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Anchoring Bias in Public Procurement Tenders: Price Sensitivity Analysis Using the Van Westendorp PSM Method

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Abstract: In this study, procurement managers in public tenders with an anchor price (opening price), a partial anchor (official cost estimate) or no anchor (control) are surveyed. Van Westendorp Price Sensitivity Meter (PSM) method and perception intensity for extreme prices was applied to questionnaires of 65 procurement managers in With Opening Price group, 22 in With Estimate group and 21 in No Anchor (control). The IDP is 575, OPP is 475 and the acceptable price range is 450-650 units. In comparison, the IDP in the With Opening Price group is 600, 20% higher than the control group, and OPP is 500, 25% higher than the control group. Box plot shows that the price anchor exposure shifts the entire range of perceived prices upwards and not only the mean of price. These findings confirm the main hypothesis of the study: anchoring bias leads to an upward price perception shift among procurement tender participants in a systematic manner and the magnitude of this effect is proportional to the strength of the anchor.

Keywords: *Price Sensitivity, Price Sensitivity Meter, Anchoring Bias, Public Procurement, Van Westendorp, IDP, OPP, Box Plot Analysis.*

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I. INTRODUCTION

In recent years, the question of how initial price information influences bidder behavior in public procurement has become a serious topic in behavioral economics and procurement policy analysis. Increasing demand for transparency, accountability and economic efficiency are forcing procurement managers to weigh the administrative costs of tender design with market acceptance and participant engagement (Walter et al., 2025). Beyond the price dimension itself, effective tender design also requires an understanding of how quality-related costs - prevention, evaluation, and the cost of nonconforming services - contribute to the total cost of procured services (Stefanova, 2023). Despite the extent of this practical relevance, it is surprising that very few studies have explicitly looked at how disclosed price information affects what participants perceive as an acceptable price. This question is at the heart of the strategic design of public procurement processes. In order to meet the competitive procurement environment, a large number of companies are investing in evidence-based pricing (Eboli et al., 2025). However, these measures may change the perceived price threshold among the bidders, especially in the context of market pricing that may change rapidly depending on whether there is an anchor figure in the market. We apply PSM methodology to identify strategic price reference points and to characterize the price boundaries perceived by procurement managers for three tender conditions, both in central tendency statistics and in box plots.

II. METHODOLOGY

The study is based on a purposive sample of 65 procurement managers with direct or indirect involvement in public tender procedures: 22 in the With Opening Price condition (G1), 22 in the With Estimate condition (G2), and 21 in the No Anchor control condition (G3). The respondents were all experienced in procurement price management. This sample size is in line with the basic criteria for business research to provide statistical robustness and allow for variation between participants.

- *Measurement Instrument*

A specially adapted questionnaire that combined the classical Van Westendorp (1976) PSM approach with an additional perception-intensity assessment was applied. In the main part of the paper, the respondents identified four main price points: Too Cheap, Cheap, Expensive, and Too Expensive. For the extreme categories, participants also rated the intensity of their perception on a five-point Likert scale (see appendix B). It is now possible to assess not only the price range but also the depth of perceptual response. All data were analyzed using XLSTAT 2024 (Addinsoft, 2024) to calculate cumulative PSM curves and distributional statistics.

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Box plots were generated for each group to visualize intra-group dispersion by price category.

➢ *Elasticity Analysis*

Price elasticity was evaluated using respondents' intensity ratings to determine if price increases affect willingness to participate. This analysis can be used to understand the sensitivity of the market to price changes across the three experimental conditions.

III. RESULTS

➢ *Descriptive Statistics and Box Plot Analysis*

The statistical characteristics and distribution structure of participants' responses were analyzed by summary statistics and box plot visualization, disaggregated by research group. Box plot diagrams - comprising median, interquartile range (IQR), whiskers, and mean markers - show not only central tendencies but also intra-group dispersion and asymmetry in price perceptions. Table 1 provides the mean and standard deviation for each price category and group. The corresponding box and whisker distributions are shown in Figures 1 and 2.

