VARNA FREE UNIVERSITY "CHERNORIZETZ HRABAR"
FACULTY OF SOCIAL, BUSINESS AND COMPUTER SCIENCES
DEPARTMENT OF ECONOMICS

LIOR YAACOV AGAI

APPLICATION OF GAME THEORY AND BEHAVIORAL ECONOMICS IN PUBLIC SECTOR PROCUREMENT PROCESSES

ABSTRACT

of a dissertation submitted for the award of the educational and scientific Degree "PhD",
Professional Field 3.8 Economics,
PhD Programme "Political Economy"

Scientific Supervisor:
Assoc. Prof. Marieta Stefanova, PhD

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Varna, 2026

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Reviewers:
Prof. Dimitar Kanev Kanev, DSc
Prof. Stela Atanasova Todorova, PhD

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The dissertation comprises a total of 243 pages and includes an introduction, three chapters, a conclusion, a summary of the scientific and applied scientific contributions, a list of references and a declaration of originality. The bibliography contains 122 academic, legislative and institutional sources.

The author of the dissertation is a PhD student in individual form of study in the professional field 3.8. “Economics” at the Department of Economics of Chernorizets Hrabar Varna Free University. The dissertation was discussed and scheduled for public defence at a meeting of the Department of Economics.

The public defence of the dissertation will take place on November 17th 2026 at 11:00 in the Meeting hall of Varna Free University “Chernorizets Hrabar”.

The materials relating to the public defence are available to interested parties at the Department of Economics and on the University’s official website www.vfu.bg.

I. GENERAL DESCRIPTION OF THE DISSERTAION

1. Introduction

Public procurement is one of the main mechanisms through which the public sector transforms budgetary resources into infrastructure, services, technologies and other outcomes of public significance. For this reason, its effectiveness cannot be measured solely by the level of the contracted price. A single procurement procedure brings together legal requirements, budgetary constraints, technical requirements, strategic behaviour on the part of participants and professional judgement under conditions of incomplete information. It is precisely this multidimensional nature that makes public procurement a suitable field for the combined application of game theory and Behavioral Economics (Dimitri, Piga, Spagnolo 2006; Krishna 2009; Camerer 2003).

Classical auction models explain how participants choose a strategy depending on their own costs, the expected actions of competitors, the rules of the procedure and the information available. Actual decisions, however, cannot be reduced to perfectly rational optimisation. Contracting authorities, experts and bidders operate under time pressure, have different levels of access to information and use professional heuristics. The published estimated value, the starting price or the absence of a price reference may simultaneously reduce uncertainty and become a reference point around which price expectations and assessments of acceptability are formed. (Vickrey 1961; Myerson 1981; Tversky, Kahneman 1974; Chapman, Johnson 1999).

The dissertation study focuses specifically on the dual role of the **price anchor**[1]**.** In public procurement, it functions both as an informational signal regarding the scale and economic framework of the procedure and as a potential behavioural reference that influences perceptions of price levels as too low, low but acceptable, high and too high.

The dual role of the price anchor is examined through two separate empirical approaches: an analysis of bidders' continued participation and a study of the price thresholds perceived by public procurement professionals. The adapted Van Westendorp Price Sensitivity Meter (PSM) measures professional judgement of price acceptability rather than consumers' willingness to pay and does not automatically determine an estimated value. Bidder Lifetime Value (BLV) is used solely as a segment-level indicator of continued participation weighted by the average bid value. The indicator does not measure revenue, profit, budgetary savings or public benefit and does not constitute an award criterion.

The study is based on the proposition that an officially disclosed price value is not neutral, as it simultaneously provides information about the procedure and may become a reference point for subsequent price judgement. The public contracting authority is not an external observer of the market: through the requirements imposed on participants, the rules governing the procedure, the information disclosed, the deadlines, the criteria and the price reference, it participates in shaping the informational and strategic environment. The dissertation challenges two widespread but analytically incomplete assumptions. The first equates the effectiveness of public procurement with achieving the lowest price

[1] In this study, the term "price anchor" refers to a price value that is disclosed in advance, perceived or fixed, which serves as a reference point and may influence subsequent judgement as to whether a price is low, acceptable, high or unacceptable.

and excludes from the assessment such factors as quality, the risk of non-performance, the sustainability of participation and the long-term state of competition. The second assumes that professional experience in itself neutralises the influence of price anchors and reference points on price judgement, even though decisions are formed under conditions of incomplete information, time pressure and institutional responsibility. Both assumptions simplify the analysis, but neither describes the actual logic of public procurement with sufficient accuracy.

The main research thesis is that price information should be managed with the same evidential and institutional rigour applied to technical requirements, selection criteria and award conditions. A price anchor may reduce uncertainty, but it may also shape expectations. It may facilitate participation, but it may also normalise a particular price level. For this reason, the price anchor is examined not as a passive administrative value, but as an object of strategic management, empirical verification and public accountability.

2. Relevance of the topic

The scientific and practical relevance of the topic is determined by several interrelated circumstances.

First, the effectiveness of public procurement cannot be assessed one-dimensionally on the basis of the lowest nominal price. A multidimensional understanding of public value is required, encompassing price, quality, risk, feasibility and the sustainability of competition. A low bid price may reflect genuine production or organisational efficiency, but it may also result from underestimated costs and risks, concerns regarding reliable performance, the likelihood of subsequent non-performance or compromises in quality. A higher bid price should likewise not automatically be

interpreted as inefficiency when it is economically justified by the complexity of the procurement, the required quality, security of performance or actual market conditions (OECD 2019; Bajari, Tadelis 2001; Decarolis 2014).

Second, the development of electronic systems and analytical tools makes it possible to analyse public procurement not only as a series of isolated transactions, but also as elements of a recurring market. In this context, the continued participation of suppliers with the necessary capacity, the entry of new participants and the preservation of competition over time are of particular importance. A one-off nominal saving may appear convincing in documents and reports, but when accompanied by the gradual withdrawal of suppliers and a narrowing of the competitive environment, it calls into question the long-term public value of procurement (Klemperer 2002; Gupta et al. 2006).

Third, price information in procurement documentation is often perceived as a technical or formal element, even though research on anchoring demonstrates that visible price values can influence subsequent judgement, including in professional decision-making. In public procurement, the potential influence is particularly significant because the price value is disclosed by a public authority, is linked to the budgetary framework and becomes simultaneously available to all potential participants. Therefore, the disclosure of an estimated value (Estimate) or an opening price (Opening Price) does not constitute a neutral administrative action, but rather an element in the design of the procedure's information environment (Tversky, Kahneman 1974; Chapman, Johnson 1999; Dekel, Schurr 2014).

Fourth, traditional performance indicators, including the number of bids, the contracted price, reported savings and the time

required for award, do not provide sufficient information about the sustainability of supplier participation or the way in which professionals perceive the boundaries of price acceptability. An analytical framework is required that links the dynamics of participation over time with professional price judgement. In the dissertation, this relationship is examined through the adaptation of the concept of Customer Lifetime Value (CLV) to Bidder Lifetime Value (BLV), as well as through the adaptation of the Van Westendorp Price Sensitivity Meter (Gupta et al. 2006; Van Westendorp 1976).

Fifth, the scientific and practical relevance of the topic is further reinforced by the need for behavioral analytical approaches in the public sector to be applied within clear legal, ethical and governance constraints. Such tools should support transparency, competition and evidence-based decision-making without becoming a means of manipulating price expectations, directing a procedure towards a predetermined preferred outcome or providing an advantage to particular participants. Accordingly, equal treatment, traceability of decisions, independent verification and the prevention of discriminatory use are integrated as internal governance safeguards within the developed model rather than as subsequent corrective measures to its application (European Parliament and Council 2014; OECD 2015; Fazekas, Kocsis 2020; UNCITRAL 2011; WTO 2012).

3. Object and subject of the study

The object of the dissertation study is the public procurement system and its strategic management under conditions of competitive procurement, incomplete information and regulatory accountability.

The subject of the dissertation study is the influence of three price-orientation environments: Opening Price, Estimate and the absence of an explicit price anchor (No Anchor). The analysis covers their impact on bidders' continued participation, Bidder Lifetime Value (BLV) and the price thresholds perceived by public procurement professionals. The scope of the study also includes the adaptation of Customer Lifetime Value (CLV) to BLV, as well as the adaptation of the Van Westendorp Price Sensitivity Meter (PSM) to decision-making in public procurement.

4. Research problem

The research problem arises from the limited ability of conventional procurement evaluation to explain the long-term market consequences of price information. The contracted price indicates the immediate financial outcome, but it does not show whether suppliers retain their interest in future procedures or whether the disclosed value has altered professional perceptions of what constitutes a normal, excessive or suspiciously low price.

The scientific problem lies in linking price-anchor design, continued participation and perceived price thresholds without prematurely presenting the observed relationship as established causality. The practical problem is to use the resulting information for market monitoring and the preparation of procurement procedures without allowing the history of a particular bidder to become a hidden selection or award criterion.

5. Research Thesis, Research Questions and Hypotheses

The main thesis of the dissertation is that the price anchor performs two functions in public procurement. It provides information about the procedure while simultaneously becoming a reference point for subsequent price judgement. This dual function allows the three information conditions to be associated with

different profiles of continued participation and different structures of perceived price thresholds. Their joint analysis may support the preparation of procurement procedures and market monitoring, provided that the requirements of transparency, equal treatment, proportionality and verifiability are observed.

