

Models of Customer Inertia, Customer Loyalty, and Price Insensitivity

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Literature Review

Customer inertia is a widely observed phenomenon in various industries, especially in oligopolistic markets with high switching costs. Inertia is defined as the tendency of customers to stick with their current service provider, subscription, or product, even when superior alternatives are available. This resistance to change is driven by factors such as the cognitive burden of evaluating alternatives, the psychological discomfort associated with switching, and the presence of contractual or logistical barriers. In markets such as insurance, telecommunications, and group purchasing, inertia significantly influences consumer behavior, allowing firms to maintain higher prices with limited risk of losing customers to competitors. Understanding the dynamics of inertia is essential for businesses seeking to maximize customer retention and profit margins, especially in markets where consumers are less responsive to changes in price or service offerings unless presented with a compelling reason to switch.

One of the main aspects of inertia is its relationship with price sensitivity and switching costs. In industries characterized by high switching costs, customers often exhibit low price sensitivity, meaning that even significant price increases may not prompt them to change providers. The costs associated with switching—including time spent researching alternatives, the complexity of switching procedures, and potential penalties for breaking contracts—act as strong deterrents. For instance, in Cao, Manthiou, and Ayadi's (2022) study on the sharing economy, high-inertia consumers on peer-to-peer platforms like Airbnb or Uber were less likely to switch platforms despite quality or price differences. Their inertia was linked to the cognitive and logistical challenges involved in switching, which outweighed potential benefits from better deals or improved services on alternative platforms. As a result, companies in such markets can maintain customer loyalty even in the face of rising competition as long as they minimize the perceived benefits of switching. [1]

Several mathematical models have been developed to formalize the concept of inertia and its impact on consumer behavior and pricing strategies. Su (2008) introduces a dynamic pricing model that captures the decision-making processes of both inertial and rational consumers. In Su's model, inertial consumers require an additional utility premium, known as the "trigger increment," to make a purchase decision, even when it would be rational to buy immediately. This model demonstrates that inertia can cause consumers to delay purchases, sometimes indefinitely, despite the short-term benefits of acting sooner. This delay creates challenges and opportunities in markets where firms can control pricing over multiple periods. Firms may need to offer greater discounts or additional incentives to prompt inertial consumers to act, especially in the first pricing period. However, Su's model also highlights a counterintuitive result: while greater inertia typically reduces firm profits, a broader base of inertial consumers can sometimes increase profits by stabilizing demand in later periods. [3] This insight is valuable for industries with fixed capacities, such as airlines or hotels, where managing the timing of demand is as important as maximizing total sales.

Empirical evidence further supports the significance of customer inertia in subscription-based models. Miller, Sahni, and Strulov-Shlain (2022) conducted a large-scale field experiment involving European newspaper subscriptions. Their study found that auto-renewal mechanisms dramatically increased customer retention, with subscribers who opted

for auto-renewal being seven times more likely to continue their subscription after the initial period than those who did not. The study also revealed that many consumers were unaware of the extent of their inertia, with 24-36% of participants actively avoiding auto-renewal features in anticipation of potential inertia-related effects. Despite this, a significant portion of the population remained inertial, underestimating the likelihood of remaining subscribed over time. This study highlights a key feature of customer inertia: while the auto-renewal subscription model boosts short-term revenues for firms through increased subscription retention, it levels off over time as what are termed “sophisticated consumers”—customers aware of the strategies and their vulnerabilities in such situations—begin to anticipate and mitigate their own inertial tendencies. [2]

Inertia is heavily driven by psychological biases, such as loss aversion, probability weighting, and hyperbolic discounting. Su's (2008) model connects inertia with loss aversion, which suggests that consumers are more sensitive to potential losses than equivalent gains. This bias leads consumers to delay purchases when there is uncertainty about future valuations, fearing that they may regret buying too early if better options arise later. For example, in dynamic pricing settings like airline ticket sales, customers may wait for a possible price drop despite the risk of higher prices or fewer available seats later. This hesitation, driven by the overweighting of potential losses, directly contributes to inertia. Similarly, probability weighting causes consumers to overestimate the likelihood of favorable future outcomes, such as price reductions, leading to further delays in decision-making.

Another important behavioral driver of inertia is hyperbolic discounting, where consumers disproportionately value immediate costs and benefits over future ones. Su's model indicates that consumers with hyperbolic time preferences are more likely to delay purchases because they overvalue the immediate cost of purchasing (e.g., paying now) and undervalue the future benefits (e.g., enjoying the product or service later). This leads to procrastination in decision-making, which firms can either exploit (by gradually raising prices) or mitigate (by offering flexible payment terms to reduce the immediate financial burden). Firms that understand the psychological drivers of inertia can design more effective pricing strategies and promotional campaigns that either capitalize on or counteract these biases.

In industry-specific contexts, customer inertia plays a significant role in shaping market dynamics. In the telecommunications industry, high switching costs, such as the hassle of porting phone numbers or changing service plans, reinforce customer inertia. Firms in this sector often use auto-renewal contracts and loyalty programs to lock in customers, who remain inert unless there is a substantial and well-known benefit to switching providers. Similarly, in the insurance industry, consumers exhibit high inertia due to the perceived complexity of comparing plans and the fear of potential coverage gaps during the switching process. As a result, insurance companies can gradually increase premiums without losing significant market share, as customers are unlikely to switch unless faced with drastic price increases or severe dissatisfaction. In group purchasing and pharmaceuticals, inertia manifests in long-term contracts or bulk purchasing decisions, where the cost of continuously renegotiating terms or evaluating alternatives deters customers from exploring competitive offers.

