

THE DIFFERENCE BETWEEN PROJECT PRICES AND FINAL PRICES OF CONSTRUCTION CONTRACTS IN THE PUBLIC SECTOR

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The publication of this article is supported by the VŠTE Internal Research Competition.

Abstract: The paper deals with the difference between project and final prices of construction contracts in the public sector. The project price of construction contracts is usually created using price systems, while the final prices of contracts are based on the actual interest of construction companies in the implementation of a given contract, actual cost, and the state of the market for construction works and materials. The paper presents an analysis of a total of 1,021 construction contracts awarded by the public sector in the Czech Republic in 2019-2020. These contracts are divided according to the predominant nature of the work into three categories, namely demolition, reconstruction, and construction. The authors conclude that the project and final prices of construction contracts differ, both in terms of regional destination and the nature of the subject of the contract (construction, demolition, etc.). The biggest savings were found in contracts dealing with demolition work, where secondary income can be expected in the form of sales of secondary raw materials. Moderate savings are also achieved in the case of contracts concerning reconstruction or construction.

Keywords: construction industry, project prices, final prices, public sector

1 Introduction

The construction industry is an integral part of the economy, as it creates and manages long-term fixed assets, and enables achieving profit in other sectors of the economy. The construction industry thus creates and adjusts the material basis for all other sectors of the economy. Even the tertiary sector could not function without the construction industry, as it would lack establishments, infrastructure, etc. Therefore, it is quite logical that the construction industry is a fundamental element of all economies in the world. Even the most advanced economies in the world have a developed construction industry, which is reflected in the materials and technologies used, as well as in the maintenance of already constructed buildings.

Customers of the construction sector can be divided into two basic groups, the first group includes commercial/private customers from companies, and the second group consists of public contractors (government institutions).

Project price is an amount determined based on project documentation and cost estimates for a given construction project. The project price includes the cost of materials, labor, technical equipment, administrative fees, and other related costs. It is usually set before the start of the construction process and serves as a starting point for evaluating and comparing offers from potential suppliers.

A public sector construction contract's final price is the actual amount paid for a completed construction project. It is the result of competition and negotiations with contractors, where costs may change based on various factors, such as changes in the scope of work, unforeseen construction problems, inflation, additional requirements, or construction risks. Vrbka et al., (2020) deal with comparing the concepts of equilibrium price and market price.

Several factors can contribute to the change between the project and the final price of construction contracts in the public sector. These factors include:

- 1) Changes to the scope of work - changes that may occur during construction can increase or decrease costs. This may be due to the requirements of investors, changes in legislation, or unexpected problems that require modifications to the project.

- 2) Additional requirements – requirements occurring during construction that were not originally included in the project documentation. These requirements may affect the total cost and may lead to a change in the final price.
- 3) Inflation and price changes - prices of materials, labor, and other costs may change over time due to inflation, market fluctuations, or economic factors. These changes may affect the final price of the construction contract.
- 4) Construction risks – construction projects are often subject to various risks such as technical problems, delays, unforeseen events, etc. These risks can have an impact on costs and can result in changes in the final price. It is important for public institutions and construction contractors to carefully monitor the difference between the project price and the final price. Transparency, effective communication, and careful monitoring of costs are key factors in managing construction projects and minimizing unwanted differences between expected and actual costs.

Selecting appropriate systems for managing public infrastructure construction project is a major challenge for governments. The existing literature provides an extensive theoretical background for the analysis of different public-private governance regimes for the provision of public infrastructure services; however, little has been said about the innovation incentives of specific contract forms and their welfare implications under different governance regimes (Dhanshyam et al 2021).

2 Literary research

In a public-private project construction projects combine both construction and management tasks, whereas, in traditional public procurement, they are delegated to individual private contractors. These two modes of service providers differ in terms of their incentives to innovate and gather private information about future costs to adapt the provision of services to changing situations. The mode preferred by the government depends on the cost of gathering information, the cost of innovation efforts, and the degree to which the efforts are contractible (Hoppe & Schmitz, 2018). Interesting findings are presented by Krulický & Vochozka (2021), who developed a method for the valuation of real estate and its consequences.

