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Determinants of customer satisfaction with a true door-to-door DRT service in rural Germany

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ABSTRACT

The effects of demographic change and the lack of acceptance represent some of the main problems for the public transport infrastructure in rural areas. As a consequence, the development of new transport service options becomes especially relevant for rural communities. The Max-Planck-Institute for Dynamics and Self-Organization developed a new form of Demand Responsive Transport the EcoBus to examine the viability of new DRT systems in rural Germany. Our work draws on customer satisfaction data during the trial runs of the EcoBus. Based on the survey data, this paper develops regression models to explain the determinants of DRT customer satisfaction. Our main findings include the importance of waiting times and the ease of entry for overall customer satisfaction. Nevertheless, we found no evidence that the presence of other guests in the vehicle had any negative impact on customer satisfaction. Findings of other works that women are significantly more likely to use DRT services could not be validated from our data.

1. Introduction

The ability to lead an independent and self-determined life is one of the most important and basic needs for people of all age groups. One aspect of this is the assurance of spatial mobility. Restriction of general mobility is often accompanied by a perceived loss in the quality of life, autonomy and freedom (Limbourg, 2015; Limbourg & Matern, 2009). Especially in rural areas, these demands represent an increased challenge. Many rural areas are characterised by similar features. Often the distances to be covered, for example to medical appointments, school or work, are very long and public transport is often insufficiently developed, so that the mobility demands of local residents cannot be adequately taken into account. Due to the low population density, traditional scheduled transport is often underutilised. Frequently, many seats in the transport vehicles remain unused and entire lines are removed from the public transport offer, as it is not worthwhile for the transport providers to continue financing the service. Regularly, the transport providers are focused on school times, since relatively large capacity utilisation can be reached here. Outside these rush hours, however, frequency of busses in rural areas is comparatively low, as low load factors or empty runs are more likely. The low frequency often leads to general dissatisfaction among citizens, for whom regular bus services are becoming less and less important, as they see no added value in their quality of life through the existing services. The need for flexible and low-cost mobility is therefore only insufficiently met by scheduled transport. A significant part of the population in rural areas therefore remains dependent on their cars. The operators of existing public transport systems are thus tasked to combine cost efficiency with a satisfactory service concept for their customers. Given this background Demand Responsive Transport (DRT) systems might be a valid possibility to provide rural areas with sufficient access to efficient public transport services. DRT systems are a mean of public transport that falls between private car usage and conventional public transport which aims at combining the benefits of busses and their higher occupancy rates with the greater comfort levels of taxi services (Bakker, 1999). Following the common definition, we define a DRT system as being publicly accessible to all groups and not focused on one special age group for example. Contrary to taxi services, fares are charged per customer and not per vehicle. Furthermore, the DRT system changes according to variations in demand and is provided by low capacity

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vehicles like vans opposed to large busses. There has already been substantial research on a wide array of different DRT cases and varying aspects of these services. However, these studies had relatively limited focus on the user perceptions of DRT services. Furthermore, many similar projects often utilised semi-fixed routes in their projects where some stop points are obligatory only allowing for some deviations from main routes (Brake, Mulley, Nelson, & Wright, 2007). Within the framework of two pilot projects the Max-Planck-Institute for Dynamics and Self-Organization researched the implementation of a DRT system in rural areas. Here, we had the possibility to examine the previously presented problems during the trial run of a true door-to-door minibus system in the regions of Bad Gandersheim and Kalefeld as well as for the Harz area of Lower-Saxony. For the pilot phases, a questionnaire on general customer satisfaction was developed. This questionnaire refers to customer experiences with the Demand Responsive Transport System EcoBus. The EcoBus was operated as part of a first pilot project in the Bad Gandersheim and Kalefeld region from 2 July 2018 to 5 August 2018 and from 11 August 2018 to 28 February 2019 in the Harz. In this work, the survey in question is to be evaluated as part of a statistical analysis. Through the evaluation of our customer satisfaction survey, we try to add to the scholarly knowledge on customer perception of DRT services. In our analysis of the viability of DRT systems we solely focus on the demand side of the service in form of satisfaction parameters. Although there is evidence that DRT services were often discontinued due to high costs (e.g., Davison, Enoch, Ryley, Quddus, & Wang, 2014; Mageean & Nelson, 2003), we think that demand for public transport is often very lacking due to the unattractiveness of the service for the average citizen. Furthermore, since we are investigating pilot projects, it would be quite difficult to investigate the actual cost of a DRT service during actual continuous operation.

