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Influence of Socio-Economic Characteristic on Travel Behaviour in Malang City

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Abstract

Background: Rapid urbanization and economic growth in Malang City have significantly influenced urban mobility patterns, increasing dependence on private vehicles and reshaping commuting behavior. Understanding the socio-economic determinants of travel behavior is therefore essential for sustainable transport planning in secondary cities in Indonesia.
Objective: This study analyzes the relationship between socio-economic factors (such as age, income, education, occupation, gender, household size, and vehicle ownership) and daily travel behavior in Malang City, including trip frequency, trip purpose, and transport mode choice.
Methods: A quantitative cross-sectional design was applied using a structured questionnaire distributed to 200 households selected through non-probability sampling. The data were analyzed using descriptive statistics and stepwise multiple linear regression to examine the effects of socio-economic variables on different dimensions of travel behavior.
Results: Education was the only significant predictor of trip frequency ($B = 0.081$, $p < 0.001$; $R^2 = 0.140$). For trip purpose, the model demonstrated strong explanatory power ($R^2 = 0.610$, $F = 50.300$, $p < 0.001$), with occupation ($\beta = 0.706$, $p < 0.001$), education ($\beta = 0.132$, $p = 0.006$), and income ($\beta = -0.107$, $p = 0.021$) identified as significant determinants. However, none of the socio-economic variables significantly influenced transport mode choice ($R^2 = 0.010$, $p = 0.931$), indicating that infrastructure conditions and transport service availability may play a more dominant role in determining mode selection.
Conclusion: Socio-economic factors influence travel behavior differently across various dimensions. While these factors significantly affect trip frequency and trip purpose, they do not determine transport mode choice.

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INTRODUCTION

Globally, rapid urbanization has fundamentally transformed travel behavior patterns, with the United Nations estimating that 68% of the world population will reside in urban areas by 2050. In developing countries across Southeast Asia, Africa, and Latin America, the proliferation of private motor vehicles has outpaced public transport infrastructure development, generating severe congestion, air quality degradation, and social inequity in mobility access (Aderibigbe & Gumbo, 2022; Phan et al., 2025) . Metropolitan areas in countries such as Indonesia, India, and China have experienced exponential growth in motorized vehicle registrations, compelling researchers to examine the socio-economic determinants that drive these mobility transitions

(Li & Guo, 2018; Mohamed & Arunasalam, 2025; Srinivasan et al., 2007). Understanding these determinants is essential for formulating transport policies that balance economic development with environmental sustainability.

The development of Malang City as a hub for education, tourism, and commerce has generated complex mobility dynamics driven by population growth and urbanization. While transportation is fundamental for daily access, the surge in private vehicle ownership challenges sustainable management According to the Central Statistics Agency (BPS kota malang, 2023), Malang City's population reached approximately 870,000 inhabitants with 227,385 households, while the number of registered motorized vehicles has grown steadily, contributing to increasing traffic congestion in key urban corridors. The city's dual character as both an educational hub hosting over 80 higher education institutions and a rapidly expanding commercial center creates unique mobility demands that distinguish it from other Indonesian secondary cities. Socioeconomic characteristics such as income, education, and gender are proven determinants of travel behavior. Anwari et al., (2021) observed this influence in developing countries, while Li et al., (2018) and Jain and Tiwari, (2019) linked income and vehicle ownership to mode choice in China and India (Vanderschuren & Lane-Visser, 2025). In the Indonesian context, Kurniasari and Ryana (2025) and Tantowi (2022) confirmed that economic factors significantly influence tourist and domestic travel demand (Seyfi et al., 2025). Furthermore, Maulana (2020) and Bakhtiari et al. (2023) highlighted the predictive value of these variables for commuter modes and demand modeling.

Transportation is fundamental to daily life, yet high mobility increases the intensity of motorized vehicle use. Anwari et al., (2021) and Li et al., (2018) emphasize that travel behavior and mode choice are significantly shaped by socio-economic factors such as income, gender, and vehicle ownership (Seyfi et al., 2025). Income acts as a primary determinant; higher income correlates with increased private vehicle trips and use of faster modes (Acharjee & Sarkar, 2021; Etminani-Ghasrodashti & Ardeshiri, 2016; Jain & Tiwari, 2019; Vanderschuren & Lane-Visser, 2025; Y. Wang et al., 2014; Wu et al., 2020). Conversely, low-income groups in developing countries are often restricted to walking or public transport, limiting their employment accessibility (Mohamed & Arunasalam, 2025; Srinivasan & Rogers, 2005). As incomes rise, a shift from non-motorized to motorized transport occurs (Srinivasan et al., 2007), a trend further influenced by housing location (Lin & Wang, 2014) and contributing to a surge in private vehicles (Hasibuan et al., 2025; Hasibuan et al., 2014).

Demographic characteristics also play a critical role. Women tend to make shorter, localized trips due to safety concerns and social expectations (Acharjee & Sarkar, 2021; Basarić et al., 2016; Ipingbemi, 2010; Vanderschuren & Lane-Visser, 2025), with low-income women facing additional barriers (Borker, 2024). Age and education further differentiate preferences; younger individuals and students are more inclined toward public transport, while older adults or those with higher education prioritize safety and comfort (Kotval & Vojnovic, 2015; Szeto et al., 2017; Zou et al., 2023). Distinct mobility behaviors are evident across different life stages and employment statuses (Alizadeh & Sharifi, 2023; Jamal et al., 2023; Kanimozhee & Srikanth, 2023; Zhang et al., 2024).

Household structure significantly impacts trip frequency. Larger families, particularly those with children, exhibit higher car dependency and complex trip chaining behaviors (Etminani-Ghasrodashti & Ardeshiri, 2016; Feng et al., 2013; Harms et al., 2014; Jeung & Seungil, 2013; Matsuyuki & Rinchumphu, 2001; McCarthy et al., 2017; Mukherjee & Raghuram, 2022; Pike & Lubell, 2016; Scheiner, 2020; Zhang et al., 2020). Vehicle ownership is a critical predictor, drastically increasing the likelihood of non-low-carbon mode choices (Ashik et al., 2025; Li et al., 2018; Wu et al., 2020), while non-owners in developing nations face participation limits (Ashik et al., 2025; Manoj & Verma, 2013; Wicaksono et al., 2020).

