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Demand for MaHtaTha[1] Bus Lines Transportation Services in Yangon City (1988-2007)

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Abstract

An attempt has been made in this paper to construct a transportation demand model for the services of MaHtaTha passenger bus services in Yangon City from 1988-89 to 2006-2007. Ordinary Least Squares (QLS) method is used. Among all the fitted trend models, the best estimated forecasting model is Sigmoid (S) curve trend model. The adjusted multiple regression results show that the passengers (demand) depends on the number of MaHtaTha's Buses, time (year) and on average MaHtaTha bus's fare. In Yangon, the development of city gives rise to the increase in passengers (demand) that was fulfilled possibly by increasing the number of MaHtaTha's buses. Time (Year) was found to have a positive effect on the passengers (demand). Another important finding of the analysis was the negative impact of MaHtaTha bus's fare as expected.

Keywords: transportation demand model, Ordinary Least Squares (QLS), Sigmoid (S) curve trend model.

1. Introduction

1.1 Rationale of the Study

Transportation is basic means of moving goods and people from one place to another. Transportation is essential in the operation of a market economy, which efficient in system can improve the productivity of the economy. Transportation also has broader role I shaping development and environment.

Transportation is linking the physical movement of people and goods between points. Transport is one of the parts of production. The product commodities need to be transported to the required destination within the specified period. The delays occurred will effect the production. It is important that the raw materials are to be transported to the required destination within required time. Transport from one place to another will occur as value to products. The easy transport will benefit the spreading of market.

Transportation system will affect the price and easy transport will cause a saving on the market price and also have an effect on the low cost of production. On the other hand the low cost of transport will minimize the production cost, and because of the low transport cost the commodity are going to the consumer directly and the consumer's price is reasonable and it will result in consumer's price falling at market. Determination of price stability and economic development depends on transportation.

There are two categories of transport functions ie, cargo transport and passenger transport. The cargo transport includes raw materials of product, finished goods, consumer goods, luxury goods, agricultural products, and capital products etc. The cargo needs to be transported to required place at the required period, easily and quickly.

The passengers transport includes the passenger's transport services of working peoples, government servants, skilled labours, technicians, schools boys and girls. The passengers

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[1] Ma Hta Tha in Myanmar language stands for Control Committee for Various Bus Lines in Yangon

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transport services contributes to the passengers travel in the required period to the required destination without harm.

In the regions there are different types of geographic areas, and the national resources are also different according the location. In order for the smooth and timely flow of the national resources there should be better transport systems. If the communication of regions to other regions is quick by smooth transport the regional development can enable the economic development to prosper and the transfer of labour forces also occur and the industrial development zones can be established. That shows that in order to get to an economic development stage of a country, and also in order to achieve the social development there should be an efficient transport system which is the main sector for all round development.

1.2 Objectives of the Study

There is direct relationship between the development of a country and the development of transportation. In order to move the State Owned Economics Enterprise to private sector the transport sector is one of the important sectors.

1. To construct a small transportation demand model for the services of MaHta Tha passenger bus line in Yangon City.
2. To explore the relationship between passenger transportation and passenger transportation demand determinant.

1.3 Scope of the Study

This study is focused on MaHta Tha passenger bus line in Yangon City from 1988-89 to 2006-07. During 1972 some of the bus line were organized by private owners and formed as Yangon Division Buses Central Committee (MaHta Tha). Yangon City passenger transport was mainly managed by Road Trade Transport Corporation (RTC) and MaHta Tha bus line. After 1988, there were extension of new townships and the road communication routes also became longer. There are fifteen bus lines in passenger transportation in Yangon City. MaHta Tha bus line has biggest number of passenger in Yangon City transport.

1.4 Methodology

The statistical methodology employed in developing forecasting models for the passengers (demand) for MaHtaTha's buses services in Yangon city is estimated by the method of Ordinary Least Squares (QLS). Among all the fitted trend models, the best estimated forecasting model is Sigmoid (S) curve trend model. The adjusted multiple regression results show that the passengers (demand) depends on the number of MaHtaTha's Buses, time (year) and on average MaHtaTha bus's fare.

1.5 Organization of the Study

The paper is organized in five chapters. Chapter one gives a brief introduction giving reasons for this study, the objective of the study, the scope of the study, and the methodology will be included. Chapter two contains the general view on transportation such as general significance of transportation, transportation and economic development, demand and supply of transportation. Chapter three contains background on Ma Hta Tha Bus Line in Yangon City transportation. Chapter four contains the Model of demand for Ma Hta Tha Bus Line transportation. It includes the model and empirical specification, the data and estimation methodology, the empirical results and finding and results for the passengers (demand of Ma Tha Bus Line in Yangon City. Finally chapter five conclude with finding.