In this paper, the problems of public and private transport in rural areas are elucidated. Furthermore, literature regarding Demand Responsive Transport systems and their possible solutions for the transport problems are presented. This is followed by a brief presentation of the statistical model, the case study and our data. Then the results of our analysis are presented. First, we analysed the influence of different variables on the satisfaction levels with an DRT system. Next, we used our model to analyse the differences between groups with time restrictions and a control group. Finally, a concluding summary is given.

2. Existing research on public transportation in rural areas

The effects of demographic change and the lack of acceptance represent some of the main problems for the public transport infrastructure in rural areas. Often, these areas are suffering from small population growth which does not sustain the overall population level. This is even further aggravated by the fact that rural regions are often subject to emigration especially of younger generations. Negative population growth then results in rising average costs per inhabitant until authorities in the countryside are ultimately no longer able to afford public transport services (Weiß, 2006).

The usual DRT providers range on the one hand from informal community transports that are for example specialised on walking impaired or older citizens to more sophisticated public or private service networks. DRT systems are also often referred to as ridepooling services. Here, the primary objective is to ensure that the routes of different passengers are served by a single journey, with passengers accepting detours that should be kept to a minimum (Alonso-Mora, Samaranayake, Wallar, Frazzoli, & Rus, 2017). Ridesharing on the other hand is generally characterised by the fact that private drivers offer their free seats in the car to third parties on a journey and determine the framework conditions, such as the place of departure, the time and the exact destination. The passengers may pay the driver an amount that generally does not exceed the total cost of the journey. If drivers cannot find passengers for the trip they are offered, they will still take the trip.

Jokinen (2016) postulated that an increased usage of DRT by public transport operators can yield higher overall cost-efficiency (in terms of consumer and societal costs) given that demand density and fleet size are sufficiently large. By providing an example of a DRT service in Finland he found that these preconditions often remain challenging. Political requirements regarding budget constraints and service area are limiting factors for the DRT fleet size. Jokinen found that for a Finnish case study average occupancy rates remained relatively low and thus subsidisation rates high. Wang, Quddus, Enoch, Ryley, and Davison (2015) have analysed a DRT service of the Lincolnshire County Council in the UK called 'CallConnect'. Through the analysis of a customer survey they gained information on customer satisfaction with the public transport system. They found that the majority of the respondents were either "very satisfied" (62.96%) or "fairly satisfied" (19.91%) with the DRT service overall. However, as far as we understand their service used semi-fixed stops. Regarding the overall success of DRT projects, Herminghaus (2019) claims that the reason for many recent systems not being successful is the low number of operating vehicles. As a result these services are unable to provide viable waiting times for customers. In his work Herminghaus estimated that costs for DRT services, in similar areas to ours are about 4 times higher per kilometre per person than for private cars. This results from higher operating costs from driver salaries and larger fuel consumption. Furthermore, he claims that until recently processing power of computers was not sufficiently high to effectively handle scheduling and travel requests. Consequently, it is asserted that in a fully developed DRT system, traffic volume and energy consumption could be reduced by a factor of five through increased ride pooling. Hence, demand responsive transport is seen as a potentially viable option even for rural areas.

Baumeister and Meier-Bebereich (2018) found that public transport in Germany's rural areas is mainly focused on school transport, which is generally becoming more expensive due to longer journeys (increasing expenditure) and decreasing numbers of pupils (decreasing capacity utilisation). By means of statutory incentives and public funding systems by policy makers, pupil transport was integrated into the public transport system, which, however, is generally unattractive for general public (e.g. because of the timetable and the connection to stops). This implicit incentivisation has led to the extensive dependence of public transport providers on school transit. Consequently, in many regions there is only rudimentary local public transport at weekends and during school holidays. Hence, dependency on a private car remains high. Berg and Ihlström (2019) also identified a lacking service offer as a main reason for car usage over public transport in rural areas. Other reasons included habits and time concerns of the residents. There are several studies that found a significantly higher share of women using DRT services (see Nelson and Phonphitakchai (2012), Rosenbloom (2004), and Koffman (2004)) Morton, Caulfield, and Anable (2016) followed a similar approach to ours in this paper. They analysed perceived quality of bus services related to convenience, cabin environment and ease of use issues. Then they analysed how these perceived differences in quality changed over socio-economic cohorts. They found females exhibiting relatively lower opinions regarding the bus interior. Other findings include that the perceived convenience of the bus service showed a significant impact on satisfaction levels. They suggest that improvements in service frequency, availability, reliability and stability are likely to increase satisfaction among passengers.