Comparing these models of inertia, Su's (2008) mathematical framework is robust in its ability to quantify the effects of inertia on firm pricing strategies and consumer behavior across different time periods. Its strength lies in its generalizability and ability to capture the delayed decision-making patterns of inertial consumers, making it applicable to a range of industries. However, it assumes a level of firm control over pricing that may not always exist in highly

regulated industries like pharmaceuticals. In contrast, Miller et al.'s (2022) empirical approach provides real-world evidence of how auto-renewal features can significantly enhance short-term revenue, though it also highlights the limitations of relying on inertia for long-term profitability. As sophisticated consumers become more aware of their tendencies, they actively avoid features like auto-renewal, reducing the firm's ability to capitalize on inertia indefinitely.

Despite these insights, there are notable gaps in the existing literature. Most studies focus on industries like telecommunications and subscription services, where the impact of inertia is more readily observable. However, less attention has been given to sectors such as healthcare or retail, where inertia may play a subtler yet equally important role. Additionally, while current models address price insensitivity and delayed decision-making, there is limited exploration of how firms can dynamically adjust their pricing strategies to account for the eventual erosion of inertia among sophisticated consumers. Future research should aim to develop more nuanced models that account for these factors and explore underrepresented industries.

In summary, the literature on customer inertia and price insensitivity provides a comprehensive understanding of how firms can leverage consumer behavior to maximize profits, particularly in oligopolistic markets with high switching costs. Theoretical models such as those proposed by Su (2008) offer valuable frameworks for predicting consumer behavior and informing pricing strategies. In contrast, empirical studies like those by Miller et al. (2022) demonstrate the real-world effectiveness of strategies like auto-renewal in maintaining customer retention. However, as consumers become more aware of their inertial tendencies, shifting toward becoming "sophisticated customers," firms must adapt their strategies to sustain profitability in the long term.

In trying to understand marketing and consumer behavior, the relationship between customer satisfaction and customer loyalty has been a focus of research. Heskett and Sasser (1994) and Parasuraman, Zeithaml, and Berry (1988) use meta-analysis and service quality models to focus on understanding how customer satisfaction, service quality, and loyalty interact. Both papers dive into how organizations can strategically foster long-term customer loyalty by managing satisfaction and service quality.

Heskett and Sasser (1994) utilize meta-analysis to understand the findings from various studies, specifically the positive relationship between satisfaction and loyalty. Their results conclude that higher customer satisfaction levels tend to be associated with higher loyalty, as satisfied customers are more likely to return to the company and recommend its services to others. However, the relationship is not constant across industries or products. It is important to note that even though the relationship is positive, it is not always linear. Changes in satisfaction do not always lead to proportional changes in loyalty. From that, the authors emphasize the importance of measuring both satisfaction and loyalty separately. While improving satisfaction is key, additional strategies may be needed to turn satisfaction into long-term loyalty, such as having more personalized customer engagement or loyalty programs to meet customers' needs.

In contrast to Heskett and Sasser's meta-analytic review, Parasuraman, Zeithaml, and Berry (1988) focus on the role of service quality as a precursor to customer satisfaction and loyalty, introducing and analyzing various service quality models, specifically the SERVQUAL model. The SERVQUAL model evaluates service quality based on the gap between customer expectations and perceptions. The model identifies five key dimensions of service quality:

- Tangibles: The physical appearance of facilities, equipment, and personnel.
- Reliability: The ability to perform services accurately and dependably.
- Responsiveness: The willingness to help customers and provide prompt service.
- Assurance: The employees' knowledge and courtesy, fostering customer trust.
- Empathy: Individualized attention and care provided to customers [6].

From the model, it can be determined that service quality is a key determinant of customer satisfaction. However, satisfaction is influenced by additional factors beyond service quality, such as customer expectations and the overall service experience, meaning that satisfaction is not the only driving force behind such a relationship. Besides service quality, the authors also study the relationship between satisfaction and loyalty. While high service quality often leads to greater customer satisfaction, satisfaction alone is insufficient to guarantee loyalty, meaning that other factors play a role in loyalty. In comparing the SERVQUAL model with other frameworks, while SERVQUAL is widely applicable, it has limitations in helping understand the relationships, specifically in industries where subjective customer experiences vary widely.

In conclusion, understanding the relationship between customer satisfaction, service quality, and loyalty is important for businesses interested in fostering long-term customer relationships. Heskett and Sasser (1994) find that while higher customer satisfaction generally leads to increased loyalty, the relationship is not always linear, and additional strategies, such as personalized engagement and loyalty programs, are necessary to turn satisfaction into loyalty. On the other hand, Parasuraman, Zeithaml, and Berry (1988) emphasize that service quality, measured through the SERVQUAL model, is a key driver of satisfaction. However, satisfaction alone is insufficient to ensure customer loyalty, as other factors, such as customer expectations and overall service experiences, also play significant roles. Although both frameworks provide valuable insights, the complex nature of satisfaction and loyalty interactions requires businesses to employ a nuanced approach tailored to specific industries and customer experiences.

