

An Exploratory Analysis of Transportation Household Expenditures in the Greater Sylhet Area in Bangladesh

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Abstract

In this study using data from Sylhet, Bangladesh, transportation expenditures are examined in detail for different income groups living in different natural and built environments. We employ Tobit models and a dataset of more than 22,000 persons in 4162 households to correlate transportation expenditures by separate income groups to land use, transportation and other infrastructure, as well as household and worker within household characteristics. Among other findings, urban high income households are not negatively affected by their environments. They have the ability to increase their transportation expenditures to reach most destinations and have access to almost all opportunities. This is vastly different from the urban poor; they are restricted by distance because most of their trips take place on foot. Moreover, rural workers are less affected by environmental indicators, presumably because they are restricted by their location and the lack of road networks near their residence. The lack of modal choices may be the determining factor on transportation expenditures. Lack of basic services increase expenditures, showing a link between underdeveloped or temporary housing and lack of near work opportunities.

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INTRODUCTION

Mobility in less developed countries is an area of increasing interest due to the rapid economic, environmental and social changes in these countries. The increased wealth, rapid population growth and increasing rate of motorization have led to increased congestion and pollution in large urban areas (1, 2, 3). This is led by increasing travel demand of urban commuters that continue to shift away from public transit towards faster, more convenient modes like personal vehicles and motorcycles (4, 5). In addition, growth in the number of vehicles is decreasing mobility for all transit users (6). Public transit users lose accessibility if the transit network does not keep up with urban development (1). As a result congested roadways severely affect the quality of travel for non-motorized modes, mostly pedestrians and cyclists. Very often both non-motorized and motorized vehicles use the same roads and there are no designated lanes or safe routes for non-motorized traffics away from high-speed traffic. In addition, roads are often in poor condition creating more hazards for non-motorized commuters (1). Although large urban areas may opt for major projects to handle this increase in travel (see <http://www.urbanrail.net/as/mumb/mumbai.htm>), smaller urban areas often rely heavily on walking and cycling and their safety and quality of life is continually threatened by the rapid pace of motorization (4).

In addition to mobility studies in less developed countries also examine accessibility. However, accessibility has been defined by the distance of one location (or neighborhood) to other specific locations, such as work or education (7). Distance does not consider secondary factors for accessibility, such as transit opportunities, route congestion or for non-motorized commuters, safety and quality of the route. While many studies focus on personal vehicle growth seen mostly in the top income quintile, fewer studies emphasize the effects of income on travel behavior and even fewer on expenditures for transportation and accessibility (3, 8). Income often defines mobility in developing nations especially for low income households that depend heavily on non-motorized modes (8) and they have tighter household budgets that restrict to very few options.

Although these examples show studies about transportation and development begin to emerge from less developed countries we still need more in-depth studies to explain relationships among travel behavior, social and economic circumstances and development. Even more important in rapidly developing countries is also the distribution of costs and benefits from development. In fact, early studies of rapid motorization seem to indicate that a small group of people gain the most from technological adoption. Before we study trends and changes it is important to understand some of the basic relationships between transportation and wealth.

A unique opportunity to start a study of this type is offered by a survey conducted on Sylhet City by the Urban Development Directorate of Bangladesh in July and August 2007 addressing travel behavior and urban infrastructure. Sylhet City is an urban area of approximately 0.6 million inhabitants making it a small urban city in comparison to typical urban areas in Southeast Asia (9). This study involves two separate surveys, one of the Sylhet City Corporation (SCC) served area, and of the surrounding rural areas that is not being served by the SCC. The survey within SCC involves 3042 households, approximately 5% of the total population. The survey outside SCC involves 760 households using the same survey format as in SCC. Separate analysis was done for both surveys and the findings are combined in this paper.

The main focus of this paper is on household expenditures for transportation by income segments. Income segmentation is important because of the relative impact expenditures may

have on the overall household budget at lower income levels. As we will see later in the paper this is an indicator that provides unique insights but it is also one aspect of transportation that to our knowledge has been neglected in the literature of both developed and less developed countries.