In their research, Čermáková & Hromada (2022) deal with the comparison of the prices of development projects across territories, when at the end of their work they proposed suitable paths for sustainable development, while Research conducted by Virglerová et al., (2022) focus on risk at SME markets.

In the case of complex public procurement projects, it is difficult to draw up enforceable contracts, where the interest in the lowest possible price often clashes with the interest in the highest possible quality of work. Failure of a contractor to meet their obligations poses an acute risk, especially in the case of intense competition for the contract. A well-established incentive mechanism used to mitigate the problem of contractor default is to withhold a payment, where the contracting authority postpones payment of part of the final price for the construction work until other requirements are met (e.g., expiry of the period of trouble-free operation of the works, etc.). Upon completion of the project, the buyer shall determine the amount of the retainage to be released to the seller, taking into account any possible defects. Although this is generally a feasible form of a contract to be implemented, the practical difficulties in assessing completion represent a moral hazard for the buyer (Fugger et al., 2019).

Horák et al., (2020) proposed a new approach for evaluating companies applicable in the case of construction companies executing contracts for the public sector.

In the context of recent initiatives to increase the transparency of public procurement, the authors focus on the effects of disclosing information about previous public procurements in an environment where an organization delegates its purchasing decisions to its employees. If employees can exercise discretion in selecting a supplier, which may be influenced by personal preferences, employee incentives may be misdirected toward the organization.

When implementing complex public procurement projects, it is often not possible to draw up complete contracts. As a result, the customer-supplier relationship is important for the success of the project. A poor relationship can result in reduced trust on the side of the customer during the sourcing process and increased opportunistic behavior on the side of the supplier after the purchase. We consider an environment where the winning supplier decides on the level of quality to be provided to the customer and compare a standard reverse auction and a customer-specified reverse auction.

Hromada (2021) addresses the issue of housing affordability in the Czech Republic, especially about socioeconomic indicators. Current trends in consumer behavior are analyzed by Dusek (2020).

The relationship between customers and suppliers is often given by factors that go beyond the terms of a contractual agreement. Customers can thus benefit from the identification of trusted suppliers. The authors claim that suppliers' pre-contractual actions, such as making higher customer-specific investments without any long-term contract, can indicate the trustworthiness of suppliers (Beer et al 2018).

Another view on real estate is provided by Krulický & Horák (2019). In their research, they focused on real estate as an investment asset. Hromada & Krulický (2021) modify investment in real estate and added socioeconomic factors to the evaluation.

In a competitive bidding process, the success and/or failure of suppliers depends to a large extent on the submitted bid price. The decision on the bid price is thus a strategic issue for construction project contractors. Some parameters of the model, such as the number of competitors and the cost of the project, are estimated by analyzing historical data. Next, a mathematical model is developed to determine a bid price that maximizes the expected profit. To reduce the risk of a large loss, a maximum acceptable risk constraint is used in the model (Rastegar et al., 2021).

Determining the bid price is a key issue for contractors and construction companies. Contractors' performance in competitive bidding directly depends on their bidding strategy (Rastegar et al., 2020).

To win a project contract through competitive bidding, contractors shall submit a bid price determined by a markup on the estimated project costs. The success of the bid thus depends largely on the accuracy of the estimate, which means that the estimation process needs to be allocated sufficient funds (Takano et al., 2018).

The bidding process for construction and infrastructure is highly competitive and complex, which entails various uncertainties contractors must face. Multi-stage bidding (MSG) is even more complex. In this process, general contractors need to handle the complexities of accounting for their subcontractors' bids and face "a greater threat of falling prey to the winner's curse" (i.e., a situation where the winning contractor underestimates the actual project cost) (Ahmed & Adway 2022).

