

Changing Modes of Transportation: A Case Study of Rajshahi City Corporation

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Abstract: *This paper presents findings of a comparative study of the changing mode of transportation in a selected city area in Bangladesh. Battery operated auto-rickshaws are a newly introduced vehicle in city areas and took the place of rickshaw because of cheap cost and comfort. We selected Rajshahi City Corporation (RCC) as a sample area, because rickshaws and auto-rickshaws are widely used for daily travelling. Based on primary data, this study tried to show the socio-economic conditions, which ultimately influence the income of auto-rickshaw drivers and rickshaw pullers. Here, linear regression model is used to estimate the income determinants. In case of auto-rickshaw opportunity cost, family member, and other costs have significant impact on income while ownership, age, education of auto-rickshaw drivers have insignificant impact. In the case of rickshaw other costs and family members have positive and significant effect on income, but education, ownership of vehicle and opportunity cost have been found insignificant here. To increase the income of auto drivers as well as rickshaw pullers, the number of rickshaw and auto-rickshaw must be limited in city area and the vehicles should have licence issued by proper authority.*

1. Introduction

Economic development and transportation are closely related. Transport is important because it carries not only passengers but also enables trade among people, which is essential for the development of civilization. Transport or transportation

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is the movement of people and goods from one place to another. Mode of transport is a term used to distinguish substantially between different types of transport. The most dominant modes of transport are aviation, land transport (which includes rail and road) and water transport. Other modes also exist, including pipelines, cable transport and space transport in different countries of the world. Three types of transport are popular in Bangladesh where most of the people use road transport for their daily travelling and transporting goods. Vehicles travelling on road and rail networks include trains, buses, trucks, car, automobiles, rickshaws, auto-rickshaws, bicycles, etc.

Bangladesh is a developing country in South Asia where rickshaw, van and bi-cycle are most important vehicles in urban and rural areas. The word rickshaw's origin lies in the Japanese language, and it literally means "a human-powered vehicle". The first known use of the term was in 1887. It is used all across the world, but more commonly in the Asian countries, especially in India and Bangladesh. The rickshaw began as a two or three-wheeled passenger cart, called a pulled rickshaw, generally pulled by one man with one or two passengers. The rickshaw is one of the oldest modes of transportation, and a source of employment for male labours in Bangladesh since the 19th century. Their popularity declined as cars, tempo, laguna, baby taxi and other forms of transportation became widely available. The various types of rickshaws also evolved over time with the earliest ones being the pulled-rickshaws. Other variations of the mode of transport include the cycle-rickshaw, the auto-rickshaw and the relatively newer iteration of the e-rickshaws (electronic rickshaw).

Auto rickshaws are becoming more popular in some cities in the 21st century as an alternative to taxis because of their low cost. Auto-rickshaws are a common means of public transportation in many countries in the world. Also known as a three-wheeler, samosa, tempo, tuk-tuk, trishaw, autorick, bajaj, tricycle, mototaxi, baby taxi or lapa in popular parlance, an auto rickshaw is a usually three-wheeled cabin cycle for private use and as a vehicle for hire.

Battery operated auto-rickshaw is a newly added para-transit mode in urban transportation system of Bangladesh. The mode, introduced in 2008 in Bangladesh, attains much popularity among urban passengers since it involves lower travel cost than other locally available transport modes as well as it provides reasonable safety and comfort to the users during travel. This popularity in turn results in rapid growth of the mode in urban areas of Bangladesh. Now, the mode has become an inseparable part of urban people's mobility network, especially in small-compact towns. Before 2008, rickshaw was the major transport vehicle in Rajshahi City Corporation (RCC) area for travelling short distance but now battery run auto-rickshaw has become popular for easy travelling and cheap cost. According to a private survey, there are nearly 11,000 battery operated auto-rickshaws, 35,000

rickshaws, 800 CHG-rickshaws and auto-tempos, 1,500 human haulers, 1,200 rickshaw vans and 1,500 cars and micro-buses in Rajshahi Metropolitan area (Rusho, 2014). According to RCC sources, there are more than 10,000 auto-rickshaws and 30,000 rickshaws moving in the city area and the RCC officials claimed that they have issued licence to 20,000 rickshaws and 1500 auto rickshaws (Feroz, 2014 and Atik, 2014).

