SAVINGS ANALYSIS OF SINGLE-BIDDER VS. MULTI-BIDDER PUBLIC PROCUREMENTS IN SLOVAKIA

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Abstract

This study analyzes public procurement offers from the Slovak Electronic Contractual System (EKS) in order to assess the impact of bidder competition on savings in Slovak public procurement environment. Focusing on contrasts between single-bidder and multi-bidder competitions, the research employs statistical methods to evaluate the implications of competitive dynamics on fiscal efficiency. Results indicate that procurements with multiple bidders yield significantly higher savings, demonstrating the benefits of competitive bidding. The study further identifies procurement categories prone to single-bidder dominance, suggesting sectors with potential for increased regulatory oversight to enhance competition. These findings underscore the importance of competitive procurement practices in enhancing fiscal efficiency and guiding effective policy interventions.

1. Introduction

Public procurement plays a crucial role in government spending and budget management. It is a key tool for how governments, public institutions, and other publicly funded organizations obtain goods and services from external suppliers. Efficient public procurement practices can result in significant cost savings for government agencies, as well as improved transparency and accountability in the use of public funds(Public procurement - OECD, 2006). However, public procurement processes can also be susceptible to anticompetitive practices, which hinder competition and lead to inefficiencies and inflated costs (Jones et al., 2018) These anticompetitive practices, such as bid rigging, collusion among suppliers, and a lack of genuine competition in the bidding processes ultimately limit the number of bidders and reduce potential cost savings (Bhagat, 2017; Heimler, 2012). This point is reinforced by empirical research, which suggests that savings in public procurement tend to escalate proportionally with the size of the procured function and the importance of price in the contract award criteria, while being adversely affected by limited bidder participation (Chapela et al., 2017). The factor "Number of Bidders" in public procurement is a well-documented determinant of cost savings. The relationship between bidder competition and procurement outcomes has been researched in various contexts and sectors. An increased number of bidders contributes to a competitive atmosphere where each participant is incentivized to offer their best possible price. This competitive environment

can prevent the prevalence of overpriced bids and limit the possibilities of collusion among bidders (Džupka et al., 2020; Onur & Taş, 2018; Chapela et al., 2017). For instance, the study titled "Optimal bidder participation in public procurement auctions" by Onur and Taş examines the optimal number of bidders needed to foster a competitive public procurement market. The research suggests that procurement costs decrease until there is participation from six to eight bidders. Having established this optimal range, policymakers have a benchmark to strive for in terms of encouraging sufficient competition to realize cost savings (Onur & Taş, 2018).

In the case of Slovakia, one major issue in public procurement is the high number of contracts awarded to only one bidder. This lack of real competition could lead to increased costs for the government. The extent and consequences of these single-bidder public procurement processes are not well-documented in academic research. In this study, we seek to compare cost savings achieved in single-bidder procurements with those in multi-bidder procurements in Slovakia. Through this analysis, we aim to understand how effective competitive bidding is at generating cost savings and ensuring value for money in public spending.

2. Methodology and description of sample

This study aims to analyse savings from public procurement competitions in Slovakia, focusing on the differences between competitions with a single bidder and those with multiple bidders. We utilized a dataset comprising over 160,000 real public procurement offers sourced from the Slovak Electronic Contractual System (EKS), a digital platform that supports electronic contracting processes.The data for this research were extracted from the EKS (www.eks.sk), which provides a comprehensive, transparent platform designed to facilitate electronic contracting. The EKS platform enables the creation, negotiation, and signing of contracts digitally, thereby enhancing efficiency and reducing paperwork. Importantly, EKS supports API approaches for big data analysis, which was crucial for handling the large volume of data in this study. The period of study spans from January 10, 2014, to December 1, 2023. This timeframe allows for a robust longitudinal analysis of trends and patterns in public procurement savings.

The Main output variable used in the study is Savings. It is defined as the difference between the estimated value of a procurement contract and the winning bid, expressed as a percentage of the estimated value. The main input variable used in this research is One Applicant. This binary variable categorizes the procurement competitions into two groups: those with only one bidder (Yes) and those with more than one bidder (No). The other variables used in the paper are:

- CPVs (Common Procurement Vocabulary): We utilized the CPV, a standardized classification system across the EU, to categorize and analyze procurement offers. This study examined four levels of CPV granularity: The first two digits identify the divisions (XX000000-Y); The first three digits identify the groups (XXX00000-Y); The first four digits identify the classes (XXXX0000-Y); The first five digits identify the categories (XXXXX000-Y).
- CO_CPV (Contractor_CPV): A unique identifier for each combination of Contractor/Applicant/Bidder and CPV, allowing for comparison across similar procurement settings.
- CO_CA_CPV (Contractor_Contracting Authority_CPV): A unique identifier for each combination of Contractor/Applicant/Bidder, Contracting Authority, and CPV, enabling detailed comparisons where the same entities are involved across different procurements.