With the huge increase in spending on public projects, contractors shall use effective and efficient bidding strategies to cope with the competitive bidding environment. General contractors usually perform part of the work and subcontract the other parts to submit a comprehensive joint bid. This bidding arrangement is referred to as multi-stage bidding, where

subcontractors submit their bids/offers to the general contractor, who, in turn, submits a final joint bid for the entire project. In a multi-stage bidding environment, general contractors may face an increased likelihood of lower or even negative profits. Despite previous research efforts aimed at developing bidding models, there is a need to address the issue of the multi-stage bidding environment, hereafter referred to as the multi-stage game, in the professional literature (Ahmed et al., 2022).

In the construction sector, contractors face many uncertainties during their projects, such as cost overruns, project schedule delays, and safety issues. To overcome such complications, contractors apply different risk management approaches that reflect their risk behavior and attitude towards expected risks, as well as bidding decisions. Risk attitudes are influenced by a variety of factors, including personal characteristics, or demographic, social, and cultural influences. The results of the survey conducted by Awwad & El Irani (2022) show that the major factors are the completeness of project information and the need for contractor work.

In large projects, project segmentation and planning the size of construction bids' contract packages is a complex and critical issue. Due to the nature of construction projects, for which large budgets, long durations, and many activities with complex procedures are typical, project segmentation requires complex decision-making. The owner can determine the bid price behavior of contractors in response to different sizes of work packages. The optimal segmentation solution from simulated scenarios is chosen using a multi-attribute decision-making method (Shiue et al., 2021).

To help manufacturers adequately hedge against the risks of input commodity price fluctuations, indices based on the price-to-contract ratio are used, based on which manufacturers can transfer part of their risk to downstream retailers and implement risk sharing in the supply chain. A two-stage Stackelberg game showing that the hedge ratio is positively related to consumer preference for green products, but inversely related to green product R&D costs is used. Interestingly, in the supply chain of a competing producer, the profits of both producers grow significantly when the input commodity price fluctuates slightly; however, when the fluctuation continues to increase, the profit of one producer decreases while the profit of the other grows slowly. From a different perspective, green degree competition negatively affects the profits of both manufacturers and retailers and decreases the green degree (Wang 2022).

A contractor's ability to prepare a competitive bid for a construction tender is essential for their survival in the market. The bid price and estimating strategy should enhance the probability of winning from a sufficient number of bids, but at the same time ensure the economic stability and development of the company. The Czech construction market is generally perceived as a low-cost-oriented market with a relatively frequent occurrence of abnormally low bids (Hanák et al., 2021).

The requirement for efficient use of public funds leads contracting authorities to use electronic reverse auctions (e-RA), a tool enabling financial savings to be achieved (Hanák et al., 2018).

Recommending bidders' identity of bidders in public procurement auctions (tenders) affects considerably many areas of public procurement; however, it has not been studied in detail. A bidder recommender could be a very beneficial tool, as the supplier (firm) can search for suitable bids, and on the other hand, the public procurement contractor can automatically discover unknown firms suitable for a given bid (Rodriguez et al 2020).

Performance management is one of the key managerial activities (Hanák & Marovič 2022).

Manta et al., (2022) point to the need to capitalize all components of sustainability. There is a need to introduce a

sustainability clause when awarding contracts. To clarify this question, countries report to the World Bank. To map this issue, the opinions of other researchers are systematized and relevant studies of international organizations (OECD, European Commission, UNESCO, World Bank) are also considered (Manta et al., 2022).

From the perspective of gaining a competitive advantage, building a positive reputation, e.g., using modern digital marketing tools, is also crucial in all sectors of the economy (Partlova et al., 2022, Sagapova et al., 2022).

Under European law, public procurement procedures are strictly regulated to ensure equality of bidders and high quality of goods and services (Plaček et al., 2020).

Vrbka et al., (2020a) focus on determining the increase in market price of real estate resulting from reconstruction. The authors deal with this issue in more detail in their other publication (Vrbka et al., 2020b).

