THE ANALYSIS OF THE PUBLIC PROCUREMENT ENVIRONMENT BEFORE AND AFTER COVID-19 BREAKTHROUGH: CASE OF SLOVAKIA

Michal Tkáč

Department of Corporate Financial Management
The Faculty of Business Economics with a seat in Košice,
The University of Economics in Bratislava
michal.tkac1@euba.sk

Michal Tkáč

Department of Quantitative Methods
The Faculty of Business Economics with a seat in Košice,
The University of Economics in Bratislava
michal.tkac@euba.sk

Juraj Till

Department of Corporate Financial Management
The Faculty of Business Economics with a seat in Košice,
The University of Economics in Bratislava
juraj.till@euba.sk

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Abstract

This study analyzes the Slovak public procurement environment before and after the COVID-19 pandemic by examining a research sample of over 102,000 real procurement offers presented in the Slovakian EKS Elektronický kontraktačný systém. The study compares the savings from public procurement contracts in the pre-COVID era and the COVID era using Box-plot analysis and the Mann-Whitney test. The results indicate that while the mean savings rate remained similar, the COVID era had a significantly lower median savings rate and a different distribution of savings rates compared to the pre-COVID era. The study also compares the distribution of savings based on the type of public procurement offers and the type of procurer. These findings can be useful for policymakers and practitioners in understanding the impact of the pandemic on public procurement.

1. Introduction

Public procurement has been a crucial aspect of government operations for a long time, intending to achieve transparency, efficiency, and effectiveness in the acquisition of goods and services. However, the outbreak of COVID-19 in 2020 has had a significant impact on public procurement processes around the world. While the pandemic has highlighted the importance of public procurement in ensuring the provision of essential goods and services, it has also exposed weaknesses in the system, including supply chain disruptions and increased demand for medical supplies. Therefore, it is essential to examine how public procurement has changed before and after the COVID-19 breakthrough to identify the challenges faced and the measures taken to mitigate them. In this paper, we provide an overview of public procurement practices before and during the COVID-19 pandemic, including the impact of the pandemic on procurement processes and the strategies used to manage the challenges posed by the outbreak. By doing so, we hope to contribute to the ongoing conversation on improving public procurement in the post-COVID-19 era.

2. Literature review

Public procurement is a critical function of government operations that aims to ensure transparency, efficiency, and effectiveness in the acquisition of goods and services. The outbreak of the COVID-19 pandemic in 2020 has had a significant impact on public procurement processes worldwide. This literature review examines the changes in public procurement before and after the COVID-19 outbreak. A survey conducted by the World Bank Group (2020) highlights the opportunities and challenges faced by public procurement during the early months of the pandemic. The study identified several issues, including supply chain disruptions, increased demand for essential medical supplies, and the need to quickly adapt to remote work environments. Furthermore, the study recommends the adoption of innovative approaches such as e-procurement and virtual bid openings to mitigate the challenges posed by the pandemic. Similarly, a report published by the European Commission (Paulović and Zomer, 2021) examines the trends that emerged during the COVID-19 pandemic in public procurement practices. The report identifies several new trends, including the increased use of sustainable procurement practices and the need for more agile procurement processes. The report also highlights the importance of strategic partnerships and cooperation between cities to address procurement challenges. Eßig, Deimling, and Glas (2021) argue that the COVID-19 crisis has exposed the deficiencies of public procurement systems, and the root causes lie in public procurement capabilities. The authors propose extended public buyer competencies based on a European Framework, evidence-based decision-making, and the use of digital technologies to improve the security of supplies. Chagelishvili and Surmanidze (2022) study the impact of the COVID-19 pandemic on simplified procurement in Georgia. The authors note that crises are conducive to the implementation of simplified procurement to address emergencies, but such measures carry the risk of corruption and less transparency. The study recommends measures to reduce the share of simplified procurement in total procurement and improve transparency. Casady and Baxter (2022) discuss the relevance of unsolicited proposals (USPs) in public-private partnerships (PPPs) in healthcare procurement during the pandemic. The authors argue that the protracted procedures of traditional PPP procurements are not suitable for times of crisis. USPs could play a pivotal role in the COVID-19 pandemic as boundary spanners between public agencies and the private sector in the PPP procurement process. The study recommends a pragmatic and practical approach to encouraging and procuring healthcare USPs. Vecchi, Cusumano, and Boyer (2020) analyze the contracting challenges faced by Italian healthcare authorities and U.S. procurement officials in the immediate aftermath of the COVID-19 crisis. The authors provide