Table 1 Descriptive Statistics - PSM Price Categories by Research Group (n=65; Mean and SD from XLSTAT 2024)

Price Category	Min.	Max.	Mean	SD	G1: Opening Price	G2: Estimate	G3: No Anchor
Too Cheap	200	450	358.46	56.23	384.09 (SD 47.27)	354.55 (SD 46.06)	292.86 (SD 57.63)
Cheap	350	550	478.46	49.17	518.18 (SD 39.48)	472.73 (SD 29.79)	407.14 (SD 42.68)
Expensive	550	750	651.54	57.89	670.45 (SD 29.52)	638.64 (SD 40.63)	635.71 (SD 80.84)
Too Expensive	700	900	801.54	49.23	815.91 (SD 32.32)	775.00 (SD 37.00)	802.38 (SD 62.20)

Source: XLSTAT 2024.4.1.1425 | n=65 Procurement Managers | G1: n=22; G2: n=22; G3: n=21 | Processing Date: 23/05/2025

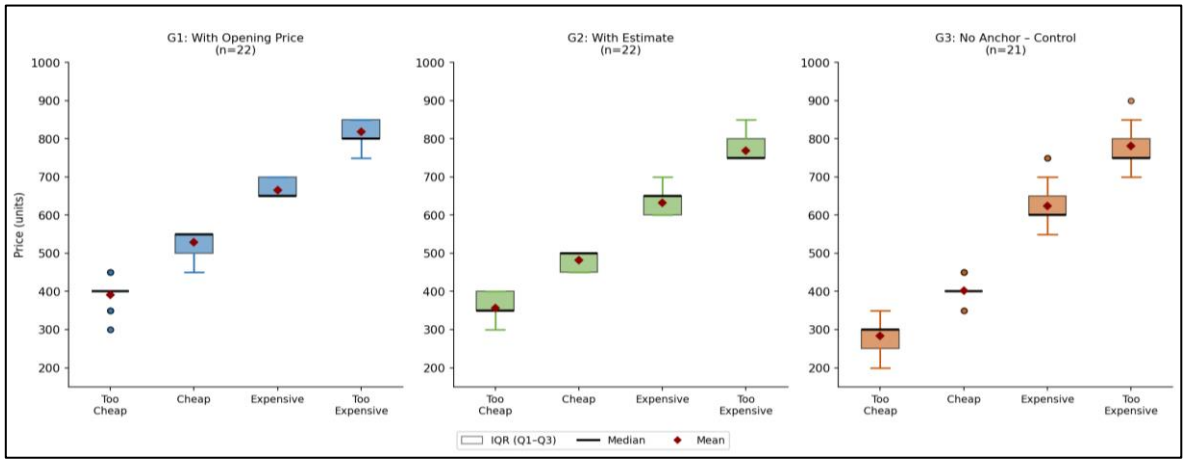

Fig 1 Box Plot Diagrams by Research Group - Distribution of Price Category Responses (n=65). Diamonds (◆) Indicate Group Means; Horizontal Lines Indicate Medians.
Source: XLSTAT 2024 / Raw Data