3 Materials and Methods

Long-term monitoring of the construction market was carried out: The data for the analysis contains information on 1130 construction contracts awarded by the public sector in the Czech Republic in 2019-2020, with the completion in 2021-2022. This is based on the relatively long duration of construction works and the efforts of the authors to always take into account the final price of the construction contract, known only after its completion.

The data was drawn from publicly available sources, as municipalities and cities are required to publish data on public contracts by Act No. 134/2016 Coll., on Public Procurement. In most cases, municipalities and cities publish information about their plans and concluded contracts on their websites, or they are available for inspection by municipal or city office staff. Prices will be given in Czech crowns excluding VAT.

For each construction contract, the database provides the identification of the contracting authority (city, municipality, governmental institution), the identification of the construction contract, the original project price of the contract, and the final price of the construction contract. All construction contracts will be into categories by their nature as follows:

- Construction
- Reconstruction/construction modifications of an already completed work.
- Demolition

Construction contracts will subsequently be divided according to the territorial aspect of their implementation by the NUTS2 nomenclature.

The first step will be to check the completeness of the data to verify whether the data for construction contracts is complete, in particular the information about the final price of the construction contract due to its non-completion or non-disclosure before the end of the construction market monitoring. These construction contracts will be excluded from further analysis.

The next step will be to determine the basic characteristics of the dataset, both in absolute and relative terms. Furthermore, the average prices per construction contract in each category will be determined.

Next, a regression analysis will be used to determine the relationship between the project and the final price of construction contracts.

4 Results

The initial dataset contained data on 1,130 construction contracts awarded by public institutions in the Czech Republic in 2019-2020. After checking the completeness of the data, data on 949 construction contracts was subject to further analyses, which means that 181 construction contracts started in 2019-2020 and their final cost was not considered.

The following table shows the number of construction contracts classified by their type and region of implementation.

Tab. 1 Overview of the number of construction contracts by type and region

Region	Demolition	Reconstruction	Construction	Total sum
City of Prague	0	99	50	149
South Bohemian region	3	36	19	58
South-Moravian region	1	92	32	125
Karlovy Vary Region	0	10	4	14
Hradec Kralove region	4	33	23	60
Liberec region	2	22	9	33
Moravian-Silesian Region	3	64	31	98
Olomouc region	3	54	27	84
Pardubice region	0	32	21	53
Pilsen Region	1	33	14	48
Central Bohemian Region	3	76	38	117
Usti Region	1	30	14	45
Highlands	0	19	13	32
Zlín Region	1	22	10	33
In total	22	622	305	949

Source: Authors.

As can be seen from the previous table, most construction contracts were implemented in the "Reconstruction" category in the city of Prague. This is apparently since in the territory of The City of Prague, there is the largest number of buildings owned by the government sector; at the same time, this region is generally considered the most creditworthy.

The following table shows the average project price in the studied regions.

Tab. 2 Average project price of construction contracts (in thousands of CZK)

Region	Demolition	Reconstruction	Construction
City of Prague	0	50,008	191,775
South Bohemian region	22,366	20,135	32,546
South-Moravian region	41,000	41,446	42,776
Karlovy Vary Region	0	18,793	13,570
Hradec Kralove region	93,265	40,372	53,209
Liberec region	19,765	45,661	10,480
Moravian-Silesian Region	44,738	30,906	31,101
Olomouc region	26,968	32,275	41,128
Pardubice region	0	36,813	60,531
Pilsen Region	400,000	70,684	144,474
Central Bohemian Region	51,901	30,101	42,272
Usti Region	97,776	23,307	62,113
Vysočina region	0	40,163	63,236
Zlín Region	15,760	28,148	25,827

Source: Authors.

The table above shows the average project price of an average construction contract in individual regions. The highest average demolition price was recorded in the Pilsen Region, but this was only one significant construction event; therefore, the value cannot be considered relevant. The highest average construction price was recorded in the City of Prague and again in the Pilsen region.

Table 3 below shows the average final price of a construction contract.