practitioner-derived lessons for improving procurement in times of disaster, including the need to recognize the strategic role of procurement, empowering procurement officials, and building trust among different governance levels.

3. Methodology

The study methodology aimed to analyze the Slovak public procurement environment using a research sample of more than 102,000 real procurement offers. The research sample was based on procurement offers presented in the Slovakian EKS. Elektronický kontraktačný systém (EKS) is an electronic platform used by Slovakian public sector organizations to manage the procurement of goods, services, and construction work. The system simplifies procurement by providing a single place for public tenders, allowing businesses to easily find and respond to opportunities. EKS incorporates features to increase transparency, ensure legal compliance, streamline administrative tasks, and facilitate efficient communication between purchasers and suppliers. Its ultimate goal is to foster fair competition, reduce corruption, and promote the efficient use of public funds. The study focused on the pre-COVID era from January 2017 to December 2019 and the COVID era from January 2020 to December 2022. Due to the non-normal distribution of savings, the study used the Box-plot analysis and Mann-Whitney test to compare the differences in savings in public procurement contracts before and after the COVID-19 outbreak. The output variable in the study was savings, which represents the difference between the estimated value and the winning bid as a percentage of the estimated value. Savings from public procurement contracts were used in this study to determine the impact of the pandemic on the Slovak public procurement environment. These findings can help policymakers and practitioners better understand the impact of the pandemic on public procurement practices in Slovakia and other countries facing similar challenges.

4. The research

The research in this paper is focused on the analysis of the Slovakian public procurement environment before and after the COVID-19 breakthrough. The descriptive analysis and statistical hypothesis testing of more than 102 000 real procurement offers placed in 6 year period in the Slovak electronic contractual system is presented in Table 1.

Table 1. Descriptive statistics of savings from public procurement offers presented in the Slovakian EKS

Saving %	Count	Mean	St. Dev.	P05th	P25th	x̃	P75th	P95th
Pre-COVID-19	60601	13.59	17.60	0	0.0417	5.79	21.93	50.75
COVID-19	41803	13.86	18.43	0	0.0357	5.375	22.24	53.06

Null Hypothesis	Test	p-value	Verdict
The distribution of Savings (%) is the same across categories of COVID-19.	Independent-Samples Mann-Whitney U Test	0.022	Reject the null hypothesis.

According to the results of the Mann-Whitney U test, there is a statistically significant difference between the savings rates from public procurement offers during the pre-COVID-19 and COVID-19 periods. Despite both periods having a similar mean savings rate of 14% and standard deviation of 18%, the median savings rate during the COVID-19 period was significantly lower at 5,3%

compared to 5,79% during the pre-COVID-19 period. Moreover, the test indicated that the distribution of savings rates in the COVID-19 period was significantly different from the pre-COVID-19 period at a 5% level of significance. While the 25th percentile in both periods had a savings rate of 0%, the 75th percentile during the COVID-19 period was higher at 22,25% compared to 21,93% in the pre-COVID-19 period. The top 5% of offers in the COVID-19 period also had a slightly higher savings rate of 53% compared to 51% in the pre-COVID-19 period. In conclusion, although the average savings rate from public procurement offers remained similar between the two periods, the Mann-Whitney U test suggests that the COVID-19 period had a significantly lower median savings rate and a different distribution of savings rates compared to the pre-COVID-19 period.

In the next step, we compare the distribution of savings based on type of the public procurement offers. The motivation behind this type of research was to describe how the distribution of savings differ in auction and contractual type of offers. The box-plot analysis is presented in Figure 1.