Background

The goal of the experiment is to study the effects that are caused by changing values for four parameters of the `calculate_market_share` function: `inertia_factors`, `price_sensitivity_means`, `price_sensitivity_stds`, and `smoothing_factors`. The first factor we will focus on is the inertia factor, for which we compare three values (0.65, 0.75, 0.85). These values stand for the proportion of customers who are unwilling to switch brands. The smaller the inertia, the more likely customers are to switch brands when a price change occurs; this results in higher market share volatility. Companies with competitive pricing strategies are likely to gain new customers faster. While the higher the inertia, the more dedicated the customers are, meaning they are less likely to change firms, causing more stable market shares. The model has two price sensitivity measures with values of (0.2 and 0.3). These values measure the average sensitivity of customers to various prices. Generally, those customers with low sensitivity condition (0.2) emphasize less value on price change indicating they may focus more on qualities such as quality or brand

loyalty. Customers with higher price sensitivity (0.3) value price differences more, causing greater shifts in market share when firms adjust their prices. Next is the price sensitivity standard deviation (0.01, 0.05), which is the variation in price sensitivity among customers. Customers under the lower std (0.01) condition have more uniform responses to price changes, as market share predictions are more straightforward. Higher std (0.05) provides greater diversity in customer reactions to price changes, leading to unpredictable shifts in market shares. Lastly, the smoothing factor of (0.01, 0.05) is a factor to smooth price differences, preventing overreactions to small price changes. Lower smoothing (0.01) means market shares are more sensitive to minor price adjustments, causing frequent fluctuations. On the other hand, higher smoothing (0.05) dampens the effect of small price changes, leading to more stable market shares. We conduct a checkpoint analysis at periods 0, 5, and 10.

- Period 0: Initial market shares reflect the starting prices and the baseline parameters.
- Period 5: As firms adjust prices, the combined effects of inertia and price sensitivity begin to manifest. Lower inertia and higher price sensitivity result in more pronounced market share changes.
- Period 10: The market starts to stabilize. High inertia and low price sensitivity lead to minimal changes, while low inertia and high price sensitivity continue to drive market share volatility.

