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Customer Perceptions of Quality of Service in Public Transport: Evidence for bus transit in Scotland

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ABSTRACT

This paper provides a detailed examination of a quality of service indicator utilised by the Scottish Government to assess the opinions of passengers towards bus transport. The quality of service indicator takes the form of an 11 item opinion scale which covers an array of service aspects. Factor analysis is employed to identify latent constructs which are present within this scale. Three latent constructs associated with attitudes towards perceived quality of bus service are identified, covering convenience, cabin environment and ease of use issues. These latent constructs are further explored through an appreciation of how attitudes towards perceived quality of bus service vary across socio-economic cohorts and the degree to which these attitudes can be useful in explaining variation in perceived satisfaction with the bus service. Results of the analysis suggest that attitudes regarding quality of bus service vary significantly across passenger groups, with females having a tendency to exhibit relatively negative opinions regarding the quality of the cabin environment with a similar finding observed in the case of passengers who are looking after the home and family. In addition, perceived convenience of the bus service appears to have a significant positive explanatory power over perceived satisfaction with the bus service, suggesting that improvements to service frequency, availability, reliability and stability will likely increase perceived satisfaction amongst existing passengers. At a more general level, this paper demonstrates the level of additional knowledge which can be attained through more detailed analysis of existing transport policy data.

KEY WORDS

Quality of Service, Public Transport, Customer Perceptions

HIGHLIGHTS

- Public transport users associate issues relating to convenience, cabin environment and ease of use to perceived quality of service
- Perceptions of quality of service tend to vary across socio-economic cohorts
- Perceptions of service convenience are central in evaluations of overall satisfaction with service

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1. INTRODUCTION

The use of public transport in the majority of industrialised nations has decreased substantially over the past half century, due mostly to the rapid expansion in the use of cars to service mobility needs. In the case of Scotland, the average number of passenger trips on local bus services per head of population has decreased from 112 in 1992 to 80 in 2014, which represents a reduction of 28.6% (Transport Statistics Great Britain, 2014). Reversing this trend is a stated policy goal of the Scottish Government, with the National Transport Strategy for Scotland expressing a desire to attract passengers by delivering a high quality service (Scottish Executive, 2006a) in an effort to 'achieve a step change in bus usage, particularly modal shift from car to bus' (Scottish Executive, 2006b p.6). Indeed, increasing bus-based public transport holds a number of potential benefits for society, with an ability to contribute towards the economic, social and environmental domains of sustainable development.

Promoting modal shift from car to public transport is an area of research which has garnered significant attention since the turn of the millennium (Graham-Rowe et al. 2011). Enhancing the quality of service of public transport is often positioned as a strategy which can pull passengers towards using bus transit (Currie and Wallis, 2008). The Scottish Government makes use of a quality of service indicator in order to measure the attitudes of citizens concerning bus transport. This indicator is characterised by an 11 item measurement scale which incorporates opinion statements associated with an array of different aspects of service quality. The measurement scale is deployed annually, to allow for changes in the opinions held by the populace to be considered over time (Scottish Transport Statistics, 2014). In this paper, the evaluation of this measurement scale is progressed by considering what dimensions of quality it measures, how these identified dimensions vary across different socio-economic cohorts and the degree to which the identified dimensions can be of use in explaining overall satisfaction with bus services.

This paper progresses by offering an overview of the existing literature which investigates quality of service and how this issue has been examined so far in transport studies. Following this, the quality of service indicator utilised by the Scottish Government is introduced and the analysis approach utilised to examine this indicator is described. The results of the analysis are subsequently presented with key findings discussed.

2. QUALITY OF SERVICE

2.1 Initial Developments

The increasing prominence of the service sector in the economies of much of the industrialised world towards the end of the twentieth century provided impetus for an improved appreciation for what quality in service provision is (Grönroos, 1984; 1988). This attention was primarily driven by marketing sciences, aimed at understanding how the desires of customers could be better catered for through the application of management processes. This understanding was considered to represent an important issue in developing policies to improve customer satisfaction and retention and to implement strategies aimed at producing a competitive advantage in service delivery. Efforts to generate such an understanding of quality of service tended to focus on how this concept is

perceived by customers, with these perceptions covering both the functional delivery of the service, such as interactions with service personnel, and the technical outcomes of the service, such as transit times in the transport sector.

2.2 Measurement and Evaluation

One of the necessary steps to take in order to construct policies and strategies through which improvements in service quality can be pursued is to first evaluate the current level of quality in the service provision. To this end, developing techniques which allow quality of service to be measured represents an issue which has attracted significant academic attention.

One of the most widely employed approaches is SERVQUAL, which measures service across a number of different quality dimensions. SERVQUAL was initially developed out of an in-depth qualitative assessment of how quality of service is discussed by service providers and service customers (Parasuraman et al. 1985) which suggested that ten determinants of service quality are present across a variety of different service contexts. These ten determinants were subsequently refined through quantitative analysis to produce a multi-item measurement scale which covers five dimensions of service quality (Parasuraman et al. 1988). These dimensions include *tangible* aspects related to facilities and equipment, the *reliability* of service provision, the *responsiveness* of service employees, the *assurances* of employees (such as expertise and knowledge) as well as employee *empathy*. Each of the quality of service dimensions is considered by measuring both customer expectations of service quality and the perceived performance level of service quality and evaluating the gap which exists between these two measurements. If performance meets expectations, customers are considered to be satisfied whilst if performance falls short of expectations, customers are deemed to be dissatisfied. Subsequent revisions to SERVQUAL have been put forward in an attempt to improve measurement reliability, validity and ease of application (Parasuraman et al. 1991; 1994).