The study is organised around four research questions:

– **Research Question 1 (RQ1).** How can the conditions "Opening Price", "Estimate" and "No Anchor" be defined and documented as distinct information environments in public procurement?

– **Research Question 2 (RQ2).** Are the different segments formed according to the type of price anchor associated with different profiles of bidder retention and Bidder Lifetime Value (BLV)?

– **Research Question 3 (RQ3).** How do the price thresholds perceived by public procurement professionals differ across the "Opening Price", "Estimate" and "No Anchor" conditions, and are the observed differences consistent with anchoring?

– **Research Question 4 (RQ4).** How can evidence on continued participation and professional price judgement be integrated into a decision-support model compatible with public-sector governance?

The main thesis is tested through two research hypotheses:

H1-1: The segments formed according to the type of price anchor are associated with different profiles of bidder retention and Bidder Lifetime Value (BLV), with the With Estimate segment expected to demonstrate the greatest sustainability of participation.

H1-2: The price thresholds perceived by public procurement professionals differ across the "Opening Price", "Estimate" and "No

Anchor" conditions, with the observed pattern of differences being consistent with anchoring.

6. Aim and Research Tasks of the Study

The aim of the dissertation is to develop and empirically substantiate an integrated decision-support framework for public procurement that explains how different environments defined by the type of price anchor are associated with bidder retention and Bidder Lifetime Value (BLV), and how the same environments are reflected in perceived price thresholds. The framework integrates public procurement management, game-theoretical reasoning, Behavioral Economics, Customer Lifetime Value and Bidder Lifetime Value analysis (Customer Lifetime Value, CLV; Bidder Lifetime Value, BLV), and the Van Westendorp Price Sensitivity Meter (PSM). Explicit safeguards are formulated against overstating causal inferences and against discriminatory use.

To achieve this aim, the following research tasks have been formulated:

Research Task 1 (RT1). To systematise the theoretical, regulatory, game-theoretical and behavioral foundations of price-anchor design, identify the research gap and derive the conceptual basis of the Anchor-Driven Procurement Value Model (ADPVM).

Research Task 2 (RT2). To develop a reproducible methodology for classifying and examining the "Opening Price", "Estimate" and "No Anchor" conditions through administrative data, CLV and BLV analysis, an adapted PSM, exploratory tests, robustness checks and governance safeguards.

Research Task 3 (RT3). To conduct the two empirical studies, analyse continued participation and perceived price thresholds, and test H1-1 and H1-2 through descriptive,

comparative, variation and sensitivity analyses, factor-oriented interpretation and exploratory statistical tests.

Research Task 4 (RT4). To integrate the results into the ADPVM and formulate application scenarios, governance safeguards, an implementation roadmap, practical recommendations, limitations and requirements for future validation.

7. Research Methodology

A quantitative design comprising two separate empirical studies was employed. The game-theoretical framework considers the contracting authority and potential bidders as interdependent participants making decisions under different conditions of public and private information. The framework serves as a basis for comparative strategic interpretation without claiming a structurally estimated Nash equilibrium. Behavioral Economics explains how the same price signal may function as a reference point in professional judgement.

Study I uses 211 bidder-level observations distributed across three segments: No Anchor, 70 observations; With Estimate, 71 observations; and With Opening Price, 70 observations. The analysis covers the average bid value, attrition, retention, censoring, modelled duration, direct lifetime estimation and discounted BLV. Monthly dynamics generated in XLSTAT over a 36-month horizon and a sensitivity analysis are also presented.

Study II comprises 65 valid professional responses: 22 under an Opening Price of 700 notional units, 22 under an Estimate of 600 notional units and 21 under the No Anchor condition. For the total sample, the Indifference Price Point (IDP), Optimal Price Point (OPP), Point of Marginal Cheapness (PMC), Point of Marginal Expensiveness (PME) and the overall acceptable price range were

calculated. The between-group comparison is based on the four directly observed thresholds, group mean values, the Kruskal–Wallis test and the epsilon-squared effect size (ε^2). Intensity indicators and Principal Component Analysis (PCA) are used as additional diagnostic procedures.

The two datasets are not combined at the calculation stage. They are brought together only at the interpretation stage because they measure different aspects of the same problem: the first study tracks actual participation over time, whereas the second examines stated professional judgement regarding price boundaries.

8. Limitations of the Subject and Problem Scope

The theoretical review focuses primarily on the period after 2000, while the empirical data and model development cover the period from 2020 to 2025. The administrative procedures originate from specific public and mixed state and municipal organisations in Israel; therefore, the results cannot be transferred mechanically to a different institutional and legal environment.

Study I is observational in nature, and the final analytical dataset does not include a complete set of control variables for procurement size and complexity, sector, contracting authority, year and type of procedure. Study II uses a purposive professional sample and compares scenarios that differ simultaneously in terms of institutional label and the numerical value of the price anchor. The results are therefore interpreted as observational associations and exploratory between-group differences rather than as established causal effects.

The ADPVM was developed on the basis of the same empirical material that motivated its components. The model is internally consistent and practically structured, but it has not been

independently validated and should not be presented as a universal algorithm for determining price or selecting a contractor.

BLV is used at segment or market level for analysis, monitoring and planning. It cannot justify preferential treatment of regular participants or unfavourable treatment of new suppliers. PSM may support diagnostic assessment and scenario analysis, but it cannot be used to manipulate price expectations or replace an independent cost estimate.

9. Validation and Practical Applicability

The empirical work and model development were carried out during the period from 2020 to 2025 using actual administrative records, a professional survey and expert consultations. The scenarios, question wording and governance constraints were discussed with practitioners, which supported the adaptation of the instruments to the logic of public procurement.

The results and individual components of the framework have been presented for scientific and professional discussion. The validation activities conducted support the practical relevance and internal consistency of the methodological framework, but they do not constitute independent external validation and do not provide grounds for defining the model as conclusively validated for all categories of public procurement. Practical institutional implementation is formulated as a subsequent stage and requires pilot application, staff training and independent validation.

The aim of the dissertation has been achieved within the evidential limits of the adopted design. RT1 was completed through the systematisation of the theoretical, regulatory, game-theoretical and behavioral foundations and the identification of the research gap. RT2 was completed through the development of the reproducible methodology and research instruments. RT3 was

completed through the implementation of the two empirical studies and the testing of H1-1 and H1-2. RT4 was completed through the development of the ADPVM, governance safeguards, practical scenarios and the roadmap for future validation.

Both hypotheses were tested and supported to the extent permitted by the data. H1-1 was supported as an empirical association, as all principal indicators produced the same ordering of the three segments. H1-2 was supported at the descriptive and exploratory statistical levels, with the strongest evidence observed for the lower price thresholds. Thus, the central thesis receives integrated theoretical and empirical support without exceeding the limitations of the observational and exploratory research design.

II. SIZE AND STRUCTURE OF THE DISSERTATION

The dissertation is structured in accordance with the logic of the research problem and the sequence of its theoretical, methodological and empirical investigation. The first chapter systematises the theoretical foundations and identifies the research gap. The second chapter develops the methodological framework of the study, while the third chapter presents the empirical results, the testing of the research hypotheses, the integrated model and the practical guidelines for its application. The dissertation includes the following main structural sections:

INTRODUCTION

CHAPTER ONE. THEORETICAL FOUNDATIONS AND LITERATURE REVIEW OF PUBLIC PROCUREMENT, GAME THEORY AND BEHAVIORAL ECONOMICS

1.1. Nature and characteristics of public procurement in the public sector: definitions, legal framework and key challenges.

1.2. Review of classical game-theory models and their applications in public procurement and tendering procedures.

1.3. Behavioral Economics and cognitive biases: role and impact on strategic behaviour in public procurement.

1.4. Systematisation and identification of the research gap.

CHAPTER TWO. METHODOLOGICAL FRAMEWORK, RESEARCH DESIGN AND APPLIED METHODS

2.1. Methodological clarification of the logic of the empirical study.

2.2. Research methods and instruments.

2.3. Research design and procedure of the empirical study.

2.4. Sample selection and respondent profile.

2.5. Operationalisation of the variables, interview questions and survey questions.

2.6. Data integrity, reproducibility and ethical boundaries.

CHAPTER THREE. APPLICATION OF GAME THEORY AND BEHAVIORAL ECONOMICS IN PUBLIC SECTOR PROCUREMENT PROCESSES

3.1. Implementation of the empirical study: description of the process, data collection and research challenges.

3.2. Analysis of the empirical results: factor-oriented, comparative and variation analysis of the collected data.

3.3. Testing of the research hypotheses.

3.4. Development of an innovative integrated model for the strategic management of public procurement based on the empirical results.

3.5. Practical recommendations and guidelines for applying the model in public-sector practice.

CONCLUSION OF THE DISSERTATION

CONTRIBUTIONS OF THE DISSERTATION

SCIENTIFIC SOURCES USED IN THE DISSERTATION

DECLARATION OF ORIGINALITY

III. SUMMARY OF THE DISSERTATION

INTRODUCTION

The introduction substantiates the need to consider public procurement simultaneously as a legally regulated process, a strategic market environment and a field of professional judgement. It formulates the object and subject of the study, the research problem, the aim, the four research questions, the main research thesis, hypotheses H1-1 and H1-2, the research tasks, the methodological framework and the limitations of the study. The principal analytical distinction is between procedures with an Opening Price, an Estimate and No Anchor. The three conditions are defined as distinct price-information environments that may be associated both with bidders' continued participation and with the price thresholds perceived by public procurement professionals.

