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Ability to Pay (ATP), Willingness to Pay (WTP) and Fare Elasticity of Non-vehicle Passengers in Ferry Service Selection: A Case Study of the Merak-bakauheni Route

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ABSTRACT

The Merak-Bakauheni corridor is Indonesia's most critical maritime transit route. The introduction of an Executive Ferry Service to complement the Regular Service has triggered an unbalanced passenger distribution, which persists amidst a 468% fare disparity (IDR 84,800 vs. IDR 18,100). This study aims to analyze the mode choice behavior by contrasting the absolute purchasing power (Ability to Pay/ATP) with the perceived premium service value (Willingness to Pay/WTP) of non-vehicle passengers who have previously utilized this ferry route. Utilizing a Stated Preference (SP) framework, primary data from 111 respondents from various passenger groups were modeled via Binary Logistic Regression. The optimized utility model confirms that ticket fare is the primary determinant for 51.4% of passengers. The empirical findings reveal a significant economic disparity: while the passengers' average ATP is high at IDR 871,443, their extracted WTP threshold for the Executive Service is merely IDR 69,543. Consequently, demand is highly elastic, with an estimated own-price elasticity of 2.55 and a cross-price elasticity of 1.28. The study concludes that the passenger distribution imbalance is driven not by a lack of affordability, but by the failure of the premium service's perceived value to justify the price markup. It is recommended that operators adjust their price ceiling closer to the estimated WTP threshold to restore traffic equilibrium and optimize long-term revenue across the dual-service system.

Keywords: Mode choice; Fare elasticity; Ability to pay; Willingness to pay; Ferry Passengers

INTRODUCTION

As an archipelagic nation, the water transportation system in Indonesia is a core infrastructure that bridges land road networks severed by maritime bodies. Globally, maritime transit is a critical component of regional mobility, particularly in European coastal regions and archipelagic states, where passenger demand is highly sensitive to pricing structures and service differentiation (Jørgensen & Solvoll, 2017). In Indonesia, the Merak-Bakauheni route represents the busiest maritime crossing corridor, interconnecting the primary economic hubs of Java and Sumatra, making it a highly relevant case study for evaluating dual-service operational models.

Operationally, the system operates with a total of 7 docks and 67 vessels, divided into two contrasting service classes. The Regular Service dominates the baseline capacity, utilizing 5 docks and 50 conventional ro-ro vessels with a sailing time of approximately 90 minutes. Conversely, the Executive Service serves as a premium alternative, offering express vessels with a shortened 70-minute transit time and modern terminals, but operates under a constrained capacity of only 2 docks and 17 vessels. Currently, the pedestrian ticket for the Executive Service is priced at IDR 84,800, whereas the Regular Service costs IDR 18,100. This massive fare disparity of 468% has triggered a stark operational imbalance in passenger distribution. If not managed through a rational tariff policy, the constrained supply of the Executive Service (2 docks and 17 vessels) faces a severe risk of queue congestion during demand surges (Suzanti et al., 2024).

Ticket pricing serves as a policy-controlled instrument and remains the most sensitive attribute within travel decision-making. In Cebu City, Philippines, factors such as safety, availability, and travel cost emerge as pivotal elements in public transport adoption decisions (Mayo & Taboada, 2020). Passenger segments traveling for social purposes, younger demographics, and tourists are generally the most vulnerable to ferry fare fluctuations (Diaz, 2011). However, this price sensitivity can be strategically managed; for instance, a study on the Washington State Ferries demonstrated that introducing a 20% discount during off-peak hours successfully shifted peak-period congestion by 5–6% (Adler et al., 2010). Consequently, evaluating the Ability to Pay (ATP) and Willingness to Pay (WTP) serves as a fundamental parameter prior to formulating fare structures (O. Z. . Tamin, 2000). An ideal fare formulation must reconcile the real household budget constraints (ATP) with the users' subjective valuation of the onboard service quality (Saz-Salazar & Tovar, 2024).

Studies employing discrete choice modeling to evaluate ferry passenger behavior and its integration with land-based modes have been extensively documented (Tanko et al., 2019). In East Nusa Tenggara, ferry transport is preferred due to its higher cargo capacity and relatively lower costs compared to air travel (Bolla et al., 2019). Utilizing discrete choice modeling, previous research identified passenger preferences and acceptance regarding alternative ferry transport hubs in the Aegean Islands, establishing that waiting time and service quality constitute crucial factors for passengers (Hatziioannidu & Polydoropoulou, 2022). Binary logit modeling is also widely applied to measure how passengers respond to hypothetical variations in transport attributes (Kim et al., 2017); (Puan et al., 2019)). The inclusion of socio-economic and psychological attributes into these models is crucial, as public acceptance and passenger monetary valuation are heavily influenced by the perceived fairness of pricing and the comparative utility of alternative modes (Kłos-Adamkiewicz, 2024);(Nyga et al., 2020). Within the context of the Sunda Strait, prior literature indicates that travel duration on the Executive Service is the primary driver for service adoption, whereas the lower fare is the main anchor keeping passengers retained within the Regular Service (Arif Rizki et al., 2024). On the other hand, travel cost elements have proven to heavily influence dock selection decisions, while service quality and safety guarantees do not yield a statistically significant impact (Wati et al., 2025). Furthermore, another study established that passenger income represents a significant determinant influencing service class selection along the Merak-Bakauheni route (Zhafira et al., 2022). A critical synthesis of these prior studies reveals a common limitation: while they successfully identify travel cost, duration, and service quality as qualitative determinants of mode choice, they predominantly treat the passenger market as a homogeneous group. These studies rarely quantify the psychological price boundaries of the passengers or measure the exact behavioral shifts triggered by dynamic pricing.