Finally, socio-economic status interacts with the built environment to determine trip length and mode (Haldar & Mistri, 2025; Ipingbemi, 2010; Mukherjee & Raghuram Kadali, 2022; Mwale et al., 2024; Tikoudis et al., 2024). While dense, mixed-use areas promote active travel (Domeneghini et al., 2026; Larranaga & Cybis, 2014; Litman, 2007; Rakhmatulloh et al., 2020; Wang et al., 2018), accessibility remains key (Zhang & Zhao, 2017). Furthermore, social networks and modern lifestyles influence travel purposes. Joint travel with family or friends drives activity

frequency (Gramsch-Calvo & Axhausen, 2024; Lin & Wang, 2014; Puhe et al., 2021; Ramezani et al., 2025; Tanjung et al., 2023). In the digital age, social media also shapes tourism behaviors (Damanik et al., 2023; Rahjasa et al., 2024; Sharma et al., 2021), while environmental values can motivate sustainable mode choices despite car access (Onderwater et al., 2019; Silm et al., 2024; Thøgersen, 2018; Zhang et al., 2024). Ultimately, socio-economic factors are often more determinant than land use alone (Darwish et al., 2023; Kotval-K & Vojnovic, 2015).

International studies by Aderibigbe and Gumbo, (2022), Phan et al., (2025), Pourramazani and Miralle-garcia, (2023) further validate that socioeconomic status dictates travel cycles, spending, and rural accessibility. Income is particularly dominant, often separating private vehicle users from those relying on public transport or non-motorized modes, a relationship reinforced by Etminani and Ardeshiri, (2016). Demographics also play a critical role, Basarić et al., (2016) noted gender disparities in trip patterns, while Ipingbemi (2010) emphasized the mobility constraints of older adults (Ashik et al., 2025). Given Malang's diverse population of students and workers, this research aims to analyze these socioeconomic influences to develop inclusive, sustainable transportation policies tailored to community needs.

Despite the extensive body of literature on socio-economic determinants of travel behavior, a critical research gap persists in the context of Indonesian secondary cities such as Malang. Previous studies have predominantly focused on metropolitan areas in developed countries or capital cities in developing nations (Li & Guo, 2018), leaving medium-sized urban centers underexplored. Moreover, existing Indonesian studies have examined individual travel dimensions in isolation, without simultaneously analyzing the differential effects of socio-economic variables on trip frequency, trip purpose, and mode choice within a single integrated framework. This gap limits the transferability of policy recommendations to cities with distinct demographic and institutional characteristics.

The novelty of this study lies in its comprehensive simultaneous examination of three travel behavior dimensions (trip frequency, trip purpose, and transport mode choice) using stepwise regression analysis applied to a diverse urban-preurban population in Malang City. Unlike prior research that examined these dimensions separately, this study enables direct comparison of the relative predictive power of socio-economic variables across distinct aspects of mobility, thereby revealing which dimensions are amenable to demographic-based policy interventions and which require infrastructure-oriented approaches.

The urgency of this research is underscored by Malang City's current transportation challenges. As a rapidly growing educational and commercial hub, the city faces escalating congestion, environmental degradation from vehicle emissions, and inequitable mobility access among socio-economically diverse communities. With the ongoing development of mass transit systems and urban revitalization programs, evidence-based understanding of how socio-economic characteristics shape travel decisions is imperative for ensuring that transport investments serve the mobility needs of all population segments.

Theoretically, this study contributes to the travel behavior literature by testing the applicability of socio-economic determinant models in the specific context of Indonesian secondary cities, thereby extending the geographical scope of existing theoretical frameworks. Practically, the findings provide actionable evidence for Malang City's transportation planners and policymakers, informing targeted interventions such as differentiated public transport subsidies, educational mobility programs, and occupation-specific commuter solutions that address the heterogeneous mobility needs of the urban population.

METHOD

This research adopts a quantitative cross-sectional survey design. This study relied on primary data collected on socio-economic characteristics and travel characteristics of household. The population for this study comprises 227,385 households in Malang City (Statistik, 2023). Due to time and cost constraints, a non-probability sampling technique was employed. The minimum sample size was determined using the Slovin formula with a precision level of 90% (margin of error d=0.1): The 10% margin of error was selected considering the exploratory nature of this study and practical constraints of household-level data collection in a geographically dispersed urban area, following precedents in Indonesian transportation surveys (Wicaksono et al., 2020).

Respondents were distributed across five administrative sub-districts of Malang City using proportional allocation based on household density data from BPS (2023), ensuring spatial representativeness of the sample (Ashik et al., 2025).

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

Where:
n = Number of samples
N = Total population (227,385 households)
d = Precision value (0.1)

Based on the calculation (n≈99.95), the minimum requirement was 100 respondents. However, to ensure higher data reliability and precision, this study expanded the sample size to 200 households, distributed randomly across the study area.

The data collection instrument was a structured questionnaire designed in three main sections:

1) Socio-economic Characteristics: Covers gender, age, education, income, marital status, employment status, occupation, and vehicle ownership.
2) Travel Characteristics: Collects data on trip frequency (daily round trips), purpose, travel time, mode choice, and travel costs.
3) Influencing Factors: Identifies the determinants affecting respondents' travel choices.

Data analyzed involved basic descriptive statistics, such as percentages and frequency counts. When necessary, more in-depth statistics, such as multiple regression, were also used in this study. All data was processed using the Statistical Package for Social Scientists (SPSS), while regression models were used to identify socioeconomic factors that impacted respondents' movements within the study locations

$$y = \text{a} + b_1x_1 + b_2x_2 + \ldots\ldots + b_\text{n}x_n + \text{e} \quad \ldots\ldots (1)$$

Where y represents the dependent variable. The dependent variables, in this case, represent
y = average Trips
x1, x2, x3 . . . . xn represent the independent variables
a, b are constants
e is the error term

In this study, seven socio-economic indicators were utilized as independent variables (predictors) to examine their influence on travel behavior. These predictors include: Age, Income, Gender, Education, Occupation, Household Size, and Vehicle Ownership.
To analyze the relationship between these predictors and the dependent variable, a Stepwise Regression analysis was performed. This method was selected for its capability to construct an optimal model by iteratively retaining only the statistically significant variables while discarding ineffective predictors throughout the analysis process. The operational definitions and codes for the variables included in this analysis are detailed in Table 1.