BACKGROUND

Bangladesh, officially the People's Republic of Bangladesh, is located in South East Asia. It is bordered by India, the Bay of Bengal and Myanmar. Almost all citizens are ethnically Bengali (98%) and practice Islam (83%). Land surface area is 133,910 sq. km, 58% is arable land including 3% of permanent crops. The terrain is mainly flat alluvial plain of the Ganges and Jamuna rivers and is very susceptible to flooding during the annual monsoon season and from cyclones formed in the Bay of Bengal (10). The hilly regions of Bangladesh are the Chittagong Hill Tracts to the southeast and the Sylhet District to the northeast, which is the area we analyze here.

Population of Bangladesh is estimated at 156 million growing approximately 2% annually. A third of the population is under the age of 15 and the median age for both genders is 22.85 years. Over 30% of the population lives in urban areas while 85% of the poor population lives in rural areas. Since poverty is mainly confined to rural areas, urban areas are experiencing increased immigration and denser living conditions (11).

Bangladesh is considered a developing nation with an estimated GDP of \$206.7 billion growing at 5-7% since the 1990s. Nearly two thirds of its' 69.7 million labor force is employed in agriculture and over half in the service sector (10). Poor infrastructure at ports and power supply, corrupt governance, weak education system, frequent flooding and natural disasters have limited economic growth (12). Health standards have also suffered since flooding of alluvial areas introduces water-borne diseases and pollutants in water, such as arsenic or pesticides. Lack of clean drinking water during and after a flood creates serious public health risks such as typhoid, cholera, hepatitis A, and multiple mosquito-borne diseases (13). Overall, health and education improvements are higher than most low income nations and overall economic stability has led to improving conditions (12). Transportation networks in Bangladesh include waterways, rail and roadways. Roads carry 80% of passenger traffic, rail carries 10% of passenger and freight traffic. Waterways carry 40% of foreign trade and are essential for travel during floods. In 2003, 3,060 km of waterways were used as cargo routes; of the estimated 239,226 kms of road lengths only 22,726 kms are paved (14). Almost all of the roads in the urban areas are paved and being maintained regularly, but a large part of the rural roads in Bangladesh are often unpaved and are washed out during flooding of the southern plains. The lack of permanent roads and poor transport service hinders movement of goods and easy movement of labor force, disrupting micro and macro economies. While the lack of extensive paved road networks limits overall mobility, access to transportation limits transit options. On average urban commuters must travel 1.25 kms and rural populations must travel 5 kms (15). In addition, only 39% of the rural population has access to permanent roads and thus all season mobility. As a result, rural populations often have access to seasonal roads and long distances to transportation stops. The overwhelming poverty in rural areas goes hand in hand with restricted economic opportunities.

SCC SURVEY STATISTICS

This paper is about Sylhet city, Bangladesh and the surrounding rural areas. Sylhet is located in the northeast corner of Bangladesh in the hilly, tea garden agricultural areas. The location and elevation of Sylhet prevent flooding from severely affecting its rural and urban areas so monsoon effects and seasonal availability of roadways are not considered in this study. The survey area is illustrated in Figure 1 with road networks as provided by the Ministry of Planning, Bangladesh.

Survey statistics from the SCC datasets show household size and average monthly expenditures (Table 1). On average a household has 5.5 members of which 36% of persons are employed, excluding home makers, both within and outside of SCC. In fact, both surveys had very similar family demographics with similar percentage of females per household and percentage of home owners. Percentage of children per household is very low; 21% of households within SCC and 14% of households outside SCC did not report any children in the household. Total number of children of the total population averages 33%, similar to the national average. Average monthly expenditures differ between urban and rural households; the average total expenditures within SCC are 7300 taka higher per month than outside SCC. Household expenditures are highest for food, shelter, education and transportation. Food is the highest expenditure and like education, is not substantially less in rural areas. Other expenditures such as rent, transportation and health are lower outside SCC and may be attributed to different opportunities than can be found in the urban environment within SCC.

Modal options in and around SCC are limited; commuters often choose non-motorized modes, such as walking or taking a human powered (paddled) rickshaw. Trip distance has a large impact on mode choice; short distances show different modal distribution than long distances. In Sylhet over 90% of trips recorded fall within a 5 km radius. This compact activity space (the space within which all activities and travel take place in a day) allows modal distribution to be dominated by walking and rickshaws, both non-motorized forms of transportation (Table 2).