Whilst SERVQUAL has seen wide application in different service settings, reviewers have identified a number of limitations associated with the approach. Buttle et al. (1996) note these limitations tend to cover theoretical and operational issues with SERVQUAL. In terms of theoretical limitations, the universality of the service quality dimensions embedded in SERVQUAL has been brought into question both in terms of the convergent and discriminant validity of the dimensions (Asubonteng et al. 1996), with certain applications of SERVQUAL identifying different dimensions across different service sectors (Babakus and Boller, 1992). Moreover Cronin and Taylor (1992) argue that considering service quality to represent an attitude of a customer as opposed to a gap between expectation and performance allows the measurement to connect with conventional psychological theory. With this in mind, Cronin and Taylor (1994) propose that taking a single measurement approach, which considers perceived performance in quality of service (referred to as SERVPERF), is superior to the dual measurement approach of SERVQUAL. Whilst SERVQUAL and SERVPERF represent reductionist techniques which allow for straightforward deployment and evaluation, Gilmore and McMullan (2009) argue that the use of qualitative techniques, such as focus groups and interviews with customers, alongside applications of quantitative measurements can enhance understanding concerning the specific issues surrounding the perceptions of service quality in different settings. Taking a multi-method approach which integrates quantitative and qualitative

elements would all researchers to consider what Buttle et al (ibid.) describe as the nebulous nature of the quality of service concept.

2.3 Conceptual Extension

Quality of service represents an important concept in understanding the ways in which customers appraise service provision. This appraisal can interact with other concepts relating to service provision such as customer satisfaction, retention and behavioural intention. Offering an initial assessment of how these different concepts interrelate, Cronin and Taylor (1992) note that significant correlations exist between SERVPERF, customer satisfaction and intention to purchase, with similar results observed by Taylor and Baker (1994). Attempting to determine the sequential structure of these concepts, Cronin et al. (2000) illustrate a number of frameworks which position the concepts in alternative formations which tend to situate quality of service as the deepest level of abstraction, customer satisfaction as an intermediate concept and behavioural intention as the focal point. Taking a longitudinal approach to evaluating the conceptual links which exist between service provision concepts, Dabholkar et al. (2000) argue that the different dimensions of service quality (i.e. tangibles, reliability, responsiveness, assurance and empathy) represent antecedents to an overall evaluation of service quality. This overall measure is conceptually linked to customer satisfaction which itself acts as a strong mediator to and predictor of behavioural intention.

2.4 Transport Applications

The provision of personal mobility by transport service providers represents a substantial aspect of the transport sector, covering such modes as bus, train, ferry, air and vehicle hire schemes. Understanding the perceptions of transit customers to quality of service can be of use to service providers in both retaining existing customers and attracting new customers from other providers or transport modes. Consequently, it is unsurprising to observe that a large body of research exists concerning quality of service in the transport sector (Redman et al. 2013) which is outlined in this section and summarised in Table 1.

Fick and Ritchie (1991) provide an initial application of SERVQUAL in the airline industry and illustrate how the measurement approach can be useful in comparing different components of a larger service sector (in their case, the tourism industry). A similar project has been conducted by Pakdil and Aydin (2007), who developed a modified version of SERVQUAL, which extended the original service quality dimensions to include issues of image, flight experience and availability of interchange, with airline passengers tending to rate responsiveness as the most important service dimension. Utilising the SERVPERF measurement approach, Abdullah et al. (2012) alternatively find that the dimensions of tangibility, reliability and assurance to be the most important in the evaluation of service quality by airline passengers. In the context of bus transit, Pérez et al. (2007) find that the five service dimensions of service quality measured in SERVPERF can be identified and that each holds an effect over purchase intention. Interestingly, their analysis also suggests that the dimensions of service quality may reach a saturation level with customers, whereby additional service enhancements do not generate increased patronage. The stability of the five dimensions of service quality in the bus sector is also supported by the findings of Susiené (2012), whose analysis illustrates that each dimension is identifiable and that bus customers express relatively large levels

of dissatisfaction with the empathy of service employees. The SERVPERF scale has also seen modification in the transport sector, with de Oña et al. (2014) providing a longitudinal analysis of changes in perceived quality of bus transit systems in Spain. Their analysis indicates that perceptions have tended to improve over time, though customers appear to consider that transit fares, which can be viewed as a proxy for value for money, have deteriorated.