The popularity of auto-rickshaw has increased because of less rent and one can quickly reach his destination. On the other land, the use of rickshaw has decreased day by day because of high rent and less speed. Before introducing auto-rickshaw in Rajshahi city area, a rickshaw puller earned Tk. 300 - Tk. 400 daily, where their present income is on an average Tk. 150 – Tk. 200 daily. On the other hand, the daily average income of an auto-rickshaw driver is Tk. 800 - Tk. 1000. Because of high income and less laborious work, lower class as well as lower middle class people show more interest in driving auto-rickshaw. At the same time the rickshaw puller has left this job because of poor income and high laborious work and has migrated to other jobs. It is easily seen that there is a sharp income inequality among the rickshaw pullers and auto-rickshaw drivers. To find out the determinants of income of rickshaw pullers and auto-rickshaw drivers we have set the following sub objectives in this paper:

1. To analysis the socio-economic condition of rickshaw pullers and auto-rickshaw drivers;
2. To investigate the nature of income and cost of rickshaw pullers and auto-rickshaw drivers;
3. To identify the key determinants of income of rickshaw pullers and auto-rickshaw drivers;
4. To find out the problems of rickshaw pullers and auto-rickshaw drivers and forward some policy suggestions.

2. Literature Review

Extended studies have been done on different aspects and issues of auto-rickshaws and rickshaws. Most of the studies tried to show the socio-economic conditions of the rickshaw pullers and energy consumption of auto-rickshaw. Generally, the researchers used the technique of tabular analysis for comparison between previous and present mode of transport.

Rahim et al. (2013) showed that auto-rickshaw reduces unemployment problem near about 2%. This study calculated the amount of energy consumed by the battery driven auto-rickshaw and it was near about 10 kilo-watt per charging. It can travel at an average distance of 150 km per charging. This study also found that battery driven auto-rickshaw has increased the income, social status, comfort and decreased the unemployment problem.

Rana et al. (2013) tried to show that battery operated auto-rickshaw offers lower travel cost than rickshaw and greater travel comfort than other urban para-transits like auto tempo, nosimon and public transport like minibus and therefore attract urban passengers significantly from those modes. They found that although this mode creates pressure on local electricity supply, energy consumption by the mode can be negotiated as the mode is liable only for 1.53 hours of load shedding a day which takes place at off-peak period (between 11:00 pm to 7:00 am) at night.

Rana et al. (2012) tried to show that investment on auto-rickshaw is highly economically beneficial as it involves an income-cost ratio of 1.85. On an average, income of individual operators from their previous occupations was BDT 251.75 per day while driving of this mode of transport has doubled it now. In addition, around 21% of the operators were unemployed previously who are now offered with employment opportunities by this mode. Around 38% of total operators intended to migrate to Dhaka, if the mode were not introduced in their towns.

Rana et al. (2013a) said that around 88% of urban passengers are availing this mode now to meet their travel demand. The mode attracts urban passengers mostly from rickshaw and also considerably from nosimon, auto-tempo and minibus through offering a set of benefits over those modes, such as, lower travel cost than rickshaw, greater comfort than minibus, nosimon, auto-tempo, limited but acceptable travel speed and satisfaction quality of service. They suggested that scientific outcomes might assist transport planners in modeling for efficient transportation in the mixed traffic condition where battery operated auto-rickshaw co-exists as well.

Islam and Sarker (2008) showed in their study that educational qualification is negatively related with the rickshaw puller earnings in Sylhet. They also found that expected higher earning is an important factor to accelerate the rural urban migration. On the other hand per capita wealth holding and per capita saving undermine the rural urban migration. Likewise, per capita loan was expected to be positively related to the rural urban migration but surprisingly it is found here negatively related with rural urban migration.

Singh (2014) has undertaken a comprehensive study on socio-economic impacts and the technical characteristics of e-rickshaws in Delhi. The study shows the positive role of this industry in urban employment and income generation and the various problems that affect the system. E-rickshaw has some clear merits and some demerits.