Trip distance distribution among all modes was analyzed for the SCC area and its' surrounding areas. The activity space for commuters in Sylhet is mostly within a 5 km radius; 94.4% and 92.6% of trips fall within 5 kms both in the SCC area and outside, respectively. Again, non-motorized forms of travel are sufficient to meet commuters' needs. Modal distribution of trip lengths (Table 2) shows commuters living within SCC area depend heavily on rickshaws and it accounts for the largest percentage of mode use across all trip distances over 1 km. Interestingly, personal vehicles, cars and SUVs, are used less as trip distance increases, this may be a factor of high fuel and maintenance costs in this area.

Small urban areas are characterized by dense living areas with frequently available public transit, high pedestrian and cycle commuters and heavy reliance on non-motorized modes and Sylhet is no exception (4).

Reported household income was clustered into five quintiled income segments for SCC and outside SCC households. Table 3 below shows the income distribution used to define the income segments used for descriptive analysis and for regression analysis. Creating separate income segments for each survey was necessary to create true income segments for analysis. The first income segment, labeled as '< 5000 Taka' within SCC and '< 1625 Taka' outside SCC represents the lowest income households and are considered poverty level. Poverty level computed for within SCC (< 5000 Taka monthly) was confirmed through the Ministry of Planning, Bangladesh but was assumed for household incomes outside SCC. This income segment often looks very different in mode choice distribution and distance traveled due to their

extreme poverty. It is important to note there are only 98 individual cases in the poverty segment outside SCC limiting the ability to use regression analysis.

In general, higher income segments in SCC have higher transportation expenditures due to higher use of costlier modes such as cars and motorcycles (see Table 4). Walking is most frequently used by poverty level households and in SCC rickshaws are the secondary form of transportation (Table 4). Poverty level commuters living outside SCC are almost completely restricted to walking to destinations. It is important to note that outside SCC walking is the most frequently used form of transportation across all income levels, but the use of rickshaws or buses gradually increases with income.

Modal distribution changes with increasing distance traveled and frequency of motorized modes increase with income. These are preliminary findings that show in SCC and outside SCC the majority of trips fall within 1 km and commuters mostly walk those trips. However, high income households do not walk often and are the highest users of rickshaws, taxis and motor vehicles increasing their average transportation cost and distance traveled. These relationships are further analyzed by considering transportation expenditure as a function of socio-demographic circumstances and a variety of other influential factors.

TRANSPORTATION EXPENDITURE ANALYSIS

Household travel time and expenditure budgets are important indicators from a variety of transportation policy analysis viewpoints (16). In this paper we examine observed heterogeneity in household expenditures for transportation. Expenditures may provide information about households' ability to use their mode choice options not solely based on availability or distance traveled but also as the result of a resource allocation decision making process at the household level. Preliminary regression analysis of transportation expenditures for this study used income as a set of explanatory variables but found that income segments had vastly different correlations with all other variables. This suggests income segments have very different mean expenditures and are differently affected by other significant indicators. All this shows a need for separate transportation expenditure regression models for each income segment. We examine expenditures as a function of the built and natural environment, household characteristics, individual head respondent to the survey, and trips reported. The natural and built environment is described by land use and availability of amenities, road characteristics and access to the transportation network, and a set of location-specific indicators capturing all locational characteristics that are not included as explicit explanatory variables. Household transportation expense was regressed using a Tobit model.

A Tobit model is a censored regression model used for continuous dependent variables (y-values) that have a substantial number of zero values. The Tobit model performs two regressions, one on y-values greater than zero where beta values are found for explanatory variables. This part is similar to a linear regression analysis and the goodness of fit is measured by analysis of variance statistics and log-likelihood statistic. The model performs a second regression on dependent cases that have a value of zero to see if households that had no recorded transportation expense were significantly different from households that recorded household transportation expenditures. In this study all Tobit regressions showed a high significance for households in each income segment with no recorded transportation expenditure.

Since the two surveys were conducted in two separate areas of Sylhet city, the surveys were not combined into one dataset for this study. The results below are categorized by the

general indicators discussed and both SCC and outside SCC results are discussed. The Tobit results shown in this paper (Tables 5, 6) contain indicators that were significant for most income segments with corresponding beta and t-test values. Again, the first income level quintile for households living outside SCC only contained 98 people. The small size of this sample made regression analysis difficult and was not included in Table 6 or the analysis.

Built Environment

Land use, road characteristics, anchor points, and location indicators represent the built environment in this study. It is the result of infrastructure development in the past and it is one of the main objectives for the study from which we extracted the data used here.