Due to the non-normal distribution of the variables, non-parametric statistical tests were employed. The primary analytical methods included: Mann-Whitney U Test, which is used to assess the statistical significance of the differences in savings between one-bidder and multi-bidder competitions. Box-Plot Analysis, which provides a visual representation of the distribution of savings across different categories and variables. Pareto Analysis, which helps identify the CPVs in which most one bidder competitions occur. Spearman Correlation Analysis which assessed the strength and direction of association between the variables.

3. Research results

The first part of our analysis is focused on comparing the distribution of savings across the entire research sample, which represents the Slovak public procurement environment. The primary motivation for this research was to understand how the distribution of savings in procurement competitions with only one bidder differs from those with more than one bidder. This comparative approach provides insights into the impact of competitive bidding on the efficiency and effectiveness of public spending. By analyzing how the presence of multiple bidders influences the financial outcomes of procurement processes, we aim to provide empirical evidence that could guide policy decisions and strategies in public procurement. The distribution of savings based on occurrence of only one bidder in competition is presented in Figure 1.

Our analysis differentiates the savings distribution between procurement competitions with a single bidder and those with multiple bidders. For competitions with multiple bidders (One Applicant= No), the data reveals a mean savings of 19%, a standard deviation also of 19%, with the lower quartile at 3%, the median at 14%, and the upper quartile at 29%. In contrast, competitions with only one bidder (One Applicant= Yes) present a starkly different profile, with a mean savings of merely 1%, a standard deviation of 6%, and both the median and the 25th percentile standing at 0%, highlighting minimal savings in most cases.

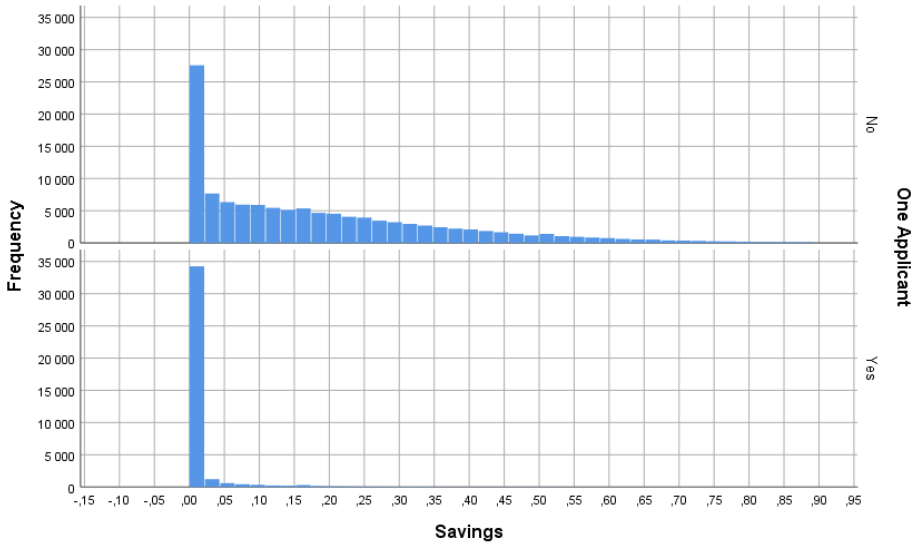

Figure 1. Distribution of public procurement savings based on presence of only one applicant

Source: (author)

To support this claim, the null hypothesis proposing that the savings distribution is identical regardless of the number of applicants (one vs. multiple) was tested. We use an independent-samples Mann-Whitney U Test. The Mann-Whitney U test provided evidence to reject the null hypothesis,

with a p-value (p-value < 0.001) far below the conventional alpha level of 0.05. This significant difference in the savings distributions between single and multiple bidder competitions confirms that the presence of additional bidders lead to increasement of savings.