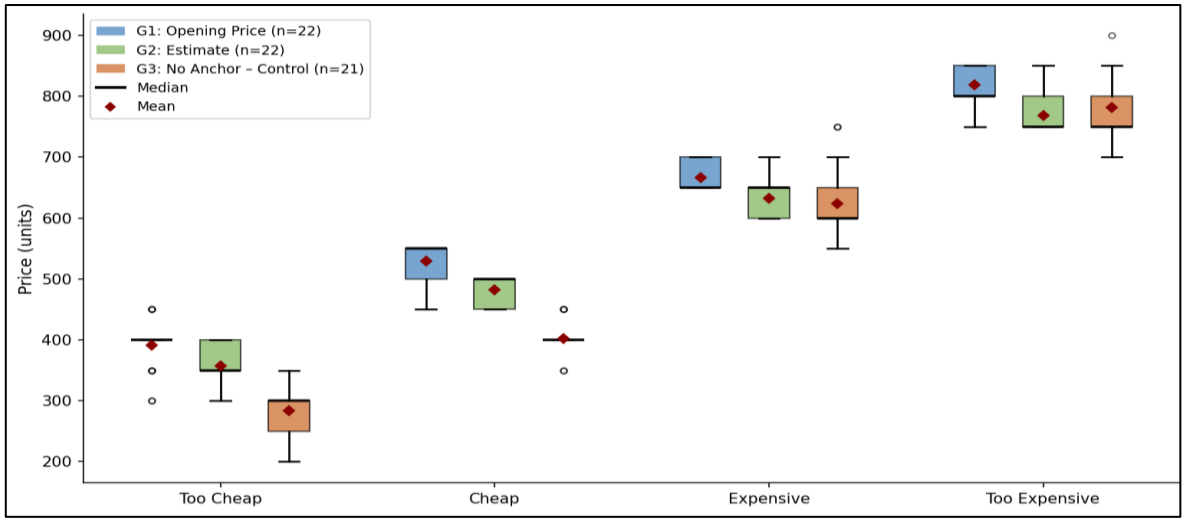

Fig 2 Combined Box Plots - All Research Groups per Price Category. The Systematic Upward Shift from G3 (No Anchor) to G1 (Opening Price) is Visible Across all Four Price Categories, Confirming the Anchoring Effect Gradient.
Source: XLSTAT 2024 / Raw Data

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The box plot presents several results that aren't simply through the lens of statistics. G1 (With Opening Price) shows a tight IQR of 350-450 units, with only a very small spread of the IQR (SD=47.27) compared to G3 (No Anchor), which shows an IQR of 200-350 units (SD=57.63). The non-overlapping interquartile range between G1 and G3 in the "Too Cheap" and "Cheap" categories is an indication of the anchoring-induced shift in the lower perceptual boundary. In the "Expensive" category, G3 has more variance in the group (SD=80.84) than G1 (SD=29.52). In such cases, the upper-bound price perception is more heterogeneous without an anchor. In the "Too Expensive" category, the groups are in the same place (G1: 815.91, G2: 775.00, and G3: 802.38). Thus, the upper rejection threshold is less affected by the anchor than the lower acceptance threshold, as expected from loss aversion theory (Kahneman & Tversky, 1979).

➢ *Cumulative PSM Curves - Between-Group Comparison*

Table 2 and Figure 3 present the strategic price points obtained from the Van Westendorp PSM analysis disaggregated by research group.

Table 2 PSM Price Points by Research Group - Between-Group Comparison

Price Point	G1: Opening Price (n=22)	G2: Estimate (n=22)	G3: No Anchor (n=21)	Δ G1 vs G3	Δ G2 vs G3
IDP - Indifference Price Point	600	600	500	+100 (+20%)	+100 (+20%)
OPP - Optimal Price Point	500	450	400	+100 (+25%)	+50 (+12.5%)
PMC - Point of Marginal Cheapness	500	450	400	+100	+50
PME - Point of Marginal Expensiveness	600	600	550	+50	+50
Acceptable Price Range (lower-upper)	500-600	450-600	400-550	+100 / +50	+50 / +50

Source: XLSTAT 2024 | Van Westendorp PSM Method | PSM_OpeningPrice, PSM_Estimate, PSM_NoAnchor Sheets