Despite these identified determinants of service choice, the existing body of literature still leaves a critical research gap. Prior studies have largely restricted their focus to mapping these explanatory variables qualitatively. There remains a lack of empirical investigations that quantitatively estimate the nominal figures of passenger ATP and WTP, as well as predict the exact probability of passenger shifts resulting from adjustments to the fare gap. Without precise probability modeling and empirical elasticity measurements, policy interventions and operator pricing strategies remain highly speculative and prone to trial-and-error failures. Yet, owing to utility differentials, even minor price fluctuations can destabilize passenger loyalty toward a specific service class. Moreover, earlier modeling efforts frequently treat the passenger market as a homogeneous group, failing to contrast absolute financial capacity against the psychological willingness to pay for premium attributes (Džupka et al., 2024; Kim & Lee, 2019; Molin et al., 2017).

To bridge this academic gap, the novelty of this study lies in the methodological integration of behavioral economic variables (Ability to Pay and Willingness to Pay) with a Stated Preference-based Binary Logistic Regression model to formulate quantitative tariff policies. Unlike previous research that relies on qualitative cost barriers, this study confronts the empirical economic paradox of maritime passengers contrasting their absolute financial capacity against their psychological valuation of premium attributes. Therefore, the primary objective of this study is to analyze the mode choice behavior of non-vehicle passengers by calculating their ATP and WTP, while precisely measuring the fare elasticity to predict mode-shifting probabilities. The implications of this research are projected to provide targeted benefits across maritime stakeholders: (1) for port operators, it offers a strategy to mitigate terminal congestion by balancing passenger distribution; (2) for ship operators, it provides empirical price boundaries to optimize fleet utilization and maximize long-term revenue; (3) for regulators (the Ministry of Transportation), it establishes a quantitative foundation for setting fair ceiling fares; and (4) for transportation researchers, it introduces a replicable analytical framework for evaluating premium service valuation in dual-service transit systems.

METHODS

This study focused its analysis on the non-vehicle passenger segment (passengers traveling without vehicles) who have previously utilized the Merak-Bakauheni ferry service. A quantitative approach is employed, combining the Stated Preference (SP) method with a socio-economic analysis to derive the Ability to Pay (ATP) and Willingness to Pay (WTP) values. To ensure that the collected data are valid and representative of empirical field conditions, the minimum survey sample size was calculated using Slovin's formula, baseline-adjusted to the existing non-vehicle passenger population data.

Sampling Technique and Sample Size Determination

This study focuses its analysis on the non-vehicle passenger segment (passengers traveling without vehicles) who have previously utilized the Merak-Bakauheni ferry service. A quantitative approach is employed, combining the Stated Preference (SP) method with a socio-economic analysis to derive the Ability to Pay (ATP) and Willingness to Pay (WTP) values. The primary data were collected through an online survey utilizing a purposive sampling technique. To ensure the sample accurately represented the target demographic, strict screening criteria were implemented at the beginning of the questionnaire. Respondents were purposefully selected based on two requirements: (1) they must have utilized the Merak-Bakauheni ferry service within the past year, and (2) they must be categorized as non-vehicle passengers. Only respondents who successfully passed these screening questions were permitted to proceed to the main questionnaire.

To ensure the validity of the data collected via the questionnaire and its capacity to represent the actual population parameters in the field, the minimum survey sample size was mathematically calculated using Slovin's formula (Sugiyono, 2013). This calculation is based on the total population data of existing non-vehicle passengers, formulated as follows:

$$n = \frac{N}{1+Ne^2} \qquad (1)$$

Where:

n = minimum required sample size,

N = total passenger population (43,999 individuals),

e = margin of error or tolerance threshold.

By establishing a margin of error (e) of 10% (0.1), the calculation results indicate that the minimum respondent threshold required for this study is 100 samples. While a tighter 5% margin of error is typically ideal for policy-oriented research, the 10% threshold was strategically adopted in this study due to substantial field constraints inherent to the online screening process. Specifically, the stringent inclusion criteria requiring respondents to be strictly non-vehicle passengers who had recently traveled significantly narrowed the accessible population pool. Furthermore, the high cognitive load required to answer the Stated Preference (SP) hypothetical scenarios rigorously restricted the number of respondents willing to validly complete the survey. Consequently, successfully capturing 111 highly qualified respondents was deemed an optimal balance; it fulfills the 10% statistical baseline while prioritizing the quality and validity of the discrete choice responses over mere quantity.