The second part of our analysis concentrates on the use of the Common Procurement Vocabulary (CPV) as a standard for categorizing the types of goods and services procured. Specifically, we evaluated the percentage representation of Public procurement competitions with only one bidder across different CPV categories. The main motivation behind this aspect of the study was to identify those CPV types where one bidder competitions represent at least half of all procurement activities. This analysis provides a clearer picture of which sectors may lack competitive diversity, potentially indicating monopolistic tendencies or specialized market conditions where few suppliers exist. The results of this segment of our analysis are graphically represented in Figure 2.

The analysis, as depicted in Figure 2, examines CPV codes at both the first divisional level and the second group level. At the divisional level, we identified six CPV categories where more than 50% of the procurement competitions involve only one bidder. They are: 73: Research and development services and related consultancy services, 66: Financial and insurance services, 51: Installation services (except software), 92: Recreational, cultural and sporting services, 24: Chemical products, 50: Repair and maintenance services. These categories suggest sectors where the market might be highly specialized, or where barriers to entry prevent a larger number of bidders from participating.

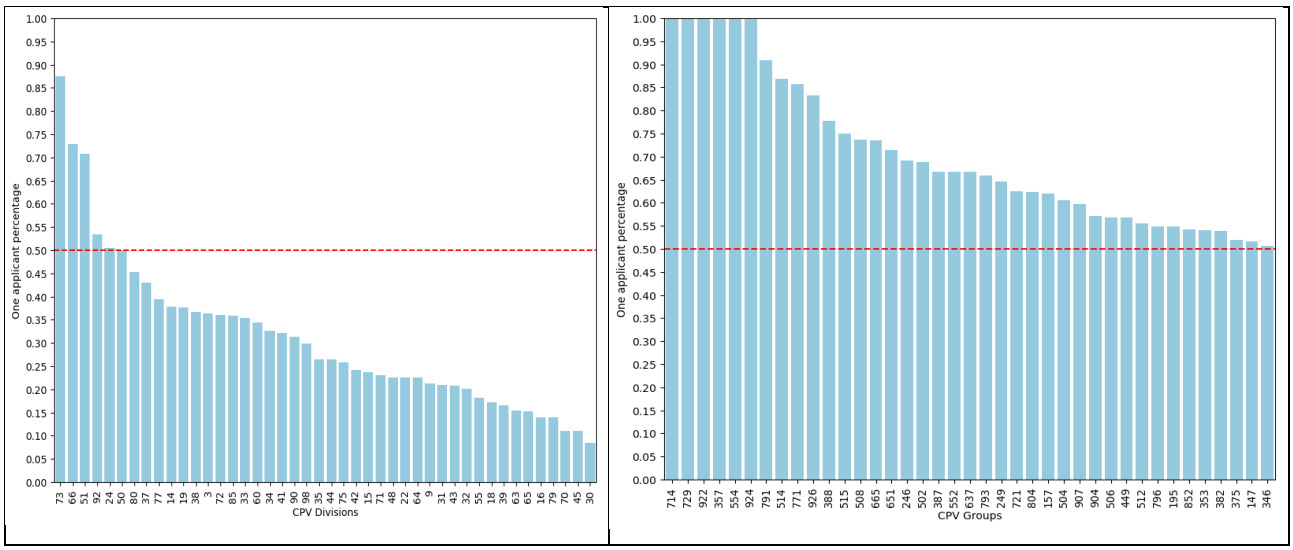

Figure 2. Overview of CPV Divisions (left) and CPV Groups (right) with majority of one-bidders competitions

Source: (author)

A more granular analysis at the second level CPV identified 47 CPV groups where competitions predominantly have only one bidder. The specific CPV codes for these groups are showed in the right graph of Figure 2, indicating a widespread presence of one bidder scenarios across various procurement categories. Additionally, we identified six CPV groups where 100% of the procurement competitions involved only one bidder. They were: 357: Military electronic systems, 554: Beverage-serving services, 714: Urban planning and landscape architectural services, 729: Computer back-up and catalogue conversion services, 922: Radio and television services, 924: News-agency services. These findings point to areas within the public procurement landscape where there is absolutely no competition, highlighting sectors potentially ripe for policy intervention to encourage more competitive bidding processes.