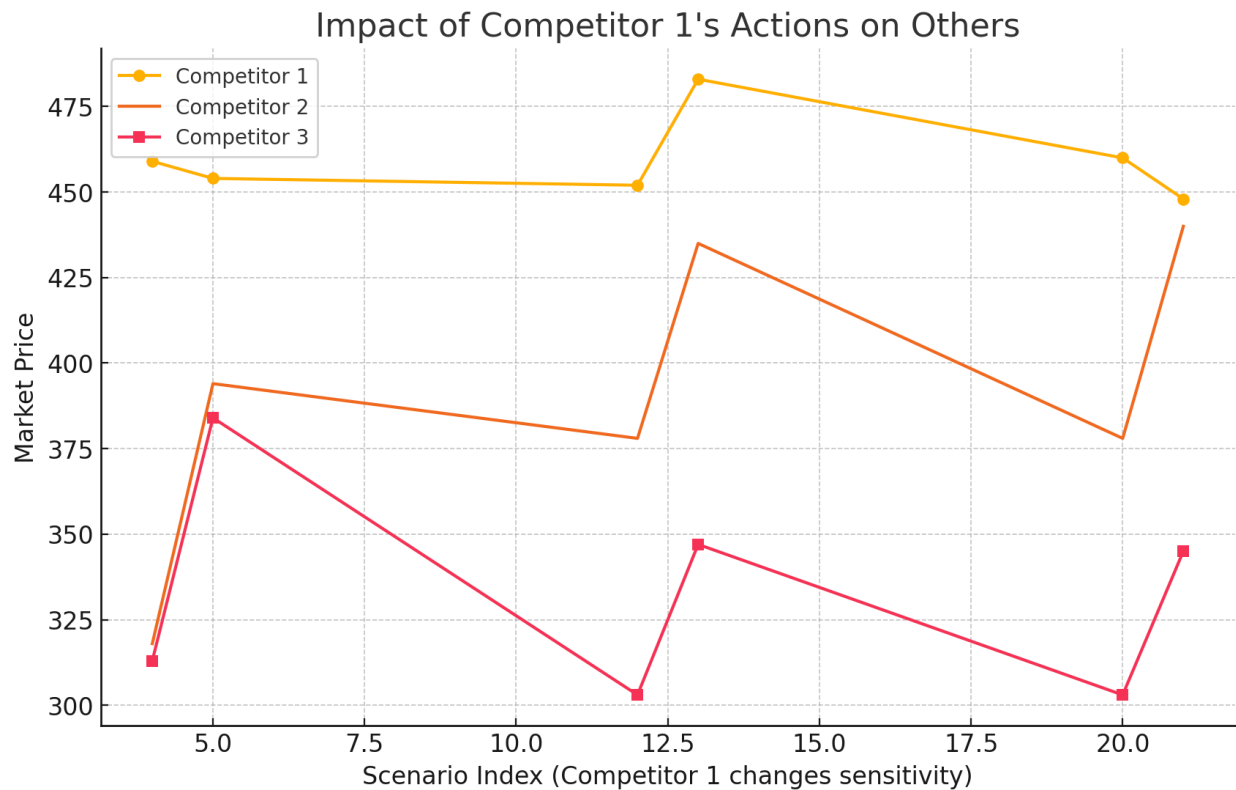
Results and Discussion

Table 1: Inertia

Version	Inertia Factor	Price Sensitivity	Price Sensitivity	Smoothing Factor	Market Prices	Market Quantities	Max Reward
Inertia	0.65	0.2	0.01	0.01	472, 436, 395	1062, 1052, 886	1309906
Inertia	0.65	0.2	0.01	0.05	444, 410, 379	1035, 1046, 919	1236701
Inertia	0.65	0.2	0.05	0.01	474, 335, 331	1062, 1063, 875	1149118
Inertia	0.65	0.2	0.05	0.05	480, 358, 319	1087, 1016, 897	1171631
Inertia	0.65	0.3	0.01	0.01	459, 318, 313	890, 1060, 1050	1074240
Inertia	0.65	0.3	0.01	0.05	497, 451, 328	886, 1061, 1053	1264237
Inertia	0.65	0.3	0.05	0.01	454, 394, 384	932, 1022, 1046	1227460
Inertia	0.65	0.3	0.05	0.05	474, 451, 418	885, 1051, 1064	1338243
Inertia	0.75	0.2	0.01	0.01	492, 485, 396	1024, 1077, 899	1382157
Inertia	0.75	0.2	0.01	0.05	483, 404, 392	1033, 1067, 900	1282807
Inertia	0.75	0.2	0.05	0.01	402, 395, 382	1040, 1091, 869	1180983
Inertia	0.75	0.2	0.05	0.05	461, 460, 427	1033, 1052, 915	1350838
Inertia	0.75	0.3	0.01	0.01	358, 356, 327	878, 1061, 1061	1038987
Inertia	0.75	0.3	0.01	0.05	435, 339, 308	924, 1031, 1045	1073309
Inertia	0.75	0.3	0.05	0.01	478, 454, 362	947, 1048, 1005	1292268
Inertia	0.75	0.3	0.05	0.05	489, 415, 343	914, 1066, 1020	1239196
Inertia	0.85	0.2	0.01	0.01	433, 318, 307	1052, 1025, 923	1064827
Inertia	0.85	0.2	0.01	0.05	466, 338, 332	1016, 1074, 910	1138588
Inertia	0.85	0.2	0.05	0.01	420, 335, 328	1027, 1081, 892	1086051
Inertia	0.85	0.2	0.05	0.05	448, 374, 353	1063, 1031, 906	1181636
Inertia	0.85	0.3	0.01	0.01	476, 444, 392	923, 1038, 1039	1307508
Inertia	0.85	0.3	0.01	0.05	489, 479, 473	856, 1091, 1053	1439242
Inertia	0.85	0.3	0.05	0.01	459, 359, 337	887, 1050, 1063	1142314
Inertia	0.85	0.3	0.05	0.05	460, 378, 303	859, 1082, 1059	1125013

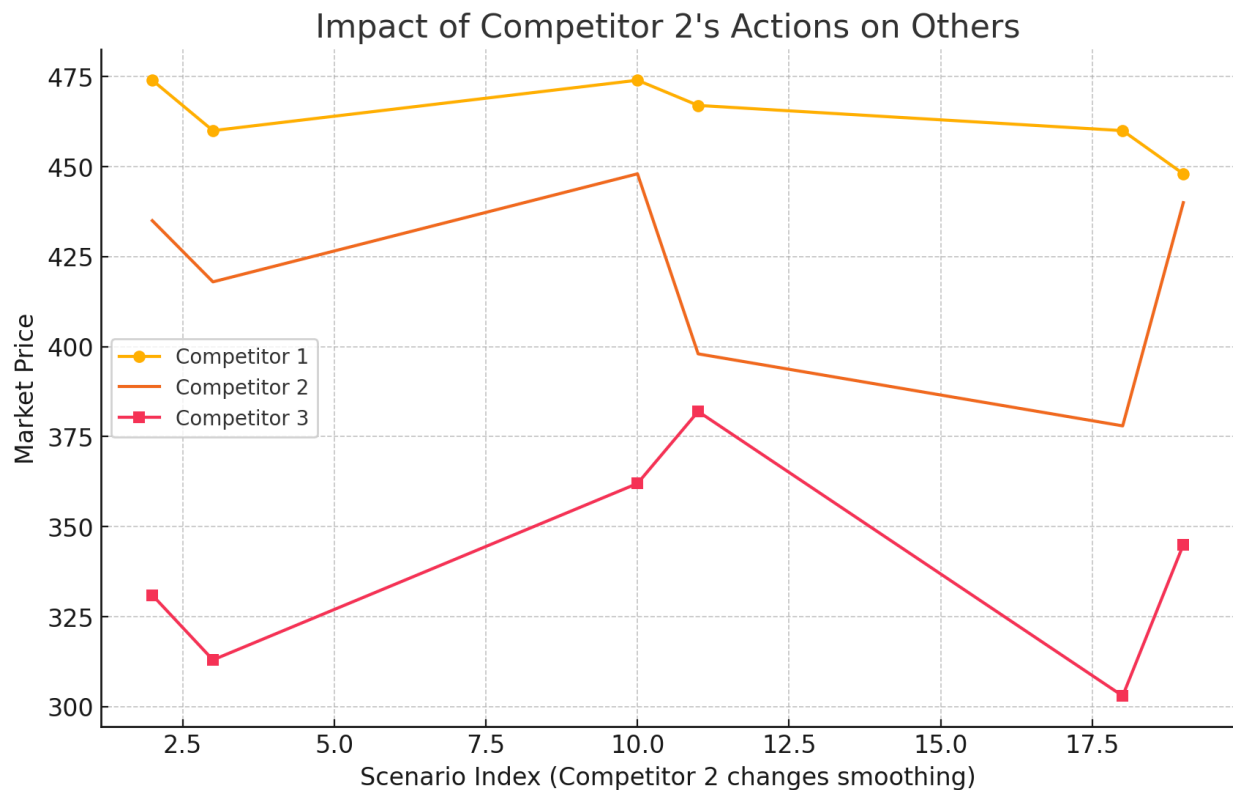
The table above shows that in order to achieve the best reward, the combination of a higher Inertia Factor (0.85) with moderate Price Sensitivity (0.3) and a small Smoothing Factor (0.01) is needed (out of the parameters tested). Those values combined provide a max reward of 1,439,242. Interpreting the results, it can be concluded that a higher inertia factor indicates that the model focuses on past trends, allowing for stability in decision-making. A model with moderate price sensitivity values shows a balance in how responsive consumers are to price changes. This means the system reacts to market fluctuations with a good balance between adaptability and control.

