & Takahashi, H. (2016). Who should bear the risk? Evidence from public procurement auctions. *31th Annual Congress of the European Economic Association and the 69th European Meeting of the Econometric Society EEA-ESEM 2016*.

Luo, Y., & Takahashi, H. (2019). Bidding for Contracts under Uncertain Demand: Skewed Bidding and Risk Sharing. *SSRN Electronic Journal*, 1–50. https://doi.org/10.2139/ssrn.3364708

Maharjan, R. (2017). *Effects of Contract Procurement Factors on Performance of Transportation Projects*.

Mandell, S., & Nilsson, J.-E. (2010). *A Comparison of Unit Price and Fixed Price Contracts for Infrastructure Construction Projects*.

Pavel, J., & Sičáková-Beblavá, E. (2013). Do e-auctions realy improve the efficiency of public procurement? The case of the Slovak municipalities. *Prague Economic Papers*, *1*, 111–124. https://doi.org/10.18267/j.pep.443

Placek, M., Schmidt, M., Ochrana, F., & Pucek, M. (2016). Impact of Selected Factors Regarding the Efficiency of Public Procurement (the Case of the Czech Republic) with an Emphasis on Decentralization. *Ekonomický Časopis*, *64*(1), 22–36. www.vestnikverejnychzakazek.cz

Schexnayder, C. J., & Richard, M. (2004). *Construction Management Fundamentals*. McGraw-Hill Professional.

Shrestha, P. P., & Pradhananga, N. (2010). Correlating Bid Price with the Number of Bidders and Final Construction Cost of Public Street Projects. *Transportation Research*

Record: Journal of the Transportation Research Board, *2151*(1), 3–10. https://doi.org/10.3141/2151-01

Shrestha, P. P., Shrestha, K., & Joshi, V. (2012). Investigation of Unbalanced Bidding for Economic Sustainability. *ICSDEC 2012*, 609–616. https://doi.org/10.1061/9780784412688.073

Simon, H. A. (1955). A Behavioral Model of Rational Choice. *Source: The Quarterly Journal of Economics*, *69*(1), 99–118.

Simon, H. A., & Barnard, C. I. (1947). *Administrative Behavior: A Study of Decision-Making Processes in Administrative Organization*. Macmillan.

Soudek, J., & Skuhrovec, J. (2013). *Public Procurement of Homogeneous Goods: the Czech Republic Case Study*.

Stark, R. M. (1974). Unbalanced Highway Contract Tendering. *Journal of the Operational Research Society*, *25*(3), 373–388. https://doi.org/10.1057/jors.1974.72

Tanzi, V. (1995). Fiscal federalism and decentralization: A review of some efficiency and macroeconomic aspects. *Annual World Bank Conference on Development Economics 1995*, 295–315.

Tas, B. K. O. (2012). Procurement Efficiency in Public Procurement Auctions: Analysis of Different Types of Products. *SSRN Electronic Journal*, 1–28. https://doi.org/10.2139/ssrn.2148638

Tas, B. K. O. (2015). *How to Achieve Efficiency in Public Procurement Auctions* (Working Papers 919).

Wang, Q., Zhang, R., & Liu, J. (2020). Price/time/intellectual efficiency of procurement: Uncovering the related factors in Chinese public authorities. *Journal of Purchasing and Supply Management*, *26*(3), 100622. https://doi.org/10.1016/j.pursup.2020.100622

White, H. (1980). A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity. *Econometrica*, *48*(4), 817–838. https://doi.org/10.2307/1912934

Williamson, O. E. (1976). Franchise Bidding for Natural Monopolies-in General and with Respect to CATV Franchise bidding for natural monopolies in general and with respect to CATV. *Source: The Bell Journal of Economics*, *7*(1), 73–104.

Williamson, O. E. (1979). Transaction-Cost Economics: The Governance of Contractual Relations. *Source: The Journal of Law & Economics*, *22*(2), 233–261. https://www.jstor.org/stable/725118

Williamson, O. E. (1999). Public and private bureaucracies: a transaction cost economics perspectives. *Journal of Law, Economics, and Organization*, *15*(1), 306–342. https://doi.org/10.1093/jleo/15.1.306

Williamson, O. E. (2000). The New Institutional Economics: Taking Stock, Looking Ahead. *Journal of Economic Literature*, *38*(3), 595–613. https://doi.org/10.1257/jel.38.3.595

Williamson, O. E., Wachter, M. L., & Harris, J. E. (1975). Understanding the Employment Relation: The Analysis of Idiosyncratic Exchange. *The Bell Journal of Economics*, *6*(1), 250–278.

Wooldridge, J. M. (2016). *Introductory Econometrics* (6th ed.). Cengage Learning.