The third part of our study focuses on comparing the average public procurement savings per CPV with the percentage of single-bidder procurements within each CPV category. This analysis aims to test the hypothesis that a higher incidence of single-bidder procurements leads to a less competitive environment, which may be associated with a decrease in average savings per CPV. To comprehensively examine this relationship, we conducted correlation analyses across four different levels of CPV fragmentation: from Divisions (Level 1) through Groups (Level 2) and Classes (Level 3) to Categories (Level 4). These analyses help to discern how savings dynamics change as we delve into more specific categories of procurement. The graphical representation of these analyses are showed in Figure 3.

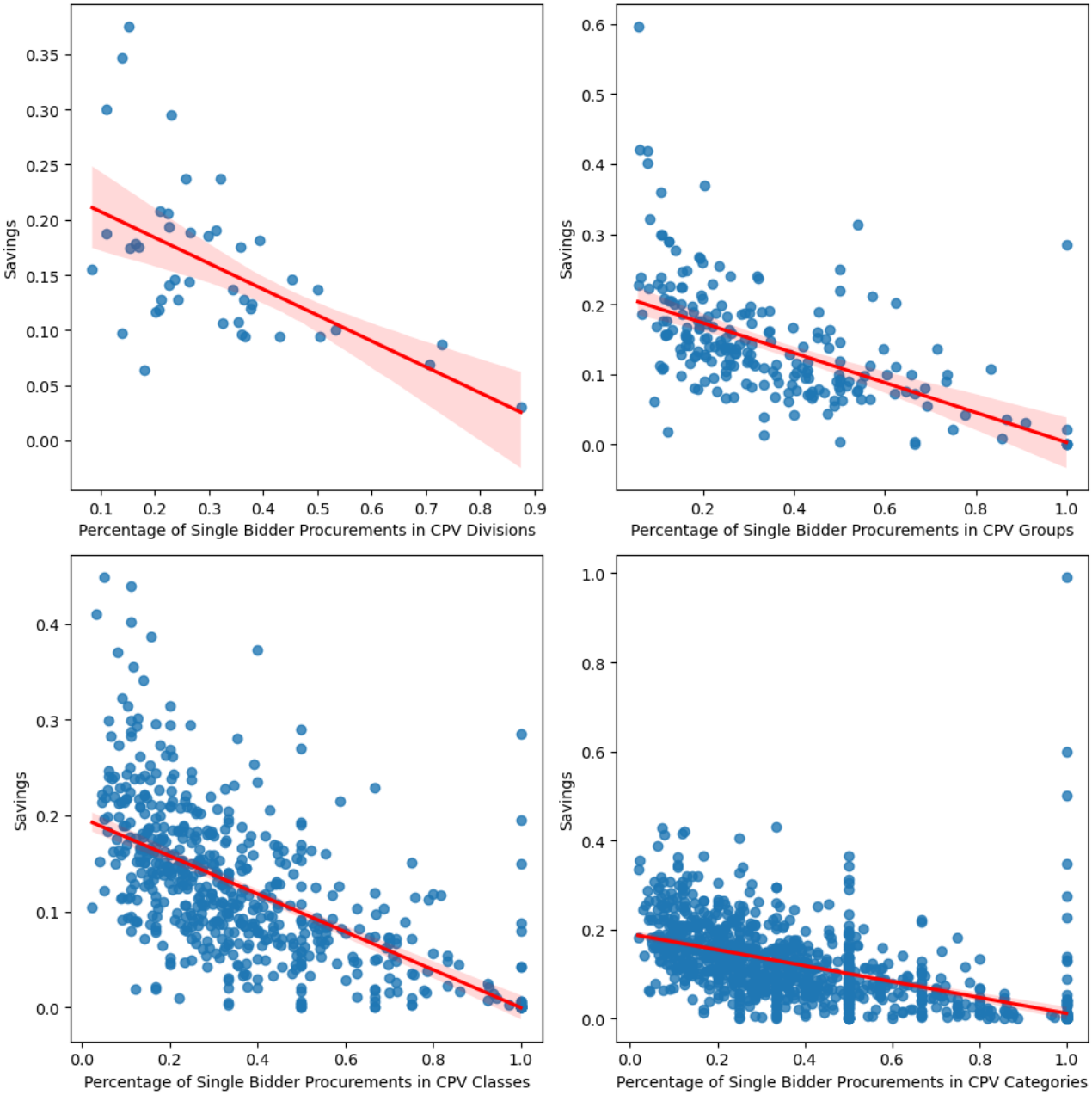

Figure 3. Overview of scatter plots comparing Savings with percentage of Single Bidders procurements in various level of CPV fragmentation