Table 1. Variable description

Variables	Description
Gender	Male/Female
Age	Respondent's age in years
Household Size	Number of people who live and share meals from the same household or dwelling unit
Occupation	Nature of respondent's job (e.g., farming, civil servant, private employee, self-employed, etc.)
Education	Highest level of education completed by the respondent (e.g., primary school, secondary/high school, or tertiary education)

Variables	Description
Income of Respondents	Average monthly income of the respondent
Number of Vehicles in the Household	Number of functional vehicles owned or available within the household
Trip Frequency	Number of daily round trips (completed trips)

RESULTS AND DISCUSSION

Results

Socio-economic characteristics of household

The socio-economic profile of the respondents is presented in Table 2. The age distribution reveals that the productive age group (23–45 years) constitutes the largest proportion (51%), followed by the youth demographic (<22 years) at 27%. Older age groups, specifically those aged 46–55 and >56, account for 12.5% and 9.5%, respectively.

Regarding household structure, the majority of respondents (63.5%) live in households with more than three members, indicating a prevalence of medium-to-large family units. In terms of education, the population is relatively well-educated, with 66.5% holding a Diploma or Bachelor's degree (S1), while those with primary and middle education comprise 12.5%.

Occupational data shows a diverse economic landscape. A significant portion of household heads are engaged in trading/self-employment (23%) and the private sector (19.5%), whereas civil servants (government workers) make up only 4.5% of the sample.

Income distribution is another critical variable influencing travel behavior. The study found that the majority of respondents (57%) earn between IDR 1–3 million. Meanwhile, 34% earn below IDR 1 million, and only a small fraction (8.5%) earn above IDR 3 million. This income structure is reflected in vehicle ownership patterns: 44% of households own both a car and a motorcycle, suggesting a high dependency on private transport despite moderate income levels. Furthermore, 37% own only a motorcycle, while 19% own only a car.

Table 2. Socio-economic characteristics of respondents

Variables	Variable	Frequency	Percent
Gender	Male	107	53.5
	Female	93	46.5
Age	below 22	54	27
	23-45	102	51
	46-55	25	12.5
	above 56	19	9.5
Household Size	1	1	1.9
	2	8	15.4
	3	10	19.2
	>3	33	63.5
Education	Primary school	25	12.5
	Middle school	25	12.5
	High school	17	8.5
	Diploma/ S1	133	66.5
	S2	0	0
Occupation	Civil servant	9	4.5
	Private sector employee	39	19.5
	Self-employed / trader	46	23
	Farmer / fisherman	3	1.5
	Informal Worker	24	12
	Student	63	31.5
	Retired	4	2
	Homemakers	5	2.5
	Unemployed	7	3.5

Variables	Variable	Frequency	Percent
Income of Respondents	<1 million rupiahs	68	34.0
	1-3million rupiahs	115	57.5
	>3 million rupiahs	17	8.5
Number of Vehicle in the household	Cars	38	19.0
	Motorcycle	74	37.0
	Cars and motorcycle	88	44.0

Source: Author's Field Work

Travel characteristics of respondents

Information about how people travel is shown in Table 3. The analysis of how often respondents travel, considering all trips for different reasons, showed that 60.5% of them usually make about two trips each day, which is the highest in that group. This is closely followed by 24.5% of respondents who make fewer than two trips per day. In short, 15% of the people surveyed go on more than two trips each day. Our study also found that 60.5% of people make more trips related to work, which are trips they don't choose to make. When looking at how respondents travel, it was found that 71% of them use their own private vehicle, while 29% rely on public transportation.

Table 3. Travel characteristics of households

Variables	Variable	Frequency	Percent
Number of trips made in a day	<2	49	24.5
	2	121	60.5
	>2	30	15.0
Purpose of the trip	Work	121	60.5
	School	63	31.5
	Shopping	10	5
	Recreation	6	3
Mode of transportation	Private Vehicle	142	71
	Public transport	58	29

How the identified socio-economic factors affect the travel decisions of people living in urban areas. The summary of the correlation from the stepwise regression analysis in the table below tries to show how the average number of trips is connected to the socio-economic factors of the people surveyed. Also, it shows the model several correlation coefficients, R, their coefficients of determination, R squared, and a modified version of these coefficients as ways to summarize how well the model fits.

Table 4. Correlation summary regression analysis the relationship between the average number of trips and the socio-economic indices of respondents

Variable	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (β)	t	Sig. (p)
(Constant)	1.640	0.261		6.290	.000
Gender	-0.022	0.064	-0.023	-0.339	.735
Age	0.044	0.036	0.083	1.219	.224
HH (Household Size)	0.020	0.049	0.028	0.415	.679
EDU (Education)	0.081	0.017	0.327	4.644	.000
OCU (Occupation)	0.023	0.018	0.090	1.267	.207
INC (Income)	0.100	0.118	0.058	0.847	.398
Model Statistics					
R	0.374				
R Square	0.140				
Adjusted R Square	0.113				
Std. Error of Estimate	0.443				

Variable	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (β)	t	Sig. (p)
F Statistic	5.240				.000
Dependent Variable	TRIP				

Table 4 presents the multiple linear regression analysis examining the influence of six independent variables Gender, Age, Household Size (HH), Education (EDU), Occupation (OCU), and Income (INC) on the average number of trips (TRIP).

The regression model produced a correlation coefficient (R) of 0.374, indicating a moderate relationship between the socio-economic predictors and trip frequency. The Coefficient of Determination (R2) is 0.140, which implies that the model explains 14.0% of the variance in the number of trips generated. After adjusting for the number of predictors, the Adjusted R2 stands at 0.113. Although the explanatory power is relatively low, the ANOVA results show an F-statistic of 5.240 with a significance level of 0.000 ($p<0.05$). This confirms that the model is statistically significant, meaning the independent variables collectively contribute to explaining the variation in daily trips.