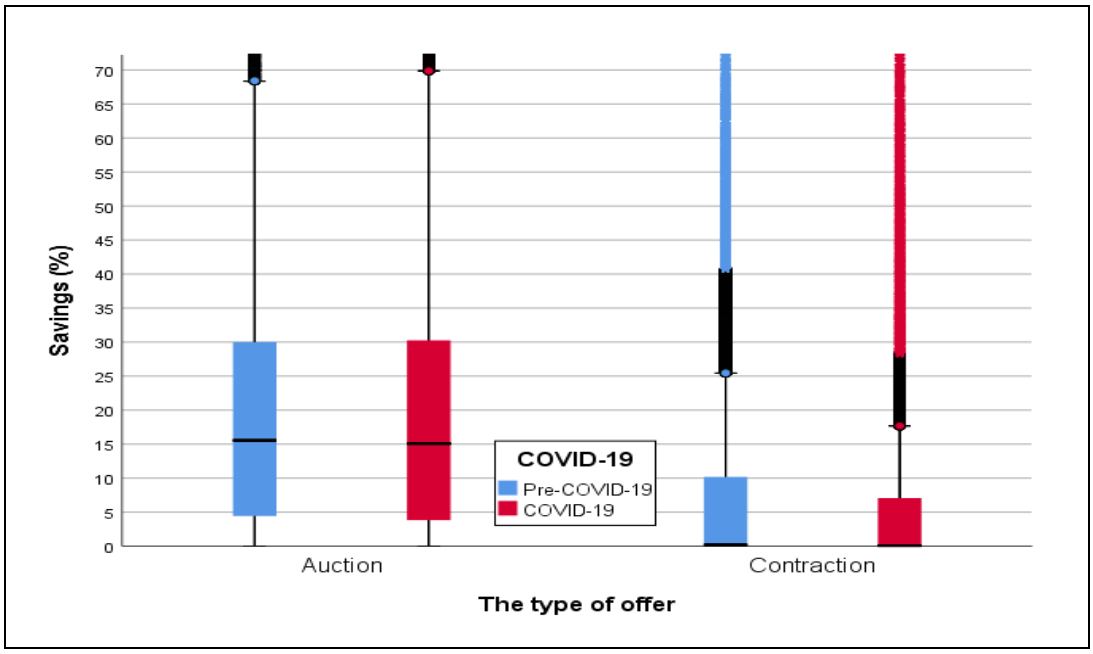

Figure 1. Box-plot analysis of savings from public procurement offers based on the contractual type of offers

Based on the provided data, it can be observed that the median values and percentile ranges for auctions and contracts in the pre-COVID-19 and COVID-19 periods were different. In the pre-COVID-19 period, the median value for auction contracts was 15.56%, and the 25th and 75th percentile values were 4.43% and 30%, respectively. On the other hand, for contraction contracts, the median value was 0.18%, and the 25th and 75th percentile values were 0% and 10.18%, respectively. During the COVID-19 period, the median value for auction contracts decreased slightly to 15.08%, while the 25th and 75th percentile values for auction contracts were 3.82% and 30.24%, respectively. For contraction contracts, the median value was even lower at 0.06%, and the 25th and 75th percentile values were 0% and 7.07%, respectively. These results suggest that the median value and percentile ranges for both auction and contraction contracts decreased during the COVID-19 period. While the median value for auction contracts decreased only slightly, the median value for contraction contracts decreased significantly. Additionally, the percentile ranges for both types of contracts also decreased during the COVID-19 period, indicating a reduction in the variability of the contract values. The Mann-Whitney U tests showed statistically significant differences at 5% level significance in distributions of savings in the Pre-COVID-19 and COVID-19 periods for both auction and contractual contracts.