The central scientific proposition is that the public contracting authority is not an external observer of the market. Through the rules of the procedure, the allocation of risk and the disclosed price information, it participates in shaping the environment in which potential bidders decide whether and how to participate. It follows that the lowest price does not constitute a self-sufficient indicator of public-sector efficiency, while professional experience does not preclude the influence of price anchors and reference points under conditions of incomplete information and uncertainty.

The Anchor-Driven Procurement Value Model (ADPVM) is presented as a decision-support framework rather than as an

automatic algorithm. The model does not replace independent cost estimation, technical and legal analysis or the professional responsibility of the contracting authority. Its purpose is to organise the evidence relating to the price-information environment, bidders' continued participation, professional price judgement and the necessary governance safeguards.

CHAPTER ONE. THEORETICAL FOUNDATIONS AND LITERATURE REVIEW OF PUBLIC PROCUREMENT, GAME THEORY AND BEHAVIORAL ECONOMICS

Chapter One is theoretical and analytical in nature. Public procurement is examined as a regulated market in which the contracting authority does not merely select an existing offer but establishes the rules of interaction. Through the subject matter of the procurement, technical specifications, qualification requirements, award criteria, deadlines, allocation of risk and published price information, the contracting authority influences which suppliers will participate and how they will assess the economic opportunity (Dimitri, Piga, Spagnolo 2006; OECD 2015).

CHAPTER ONE. THEORETICAL FOUNDATIONS AND LITERATURE REVIEW OF PUBLIC PROCUREMENT, GAME THEORY AND BEHAVIORAL ECONOMICS

Chapter One establishes the theoretical foundation of the dissertation study. Public procurement is examined simultaneously as a legally regulated process, a strategic market environment and a field of professional judgement under conditions of incomplete information. The principles of public procurement management, game and auction theory, and Behavioral Economics are systematised in order to substantiate the dual function of the price anchor as an informational signal and a potential reference point.

The relationship between the design of disclosed price information, bidders' continued participation and perceived price thresholds is identified.

1.1. Nature and Characteristics of Public Procurement in the Public Sector: Definitions, Legal Framework and Key Challenges

The institutional specificity of public procurement is clarified as a mechanism through which the public sector acquires goods, services and works while simultaneously requiring economic justification and procedural legitimacy. The public contracting authority is not an ordinary buyer, since its decisions must comply with the principles of transparency, equal treatment, non-discrimination, proportionality, competition, auditability and value for money. It is argued that efficiency cannot be equated solely with the lowest nominal price when quality, risk, feasibility and the sustainability of the competitive environment are not taken into account (OECD 2015; European Parliament and Council 2014; WTO 2012; UNCITRAL 2011). The influence of the contracting authority on the market is examined through the subject matter of the procurement, technical specifications, qualification requirements, evaluation criteria, deadlines, allocation of risk and price information. An officially disclosed price value may reduce uncertainty, but it may also be perceived as a budget ceiling, expected cost, signal of quality or indication of competitors' likely behaviour. For this reason, the Opening Price, Estimate and No Anchor conditions are defined as distinct information environments rather than as formal administrative designations (Dimitri, Piga, Spagnolo 2006; Coviello, Mariniello 2014; OECD 2015). The relationship between the contract price, allocation of risk and subsequent performance is analysed. A very low bid may reflect

genuine efficiency, but it may also indicate underestimation of costs, strategic underbidding, risk of non-performance or pressure for subsequent contract modification. A higher price may be economically justified by complexity, quality, deadlines and the risk assumed. Price therefore acquires managerial significance only when considered together with the probability of reliable performance and long-term public value (Bajari, Tadelis 2001; Decarolis 2014; OECD 2019).

Attention is also given to the participation of small and medium-sized enterprises, bid preparation costs and supplier capacity. Complex documentation, disproportionate requirements and an unclear economic framework may restrict access and narrow the competitive base. It is established that monitoring bidder retention, attrition, new entry and diversity complements traditional indicators such as the number of bids and the contract price. Bidder Lifetime Value (BLV) may support segment-level market analysis, but it cannot be used to favour previous participants or to introduce a hidden award criterion (Loader 2007; Flynn, Davis 2017; OECD 2019).

1.2. Review of Classical Game-Theory Models and Their Applications in Public Procurement and Tendering Procedures

Game theory is used as an analytical basis for examining the strategic interdependence between the contracting authority and potential bidders. The decision to participate and the formulation of a bid depend on the bidder's own costs and capacity, the expected number and behaviour of competitors, the evaluation rules, the information available and performance risk. The framework serves as a basis for comparative interpretation of incentives and expectations without claiming a structurally estimated Nash

equilibrium or a complete solution to the procurement mechanism (Klemperer 2002; Krishna 2009; Myerson 1981).

The principal auction formats and the logic of strategic bid adjustment are examined. In a first-price sealed-bid auction, the bidder balances the probability of winning against the expected margin. Reserve, opening and reference prices influence the feasible price space and expectations regarding the economic viability of the procurement. A published Estimate may facilitate market orientation, but it may also direct bids towards the official reference value. In the absence of a numerical anchor, greater scope remains for independent calculation, but the informational burden and participation costs increase (Vickrey 1961; Rosenkranz, Schmitz 2007; Krishna 2009).

Decisions concerning initial and continued participation, information asymmetry, signalling and screening are examined. Suppliers possess private information about their costs, capacity and operational constraints, while the contracting authority defines the public information environment through specifications, requirements, criteria and price references. An inaccurately calibrated Estimate may be perceived as reliable merely because of its official status and may alter both the decision to participate and the formulation of bids (Akerlof 1970; Myerson 1981). Scoring auctions, multi-attribute procedures and repeated interactions are also examined. In these settings, price is assessed in relation to quality, deadlines, technical characteristics, sustainability and risk. Repeated interaction may reduce costs through accumulated experience, but it may also intensify concentration, informal coordination and barriers to new entrants. Continued participation is therefore not automatically regarded as a positive outcome but is assessed alongside bidder diversity, market concentration and the

risk of collusive behaviour (Camerer, Ho, Chong 2004; Fazekas, Kocsis 2020; OECD 2015).

1.3. Behavioral Economics and Cognitive Biases: Role and Impact on Strategic Behaviour in Public Procurement

The need for a behavioral analysis of professional decision-making in public procurement is substantiated. Bounded rationality does not imply a lack of competence; rather, it reflects the fact that complexity, time pressure and incomplete information compel participants to rely on heuristics, accumulated experience and visible reference points. Professional expertise reduces the likelihood of obvious errors but does not eliminate the influence of anchoring, framing and reference-point dependence (Simon 1955; Tversky, Kahneman 1974; Chapman, Johnson 1999). The analysis traces how an initially presented price value may influence subsequent judgement and result in insufficient adjustment away from that value. Opening prices, Estimates, budget ceilings, previous contract prices and values indicated during market consultations are considered as potential anchors. Reference dependence and loss aversion explain why a price above the Estimate may be perceived as a loss and a price below it as a saving, until concerns arise regarding quality and feasibility. Price acceptability therefore has both a lower and an upper boundary and cannot be explained by the linear rule that a lower price is always better (Kahneman, Tversky 1979; Kőszegi, Rabin 2006). Fairness, trust, procedural legitimacy, overconfidence, the winner's curse and escalation of commitment are also analysed. Clear and consistently applied rules may sustain participation even following an unfavourable outcome for a particular bidder, whereas unrealistic Estimates, unclear criteria and the perception of a predetermined outcome may lead to withdrawal. At the same time, aggressive

pricing and underestimation of risk may subsequently manifest themselves through delays, contract modifications or compromises in quality (Fehr, Schmidt 1999; Tyler 1988; Staw 1976; Decarolis 2014). Behavioral public policy is examined through the lens of choice architecture and its ethical boundaries. Price anchors may reduce uncertainty, but they should not be used to covertly steer bids or favour particular participants. To measure professional price judgement, the adaptation of the Van Westendorp Price Sensitivity Meter (PSM) is substantiated. The four thresholds represent Too Cheap, Cheap, Expensive and Too Expensive price levels. In the dissertation, the PSM is used as a diagnostic instrument for feasibility, quality, risk and budgetary defensibility rather than as a consumer demand curve or an automatic price-setting mechanism (Van Westendorp 1976; Thaler, Sunstein 2008; OECD 2015).

1.4. Systematisation and Identification of the Research Gap

The systematisation of the scientific literature shows that the principal elements of the problem have been developed within separate research strands but are rarely brought together within a common framework. Game and auction theory explains rules, information structures and participation decisions. Behavioral Economics examines anchoring and reference dependence. The public procurement literature emphasises transparency, competition, value for money and performance.