Additionally, having the low smoothing factor allows the system to respond efficiently to changes occurring in real-time. Having the max reward of 1,439,242 in a market context indicates that participants value past trends, maintain moderate responsiveness to price signals, and minimize over-adjustments. Such balance allows the system to operate in dynamic environments without sacrificing long-term stability or short-term adaptability.

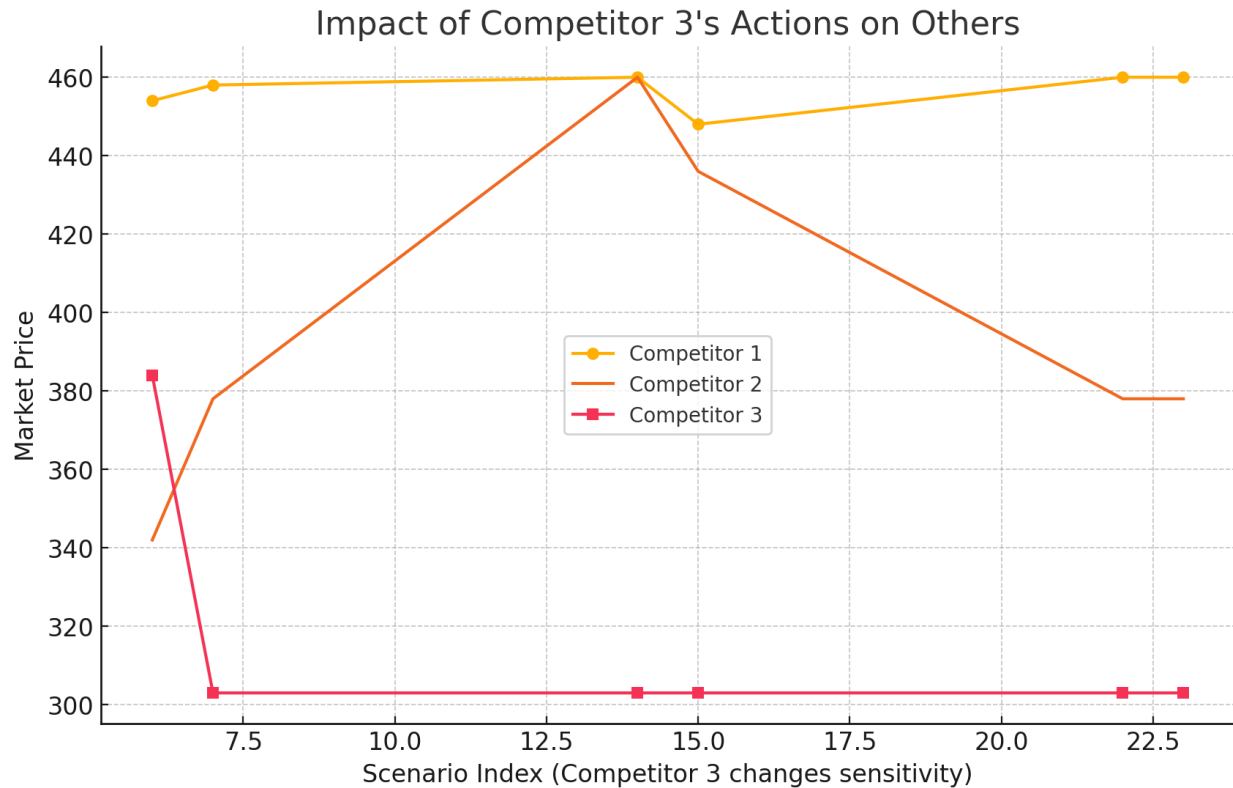


This graph shows the Impact of Competitor 1's Actions on Others regarding market prices across various scenario indices. This seems to have relatively stable market prices with only a couple of fluctuations, meaning there is a steady pricing strategy that avoids risk. Competitor 2 indicates a medium response to changes in Competitor 1's behavior. Competitor 2 makes adjustments gradually using a pricing strategy that is responsive but not sensitive, continuing to have consistency in market share.

Competitor 3 has significant volatility in its market prices. It experiences first sharp declines followed by a recovery later on. This suggests a more aggressive pricing strategy, showing strong reactions to changes made by Competitor 1. Overall, the graph reveals differing competitive dynamics: Competitor 1's stability contrasts with the more dynamic responses of Competitors 2 and 3, with Competitor 3 being the most reactive.



Here, the graph shows how Competitor 2 adjusts to its smoothing parameter on its own market price as well as the strategies of other competitors. Competitor 1's market price remains relatively stable throughout the scenarios, meaning it does not change its strategy based on others' strategies. Competitor 2 experiences fluctuations in its market price. This pattern suggests that Competitor 2's pricing is highly sensitive to its own changes in smoothing, potentially suggesting internal instability. Competitor 3 shows dynamic responses to Competitor 2's changes. Initially, Competitor 3's prices rose steadily, peaking mid-scenario, likely taking advantage of Competitor 2's price decline during this period. However, Competitor 3's prices subsequently fell sharply before recovering toward the end. This behavior reflects Competitor 3's opportunistic strategy, which capitalizes on Competitor 2's pricing instability but also results in significant fluctuations.