Tab. 3 Average final price of construction contracts (in thousands of CZK)

Region	Demolition	Reconstruction	Construction
City of Prague	0	52 288	192 055
South Bohemian region	11 366	16 914	32 475
South-Moravian region	40 000	35 376	42 237
Karlovy Vary Region	0	18 838	11 324
Hradec Kralove region	87 652	38 534	43 574
Liberec region	15 101	43 945	8 980
Moravian-Silesian Region	38 670	28 727	28 322
Olomouc region	25 339	30 120	44 238
Pardubice region	0	35 401	55 335
Pilsen Region	346 739	74 623	149 942
Central Bohemian Region	41 370	28 009	36 406
Usti Region	84 821	21 110	66 292
Vysočina region	0	37 946	57 868
Zlín Region	12 236	25 201	20 884

Source: Authors.

Table 3 presents an overview of the average final price of construction contracts in the monitored regions. Based on the presented data, the highest final price of construction contracts was recorded for construction contracts - construction in the City of Prague.

Table 4 shows the relative difference between the project and the final price of construction contracts.

Tab. 4 The relative difference between the project and the final price of construction contracts

Region	Demolition	Reconstruction	Construction
City of Prague	x	+5 %	+/- 0 %
South Bohemian region	-49 %	-16 %	+/-0 %
South-Moravian region	-2 %	-15 %	-1 %
Karlovy Vary Region	x	+/- 0 %	-17 %
Hradec Kralove region	-6 %	-5 %	-18 %
Liberec region	-24 %	-4 %	-14 %
Moravian-Silesian Region	-14 %	-7 %	-9 %
Olomouc region	-6 %	-7 %	+8 %
Pardubice region	x	-4 %	-9 %
Pilsen Region	-13 %	+6 %	+4 %
Central Bohemian Region	-20 %	-7 %	-14 %
Usti Region	-13 %	-9 %	+7 %
Vysočina region	x	-6 %	-8 %
Zlín Region	-22 %	-10 %	-19 %

Source: Authors.

It follows from the table that the biggest difference was recorded in the case of demolition contracts when the difference represented a saving compared to the project price. This can be explained by achieving secondary income from demolition (sale of secondary materials, ...). The table also shows that there was usually a reduction in the final price compared to the original project price. This may be due to the competitive struggle between construction companies and the construction project prices based on general price lists for construction works, i.e., without considering the possible savings and the profit policy of the individual company.

4.1 Difference between project and final prices depending on the project price.

Table 5 below shows the determined correlation coefficient between the project price and the achieved difference in final prices for individual orders. It can be assumed that in the case of large construction contracts, economies of scale are reflected, and therefore for a contract with a higher project price that does not consider economies of scale, these potential savings will be reflected in an overall lower final price for the work.

Tab. 5 Correlation of the difference between the project price and the final price

	Demolition	Reconstruction	Construction
Number of contracts	22	622	305
Correlation	0.22817	-0.01372	0.02017

Source: Authors.

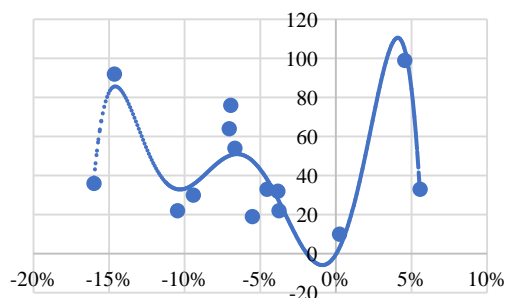
As can be seen from the table above, the correlation coefficient reaches relatively low values. It is thus not possible to confirm the mutual dependence and determine the final price based on the original project price of the construction contracts. A relatively stronger correlation was only observed in the case of construction contracts in the category "demolition".

4.2 Difference between project and final prices depending on the number of contracts by region.

Below, the relationship between the project and the final price of construction contracts will be analyzed in the "construction", "reconstruction", and "demolition" categories depending on the number of contracts processed in individual regions. At this point, it can be assumed that the higher the number of construction contracts in the region, the higher the demand is directed to the construction companies, which can allow them to increase the bid price.