Table 1: Overview of transport sector quality of service research

Authors	Year	Mode	Approach	Quality of Service Dimensions
Fick and Ritchie	1991	Airline	SERVQUAL	Tangibles, reliability, responsiveness, assurance and empathy
Pakdil and Aydin	2007	Airline	SERVQUAL (modified)	Employees, tangibles, responsiveness, reliability and assurance, flight patterns, availability, image and empathy
Abdullah, Jan and Manaf	2012	Airline	SERVPERF	Tangibles, reliability, responsiveness, assurance and empathy
Pérez, Abad, Carrillo and Fernández	2007	Bus	SERVPERF	Tangibles, reliability, responsiveness, assurance and empathy
Susiené	2012	Bus	SERVQUAL	Tangibles, reliability, responsiveness, assurance and empathy
de Oña, Eboli and Mazzulla	2014	Bus	SERVPERF (modified)	Fare, information, courtesy, safety, accessibility, cleanliness, space, temperature, proximity, speed, punctuality and frequency
Eboli and Mazzulla	2007	Bus	Original measure	Service planning and reliability, comfort and ancillary factors and network design
Stradling, Carreno, Rye and Noble	2007	Bus	Original measure	Safety, service provision, unwanted arousal, cost, disability access, self image
Chou, Lu and Chang	2014	Train	Original measure	Tangibles, convenience, employee interaction and reliability
Lai and Chen	2011	Public transport	Original measure	Core services and physical environment
Şimşekoğlu, Nordfjaern and Rundmo	2015	Public transport	Original measure	Flexibility, convenience and safety
Yaya, Fortià, Canals and Marimon	2014	Bus	Original measure	Functional, physical and convenience
Carreira, Patfício, Jorge and Magee	2014	Bus	Original measure	Individual space, information provision, staff skill, social environment, vehicle maintenance, off-board facilities and ticketing services
Mahmoud and Hine	2016	Bus	Original measure	Comfort, transfer requirement, stop location, park and ride availability, waiting time, reliability, frequency, information, fare, discounts and safety

A number of research projects investigating perceptions of transport service quality have not made use of either SERVQUAL or SERPERF, instead utilising original measurement methods to evaluate this concept. Eboli and Mazzulla (2007) develop a quality of service measurement scale for bus transit which identifies three different quality dimensions which cover service planning and reliability, comfort and ancillary factors as well as network design. Of these three dimensions, their analysis indicates that only comfort and ancillary factors affects the perceived satisfaction of passengers. Chou et al. (2014) conduct a similar analysis for high speed rail transit and develop a five dimension quality of service indicator from past results in transport studies with the dimensions covering perceptions of the tangible aspects of the cabin environment, convenience of the service, interactions with employees and service reliability. These dimensions perform markedly well when considering their internal consistencies and prove highly effective in explaining variance in perceived satisfaction with service across different passenger cohorts. Approaching the topic of perceived quality of service from a different direction, Stradling et al. (2007) utilise a 68 item measurement scale to evaluate the service aspects which current bus users dislike about the service. Their analysis indicating that six quality dimensions are apparent covering safety, service provision, unwanted arousal, cost, access difficulties due to disabilities and considerations of self image. Moreover, Stradling et al (ibid.) demonstrate that the quality of bus services are not evaluated in isolation, with bus users also weighing up the quality of car and active transport modes in their evaluations of bus quality.

Investigating the intentions of individuals to make use of public transportation, Lai and Chen (2011) deploy an original measurement scale of perceived service quality which identifies two dimensions associated with core transit services (i.e. service coverage, frequency and information) and physical environment (i.e. cleanliness, safety and stability) and find that these dimensions significantly affect perceived satisfaction. A similar project has been conducted by Şimşekoğlu et al. (2015), who developed an original measurement scale of perceived quality of service which identified three distinct dimensions covering flexibility, convenience and safety. Considering the ways in which these dimensions can be of use in explaining variance in intention to make use of public transport, the results indicated that both perceived convenience and safety hold a significant effect. A number of the dimensions of service quality identified by Lai and Chen (ibid.) and Şimşekoğlu et al. (ibid.) are supported by the findings of Yaya et al. (2014), whose results suggest that public transport users consider service quality to cover functional issues of service provision (such as information and employee interaction), aspects of the physical environment (such as crowding, legroom and temperature) as well as perceptions of service convenience.

Offering a detailed evaluation of perceived service quality in bus transit, Carreira et al. (2014) develop a measurement scale from an in-depth qualitative assessment of customer opinion (Carriera et al. 2013) which includes the dimensions of individual space, information provision, staff skill, social environment, vehicle maintenance, off-board facilities and ticketing services. These dimensions also appear to interact with a number of different aspects of service provision, covering perceptions of value, satisfaction, loyalty and the emotional attachments customers hold towards the service. A similarly rich description of how current and potential bus customers perceived quality of service is offered by Mahmoud and Hine (2016), whose exploratory analysis finds that eleven indicators can be of use in explaining variance in user quality perceptions. Of these eleven indicators,

the analysis suggests that the need to transfer, the frequency of service and the availability of park and ride facilities are central dimensions in user evaluations of service quality.

To summarise, the transport sector has seen wide application of service quality assessments, some taking the standardised approach through applications of SERVQUAL or SERVPERF whilst others have applied original measurement instruments. The standardised approach proves useful in allowing for comparison between different modes and service providers whereas the original approach allows for the specific context of the service under evaluation to be considered. Whilst a number of clear overlaps in the identified dimensions of service quality are apparent, the findings of the literature so far suggest that an array of different issues are active when customers are considering their perceptions of service quality in transport services. This rich inventory of quality of service dimensions is used in this paper to evaluate the analysis of the quality of service indicator deployed by the Scottish Government in order to illustrate where overlaps in dimension structure are present and to consider the value of the indicator in the light of past research findings.