The research gap is defined as the absence of an integrated approach that simultaneously links disclosed price information with bidders' continued participation and professional judgement of price acceptability. To address this gap, the adaptation of Customer Lifetime Value (CLV) to Bidder Lifetime Value (BLV) is substantiated. The commercial logic of revenue generated by a

customer is not transferred mechanically. The main focus is placed on bidder retention, attrition, survival, duration and repeat participation. BLV is interpreted at the level of a segment, category or price-information environment as an indicator of the condition of the competitive base rather than as an individual supplier rating or a measure of public revenue (Gupta et al. 2006; OECD 2015).

The second **adaptation concerns the PSM**, the results of which are limited to professional price thresholds and do not replace cost estimation, technical analysis or current market data. On the basis of the two methodological adaptations, the conceptual foundation of the Anchor-Driven Procurement Value Model (ADPVM) is derived. The model links the price-information environment, bidders' responses and continued participation, professional price judgement, public value and governance safeguards. The disclosed price value is considered simultaneously as information, an element of procedure design and a potential behavioral reference point. The conditions affecting the reliability of the price anchor are identified: the quality of the preliminary estimate, the currency of market data, the credibility and calibration of the value, procurement complexity, market maturity and the category of acquisition. Abnormally low bids are examined as a lower boundary of price acceptability, budget ceilings as a factor affecting the upper boundary, and the limitations of universal rules across different supplies, services, works, information systems and innovation procurement are considered. The need for analytical results to be reproducible, auditable and compatible with equal treatment and non-discrimination is emphasised (European Parliament and Council 2014; Fazekas, Blum 2021; OECD 2015). The theoretical, methodological and ethical boundaries of the developed model are formulated. The ADPVM does not assume a

mechanical influence of the price anchor, does not constitute a complete equilibrium solution and does not transform observed relationships into established causality. BLV cannot be used to favour participants on the basis of previous participation, while the PSM cannot automatically determine the Estimate or the contract award price. The systematisation **fulfils the first research task**, substantiates the hypotheses and provides the transition to the methodological framework developed in Chapter Two.

CHAPTER TWO. METHODOLOGICAL FRAMEWORK, RESEARCH DESIGN AND APPLIED METHODS

Chapter Two translates the theoretical propositions developed in Chapter One into a specific and reproducible procedure for empirical investigation. The research questions, hypotheses and tasks are not reformulated, but are linked to specific data sources, units of analysis, variables, methods and rules of interpretation. The developed framework combines administrative data on bidders' continued participation, an adapted Bidder Lifetime Value (BLV) analysis, the Van Westendorp Price Sensitivity Meter (PSM) (Van Westendorp 1976), exploratory statistical tests and a limited game-theoretical framework. A fundamental principle is that the strength of the scientific conclusions should not exceed the evidential capacity of the data used.

2.1. Methodological Clarification of the Logic of the Empirical Study

The logic of two independent but mutually complementary empirical studies is clarified. Study I uses administrative records to establish whether the Opening Price, Estimate and No Anchor environments are associated with different profiles of retention, attrition and continued participation. Study II examines how the

same information conditions are reflected in the price thresholds perceived by public procurement professionals. The two datasets are not statistically combined, as they measure different outcomes, but are linked only at the level of interpretation.

Three operational strands are distinguished. The first adapts Customer Lifetime Value (CLV) to the analysis of participation sustainability through BLV. The second measures professional price thresholds using the PSM. The third compares the results of the two studies as complementary evidence for the development of the Anchor-Driven Procurement Value Model (ADPVM). The integration is not used as evidence of causality and does not turn one dataset into a validation of the other. The permissible evidential status of the hypotheses is specified. In Study I, the observed differences are interpreted as associations because the price-information environment cannot be separated from all characteristics of the specific procurement procedures. In Study II, the results are descriptive and exploratory in statistical terms because of the purposive sample and the simultaneous differences between the scenarios in both institutional label and numerical value. In this way, the methodological logic places prior limits on causal claims and ensures consistency between the questions, data and conclusions.

2.2. Research Methods and Instruments

A quantitative research design has been developed, combining documentary analysis, administrative data, adapted CLV/BLV analysis, the PSM, exploratory non-parametric tests and expert consultation. Each method addresses a different part of the research problem. Administrative records show the dynamics of participation over time, the PSM structures professional judgement regarding price boundaries, and the game-theoretical framework

explains why disclosed information may influence both participation decisions and price expectations.

In Study I, the unit of analysis is an anonymised bidder-level record linked to a specific procedure and a pre-documented price-information environment. The analytical framework functionally accounts for the two-stage logic of evaluation. The first stage serves as a preliminary institutional filter through which grounds for exclusion, selection criteria, and the formal and technical compliance of bids are examined. The dissertation deliberately begins the analysis after completion of this stage and examines the second stage, in which admissible bids are compared according to the pre-announced award criterion. In procedures using the “lowest price” criterion, price remains the decisive comparative indicator. The first stage is therefore not omitted, but treated as a prerequisite for inclusion in the analytical dataset; its independent investigation would require different data, separate hypotheses and another research design. Procurement size and complexity, sector, contracting authority, year and type of procedure are not eligibility criteria, but characteristics of the contractual and institutional context. Due to the absence of a complete and homogeneous set of these control variables, the results are interpreted as observational associations rather than as an isolated causal effect of the price anchor. The logic of CLV is adapted only in relation to retention, attrition and duration. The software term for average revenue is replaced in the substantive interpretation by Average Bid Amount (ABA). The principal indicators are retention, attrition, survival, censoring and modelled duration of participation. Direct lifetime estimation and discounted BLV are secondary indicators weighted by the average bid amount. They do not measure public revenue,

budgetary savings, public benefit, supplier quality or grounds for contract award (Gupta et al. 2006; Berger, Nasr 1998).

In Study II, the Van Westendorp procedure is adapted to derive four professional thresholds: Too Cheap, Cheap, Expensive and Too Expensive. For the full sample, the cumulative curves make it possible to determine the Indifference Price Point (IDP), the conventional Optimal Price Point (OPP), the Point of Marginal Cheapness (PMC) and the Point of Marginal Expensiveness (PME). The OPP is understood solely as a standard PSM intersection point and not as an automatically optimal procurement price. The method does not measure consumer demand, willingness to pay, the expected number of bidders or public revenue (Van Westendorp 1976). The game-theoretical component defines the contracting authority and potential bidders as participants in a strategic environment characterised by public and private information. The contracting authority selects the disclosure regime and designs the procedure, while bidders decide whether to participate, what price to offer and whether to participate in future procedures. The framework is used for comparative interpretation of incentives, expectations and information asymmetry without structurally estimating a Nash equilibrium or providing a complete solution to the procurement mechanism (Myerson 1981). The statistical procedures are aligned with the limitations of the data. For Study I, descriptive comparisons, sensitivity analysis and robustness checks under changing assumptions are envisaged. In Study II, between-group differences are assessed using the mean values of the directly observed thresholds, the Kruskal–Wallis test and the epsilon-squared effect size. Intensity ratings and Principal Component Analysis (PCA) serve an additional diagnostic function and are not

used as independent evidence for H1-2 (Kruskal, Wallis 1952; Lakens 2013).

2.3. Research Design and Procedure of the Empirical Study

The research procedure is organised into six consecutive stages: alignment of the concept with the aim and title of the dissertation, data extraction and classification, analysis of Study I, development and administration of the instrument for Study II, sensitivity and robustness checks, and integration of the results into the ADPVM. This sequence guards against the use of ambiguously defined variables, the conversion of observational differences into causal evidence and the presentation of the model as externally validated prior to independent verification. For **Study I**, a bidder-level dataset was constructed, including an anonymised identifier, procedure identifier, contracting organisation, date, type of price-information environment, bid value and temporal data used to determine duration and status. An exclusion log is provided, recording missing classification, incomplete dates, impossible values, unresolved duplicates and mixing between segments. In this way, every transformation and every excluded observation can be verified. **Study II** follows a between-group design. Each respondent receives only one scenario: an Opening Price of 700 notional units, an Estimate of 600 notional units or a condition with no disclosed price anchor. The approach limits the transfer of information between conditions, but at the same time changes both the label and the numerical level. The comparison therefore concerns complete information regimes and does not independently isolate the effect of the institutional designation from the effect of the specific numerical value.

2.4. Sample Selection and Respondent Profile

Study I comprises 211 bidder-level observations distributed across three relatively balanced segments: No Anchor with 70 observations, With Estimate with 71 observations and With Opening Price with 70 observations. The sampling is purposive and document-based rather than random. Classification is based on the content of the procurement documentation, taking into account the presence or absence of an official price reference and its institutional nature. The final analytical dataset does not include a complete set of control variables for procurement size and complexity, sector, contracting authority, year, type of procedure and the composition of the competitive environment. Accordingly, no claim is made that full balancing, matching or regression adjustment has been undertaken. The observed differences are interpreted as unadjusted observational associations whose confirmation requires richer administrative data. Study II uses a purposive professional sample of 65 managers and specialists with experience in public procurement. The Opening Price condition includes 22 respondents, the Estimate condition also includes 22 respondents, and the No Anchor condition includes 21 respondents. The profile is characterised by professional role, length of experience, employment in the public or private sector, familiarity with bid evaluation and experience with Estimates or Opening Prices. The sample is suitable for descriptive, diagnostic and exploratory analysis, but does not permit strong generalisations about all public procurement professionals. Anonymity was maintained throughout the process.