In further research, we compare the distribution of savings based on the type of agreement. The motivation for this kind of research was to determine whether the distribution of savings differs based on the type of proposed contracts. The box plots are presented in Figure 2. The data provided in Figure 2 shows the statistics of savings from public procurement offers for different types of contracts in the pre-COVID-19 and COVID-19 periods. The percentile values for the 25th, 50th (median), and 75th percentiles are given for each type of contract. For Framework Agreements, there was a slight increase in the 25th percentile value from 0.025% to 0.044% in the COVID-19 period. The median savings rate also increased from 5.47% to 6.28%, and the 75th percentile value increased from 21.69% to 23.88%. For Purchase Contracts, the 25th percentile value decreased from 0.04% to 0.03% in the COVID-19 period, while the median savings rate remained similar at 5.6% and 5.03% in the pre-COVID-19 and COVID-19 periods, respectively. The 75th percentile value decreased slightly from 21.12% to 20.81%. For Service Contracts, the 25th percentile value decreased from 0.13% to 0.05% in the COVID-19 period. The median savings rate remained similar at 7.67% and 7.13% in the pre-COVID-19 and COVID-19 periods, respectively. The 75th percentile value increased significantly from 32.35% to 42.26%. For Work Contracts, the 25th percentile value decreased significantly from 0.42% to 0.14% in the COVID-19 period. The median savings rate decreased from 12.50% to 6.81%, and the 75th percentile value decreased slightly from 34.79% to 31.41%. The results suggest that the savings from public procurement offers varied across different types of contracts in the pre-COVID-19 and COVID-19 periods. While there were some increases in the median and 75th percentile values for Framework Agreements and Service Contracts, there were decreases in the 25th percentile values for all types of contracts, indicating that the lowest savings rates decreased in the COVID-19 period.

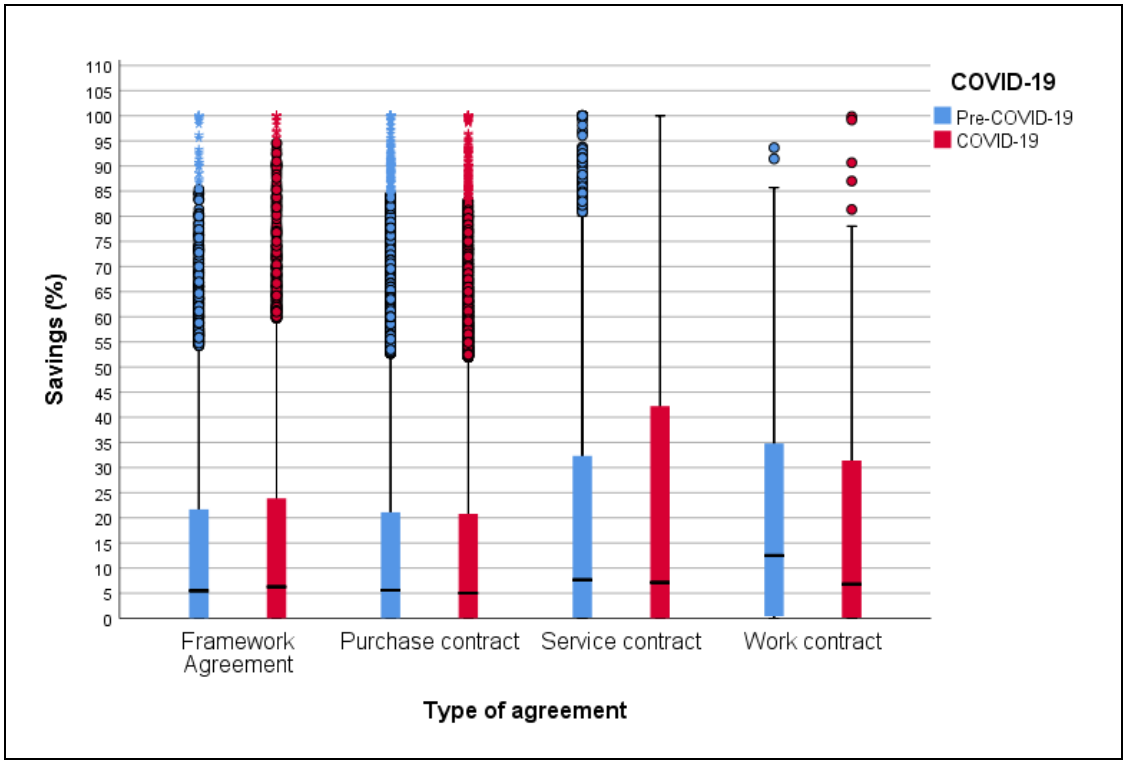

Figure 2. Box-plot analysis of savings from public procurement offers based on contractual types of agreements