Some of those indicators were used in the model to determine how development affects each income segment in its expenditures.

Infrastructural development in and around SCC includes density, access to basic services, accessibility to work or education opportunities, that have a significant factor in transportation. First, density plays a different role for households in different income levels. Living in lower density residential areas has a significant effect on expenditures, low income households spend less, while high income households spend more. Low density areas have opportunities for low income households; they spend less for travel. However, high income households spend more to travel to work, education and shopping destinations and is illustrated in Table 4 by the increased use motorized modes. Thus, opportunities not available in low density areas are still reachable by high income households but low income households are restricted by density.

Rural areas outside SCC have fewer infrastructure indicators than within SCC. For rural commuters, the average income level of the residential area of the household significantly affects expenditures. Low income areas decrease transportation expenditures for lower income households and increase expenditures for high income households. Similar to low density areas, low income areas provide needed services for low income households, decreasing their expenditures. Low income areas can lack mode choice, leaving walking or cycling as the only affordable options for poor households. This shortens distance reached and reduces opportunities available. High income households spend more to access opportunities found in higher income areas; they are not limited based on residential location. Briefly, high income households can use costly forms of transportation while low income households will be forced to use non motorized options by lack of choice and thus decreasing their total expenditures.

Access to drinking water is an indicator of basic services available to households of all income levels. Within SCC 21.8% to 28% of households in all income categories do not have access to safe water. High income households have higher than average expenditures with access to safe water, possibly due to generally higher living costs and standard of living. All other income segments have lowered expenditures, simply indicating access to amenities in developing nations significantly affects commuter behavior. Households outside SCC access to adequate water is significant for most income levels but the model does not show a relationship between increasing income and transportation expenditures.

An adequate usable/safe water supply is significant for all income levels and generally decreases transportation expenditures for households within SCC. Households living in the rural areas outside SCC are significantly affected by access to enough water, but there is no obvious trend between income and expenditures. Another significant indicator is quality of the sewerage system of the household. This is a strong indicator of the cleanliness and overall development of

the residence, but may not be an indication of nearby transportation services. Planning in urban areas of developing nations may have modern sewerage system in a new apartment building next to a slum with no running water. Thus a hygienic sewerage system is significant for households within SCC but without an obvious trend based on income segments. Rural households outside SCC have lowered transportation expenditures when they have access to hygienic sewerage systems possibly indicating higher development.

Distance to anchor points is often an indicator of accessibility to general household needs and how households may decide on housing locations. The survey included distance to anchor points, such as markets, retail locations, educational and transit facilities and the perceived quality of these locations measured as good, moderate and bad. Markets are a necessary destination for all households and distance to a market is significant but the beta values shows small increases in expenditures for low income households in SCC. High income households do not face this challenge; their costs actually decrease with increased distance. High income households can avoid poor market quality; they are able to choose their markets, and their expenditures increase when the closest market is perceived as low quality. They spend more to travel farther distances to better markets and more choices. Other anchor points such as distance or quality of bus and rail stations, proximity to worship places are significant for most income levels but do not a trend that follows increase in income level.

Urban areas tend to have greater number of locations and choice of services and will influence households differently than in rural areas. As a result, there were not as many anchor points with significance across most income levels outside of the SCC area. Increased distance to a market increases expenditures but increased distance to retail locations actually decreases transportation expenditures. A library can indicate educational institutes, higher educational work opportunities and high income households living in close proximity to a library spend less on transportation. Even high income households will spend less on transportation if good opportunities are close. As seen earlier, high income households are not restricted by distance and have the means to spend more to reach farther services than is possible for low income households.

Road accessibility (road characteristics in Tables 5 and 6) indicates development near the households' residence and their employment and other opportunities. Findings within SCC illustrate a typical urban area where road characteristics affect the availability of modes and thus expenditures. The width of roads increases transportation expenditures for the low three income segments. This is expected since roads need to be wide enough for motorized forms of transportation and thus as width increases, expenditure increases. Another indicator is the type of road closest to households, paved or non-paved. Paved roads are accessible to non-motorized modes and thus expenditures increase. Poverty income households spend less when living near a paved road possibly due to increased opportunities in smaller distances where road networks are permanent. It is interesting to note while the urban poor are still limited by their income, areas with high density and high levels of development may provide enough opportunities within walking distance.