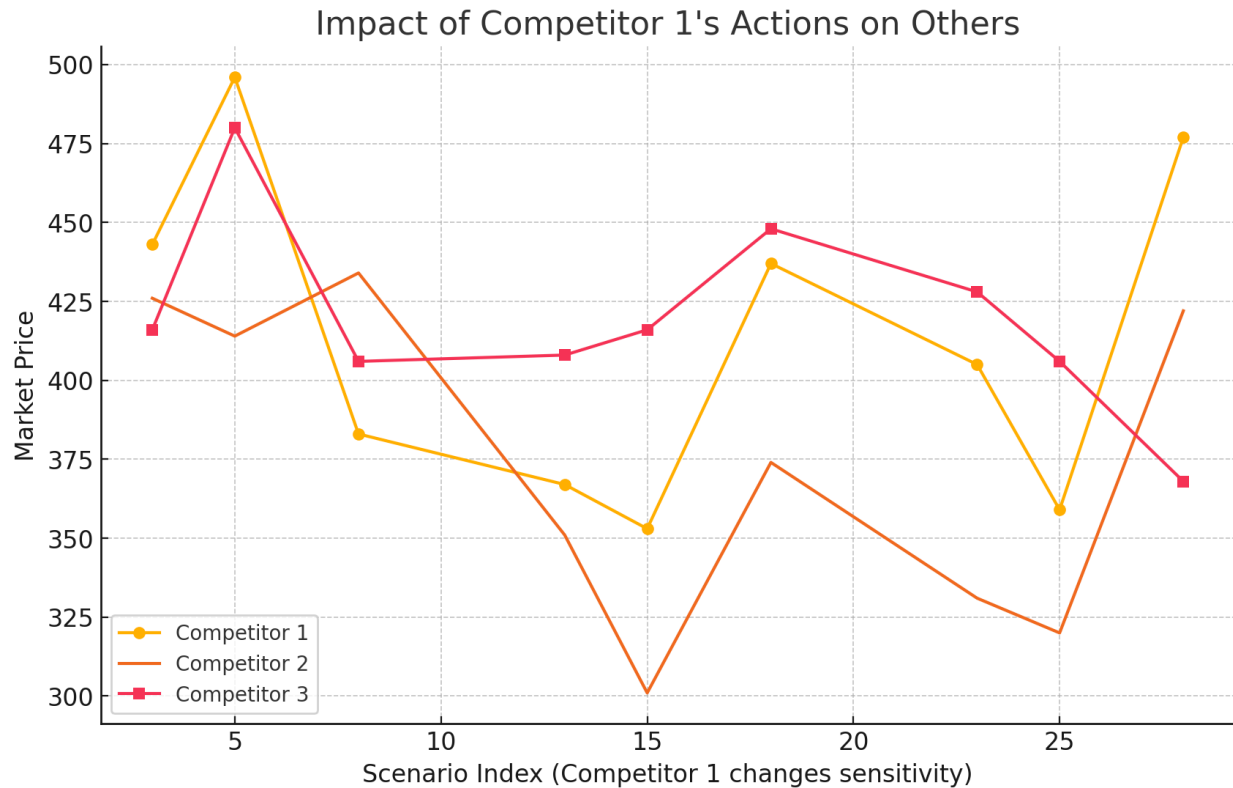


This graph demonstrates the Impact of Competitor 3's Actions on Others. Competitor 3 experiences small price changes, having a low but stable price. This indicates that Competitor 3's pricing strategy is not impacted by its own changes in price sensitivity. Competitor 1 shows slight stability, with its market price remaining relatively unchanged, being consistent and only having a couple of fluctuations. In contrast, Competitor 2 demonstrates a significant increase in market price early in the scenarios, peaking at the midpoint of the indices, followed by a steady decline.