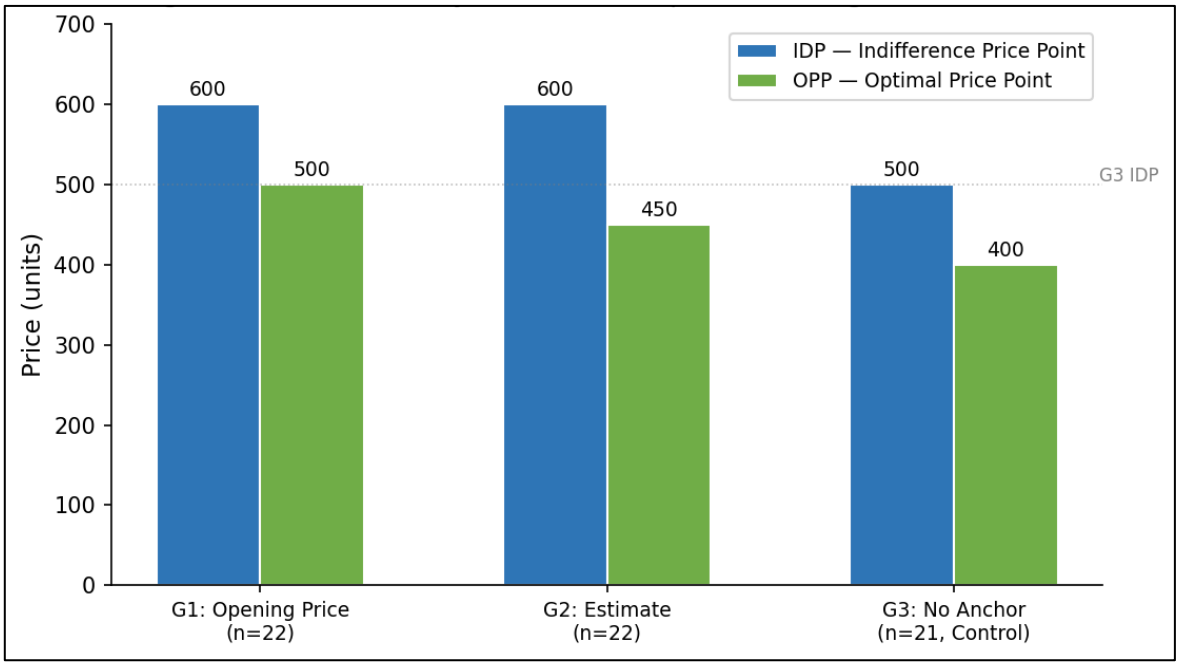

Fig 3 IDP and OPP by Research Group - Anchoring Effect Gradient

Group 1 versus Control: IDP +20% (600 versus 500); OPP +25% (500 versus 400). Group 2 versus Control: IDP +20% (600 versus 500); OPP +12.5% (450 versus 400). The partial anchor (in the official estimate) produces a moderate anchoring effect but is less pronounced than the full opening price disclosure. The gradient G1 > G2 > G3 is the same for all strategic price points. Hypothesis H1 is supported: the anchoring bias in procurement price perception is confirmed.

➢ *Pooled PSM Analysis (n=65) and Cumulative Curves*

Table 3 and Figure 4 are the strategic price points derived from the pooled PSM analysis across the full sample.