Analysis Among the specific variables tested, Education (EDU) was identified as the only statistically significant predictor ($t=4.644$, $p=0.000$). The positive coefficient ($B=0.081$) suggests that higher educational attainment is associated with a higher frequency of daily trips. Conversely, the other variables Gender, Age, Household Size, Occupation, and Income did not show a statistically significant influence on trip frequency in this model ($p>0.05$). Substantively, this indicates that each incremental level of education is associated with approximately 0.081 additional daily trips, reflecting the expanded activity spaces, professional obligations, and social networks that accompany higher educational attainment. Individuals with tertiary education typically engage in multi-purpose trip chaining encompassing work, childcare, professional development, and social activities, which collectively elevate their trip generation rates compared to less educated cohorts.

The relatively low R2 value (14%) suggests that while education is a key driver, trip frequency is likely influenced by other unmeasured factors such as land-use patterns, specific daily needs, or cultural activities not captured by these demographic variables alone The modest explanatory power of this model is consistent with findings in travel behavior research globally; Kotval-K & Vojnovic (2015) reported similarly low R^2 values when modeling trip frequency solely with demographic variables (Darwish et al., 2023). This outcome aligns with the theoretical understanding that trip frequency is a highly heterogeneous behavior influenced by daily scheduling variability, spatial accessibility, weather conditions, and individual preferences that demographic variables cannot fully capture. The significance of the overall F-test ($p<0.001$) nonetheless confirms that the identified relationship between education and trip generation is robust and not attributable to random variation. However, the model diagnostics (Tolerance and VIF) indicate no issues with multicollinearity, supporting the reliability of the significant relationship found between education and trip generation.

Table 5. Correlation summary regression analysis the relationship between Purpose to trips and the socio-economic indices of respondents

Variable	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (β)	t	Sig. (p)	VIF
(Constant)	0.979	0.185		5.299	.000	
Gender	0.007	0.045	0.007	0.163	.871	1.042
Age	-0.018	0.026	-0.033	-0.712	.477	1.046
HH (Household Size)	-0.057	0.035	-0.075	-1.649	.101	1.031
EDU (Education)	0.034	0.012	0.132	2.780	.006	1.112
OCU (Occupation)	0.187	0.013	0.706	14.707	.000	1.141

Variable	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (β)	t	Sig. (p)	VIF
INC (Income)	-0.195	0.084	-0.107	-2.333	.021	1.047
Model Statistics						
R	0.781					
R Square	0.610					
Adjusted R Square	0.598					
Std. Error of Estimate	0.314					
F Statistic	50.300				.000	
Dependent Variable	PUR					

Table 5 presents the results of the multiple linear regression analysis predicting the dependent variable Purpose to Trip (PUR). The model identifies three independent variables Occupation (OCU), Education (EDU), and Income (INC) as statistically significant predictors at the 5% significance level ($p<0.05$).

Significant Predictors Among the significant variables, Occupation (OCU) exhibited the strongest positive effect ($B=0.187$, $\beta=0.706$, $p<0.001$). The high standardized beta coefficient ($\beta=0.706$) indicates that occupational status is the dominant determinant in this model, suggesting that specific job types strongly drive trip purposes. Education (EDU) also demonstrated a positive and significant relationship ($B=0.034$, $\beta=0.132$, $p=0.006$), implying that higher educational attainment is associated with a higher frequency or intensity of PUR-related activities. In practical terms, occupation serves as the primary gateway through which socio-economic status translates into specific travel demands: formal sector employees generate work-commute trips with fixed schedules and destinations, while self-employed individuals and informal workers exhibit more variable and multi-stop travel patterns. This finding suggests that occupation-targeted transport interventions (such as employer-based shuttle services, flexible transit passes, and telework incentive programs) could effectively reshape trip purpose distributions in Malang City.

Conversely, Income (INC) revealed a significant negative influence ($B=-0.195$, $\beta=-0.107$, $p=0.021$). This inverse relationship suggests that as income levels rise, the engagement in PUR-related behaviors tends to decrease. This could be attributed to higher-income groups outsourcing certain tasks or having different lifestyle priorities that reduce the necessity for specific trip purposes.

Insignificant Predictors and Model Diagnostics The remaining demographic variables Gender, Age, and Household Size (HH) did not show statistically significant effects ($p>0.05$), indicating limited predictive value for trip purpose in this specific context. Furthermore, multicollinearity diagnostics confirm the reliability of these findings; the Variance Inflation Factor (VIF) values for all predictors were well below 1.2, ensuring that the coefficient estimates are stable and not biased by inter-variable correlations.

Table 6. Correlation summary regression analysis the relationship between Mode Transportation and the socio-economic indices of respondents

Variable	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (β)	t	Sig. (p)	VIF
(Constant)	1.125	0.272		4.135	.000	
Gender	-0.016	0.067	-0.018	-0.246	.806	1.042
Age	-0.007	0.038	-0.014	-0.195	.845	1.046

Variable	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (β)	t	Sig. (p)	VIF
HH (Household Size)	0.059	0.051	0.085	1.164	.246	1.031
EDU (Education)	-0.006	0.018	-0.026	-0.341	.733	1.112
OCU (Occupation)	-0.006	0.019	-0.023	-0.301	.764	1.141
INC (Income)	0.023	0.123	0.014	0.191	.849	1.047
Model Statistics						
R	0.098					
R Square	0.010					
Adjusted R Square	-0.021					
Std. Error of Estimate	0.462					
F Statistic	0.311				.931	
Dependent Variable	MOD					

Based on Table 6, the regression analysis indicates that transport mode choice (MOD) is not significantly influenced by the socio-economic variables examined in this study. The model yields a very low coefficient of determination (R2=0.010), explaining only 1% of the variance in mode choice. Furthermore, the F-statistic of 0.311 with a significance level of 0.931 (p>0.05) confirms that the model is not statistically significant.

Individually, all predictors Gender, Age, Education, Occupation, Income, and Household Size yielded p-values greater than 0.05. This suggests that demographic and socio-economic characteristics do not play a decisive role in determining the choice of transport mode within the studied context of Malang City. This finding implies that external factors such as service availability, infrastructure quality, travel time, cost, and accessibility likely exert a stronger influence on transport mode choice than individual socio-economic attributes. These results align with transport behavior literature which suggests that in areas with limited public transport options or high motorcycle dependency, mode choice becomes homogenous regardless of socio-economic status. Potential omitted variables that may better explain transport mode choice include: travel distance and commuting time, public transport route coverage and service frequency, fuel costs and parking availability, road network quality, weather conditions, and attitudinal factors such as environmental awareness and safety perceptions. The inclusion of these built-environment and attitudinal variables in future modeling efforts could substantially improve the explanatory power of mode choice models in the Malang City context.