The following figure graphically illustrates the project and final price ratio and the number of construction contracts in the "reconstruction" category in individual regions of the Czech Republic.

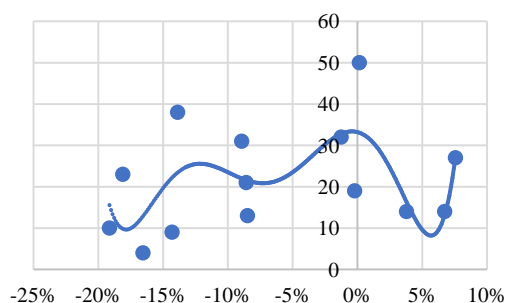
Figure 1 The relationship between the project and final price and the number of "reconstruction" contracts in the regions



Source: Authors.

The following figure graphically shows the project and final price ratio and the number of construction contracts in the "construction" category in individual regions of the Czech Republic.

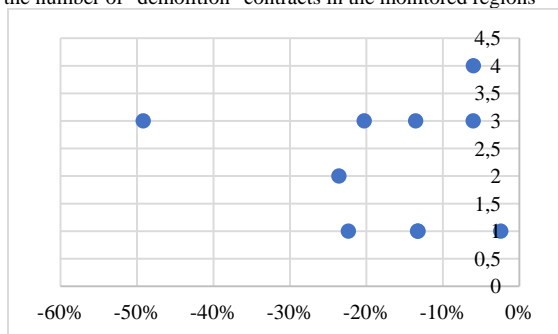
Figure 2 The relationship between the project and final price and the number of "construction" contracts in the regions



Source: Authors.

The following figure graphically shows the project and final price ratio and the number of construction contracts in the "demolition" category in individual regions of the Czech Republic.

Figure 3 The relationship between the project and final price and the number of "demolition" contracts in the monitored regions



Source: Authors.

Based on the presented analyses, it can be concluded that the difference in the final price compared to the original project price (savings or price increase) is not influenced by the number of contracts processed in a given region.

5 Discussion

The processed data confirmed the fact that the final price of construction works is usually lower than the original project price. About the significant statistical set of researched works (949 construction contracts) awarded by public institutions in the Czech Republic between 2019-2020 and subsequently completed, it can be concluded that public institutions have

economically rational expectations when awarding construction contracts, which makes it possible to achieve savings in most cases compared to the original project price. The largest savings are achieved in the case of "demolition" construction contracts, where it is possible to expect the use of secondary raw materials by construction companies. In this regard, construction companies seem to count on secondary income and are thus willing to execute demolition contracts well below the project price.

The difference between the project price and the final price is also due to the different methodologies of their determination, as project prices are determined based on the price list of construction works, which is the basic general guide for drawing up itemized budgets. However, specific final prices also reflect the specifics of individual buildings and the pricing (profit) policy of construction companies.

6 Conclusion

The goal of the paper was to determine a possible difference between the original project and the final prices of works in awarding public construction contracts by public institutions in the Czech Republic. The original project prices are made public by the institutions at the time of announcing public contracts as "expected prices". Construction companies can then apply for tenders and offer a price for which they would implement the given construction contract. Based on their judgment, construction companies can offer a price higher or lower than the original project price. The authors analyzed 949 construction contracts awarded by public institutions in the Czech Republic in 2019-2020 and subsequently complemented until 2022. These contracts were divided by their nature into the "demolition", "reconstruction" and "construction" categories. The research results show that in most cases, the final price of the construction contract is lower than the original project price, which means that public contracting authorities usually achieve savings. The analysis of the data shows that there are no differences in terms of the amount or number of contracts or the region in which the contract is executed.

Further research could focus on monitoring contracts awarded in the next years, i.e., from 2021 on, and monitoring the final prices. Considering the long-term horizon between the award of the contract and the knowledge of the final price for work in the order of years, the authors would suggest repeating this study approx. in 2 years, e.g., in 2024.

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Primary Paper Section: A

Secondary Paper Section: AH, AP