II The significance of the transportation

Our daily journeys to and from work, shopping centers, or university classrooms involve transportation. Every product we consume has been transported, usually several times, before it gets to us. Even the services we consume would be impossible without transportation of tools, repair parts, or other means of producing services.

In a more general way, transportation is an important part of our culture and heritage. It played a pivotal role in the discovery, settlement, and development of our nation. The freedom and mobility of our people, literally a nation on wheels and a people ever curious to see new places and ever anxious to undertake new tasks, is based upon efficient transportation.

2.1 General significance of transportation

Much of our social and cultural unity is based upon the existence of adequate transportation. Society is a blend of many regional and local viewpoints and traditions growing out of differing heritages, environments, and problems. International contracts through travel and the exchange of goods promote the interchange of ideas and the breakdown of parochialism, thus encouraging an upward uniformity in tastes, health, education, and way of life in general.

Likewise, efficient transportation makes it possible for large geographic areas to be politically unified. Cultural similarity, mutual understanding, and the economic interdependence brought about by large-scale inter-regional trade reduce tendencies toward isolationism, while the ability to communicate rapidly makes unification administratively feasible.

2.2 Transportation and economic development

Several basic elements are necessary for substantial economic growth. Three of these are adequate transportation system, an adequate system of communication, and a flexible source of energy or power. Our primary concern is with adequate transportation. The transportation system is an integral part of production and distribution. Both large-scale production and mass distributions are necessary for economic development. Neither is possible without efficient and relatively cheap transportation. Transportation is the very foundation of economic development.

Economic significance of transportation is that it provides a foundation upon which the economic growth of a nation progresses. Therefore, who make decisions affecting transportation, whether private transport company managers, public officials, or users of transport services, have grate social responsibilities.

Economists use three different arguments to link transportation to economic growth. The first is a macroeconomic view that looks at economic indicators and finds correlations to transportation investment and efficiency. The second is a microeconomic perspective that considers that actions of specific companies in response to improvements in transportation services or reliability. The third is an equilibrium model that argues that improved transportation allows for economic specialization, with trade leading to prosperity. While these arguments each have distinctive bases, they share the view that better transportation leads to economic prosperity. Transportation allows for economic specialization, with trade leading to prosperity. While these arguments each have distinctive bases, they share the view that better transportation leads to economic prosperity.

2.3 Demand and Supply of transportation

Transportation and the marketplace for transportation function can be studied with demand for transportation and supply of transportation. **Suppliers** are the railroads, airlines, public transit systems, and so on. **'Demand' for transportation** is people wish to travel, for any number of reasons, and they are the people (or firms or governmental agencies) desiring to ship messages and freight. These users pay to use our transportation system. As expenditures by individuals and others on transportation total nearly 20 percent of our nation's gross national product.

When discussing transportation demand, the terms *disaggregate* and *aggregate*. Disaggregate demand is the demand of a single traveller or the shipper of a single piece of freight. Aggregate demand is all these individual demands added together.

2.4 Demand for Personal Transportation

Personal travel can be understood, somewhat, by behavioural analysis, that is understand the various "forces" at work influencing one's decision to travel. Depending on a combination of "situations." one makes the travel decision. There are five different types of situational factors influence the personal travel decision.

1. Physical surroundings including the weather, and conditions at the trip's origin, destination, and in between.
2. Social surroundings such as travelling alone, with associates, or family.
3. Temporal, or time, perspective: length of trip, time from now until departure, time pressures.
4. Major purpose of trip.
5. " State " of passenger: anxious, nervous, ill.[3]

Nearly all personal travel is influenced by the prices called *price elasticity.*

We deal with the demand for goods in a specific geographic location. The price of the goods in the marketplace includes the transportation costs of moving them there. It also includes any other transportation costs associated with their assembly. In freight transportation, there is usually slightly less concern about time savings than is the case for passenger transportation because:

a. time has a different value for the traveller than for the owne of goods.
b. in passenger transportation, time is usually counted in minutes and hours; in goods transportation, it is counted in hours and__ most frequently__ in days.
c. freight transportation operations are performed continuously day and night whereas, in most cases, the goods to be carried are produced during working hours.
d. shortened delivery time must meet other equirements, such as reliability, security, and regularity of deliveries.

III Background on Ma Hta Tha Bus Line in Yangon City Transportation

3.1 City Road Transportation in Yangon

The population of Myanmar is spread over seven states and seven divisions and is estimated at 56.68 million in 2006-2007 of which 12% lived in greater Yangon, 22% in urban area and 71 % in rural area.