Therefore, the model equations for the analysis based on the Unstandardized Coefficients (B) from the previous tables (PUR) and this table (MOD) are as follows:

$$YTRIP=1.640-0.022X1+0.044X2+0.020X3+0.081X4+0.023X5+0.100X6 \quad (2)$$
$$YPUR=0.979+0.007X1-0.018X2-0.057X3+0.034X4+0.187X5-0.195X6 \quad (3)$$
$$YMOD=1.125-0.016X1-0.007X2+0.059X3-0.006X4-0.006X5+0.023X6 \quad (4)$$

Where*:*
X1: Gender
X2: Age
X3: Household Size (HH)
X4: Education (EDU)
X5: Occupation (OCU)
X6: Income (INC)

This finding implies that external factors such as service availability, travel time, cost, comfort, and accessibility may exert stronger influence on transport mode choice compared to individual socio-economic attributes. Such results are consistent with transport behavior literature, which emphasizes that service quality and infrastructure conditions often outweigh personal characteristics in shaping travel decisions.

Discussion

The findings of this study can be interpreted through the lens of activity-based travel demand theory (Kanimozhee & Srikanth, 2023) and the socio-ecological model of transport behavior (Tikoudis et al., 2024). Activity-based theory posits that travel is a derived demand generated by the need to participate in spatially distributed activities, and that socio-economic characteristics shape both the set of activities individuals engage in and their temporal-spatial constraints. The differential predictive power of socio-economic variables across the three travel dimensions examined in this study provides empirical support for this theoretical framework: while education and occupation determine the types and frequency of activities (and hence trips), the physical act of choosing a transport mode is governed more by contextual and infrastructural factors than by individual demographics.

The regression analysis reveals distinct patterns in socio-economic determinants. For the TRIP model, only education (EDU) emerged as a significant predictor, suggesting that educational attainment shapes mobility through broadened opportunities. Conversely, the PUR model demonstrated strong explanatory power (R2=0.610), confirming that socio-economic variables collectively play a substantial role in consumer decisions. These findings align with Sharma et al., (2021), who linked income and occupation to shopping behavior, and Kurniasari and Ryana (2025) who highlighted the role of socio-economic background in tourist travel.

These findings demonstrate both convergences and divergences with international evidence. The significance of education as a predictor of trip frequency aligns with Acharjee & Sarkar (2021) in India and Alizadeh and Sharifi (2023) in Iran, who similarly identified education as a mobility enabler (Vanderschuren & Lane-Visser, 2025). However, the non-significance of income in the trip frequency model contrasts with findings from Haldar and Mistri (2025) in India and Mwale et al. (2024) in Zambia, where income strongly predicted trip generation. This divergence may reflect Malang City's relatively compressed income distribution, where the majority of respondents (57%) fall within a narrow income band of IDR 1–3 million, limiting the variable's discriminatory power. The strong dominance of occupation in the trip purpose model (β=0.706) exceeds the effect sizes typically reported in comparable studies; Bakhtiari et al. (2023) found occupation coefficients ranging from β=0.3 to β=0.5 in their Iranian sample, suggesting that the rigid occupational structuring of activities in Malang City (where students, traders, and civil servants maintain highly differentiated daily routines) amplifies this relationship relative to contexts with more fluid labor markets.

The finding that socio-economic variables collectively fail to predict transport mode choice is particularly noteworthy and warrants careful interpretation. This result contrasts with Etminani-Ghasrodashti and Ardeshiri (2016) who found significant socio-economic effects on mode choice in Iran, and Li et al. (2018) who identified income and vehicle ownership as key mode determinants in China (Ashik et al., 2025). The discrepancy likely reflects Malang City's transport environment, characterized by limited public transport options, near-universal motorcycle ownership (81% of households own at least one motorcycle), and relatively uniform commuting distances. In such a context, mode choice becomes constrained by supply-side factors rather than demand-side preferences, rendering socio-economic characteristics statistically impotent as predictors. This interpretation is consistent with Ranjan and Sinha (2025), who emphasized that mode choice in cities with homogeneous transport supply is primarily determined by infrastructure availability rather than individual characteristics. Basarić et al. (2016) and Vanderschuren and Lane-Visser (2025) further corroborate that in transport-constrained environments, equity in mode access, or lack thereof, overrides the influence of individual socio-economic profiles.

In contrast, the transport mode choice (MOD) model showed that socio-economic variables do not exert statistically significant effects on mode utilization, indicating that

demographics alone are insufficient to explain these decisions. This consistency is supported by Maulana (2020) and Basalim (2025), who found that service quality and infrastructure reliability outweigh socio-economic factors in Jakarta and Aceh, respectively. Furthermore, Ranjan and Sinha (2025) and Convery (2019) corroborated that built environment, land-use, and transport supply are more dominant determinants than socio-demographic predictors (Paydar & Fard, 2025). Consequently, transport policy should prioritize infrastructure and service improvements, while future research should incorporate spatial and attitudinal variables to better capture the multifaceted nature of transport behavior

CONCLUSION

This study demonstrates that socio-economic characteristics exert differential influences across distinct travel behavior dimensions in Malang City. Specifically, education emerged as the sole significant predictor of trip frequency (B=0.081, p<0.001), while occupation (β=0.706, p<0.001), education (β=0.132, p=0.006), and income (β=−0.107, p=0.021) collectively explained 61% of variance in trip purpose. Critically, none of the socio-economic variables significantly predicted transport mode choice (R^2=0.010, p=0.931), indicating that modal decisions in Malang City are governed primarily by infrastructure availability and service quality rather than individual demographic attributes. These findings carry important implications for urban transport planning: policies aimed at shaping trip patterns should target education and occupation-related mobility needs through differentiated transit services and employer-based transport programs, while efforts to shift mode choice require investment in public transport infrastructure, pedestrian and cycling facilities, and service reliability improvements. Future research should incorporate built-environment variables, attitudinal measures, and spatial accessibility indices to develop more comprehensive models of travel behavior in Indonesian secondary cities.