3. Case study area and data description

The geographical area of Südniedersachsen is located in the south-eastern part of the federal state of Lower-Saxony in Germany. It is comprised of the county districts of Goslar, Göttingen, Holzminden and Northeim. With the exception of Göttingen, the region is characterised by sparsely settled rural districts or districts with some rudimentary settlement densification. Specifically, the areas where the DRT trial projects took place, Northeim and the former county district of

Osterode am Harz (now county district Göttingen) are counties with an urban population share of less than 50% and a population density of less than 100 inhabitants per square kilometre, while the district of Goslar has a population density of less than 150 inhabitants per square kilometre but an urban population share slightly above 50% BBSR. The “Verkehrsverbund Südniedersachsen” is the municipal public transport service provider for the region. In cooperation with the Max Planck Institute for Dynamics and Self-Organization located in Göttingen they initiated the EcoBus project. The EcoBus is a newly created DRT system which operated during two trial runs in Bad Gandersheim and Kalefeld (District Northeim) and in the Harz region of Lower-Saxony (former district Osterode am Harz and district Goslar). Apart from DRT, public transport in the trial areas is generally provided by conventional bus and sparsely available train services. In these areas, mobility along the main transport routes is mostly available through aforementioned busses. However, public transport routes are generally inflexible regarding their routing and scheduling offers and are less accessible outside of the main school hours. Given the lacking public transport service provision, most inhabitants rely on the motorised individual transport. Based on these characteristics, the EcoBus was created to supplement the existing public transport through a flexible demand responsive transport component. The EcoBus system is designed to transport customers to their destination on demand and without predetermined routes, timetables or stops. The customer can book the desired journey online, via app or by ordering over a call centre. The call centre option was implemented to make the service accessible to all user groups especially elderly people who are less willing or unable to get involved with a smartphone (Clewlow & Mishra, 2017; Kloth & Mehler, 2018). Journey requests are consequently bundled and assigned to the individual busses. Route planning and optimisation is facilitated by a route optimising algorithm. The algorithm and accompanying software were designed by the Max-Planck-Institute for Dynamics and Self-organization in Göttingen. After booking the user receives feedback on his planned pick-up period. Ticketing and pricing were based on the already existing infrastructure of the local transport providers such that the DRT system was fully integrated in the existing public transport system and required no further adjustments. A ticket for the DRT service had the same price as a regular bus ticket on the same route and was charged per ride with no additional charge per driven kilometre.

From 10 June 2018 to 5 August 2018, the very first EcoBus pilot test took place in Bad Gandersheim and Kalefeld in the county district of Northeim parallel to the Gandersheim Cathedral Festival. Here, the system could be tested for the first time in a small trial area during the summer season to gather knowledge for the regular service operation Fig. 1a. From 11 August 2018 to 28 February 2019, the EcoBus was tested in a much larger area in the Harz in the districts of Goslar and Göttingen. In the mountainous area, the number of inhabitants, the topography and also the mobile phone coverage as well as the climate and the time of year posed different challenges (Fig. 1a, b). The initial number of five busses in operation was subsequently increased to a total of eight operating busses with a capacity of eight passengers and one driver per vehicle. The operating hours were: 06:00–22:00 on Mondays through Thursdays, 06:00–02:00 on Fridays, 08:00–02:00 on Saturdays and 08:00–22:00 on Sundays. The EcoBus service area pictured in Fig. 1b shows the main traffic routes along with the main train stations in the trial areas. Inside this area every single point along a passable road could be serviced by the system. The EcoBus system can therefore be considered a “true” door-to-door system that is not reliant on any (virtual) bus stops. The system was designed to provide the highest degree of comfort for customers.

Pickup requests inside impassable areas such as pedestrian zones, were handled by a “snapping” software that guided the customer on the app to the nearest passable street to be picked up by the bus. To fulfil the EcoBus' ambition to cooperate rather than compete with existing public transport services (e.g. bus lines) some areas inside the trial region were declared to be solely pickup or drop-off zones. This means a person could order a lift to or from a point inside the special zone to any other point in the service area except inside the special zone. This was the case for the core city of Bad Gandersheim in the first trial region and for the urban areas of Goslar, Langelsheim and Oker inside the second area. These areas that are rather urban in character were deemed to have an already sufficient public transport offer through existing measures. The declaration of the pickup/drop-off zones was done to prevent cannibalisation of conventional (in urban areas more efficiently) operating bus systems. Outside of these designated areas there was no implemented mechanism to prevent DRT trips parallel to regular bus lines.