Yangon division is located in the lower Myanmar, commercial areas and the most important urban centre of the whole country. The urban expansion of the large built up areas has been carried out many times by creation of new sectors added to the existing layout. It is formed

[3] James M, Daley, Raymond W. Laforge, and Clifford E. Young, " Situational Influences affecting Consumer Travel Behavior, " Proceeding, 1985 Transportation Research Forum, pp. 169-174.

with four districts, which are Yangon East District, Yangon West District, Yangon North District, and Yangon South District. There are 33 townships under the Yangon City Development Committee (YCDC) and 12 townships in the regional area outside the YCDC zone of influence.

Under the government of State Law and Order Restoration Council the new satellite townships such as Shwepyitha, Hlaingtharyar, South Dagon, North Dagon, Shwepaukkan, Waibarge were extended and government servants were given plots of land, rendering the transfers of townships and urban areas to new towns associate with secluded land, and new bus lines that were commenting passengers from the year 1990.

3.2 The Nature of Commuter in Yangon

In order to perform the office duties, and to do the daily social affairs of the societies, buses are used for travelling. The road transport facilitates easy access to commercial business, office affairs, juridical affairs, super markets, big store shops, training course elc. In Yangon, Sule Pagoda road, Shwedagon Pagoda road, junctions of Myaynegone, junction of Hledan, junction of 8 miles are major commuter mode of transport. The Sule surroundings are much bigger than other places because there are many office, business and trading centre concentrated in the area.

The extensions of new towns enable industrial zones, to be set up and the population is spreading proportionately in towns and new towns areas. Hence, the populations over crowding in downtown area are automatically avoided.

3.3 Transportation Management in Yangon City

The State Law and Order Restoration Council had declared that among its principal objectives and tasks, the improvement of roads and communications had a vitally important role. With the establishment of new towns and the expansion of the city highways to the city were constructed to facilitate travel for the masses living in the new towns, and to assist in the development of economic enterprises. Thus there are now highways into the city, some expanded from old existing roads and others which were newly constructed.

3.4 Types of Road Transport Service Groups

During the era of State Revolutionary Council (1962), the private transport bus lines were nationalized by the government and from that time onwards, road transport was under the control of government. During 1972 some of the bus lines were organized by private owners and formed as Yangon Division Buses Control Committee (MaHtaTha).

3.5. Demand of MaHtaTha Bus Lines in Yangon City

For Yangon city passenger transport was mainly managed by Road Transport Corporation (RTC) and Yangon Division Buses Control Committee (MaHtaTha). After 1988, there were extensions of new townships and the road communication routes also became longer. Because of market economic system there occurred new jobs opportunities and the travelling of passengers rose more than before.

When road transport was managed the by government, transport business suffered from sustained losses. After 1972 the bus lines were transferred to private sectors gradually. For the State own transport bus lines, instead of running passengers transport service. Themselves; they only allowed services to private sectors as charter system. The charter of buses to private

sector paused for the way the participation of private associations that kept growing to the present level.

After 1990, the Yangon city passenger transport service was strengthened with the extension of each lines as Thanmyanthu, Pyaykhaingphyo, Shweinnwa, City Municipal and Myanmatharkaung et. Moreover, under the supervision of township Peace and Development Council transportation concerns were made to Northern Division, Southern Division, Western Division and Eastern Division.