3. METHODOLOGY

The methodology section of the paper describes the quality of service indicator, outlines the dataset utilised in the analysis and provides an overview of the statistical approach employed in the analysis.

3.1 Quality of Service Indicator

Initially introduced in 2001, the Scottish Government makes use of a bespoke quality of service indicator in order to monitor the perceived experiences of customers concerning local bus services. The quality of service indicator comprises a multi-item attitudinal scale which asks bus users to state the degree to which they agree with each of the opinion statements (scale items) on a five point Likert-scale which ranges from highly disagree to highly agree. In addition, the Scottish Government utilises a single-item scale to evaluate the perceived level of satisfaction customers have concerning public transport services. This satisfaction indicator asks bus users to state their perceived satisfaction on a five point Likert-scale which ranges from highly dissatisfied to highly satisfied. The quality of service and satisfaction indicators are detailed in Table 2, which notes the opinion statements which comprise them and a number of descriptive statistics concerning the responses to these statements.

Table 2: Overview of quality of service indicator and satisfaction indicator utilised by the Scottish Government in the bus sector

No	Opinion Statement	M	SD
<i>Quality of Service Indicator</i>			
1	Buses are on time	3.79	1.08
2	Buses are frequent	3.92	1.06
3	Services run when I need it	3.76	1.12
4	Service is stable and isn't regularly changing	4.00	0.93
5	Buses are clean	3.82	1.00
6	Buses are comfortable	3.81	.098
7	I feel personally safe and secure on the bus	3.96	0.94
8	It is simple deciding the type of ticket I need	4.29	0.75
9	Finding out about routes and times is easy	3.97	0.97
10	It's easy changing from buses to other forms of transport	3.91	0.93
11	The fares are good value	3.70	1.30
<i>Satisfaction Indicator</i>			
1	Overall, how satisfied or dissatisfied are you with public transport	3.72	1.07

M: Mean; SD: Standard Deviation

3.2 Data Source

The quality of service and satisfaction indicators are incorporated into the Scottish Household Survey (SHS). The SHS is a large-scale annual survey of the Scottish populace covering a wide variety of social issues with a detailed section regarding transport. For the analysis reported in this paper, the 2007 – 2008 version of the SHS has been utilised (Scottish Government, 2009). At the time the analysis was conducted, the 2007 – 2008 dataset represented the most recent version of the SHS which was publicly available. Specific details regarding the sampling procedure utilised to attain the SHS can be viewed in the official documentation linked to the survey (Hope and Burnett, 2010).

3.3 Data Preparation

The final dataset used in the analysis reported in this paper was prepared in the following ways. Firstly, only the data for respondents aged 16 and over was used as this provided the necessary socio-economic characteristics (e.g. income levels, education levels) to conduct the cohort comparisons. Secondly, only respondents with full data on their socio-economic characteristics were used, with respondents who refused to provide this information removed from the analysis. Thirdly, only respondents who had made use of local bus services in the past month were included in the analysis as these are the citizens who are asked to complete the quality of service and satisfaction indicators. These preparations allowed for a detailed profile of each respondent included in the analysis to be generated. The size of the dataset after these preparations is 3,797 respondents with the basic characteristics of this dataset detailed in Table 3.

Table 3: Descriptive statistics of the dataset utilised in the analysis (n = 3,797)

Variable	Percent
<i>Gender</i>	
Male	48.4%
Female	51.6%
<i>Age (years)</i>	
16 – 24	15.9%
25 – 34	16.0%
35 – 44	19.0%
45 – 59	24.3%
60 – 74	17.5%
75+	7.3%
<i>Economic Status</i>	
Employed	58.6%
Looking after Home or Family	5.4%
Retired	20.4%
Unemployed and Seeking Work	3.3%
Education or Training	6.9%
Permanently Sick or Disabled	5.3%
<i>Gross Personal Income (GBP)</i>	
5,199 or less	14.9%
5,200 – 10,399	23.5%
10,400 – 15,599	19.4%
15,600 – 20,799	13.2%
20,800 – 25,999	9.0%
26,000 – 31,199	6.8%
31,200 – 36,399	4.7%
36,400 – 51,999	4.8%
52,000 or above	3.8%
<i>Level of Education</i>	
No Qualifications	21.3%
High School (Scottish Standard Grades)	50.9%
Pre University (Scottish Highers)	29.9%
Further Education (College)	10.0%
Higher Education (University)	17.5%

3.4 Data Analysis

The following approach is followed in order to analyse the prepared dataset. Firstly, an Exploratory Factor Analysis (EFA) is conducted on the quality of service indicator in order to identify the latent constructs which it contains. This EFA utilises a Principal Component Analysis (PCA) specification with direct oblimin rotation to allow the identified constructs to correlate with one another (Field, 2009). Scale diagnostics have also been calculated covering the Kaiser Meyer Olkin (KMO) test of sampling adequacy, Bartlett's test of sphericity and Cronbach's alpha (α) test of internal consistency. Secondly, the results of the EFA are further evaluated in a Confirmatory Factor Analysis (CFA) which

utilises a maximum likelihood specification to consider the degree to which the scale items fit the identified construct structure (Byrne, 2009). A benchmark CFA is initially specified with modification indices calculated to consider if inserting co-variances between item error terms is required. The model fit indices described by Hooper et al. (2008) are employed to illustrate the degree to which allowing for co-variance between item error terms improves the fit of the analysis. Factor scores are calculated for each of the constructs identified in the CFA using the regression method (DiStefano et al. 2009) to allow each respondent to be assigned a score for each of the constructs according to the manner in which they responded to the items which load on each construct.