The data used in this study comes from a customer survey conducted during the two trial periods of the EcoBus service. It contains responses from 212 customers. The survey was carried out inside the busses during operating hours. The bus operators were asked to inform their customers about the provided survey questionnaires which were available in paper form and could be returned into submission boxes inside the busses. Hence, there was no specific selection criteria for participants. The customers were asked to fill out only one survey. Questions asked in the survey include the type of ticket used, whether and how many other guests were on the bus, the waiting time, satisfaction with the entry possibilities of the bus, satisfaction with bus equipment, overall satisfaction, reason for travelling, car ownership, age, gender and job status. Regarding the waiting times, the EcoBus service had no predetermined timetable. After ordering a bus the customer received a pickup offer according to possible scheduling that depended on the number of vehicles operating and already planned trips. When the pickup offer was accepted the customer got a guaranteed time window of 20 min to be picked off by the EcoBus.

4. Statistical model

In this study we used an ordered logit model (OLOGIT) to identify the factors influencing overall satisfaction with the DRT system. The choice for this type of model is straightforward in this case. Ordinal Regressions are an extension of binomial logistics regression. The OLOGIT regression is used in this case to predict the overall satisfaction variable with multiple ‘ordered’ categories and independent variables. Generally, the regression is used to identify the relationship between the dependent variable (being made up of several ordered levels) and the independent variables. In our survey we asked the respondents to reflect on their level of satisfaction on a five-point scale ranging from very satisfied to very unsatisfied. Consequently, in our analysis we added intermediary levels to the responses, rather satisfied, neutral and rather dissatisfied. Doing so, we can identify a natural order in our levels. The observed overall satisfaction in form of our five ordered levels is estimated with one base level and four thresholds according to the ordered levels. Interpretation of the model coefficients is uncomplicated. Positive signs of the coefficients indicate a positive influence of the independent variables on overall satisfaction with the DRT service and vice versa. Like logistic models, the odds and odds ratio of a certain outcome can be computed to ease the coefficients interpretation. Limitations of OLOGIT regressions include the assumption of proportional odds in the outcome of our dependent variable and the problem of under reporting in our data (Quddus, Wang, & Ison, 2009; Yamamoto, Hashiji, & Shankar, 2008). However, Wang et al. (2015) validated the viability of the OLOGIT model in a similar case study.

Our chosen variables are presented in Table 1. All of our variables come from the survey done during the operating time of the EcoBus. Satisfaction is our five-level dependent variable which we want to explain. Waiting time is a four-level variable (1 = up to 10 min; 2 = up to 20 min; 3 = up to 30 min; 4 = more than 30 min). Entry is a five-level variable giving information of the perceived ease of entry into the vehicle (1 to 5 from very uncomfortable to very comfortable). Ease of