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AUTHOR CONTRIBUTION STATEMENT

Taufikkurrahman helped with coming up with the idea for the study, gathering the data, analyzing it, and writing the manuscript. Pratikso helped in creating the research plan, guided the methods used, and reviewed the manuscript carefully. Kartono Wibowo helped with understanding the data, improving the discussion, and revising the final version of the manuscript.

REFERENCES

Acharjee, A., & Sarkar, P. P. (2021). Influence of attitude on bicycle users and non-users: A case study of Agartala City, India. *Transportation Research Part D: Transport and Environment*, *97*(June), 102905. https://doi.org/10.1016/j.trd.2021.102905

Aderibigbe, O., & Gumbo, T. (2022). *Influence of Socio-economic Attributes on Travel Behaviour in the Rural Areas of Nigeria : Towards a Sustainable Rural Planning and Development Influence of Socio-economic Attributes on Travel Behaviour in the Rural Areas of Nigeria : Towards a Sustainabl*. https://doi.org/10.1080/21650020.2022.2072946

Alizadeh, H., & Sharifi, A. (2023). Analyzing Urban Travel Behavior Components in Tehran, Iran. *Future Transportation*, *3*(1), 236–253. https://doi.org/10.3390/futuretransp3010014

Anwari, N., Ahmed, M. T., Islam, M. R., Hadiuzzaman, M., & Amin, S. (2021). *Exploring the travel behavior changes caused by the COVID-19 crisis: A case study for a developing country*. https://doi.org/10.1016/j.trip.2021.100334

Ashik, F. R., Barrington-Leigh, C. P., & Manaugh, K. (2025). Built environment's main and moderating associations with travel mode choice across trip purposes. *Journal of Transport Geography*, *129*, 104434.

Bakhtiari Mirzahossein, H., Kalantari, N., A., & Jin, X. (2023). *Inferring Socioeconomic Characteristics from Travel Patterns*. https://doi.org/10.5614/jpwk.2023.34.1.7

Basalim, S. (2025). *Assessing the Potential for Transportation Mode Switching in Mid-Sized Urban Areas Using Binary Logistic Regression*. *13*(December 2024), 223–232.

Basarić, V., Vujičić, A., Simić, J. M., Bogdanović, V., & Saulić, N. (2016). Gender and Age Differences in the Travel Behavior - A Novi Sad Case Study. *Transportation Research Procedia*, *14*, 4324–4333. https://doi.org/10.1016/j.trpro.2016.05.354

Borker, G. (2024). Understanding the constraints to women's use of urban public transport in developing countries. *World Development*, *180*(February), 1–14. https://doi.org/10.1016/j.worlddev.2024.106589

BPS kota malang. (2023). *Kota Malang Dalam Angka, Malang Municipality in Figures 2023*.

Convery, S. (2019). *Determinants of Transport Mode Choice for Non-Commuting Trips : The Roles of Transport , Land Use and Socio-Demographic Characteristics*. 1–25.

Damanik, J., Priyambodo, T. K., Wibowo, M. E., Pitanatri, P. D. S., & Wachyuni, S. S. (2023). Travel behaviour differences among Indonesian youth in Generations Y and Z: pre-, during and post-travel. *Consumer Behavior in Tourism and Hospitality*, *18*(1), 35–48. https://doi.org/10.1108/CBTH-07-2021-0184

Darwish, A. M., Zagow, M., & Elkafoury, A. (2023). Impact of land use, travel behavior, and socio-economic characteristics on carbon emissions in cool-climate cities, USA. *Environmental Science and Pollution Research*, *30*(39), 91108–91124.

Domeneghini, J., Zampieri, F. L., & Correa, A. S. (2026). Porto Alegre's urban parks: accessibility and socioeconomic exclusion. *Finisterra*, *61*(131), e41818–e41818.

Etminani, R., & Ardeshiri, M. (2016). The impacts of built environment on home-based work and non-work trips: An empirical study from Iran. *Transportation Research Part A: Policy and Practice*, *85*, 196–207. https://doi.org/10.1016/j.tra.2016.01.013

Feng, J., Dijst, M., Wissink, B., & Prillwitz, J. (2013). The impacts of household structure on the travel behaviour of seniors and young parents in China. *Journal of Transport Geography*, *30*, 117–126. https://doi.org/10.1016/j.jtrangeo.2013.03.008

Gramsch-Calvo, B., & Axhausen, K. W. (2024). Exploring the influence of social relations and knowledge of the urban environment on leisure travel. *Journal of Transport Geography*, *117*(March), 103860. https://doi.org/10.1016/j.jtrangeo.2024.103860

Haldar, N., & Mistri, T. (2025). Exploring the socio-economic determinants of transport mode choice: A case study of Burdwan city, India. *Case Studies on Transport Policy*, *20*(March), 101425. https://doi.org/10.1016/j.cstp.2025.101425

Harms, L., Bertolini, L., & te Brömmelstroet, M. (2014). Spatial and social variations in cycling patterns in a mature cycling country exploring differences and trends. *Journal of Transport and Health*, *1*(4), 232–242. https://doi.org/10.1016/j.jth.2014.09.012

Hasibuan, H. S., Permana, C. T., Elizandri, B. N., Asrofani, F. W., Harmain, R., & Putra, D. P. (2025). Sustainable Mobility in Jakarta's Transit-Oriented Development: Energy Savings and Emission Reduction Strategies. *Sustainability*, *17*(23), 10603.