Data Collection Setting and Period

To accommodate the geographical spread of the target population and ensure a diverse representation of passenger demographics, the survey was administered entirely online. The digital questionnaire was distributed across various social media platforms, targeting transportation community networks and individuals traversing the Java-Sumatra corridor. This digital distribution strategy was deliberately chosen to capture a broad spectrum of respondent categories and professional backgrounds, thereby avoiding the demographic bias that often occurs in localized, time-constrained terminal intercepts. The primary data collection was actively conducted throughout March 20Stated Preference Design

Research Instrument and Stated Preference Design

The research instrument employed a Stated Preference (SP) framework to evaluate passenger choice behavior. Attributes were defined by five incremental fare levels (-30%, -10%, baseline, +10%, +30%) relative to the existing baseline fares (Regular: IDR 18,100; Executive: IDR 84,800). To avoid the cognitive bias and fatigue inherent in a full-factorial design (25 scenarios), we implemented an 8-scenario D-optimal design to select the most statistically efficient combinations. This design strictly enforced a logical constraint ensuring the Executive fare remains higher than the Regular fare, consistent with current market positioning. To validate the model against existing market equilibrium, a 9th baseline scenario was included. Consequently, each respondent performed 9 discrete choice tasks, choosing between Regular (coded 0) and Executive (coded 1) service alternatives.

Validity and Reliability

Stated Preference (SP) experiments are grounded in Random Utility Theory (RUT) (Lancsar et al., 2017). Thus, instrument robustness is evaluated through econometric paradigms rather than traditional internal consistency metrics. In this study, content validity was established by aligning fare attributes directly with the empirical realities of the Merak-Bakauheni crossing. Reliability is intrinsically embedded within the D-efficient design, which mathematically minimizes the variance-covariance matrix of parameter estimates and reduces random error. Finally, construct validity is empirically verified through the model estimation results, demonstrated by a statistically significant negative utility coefficient for the fare variable, which confirms the expected inverse relationship between price and service selection.

Modelling and Data Analysis

The data obtained from the SP questionnaire were subsequently processed using Binary Logistic Regression within the SPSS software environment, executed in two main stages:

***Stage 1 (Full Model Construction, Variable Selection, and Validity Testing)*:** In the initial stage, a comprehensive model was constructed by entering all independent variables simultaneously including the Fare Difference, Reason for Class Selection, Trip Purpose, and the respondents' socio-demographic profiles. Following this initial iteration, a rigorous variable selection process was executed to identify and eliminate statistically non-significant predictors based on their Wald statistics and p-values. The model was subsequently re-estimated using only the remaining significant independent variables. To ensure the statistical soundness and explanatory power of this refined model, comprehensive goodness-of-fit diagnostic evaluations were performed using the Omnibus Test of Model Coefficients, the Hosmer and Lemeshow Goodness-of-Fit Test, and by assessing the Nagelkerke R-Square value.

***Stage 2 (Model Simplification)*:** Variables that are qualitative in nature (such as the reason for selection and trip purpose) were subsequently weighted and aggregated into a single constant. The objective of this stage is to derive a highly practical utility function, whose equation relies exclusively on the Fare Difference variable (X_1). The final equation is expressed as $U = \alpha + \beta_1 X_1$, where U represents the Utility function, denoting the relative satisfaction or perceived value a passenger gains from choosing the Executive service over the Regular service. The probability (P) of a passenger choosing the Executive ferry is calculated as follows:

$$P_{executive} = \frac{e^U}{1+e^U} = \frac{1}{1+e^{-U}} \quad (2)$$

Estimation of ATP, WTP, and Elasticity

To ensure that this discrete choice model remains realistic considering the passengers' economic circumstances, the nominal values for Ability to Pay (ATP) and Willingness to Pay (WTP) must be quantified.

***Ability to Pay (ATP)*:** ATP reflects the actual financial capacity of a passenger's wallet to afford the transport service. The Ability to Pay (ATP) describes the financial capacity of users to pay for a transportation service without compromising their baseline expenditure for primary household needs. Essentially, the Ability to Pay (ATP) is an indicator of an individual's capacity to pay based on an income allocation deemed ideal for the transportation services received (Amaliah & Widyastuti, 2024). It is calculated using a household expenditure approach adjusted for maritime travel (O. Tamin et al., 1999), using the following formula:

$$ATP = \frac{I_t \ x \ P_{tr} \ x \ P_f}{F_t} \quad (3)$$

where: I_t = respondent's monthly income, P_{tr} = percentage of income allocated for overall transportation, P_f = proportion of the transport budget specifically dedicated to ferry crossings, and F_t = frequency of ferry crossings performed within a single month.