2.5. Operationalisation of Variables, Interview Questions and Survey Questions

The operationalisation was developed so that each variable has an unambiguous meaning, a verifiable source, a unit of

measurement, a coding method, a calculation rule and a clearly defined role in the analysis. This limits the possibility of the same concepts being used with different meanings during data processing and interpretation. In Study I, the main independent variable is the price-information environment, represented by the Opening Price, Estimate and No Anchor conditions. Outcome indicators include the average bid amount, bidder status, attrition event, duration of participation, retention, attrition, survival, direct lifetime estimation and discounted Bidder Lifetime Value (BLV). A clear distinction is made between directly observed data and indicators derived through modelling. The rules for identifying attrition, right-censoring of active observations and the treatment of missing values were also determined in advance. In Study II, the respondent's assigned condition, the four perceived price thresholds, the two intensity ratings and the summary indicators of the Van Westendorp Price Sensitivity Meter (PSM) (Van Westendorp 1976) are operationalised. The questions identify the price levels at which a bid begins to be perceived as too low and therefore raising concerns, low but acceptable, high but still potentially defensible, and excessively high. The measurement is therefore directed towards professional judgement of economic feasibility, quality, risk, supplier reliability and budgetary defensibility rather than consumer willingness to pay or market demand.

The expert consultation, conducted through an interview, was used to refine the rules for classifying price-information environments, the realism of the scenarios, the wording of the questions, indicators of bidder attrition and the governance safeguards associated with the use of the analytical results. The interview is not presented as an independent qualitative empirical study because the information obtained was not processed through

systematic thematic coding and inter-coder verification. Accordingly, no separate empirical findings are derived from it; its function is consultative and methodologically supportive.

2.6. Data Integrity, Reproducibility and Ethical Boundaries

The credibility of the empirical results is linked to the transparency of data classification, cleaning, transformation and calculation. A reproducibility package has been developed, including the raw anonymised dataset, the final analytical dataset, a data dictionary, an exclusion log, a procedure-selection file, a register for classifying price-information environments, Excel and XLSTAT working files (Lumivero 2026), the PSM questionnaire, a version log and the software settings used. Visible calculation cells and documented rules allow the results to be independently traced (Addinsoft 2024).

The ethical and governance boundaries of application are defined. BLV and the ADPVM cannot be used to favour bidders with a high calculated value, exclude participants with a weaker profile or treat participants differently during evaluation. BLV may support market monitoring, communication, procedure preparation and ex post analysis, but it does not constitute an individual selection or award criterion.

The safeguards designed to prevent manipulation of price anchors include pre-defined rules for their formation, independent cost estimation, an audit trail, organisational separation between modelling and procurement decision-making, verification of unusually high and low reference values, monitoring of the participation of small and medium-sized enterprises and bidder diversity, as well as subsequent monitoring for price clustering and restrictions on competition. The fulfilment of the Second Research

Task is reflected in the development of a reproducible methodological framework that links the two empirical studies within clearly defined evidential and ethical boundaries and provides the transition to the analysis in Chapter Three.

CHAPTER THREE. APPLICATION OF GAME THEORY AND BEHAVIORAL ECONOMICS IN PUBLIC SECTOR PROCUREMENT PROCESSES

Chapter Three is empirical and applied in nature. It implements the research design, presents the results of the two separate empirical studies, tests hypotheses H1-1 and H1-2, and evaluates the support for the main research thesis. The evidence obtained is used to develop the Anchor-Driven Procurement Value Model (ADPVM) and to formulate practical guidelines for its controlled application. The empirical logic follows a strict distinction between observed bidder participation and stated professional judgement regarding price boundaries. Study I uses administrative records and tracks continued participation over time. Study II uses a scenario-based survey and establishes how public procurement professionals position the thresholds of “too low”, “low but acceptable”, “high” and “too high” prices. The two datasets are not statistically merged. The results are compared only at the level of interpretation, as they represent different manifestations of the same price-information environment.

3.1. Implementation of the Empirical Study: Description of the Process, Data Collection and Research Challenges

Two empirical studies were conducted using different units of analysis, data sources and evidential status. In **Study I**, a dataset of 211 anonymised bidder-level observations was constructed from administrative public procurement records. Preliminary

classification based on the procurement documentation distributed the observations into three segments: No Anchor, 70 observations; With Estimate, 71 observations; and With Opening Price, 70 observations. For each segment, the Average Bid Amount (ABA), active or inactive status, attrition and retention rates, modelled average time to attrition, direct lifetime estimate and discounted Bidder Lifetime Value (BLV) were determined. Observations that remained active at the end of the period were treated as right-censored. Monetary results were used as secondary indicators of continued participation weighted by the average bid amount, rather than as revenue for the contracting authority, budgetary savings or public benefit.

In addition, the monthly dynamics generated by XLSTAT (Lumivero 2026) over a 36-month horizon were analysed. The output was interpreted as a sequence of monthly modelled values rather than as a cumulative discounted amount. A one-factor sensitivity check was also conducted, in which retention was increased by five percentage points in the segments where such a change did not exceed the logical limit of 100%. Study II comprises 65 valid responses from managers and specialists with experience in public procurement. A between-group design was applied. An Opening Price condition of 700 notional units was presented to 22 respondents, an Estimate condition of 600 units was presented to 22 respondents, and 21 respondents received a No Anchor condition. Using the adapted Van Westendorp Price Sensitivity Meter (PSM), the four directly observed price thresholds and the principal summary intersection points were established.

Between-group differences were assessed using group mean values, Kruskal-Wallis tests and the epsilon-squared effect size (ε^2). Additional intensity ratings and Principal Component Analysis

(PCA) were used only to clarify the internal structure of the variables. They were not treated as measures of demand, probability of participation or independent evidence for H1-2.

Preliminary documentary classification of the price environment, separate processing of the two datasets, traceability of the formulae and restrictions on interpretation were ensured. Study I is observational in nature and does not isolate the influence of procurement size, complexity, sector, contracting authority, year or type of procedure. Study II uses a purposive professional sample and compares scenarios that differ simultaneously in institutional label and numerical value. The results are therefore presented as associations and exploratory between-group differences rather than as established causal effects.

3.2. Analysis of the Empirical Results: Factor-Oriented, Comparative and Variation Analysis of the Collected Data

The analysis of Study I identifies a clear and consistent ordering across all principal indicators of continued participation. The With Estimate segment has the highest retention, the lowest attrition and the longest modelled duration. The With Opening Price segment occupies an intermediate position, while the No Anchor segment has the weakest observed profile.

Table 1. Key Indicators of Continued Participation and Lifetime Value by Segment

Segment	n	Retention	Churn rate	Modelled Mean Time to Attrition, Months	Direct Lifetime Estimate	Discounted BLV
No Anchor	70	89,75%	10,25%	9,754	5 447 007,291	4 521 073,664
With Estimate	71	99,00%	1,00%	100,200	56 269 809,355	30 358 710,851
With	7	93,30%	6,70%	14,919	8 885 078,548	7 372 882,705

Opening Price	0					

Source: Author's calculations based on the final dataset from Study I. The direct lifetime estimate and discounted BLV are segment-level indicators weighted by the Average Bid Amount and are not interpreted as public revenue, savings or an individual bidder assessment.

The comparison shows that the Average Bid Amount does not, in itself, explain the observed ordering. The highest average bid was recorded under the Opening Price condition, at 595,540.400, whereas under the Estimate condition it was 561,574.944, and under the No Anchor condition 558,459.886. Nevertheless, the With Estimate segment has substantially higher lifetime indicators. The result is determined by retention close to one and the modelled duration arising from it, rather than by the nominal size of the average bid.

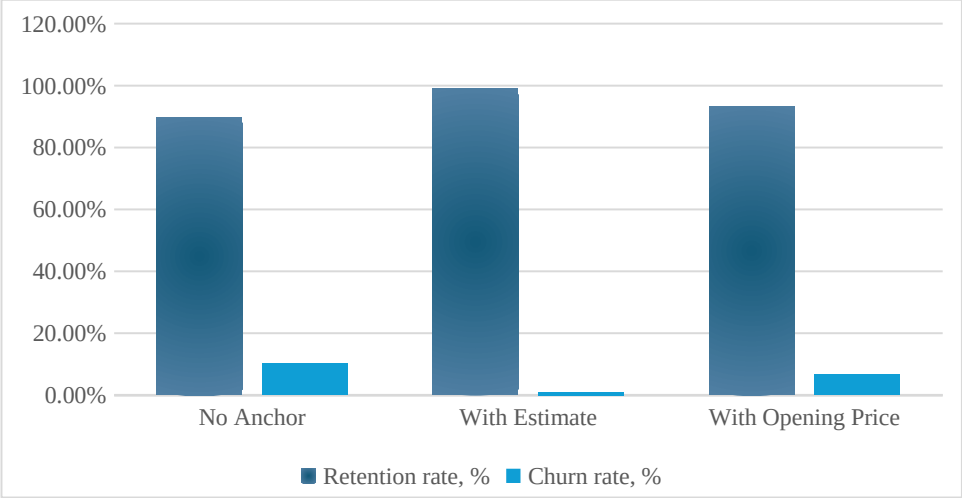


Figure 1. Bidder Retention and Attrition by Price-Information Segment.