Thirdly, the factor scores associated with each of the constructs identified in the factor analysis are further evaluated to consider how these scores vary across socio-economic cohorts. As the scores are not strictly normally distributed, non-parametric variants of hypothesis testing are utilised with the Mann-Whitney U test used when the comparison variable has two outcomes (such as gender and educational attainment) whilst the Kruskal-Wallis test is employed in instances where the comparison variable could take more than two outcomes (such as economic status and gross personal income). Fourthly, a Spearman's correlation analysis is conducted between the constructs identified in the factor analysis and the satisfaction indicator to consider where significant relationships between these issues are present. In the final stage of the analysis, a regression model is specified which utilises the constructs identified in the factor analysis as independent variables to explain variance in the satisfaction indicator. As the satisfaction indicator is measured on a sequential scale, an ordinal logistic regression approach is utilised.

4. RESULTS

The results of the analysis are presented in accordance with the statistical approach outlined in Section 3.4.

4.1 Exploratory Factor Analysis

The results of the PCA are presented in Table 4, which indicates that three latent constructs are present in the quality of service measurement scale. Each of these constructs is defined by the opinion statements which have a construct loading in excess of 0.4, the total variance which it explains in the scale (TVE) and Cronbach's alpha measure of internal consistency (α). In addition, each of the constructs is assigned a label which attempts to capture the content of the opinion statements comprising the construct. Opinion statement number 11, which covers perceptions of transit fares, has a relatively low level of extraction in the analysis, suggesting that it does not connect strongly to the other issues embedded in the scale. This result supports the findings of Lai and Chen (2011) whose analysis implies that perceived value represents an independent construct which, whilst related to service quality, holds a separate effect on customer's satisfaction of public transport. Consequently, opinion statement 11 has been removed from the EFA presented in this paper.

Table 4: Principal Component Analysis of the quality of service indicator deployed by the Scottish Government with latent construct labels, opinion statement groupings and construct loadings (KMO: .863; Bartlett's: 13623.27, p-value .000)

No	Statement	F1	F2	F3
<i>Quality of Service: Convenience (α: .82 TVE: 42.8%)</i>				
2	The buses are frequent	0.907	-0.097	0.002
3	The service runs when I need it	0.862	-0.043	0.044
1	The buses are on time	0.725	0.164	-0.084
4	The service is stable and isn't regularly changing	0.629	0.104	0.140
<i>Quality of Service: Cabin Environment (α: .78 TVE: 13.4%)</i>				
5	The buses are clean	0.013	0.900	-0.061
6	The buses are comfortable	0.045	0.850	-0.014
7	I feel personally safe and secure on the bus	-0.014	0.698	0.160
<i>Quality of Service: Ease of Use (α: .68 TVE: 10.5%)</i>				
9	Finding out about routes and times is easy	-0.110	0.042	0.812
8	It is simple deciding which ticket I need	0.041	0.059	0.768
10	It's easy changing from buses to other forms of transport	0.171	-0.051	0.683

The identified constructs appear to be distinct in the opinion statements which comprise them, with no significant cross loading of statements on multiple constructs being apparent. In addition, the alpha scores calculated for each of the constructs are satisfactory in each case, suggesting that the constructs are reasonably internally consistent. With this in mind, the results of the EFA have outwardly identified constructs which have discriminant and convergent validity.

Exploring the construct composition, it appears as if the first construct extracted from the measurement scale (labelled *Quality of Service: Convenience*) collects attitude statements which are connected with the perceived convenience of the service, with statements covering such issues as service punctuality, frequency and predictability. This construct explains a substantial quantity of the variance in the measurement scale (TVE: 42.8%) and provides support to the findings Yaya et al. (2014) and Şimşekoğlu et al. (2015) that issues concerning service convenience are connected to perceived quality of service. For the second identified construct (labelled *Quality of Service: Cabin Environment*), the attitude statements indicate that this construct is focused on the pleasantness of the travel experience, containing issues covering the observed cleanliness, perceived comfort and the degree to which the respondent feels safe using the bus. This finding shares parallels with the results observed by Lai and Chen (2011) and Chou et al. (2014), with public transport customers considering the physical environment of the vehicles to be an important aspect of service quality. The final construct extracted from the scale (labelled *Quality of Service: Ease of Use*) groups three opinion statements covering such issues as simplicity in ticketing, seamless transfer to alternative transport modes and access to service information. In this instance, this particular construct does not have clear equivalent in the existing literature, indicating that it might reveal an original dimension of service quality.