Willingness to Pay (WTP)**:** The WTP value is derived directly from the empirical processing of the SP data. This figure represents the maximum price threshold up to which passengers are still willing or accept to pay for the Executive Service before they completely shift their preference to the Regular Service, reflecting the true monetary value assigned to the premium consumption experience (Schmidt & Bijmolt, 2020).

Elasticity**:** Passenger sensitivity with respect to price adjustments (elasticity/E) is computed using the derivative of the logistic function (O. Z. . Tamin, 2000).

Own-Price Elasticity:

$$E_{own\ exe} = \beta_1 \ . \ X_{exe} \ . \ (1\text{-}P_{eks}) \quad (4)$$

$$E_{own\ reg} = \beta_1 \ . \ X_{reg} \ . \ (1\text{-}P_{reg}) \quad (5)$$

Cross-Price Elasticity

$$E_{cross\ exe} = -\beta_1 \ . \ X_{reg} \ . \ (1\text{-}P_{eks}) \quad (6)$$

$$E_{cross\ reg} = \beta_1 \ . \ X_{exe} \ . \ (P_{eks}) \quad (7)$$

In these formulations, β represents the estimated fare coefficient parameter, X denotes the respective ticket price, and P indicates the probability of a passenger choosing that specific service class.

RESULTS AND DISCUSSION

This section presents the empirical findings derived from the field survey and subsequent data analysis of 111 non-vehicle passenger respondents (passengers traveling without vehicles) who utilized the Merak-Bakauheni ferry crossing service

Socio-Demographic and Travel Characteristic

The socio-demographic profile of the sample population provides a baseline understanding of the market segment currently utilizing this maritime crossing corridor

Gender and Age Distribution

Table 1. Gender Distribution of Respondents

Classification	Percentage (%)
Male	49,5%
Female	50,5%

In terms of age demographics, the sample is highly concentrated within the productive age bracket. Individuals aged between 20 and 39 years constitute the vast majority of the respondents, accounting for 69.4% of the total sample. The complete age distribution is presented in Table 2.

Table 2. Age Distribution of Respondents

Classification	Percentage (%)
< 20 Years Old	6,3%
20 – 39 Years Old	69,4%
40 – 59 Years Old	19,8%
>59 Years Old	4,5%

Occupational Profile

The occupational background of the passengers exhibits significant diversity. Private sector employees (including state-owned enterprise workers) represent the single largest occupational group at 33.3%. This is followed by civil servants, military, and police personnel (PNS/TNI/Polri) at 24.3%, and entrepreneurs, merchants, or traders at 19.8%. The detailed occupational breakdown is summarized in Table 3.

Table 3. Occupational Profile of Respondents

Classification	Percentage
Students (School / University)	13,5%
Private Sector / SOE Employees	33,3%
Civil Servants / Military / Police	24,3%
Entrepreneurs / Traders / Business	19,8%
Homemakers / Unemployed	8,1%
Others	0,9%

Trip Purpose

The survey results reveal distinct travel patterns and behavioral characteristics among non-vehicle passengers. The primary motivations for crossing the Sunda Strait are predominantly driven by economic and family obligations, with Work/Business activities accounting for 34.2% and returning home/commuting accounting for 33.3% of the travel demand.

Table 4. Primary Trip Purpose

Classification	Percentage (%)
Homecoming (*locally known as mudik*)	33,3%
Leisure / Tourism	23,4%
Work / Business	34,2%
Education	8,1%
Others	0,9%

Intriguingly, when respondents were queried regarding their primary reason for selecting a specific ferry service class, more than half of the sample (51.4%) cited the Ticket Fare / Tariff as the overriding determinant. This monetary attribute significantly outweighs non-monetary quality attributes, such as Vessel Comfort (24.3%) and Sailing Duration (12.6%), as shown in Table 5. This empirical distribution serves as a critical preliminary indicator that this passenger segment exhibits an exceptionally high degree of price sensitivity.

Table 5. Primary Determinant in Ferry Service Class Selection

Classification	Percentage (%)
Ticket Fare / Tariff	51,4%
Terminal Waiting Time	5,4%
Terminal Service	6,3%
Vessel Service	24,3%
Sailing Time	12,6%

Mode Choice Modeling and Statistical Evaluation

Based on the results of the binary logistic regression analysis applied to the stated preference data, independent variables that did not yield a statistically significant impact on ferry service selection were identified and systematically excluded from the model. A re-estimation was then conducted focusing exclusively on the predictors that exert a highly significant influence on service class choice (p < 0.01***) to generate the optimized model. The maximum likelihood estimates, and goodness-of-fit indicators are presented in Table 6.