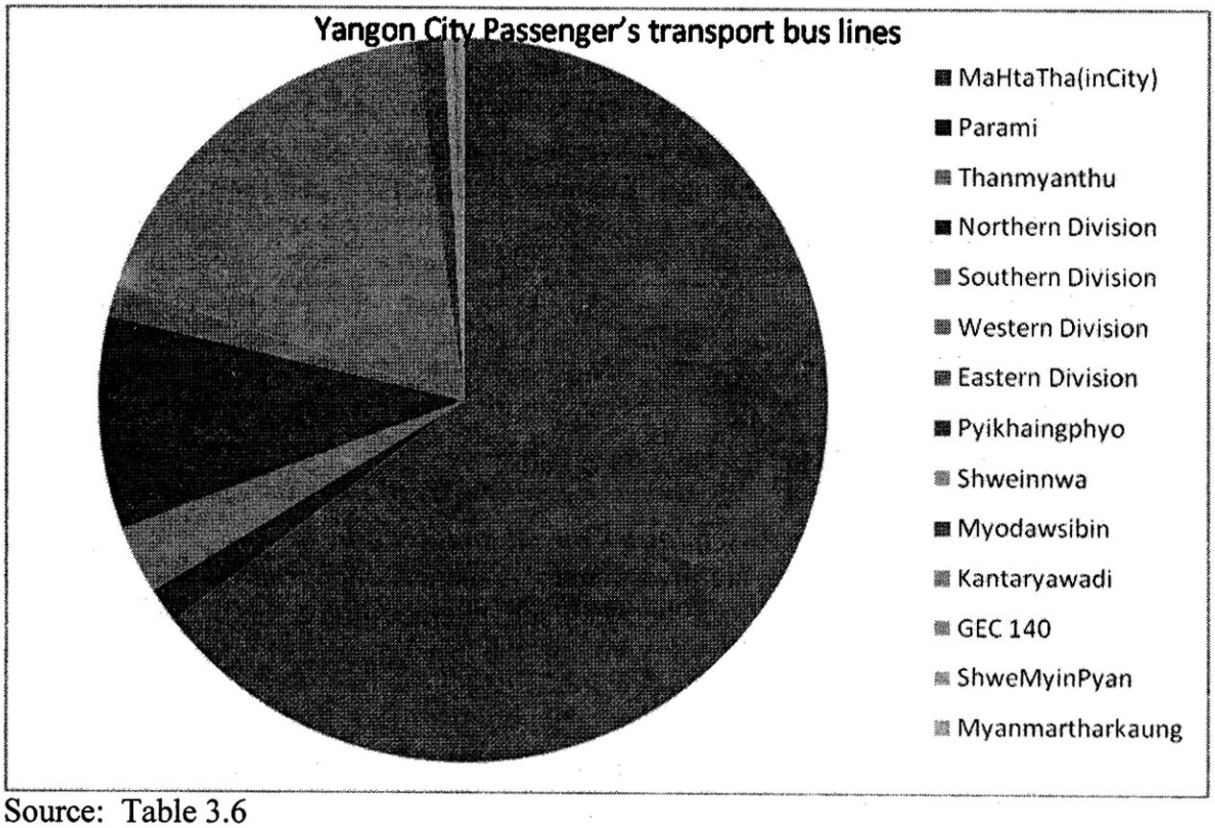
The Yangon Division Buses Control Committee (MaHtaTha) manages the bus lines in the Yangon city passenger's transport. Besides, under Bandoola transport Co.,Ltd the Parami city passenger transport lines are providing services for the Yangon city people to ensure smooth and easy travelling.

The table (1) shows that among the Yangon city passengers transport lines MaHtaTha with the biggest numbers of buses is giving service to the biggest number of passengers. The other city bus lines transport capacity is 41% and under MaHtaTha supervision there is the biggest buses number and city passenger transport of MaHtaTha is 64% which is a big responsibility. Parami is 1.6%, Thanmyanthu is 3.0%, Northern Division is 9.4%, Southern Division is 1.4%, Western Division is 17.3%, and Eastern Division is 0.24%. Also Pyikhaingphyo is 1.3%, Shweinnwa is 0.4%, Myodawsibin is 0.1%, Kantaryawadi is 0.2%, GEC 140 is 0.02%, ShweMyinPyan is 0.1%, Myanmartharkaung is 0.1%, ShweAethe is 0.84% as shown in the table.

Table (1) Yangon City Passenger's transport bus lines (2008-09)

Sr	Particular	Bus line		Numbers of Buses		Passenger Transport	%
		No.	%	No.	%		
1	MaHtaTha(inCity)	131	41	2321	37	2586378	64
2	Parami	15	5	352	7	62050	1.6
3	Thanmyanthu	26	8	540	7	102140	3.0
4	Northern Division	22	7	741	12	365233	9.4
5	Southern Division	53	17	646	10	44790	1.4
6	Western Division	23	7	1027	16	748210	17.3
7	Eastern Division	7	2	101	2	9996	0.24
8	Pyikhaingphyo	28	9	282	5	50791	1.3
9	Shweinnwa	3	.95	52	0.8	15000	0.4
10	Myodawsibin	1	0.3	20	0.51	1830	0.1
11	Kantaryawadi	2	0.6	68	1.19	8880	0.2
12	GEC 140	1	0.3	6	0.1	800	0.02
13	ShweMyinPyan	2	0.6	15	0.2	4350	0.1
14	Myanmartharkaung	3	095	15	0.2	3739	0.1
15	ShweAethe	2	0.6	62	1	16648	0.84
	Total	318	100	6248	100	4020835	100

Source: MaHta Tha Planning Department Yangon



Source: Table 3.6

3.6 Yangon Division Buses Control Committee (MaHta Tha)

The Yangon Division Buses Control Committee (MaHta Tha) is operating the city passengers' transportation with the largest number of buses out of total transport buses. Since the government of Myanmar allowed its economy to function with open market economic system after 1988, private road transportation expanded and the role of MaHta Tha becomes more important and wide.