The data presented in Table 2 indicates the distribution of savings from public procurement offers in the pre-COVID-19 and COVID-19 periods, categorized by contract type. The Mann-Whitney U test revealed that there is a statistically significant difference between the two periods for all types of contracts, except for service contracts.

Table 2. The results of the statistical tests comparing distributions savings from public procurement offers based on the contractual type of agreements.

	Type of contract	Null Hypothesis	p-value	Verdict
H2	Framework Agreement	The distribution of Savings (%) is the same across categories of COVID-19.	0.000	Reject null
H3	Purchase contract		0.000	Reject null
H4	Service contract		0.276	Retain null
H5	Work contract		0.037	Reject null

CPV categories also play a significant role in the distribution of savings in public procurement offers. Therefore we tried to identify for which CPVs the distribution of savings changed and for which CPV was the same, with the breakthrough of the pandemic. Based on statistical hypothesis testing, Table 3 shows the CPVs for which the distribution of savings between the PRE-COVID-19 and COVID-19 periods were significantly different. The data show that there was a statistically significant difference in the distribution of savings for all CPVs listed. The largest difference was observed in the Health and Social Work Services CPV, with a median difference of -9.57%. The CPV with the smallest difference was Public Utilities, with a median difference of 16.66%. The table also shows the number of observations for each period and the median savings for each CPV. The results of the Mann-Whitney U test, which was used to test for the significance of the differences in the distribution of savings, are shown in the p-value column. All p-values were less than 0.05, indicating that the null hypothesis of no difference in the distribution of savings between the two periods can be rejected. Therefore, the verdict is to reject the null hypothesis and accept the alternative hypothesis that there is a significant difference in the distribution of savings between the two periods for all CPVs listed in the table.

Table 3. The list of CPVs with statistically significant changes in the distribution of savings

	Pre-Covid-19		Covid-19		Comparison	
CPV	N	$\tilde{x}$	N	$\tilde{x}$	$\tilde{x}$ diff.	p-value
Public Utilities	60	41.67	44	58.32	16.66	0.000
Business services: law, marketing, consulting, recruitment, printing and security	944	30.59	816	43.77	13.18	0.000
Security, fire-fighting, police and defence equipment	410	6.89	523	17.19	10.30	0.000
Other community, social and personal services	292	5.91	256	16.20	10.29	0.000
Agricultural, forestry, horticultural, aquacultural and apicultural services	121	21.85	63	31.89	10.04	0.001
Clothing, footwear, luggage articles and accessories	1155	6.99	914	15.03	8.04	0.000
Agricultural machinery	803	1.59	431	7.11	5.52	0.000
Industrial machinery	1427	4.44	1136	7.50	3.06	0.023
Agricultural, farming, fishing, forestry and related products	971	3.20	850	5.88	2.68	0.004

	Pre-Covid-19		Covid-19		Comparison	
CPV	N	x̃	N	x̃	x̃ diff.	p-value
Petroleum products, fuel, electricity and other sources of energy	1726	6.86	943	9.01	2.14	0.011
Software package and information systems	789	6.46	610	8.22	1.76	0.044
Leather and textile fabrics, plastic and rubber materials	664	0.59	363	2.20	1.61	0.005
Medical equipment, pharmaceuticals and personal care products	8802	0.36	4627	1.59	1.23	0.000
Chemical products	2835	0.10	1508	0.36	0.27	0.000
Hotel, restaurant and retail trade services	260	0.76	145	0.13	-0.64	0.012
Repair and maintenance services	905	1.00	769	0.18	-0.82	0.000
Radio, television, communication, telecommunication and related equipment	886	7.06	739	5.04	-2.02	0.011
Transport equipment and auxiliary products to transportation	4138	3.40	3504	0.26	-3.14	0.000
Mining, basic metals and related products	284	3.66	224	0.29	-3.37	0.006
Office and computing machinery, equipment and supplies except furniture and software packages	12671	9.38	9322	5.81	-3.56	0.000
Transport services (excl. Waste transport)	870	8.72	191	1.54	-7.18	0.001
Printed matter and related products	802	14.70	354	6.88	-7.82	0.000
Health and social work services	57	16.18	40	6.61	-9.57	0.017