4.2 Confirmatory Factor Analysis

The results of the EFA have been further evaluated in a CFA. An initial benchmark CFA is calculated and returns an acceptable degree of model fit (χ^2 : 658.803 df = 32; GFI: 0.963; AGFI: 0.936; CFI: 0.952; RMSEA: 0.074). An inspection of the modification indices of the benchmark CFA indicates that allowing a number of the opinion statement error terms of the construct *Quality of Service: Convenience* to co-vary could improve the model. With this in mind, a modified CFA is specified with co-variances between the error terms of statement number 1 and 3, 1 and 4, 2 and 3 as well as 2 and 4. After these revisions are installed, the CFA returns an enhanced model fit (χ^2 : 314.006 df = 28; GFI: 0.983; AGFI: 0.967; CFI: 0.978; RMSEA: 0.053), with the statistics suggesting that a good solution is present. The modified version of the CFA is illustrated in Figure 1, which outlines its structural form and standardised estimates.

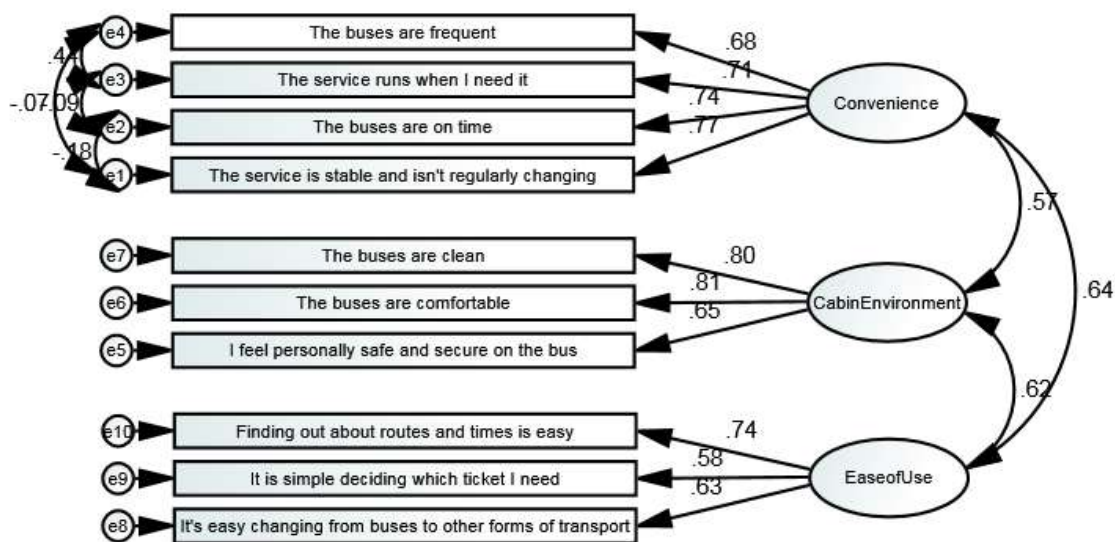


Figure 1: Confirmatory factor analysis of the quality of service indicator deployed by the Scottish Government (χ^2 : 314.006 df = 28; GFI: 0.983; AGFI: 0.967; CFI: 0.978; RMSEA: 0.053)

4.3 Socio-economic Cohort Analysis

Table 5 presents the results of a series of hypothesis tests which explore if the attitudes towards the perceived quality of service, which cover the latent constructs identified in the factor analysis (reported in Table 4 and Figure 1), vary across socio-economic cohorts. Examining the results of the hypothesis testing, a number of significant differences have been identified with respondent cohorts displaying distinct attitudes towards perceived quality of service.

In terms of gender, only attitudes towards the cabin environment vary, with male respondents showing a tendency to state higher levels of perceived quality compared to females (male \bar{x} : 0.053; female \bar{x} : -0.043). This observation provides partial support to the findings of Stradling et al. (2007), who note that females have a tendency to express heightened concerns relating to safety considerations when using bus transport. Significant differences are observed across all three constructs in terms of age profiles, with attitudes towards perceived quality of service generally

becoming more positive as the age of respondents increases. Attitude variation is also present in terms of economic status, with respondents who are retired tending to hold relatively positive attitudes concerning the perceived quality of service (*Quality of Service: Convenience* π : 0.158; *Quality of Service: Cabin Environment* π : 0.204; *Quality of Service: Ease of Use* π : 0.164) whereas respondents who are looking after the home or family have a propensity to display negative loadings on the three constructs (*Quality of Service: Convenience* π : -0.162; *Quality of Service: Cabin Environment* π : -0.204; *Quality of Service: Ease of Use* π : -0.224).

Table 5: Hypothesis testing to identify differences in quality of service attitudes across socio-economic cohorts