There are nine departments under the management of MaHta Tha and the passengers transport bus lines are running under the supervision of MaHta Tha. The situation of the passenger bus lines running is as mentioned below.

Table (2) Average Daily Running Buses (2008-2009)

Sr No	Department	No: of Bus Line	Buses	Average Daily Running Buses
1	1	22	354	261
2	2	14	301	231
3	3	17	295	215
4	4	17	232	174
5	5	12	293	246
6	6	9	162	125
7	7	10	214	173
8	8	10	253	179
9	9	19	323	237
	Total	130	2427	1841

Source: Planning Department of MaHta Tha (2008-2009)

Under the control of MaHta Tha and the types of buses are city bus, bus, mini bus, light truck bus and special bus etc.:

Table (3) MaHta Tha bus transport and passengers (2008-2009)

Sr No	Types of Buses	Number of Buses	Daily Average Running Buses	Daily Average Running %	Daily Average No of Trips	No of passenger per Trip (Qty)	Daily Passenger (Qty) (Lakh)
1	City bus	1177	834	71	6662	166	11.08
2	Bus (including minibus)	591	495	84	5010	110	5.49
3	Light truck	516	382	74	3236	94	3.03
4	Special bus	186	162	87	2323	60	1.39

Source: Planning Department of Ma Hta Tha (2008-2009)

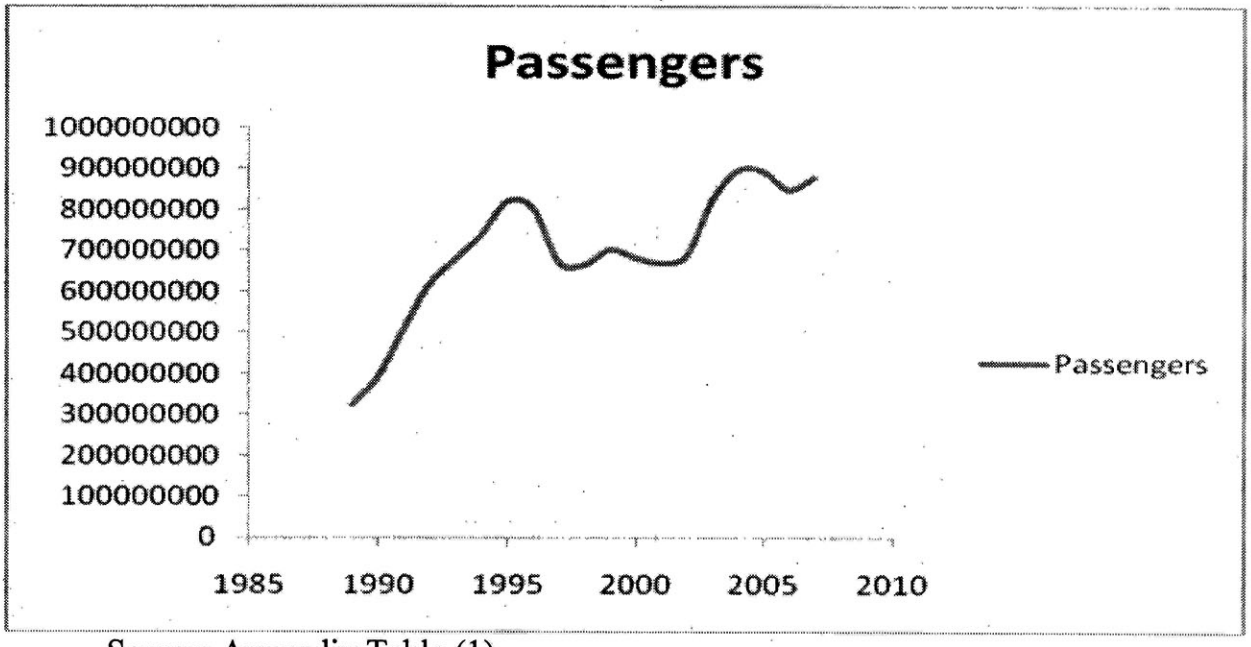
3.7 The Ma Hta Tha Committee for Disciplines Control and Actions:

In the MaHta Tha organization, there are investments in the passenger bus by the bus owners for their profit. There has to be a balance between self interest motive and reasonable and economical passenger transport facility motive for the passenger and MaHta Tha is the systematically managed to fulfill these motives.

3.8 Trends of Demand for MaHtaTha Bus Lines in Yangon

The information of the passengers was collected from Ma Hta Tha's head office.