There were also several CPVs for which, based on the Mann-Whitney U test, we cannot confirm statistically significant changes in distributions of savings in the pre-COVID-19 and COVID-19 periods. They were: Electrical machinery, apparatus, equipment and consumables; Lighting (p=0.088), Machinery for mining, and quarrying, construction equipment (p=0.941), IT services: consulting, software development, Internet and support (p=0.318), Musical instruments, sports goods, games, toys, handicraft, art materials and accessories (p=0.921), Education and training services (p=0.138), Laboratory, optical and precision equipments (excl. glasses) (p=0.949), Furniture (incl. office furniture), furnishings, domestic appliances (excl. lighting) and cleaning products (p=0.317), Construction structures and materials; auxiliary products to construction (excepts electric apparatus) (p=0.640), Food, beverages, tobacco and related products (p=0.329), Sewage-, refuse-, cleaning-, and environmental services (p=0.460), Postal and telecommunications services (p=0.312), and Architectural, construction, engineering and inspection services (p=0.950). These findings suggest that there were no statistically significant alterations in public procurement savings for these specific CPVs during the pandemic period. As such, the influence of the Covid-19 pandemic on public procurement savings within these sectors remains unconfirmed based on our current dataset.

5. Conclusion

The study aimed to analyze the impact of the COVID-19 pandemic on the Slovak public procurement environment. The data for the study was collected from the Slovakian EKS Elektronický kontraktačný systém, which presented more than 102,000 real procurement offers. The study focused on the pre-COVID-19 period from January 2017 to December 2019 and the COVID-19 period from January 2020 to December 2022. The output variable of the study was savings, which represented the difference between the estimated value and the winning bid as a percentage of the estimated value. The Mann-Whitney U test results showed that there was a statistically significant difference between the savings rates from public procurement offers during the pre-COVID-19 and COVID-19 periods. Although both periods had a similar mean savings rate of 14% and a standard deviation of 18%, the median savings rate during the COVID-19 period was significantly lower at 5.3% compared to 5.79% during the pre-COVID-19 period. The 75th percentile during the COVID-19 period was slightly higher at 22.25% compared to 21.93% in the pre-COVID-19 period. The top 5% of offers in the COVID-19 period also had a slightly higher savings rate of 53% compared to 51% in the pre-COVID-19 period. These findings indicate that although the average savings rate remained similar between the two periods, the COVID-19 period had a significantly lower median savings rate and a different distribution of savings rates compared to the pre-COVID-19 period. The study also compared the distribution of savings based on the type of public procurement offers, namely auctions and contracts. The results indicated that the median value and percentile ranges for both auction and contraction contracts decreased during the COVID-19 period. The Mann-Whitney U tests also showed statistically significant differences in distributions of savings in the pre-COVID-19 and COVID-19 periods for both auction and contractual contracts. These findings suggest that the COVID-19 pandemic had a significant impact on public procurement practices in Slovakia. Furthermore, the study compared the distribution of savings based on the type of procurer. The results showed that the percentile ranges for different types of procurers were different, with legal persons under $2 having the lowest median savings rate and state institutions having the highest median savings rate during the pre-COVID-19 and COVID-19 periods. In conclusion, the study provides valuable insights into the impact of the COVID-19 pandemic on the Slovak public procurement environment. The findings can help policymakers and practitioners better understand the changes in public procurement practices in Slovakia and other countries facing similar challenges. The study highlights the need for policymakers to focus on increasing the median savings rate in public procurement contracts during the COVID-19 pandemic and reducing the variability of contract values.

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