Variable	Quality of Service: Convenience		Quality of Service: Cabin Environment		Quality of Service: Ease of Use	
	Mean	SD	Mean	SD	Mean	SD
<i>Gender</i> ^A	p-value: .844		p-value: .003		p-value: .759	
Male	0.029	0.969	0.053	0.975	-0.007	1.032
Female	-0.024	1.024	-0.043	1.018	0.005	0.973
<i>Age (years)</i> ^B	p-value: .000		p-value: .000		p-value: .000	
16 – 24	-0.173	1.025	-0.282	1.086	-0.050	0.946
25 – 34	0.020	0.925	-0.026	0.957	-0.031	0.970
35 – 44	0.020	1.051	0.042	1.004	-0.106	1.071
45 – 59	-0.022	1.024	0.074	0.983	-0.057	1.101
60 – 74	0.095	0.979	0.139	0.902	0.177	0.924
75 plus	0.259	0.871	0.279	0.896	0.151	0.905
<i>Economic Status</i> ^B	p-value: .000		p-value: .000		p-value: .000	
Employed	-0.042	0.987	0.006	0.982	-0.036	1.023
Looking after Home/Family	-0.162	1.187	-0.204	1.105	-0.224	1.038
Retired	0.158	0.957	0.204	0.898	0.164	0.930
Unemployed	-0.018	1.080	-0.245	1.053	-0.097	0.987
Education or Training	-0.087	0.981	-0.174	0.990	0.004	0.915
Disabled	0.117	0.960	0.025	1.158	-0.025	1.131
<i>Gross Personal Income (GBP)</i> ^B	p-value: .793		p-value: .007		p-value: .001	
0 – 15,599	-0.009	1.005	-0.031	1.009	0.030	0.963
15,600 – 31,199	0.009	1.024	0.069	0.986	-0.009	1.042
31, 200 and above	0.047	0.915	0.052	0.976	-0.178	1.139
<i>No Education</i> ^A	p-value: .000		p-value: .000		p-value: .000	
Yes	0.117	1.019	0.125	0.986	0.127	0.974
No	-0.036	0.994	-0.039	1.002	-0.038	1.006
<i>University Education</i> ^A	p-value: .428		p-value: .802		p-value: .000	
Yes	0.019	0.921	0.001	0.956	-0.133	1.038
No	-0.005	1.017	-0.002	1.010	0.027	0.991

A: Mann-Whitney U Test

B: Kruskal-Wallis Test

In terms of gross personal income, significant variations are observed for both *Quality of Service: Cabin Environment* and *Quality of Service: Ease of Use*, with respondents who earn between £0 –

15,599 tending to display relatively unfavourable perceptions of the cabin environment compared to respondents in the higher income segments. Moreover, respondents in the top income bracket have a greater likelihood of displaying relatively unfavourable attitudes towards the perceived ease of use of buses compared to respondents in the lower income brackets. Focusing on the level of formal education, significant variations in the perceived quality of bus service are observed across respondents who do and do not have qualifications. Specifically, respondents who state that they have no formal educational qualifications appear to display more positive attitudes across all constructs compared to respondents with formal education qualifications (no formal education α : .117, .125, .127; formal education α : -.036, -.039, -.038). In addition, respondents who have attained a university degree have relatively unfavourable attitudes towards the perceived ease of use of buses compared to respondents who do not have a university degree (degree α : -.133; no degree α : .027). These findings agree with those stated by Yaya et al. (2014), who observed that the attitudes of passengers concerning perceived quality of service in public transport tend to be highest amongst citizens with high school qualifications.

4.4 Correlation Analysis

The results of the Spearman's correlation analysis between the quality of service constructs identified in the factor analysis (reported in Table 4 and Figure 1) and the perceived satisfaction of public transport indicator (reported in Table 2) are detail in Table 6. The results indicate that a significant degree of interaction exists between the variables included in the analysis. Notably, the constructs *Quality of Service: Convenience* and *Quality of Service: Ease of Use* share a strong positive correlation (r_s : 0.714), indicating that bus customers may consider these issues to reflect similar perspectives of perceived quality. All three of the quality of service constructs also display moderately strong significant correlation coefficients with perceived satisfaction (r_s : 0.565; 0.426; 0.453), indicating that quality of service as evaluated by the Scottish Government's measurement scale represents a useful indicator of customer satisfaction.

Table 6: Spearman's correlation analysis between quality of service constructs and perceived satisfaction

Variable	A	B	C	D
Quality of Service: Convenience (A)	1.000			
Quality of Service: Cabin Environment (B)	0.634**	1.000		
Quality of Service: Ease of Use (C)	0.714**	0.736**	1.000	
Perceived Satisfaction (D)	0.565**	0.426**	0.453**	1.000

** : p-value < .01

4.5 Regression Analysis

The final stage of the analysis considers the degree to which attitudes towards perceived quality of service can be of use in explaining expressed satisfaction with service provision. To gain insights on this issue, an ordinal logistic regression model is constructed which utilises the perceived satisfaction with public transport indicator (reported in Table 2) as the dependent variable. The independent

variables cover the latent constructs associated with attitudes towards perceived quality of service (reported in Table 4 and Figure 1). The results of the model are presented in Table 7.

Table 7: Ordinal logistic regression model with perceived satisfaction with service as the dependent variable and quality of service constructs as the independent variables

Variable	Beta	Std. Err.	Wald	95% Conf. Int.
QoS: Convenience	1.415**	0.054	687.954	1.309 - 1.520
QoS: Cabin Environment	0.278**	0.053	27.722	0.174 - 0.381
QoS: Ease of Use	0.176**	0.061	8.261	0.056 - 0.297
Model Fit				
-2LL (intercept)	6215.370			
-2LL (final)	4568.311			
χ^2 (df = 3)	1647.059**			
Nagelkerke R ²	0.411			