Figure (1) Trends of Demand for MaHtaTha Bus Lines in Yangon



Source: Appendix Table (1)

According to Figure (1) the passengers (demand) were increasing form 1988-89 to 1994-95. In 1995-96 to 2001-02 the passengers declined year after year. From 2002-03 to 2004-05, the passengers (demand) were increasing annually. In 2005-06, the passengers declined and in 2006-07 the passengers (demand) increased. Therefore, the pattern of the passenger transport in Yangon City is S shape.

IV Model of Demand for MaHtaTha Bus Lines in Transportation

Economic theory solves one but not both of these problems. Economic theory enables the decision- maker to limit the scope of the information required to make informed decisions. In general, the solution to an individual's passenger transportation constrained a set of depend upon the followings simplifying assumptions.[4]

D = f (a, b, c, d, f, g)
D = demand for transportation
a= distribution over business, factory, school and office
b= population
c= per capital GDP
d= Suburb and a, b, c, d, e distribution
f= private vehicle
g = bus's fare

This paper collect data and try to empirically identify the demand for transportation.

4.1 The Model and Empirical Specification

The statistical methodology employed in developing forecasting models for the passengers (demand) of MaHtaTha's buses in Yangon city is the technique of trend analysis based on the time series data. Different forms of trend models fitted using time series data are eleven models. Among all the fitted trend models, the best estimated forecasting model is Sigmoid (S) curve trend model. The S-curve (Sigmoid) model is

$$Y_i = \{\exp(\beta_0 + \frac{\beta_1}{T_i})\}\exp(u_i)$$

Estimated model is

$$y_i = \hat{Y}_i = e^{(b_0 + \frac{b_1}{T_i})}$$

$$\ln(y_i) = b_0 + \frac{b_1}{T_i}$$

Where Y_i = the passengers of Ma Hta Tha's Buses of Yangon city at i^{th} year
T_i = Time at i^{th} year
e is the base of the natural logarithm. If b_1 is positive, the slope is upward; if negative, downward. Also, $\ln(y_i) = b_0 + \frac{b_1}{T_i}$. Below b_0 is 2.009 and b_1 is -0.331, reported in the Model Summary and Parameter Estimates".

And then, the effect of factors influencing the passengers (Demand) of Yangon city will be examined by using the multiple regression models.

The multiple regression model, used in this paper is

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 T_i + \beta_3 X_{2i} + u_i$$

Where Y_i = the passengers of Ma Hta Tha's Buses of Yangon city at i^{th} year
X_{1i} = number of Ma Hta Tha's Buses
T_i = Time at i^{th} year
X_{2i} = Ln average Ma Hta Tha bus's fare at i^{th} year

and u_i is the random disturbance term usually assumed to be satisfying with classical assumptions.

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[4] . McCarthy, Patrick S. Transportation Economics: theory and practice: a case study approach, Blackwell Publishers Inc. USA. 2001

4.2. The Data and Estimation Methodology

The data are compiled from the record books of from Ma Hta Tha's head office and they are described in the Table of appendix. The model for the passengers (demand) is estimated by the method of Ordinary Least Squares (OLS).

4.3. Empirical Results and Finding

a. The passengers (demand) exhibits a S-curve during the period (1988/89 - 2006/07)

The estimated trend models are the forecasting models constructed on the time series data, in addition to the model, selection criteria as presented in Swe (2006), the Bayesian information criterion (BIC), Hannan and Quinn (HQ), final prediction error (FPE) as shown in Holden et. al. (1990) are computed for each of the estimate models. On the basic of these selection criteria, the best fitted forecasting model for the demand for Ma HtaTha's buses in Yangon city was selected as Sigmoid (S) curve trend model.

S-shape pattern means, the passengers (demand) curve represents a S-curve. Mathematically, S-curve is represented by the following equation.

$$\ln(y_i) = b_0 + \frac{b_1}{T_i}$$

The best fitted regression model relating the passengers of MaHtaTha's Buses to time is obtained as follows: (computed t-values are presented in parentheses). The * indicates significance at 5% level.