Rural areas of Bangladesh often do not have similar road infrastructure and road characteristics as seen in urban areas. Motorized traffic bearing roads can be sparse, and thus the road network characteristics for rural commuters did not have much. Road distance and type (paved or not) was significant for low income and high income households; low income households spend less for transportation when their residence is close to a paved road. Again, higher development suggests more opportunities in close proximity to home. High income

households are inclined to spend more for transit when living close to a paved road, perhaps due to a preference for motorized modes as illustrated in Table 4.

Household and Individual characteristics

Since expenditures were recorded as single value for all household members fewer individual and trip indicators were significant for all income levels. Overall, more household members lowers transportation expenditures. As seen earlier, large families does not indicate many children; large families may indicate older members that have fewer trips and decreased overall expenditures. Immigration status of the head of households was significant for households living within SCC, non-native low income households have higher than average expenditures. Further research into non-native occupations and distance to travel may help to understand why immigrant status increases expenditures.

Education level was not highly significant but since the segments were based on income education level attained will be highly correlated and was generally not significant as an explanatory variable. As an exception, individuals with a masters or higher living outside SCC have a significant increase in transportation expenditures. Commuters aged 15-17 and over the age of 35 living within SCC show a significant increase in transportation expense, but there was no trend to age and transportation expenditures outside SCC. Occupation segments do not show significance across income segments outside SCC but persons within SCC in manual labor positions have lower than average household expenditures. Other occupations, such as employed in home duties, a student or working in business did not affect expenditures.

Location

The study included ward number for within SCC households and mauza number for households outside SCC. Wards are found within municipalities and are administrative units identified by number. Mauzas are administrative units outside the SCC area and are also identified by number. The survey area is illustrated in Figure 1 including ward borders overlaid with the road networks as provided by the Ministry of Planning, Bangladesh. Road network complexity and overall accessibility within the urban inner area is much higher than in the rural outlying areas. Locational bias is overcome by including the ward or mauza of residence in the Tobit models. This may capture a variety of natural characteristics not included explicitly as explanatory variables. As a result, some wards were significant for most income segments and those wards are included in the regression models. Among those are wards 5, 14 and 21 labeled in Figure 1. These wards do not have higher road network density than other wards but expenditures are significantly affected for commuters in that area. More detailed study of demographics and transit connections in these wards may increase understanding of commuter behavior. Outside SCC respondents live outside the ward boundaries and within the outer SCC boundary. Respondents listed in which mauza they resided which was included in the Tobit regressions and a few mauzas were significant for most income levels. They are included in table 4, but further research will include more location data such as mauza boundaries, topography, land use characteristics, etc.

SUMMARY

This study looked at the differences between income segments and how their environment limits their ability to use all modes of transportation available. Since modal distribution is limited and trip distances are so low, built environments and socio-demographic indicators do show differences among income segments.

One finding is that urban high income households are not negatively affected by their environments. They have the ability to increase their transportation expenditures to reach most destinations and have access to almost all opportunities. This is vastly different from the urban poor; they are restricted by distance because most of their trips take place on foot. Rural commuters have fewer environmental indicators that affect their mode choice behavior and are restricted by their location and the lack of road networks near residence. The lack of modal choices due to slow development in rural areas may be the determining factor on transportation expenditures for rural commuters.

Studies have found location to be the main determining factor for accessibility but this study looked for the indicators within all locations that can impact household choices. As stated earlier, high income households have few significant indicators because their income overcomes any environmental obstacles to travel. For the remaining households, the lack of basic amenities has a significant effect on household expenditures showing a link between underdeveloped or temporary housing and lack of accessible work opportunities.

Although this study identified relationships that make intuitive sense, it also identified relationships that lead us to question the type of income segmentation and the use of the explanatory variables. Future research will attempt to create clusters of households and their commuters not solely dependent on income but based on indicators used for this study. More sophisticated clusters will show population segments that face different constraints in a more complete way and identify barriers to their ability to reach opportunities. In addition, detailed land use and urban density map, showing actual road networks and overall development in and around SCC will also be used to study in detail the environment and its impact on individual expenditures.