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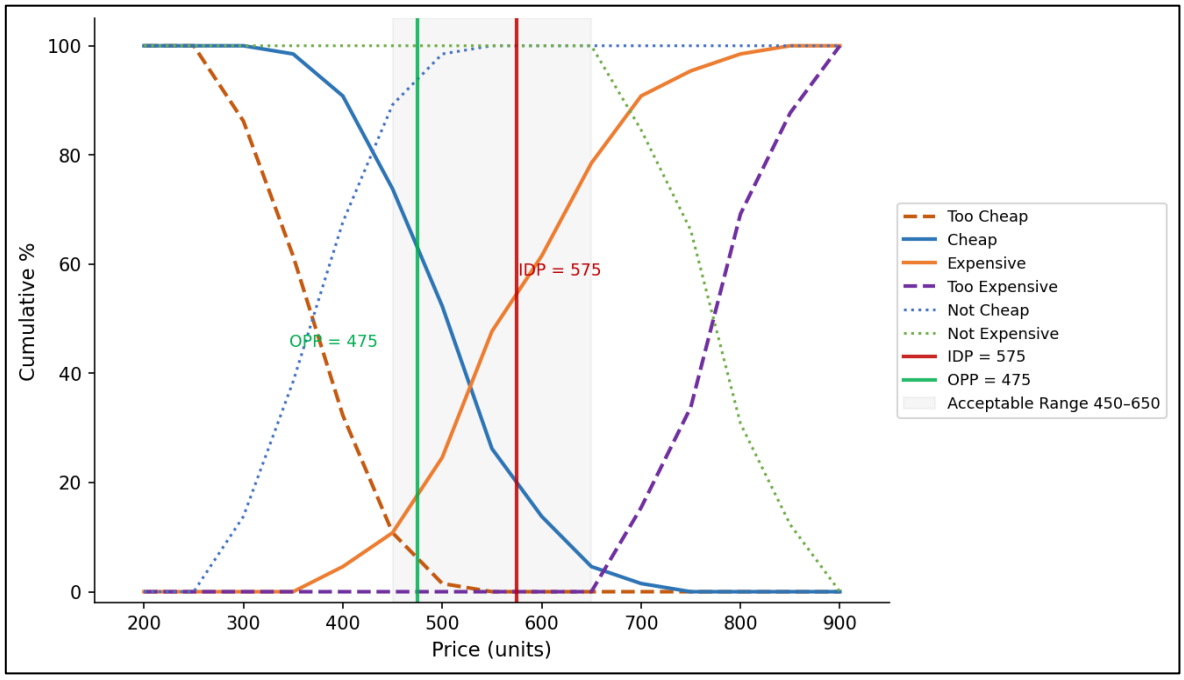

Fig 4 Price Sensitivity Meter - Cumulative Curves, Pooled Sample (n=65) | IDP=575, OPP=475

Table 3 Summary of PSM Analysis - Pooled Sample (n=65)

Parameter	Value (units)	n=65	%	Interpretation
IDP - Indifference Price Point	575	65	50% / 50%	Price equilibrium
OPP - Optimal Price Point	475	65	-	Minimum rejection risk
Acceptable Range - Lower Bound	450	65	-	Below: quality doubts
Acceptable Range - Upper Bound	650	65	-	Above: market rejection
Mean "Too Cheap" (pooled)	358.46	65	SD = 56.23	Perceived lower threshold
Mean "Too Expensive" (pooled)	801.54	65	SD = 49.23	Perceived upper threshold

Source: XLSTAT 2024.4.1.1425 - Price Sensitivity Meter (Van Westendorp) | Sheet: Price Sensitivity Meter6 | Processing: 23/05/2025

The Indifference Price Point (IDP=575) represents the equilibrium between "Cheap" and "Expensive" perceptions and is the natural starting point for procurement price positioning. The Optimal Price Point (OPP=475) represents the price point at which rejection risk is minimized. The Acceptable Price Range (450-650) is where procurement management can be competitive without losing perceived value.

IV. CONCLUSIONS AND RECOMMENDATIONS

The results demonstrate that the PSM approach combined with box plot distribution analysis is a powerful tool for analyzing acceptable price levels in public procurement processes in a price-anchoring scenario. The box plot analysis adds an important distributional aspect: price anchors not only change the mean but also the entire range of responses, particularly in the lower price categories (Too Cheap, Cheap). We make the following recommendations. Firstly, we recommend that the type of anchor be chosen according to the procurement purposes: a full-opening price anchor allows for bidder stability and helps to control the price dispersion; we should not expect an unbiased price estimate, but rather an estimate that is flexible and competitive; and if no anchor is used, we would still get a clean market price but with greater perceptual heterogeneity and lower acceptance thresholds. Secondly, the close groupings of groups in the Too Expensive category show that the ceiling rejection level is not anchor-resistant, which means that procurement managers are able to keep at the same price level regardless of the price anchoring. Third, PSM analysis in conjunction with box plot diagnostics should be incorporated into the procurement planning cycle as a standard tool to assess market responsiveness to price-information design. Embedding such diagnostics within a broader cost-of-quality framework that prioritizes preventive action over corrective expenditure would further strengthen evidence-based tender design (Stefanova, 2023).

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