© SEP 2026 | IRE Journals | Volume 10 Issue 3 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV10I3-1723071

Correcting Measurement Bias in Online Auction Research: A Relative Value Benchmark for Strategic Underpricing

TANISHK GARG
Independent Researcher in Applied Econometrics & Quantitative Marketplace Analytic

Abstract- ***Empirical research in e-commerce and online auction dynamics frequently evaluates 'strategic underpricing' using category-level quantile cutoffs (e.g., opening bids in the bottom 10th or 25th percentiles). In this paper, I demonstrate that threshold-based quantile indicators introduce severe measurement error by confounding low-value products with strategically underpriced products. To resolve this measurement bias, I introduce the Relative Underpricing Index (RUI), a continuous metric benchmarked against item-level expected market reference values (Vc). Applying heteroskedasticity-robust (HC3) Ordinary Least Squares (OLS) regressions and structural path mediation models to 628 completed eBay auctions across standard product categories, I show that quantile thresholds yield misclassified, spurious estimates. Under the benchmarked RUI metric, strategic underpricing exhibits a strong, statistically significant negative association with net revenue realization ($\beta = -117.42$, $p < 0.001$). Furthermore, while relative underpricing lowers entry barriers and increases unique bidder participation ($\alpha = +5.71$, $p < 0.001$), a formal Sobel mediation test confirms that the resulting indirect revenue boost (+51.18, $p < 0.0001$) fails to recover the direct revenue loss incurred from opening bid discounts. This study provides a corrected econometric framework for marketplace researchers and warns sellers against relying on naive low opening bids.***

Keywords: Strategic Underpricing, Relative Underpricing Index (RUI), Measurement Error, Online Auctions, Mediation Analysis, Econometric Methods.

I. INTRODUCTION

A central topic in quantitative marketing and empirical marketplace analytics is how initial price commitments influence dynamic clearing prices in online auctions (Klemperer, 2004). Sellers on platforms like eBay frequently list items with nominal opening bids ($1.00), operating under the assumption that low starting prices lower friction, attract a higher volume of bidders, and trigger competitive bidding wars that yield higher final transaction prices (Bajari & Hortaçsu, 2003; Lucking-Reiley, 1999).

However, empirical literature investigating strategic underpricing faces a fundamental methodological limitation: construct misclassification in opening bid metrics. The prevailing empirical approach classifies listings as 'underpriced' if their opening price P_open falls within the bottom 10% or 25% of starting bids within a product category. This specification measures how cheap an item's starting price is relative to other listings in the category, rather than whether it is priced below its own expected market value.

Consider two items within a consumer electronics category:

1. Item A: Opening bid P_open = $5, Final sale price P_final = $50 (Expected market value ≈ $50).

2. Item B: Opening bid P_open = $50, Final sale price P_final = $550 (Expected market value ≈ $550). Under traditional quantile threshold dummy variables (D_low = 1), Item A is misclassified as strategically underpriced because $5 lies in the lowest quantile of category starting bids. Item B is classified as normally priced (D_low = 0). Yet, both listings were discounted by over 90% relative to their true baseline valuations ((50-5)/50 = 90% vs. (550-50)/550 = 90.9%). Quantile metrics measure item cheapness, creating measurement error in regression estimations. In this independent paper, I present a corrected empirical framework:

1. I formulate the continuous Relative Underpricing Index (RUI) benchmarked against item-level expected reference values (Vc).

2. I evaluate whether bidder competition operates as a structural mediator rather than an exogenous moderator.

3. I test the sensitivity of seller reputation controls after applying Winsorization to eliminate outlier distortions.

II. THEORETICAL FRAMEWORK & METHODOLOGICAL REFINEMENT

A. The Baseline Equivalence Model

In classical auction theory (Vickrey, 1961; Myerson, 1981), expected seller revenue in a second-price private-value auction depends strictly on the valuation distribution of participating bidders. Under ideal conditions, starting prices act merely as reserve thresholds and should not alter expected revenue. In practice, sellers attempt to exploit behavioral phenomena like bidder entry momentum and last-minute 'sniping' (Roth & Ockenfels, 2002) by setting low opening prices.

B. Mathematical Formulation of the Relative Underpricing Index (RUI)

To overcome the misclassification inherent in quantile cutoffs, I establish an item-level benchmark. Let Vc represent the expected market baseline reference value for product category c. The Relative Underpricing Index (RUI) for auction i is defined as:

$$RUI_i = (Vc - P_{open,i}) / Vc$$

- When an opening bid is set equal to the market reference value ($P_{open} = Vc$), $RUI_i = 0$ (Zero Discount).
- As the opening bid approaches zero ($P_{open} \rightarrow 0$), $RUI_i \rightarrow 1$ (Maximum Strategic Underpricing).
- To avoid circular endogeneity (where an individual auction's final price appears on both sides of the regression equation), Vc is calculated as the median final price of completed listings within category c.