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FIGURE 1 Road Network of Sylhet City Corporation and Ward Location

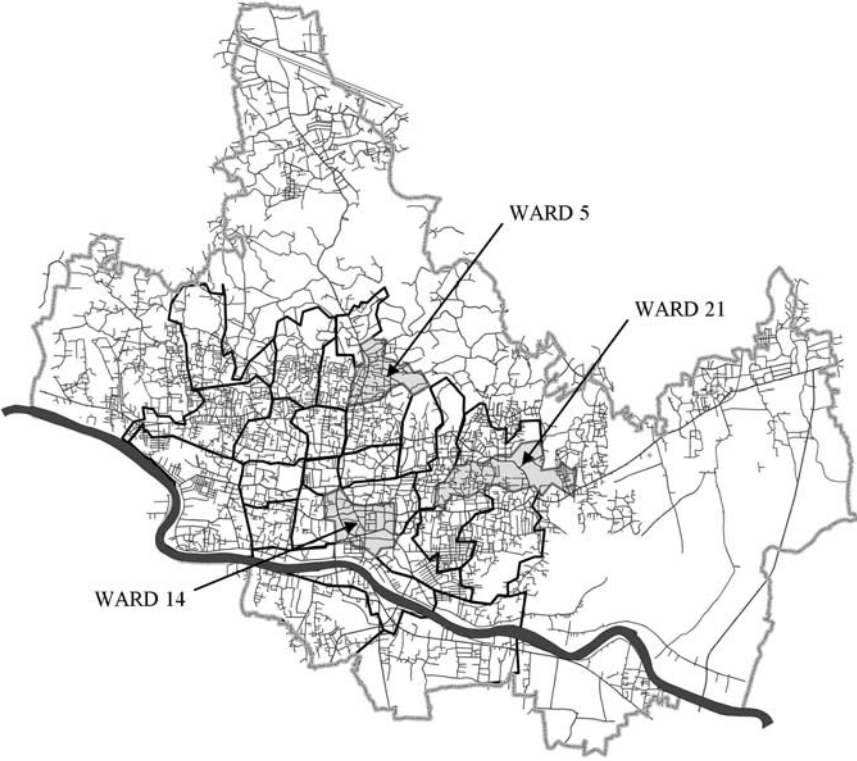


TABLE 1 Survey Statistics

Survey Statistics	SCC Area	Outside SCC Area
Average household size	5.54	5.6
Number of employed persons	6516	1551
Average number of females per household	2.46	2.44
Number of children under 5 per household	0.4	0.6
Number of children aged 5-14 per household	0.9	1.2
Number of children aged 15-17 per household	0.4	0.4
% home owners	55.1	53.8

Expenditure statistics (in Bangladesh Taka)	SCC Area	Outside SCC Area
1 USD = BDT 69		
Average total income	19100	11800
Expenditure for house maintenance	809	453
Expenditure for house rent	3392	1835
Expenditure for food	6302	5033
Expenditure for transport	1194	742
Expenditure for health	756	505
Expenditure for clothing	1033	493
Expenditure for education	1958	1150
Expenditure for electricity, fuel, telephone etc.	1183	810
Expenditure for festival	647	414
Expenditure for others	1331	855
Total number of respondents	18409	4264

TABLE 2 Percentage Modal Distribution of Trip Lengths Within SCC Area

Trip Length	Rickshaw	Bicycle	Motor -cycle	Car, SUV, Micro -bus	Bus	Baby taxi, Tempo	Walking	Other	Total
< 1	20.4	0.6	0.7	0.6	0.2	0.1	25.6	0.6	48.8
1—3	24.6	0.5	1.8	0.9	0.7	0.4	5.8	0.1	34.8
3--5	6.9	0.3	0.7	0.5	1.0	0.4	1.0	0.0	10.8
5—7	2.0	0.1	0.3	0.2	0.6	0.2	0.2	0.0	3.6
> 7	0.9	0.0	0.2	0.2	0.6	0.2	0.2	0.0	2.3

Outside SCC Area

Trip Length	Rickshaw	Bicycle	Motor -cycle	Car, SUV, Micro bus	Bus	Baby taxi, Tempo	Walking	Others	Total
< 1	6.8	0.7	0.4	0.5	1.7	0.9	43.8	9.9	64.7
1—3	4.8	1.0	0.8	0.3	2.8	2.7	6.0	1.3	19.7
3--5	2.0	0.3	0.1	0.3	2.1	1.5	1.4	0.5	8.2
5—7	0.8	0.1	0.1	0.3	1.4	1.1	0.4	0.2	4.4
> 7	0.5	0.1	0.2	0.1	1.4	0.6	0.2	0.0	3.1

