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Determinants of Rail Passenger Transport
Usage: A Case of Buffalo City Municipality

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Abstract: This study investigated the determinants of rail passengers transport usage. Descriptive analysis in the form of Pearson-chi square and inferential analysis using probit regression were used in this study for data analysis. The study used closed-ended questionnaires and they were distributed to 100 people. The results of the study revealed that level of income, occupation, level of education, safety, and affordability are the common factors that influence the usage of trains for transport. The frequency of usage based on income was about 44%, with about 55% of people indicating they make use of trains because they find it a safe mode transport. The income level, safety, occupation and affordability were statistically insignificant. The level of education had a high frequency at 74% and it was statistically signifacant.004. The second part of the study assessed the incidence of train usage and results revealed that most of people (about 74%) travel by train daily. The policy recommendation from this study is that efforts should made to improve the rail transport services, like the facilities, speed and the time schedule. This study will contribute to generation of knowledge around these issues.

Keywords: Transport Economics; Transport usage; Economic Activities; Consumer Tastes

JEL Classification: D11

1. Introduction

Transport makes it possible for economic activities and social activities to take place in a particular place and time (Doll & Wietschel, 2008). It is divided into four modes which are road, air, sea, and rail. The focus of this study was on rail transport. According to Haglund (2010), rail transport has different features from other modes of transport such as large capacity and free from traffic jams.

For the past 150 years South Africa has been using rail transport, and this mode of transport was known as one of the pillars of South Africa's infrastructure (Africa & Point, 2010). Even today, South Africa still regards rail transport as suitable transport compared to other modes of transport since rail transport is mostly utilised for conveying of bulk freight over medium and long distances and for mass commuter traffic. Africa & Point (2010) considered rail transport as the important tool for growth and this was supported by Road, Nadu, Thavathivu & Thirumand (2014) who noted that it is suitable for both long distance travel and bulk mode. Today South Africa is still reaping the benefits provided by rail transport, which still occupies a critical role in the transport system of our country. In Buffalo City Municipality, rail transport plays a vital role to the residents due to population growth. There is ongoing demand for transport, particularly rail transport, since the area is dominated by poor people and they find rail

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transport as the best mode of transport due to its capacity and they have been utilising it for decades (Statistics of South Africa (STATS SA), 2016. Therefore, this study focused on the extent to which one uses rail transport, not the uses of rail transport compared to other modes of transport.

2. Problem Statement of the Study

Rail transport in South Africa has not received enough attention from the authorities (Mathabatha, 2015). A number of studies were done on this mode of transport such as that by Mokonyama, Venter, Letebele, Dube & Masondo (2013) who conducted a study on the analysis of modal shift in South Africa and Mathabatha (2015) who conducted rail transport and economic competitiveness of South Africa. In addition, Hermant (2011) who conducted a study on human movement behaviour in South African railway stations: implication for design. But none of the scholars looked at the factors that influence the use of rail transport.

Furthermore, Railway Safety Regulator Annual Report (2011) revealed that in South Africa's rail transport the major problem is poor conditions of infrastructure and personal safety which includes robbery, theft and crime and these are the major problems in rail sector.

The Eastern Cape Province is no exception to these problems. It has been claimed that the East London rail system has been plagued with inefficiencies and delays. Further, breakdowns and track theft have been a common problem in East London station (Marina, Cameron, Mokonyama & Shaw, 2007). In East London area, the Passenger Rail Agency of South Africa (PRASA) is still having challenges that include deprived maintenance practices, arguments with Transnet about access to its network and pricing of services. These unresolved matters with companies involve the refurbishment of coaches and the supply of key components.

3. Empirical Literature

Wijeweera & Michael (2013) from Australia, Heljedal (2013) from Europe, Paulley, Balcombe, Mackett, Titheridge, Preston, Wardman, Shires & White (2006) from Britain agreed that price is the main determinant that influences the use of rail transport. These studies pointed out that the reason many people use rail transport is because it is affordable. Moreover, these studies also found that price changes affect consumption or rail demand, since price is statistically significant to demand of rail. This means that when prices increase, people will shift from using rail transport and use other modes of transport.

In addition, Wijeweera & Michael (2013) examined a study on determinants of passenger rail demand in Perth Australia: A time series analysis. The study used annual data from the period of 1983 – 2008 and discovered population as the determinant of transport demand.