$$\ln(y_i) = 20.537 - \frac{1.072}{T_i}$$

$$(570.591) \qquad (-8.623)^*$$

$R^2 = 0.814$ $\qquad R_a^2 = 0.803$

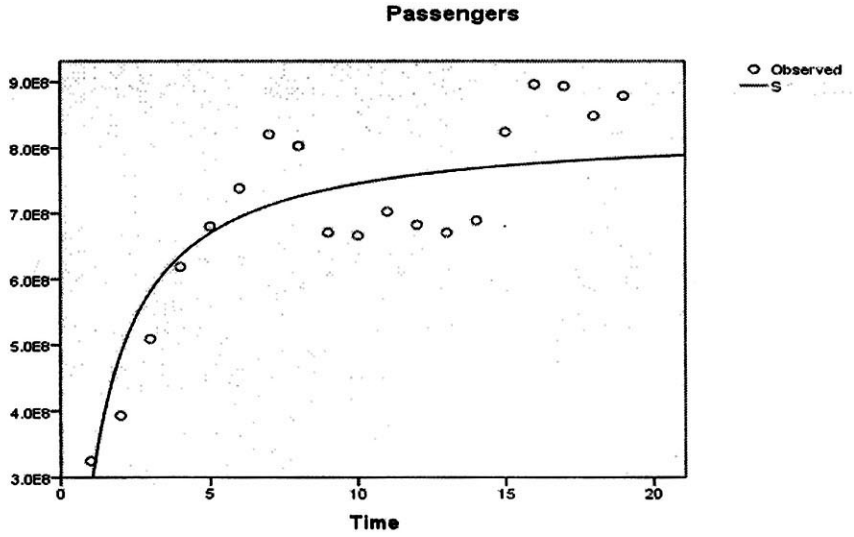
Computed F - value = 74.363*, $\qquad S.E = 0.120$

Independent variable = Time (Year)

Dependent variable = Number of Passengers of Ma Hta Tha's Buses

According to above equation, the R^2 value of S-curve form is higher than that of other forms. The coefficients, b_1 and b_2 are significant at 5 percent level. So, the S-curve form is the best fitted form. Therefore, the S-curve pattern is met with the passengers Ma Hta Tha's buses in Yangon city. The Figure (2) shows the observed data and S-curve plotted for the estimated passengers of Ma Hta Tha's buses in Yangon city model. If time (year) trend to infinity, passengers will be have 830,052,907 ($e^{20.537}$).

Figure(2) Observed data and S-curve for The Passengers of Ma Hta Tha Buses in Yangon City (1988/ 89 – 2006/07)



According to Figure (2), the S-curve model is the best fitted regression line for the passengers of MaHtaTha's Buses in Yangon city.

b. Results for the passengers (demand) of MaHtatha's buses in Yangon City

In this section, the study portrays the relationship between the Passengers of MaHtaTha's buses in Yangon city and its regressors. Its regressors are number of MaThaTha's buses, time (year), and Ln average MaHtaTha bus's fare. The regression model is

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 T_i + \beta_3 X_{2i} + u_i$$

Where μ_i is the random error term with mean zero and constant variance σ^2, and E (u_i u_j) = 0 ($i \neq j$).And then, this model is applied with observed data for the period from (1988-89 to 2006/07) by using the ordinary least square methods. The following Table (4) represents the analysis of variance for the estimated passengers (demand) model (1988-89 to 2006-07).

Table (4) Analysis of Variance for the Passengers (Demand) Model (1988-8980-2006-07)

	Sun of Squares	Df	Mean Square	F	Sig
Regression	3.976E17	3	1.325E 17	35.257	0.00
Residual	5.638E16	15	3.759E15		
Total	4.540E17	18			

According to Table (4) this model is significant at five percent level of significance. The computed adjusted R square value and its summary statistics are described in Table (2).

Table (5)

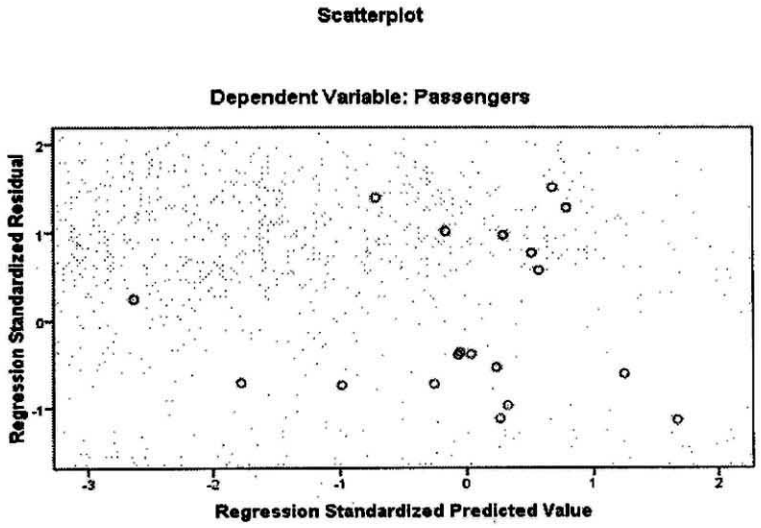
Summary Statistics for the Passengers (Demand) Model (From 1988-89 to 2006-07)

R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
0.876	0.851	6.131E7	1.293

According to Table (5), adjusted R square value is 0.851 which means that this model can explain about 85.1 percent for the passengers of MaHtaTha buses in Yangon city. The Durbin-Watson statistic is 1.293. To check for the assumption of the constant variance, the residual

plot is to be plotted. The Figure (3) shows the residual plot for the estimated passengers of MaHtaTha's buses in Yangon city model.