Source: (author)

The correlation analysis conducted to explore the relationship between the percentage of single-bidder procurements and average savings in public procurement at various levels of CPV classification revealed statistically significant negative correlations at all levels. For Level 1 (Divisions) a correlation coefficient of -0.525 indicates a strong negative relationship between the increase in single-bidder procurements and a decrease in average savings within CPV divisions. The statistical significance of this correlation is supported by a p-value of 0.00025. For Level 2 (Groups), the correlation coefficient deepens to -0.609 at the group level, suggesting an even stronger negative association compared to the divisional level. This result, with a p-value of less than 0.00001, underscores a robust inverse relationship between single-bidder dominance and savings at this more detailed classification level. The strength of the negative correlation increases further to -0.674, indicating that as we narrow down to specific classes within the CPV (Level 3), the impact of single-bidder procurements on reducing savings becomes more pronounced. The p-value remains below 0.00001, confirming the reliability of these findings. At the most detailed level of CPV classification (Level 4), the correlation coefficient is -0.678, the strongest among all levels tested, suggesting that the specific categories of procurement where competition is limited see the most substantial decrease in savings. Like the previous levels, the statistical significance of this correlation is extremely high, with a p-value of less than 0.00001. These results collectively indicate that there is a consistent and strengthening negative relationship between the percentage of single-bidder procurements and the average savings across increasingly specific levels of the CPV classification. The negative correlation becomes more pronounced as the CPV level becomes more detailed, illustrating that higher levels of procurement specificity are associated with more significant impacts of reduced competition on cost savings. This pattern highlights critical insights into the dynamics of competition within public procurement and underscores the importance of fostering competitive environments to enhance efficiency and savings across all levels of public contracting.

The final part of our research focused on examining how savings from various public procurement competitions within the same Common Procurement Vocabulary (CPV) category are affected by the presence of competition. To achieve this, we developed a unique identification system for each contractor (bidder) based on their Tax Identification Number. This system allowed us to assign a specific CO_CPV ID to each contractor for every procurement they won within a particular CPV. By grouping procurement competitions based on the winning contractors for each CPV, we could further subdivide these groups into two: the first group comprised competitions where the contractor was the sole bidder, and the second group included competitions where the contractor faced other bidders. This segmentation enabled us to compute and compare the average savings for both groups. The primary variable of interest, "savings difference," was calculated as the average savings from competitions with multiple bidders minus the average savings from competitions with a single bidder. The motivation behind this analysis was to explore how the distribution of savings differs when a bidder competes alone versus when competing against others within the same CPV. See first boxplot of Figure 4. A total 4,668 unique CO_CPV ID were analysed, focusing on scenarios where a contractor was alone and also faces competition within the same CPV. On average, savings increase by 15.40% when the contractor is not the sole bidder in the competition for particular CPV. This indicates a substantial improvement in savings when there is more than one bidder. On the other hand the variable savings difference has a standard deviation of 13.53%, suggesting considerable variability in how much savings increase when additional bidders are present.

Building on our earlier analysis, we introduced an additional layer of complexity by creating a unique identifier, the COCA-CPV ID. This identifier encapsulates every combination of Contracting Authority (CO) and winning contractor (CA) for all competitions within the same CPV. This step allowed us to precisely track how specific pairings between contractors and contracting authorities

impact savings under different competitive conditions. For each COCA-CPV ID, we segmented the procurement data into two groups: the first group consisted of competitions where the contractor was the sole bidder, and the second group where the contractor faced competition. We then calculated the average savings for both groups and determined the "savings difference" by subtracting the average savings of the first group from the average savings of the second group. The motivation behind introducing the COCA-CPV ID and conducting this additional layer of analysis was to examine how the dynamics between specific contracting authorities and contractors influence savings outcomes within the same CPV. This approach aimed to assess whether consistent relationships between particular contractors and contracting authorities could either mitigate or exacerbate the effects of competition on procurement savings. The distribution of Savings difference for competitions within various COCA-CPV ID are presented in second box-plot of figure 4. Our dataset includes 7,450 unique Contracting authority – Winning contractor pairs which have both experience with single bidder procurement and multi bidder procurement. The average increase in savings when the contractor is not alone is 14.12%. This figure is slightly lower than in the CO_CPV analysis, suggesting that the dynamics between specific contracting authorities and contractors might not be as conducive to significant savings increases.