Rahman (2013) showed around 700,000- 800,000 rickshaws were operating in Dhaka city in 2012 and employed over one million people. Everyday about 7 million passenger trips are made in Dhaka by rickshaw over a distance of 11 million passenger miles. The rickshaw pullers are doing very hard job. Two or three persons sit on a rickshaw and the driver pulls or drives it by hand or foot. It

is very much inhumanity. He suggested the way to save rickshaw pullers from doing very hard job by using electric motor instead of pull or drive manually and the rickshaw will take charge from Grid Line in off-peak time.

Rahman et al. (2008) analyzed a preliminary framework for the future place of the Non-Motorized Public Transport (NMPT) rickshaw and explore the problems as well as opportunities for its sustainable co-existence in a mixed mode transport stream that best meets the network performance needs of Dhaka.

Rahman et al. (2009) in their paper provide a brief preliminary analysis of the existing condition of non-motorized public transport (NMPT) sector throughout the developing world, especially those with dominant NMPT market, using Dhaka as a case application. The multi dimensional non- transport contribution (social, economic and environmental) of the NMPT industry is also established through analysis which admits its significance as an integral part of the overall urban system in many developing cities.

Iqbal (2013) in his research paper has compared the battery operated easy bike with CNG operated auto rickshaw in terms of cost (operating cost, manufacturing cost, maintenance cost), user benefit and environment issue. From the study it is seen that the manufacturing cost and maintenance cost are little bit higher for CNG operated Auto Rickshaw than that of Battery operated Easy Bike. He showed, the battery of Battery operated Easy Bike is not environment friendly, because the battery is dumped in open space. Battery contains harmful chemical known as lead-acid battery. This makes the land polluted as well as the air.

Saha et al. (2011) focused on their research to develop an Electric Hybrid Rickshaw without requiring significant changes in the structure of widely popular existing rickshaws. The hybrid system was found to work satisfactorily. The system could be fitted in the existing conventional rickshaw, at a small conversion cost. It allowed reduction of human effort as well as use of relatively small capacity motor and battery. Required human efforts varied from 0% to 25% as compared to a conventional manually operated human power vehicle.

Begum and Sen (2004) suggested in their paper about the income, health, livelihood and other indicators of well being of the rickshaw puller. They showed that most of the rickshaw pullers came from a very poor economic background consistent with the characteristics of chronic poverty. They are susceptible to systematic health risks, very limited schooling and the poor range of occupational choices for children. They suggested some policy for the improvement of the conditions of rickshaw pullers.

From the literature it can be said that very few empirical studies have been done on income determinants of rickshaw pullers and auto-drivers and a few of them used econometric model. This study is based on field survey and used econometric tool to find out the determinants of income.

3. Methodology

Methodology of this study describes the selection of study area and sample size, preparation of questionnaire, collection of data and analytical techniques.

Study Area and Sampling Procedure

There are 10 city corporations in Bangladesh, of which Rajshahi is among the oldest. It was established in 1988 (RCC, 2014). The study is carried out in Rajshahi City Corporation, located in Northwest part of Bangladesh. In the previous decades Rajshahi was called a city of rickshaw but now it is called a city of both rickshaw and auto-rickshaw since a major portion of the city people earn their livelihood from these sources. Therefore, Rajshahi City Corporation is the best place to investigate income determinants of rickshaw pullers and auto-rickshaw drivers because samples are available and there are huge variations among the samples on the basis of socio-economic perspectives.

We collected primary data from different wards of Rajshahi City Corporation to find out the socio-economic conditions of rickshaw pullers and auto-rickshaw drivers. For collecting data, a multistage random sampling technique was used in this study. There are 4 thanas (Administrative Unit) in Rajshahi City Corporation, which includes 30 wards. Among 4 thanas we selected two, namely Rajpara and Motihar, which include 7 and 8 wards, respectively. We selected 2 wards randomly from each thana and finally we selected 2 important city points from each wards where rickshaws and auto-rickshaws were available all day long. There are several important city points namely Shaheb Bazar, New Market, Rail Gate, Lazmipur, Court Point, Court Station, Kazla, Talaimari, Binodpur Bazar, Vodrar More, C&B More, Bornali, Amchottor and among these points we select Court Point, Court Station under Rajpara thana and Kazla and Binodpur Bazar under Motihar thana.