TABLE 3 Income Segments Description

Income Segment in SCC Area	Number of hholds	Income Segment Outside SCC Area	Number of hholds
Income < 5000 taka monthly	1066	Income < 1625 taka monthly	98
Income > 5000 & <= 10000 taka monthly	3921	Income > 1625 & <= 7000 taka monthly	1628
Income > 10000 & <= 16000 taka monthly	4486	Income > 7000 & <= 12000 taka monthly	925
Income > 16000 & <= 25000 taka monthly	4789	Income > 12000 & <= 20000 taka monthly	854
Income > 25000 taka monthly	4144	Income > 20000 taka monthly	759
Total	18406	Total	4264

TABLE 4 Mode Choice Distribution by Income Level, in Percentage Within SCC Area

Mode choice	Income levels					Average
	< 5,000 Taka	5,000 - 10,000 Taka	10,001 - 16,000 Taka	16,001 - 25,000 Taka	> 25,000 Taka	
Rickshaw/Van	22.5	43.6	58.2	67.6	63.6	51.1
Bicycles	1.3	2.1	1.9	1.4	0.8	1.5
Motor cycle	0.0	0.5	2.8	4.4	7.3	3.0
Car/Zeep/Micro- bus	1.0	0.3	0.3	1.5	7.5	2.1
Bus	1.3	2.2	3.3	3.4	3.5	2.7
Babytaxi/Tempo	0.3	1.2	1.8	0.9	1.4	1.1
On foot	72.0	49.0	31.2	20.4	15.5	37.6
Others	1.8	1.2	0.5	0.6	0.3	0.9

Outside SCC Area

Mode choice	Income levels					Average
	< 1,625 Taka	1,626 - 7,000 Taka	7,001 - 12,000 Taka	12,001 - 20,000 Taka	> 20,000 Taka	
Rickshaw/Van	2.1	7.1	17.1	24.8	25.6	15.4
Bicycles	0.0	1.0	1.0	1.6	1.4	1.0
Motor cycle	0.0	0.0	1.0	5.1	4.3	2.1
Car/Zeep/Micro- bus	0.0	0.1	0.5	1.3	4.3	1.3
Bus	0.0	3.6	14.3	19.7	19.1	11.3
Babytaxi/Tempo	2.1	3.4	9.0	6.4	8.7	5.9
On foot	95.7	83.8	56.5	39.2	36.5	62.3
Others	0.0	0.7	0.5	1.9	0.0	0.6

TABLE 5: Regression Coefficients and (T-test) Values of Tobit Regressions by Income Segments, within SCC Area