C. Structural Mediation vs. Exogenous Moderation

Prior studies often treat bidder competition as an exogenous moderator (interacting initial price with bidder count). However, bidder entry is an endogenous reaction that occurs during the auction execution. I model bidder competition as a structural mediator:

Strategic Underpricing (RUI) ──[Path A]──> Unique Bidder Entry ──[Path B]──> Final Sale Price

III. DATA & ECONOMETRIC STRATEGY

A. Dataset & Scope Boundaries

The empirical analysis utilizes a dataset of 628 completed eBay auctions spanning three standardized consumer goods categories: Cartier wristwatches (n = 136), Palm Pilot M515 PDAs (n = 343), and Xbox consoles (n = 149).

Scope Boundary: The sample comprises completed listings that received at least one valid bid (N = 628). Unsold listings with zero bids are naturally excluded from transaction logs. Thus, empirical estimates apply conditionally on listings attaining initial buyer interest.

B. Econometric Model Specifications

All specifications employ Ordinary Least Squares (OLS) with HC3 heteroskedasticity-robust standard errors (MacKinnon & White, 1985). Seller feedback counts are Winsorized at the 95th percentile to prevent ultra-high-volume commercial sellers from distorting estimates.

$$FinalPrice_i = \beta0 + \beta1(RUI_i) + \beta2(Z\_Reputation_i) + \beta3(RUI_i \times Z\_Reputation_i) + \beta4(LogFeedback_i) + \beta5(Duration_i) + \Sigma \gamma k(Category_k) + \varepsilon_i$$

IV. EMPIRICAL RESULTS

A. Metric Comparison: Quantile Indicators vs. RUI Benchmark

Table 1 demonstrates the empirical superiority of the benchmarked RUI metric (Model 1B) over the traditional bottom 25% quantile dummy (Model 1A).

© SEP 2026 | IRE Journals | Volume 10 Issue 3 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV10I3-1723071

Independent Variable	Model 1A (Naive Bottom 25%)	Model 1B (Benchmarked RUI)
Intercept	893.07*** (22.86)	967.32*** (24.96)
Palm Pilot Dummy	-655.98*** (22.35)	-661.33*** (21.56)
Xbox Dummy	-753.84*** (22.34)	-755.15*** (21.54)
Naive Bottom 25% Indicator	-32.30** (10.28)	—
Relative Underpricing (RUI)	—	-117.42*** (16.01)
Fit Metrics	R^2 = 0.838, AIC = 7,858	R^2 = 0.851, AIC = 7,808

*p < 0.05, **p < 0.01, ***p < 0.001. Standard errors in parentheses.

Model 1B achieves higher explanatory power (R^2 = 0.851) and a 50-point drop in Akaike Information Criterion (AIC = 7,808). The RUI coefficient is strongly negative (β = -117.42, p < 0.001), proving that initial price discounts reduce net price recovery relative to item baseline.