Source: Author's calculations based on the final data from Study I.

Figure 1 illustrates the differences between the three segments. Under the Estimate condition, retention reaches 99.00%,

compared with 93.30% under the Opening Price condition and 89.75% under the No Anchor condition. The reverse ordering is observed for attrition. The consistency in direction across retention, attrition, modelled duration, direct lifetime estimate and discounted BLV makes the result robust to reliance on any single indicator.

The monthly dynamics generated by XLSTAT preserve the same relative ordering throughout the entire 36-month horizon. By month 36, the modelled monthly values are 615,669.371 for the No Anchor segment, 26,749,165.639 for the With Estimate segment and 4,121,840.629 for the With Opening Price segment. These values do not represent cumulative value and should not be equated with discounted BLV. They constitute a separate software output that confirms the comparative ordering but remains dependent on the assumptions of the model (Lumivero 2026).

The sensitivity check reveals differing potential for change in the direct lifetime estimate under a hypothetical improvement in retention. In the No Anchor segment, an increase from 89.75% to 94.75% almost doubles the estimate. Under the Opening Price condition, an increase from 93.30% to 98.30% produces the strongest absolute and relative scenario effect. For the Estimate condition, the same scenario is not admissible because the baseline retention rate is already 99.00%.

Table 2. Sensitivity Analysis of the Direct Lifetime Estimate

Segment	Baseline Profile	Scenario Profile	Change in Direct Estimate	Interpretation
No Anchor	Retention 89.75%; time 9.754 months; estimate 5,447,007.291	Retention 94.75%; time 19.038 months; estimate 10,632,065.151	+5,185,057.860 (+95.19%)	High relative sensitivity from the weakest baseline position
With	Retention	Not calculated	Not calculated	Strongest

Segment	Baseline Profile	Scenario Profile	Change in Direct Estimate	Interpretation
Estimate	99.00%; time 100.200 months; estimate 56,269,809.355	because an increase of 5 percentage points would exceed 100%		baseline profile and boundary effect of retention
With Opening Price	Retention 93.30%; time 14.919 months; estimate 8,885,078.548	Retention 98.30%; time 58.730 months; estimate 34,976,182.222	+26,091,103.674 (+293.65%)	Strongest modelled leverage of retention

Source: Author's calculations. The scenario represents a one-factor sensitivity check based on a five-percentage-point increase in retention and does not constitute a causal forecast of the effect of changing the price anchor.

The results of Study II begin with the summary analysis of the 65 valid responses. The mean threshold for a "too low price" is 344.615 notional units, for a "low but acceptable price" 466.923, for a "high price" 648.462, and for a "too high price" 797.692. The standard deviation is greatest at the lower end of the price structure, indicating greater variation in professional judgement as to when a low price begins to raise concerns regarding feasibility and quality.

The aggregated PSM curves identify an Indifference Price Point (IDP) of 550 units, a conventional Optimal Price Point (OPP) of 575 units, a Point of Marginal Cheapness (PMC) of 400 units and a Point of Marginal Expensiveness (PME) of 750 units. The interval from 400 to 750 units represents the perceived acceptable price range for the overall sample rather than an automatic recommendation for an Estimate or contract award price.

Table 3. Key Summary Indicators of the Van Westendorp Price Sensitivity Meter (PSM)

PSM Indicator	Value	Interpretation
Indifference Price Point (IDP)	550.000	Balance between perceptions of a low and a high price
Optimal Price Point (OPP)	575.000	Conventional PSM point of minimum combined extreme rejection
Point of Marginal Cheapness (PMC)	400.000	Lower boundary of perceived price acceptability; below this point, the price begins to appear suspiciously low
Point of Marginal Expensiveness (PME)	750.000	Upper boundary of perceived price acceptability; above this point, the price is perceived as too high
Overall Acceptable Price Range	from 400.000 to 750.000	Diagnostic range for the overall sample

Source: Author's calculations based on the final dataset from Study II. The indicators are diagnostic and do not automatically determine an Opening Price, Estimate, budget ceiling or contract award price.

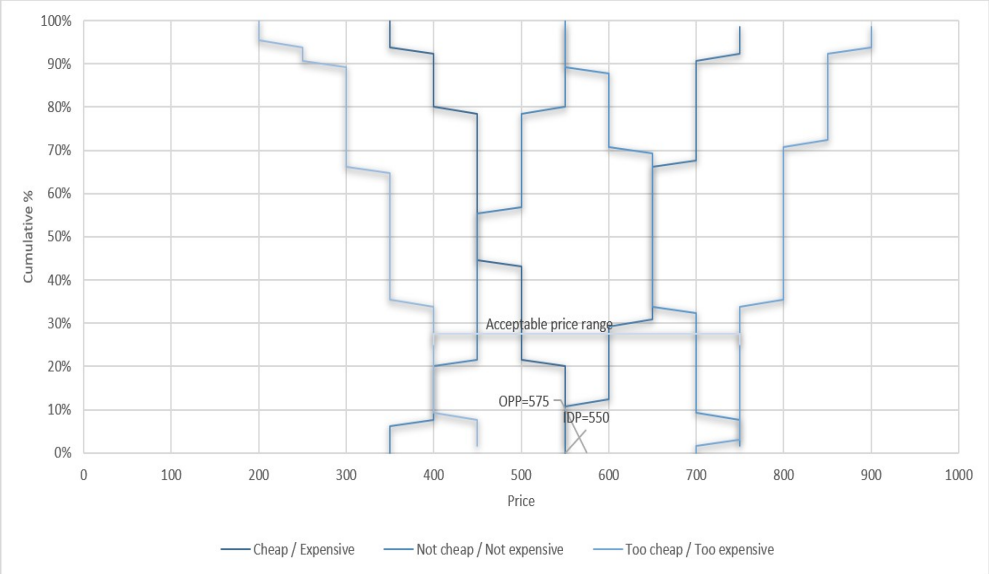


Figure 2. Aggregated Van Westendorp Curves and Perceived Acceptable Price Range (n = 65) Source: Author's calculations based on the final PSM dataset and XLSTAT. IDP = 550; OPP = 575; PMC = 400; PME = 750.

The between-group comparison shows that the clearest and most consistent pattern emerges at the lower price thresholds. The mean value for “Too Cheap” is 384.091 under the Opening Price condition, 354.545 under the Estimate condition and 292.857 under the No Anchor condition. For “Cheap”, the corresponding values are 518.182, 472.727 and 407.143. The presence of a visible price reference is associated with a higher boundary below which a bid begins to appear insufficiently realistic or risky.

Table 4. Group Mean Values and Exploratory Tests for Perceived Price Thresholds

Threshold	Opening Price	Estimate	No Anchor	H	p	Effect Size ε^2
Too Cheap	384.091	354.545	292.857	22.110	< 0.001	0.324
Cheap	518.182	472.727	407.143	38.804	< 0.001	0.594
Expensive	670.455	638.636	635.714	5.303	0.0705	0.053
Too Expensive	815.909	775.000	802.381	10.453	0.0054	0.136

Source: Author’s calculations, n = 65. The Kruskal–Wallis test is an omnibus test and does not, on its own, establish which specific pairs of groups differ.

The tests confirm that the strongest between-group difference occurs for the “Cheap” threshold, where $H = 38.804$, $p < 0.001$ and $\varepsilon^2 = 0.594$. A clear difference is also identified for the “Too Cheap” threshold, $H = 22.110$, $p < 0.001$ and $\varepsilon^2 = 0.324$. The “Expensive” threshold does not reach the conventional 5% significance level, while for “Too Expensive” there is a statistically supported overall difference without a monotonic ordering. Anchoring therefore does not manifest itself as an identical shift across all thresholds. The most robust pattern is concentrated in the lower part of the price structure.

The intensity ratings do not differ substantially across conditions. The additional PCA shows that the four price thresholds share a dominant location component explaining 53.023% of the standardised variance, while the intensity ratings form a separate supplementary structure. This result supports the decision to base the main conclusions on the location of the directly observed thresholds, while retaining intensity as a supplementary diagnostic measure.

The comparison of the two studies reveals different but coherent manifestations of the price-information environment. The Estimate condition is associated with the strongest observed continued participation, but not with the highest lower price thresholds. The Opening Price condition is associated with an intermediate participation profile and the highest values for “Too Cheap” and “Cheap”. The No Anchor condition is associated with the weakest participation profile and the lowest lower thresholds, while at the same time preserving greater scope for independent price formation. No single regime can be declared universally best without taking into account the context, the quality of the initial estimate and the state of the market.

3.3. Testing of the Research Hypotheses

The hypotheses were tested by comparing the propositions formulated in advance with the indicators defined in Chapter Two. The term “testing” does not imply absolute causal proof. In Study I, the robustness of the observed ordering between the segments is assessed, while in Study II, the direction, statistical support and magnitude of the between-group differences are evaluated.

H1-1 states: “The segments formed according to the type of price anchor are associated with different profiles of bidder retention and Bidder Lifetime Value (BLV), with the With Estimate

segment expected to demonstrate the greatest sustainability of participation.” H1-2 states: “The price thresholds perceived by public procurement professionals differ across the Opening Price, Estimate and No Anchor conditions, with the observed pattern of differences being consistent with anchoring.”