Haglund (2010) conducted a study on Analysis of train passenger responses on provided service Case study: PT. Kereta Api Indonesia, and Barnum, Mcneil & Hart (2007) conducted a study on comparing the efficiency of public transportation subunits using data envelopment analysis. Both results showed that service quality is one of the vital factors that influence the choice of travel

Mokonyama, Venter, Letebele, Dube & Masondo (2013) uses the quantitative approach and the study revealed that the modal shift is a result of personal choice, and also showed that the choice of modal transport depends on the income that the individual earns, since rail transport has been found as the mode of transport that is affordable.

4. Methodology

This paper sought to find the determinants of rail transport usage in the Buffalo City Municipality. The model estimated was as follows:

RTU=f (*DEMG, SE and PHYS*)

In this study (RTU) is the dependent variable that is rail transport usage, on the right side are independent variables such as (DEMG), the demographic factors, (SE), the socio economic factors and (PHYS), the physical factors

Where:

RTU= Rail transport usage

DEMG= Demographics factors

SE= Social economic factors

PHYS= Physical factors

The table below summarises the definition of the variable, usage of the literature.

Variables	Some application of the literature
Rail transport usage	Road et al., (2014)
Demographics factors	Nurdden et al., (2007) and Buehler (2011)
Socio economic factors	Bresson, Dargay, Mandre & Pirotte, 2003) and Mokonyama, Venter, Letebele, Dube & Masondo, 2013) and Road *et al*., (2014)
Physical factors	Nurdden et al*.,* (2007) referred to Mokonyama et al., (2013)

4.1. Data Source

The data was obtained through a household survey conducted in 2017 (October-November) in Buffalo City Municipality in the Eastern Cape. In this study the Mdantsane and Berlin were the part of the survey. The researcher chose municipality of study because it is the second largest metropolitan municipality in the Eastern Cape. Close ended questionnaire was c and were distributed on door to door by the trained research assistance. A total of 100 households have responded fully to the instrument and with data usable.

4.2. Data Analysis Techniques

The study follows the quantitative approach. The descriptive and the inferential statistics were applied to in this study in order to understand it better the data. Regression analysis has been applied in this study to determine the significant factors explaining rail transport.

5. Results and Discussion

Demographics of the Study Sample

In terms of gender, from the sample about 54% females and only 46% males indicated that they are using train. Such divide reflects the proportion of gender within the population; therefore, it may not show any bias towards use of rail passenger transport. Regarding higher education, 76.0% of those with grade 8-12 indicated that they travel by train , 17.0% are have reached grade 1-7 and only 5 .0% those who obtained Bachelor's degree travel by train. The most educated are likely to get better paying jobs

and to reflect such status, may use private road transport or if not well paid may want public road transport. In addition, the results showed that 100% Africans travel by train. However, 73.0 % of single people travel by train, 21.0% that are married also use trains but only 3.0% that are widows travel by train. It is also shown that 98% of people that are using the train are without disability and only 2% are disabled. On the other hand, 32% of students travel by train , 34% of those working in town, 14% of business and trading people travel by train and only 6% of the private sector or NGO personnel travel by train. Interpretation of the regression analysis and inferences considers these demographics.

Mokonyama, Venter, Letebele, Dube and Masondo (2013); Wijeweera & Michael (2013) and Nurdden, Rahmat & Ismail (2007) agreed that the choice of mode of transport depends on the income that the individual earns. Most travellers use rail transport because of their income, 24% of those that earn between R1001-R2000, 14% people that earn from R5, 001-R10, 000 and only 2% of those that earn between R10000 to R 20000 travel by train. This could be due to the financial status of the person and the affordability, especially for people earning from R10000-R20000 and these results are reasonable when checking percentages.