These findings highlight the significant impact that competition has on increasing savings in public procurement, both in generalized contractor scenarios and in specific contractor-authority relationships. The CO_CPV results generally show a higher potential for savings increase compared to COCA_CPV scenarios, suggesting that competitive dynamics might be less effective in contexts where contractors repeatedly engage with the same contracting authorities.

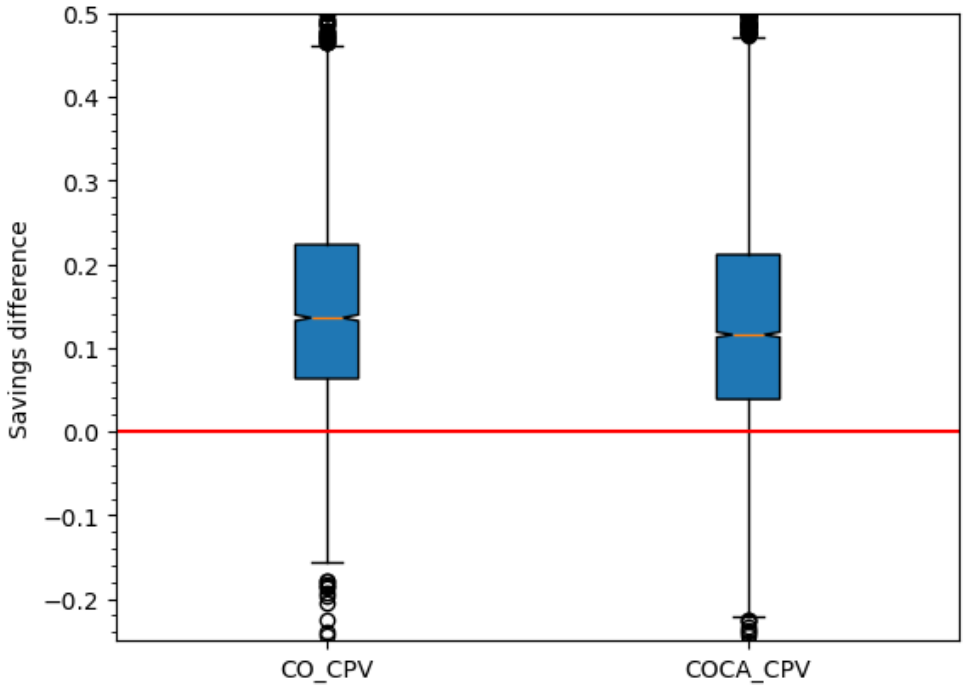

Figure 4. Boxplots of Savings Differences: Comparing Single and Competitive Bids Across CO_CPV and COCA_CPV Categories

Source: (author)

5. Conclusion

This study delves into the dynamics of savings in public procurement competitions in Slovakia, with a focus on the contrast between competitions with single bidders and those with multiple bidders. By analyzing over 160,000 real public procurement offers, the research explored the relationship between savings and competition, employing various statistical methods such as Mann-Whitney U Test, Box-Plot Analysis, and Spearman Correlation Analysis. The results reveal a stark contrast in savings 313 between competitions with single bidders and those with multiple bidders. Competitions with multiple bidders demonstrated significantly higher savings, emphasizing the positive impact of competition on fiscal efficiency in public procurement. Moreover, the analysis identified specific CPV categories where one-bidder competitions were prevalent, suggesting areas of potential market specialization or monopolistic tendencies. The findings underscore the critical role of competitive bidding in driving savings in public procurement processes. By fostering competition, governments can maximize efficiency and ensure optimal utilization of public funds. The identification of CPV categories dominated by one-bidder competitions sheds light on sectors where market conditions may hinder competitive diversity, warranting policy interventions to encourage broader participation. Moreover, the correlation analysis across different levels of CPV fragmentation reveals a consistent negative relationship between the percentage of single-bidder procurements and average savings. This implies that increased competition leads to higher savings across all levels of procurement specificity, emphasizing the importance of fostering competitive environments in public contracting. In conclusion, this research provides robust empirical evidence supporting the efficacy of competitive bidding in enhancing fiscal efficiency in public procurement. The findings underscore the need for policies and strategies aimed at promoting competition to maximize savings and ensure optimal resource allocation in public spending. By leveraging insights from this study, policymakers can develop targeted interventions to foster competitive environments, thereby driving efficiency and effectiveness in public procurement processes.

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