A well designed and pre-tested questionnaire was used, which included both open and close ended questions. The sample has been selected in such a way that it covers all necessary information. We interviewed 40 rickshaw pullers and 40 auto-rickshaw drivers taking 20 (10 rickshaw pullers and 10 auto-rickshaw drivers) samples from each area.

Analytical Framework

In this study, tabular technique was used to illustrate the over-all socio-economic characteristics of the samples. Tabulated data were analyzed by using average, sum, percentage etc. and we also compared the socio-economic characteristics of the selected groups of rickshaw pullers and auto-rickshaw drivers. An econometric model such as linear regression model was used to find out the income determinants of rickshaw pullers and auto-rickshaw drivers.

Specification of the model

To find out the determinants of the income of rickshaw pullers and auto-rickshaw drivers the following linear regression model was applied.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 D_1 + \epsilon$$

Where,

- Y = Yearly income of rickshaw pullers or auto-rickshaw drivers;
- X_1 = Opportunity cost (purchasing or rental cost of rickshaw or auto-rickshaw);
- X_2 = Other costs (Repairing cost, bribe, pocket money);
- X_3 = Age of rickshaw pullers or auto-rickshaw drivers;
- X_4 = Number of family members of rickshaw pullers or auto-rickshaw drivers;
- X_5 = Year of schooling of rickshaw pullers or auto-rickshaw drivers;
- D_1 = Dummy variable, if respondent has own vehicle then 1, otherwise 0.
- ϵ_i = Disturbance term.

$\beta_0, \beta_1, \dots, \beta_6$ are known as the parameters of the model or intercept and slope coefficients respectively. There are five explanatory variables.

Here, the independent variable is yearly gross income of rickshaw pullers or auto-rickshaw drivers ignoring the ownership of vehicle. There are six explanatory variables in this model where opportunity cost includes purchasing or rental cost of rickshaw or auto-rickshaw. In the case of purchasing cost we consider the depreciation cost of rickshaw and auto-rickshaw on yearly basis and in the case of rent we simply calculate it, which is paid in a year by rickshaw pullers or auto drivers to the owners. Other costs include repairing cost, battery charging cost, pocket money and bribe which are paid by pullers or auto drivers on yearly basis. Age of rickshaw pullers or auto-drivers has positive impact on income. Number of family member is counted on the basis of dependent people of the particular pullers or

drivers. In general view, education has a positive impact on income and in this study we consider the years of school the pullers or drivers attended. In the case of ownership of vehicle we use dummy variable and we put 1 if the pullers or drivers have their own vehicle and 0 otherwise.

Assumptions of this Model

1. All other excluded variables are constant.
2. The disturbances satisfy the usual assumption of the classical linear regression model.

Hypothesis of the study

The main hypotheses of this study are given below.

$$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \dots = \beta_{11} = 0$$

$$H_1: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \dots = \beta_{11} \neq 0$$

If the null hypothesis is rejected then we can conclude that these variables have an influence on the income of the rickshaw pullers and auto-rickshaw drivers, otherwise not.

Result and Discussion

Socio-economic characteristics play an important role for increasing income of poor people. Personal assets, education, family size, ownership of house, and access to credit facility have positive effect on income of rickshaw puller and auto-drivers. In this study, we tried to investigate some characteristics which play vital role in daily income.

Age of Auto-Rickshaw Drivers and Rickshaw Pullers

Table -1 shows that maximum drivers of auto-rickshaw were in the range of 31 – 40 years. In 11-20 age groups, there was a 17.5% auto-rickshaw drivers but there was no rickshaw puller. Where the majority of auto-rickshaw drivers and rickshaw pullers lie in 21-30 and 31- 40 age groups, their percentage was 32.5% and 27.5% in auto-rickshaw drivers and 40.0% and 27.5% in rickshaw pullers, respectively. After that age group, the number of auto-rickshaw drivers and rickshaw pullers was decreasing gradually.