Consequently, 74% of people travel by train daily, 11% of people travel by train once a week, 14% do not use the train at all and only 1% of people use train once a month. This reflects the dominants of rail passenger transport within the studied area. In addition, the results show that 67% of people are using the train for school or work purposes, 14% of people are not using train, 10% are those that use the train for business trip purposes, only 8% of people travel by train for leisure purposes and lastly, only 1% of people use train for other purposes. The table below shows the frequency for demographics

Table 1. Descriptive statistics table

	N	Minimum	Maximum	Mean	Standard deviation
Age in year	100	19	62	33.71	13.587
Number of years spent in school	100	0	16	10.72	3.668
Household size	100	1	13	5.32	2.478

Source: own creation table

The survey covered those from the age of 19-years and maximum of 62-years old and the average of age 34 and the standard deviation of 13.587. On education side, considering years spent in school, minimum is 0 number years (no formal education), maximum 16, and average of 11 and the standard deviation is 3.6. House size ranges from a minimum of 1 person and the maximum of 13, with an average of 6 people in one household and 2.478 as standard deviation.

Facilities Rating

The study showed that about 52.0% of people said that they are rather satisfied with the connection with other public of transport, 15% people that are very satisfied with facilities of train with connection with other public transport and only 7.0% that are rather satisfied. It is shown that 35.0% of people are rather satisfied with the facilities of car parking although 29.0% people are very dissatisfied, 16 are rather dissatisfied and only 6 .0% are very satisfied. Forty-nine percent of people are very dissatisfied with the quality of train facilities and service. Jaiswal & Sharma (2012) commented by saying rail transport needs to adjust their services to the attributes required by the travellers in order to become more attractive to their users. The study also found that many people are very dissatisfied with train facilities. People that are rather satisfied comprise 25.0%, and 2.0% people are satisfied with the quality of the train facilities. Due to the problem of lack of information about changes in the train schedules there is high number of

the people 34.0% that are very dissatisfied with the provision of information about train, rather dissatisfied equalled 33.0% and 7.0% stated that are very satisfied with the provision of information about trains. However, 61.0% of people are very satisfied with the train ticket, Wijeweera & Michel (2013) and Heljedal (2013) agreed that most people using trains are very satisfied with the train tickets, 23.0% of people are rather satisfied with the ticket train and 2.0% are rather dissatisfied. Only 45.0% of people are very dissatisfied with the way complaints are handled, 27.0% are rather dissatisfied, 10.0% are rather satisfied and 4.0% are very satisfied. Results indicate that 45.0% of people are very dissatisfied with the cleanliness of the station facilities, 20.0% of the people are rather dissatisfied and 5.0% of people are very satisfied with the cleanliness of station facilities. Then, 47.0% of the respondents indicated they are rather satisfied with the security at stations, 15 .0% are the very satisfied, 14.0% rather dissatisfied and only 10.0% are very dissatisfied with the security at stations.

Train Time Rating

The study revealed that 32.0% of people are rather satisfied with the frequency of train, 28% are very dissatisfied, 22 % are rather dissatisfied and 4% are satisfied. Whereas study results indicate that 32% of people are rather dissatisfied with the speed of train, 30% are very dissatisfied and only 9% are satisfied, Barlombe, Mackett, Paulley, Preston & Shires (2004) commented that many people are dissatisfied with speed of train. They said train speed should improve. According to this study, 59% of people are very dissatisfied with the punctuality of train. Jaiswal & Sharma, (2012) said that rail transport has the problem of not being punctual and the study also found that passengers are complaining that trains arrive late, with 15% being rather dissatisfied and only 2% being satisfied with the train punctuality. About 55% of people indicated they are satisfied with personal security whilst on board, 15% are rather dissatisfied with the security, 9% are very dissatisfied and 7% are satisfied. Also 51% are very dissatisfied with the cleanliness and good maintenance of trains, such as cleanliness of the train. About 20% are rather dissatisfied, 12% are rather satisfied and 3% are satisfied with the cleanliness of train. Rail transport has poor service quality. The study also commented by saying rail transport needs to adjust their services to the attribute required by the travellers in order to become more attractive to their users as many people are not happy with the maintenance of train transport (Jaiswal & Sharma 2012). In addition, 55% of people are very dissatisfied with the provision of information during the journey, 23% are rather satisfied, 5% are rather satisfied and only 3% are satisfied.

On the other hand, 40% are very dissatisfied with the sufficient capacity for passenger travelling by rail, 28% of the people are rather dissatisfied, 16% are satisfied and only 2% is very satisfied with the sufficient capacity. Therefore, 50% of people are very dissatisfied with the seating area, 26% are rather dissatisfied, and 3% are very satisfied. It is also reported that 41% are very dissatisfied with the train services, 23% are satisfied with the train service, 18% are rather satisfied with the train service and 4% are very satisfied with the train service. Fifty percent of the people are very dissatisfied with the train staff, 20% are rather dissatisfied, 7% are rather satisfied and 7% are the very satisfied with train staff. In addition. 58% of people are very dissatisfied with the assistance of the elderly, 21% are rather dissatisfied, 5% are rather satisfied and 2% are the very satisfied with the assistance of the elderly people in the train.