** : p-value < .01

Appraising the effectiveness of the model in explaining variance in customer satisfaction, the model displays a significant chi-square indicating it offers some degree of explanatory power compared to an intercept only model. The Nagelkerke pseudo R² of the model is .411, suggesting that the model accounts for over a third of the variation in perceived satisfaction levels. Exploring the structure of the model, it is apparent that all of the explanatory variables included display some degree of significant effect over customer satisfaction. The comparative size of the model coefficients associated with each of the quality of service constructs provides insight concerning the relative importance of these issues in customer satisfaction. The construct *Quality of Service: Convenience* displays a markedly large coefficient (Beta: 1.415), suggesting that customer perceptions of bus frequency, availability, reliability and stability are principal in evaluations of satisfaction. The remaining quality of service constructs, whilst still being significant in the model, exhibit distinctly smaller model coefficients (Beta: 0.278; 0.176), which indicates that perceptions of cabin environment quality and the ease of use of bus services are secondary issues in customer assessments of satisfaction. The results of the ordinal logistic regression analysis appear to share similarities to the findings of Mahmoud and Hine (2016), whose analysis demonstrated that transfer requirement, service frequency and park and ride availability, which can be viewed as aspects of service convenience, are central issues in the way bus customers consider quality of service.

5. DISCUSSION AND CONCLUSIONS

The primary objective of the research project reported in this paper is to demonstrate the additional knowledge which can be generated through a more detailed evaluation of the quality of service indicator for bus transport utilised by the Scottish Government. Factor analysis of the measurement scale which comprises this indicator identifies three latent constructs to be present covering issues related to perceived convenience, quality of the cabin environment and ease of use. This construct structure holds similarities to that observed by other research projects investigating this topic (Eboli

and Mazzulla, 2007; Yaya et al. 2014), suggesting that a three construct structure for quality of service provides a useable representation of this concept. Taking this into account alongside the way in which the identified constructs share similarities with past research findings, the constructs identified in the factor analysis seemingly represent underlining dimensions of perceived service quality.

The dimensions of perceived service quality identified in the factor analysis appear to vary significantly across socio-economic cohorts, suggesting that citizens from different life-stages and circumstances hold distinctive attitudes regarding the perceived quality of service. Understanding where differences in attitudes exist across different socio-economic cohorts can be useful in targeting service improvements. The results of the analysis reported here indicate that females tend to hold more negative attitudes concerning the quality of the cabin environment compared to males. This suggests that policies which focus on enacting improvements to the cabin environment will likely enhance the perceived quality of service experienced by female passengers in particular. Along similar lines, respondents who are currently looking after the home or the family have a propensity to hold more negative attitudes on all three quality of service dimensions. The implications of this are that an in-depth analysis of the needs and desires of this particular citizen cohort may reveal how changes to service provision could be altered to better cater to their mobility requirements.

Exploring the degree to which the three dimensions of service quality identified in the factor analysis can be of use in explaining overall satisfaction with the service, the results of the ordinal logistic regression analysis provide a number of useful insights. Firstly, the analysis indicates that perceived service convenience represents a central dimension concerning how bus customers assess overall satisfaction with service provision. An interpretation of this finding is that, in order to improve satisfaction with existing customers, transport service providers may find it useful to concentrate efforts on improving service frequency, availability, reliability and stability. Secondly, the analysis implies that perceptions of the cabin environment and ease of service use, whilst holding significant effect over customer satisfaction, are secondary issues and are subordinate to perceptions of service convenience.

The analysis reported in this paper may also be of use in considering how the quality of service indicator employed by the Scottish Government could be developed to produce additional insights. Firstly, in its current form, the quality of service indicator is only deployed with existing bus customers. Whilst this allows the Scottish Government to understand how current patrons perceive the service, it offers no insights concerning the perceptions of non-bus users towards service quality. Extending the deployment to non-bus users would allow the Scottish Government to understand how perceptions differ between current customers and citizens who currently do not utilise bus services. This understanding may offer insights regarding how non-bus users could be attracted to the service, which would assist in the development of policies aimed at generating modal shift from car to bus which represents a strategic objective of the Scottish Government.

Secondly, the Scottish Government may want to consider extending the service of quality indicator to include a number of additional issues which past research has shown to represent valid quality dimensions. Notably, the inclusion of scale items which evaluate perceptions of employee

interaction, which represents a key component of the standardised SERVQUAL and SERVPERF approaches and has been found to be an identifiable issue in transport services (Pérez et al. 2007; Chou et al. 2014; Carreira et al. 2014), will allow for the importance of this dimension to be evaluated. Moreover, the current approach taken by the Scottish Government, whilst covering a multi-item measurement scale for service quality and a single item measurement scale for service satisfaction, excludes ancillary concepts of service provision such as service retention and service loyalty in the case of existing customers as well as service intention in the case of non-bus users. Taking measurements of these ancillary service provision concepts could allow the Scottish Government to consider how strategies to retain existing customers and policies to attract new customers could be developed. However, extending the approach to include additional dimensions and service provision concepts will lead to an expansion of the questions asked to respondents, which will lengthen survey completion times and lead to increased financial expenditure in data collection and analysis. With this in mind, the Scottish Government may want to evaluate if such an expansion would generate additional value in excess of these extra costs.

At a more general level, this paper demonstrates the added value which can be attained by a more thorough analysis of existing transport policy data. Indeed, relatively simple quality of service indicators such as the one utilised by the Scottish Government can offer further insights upon closer inspection. With growing levels of data being made available as governments follow openness and transparency policies, significant opportunities are emerging for secondary data analysis which will likely have a direct engagement with the issues currently active in the policy making environment.

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