Table 1 : Age range of auto-rickshaw divers and rickshaw pullers

Age range	Auto-rickshaw driver	Rickshaw puller
11 – 20	7 (17.5%)	0
21 – 30	13 (32.5%)	11 (27.5%)
31 – 40	16 (40.0%)	11 (27.5%)
41 – 50	2 (5.0%)	9 (22.5%)
51 – 60	1 (2.5%)	6 (15.0%)
61 – 70	0	2 (5.0%)
71 – 80	1 (2.5%)	1 (2.5%)
Total	40 (100%)	40 (100%)

Source: Authors' Own Calculation

Level of Education of Auto-rickshaw Drivers and Rickshaw Pullers

It is seen from Table 2 that the level of education of the rickshaw pullers and auto-rickshaw drivers was very low in the study area. It was found that 30% of auto-rickshaw drivers and 77.5% of rickshaw pullers were illiterate or at best having ability of signature. About 45% of auto-rickshaw drivers completed PSC (Primary School Certificate) to SSC (Secondary School Certificate) level education whereas only 5% of rickshaw pullers had this level of education. It is found from Table 2 that auto-rickshaw drivers were more educated than rickshaw pullers.

Table 2 : Level of education of auto-rickshaw drivers and rickshaw pullers

Education	Auto-rickshaw	Rickshaw
Up to PSC	5 (12.5%)	7 (17.5%)
From PSC to SSC	18 (45.0%)	2 (5.0%)
From SSC to HSC	3 (7.5%)	0
BSS or more	2(5.0%)	0
Illiterate or Can Sign	12 (30.0%)	31 (77.5%)
Total	40 (100%)	40 (100%)

Source: Authors' Own Calculation

Family Member

Family members play an important role as an income determinant since if the family size is large then driver or puller tries to earn more money. Table 3 showed that most of the families are nuclear in the case of auto-rickshaw drivers and rickshaw pullers. Now, the joint family is breaking down with the change of social and economic conditions. Very few auto-rickshaw drivers and rickshaw pullers lived in joint family. In this study, it was found that most of the auto-rickshaw drivers and rickshaw pullers have 3 or 4 members in their family.

Table 3 : Family member

	Auto-rickshaw	Rickshaw
Mean	4.42	4.48
Maximum	10	8
Minimum	2	2

Source: Authors' Own Calculation

Ownership of the Vehicles

Table 4 portrays the ownership of auto-rickshaw and rickshaw. In the case of auto-rickshaw 52.5% drivers have their own auto-rickshaw and 47.5% are used vehicles on rented basis. On the contrary, 72.5% rickshaw was personal and 27.5% rickshaw was rented. Because of increasing demand and high income, the number of auto-rickshaw also goes up both in the case personal and rented vehicles. Due to low cost of rickshaw compared to auto rickshaw a greater percentage of rickshaw pullers have their own rickshaw.

Table 4 : Ownership of the vehicles

Ownership	Auto-rickshaw	Rickshaw
Personal	21 (52.5%)	29 (72.5%)
Rented	19 (47.5%)	11 (27.5%)
Total	40 (100%)	40 (100%)

Source: Authors' Own Calculation

Cost and Rent of Auto-Rickshaw and Rickshaw

Table 5 describes that the average buying cost of an auto-rickshaw was Tk. 1,19,809.52 where the average buying cost of rickshaw was Tk.7,075.86. Average rent of auto-rickshaw was Tk. 501.58 per day and it was Tk. 35 for rickshaw. It has been seen that maximum buying cost of an auto-rickshaw was Tk. 1,68,000 which was actually brand new and in the case of second hand auto-rickshaw the minimum cost was Tk. 50,000. On the other side, maximum and minimum buying cost of a rickshaw was Tk. 15,000 and Tk. 3,000. In case of rented vehicle, maximum and minimum rent was Tk. 550 and Tk. 400 for auto-rickshaw and Tk. 40 and Tk. 20 for rickshaw.