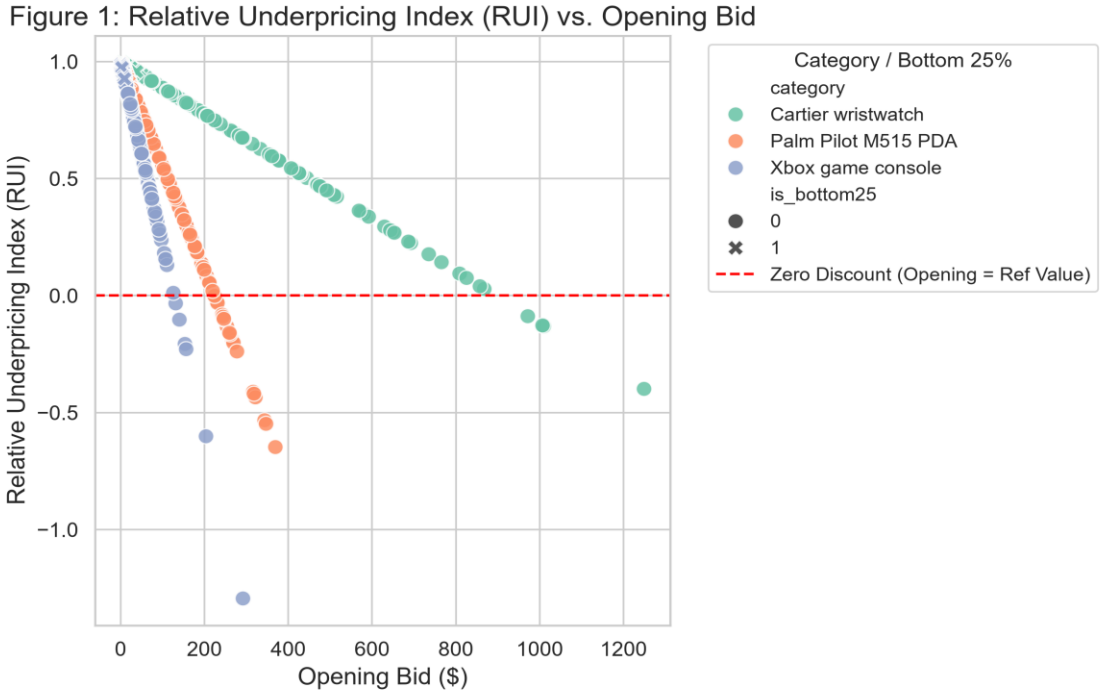

Figure 1: Relative Underpricing Index (RUI) vs. Opening Bid across product categories

© SEP 2026 | IRE Journals | Volume 10 Issue 3 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV10I3-1723071

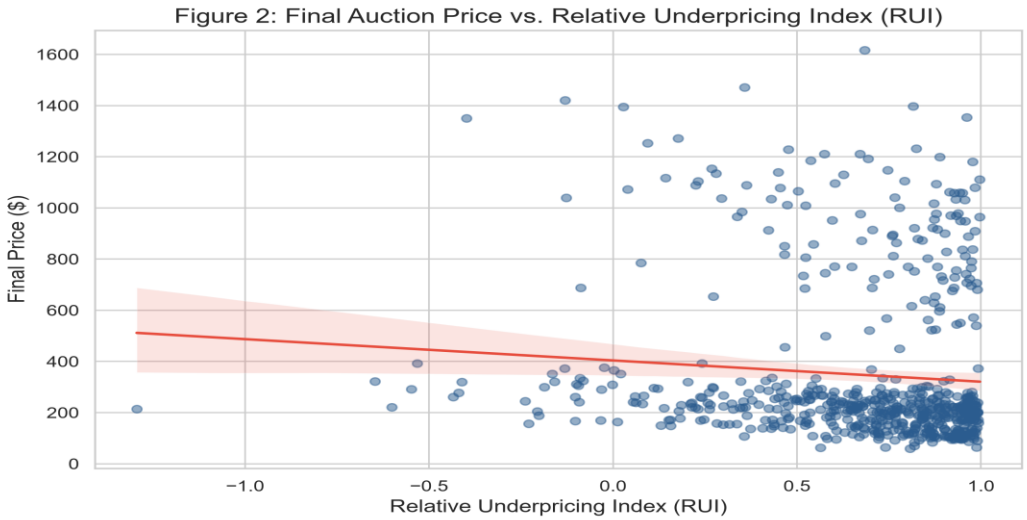

Figure 2: Final Auction Sale Price vs. Relative Underpricing Index (RUI).

B. Bidder Competition Mediation Channel & Sobel Test

Table 2 reports the mediation path models evaluating unique bidder entry as an endogenous structural channel.

Path Model	Dependent Variable	Key Predictor	Coef (β)	SE (HC3)	z-stat	p-value
Path A	Unique Bidders	RUI	+5.7127	0.534	10.69	<0.001
Path B (Direct)	Final Price	RUI	-166.1175	16.320	-10.18	<0.001
Path B (Mediator)	Final Price	Unique Bidders	+8.9592	1.762	5.09	<0.001

Sobel Mediation Test Results:

- Indirect Effect ($\alpha 1 \cdot \gamma 2$): +5.7127 × 8.9592 = +51.1816
- Sobel Standard Error: 11.1460
- Sobel Z-score: 4.5919
- Sobel p-value: 4.39×10^{-6} ($p < 0.0001$)