Meeting of Transport User Requirements

The results from the study demonstrate that only 20% of people strongly agree that when ticket prices increase they receive alerts by train attendants, 56% agree that they are being informed when ticket prices increase, 7% of people disagree with statement and 3% strongly disagree. According to the table, 46% of people agree that they are using train because it's affordable, 38% strongly agree with the

statement and 2% disagree. Sam *et al.* (2014) and Mokonyama *et al.* (2013) noted that many people are using transport because it is affordable transport. However, 44% of people disagree that they find comfort in using trains, 28% strongly disagree, and 4% of people strongly agree that they find comfort using trains. Sam *et al.* (2014) and Polat (2012) agreed that most people find comfort in using trains. Fifty three percent of people agree that comfort of passengers should be ensured, 24% strongly agree, 6% strongly disagree and 3% disagree that comfort of passengers should be ensured. Additionally, 45% of people disagree with the punctuality of time, 29% strongly disagree, 6% agree, and 6% of people strongly agree with the departure time. Jaiswal & Sharma (2012) pointed out that delay has become regular rail transport problems and these problems will result in passengers using other modes of transport.

Not Meeting Transport User Requirements

Regarding the statement that patronising rail transport makes passengers vulnerable to crime, 52% of people agree, 17% disagree, 12% strongly agree and 5% strongly disagree. The results showed that about 64% of people disagree that theft is a common challenge for rail transport, 18% agree, and 2% of people strongly agree. About 51% of people agree that they experience discomfort, 26% strongly agree, 7% disagree and 2% are disagree. Of people that have been experiencing discomfort in trains, about 52% agree, 24% strongly agree, 7% disagree and 3% strongly disagree. Also, 67% of people disagree with the statement of missing luggage, 16% agree and 3 % strongly disagree .People that agree with sufficient space for luggage make up 57%, 21% are disagree, and 8% strongly agree with sufficient space available for luggage. People that agree with the statement about delay experience make up 49% and Jaiswal & Sharma (2012) said that delay has become a rail transport which if not addressed, will result in passengers using other modes of transport. People that strongly agree with the statement of delay experience total 32%, 4% disagree, 1% strongly disagree with the statement of delay experience. People that agree with late arrival of trains make up 47%, 34% of people strongly agree, 4% disagree and 1% strongly disagrees with late arrival of trains.

Table 2 below shows the summary of descriptive statistics. The facilities score have the high mean (35) followed by the negative usage (26), positive usage (23) lastly followed by train time (20). The maximum value for train time is high than the positive value.

Table 2. Descriptive statistics for total score

	N	Minimum	Maximum	Mean	Standard deviation
Facilities score	86	21.00	55.00	34.6977	8.13861
Train	86	11.00	40.00	19.7209	5.73462
Positive	86	15.00	30.00	22.9884	2.65460
Negative	86	20.00	33.00	26.3372	2.75515

Source: Author's Computation

From the table above, the minimum of 21 facilities score and maximum of 55 , facilities score and 8.1 of the standard deviation . Minimum of 11 of train and maximum of 40 and the standard deviation of 5.7. Minimum of 15 positive usage score, maximum of 30 positive score and the 2.6 standard deviation. Negative score has 20 minimum, maximum of 33 and 2.8 standard deviation.

This following section presents regression analysis results. Only Probit regression results are presented here as results of multinomial logistic regression are not reported here given the limited cases in some instances as the sample was thinly spread across the categories

5.1. Probit Regression

Table 3 presents Probit regression results, showing five factors being statistically significant; namely number of years spent in school (proxy for level of education); quality of facilities; rating of train services; negative perception/attitudes (challenges with rail transport) as well as positive perceptions/attitudes.