Table 5 : Cost and rent of auto-rickshaw and rickshaw

Cost (in Tk.)	Auto-rickshaw	Rickshaw
Average buying cost	1,19,809.52	7,075.86
Maximum buying cost	1,68,000	15,000
Minimum buying cost	50,000	3,000
Average rent per day	501.58	35
Maximum rent per day	550	40
Minimum rent per day	400	20

Source: Authors' Own Calculation

Net income of auto-rickshaw drivers and rickshaw pullers

Generally, the income level of auto-rickshaw driver is high compared to rickshaw pullers and for this reason the living status of auto-rickshaw drivers is comparatively better than rickshaw pullers. Table 6 shows that the monthly average net income from auto-rickshaw and rickshaw was Tk. 11,625 and Tk. 4,563, respectively, whereas the maximum income from an auto-rickshaw was Tk. 22,200, which was around 2.5 times higher than the income of rickshaw. A rickshaw puller's minimum income was Tk. 1,950 per month whereas the minimum income of auto-rickshaw driver was Tk. 12,000 that was 6 times higher than rickshaw.

Table 6 : Net income from auto-rickshaw and rickshaw (in a month)

Income	Net income of auto-rickshaw drivers	Net income of rickshaw pullers
Mean	11,625	4563
Maximum	22,200	9000
Minimum	12000	1950

Source: Authors' Own Calculation

Repairing cost of auto-rickshaw and rickshaw

Auto-rickshaw drivers and rickshaw pullers have to spend a large portion of their income for repairing purpose. Most of the cost occurred for changing battery of auto-rickshaw and tyre and tube of auto-rickshaw and rickshaw. Table 7 shows the average repairing cost of rickshaw and auto-rickshaw and the costs are Tk. 353 and Tk. 2,620, respectively, but the repairing cost varied because of new and old vehicles. It was found that the maximum repairing cost of an auto-rickshaw was Tk. 10,000 which includes the cost of replacing battery. In comparative analysis, the repairing cost of auto-rickshaw was much higher than rickshaw.

Table 7 : Repairing cost of auto-rickshaw and rickshaw

	Auto-rickshaw	Rickshaw
Mean	2620	353
Maximum	10,000	900
Minimum	200	50

Source: Authors' Own Calculation

Daily expenses for food and refreshment

Except the repairing cost every driver and puller needed some money for their daily expenses such as consuming tea, cigarette and food. Table 8 describes the amount of pocket money that was spent for consuming food and for refreshment. Average pocket money of an auto-rickshaw driver was Tk. 72.25 per day, while it was Tk. 59.38 for rickshaw puller. An auto-rickshaw driver spent from minimum Tk.15 to maximum Tk. 150. On the other hand, a rickshaw puller's daily expenditure was maximum Tk.125 and minimum Tk. 20.

Table 8 : Daily expenses of auto-rickshaw drivers and rickshaw pullers as pocket money.

Pocket money	Auto-rickshaw	Rickshaw
Mean	72.25	59.38
Maximum	150	125
Minimum	15	20

Source: Authors' Own Calculation

Bribe paid by auto-rickshaw drivers and rickshaw pullers

Among other costs bribe was one and since most of the drivers and pullers have no legal licence, they have to pay bribe to the traffic sergeant. It is very difficult to measure the amount of bribe since most of the drivers and pullers didn't give the information properly about the exact amount of bribe. Table 9 presents information about the percentage of driver who has given bribe. It is seen that almost 19 (47.5%) auto-rickshaw drivers have given bribe and 21 (52.5%) auto-rickshaw drivers didn't give it. On the contrary 39 (95.5%) rickshaw pullers replied that they did not pay such kind of bribe. There is also charge for auto-rickshaw drivers in the name of "Somiti" which is also counted as bribe.

Table 9 : Bribe paid by auto-rickshaw drivers and rickshaw pullers

	Auto-rickshaw	Rickshaw
Yes	19 (47.5%)	1 (2.5%)
No	21 (52%)	39 (97.5%)
Total	40 (100%)	40 (100%)

Source: Authors' Own Calculation

4. Results and Discussion

The results of the estimated model of the determinants of income of auto-rickshaw drivers and rickshaw pullers are explained in this section with the help of multiple regression models. In this study we tried to find out the effect of different factors on the income of both auto-rickshaw drivers and rickshaw pullers separately.