Table 5. Decisions on the Research Hypotheses

Hypothesis	Main Evidential Basis	Decision
H1-1	Consistent ordering across retention, attrition, modelled duration, direct lifetime estimate and discounted BLV	Supported as an empirical association; causal exclusivity is not claimed
H1-2	Group mean values, Kruskal-Wallis tests and ε^2 for the four directly observed price thresholds	Supported at the descriptive and exploratory statistical levels; strongest evidence at the lower thresholds

Source: Author’s systematisation based on the results of Study I and Study II.

H1-1 is supported within the limits of the observational design. The With Estimate segment ranks first in retention, modelled duration, direct lifetime estimate and discounted BLV, and last in attrition. The Opening Price condition has an intermediate profile, while the No Anchor condition has the weakest profile. The consistency across all principal indicators reduces the risk that the decision is the result of selectively relying on a single measure. Causal exclusivity is not claimed because the incomplete set of control variables does not allow the influence of the price environment to be separated from the characteristics of the specific procurement procedures.

H1-2 is supported at the descriptive and exploratory statistical levels. The clearest ordering is observed for the “Too Cheap” and “Cheap” thresholds, where the Opening Price condition is associated with the highest thresholds, the Estimate condition with intermediate thresholds and the No Anchor condition with the lowest thresholds. For the “Expensive” threshold, the evidence is weaker, while for the “Too Expensive” threshold the difference is statistically supported but does not follow a simple sequential pattern. The results confirm a differentiated structure of professional price judgement without implying an identical shift across all thresholds.

Taken together, the results provide coherent empirical support for the main research thesis. Within the limits of the observational and exploratory design, it is confirmed that the price anchor performs a dual function in public procurement. It characterises the strategic information environment in which bidder participation is formed and sustained, while at the same time it may become a reference point for professional price judgement. Study I supports the first dimension, while Study II supports the second. Linking the two does not demonstrate universal causality, but it does show that disclosed price information is not an analytically neutral element of the procurement procedure. Through the implementation of the two empirical studies, the analysis of continued participation and perceived price thresholds, and the testing of H1-1 and H1-2, Research Task 3 (RT3) has been completed. Empirical answers are also provided to RQ2 and RQ3: different price environments are associated with different participation profiles and with different structures of perceived price thresholds.

3.4. Development of an Innovative Integrated Model for the Strategic Management of Public Procurement Based on the Empirical Results

On the basis of the theoretical framework and the convergent results of the two studies, the Anchor-Driven Procurement Value Model (ADPVM) has been developed. The model is an empirically motivated decision-support framework compatible with the principles of public governance. It does not combine heterogeneous indicators into a single mechanical index, does not determine an automatic price and does not rank individual bidders.

Table 6. Main Components of the Anchor-Driven Procurement Value Model (ADPVM)

Component	Empirical or Documentary Basis	Function and Limitation
Classification of the price environment	Documentation relating to an Opening Price, Estimate or No Anchor condition	Defines the information condition in advance; it is not altered according to the outcome
Diagnosis of continued participation	Retention, attrition, censoring, modelled duration and secondary BLV indicators	Supports monitoring at segment or category level; it is not an assessment of an individual bidder
Diagnosis of price thresholds	"Too Cheap", "Cheap", "Expensive" and "Too Expensive" prices and summary PSM points	Describes perceived boundaries; it does not replace independent cost estimation
Sensitivity and robustness	Scenario calculations, Kruskal-Wallis, ε^2 and supplementary PCA	Shows the dependence of the results on assumptions; it is not a causal forecast
Governance safeguards	Equal treatment, independent verification, audit trail and data integrity	Restricts manipulative, discriminatory and automatic use
Subsequent monitoring and learning	Participation, diversity, prices and performance after the procedure	Supports review and calibration in subsequent cycles

Source: Author's development based on the theoretical framework and the results of the two empirical studies.

The conceptual sequence begins with documenting the subject matter, risk, market information and the selected disclosure regime. This is followed by the preliminary classification of the procedure, verification of data readiness and comparability, and separate analyses of continued participation and price thresholds. The results are brought together at the stage of integrated interpretation, undergo governance review and are then used for subsequent monitoring and institutional learning.

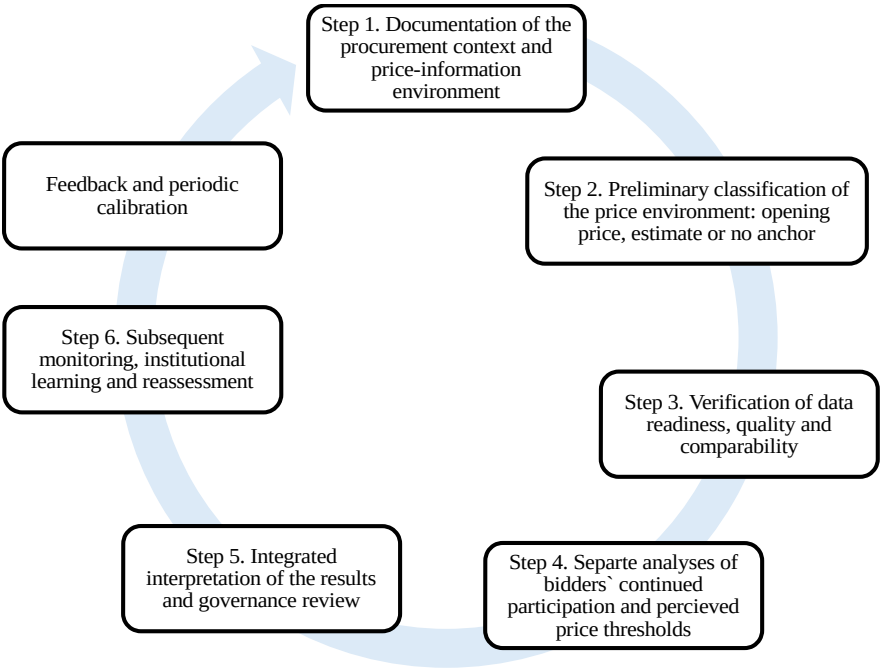


Figure 3. Conceptual Sequence of the Anchor-Driven Procurement Value Model (ADPVM)

Source: Author's development based on the theoretical framework and the results of Study I and Study II.

The graphical sequence emphasises that the analytical process does not end with the calculation of an indicator. The decision regarding the price-information environment must have a documentary basis, be verified against the available market data and remain subject to the principles of equal treatment, proportionality, transparency and auditability. Governance safeguards form part of the architecture of the ADPVM rather than an external addition introduced after its application (European Parliament and Council 2014; OECD 2015; Fazekas, Blum 2021).

The model provides an answer to RQ4 by demonstrating how data on continued participation and professional price judgement can be integrated without conflating their evidential status. Research Task 4 (RT4) has also been completed, as the empirical results have been transformed into a structured framework with defined components, scenarios, governance boundaries and requirements for future validation.

3.5. Practical Recommendations and Guidelines for Applying the Model in Public-Sector Practice

The practical recommendations arise from the understanding that the choice between an Opening Price, an Estimate and the absence of a numerical reference is a decision concerning the design of the information environment. The contracting authority should document in advance the source, date, assumptions, uncertainty and independent verification of any disclosed price value. The habitual use of historical values or reliance on software output without substantive verification does not create a reliable anchor.

Retention, attrition and BLV should be used at category, segment or system level for monitoring competitive capacity. High retention is not automatically evidence of a healthy market, as it may

coexist with concentration and limited entry of new participants. Low retention likewise does not demonstrate a defect in the price anchor unless the specification, qualification requirements, allocation of risk, participation costs and market structure have also been examined. The adapted PSM may support professional assessment of the lower and upper price boundaries, but it cannot replace technical costing, market research and legal review. Particular attention should be paid to the lower threshold, where a low price ceases to represent only a competitive advantage and begins to raise concerns regarding the realism of costs, quality and feasibility.

Table 7. Practical Guidelines and Limitations for the Application of the ADPVM

Area	Practical Requirement	Impermissible Use
Selection of the price environment	Prior documentation of the source, method, uncertainty and independent review	Retrospective selection of an anchor according to the desired outcome
Continued participation and BLV	Monitoring at segment or category level together with new entry, diversity and concentration	Preferential treatment of frequent suppliers or unfavourable treatment of new participants
PSM diagnostics	Comparison with cost estimates, technical requirements, risk and current market data	Automatic determination of an Estimate, budget ceiling, minimum price or award criterion
Governance control	Equal treatment, conflict-of-interest safeguards, version control, audit trail and data protection	Covert steering of the market or manipulation of price expectations
Implementation	Pilot application in recurring and comparable categories, training and subsequent monitoring	Immediate general application without checking data readiness
Validation	Independent verification across other contracting authorities,	Presenting the model as universally

	sectors, periods and jurisdictions	validated or causally predictive

Source: Author's systematisation based on the practical recommendations and governance safeguards developed in the dissertation.

The implementation of the ADPVM should be phased. The initial stage includes legal and institutional mapping, classification of pricing practices and verification of the available data. This is followed by pilot calculation of continued-participation indicators and, where an appropriate professional sample is available, PSM diagnostics. Broader application is permissible only after governance review, training, subsequent monitoring and independent external verification.