Table 3. Probit regression analysis

Parameter estimates						
Parameter	Estimate	Std. Error	Z	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Age in years	-.004	.004	-1.015	.310	-.012	.004
Number of years spent in school	-.030	.017	-1.793	.073	-.062	.001
Household size	.014	.020	.696	.487	-.026	.054
facilities score	.019	.008	1.976	.048	-.030	.045
Train	.028	.013	2.456	.008	.002	.054
Negative	-.012	.018	-1.993	.014	-.024	.000
Positive	.031	.020	1.752	.079	.002	.053
Intercept	-1.610	.718	-2.244	**.025**	-2.328	-.893
PROBIT model: PROBIT(p) = Intercept + BX						

Source: Author's Computation

The dependent variable is dichotomous, with 1 being 'YES' to use of rail transport and 0 "Never". The coefficients therefore provide how much change in the probability of an individual responding "YES" compared to "NO" given each factor.

An additional year in school reduces the probability of using rail transport by 0.30 (3%). This may be explained by the fact that highly educated individuals can afford to buy private cars and therefore do not use rail transport, which more often is considered transport for the poor. With reference to the literature, Nurdden et al., (2007) and Road et al., (2014) agreed that educated people tend to buy their own private car since they can afford it.

The facilities increases the probability of travelling by rail by .019 (nearly 2%).Sam et al., (2014); Wijeweera & Michel, (2013) and Road et al., (2014) commented that many people use rail transport because of the facilities of the train. Also, the utility theory pointed out that people use transport because of the benefits the transport offers.

The rating of train service that includes schedule and being on time, among other things, also increases the probability of using rail transport. Each additional score increases the probability by .028 (2.8%). With reference to the literature, Polat, (2012) and Sam et al., (2014) and Michel (2013) agreed that individuals are using the train because they find safety and comfort. Utility maximisation theory pointed that before individuals make their choice of mode of transport, they look at the benefit that transport offers, such as comfort and affordability.

The challenges (negative) that individuals hear about reduce the probability of them using the train by .012. The challenges include crime, which is one of the serious challenges facing the sector – crime on board and on the facilities. Polat (2012) established that there are individuals that are not happy about the train, for example they complain about train delays.

On the other hand, any positive sentiments increase the probability of using rail transport by .031 (3.1%). With reference to the literature, the utility theory noted that the more benefits the transport offers, the

more people demand it. Sam et al., (2014) and Jaiswal &Sharma, (2012) stated that rail transport should more offer positive services to attract more passengers.

5.2. Qualitative Data Analysis (Time Schedule and Train is very Slow)

In this study, people that are not using trains were also evaluated and they reported the main reason for not using trains. The reasons are discussed below.

Time schedule for train – People complained about the time schedule for trains and suggested that if trains could change their time schedule or provide more trains, it would be better. Constantinos & Tyrinopoulous (2013) and Fenta (2014) said that time is a big constraint because people cannot change the time spent on travel indefinitely and time wasted can never return (Wale & Steenburgen, 2006). Travelling time includes three components such as access time, waiting time, and journey time. These three components have different values for passengers, depending on the purpose of travel and journey. The study added by saying time schedules for train are often not suitable and that the train is an inflexible mode of transport, unlike the taxi and bus.

Trains are very slow – People said that the train is slow and they cannot use it if they are rushing somewhere. They suggested that trains should be improved and upgraded to accommodate anyone who needs transport at a particular time. Bresson, Dargay, Madre & Pirotte, (2003) stated that trains should improve and upgrade their speed so as to avoid passengers being late for their appointments.

Stations are far – People commented that stations are far from their homes, so that makes it difficult for them to use the train. They said that sometimes you arrive late and it is not safe to walk from the station to home.

6. Conclusion

This study set out to investigate the determinants of rail passenger transport usage in Buffalo City Municipality. The study employed Probit regression to determine the incidence of rail transport usage in Buffalo City Municipality. A household survey was conducted and the data was analysed through the Probit. . For first objective the analysis was done and the findings showed that rail transport is used daily in Buffalo City municipality and is used by students and workers. The findings for the second objective showed that low income earners are the most people that travel by train, education level that someone attained determine the mode of transport that would someone use, because from the analysis that was done in this study most of people with bachelor were not using rail transport. Lastly the findings showed that the facilities of train are the factors that influence the usage of rail transport in Buffalo City Municipality. An assessment of literature on the rail transport was conducted and from it an empirical model was specified. The literature revealed the main determinants of rail transport usage, and also identified the key theories based on this field.

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