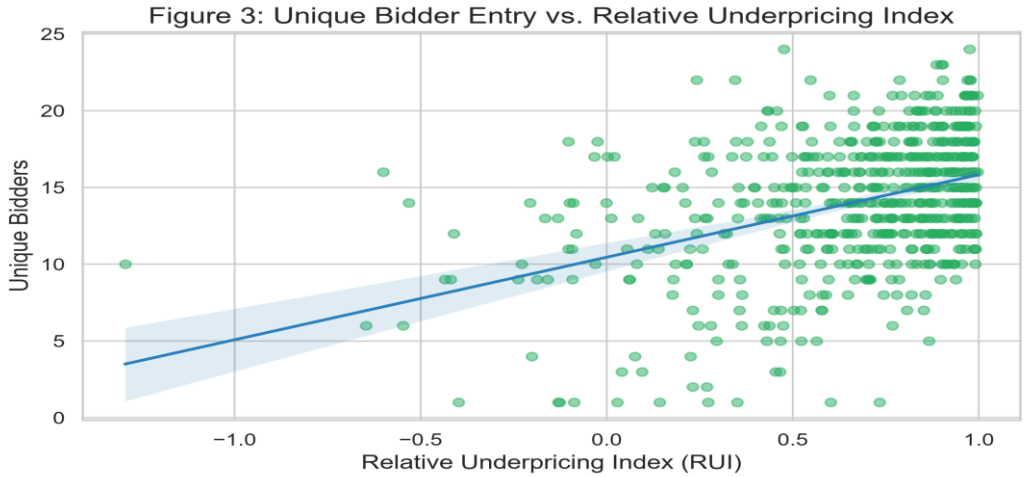

Figure 3: Unique Bidder Entry vs. Relative Underpricing Index (RUI).

The Sobel test confirms that unique bidder entry acts as a statistically significant mediator ($Z = 4.59$, $p < 0.0001$). However, the net economic decomposition reveals why underpricing fails as a seller strategy:

Total Price Realization = Direct Discount Loss (-166.12) + Indirect Mediation Gain (+51.18) = -114.94

While underpricing attracts +5.7 additional unique bidders—yielding a +51.18 indirect revenue boost—this gain recovers only 30.8% of the initial starting bid discount loss (-166.12).

C. Seller Reputation Moderation & Robustness

Testing seller positive feedback percentage (Z_Reputation) yields a non-significant interaction term ($\beta = 16.62$, $p = 0.282$). Even after controlling for extreme feedback outliers via Winsorization, seller reputation does not alter underpricing outcomes.

Furthermore, a full log-log robustness model ($\ln(\text{FinalPrice}) \sim \text{RUI} + \ln(\text{Bidders}) + \text{Controls}$) confirms model stability ($R^2 = 0.921$, $\beta\_RUI = -0.5170$, $p < 0.001$).

V. DISCUSSION & PRACTICAL IMPLICATIONS

1. Resolving Methodological Misclassification: Naive quantile indicators introduce severe measurement error in marketplace research by confusing cheap goods with underpriced goods. The Relative Underpricing Index (RUI) provides a benchmarked, generalizable framework for future empirical auction studies.

2. The Illusion of Strategic Underpricing: Sellers who set $1.00 opening bids on valuable items experience an unrecoverable net loss. Although initial underpricing lowers entry friction and increases bidder participation, the competitive bidding boost is insufficient to bridge the initial price gap.

3. Actionable Merchant Strategy: Sellers should set opening prices reflecting their true minimum acceptable threshold rather than relying on initial underpricing tactics.

VI. CONCLUSION

This paper presents a corrected empirical methodology for analyzing strategic underpricing in online auctions. By replacing quantile indicators with the continuous Relative Underpricing Index (RUI), I show that starting bid discounts lead to net revenue losses. Although underpricing stimulates bidder participation ($p < 0.0001$ via Sobel mediation), the resulting indirect gain recovers less than one-third of the starting discount loss. Future marketplace research should adopt benchmarked relative metrics when modeling seller pricing tactics.

REFERENCES

[1] Bajari, P., & Hortaçsu, A. (2003). The winner's curse, reserve prices, and endogenous entry: Empirical insights from eBay auctions. *The RAND Journal of Economics, 34*(2), 329–355. Crossref

[2] Cabral, L., & Hortaçsu, A. (2010). The dynamics of seller reputation: Evidence from eBay. *The Journal of Industrial Economics, 58*(1), 54–78. Crossref

[3] Klemperer, P. (2004). *Auctions: Theory and Practice*. Princeton University Press.

[4] Lucking-Reiley, D. (1999). Using field experiments to test equivalence between auction formats: Magic on the Internet. *American Economic Review, 89*(5), 1063–1080. Crossref

[5] MacKinnon, J. G., & White, H. (1985). Some heteroskedasticity-consistent covariance matrix estimators with improved finite sample properties. *Journal of Econometrics, 29*(3), 305–325. Crossref

[6] Myerson, R. B. (1981). Optimal auction design. *Mathematics of Operations Research, 6*(1), 58–73. Crossref

[7] Roth, A. E., & Ockenfels, A. (2002). Last-minute bidding and the rules for ending second-price auctions: Evidence from eBay and Amazon auctions on the Internet. *American Economic Review, 92*(4), 1093–1103. Crossref

[8] Vickrey, W. (1961). Counterspeculation, auctions, and competitive sealed tenders. *The Journal of Finance, 16*(1), 8–37. Crossref