Income determinants of auto-rickshaw drivers

Result of the multiple regression model of the auto-rickshaw drivers are presented in Table 10. The estimated results show that factors such as age, education and type of ownership of auto-rickshaw are not statistically significant but they have positive effect on income generation. The elasticity of income with respect to opportunity cost of auto-rickshaw drivers is highly significant and it is significant at 10% level, which means that the probability of occurring Type 1 error is 10%, so the confidence interval is 90%. If the opportunity cost (purchasing or rental cost of vehicles) increases by one percent, income will increase by 0.347 percent, because, if the drivers spend more money for purchasing or renting new auto-rickshaw then they can get better service and the repairing cost is also low compared to second hand auto, the cost of which is low. Other costs (repairing cost, pocket money and bribe) and family size have significant but negative impact on income at 5% level. These indicate that if the other costs and family members of auto driver increase by one percent then income will fall by 0.335 percent and 0.198 percent, respectively.

Table 10: Regression model for determinants of income of auto-rickshaw drivers

Variables	Coefficient	Standard Error	t-statistics	Significance
(Constant)	12.359	2.525	4.895	.000
Opportunity Cost	.347***	.187	1.855	.073
Other Costs	-.335**	.143	-2.336	.026
Age of Auto Driver	.008	.055	.138	.891
Family Member	-.198**	.073	-2.696	.011
Education of Auto Driver	.026	.064	.402	.690
Ownership of Auto	-.005	.040	-.120	.905
Adjusted R ²	.571			

Source: Authors' own calculation

* Significant at 1% level, ** Significant at 5% level, *** Significant at 10% level

The relationship between income of auto-rickshaw driver and education is found positive but it has no significant effect on income. It was also expected that education level should impact positively to the respondent's present income. The main reason for this might be that auto-rickshaw driving is a better and less laborious job than rickshaw, so that educated people who have a better educational qualification might choose these types of job. However, the relationship of income with age is positive but insignificant. From the field survey it can be said that middle aged auto-rickshaw drivers might earn more than old and young auto-rickshaw drivers.

Surprisingly, independent variable like ownership of auto-rickshaw is negatively related with the income of auto-rickshaw drivers. Since, the depreciation cost of auto-rickshaw is very high than rental cost and the number of auto-rickshaw is very large in Rajshahi city compared to requirement. So, their income is relatively poor who have their own auto. As a result, the increasing number of owned auto-rickshaw has a great impact on decreasing average income of the auto-rickshaw driver. The coefficient of determination (R^2) of income determinants of auto-rickshaw drivers show that 57.1 percent of the variation is explained by independent variables.

Income determinants of rickshaw pullers

The result of the estimated model on the income of rickshaw puller is shown in Table 11. The estimated result shows that variables like opportunity cost, education of rickshaw puller, ownership of rickshaw are not statistically significant, whereas other cost and family member are positively significant but the age of rickshaw puller has significant but negative impact on income.

Table 11: Regression model for determinants of income of rickshaw pullers

	Coefficient	Standard Error	t-statistics	Significance
(Constant)	9.574	1.548	6.185	.000
Opportunity Cost	.015	.112	.131	.896
Others Cost	.225***	.117	1.921	.063
Age of Rickshaw puller	-.317**	.122	-2.591	.014
Family Member	.175***	.097	1.808	.080
Education of Rickshaw puller	-.028	.017	-1.640	.111
Ownership of Rickshaw	.097	.096	1.014	.318
Adjusted R^2	.643			

Source: Authors' own calculation

* Significant at 1% level, ** Significant at 5% level, *** Significant at 10% level

Opportunity costs (Purchasing or rental cost) is positively related with the income of rickshaw puller but it does not significantly affect the income level. The coefficient of income with respect to other cost (repairing cost and pocket money etc.) has a significant impact on income at 10% level, the probability of Type I error is 10% and so, the confidence interval is 90%. If the other costs increase by one percent, the income will increase by 0.225 percent.