The practical value of the model is procedural and diagnostic. The ADPVM does not promise an automatically optimal price and does not eliminate professional judgement. Its purpose is to discipline and document decision-making, to link disclosed price information with market response and to define the boundary between a permissible analytical conclusion and impermissible managerial use.

In summary, Chapter Three fulfils the empirical and applied part of the dissertation study. H1-1 is supported as an empirical association, H1-2 is supported at the descriptive and exploratory statistical levels, and the main research thesis receives coherent support from the two independent data sources. The price anchor manifests itself both as a characteristic of the strategic information environment and as a potential reference point for professional price judgement. The resulting findings are transformed into a governance-constrained and verifiable model rather than a universal rule for price setting or contractor selection.

Overall, Chapter Three supports the central thesis that price information has both strategic and behavioral significance. The

results do not establish the universal superiority of any one regime and do not demonstrate a pure causal effect. They substantiate the need for price references to be calculated, disclosed and monitored as active elements of the strategic management of public procurement. The development of the ADPVM, the governance safeguards, application scenarios, practical guidelines and implementation roadmap confirm the completion of RT4. All four research tasks have been completed, the aim has been achieved within the limits of the selected design, and the author's thesis is supported by mutually complementary theoretical and empirical arguments.

CONCLUSION OF THE DISSERTATION

The dissertation begins with an apparently simple question: what happens when a public contracting authority discloses a price? The theoretical and empirical analyses show that the disclosed price value does not remain a passive administrative parameter in the procurement documentation. It enters the information environment of the procedure, may reduce uncertainty and facilitate participation, but at the same time may become a reference point around which expectations and professional judgements concerning a suspiciously low, low but acceptable, high or unacceptable price are organised. The main scientific conclusion is that the decision to use an Opening Price, an Estimate or no explicit price anchor (No Anchor) is not a neutral administrative choice. The decision forms part of the market design created by the public contracting authority through the rules, information, deadlines, requirements and allocation of risk. The dual role of price information links the game-theoretical logic of strategic interaction with the behavioral logic of anchoring and reference dependence.

Study I establishes a consistent association between the three price-information environments and the profiles of continued participation. The With Estimate segment shows the highest retention and the lowest attrition, the With Opening Price segment occupies an intermediate position, and the No Anchor segment has the weakest observed profile. The same ordering is maintained for modelled duration, the direct lifetime estimate and discounted BLV. H1-1 is supported as an empirical association, without claiming that the price anchor is the sole cause of the observed differences.

Study II establishes that the clearest differences between the three conditions emerge at the lower price thresholds. The Opening Price condition is associated with the highest values for “Too Cheap” and “Cheap”, the Estimate condition occupies an intermediate position, and the No Anchor condition is associated with the lowest values. The results for the upper thresholds are more heterogeneous. H1-2 is supported at the descriptive and exploratory statistical levels, but no claim is made of a uniform shift across all thresholds, representativeness for the entire population or an established causal effect. The methodological value of the study does not lie in the mechanical transfer of commercial tools. BLV is not public revenue, savings or the value of a particular supplier, but a secondary segment-level indicator of continued participation. The PSM is not a demand curve and does not automatically determine an award price, but structures professional judgement concerning price boundaries. Software can calculate a result, but scientific responsibility determines its actual meaning.

On the basis of the results, the Anchor-Driven Procurement Value Model (ADPVM) has been developed. The contribution of the model does not lie in creating another isolated indicator, but in organising the evidence, defining the permissible interpretation of

each result and introducing the governance conditions for its use. The model is intended to discipline and document professional judgement rather than automate it.

The limitations of the study define the boundaries of the conclusions. Study I is observational and does not include a complete set of contractual control variables. Study II uses a purposive professional sample and compares scenarios that differ simultaneously in both label and numerical value. The ADPVM is empirically motivated and internally consistent, but requires independent external validation. These limitations do not invalidate the results, but define the next legitimate stages of verification.

The main conclusion of the study is not that public contracting authorities should always use an Estimate, always disclose an Opening Price or always leave the market without a numerical reference. Such a claim would replace analysis with a dogmatic rule. The results show that every decision to disclose, frame or withhold price information constitutes a strategic and behavioral intervention in the market. The decision should therefore be evidence-based, subject to independent verification, proportionate to the objectives and characteristics of the procedure, and evaluated through subsequent monitoring of the results.

Effective public procurement is not exhausted by achieving a low price within a single procedure. It requires the design of a market environment in which suppliers with the necessary capacity have reason to participate again and in which competition remains genuine and sustainable over time. The principal scientific and practical result of the dissertation is to move the price anchor beyond the role of an apparently neutral administrative parameter and establish it as an independent object of strategic management, empirical investigation and public accountability.

IV. CONTRIBUTIONS OF THE DISSERTATION

Scientific Contributions

1. Scientific knowledge in the field of public procurement management has been enriched through the development of an integrated theoretical framework in which public procurement is considered as a regulated recurring market, while the Opening Price, Estimate and No Anchor conditions are defined as distinct pre-specified information environments. The publicly disclosed price value is conceptualised simultaneously as a strategic informational signal and as a potential behavioral reference point.

2. The methodological foundations for analysing bidders' continued participation have been developed through the adaptation of the logic of Customer Lifetime Value to Bidder Lifetime Value at segment level. The analytical focus is shifted from revenue generated by a customer to retention, attrition, censoring, modelled duration and repeat participation, while the direct lifetime estimate and discounted BLV are clearly distinguished from public revenue, budgetary savings, public benefit, supplier quality or the individual value of a particular bidder.

3. The Van Westendorp Price Sensitivity Meter has been methodologically adapted to professional judgement in public procurement. The "Too Cheap", "Cheap", "Expensive" and "Too Expensive" thresholds are reconceptualised as perceived boundaries related to feasibility, quality risk, supplier reliability, budgetary defensibility and value for money rather than as indicators of consumer willingness to pay or observed demand.

4. New empirical findings have been obtained concerning the relationship between price-information environments, bidders' continued participation and the price thresholds perceived by public procurement professionals. Study I establishes a consistent

association between the three segments and different profiles of continued participation. Study II identifies structured between-group differences, with the strongest pattern consistent with anchoring observed for the “Too Cheap” and “Cheap” thresholds. The observed relationships are clearly distinguished from causal claims.

Scientific and Applied Contributions

1. A reproducible methodology comprising two independent empirical studies for analysing price anchors in public procurement has been developed and applied. The methodology includes prior documentary classification of the information conditions, construction of bidder-level administrative datasets, analysis of retention, attrition, censoring, modelled duration and Bidder Lifetime Value (BLV), an adapted Van Westendorp Price Sensitivity Meter (PSM), sensitivity analysis, exploratory non-parametric tests, effect-size estimation and supplementary Principal Component Analysis. The two datasets are processed separately and integrated only at the stage of interpretation.

2. The Anchor-Driven Procurement Value Model (ADPVM) has been developed as an empirically motivated decision-support framework compatible with the principles of public governance. The model integrates prior classification of the price environment, diagnosis of continued participation, analysis of the price thresholds perceived by public procurement professionals, sensitivity and robustness checks, governance safeguards and subsequent institutional learning, without allowing participants’ histories or behavioral indicators to become hidden selection or award criteria.

3. A set of practical tools has been developed for the controlled application of the Anchor-Driven Procurement Value Model (ADPVM), including a procedure for selecting and

documenting the price anchor, category-level monitoring, application scenarios, a phased implementation roadmap, training modules, procedures for subsequent learning, and safeguards for independent cost verification, equal treatment, protection of new participants and small and medium-sized enterprises, monitoring of bidder diversity, auditability, data integrity and separation of analytical diagnostics from the evaluation of individual bids.

V. PUBLICATIONS RELATED TO THE DISSERTATION

Four scientific publications related to the topic of the dissertation research have been published, one of which is indexed in Scopus:

1. **STEFANOVA, Marieta; KANEV, Dimitar; AGAI, Lior.** Forestry logistics and sustainability – adaptation to price challenges. In: *WoodEMA 2025 – Wood for the Future: Integrating Sustainability Across Industries: Proceedings of Scientific Papers from the 18th International Scientific Conference*, Ohrid, North Macedonia, 17–19 September 2025. 2025, pp. 133–138. ISBN 978-953-8446-04-7. **Индексирана в Scopus.**
2. **STEFANOVA, Marieta; KANEV, Dimitar; AGAI, Lior.** Customer retention strategies in the maritime sector through segmentation and behavioralanalysis. *Scientific Bulletin of Naval Academy*. 2025, vol. XXVIII, pp. 39–44. ISSN 2392-8956; ISSN-L 1454-864X. DOI 10.21279/1454-864X-25-I1-004.
3. **AGAI, Lior.** Anchoring Bias in Public Procurement Tenders: Price Sensitivity Analysis Using the Van Westendorp PSM Method. *International Journal of Innovative Science and Research Technology*. 2026, vol. 11, no. 7, pp. 1908–1912. ISSN 2456-2165. DOI 10.38124/ijisrt/26jul1207.
4. **AGAI, Lior.** Anchoring Bias in Public Procurement Tenders: A Bidder Lifetime Value (BLV) Analysis. *International Journal of Innovative Science and Research Technology*. 2026, vol. 11, no. 7, pp. 1893–1897. ISSN 2456-2165. DOI 10.38124/ijisrt/26jul1203.