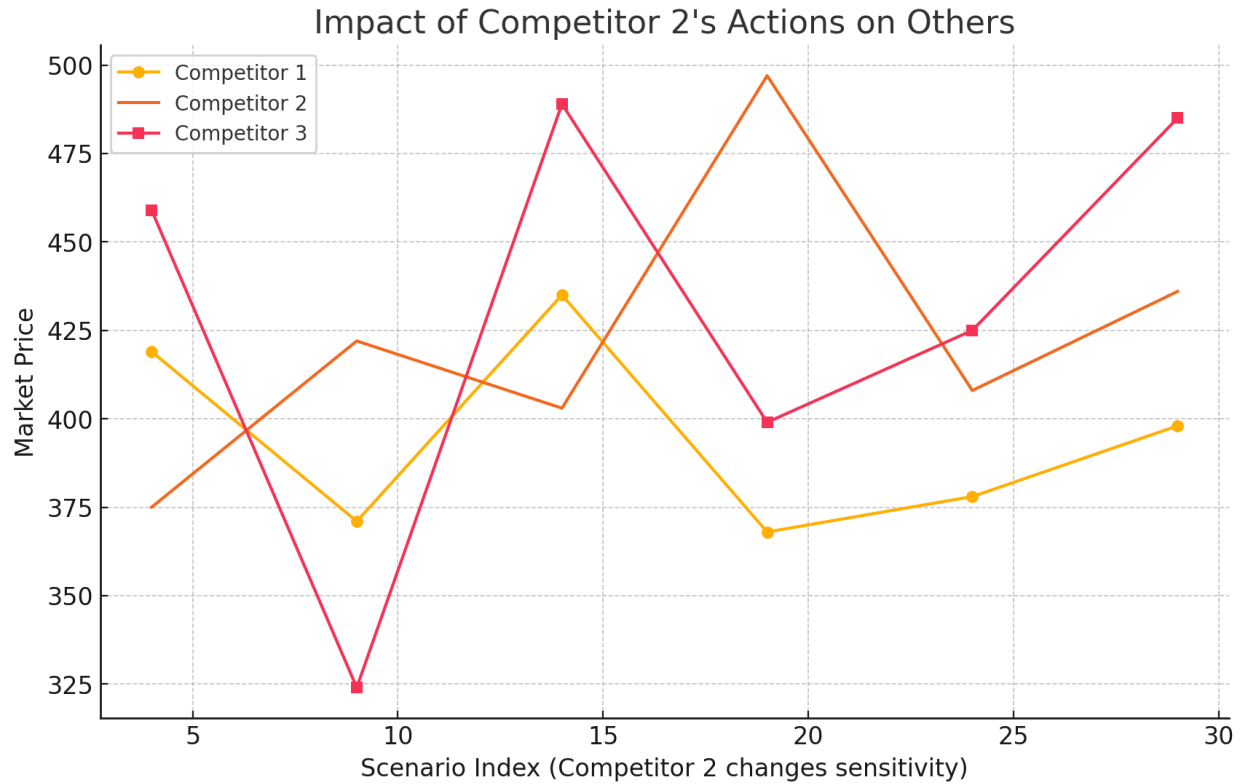
Table 2: Changing Inertia

Version	Inertia Factor	Price Sensitivity	Price Sensitivity	Smoothing	Market Prices	Market Quantities	Max Reward
Changing Inertia	0.65	0.2	0.01	0.05	428, 419, 345	1061, 1047, 892	1200541
Changing Inertia	0.65	0.2	0.05	0.01	479, 342, 314	1083, 1054, 863	1150207
Changing Inertia	0.65	0.2	0.05	0.05	495, 477, 441	1058, 1057, 885	1418184
Changing Inertia	0.65	0.3	0.01	0.01	441, 440, 412	916, 1027, 1057	1291320
Changing Inertia	0.65	0.3	0.01	0.05	458, 376, 347	880, 1050, 1070	1169130
Changing Inertia	0.65	0.3	0.05	0.01	476, 454, 415	890, 1103, 1007	1342307
Changing Inertia	0.65	0.3	0.05	0.05	411, 380, 331	871, 1091, 1038	1116139
Changing Inertia	0.75	0.2	0.01	0.01	372, 361, 309	1045, 1046, 909	1047227
Changing Inertia	0.75	0.2	0.01	0.05	467, 398, 377	1053, 1031, 916	1247421
Changing Inertia	0.75	0.2	0.05	0.01	382, 310, 302	1092, 1033, 875	1001624
Changing Inertia	0.75	0.2	0.05	0.05	398, 381, 345	1076, 1026, 898	1128964
Changing Inertia	0.75	0.3	0.01	0.01	483, 410, 381	942, 1034, 1024	1269070
Changing Inertia	0.75	0.3	0.01	0.05	472, 418, 415	875, 1039, 1086	1297992
Changing Inertia	0.75	0.3	0.05	0.01	441, 321, 321	887, 1048, 1065	1069440
Changing Inertia	0.75	0.3	0.05	0.05	485, 328, 302	863, 1055, 1082	1091359
Changing Inertia	0.85	0.2	0.01	0.01	458, 451, 328	1049, 1109, 842	1256777
Changing Inertia	0.85	0.2	0.01	0.05	461, 317, 314	1060, 1032, 908	1100916
Changing Inertia	0.85	0.2	0.05	0.01	362, 336, 323	1062, 1038, 900	1023912
Changing Inertia	0.85	0.2	0.05	0.05	465, 357, 317	1061, 1053, 886	1150148
Changing Inertia	0.85	0.3	0.01	0.01	430, 390, 388	880, 1057, 1063	1203074
Changing Inertia	0.85	0.3	0.01	0.05	494, 420, 339	876, 1060, 1064	1238640
Changing Inertia	0.85	0.3	0.05	0.01	439, 420, 373	903, 1055, 1042	1228183
Changing Inertia	0.85	0.3	0.05	0.05	452, 419, 302	916, 1002, 1082	1160634