The coefficient of other costs significantly affects the level of income of rickshaw puller at 10% level. This means that if other costs increase by one percent, income will increase by 0.225 percent. If the pullers spend more money for repairing purpose, they can pull the rickshaw easily and earn more money.

Age of rickshaw puller has negative but significant effect on income of pullers at 5 percent level. If the age of rickshaw pullers increases by one unit income will decrease by 0.317 units, as rickshaw pulling is very much laborious and it is very much difficult to pull rickshaw by aged people.

If the family size of rickshaw pullers is large then they have to work hard since they have no alternative income sources. In this study, family size has positive and significant impact on income and if the family member increases by one percent, income will increase by 0.175 percent. It is significant at 10% level, which means that the probability of Type 1 error is 10% and the confidence interval is 90%.

The relation of the income of rickshaw pullers with the level of education is found negative. It is also expected that education level should impact negatively to the rickshaw puller's present income. The main reason for this might be that rickshaw pulling is a low class informal job so that he who has a better educational qualification might not end up with this type of job. However, result shows that rickshaw puller's income with education is negatively related. The result reveals that having own rickshaw has a positive relationship with the present earning but it is not statistically significant.

The coefficients of determination (R^2) for income determinants of rickshaw pullers indicate that 64.3 percent of the variations of income is explained by independent variables.

Problems, Policy Recommendations and Conclusion

Battery operated auto-rickshaws and rickshaws are causing unbearable traffic jam in Rajshahi city by illegally parking near markets and other institutions. The traffic situation is worse in front of the main kitchen markets and populated areas like Shaheb Bazar, Moni Chattar and Rail Gate. There are inadequate traffic police to supervise the busiest points in the city. Moreover, excessive auto-rickshaw and

rickshaw have reduced the income of auto drivers and rickshaw pullers. Therefore, the authority of city corporation must limit the number of rickshaw and auto-rickshaw and issue licence according to the requirement of vehicles of city dwellers.

Rechargeable battery is the main part of auto rickshaw and at least two batteries are needed to run the auto-rickshaw. The length of life of these batteries does not exceed one year and the replacing cost is very high. Therefore, quality of rechargeable battery needs to be improved and government should take necessary steps to produce battery domestically.

All the auto-rickshaws run in the country are imported from China and a huge amount of foreign exchange goes out of the country. So, government should take new project to produce auto-rickshaw domestically as well as improve the quality of these vehicles.

Though travelling is safe by auto-rickshaw, it sometimes causes serious accidents. Quite often, the scarf of female passengers goes to the shaft and wrings within a second and the passengers get seriously injured. To reduce this kind of accidents, owner of auto rickshaw as well as the producer should cover the shaft in a proper way.

According to some auto-drivers, rent is very high for them, which is around Tk. 500 per day, If the owners reduce the rent then their income will increase. The income of rickshaw pullers is less compared to auto drivers and gradually the demand of rickshaw has decreased and they become jobless. Government should provide credit facility to the rickshaw pullers to buy auto-rickshaw and train them for other jobs.

This study reveals that the socio-economic condition of auto-rickshaw drivers is better than the rickshaw pullers. Auto-rickshaw driving is beneficial over rickshaw pulling and day labour in terms of income, comfort and social status. Around 88% of urban passengers are availing this mode, now to meet their travel demand. High quality auto rickshaw positively affects the income of auto drivers where repairing cost and large family size negatively affect the income of auto drivers. In the case of rickshaw pullers, age has negative impact on income since rickshaw pulling is a laborious job. Other costs and family size are positively related with income of rickshaw pullers because rickshaw pullers spend very small amount of money for repairing vehicle and for daily consumption purposes. Therefore, if pullers spend more money for repairing and consumption purposes then their earning will increase. If family size is large, then other members can also involve in this job and family income will increase. Finally, government should take proper steps to

control the number of rickshaw and auto-rickshaw in the city area and improve the quality and produce vehicles locally.

Moreover, government should be more concerned about this employment opportunity and help them through better scope of education, health, security and housing and, above all, a good working environment.

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