Table 6. Binary Logistic Regression Estimation for Merak-Bakauheni Ferry Service Selection

Variables	B	S.E.	Wald	p-value	Odds Ratio (OR)
Constant	0.773	0.276	7.829	0.005	2.166
Fare Difference **(X1)**	-0.0004517	0	120.1	<0.001***	1
Primary Reason of choice (Ref: Fare/Tariff)			136,658	<0,0001***	
Terminal Waiting Time **(X2)**	-0.008	0.382	0	0.983	0.992
Terminals Service **(X3)**	2.074	0.336	38.018	<0.001***	7.953
On Board Service **(X4)**	2.419	0.228	112.802	<0.001***	11.238
Sailing time **(X5)**	1.848	0.253	53.467	<0.001***	6.346
Trip Purpose (Ref: Homecoming /mudik)			50,966	<0,001***	
Leisure / Tourism **(X6)**	0.392	0.244	2.573	0.109	1.48
Work / Business **(X7)**	0.993	0.219	20.625	<0.001***	2.7

Variables	B	S.E.	Wald	p-value	Odds Ratio (OR)
Education (School / College) **(X8)**	2.061	0.315	42.952	<0.001***	7.857
Model Diagnostics & Goodness-of-Fit					
-2 Log Likelihood	947.622				
Omnibus Test (df = 8)	365.05			<0.001***	
Cox & Snell R^2	0.308				
Nagelkerke R^2	0.420				
Hosmer & Lemeshow (df = 8)	10.181			0.253	
Overall Classification Accuracy	78.50%				

Based on the binary logit empirical results, utility function (U) for selecting the Executive Ferry Service is formulated as follows:

$$U = 0{,}773 - 0{,}000451x_1 - 0{,}008\,x_2 + 2{,}074\,x_3 + 2{,}419x_4 + 1{,}848x_5 + 0{,}392\,x_6 + 0{,}993x_7 + 2{,}061x_8 \quad (8)$$

From this comprehensive model, sensitivity graphs can be plotted to illustrate the probability of passenger shifts based on both trip purposes and the primary determinants for choosing the ferry service.