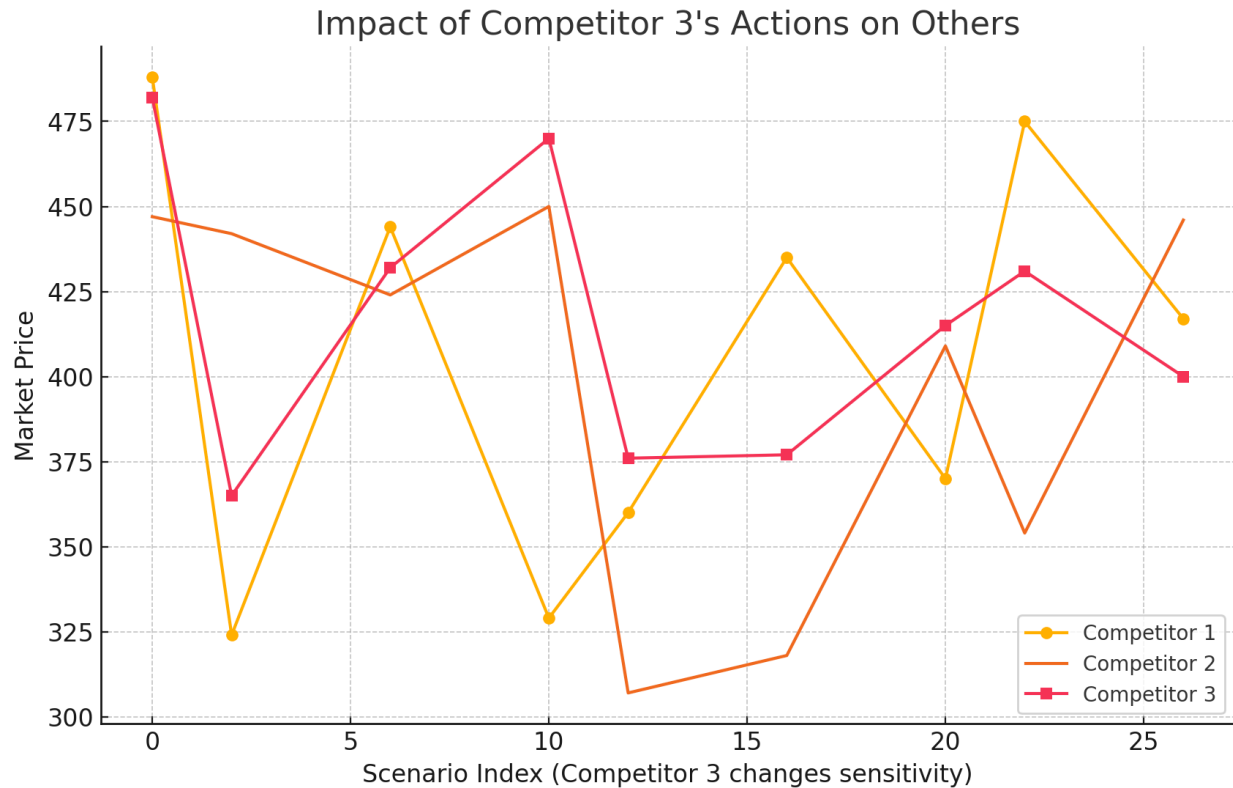
This chart shows that the environment performs better with higher inertia, which means there is more stability. A higher value in price sensitivity of (0.3) yields better performance in certain combinations, which can be seen by the maximum reward achieved in some scenarios. The best combination here turned out to be with an inertia factor of 0.75 and price sensitivity of 0.3; the maximum reward peaks at 1,293,184. The smoothing parameter has an impact with lower values (0.01), producing a smoother progression of market prices and quantities.



The graph shows how changes in Competitor 1's sensitivity (represented by the scenario index) affect market prices for each competitor. Competitor 1's market price exhibits significant volatility, with sharp increases and decreases across the scenarios. Competitor 2 demonstrates a general downward trend in market price. Competitor 3's market price appears relatively stable compared to the others. However, it also experiences a moderate upward trend toward the middle scenarios before declining again. The spikes and dips in Competitor 1's prices suggest aggressive changes in its market actions, likely leading to ripple effects in the pricing strategies of Competitors 2 and 3.



The graph shows how adjustments in Competitor 2's sensitivity influence market prices for the other competitors. Competitor 2's market price demonstrates a highly volatile pattern, with significant peaks and declines. Competitor 1's price also varies significantly, having some stable sections but also sharp declines. Competitor 3's prices have both an upward and downward trajectory throughout. The sharp dip in Competitor 2's price at the beginning likely reflects an aggressive pricing strategy.



The graph shows the impact of Competitor 3's changes in sensitivity on market prices for other competitors. Competitor 3's market price fluctuates, experiencing peaks at the beginning and middle, followed by a sharp drop. Competitor 1 exhibits extreme volatility, with dramatic declines and recoveries. Competitor 2, while less volatile than the other two, shows a consistent downward trend early on, then experiences a recovery towards the end. This graph indicates Competitor 3's key role in influencing the market, as its sensitivity adjustments seem to cause ripple effects across all competitors.

Conclusion

Analyzing market dynamics across the three competitors reveals the significant interdependencies and the impacts of strategic sensitivity adjustments. The graphs above show the competitive relationships and the market's sensitivity to individual competitors' actions. In conclusion, the strategies between these competitors demonstrate the complexity of strategic decision-making in a highly interconnected market. In order to be successful in this environment, calibration of sensitivity to market conditions, an understanding of competitors' behaviors, and the ability to anticipate and mitigate the impacts of the adjustments. Each competitor's performance is reflected by the balance between adaptability and stability in navigating the dynamic market landscape.

Works Cited

- [1] L. Cao, A. Manthiou, and K. Ayadi, "Extension and customer reaction on sharing economy platforms: The role of customer inertia," *Journal of Business Research*, vol. 144, pp. 513–522, May 2022, doi: <https://doi.org/10.1016/j.jbusres.2022.02.013>.
- [2] K. Miller, N. S. Sahni, and A. Strulov-Shlain, "Sophisticated Consumers with Inertia: Long-Term Implications from a Large-Scale Field Experiment," *SSRN Electronic Journal*, 2022, doi: <https://doi.org/10.2139/ssrn.4065098>.
- [3] X. Su, "A Model of Consumer Inertia With Applications to Dynamic Pricing," *SSRN Electronic Journal*, 2008, doi: <https://doi.org/10.2139/ssrn.945903>.
- [4] "The Relationship Between Customer Satisfaction and Customer Loyalty: A Meta-Analytic Review" Authors: Heskett, James L., and W. Earl Sasser Jr. Journal: *Journal of Retailing* (1994)
- [5] "Service Quality, Customer Satisfaction, and Customer Loyalty: A Comparative Analysis of Service Quality Models" Authors: Parasuraman, A., Valarie A. Zeithaml, and Leonard L. Berry Journal: *Journal of Retailing* (1988)