Figure(3): Residual Plots for The Passengers of MaHtaTha's Buses in Yangon City Model(1988-89 to 2006-07)



The residual plot does not show any pattern and it can be said that their variance is constant. Hence, the model is the best fitted regression line for the passengers of MaHtaTha Buses in Yangon city. The estimated values of coefficients for this model are described in the Table (6).

Table (6) Estimated Values of Coefficients for the Passengers of Ma HtaTha Buses in Yangon City Model (1988-89 to 2006-07)

Variable	Coefficient	Std. Error	t	P value
Constant	-2.754E8	1.477E8	-1.865	0.082
X_{1i}	754.533	154.865	4.872	0.000
T_i	6.253E7	1.302E7	4.803	0.000
X_{2i}	-8.889E7	3.567E7	-2.492	0.025

According to Table (6), the estimated regression model can be described as follows:
The passengers of Ma Hta Tha Buses = -2.754E8+ 754.533 number of MaHtaTha buses + 6.253E7 time (year) – 8.889E7 Ln average Ma Hta Tha bus fare.
All coefficients of number of MaHtaTha Buses, time (year) and Ln average Ma Hta Tha bus fare are significant at one percent level. Hence, we can say that Passengers (demand) is influenced by number of Ma Hta Tha's Buses, time (year) and Ln average Ma Hta Tha bus fare.

11. Conclusion

According to our finding, there is the S-curve pattern of the passengers (demand) during the city development period of Yangon.

The passenger (demand) depends on number of MaHtaTha Buses, time (year) and Ln average Ma HtaTha bus fare.

The important findings of this study relate to the determinants of the passengers (demand) as follows:

In Policy implication of the strong link between Ma HtaTha buses and Ma HtaTha bus fare is that the policy makers should concentrate on reducing Ma HtaTha bus fare. Analysis of this paper may provide useful solutions to policy makers in designing city development policies, and for taking initiatives and formulating programs appropriate for promoting city transportation.

APPENDIX

Table (A1) MaHtaTha's Buses, Average Fare and Passengers in Yangon City (1988-89 to 2006-07)

Year	MaHtaTha's buses	Passengers	Average fare (Kyat)
1988-89	692337	324814309	1
1989-90	778032	392958096	1
1990-91	851446	509208606	1
1991-92	912622	618505347	1
1992-93	820784	680152677	2
1993-94	893962	738652464	3
1994-95	1015739	820550072	5
1995-96	1007222	803397793	15
1996-97	919361	671189396	15
1997-98	804924	666666986	20
1998-99	807810	702805057	25
1999-2000	767683	682601313	50
2000-01	748845	670788794	100
2001-02	740246	689259231	100
2002-03	694389	824091572	100
2003-04	665655	896211790	100
2004-05	642763	893827972	200
2005-06	672111	848687651	200
2006-07	672630	878813495	200

Sources : MaHtaTha Head Office in Yangon.

APPENDIX

Table (A2) Curve Estmation

Sr no:	Curve name	Variable	Coeffient	T value	P- value	R^{-2}
1	Linear	Const t	4.818E8 2.155E7	10.428 5.436	0.000 0.000	0.613
2	LogLinear	Const Ln (t)	3.444E8 1.714E8	6.947 7.694	0.000 0.000	0.764
3	Inverse	Const 1/t	8.095E8 -5.840E8	30.250 -6.319	0.000 0.000	0.684
4	Quadratic	Const t	3.889E8 4.694E7	5.587 3.075	0.000 0.007	0.653

		t^2	-1.215E6	-1.716	0.105	
5	Cubic	Const	1.869E8	2.356	0.032	0.794
		t	1.504E8	4.679	0.000	
		t^2	-1.326E7	-3.762	0.002	
		t^3	381497.839	3.459	0.004	
6	Power	Const	4.754E8	11.928	0.000	0.560
		t	1.036	139.018	0.000	
7	Compound	Const	3.667E8	12.688	0.000	0.794
		Ln (t)	0.297	8.383	0.000	
8	Sigmoid (s)	Const	20.537	573.912	0.000	0.805
		1/t	-1.071	-8.669	0.000	
9	Growth	Const	19.980	238.311	0.000	0.560
		t	0.035	4.891	0.000	
10	Exponential	Const	4.754E8	11.928	0.000	0.560
		t	0.035	4.891	0.000	
11	Logistic	Const	2.103E-9	-	-	0.560
		t	0.965	139.018	0.000	

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