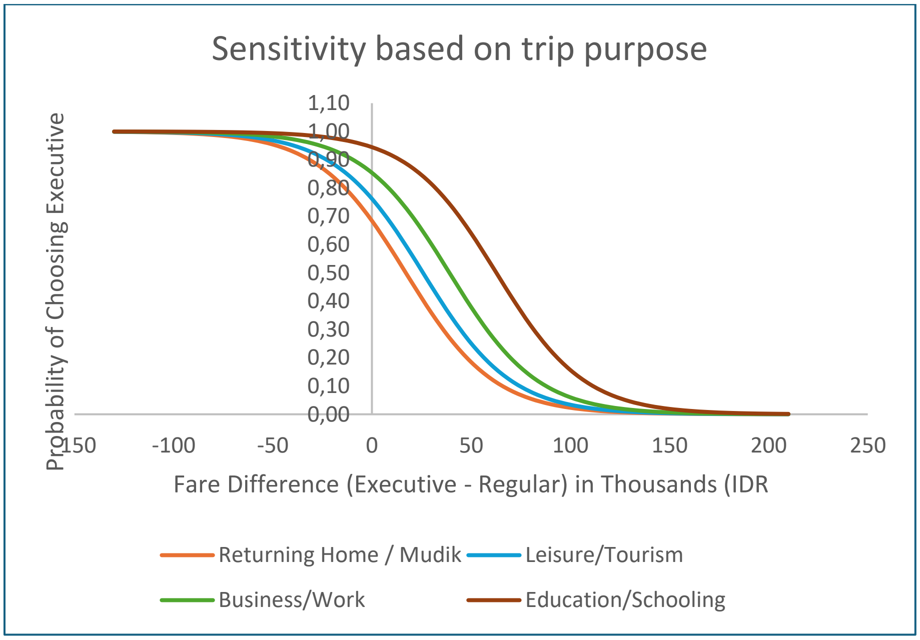

Figure 1. Mode Shift Probability based on Trip Purpose

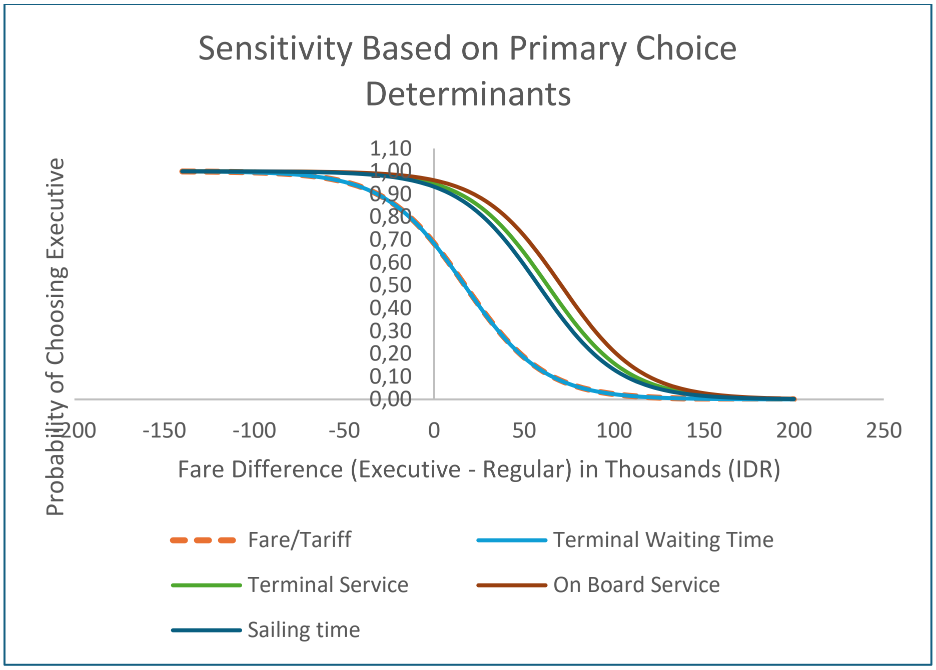

Figure 2. Mode Shift Probability based on Primary Choice Determinants

The sensitivity analysis of the full model demonstrates that passengers traveling for Work/Business purposes display a higher tolerance toward fare increases compared to those traveling for Homecoming (*Mudik*). Business travelers typically prioritize travel time certainty and punctual schedules to avoid economic losses. Conversely, passengers whose primary determinant is heavily anchored on the Ticket Fare/Tariff (51.4%) display the steepest, most precipitous decline on the probability sensitivity curve. Even a minor widening of the fare gap will prompt an immediate, mass exodus of these price-sensitive passengers away from the Executive Service.

Utility Function for Passengers

To facilitate fare simulations, the qualitative behavioral variables (reasons for service selection and trip purposes) were simplified and aggregated into a single numeric constant. This reduction yielded a parsimonious single utility equation: **U = 2,32371 - 0,00004517** $\mathbf{X_1}$. This mathematical formulation is highly intuitive. The positive constant (2.32371) represents the baseline utility or intrinsic preference; this implies that if the ticket prices for the Regular and Executive services were equalized, all passengers would naturally prefer the Executive Service due to its superior comfort and amenities. Conversely, the negative coefficient (-0.00004517 X_1) serves as the economic penalty. Each one-Rupiah increase in the fare difference (X_1) systematically erodes the attractiveness and overall utility of the Executive Service option

The negative sign of the fare coefficient (-0.00004517) demonstrates a causal relationship that is perfectly consistent with the foundational principles of transport economics: any widening of the price margin between the two service classes linearly reduces the utility value of the premium service. This negative coefficient structure on the cost variable aligns with binary logit models developed for urban mode choice in Johor Bahru (Puan et al., 2019) where an increased cost burden consistently acts as the primary disincentive for users in making transit choices.

The exceptionally high tariff sensitivity among non-vehicle passengers also confirms the empirical findings of a study on the same corridor (Arif Rizki et al., 2024) which established that travel cost and travel duration components serve as the primary anchors keeping passengers retained within the Regular Service. When premium service quality and security guarantees at the executive terminal are not perceived as primary necessities by non-vehicle passengers (Wati et al., 2025), price fluctuations even in small nominal amounts will immediately trigger aggressive mode-shifting elasticity.

Comparative Analysis of Fares, Ability to Pay (ATP), and Willingness to Pay (WTP)

Before dissecting the mode-shift probabilities, it is essential to examine the economic reality of the passengers' actual financial capacity and contrast it directly with the current tariff structure and their psychological pricing thresholds.

Purchasing Power / Ability to Pay (ATP): Based on calculations derived from the respondents' income data, travel frequencies, and transport budget allocations, the average ability to pay (ATP) of non-vehicle passengers is remarkably high, reaching IDR 871,443. This indicates that, from a purely financial standpoint, these passengers possess more than adequate absolute purchasing power to afford the Executive Service tickets, which are currently priced at IDR 84,800.