Indicators	< 5,000 Taka		5,000-10,000 Taka		10,001-16,000 Taka		16,001-25,000 Taka		> 25,000 Taka	
	Beta	T-test	Beta	T-test	Beta	T-test	Beta	T-test	Beta	T-test
Sigma	314.3	40.3	420.3	84.5	595.1	94.2	778.1	96.8	1591.9	90.1
Built Environment										
Density of area	-111.8	-4.5	-28.8	-2.0	52.2	2.2			307.9	4.7
Quality of water	-155.2	-2.3			70.5	2.2	382.7	10.2	379.3	4.8
Quality of sewerage system			32.1	2.6	-64.1	-3.6	67.1	2.5		
Adequate water supply	-74.1	-1.8	9.1		-235.9	-2.2	-658.9	-5.2	1346.0	2.2
Distance to market	0.8	2.2	42.9	3.8			-137.7	-8.8	-84.3	-1.9
Quality of market	-81.8	-3.4	-50.9	-4.6				7.4	170.2	3.1
Distance to bus/tempo stand	36.0	4.4	0.1	-4.6	26.7	4.4	-1.0	-3.4	-0.2	-2.6
Quality of worship place	83.6	2.4	-34.7	-1.7	-83.4	-3.1			-0.1	5.4
Road Characteristics										
Dist. to traffic bearing road	44.8	2.8	35.4	3.8						
Width of road of residence	70.7	3.0	81.8	5.8	93.1	5.0				
Type of road of residence	31.6	3.8			-19.7	-2.1			-152.8	-4.5
Household Characteristics										
Is residence owned	-181.7	-2.7	215.8	3.2	187.3	7.2	180.0	5.3		
Home structure type	65.0	3.3	63.5	5.1			63.3	2.3		
Number of household members	-21.3	-2.7	-45.1	-10.2	-45.0	-8.6	-28.5	-4.8		
Source of fuel for household	48.9	3.5			40.5	2.8	-35.7	-1.7	-138.5	-2.8
Is head of household local born	124.7	3.3	-134.8	-6.4	-46.8	-1.9			110.6	1.6
Individual Characteristics										
Upto masters/high degree	106.4		-98.2	-3.6			55.0	2.0		
Aged 15-17			191.8	2.3	149.6		-424.9	-3.4	460.2	2.0
Aged 35-59	79.7	2.6	201.8	2.5	182.2	1.9				
Aged over 60	148.8	2.5	254.2	3.0	190.0	1.8			405.8	1.7
Occupation: manual labor	-64.4	-2.0	-147.0	-4.6	-83.1	-1.8				
Trip Characteristics										
Trip purpose	-16.8	-1.9	9.7	1.8	13.4	2.0	-33.5	-3.8		
Trip problems	30.1	1.8			10.9	-2.0			-43.0	-2.9
Trip distance	41.9	2.2					78.3	5.9	78.9	2.9
Location indicators										
Ward 5	-176.3	-2.0	-184.6	-4.8	-279.9	-4.9	184.3	3.2	1303.9	9.1
Ward 14	-32.8		-133.1	-4.2	-459.7	-10.4	-318.6	-4.9	-548.2	-3.3
Ward 21	177.8	2.9	-133.2	-2.7	-599.8	-10.1	-356.0	-3.9	-1338.3	-6.9

TABLE 6 Regression Coefficients and (T-test) Values of Tobit Regressions by Income Segments, outside SCC Area

Outside SCC Area								
Indicators	5,000- 10,000		10,001- 16,000		16,001- 25,000		> 25,000	
	Taka		Taka		Taka		Taka	
	Beta	<i>T-test</i>	Beta	<i>T-test</i>	Beta	<i>T-test</i>	Beta	<i>T-test</i>
Sigma	171.7	52.1	194.3	41.7	546.0	41.3	479.8	39.0
Built Environment								
Income level of residential area	-70.8	-7.7	-138.3	-9.7	462.9	8.9	112.6	2.0
Household affected by earthquake	46.7	2.9	56.5	2.5			-299.7	-3.3
Waterlogging in locality	-41.5	-3.8	-37.7	-2.2	-304.9	-6.5	524.5	9.2
Quality of sewerage system	-18.5	-2.5	-46.7	-3.2	149.7	3.8	-810.7	-11.5
Adequate water supply available			248.7	4.4	-577.1	-6.3	4202.3	7.5
Distance to market	18.4	4.1			140.0	8.6		
Distance to retail	-11.8	-4.2			-28.5	-3.0		
Distance to library	43.9	4.1	-20.4		-29.8	-4.0	-828.9	-13.9
Distance to worship place	-15.4	-2.9	121.3	3.7			207.5	5.0
Quality of worship place	62.2	5.1	-71.3	-4.2	148.9	2.2		
Road Characteristics								
Presence of lamp post on road	34.2	2.5	71.3	3.6			351.2	5.6
Household Characteristics								
Number of floors in residence	34.0	4.2			-161.2	-3.4	-247.1	-8.6
Number of household members	-8.4	-2.8	-18.8	-4.5	-115.3	-9.3	91.0	6.8
Individual Characteristics								
Upto masters/high degree	83.6	2.1	79.9	2.9			113.0	2.4
Trip Characteristics								
Trip distance	13.7	1.7	50.5	5.0	69.9	3.2		
Trip duration	-0.9	-2.3	-3.5	-4.8	-3.2	-2.3		
Location indicators								
Mauza 13	-75.2	-3.0	-140.6	-4.2	226.2	1.7		
Mauza 16	118.2	3.3			331.7	3.5	407.5	4.1
Mauza 17	173.3	9.3	151.7	4.3			632.5	3.9
Mauza 18	123.6	3.7	-99.5	-2.5			-3221.3	-13.0
Mauza 20	0.0	0.0	154.9	3.9	-241.2	-2.1	-1552.6	-5.2