Hasibuan, S. H., Soemardi, T. P., Koestoer, R., & Moersidik, S. (2014). The Role of Transit Oriented Development in constructing urban environment sustainability , the case of Jabodetabek , Indonesia. *Procedia Environmental Sciences*, *20*, 622–631. https://doi.org/10.1016/j.proenv.2014.03.075

Ipingbemi, O. (2010). Travel characteristics and mobility constraints of the elderly in Ibadan, Nigeria. *Journal of Transport Geography*, *18*(2), 285–291. https://doi.org/10.1016/j.jtrangeo.2009.05.011

Jain, D., & Tiwari, G. (2019). Explaining travel behaviour with limited socio-economic data: Case study of Vishakhapatnam, India. *Travel Behaviour and Society*, *15*(October 2018), 44–53. https://doi.org/10.1016/j.tbs.2018.12.001

Jamal, S., Newbold, K. B., & Scott, D. M. (2023). Analysis of millennials and older adults' automobility behavior in Hamilton, Ontario. *Urban, Planning and Transport Research*, *11*(1), 1–23. https://doi.org/10.1080/21650020.2023.2197979

Jeung, J. Y., & Seungil, L. (2013). Analyzing weekend leisure travel behavior characteristics by reference group focused on family life cycle: A case study of Seoul. *Proceedings of CUPUM*

2013: 13th International Conference on Computers in Urban Planning and Urban Management - Planning Support Systems for Sustainable Urban Development, 1–15.

Kanimozhee, S., & Srikanth, S. (2023). *Analysis of Non-workers Activity-Travel Mode Choice Behaviour for the Effective Usage of Sustainable Transportation Infrastructure*. https://doi.org/10.1088/1755-1315/1280/1/012045

Kotval-K, Z., & Vojnovic, I. (2015). The socio-economics of travel behavior and environmental burdens: A Detroit, Michigan regional context. *Transportation Research Part D: Transport and Environment*, *41*, 477–491. https://doi.org/10.1016/j.trd.2015.10.017

Kurniasari;, I Made Dyah Ryana, P. G. A. Y. (2025). *Women on the move: how socio-economic background through lifestyle shapes travel behavior to bali*. *23*(1), 208–224.

Larranaga, A. M., & Cybis, H. B. B. (2014). *The relationship between built environment and walking for different trip purposes in porto alegre, Brazil*. https://doi.org/10.2495/SDP-V9-N4-568-580

Li, J., Lo, K., & Guo, M. (2018). Do Socio-Economic Characteristics Affect Travel Behavior ? A Comparative Study of Low-Carbon and Non-Low-Carbon Shopping Travel in Shenyang City , China. *International Journal of Environmental Research and Public Health*, *15 (1346)*, 1–11. https://doi.org/10.3390/ijerph15071346

Lin, T., & Wang, D. (2014). Social networks and joint/solo activity-travel behavior. *Transportation Research Part A: Policy and Practice*, *68*, 18–31. https://doi.org/10.1016/j.tra.2014.04.011

Litman, T. A. (2007). *Land Use Impacts on Transport How Land Use Factors Affect Travel Behavior Land Use Impacts On Transportation*.

Manoj, M., & Verma, A. (2013). *Analysis and Modelling of Activity-travel Behaviour of Non- workers from a City of Developing Country, India*. https://doi.org/10.1016/j.sbspro.2013.11.156

Matsuyuki, M., & Rinchumphu, D. (2001). Study on Transportation Behavior of Middle-Class Households with Children in Bangkok , Thailand. *Proceedings of the Eastern Asia Society for Transportation Studies, Vol.11*, 1–13.

Maulana, R. H. Y. (2020). *Socio-Economic Factors Affecting The Choice*. *16*(4), 245–252.

McCarthy, L., Delbosc, A., Currie, G., & Molloy, A. (2017). Factors influencing travel mode choice among families with young children (aged 0–4): a review of the literature. *Transport Reviews*, *37*(6), 767–781. https://doi.org/10.1080/01441647.2017.1354942

Mohamed, A. R., & Arunasalam, V. (2025). Digital Economic Community and Transforming Urban Living and Mobility Planning and Design—A Case of Peri-Urban Chennai, India. In *Indo-Pacific Core and Peripheral Digital Economic Communities* (pp. 167–194). Springer.

Mukherjee, J., & Raghuram Kadali, B. (2022). *A comprehensive review of trip generation models based on land use characteristics*. https://doi.org/10.1016/j.trd.2022.103340

Mwale, M., Pisa, N., & Luke, R. (2024). Travel mode choices of residents in developing cities: A case study of Lusaka, Zambia. *Journal of Transport and Supply Chain Management*, *18*, 1–14. https://doi.org/10.4102/jtscm.v18i0.1005

Onderwater, M., Boisjoly, G., & El-Geneidy, A. (2019). Influence of Travel Behavior, Personal Preferences, and Lifestyle on Perceived Convenience to Amenities among Calgary Residents. *Transportation Research Record*, *2673*(8), 508–522. https://doi.org/10.1177/0361198119844967

Paydar, M., & Fard, A. K. (2025). Travel mode choice of the commuters in Temuco, Chile: The association of personal factors and perceived built environment. *Transportation Research Interdisciplinary Perspectives*, *31*, 101412.

Phan, K., Chen, S., Pai, W., Lee, J., & Hsieh, C. (2025). *How Travel-Related Factors and the Socioeconomic Characteristics of Tourists Shape Tourism Demand ? New Evidence from the Role of Satisfaction*. *1*, 1–26. https://doi.org/10.1177/21582440251335471

Pike, S., & Lubell, M. (2016). Geography and social networks in transportation mode choice. *Journal of Transport Geography*, *57*, 184–193. https://doi.org/10.1016/j.jtrangeo.2016.10.009

Pourramazani, H., & Miralle-garcia, J. L. (2023). *International Journal of Transport Development and Integration*. *7*(3), 167–176.

Puhe, M., Schippl, J., Fleischer, T., & Vortisch, P. (2021). Social network approach to analyze stability and variability of travel decisions. *Transportation Research Record*, *2675*(9), 398–407. https://doi.org/10.1177/03611981211002200

Rahjasa, S. L., Prasasti, G., & Apriliani, K. M. (2024). How Travel Influencer and Social Media Influence Tourist Travel Decision to Ubud. *TRJ Tourism Research Journal*, *8*(1), 127–141. https://doi.org/10.30647/trj.v8i1.243

Rakhmatulloh, A. R., Dewi, D. I. K., & Nugraheni, D. M. K. (2020). Analysis of Pedestrian Travel Demand for Bus Trans Semarang through 3D Method (Density, Diversity, Design). *Jurnal Teknik Sipil Dan Perencanaan*, *22*(2), 127–136. https://doi.org/10.15294/jtsp.v22i2.26218

Ramezani, S., Soinio, L., Kyttä, M., & Weitkamp, G. (2025). Mobility lifestyles and residential dissonance; Effects on travel behavior, perceived health, and life satisfaction. *Transportation Research Interdisciplinary Perspectives*, *31*(March), 1–15. https://doi.org/10.1016/j.trip.2025.101405

Ranjan, R., & Sinha, S. (2025). *A systematic review of mode choice behavior in urban transportation with emphasis on individual preferences and influencing factor*.