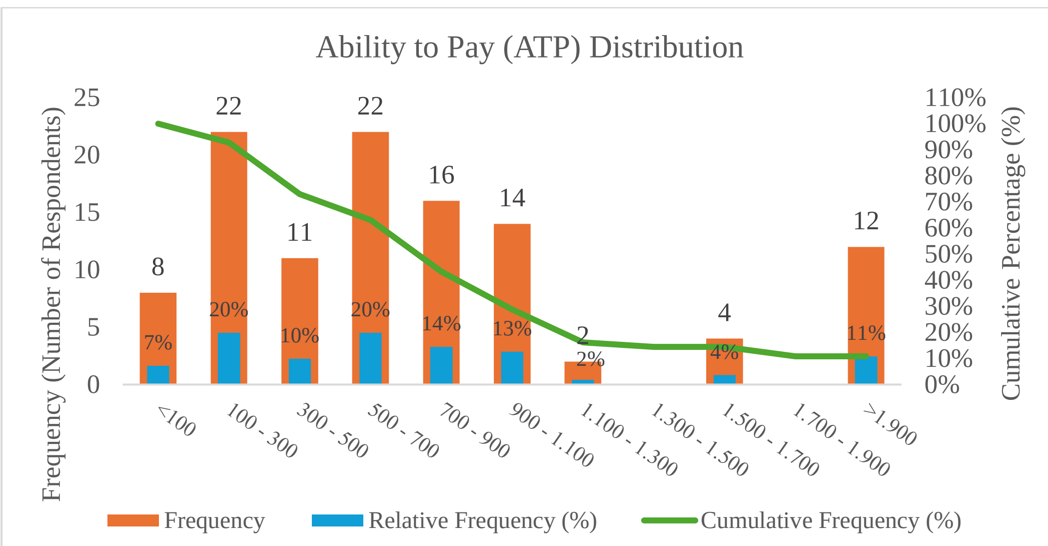

Figure 3. Passenger Ability to Pay (ATP) Distribution Graph

***Willingness to Pay (WTP)*:** Although absolute financial capacity is present, the psychological willingness to allocate those resources represents a distinct behavioral matter. Derived from the fare-difference model via the Stated Preference approach, respondents indicate that the maximum acceptable price ceiling for an Executive Service ticket (total WTP) is merely IDR 69,543. This nominal value is calculated from the baseline Regular fare (IDR 18,100) combined with the maximum acceptable premium tolerance that users are willing to pay for the upgraded class (IDR 51,443).

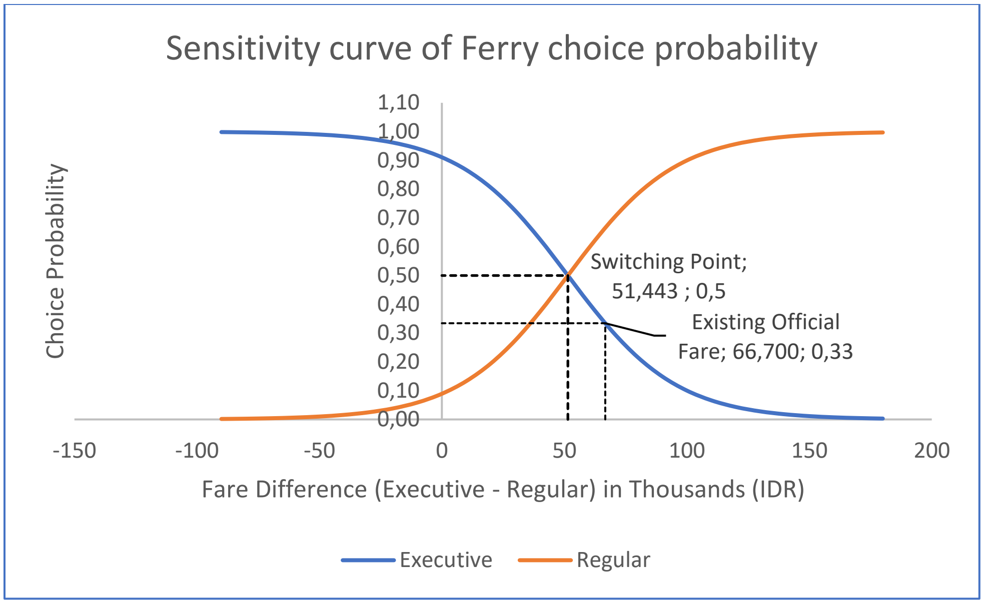

Figure 4. Mode Shift Probability

This disparity sharply highlights a clear behavioural economics phenomenon, which can be expressed through the following hierarchical relationship: (ATP > Existing Tariff > WTP). The passengers' purchasing power is remarkably high, standing at an average of IDR 871,443, yet their willingness to pay for the premium executive service remains significantly below the current tariff. Rather than an absolute lack of financial capacity to afford executive tickets, passengers perceive the IDR 84,800 fare as disproportionately high relative to the marginal utility derived from the service.

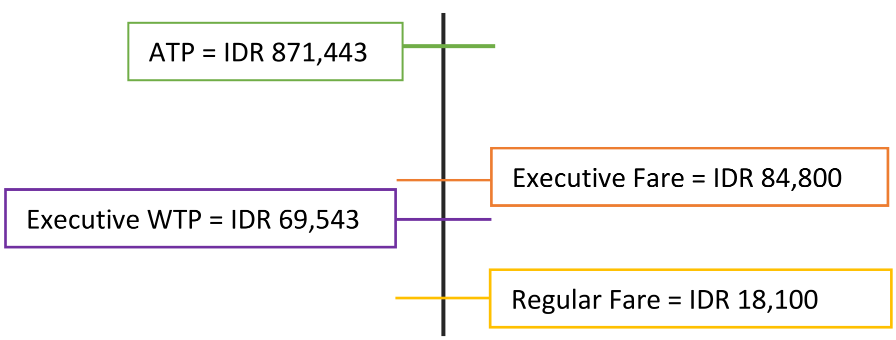

Figure 5. Comparative of Fare, ATP and WTP

Elasticity Analysis

Through the estimated utility function, elasticity values can be mathematically derived, comprising both the own-price and cross-price elasticities for each service class. Table 8 summarizes the demand characteristics of these services:

Table 8. Price and Cross-Price Elasticity Estimates for Ferry Services

	Elasticity
Executive Own-Elasticity (E_{ee})	*-2,55*
Executive Cross-Elasticity *(E_{er})*	*0,54*
Regular Own-Elasticity (E_{rr})	*-0,27*
Regular Cross-Elasticity *(E_{re})*	*1,28*

The results of the elasticity analysis carry crucial managerial implications for vessel operators and port authorities:

Highly Elastic Price Sensitivity **(**$|E_{ee}| = 2,55 > 1$**):** The own-price elasticity value of -2.55 signifies a highly elastic demand curve. According to microeconomic price theory, for services exhibiting elastic demand, a reduction in price optimizes total revenue, as the proportional increase in quantity demanded outweighs the price decrease. The model projects that adjusting the Executive fare downward from IDR 84,800 to approach the empirical WTP of approximately IDR 69,500 (an 18% reduction) could theoretically increase the probability of Executive class selection by approximately 45%. However, it must be emphasized that this figure represents a *ceteris paribus* econometric projection rather than an operational certainty. Actual demand realization will be subject to operational constraints, such as real-time vessel capacity limits and terminal queuing dynamics. This extreme elasticity corroborates the findings of (Adler et al., 2010)regarding maritime transit, yet it presents a notably steeper sensitivity compared to typical urban land-transit models (Puan et al., 2019), underscoring the high vulnerability of intercity ferry passengers to fare fluctuations

Positive Substitution Effect $|E_{re}| = 1,28 > 0$**):** The positive cross-price elasticity mathematically confirms that the Executive and Regular ferries operate as substitute services. An estimated 1.28% expansion in Regular passenger volume is driven by every 1% increase in the Executive fare. This cross-elasticity provides a theoretical explanation for the current operational imbalance. The extreme fare disparity of 468% acts as a powerful deterrent, forcing passengers with adequate absolute purchasing power (ATP) to substitute the premium service for the basic tier, thereby exacerbating congestion on the Regular vessels. This aligns with (Hatziioannidu & Polydoropoulou, 2022), affirming that while travel time is valued, the monetary attribute remains the ultimate mode-choice anchor in maritime settings without alternative terrestrial routes

Through these analytical insights, operators and policymakers can strategically evaluate passenger shifts and capacity availability across both service classes. This allows for a more equitable and balanced demand distribution, preventing overcrowding in one service while eliminating capacity inefficiencies in the other.

CONCLUSION

This study confirms that the operational imbalance on the Merak-Bakauheni ferry route is primarily driven by extreme fare disparity rather than absolute financial constraints. While non-vehicle passengers possess a remarkably high average Ability to Pay (ATP) of IDR 871,443, their extracted Willingness to Pay (WTP) threshold for the Executive service is strictly bounded at IDR

69,543. The 468% fare markup acts as a significant barrier, resulting in a highly elastic demand ($|E_{ee}|$ = 2,55 > 1) and a positive cross-elasticity ($|E_{re}|$ = 1,28 > 0). Consequently, the fare difference serves as the overriding determinant of mode choice, forcing a substitution effect where passengers default to the Regular service despite having sufficient purchasing power for premium transit. The implications of this study are multifaceted, contributing to the theoretical discourse, operational management, and regulatory policies of maritime transportation. The empirical findings offer theoretical pathways to address the severe operational imbalance in passenger distribution across the port. Policymakers and operators could consider restructuring the Executive fare ceiling to approach the empirical WTP threshold or implementing dynamic pricing mechanisms. However, such pricing interventions must be carefully calibrated against the existing infrastructural reality. The Executive service operates with limited capacity (comprising only 2 docks and 17 vessels), in stark contrast to the Regular service's massive absorption capacity (5 docks and 50 vessels). Therefore, while lowering Executive fares could theoretically stimulate a demand shift, it must be executed proportionally to prevent overwhelming the limited physical capacity of the premium terminals. This study acknowledges several methodological and operational boundaries. The findings are derived from a *ceteris paribus* Stated Preference model designed exclusively to estimate passenger choice probabilities from a demand-side perspective. The mathematical model does not account for real-time supply-side constraints, such as maximum vessel capacity, terminal queuing dynamics, or the operators' internal cost structures (e.g., fuel and maintenance overheads). Consequently, definitive claims regarding optimized operator profitability or actual revenue gains cannot be asserted from this behavioral analysis alone. To advance the understanding of intercity maritime transit, future research must bridge the gap between passenger demand modeling and operational supply management. Subsequent studies should integrate discrete choice models with capacity-constrained revenue management simulations. Incorporating empirical operational data, dynamic scheduling, and specific operator cost functions is essential to comprehensively validate whether fare adjustments will translate into sustainable profitability and efficient port operations.

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