Scheiner, J. (2020). Changes in travel mode use over the life course with partner interactions in couple households. *Transportation Research Part A: Policy and Practice*, *132*(June 2019), 791–807. https://doi.org/10.1016/j.tra.2019.12.031

Seyfi, S., Kuhzady, S., Rastegar, R., Vo-Thanh, T., & Zaman, M. (2025). Exploring the dynamics of tourist travel intention before and during the COVID-19 pandemic: A scoping review. *Tourism Recreation Research*, *50*(4), 701–714.

Sharma, A., Gani, A., Asirvatham, D., Ahmed, R., Hamzah, M., & Asli, M. F. (2021). Travel Behavior Modeling: Taxonomy, Challenges, and Opportunities. *International Journal of Advanced Computer Science and Applications*, *12*(5), 774–786. https://doi.org/10.14569/IJACSA.2021.0120590

Silm, S., Tominga, A., Saidla, K., Poom, A., & Tammaru, T. (2024). Socio-economic and residential differences in urban modality styles based on a long-term smartphone experiment. *Journal of Transport Geography*, *115*(December 2022), 103810. https://doi.org/10.1016/j.jtrangeo.2024.103810

Srinivasan Lakshmi Bhargavi, P. V., Ramadurai, G., Muthuram, V., K. K., & Srinivasan, S. (2007). *Determinants of changes in mobility and travel patterns in developing countries: Case study of Chennai, India*. https://doi.org/10.3141/2038-06

Srinivasan, S., & Rogers, P. (2005). Travel behavior of low-income residents: Studying two contrasting locations in the city of Chennai, India. *Journal of Transport Geography*, *13*(3), 265–274. https://doi.org/10.1016/j.jtrangeo.2004.07.008

Statistik, B. P. (2023). *Kota Malang Dalam Angka 2023. Badan Pusat Statistik, 1–458*.

Szeto, Y. L., Wong, R. C. P., Li, Y. C., W. Y., & Wong, S. C. (2017). *Spatio-temporal travel characteristics of the elderly in an ageing society*. https://doi.org/10.1016/j.tbs.2017.07.005

Tanjung, L. E., Dharmowijoyo, Yurnalis, F., Hartieni, P., Wicaksono, A., Puri, A., & Ali, M. (2023). The impact of activity travel participation on the individual's mental and social health. *AIP Conference Proceedings*, *2711*(January). https://doi.org/10.1063/5.0136982

Tantowi, A. (2022). *Determinants of domestic tourism demand in indonesia*. *7*(2), 185–196. https://doi.org/10.20473/jiet.v7i2.38817

Thøgersen, J. (2018). Transport-related lifestyle and environmentally-friendly travel mode choices: A multi-level approach. *Transportation Research Part A: Policy and Practice*, *107*(June 2016), 166–186. https://doi.org/10.1016/j.tra.2017.11.015

Tikoudis, I., Carrone, A. P., Mebiame, R. M., Lamhauge, N., Hassett, K., & Bystrom, O. (2024). *Household transport choices: New empirical evidence and policy implications for sustainable behaviour* (Issue 246).

Vanderschuren, M., & Lane-Visser, T. (2025). Transport equity in South Africa - How much progress was made over the last two decades? *African Transport Studies*, *3*(August 2024), 100057. https://doi.org/10.1016/j.aftran.2025.100057

Wang, Y., Li, L., Wang, L., Moore, A., Staley, S., & Li, Z. (2014). Modeling traveler mode choice behavior of a new high-speed rail corridor in China. *Transportation Planning and Technology*, *37*(5), 466–483. https://doi.org/10.1080/03081060.2014.912420

Wang, Z., He, S. Y., & Leung, Y. (2018). Applying mobile phone data to travel behaviour research: A literature review. *Travel Behaviour and Society*, *11*, 141–155. https://doi.org/10.1016/j.tbs.2017.02.005

Wicaksono, A., Nugroho, M. W., Dharmowijoyo, D. B. E., & Zainul Arifin, M. (2020). Initial study on the daily activity, trip arrangement, the use of ICT and social-economic characteristic in malang city. *Journal of Advanced Research in Dynamical and Control Systems*, *12*(3 Special Issue), 1101–1106. https://doi.org/10.5373/JARDCS/V12SP3/20201356

Wu, J., Wang, B., Ta, N., Zhou, K., & Chai, Y. (2020). Does street greenery always promote active travel? Evidence from Beijing. *Urban Forestry and Urban Greening*, *56*(September). https://doi.org/10.1016/j.ufug.2020.126886

Zhang, J., Wang, F., Shao, C., & Mi, X. (2020). Structural equation modelling of household long-distance flexible travel behavior. *International Journal of Sustainable Development and Planning*, *15*(4), 461–467. https://doi.org/10.18280/ijsdp.150406

Zhang, M., & Zhao, P. (2017). The impact of land-use mix on residents' travel energy consumption: New evidence from Beijing. *Transportation Research Part D: Transport and Environment*, *57*(October), 224–236. https://doi.org/10.1016/j.trd.2017.09.020

Zhang, Y., Manley, E., Martens, K., & Batty, M. (2024). A metro smart card data-based analysis of group travel behaviour in Shanghai, China. *Journal of Transport Geography*, *114*(March 2023), 103764. https://doi.org/10.1016/j.jtrangeo.2023.103764

Zou, Y., Han, W., Lin, B., Wu, B., Li, L., Wu, S., & Abid, M. M. (2023). Cross-Border Travel Behavior Analysis of Hong Kong-Zhuhai-Macao Bridge Using MXL-BMA Model. *Journal of Advanced Transportation*, *2023*, 1–12. https://doi.org/10.1155/2023/6690346