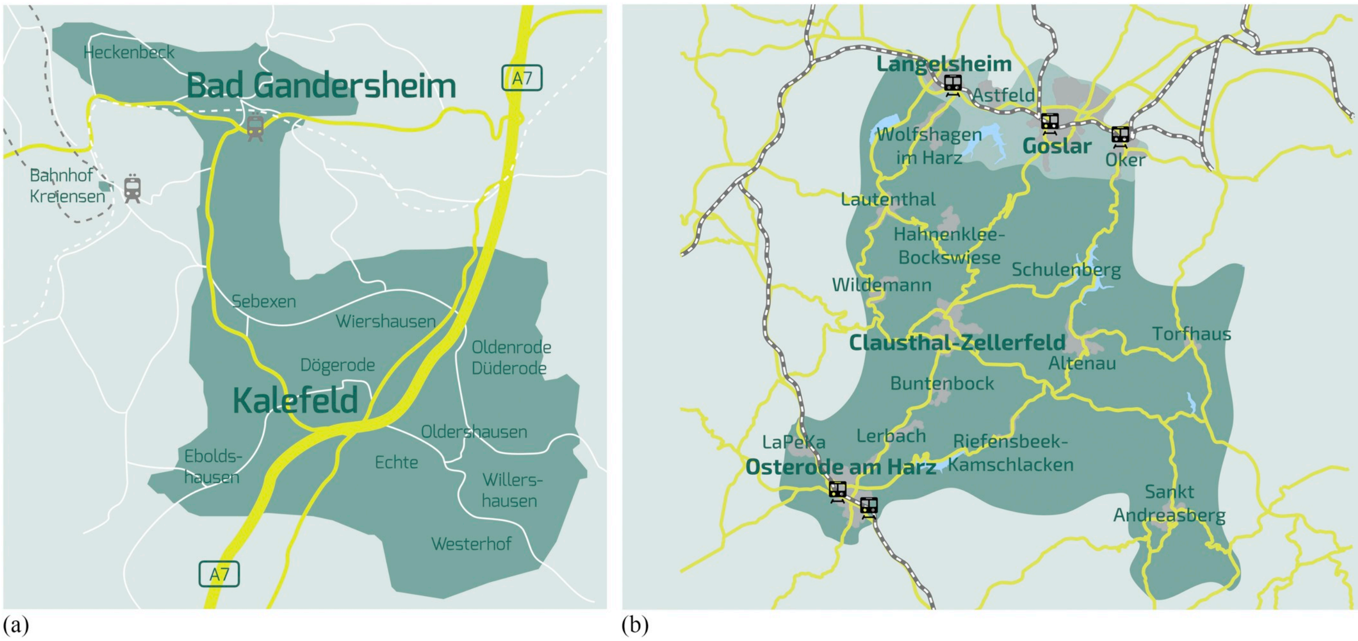

Fig. 1. Service areas of EcoBus Pilots.

Table 1
Variables used in regressions.

	Obs	Mean	Std. Dev.	Min	Max	NA
Satisfaction	210	4.510	0.810	1	5	2
Waiting time	207	1.330	0.700	1	4	5
Entry	209	4.640	0.700	1	5	3
Car Ownership	210	0.320	0.470	0	1	2
Age	209	40.170	19.500	10	90	3
Other Guests	212	0.480	0.500	0	1	0

entry in this case is only related to the perceived effort to enter the bus. We did not see a need to integrate another question regarding the general accessibility of the service, since the EcoBus offered its service at almost every point in the service area. Car Ownership is a dummy variable giving information whether the respondent is owning a car (with zero meaning no car ownership). Other guests in this case means whether there were other guests in the vehicle apart from the respondent or the group travelling with the respondent. Additionally, we chose the declared age of the respondent as a continuous variable. The choice of our independent variables used in our models was based on the statistical significance in the regression model. We also included gender of the respondents and the presence of other guests in the vehicle are also expressed by dummy variables in our first model.

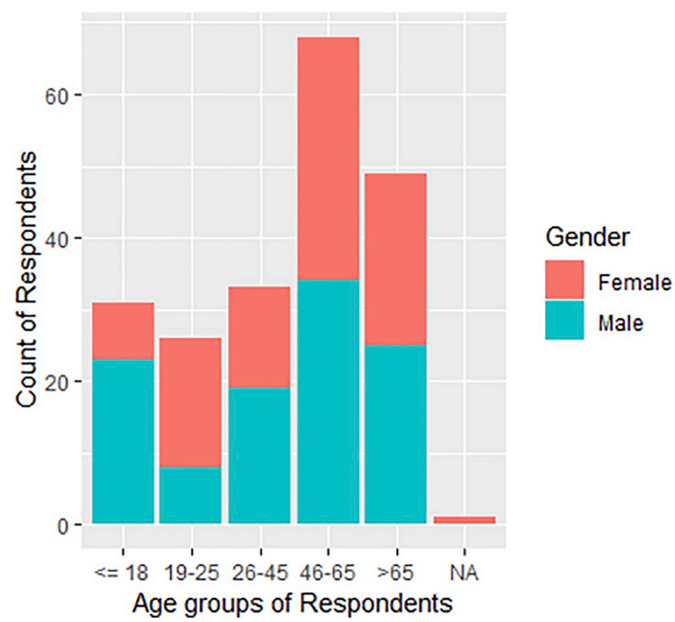

Fig. 2. Gender and age groups of respondents.

5. Results

Before dwelling deeper into our regression analysis we present shortly the distribution of our most important variables. An overview of the age groups separated by gender can be seen in Fig. 2. The age group 46–65 is the largest group. Gender shares of the interviewees are relatively evenly distributed. The findings by Wang, Quddus, Enoch, Ryley, and Davison (2014) that demand responsive transport services are used significantly more by women cannot be confirmed in this case since genders in our observed study area are roughly evenly distributed at around 50% each (BBSR, 2019). This might be due to the fact that in this particular case of rural Germany safety aspects might be not as relevant for women compared to larger cities. Therefore the added (safety) benefits from using a DRT compared to a regular bus service might not be that great. Another possibility to look at this finding is that the added benefits only really come to fruition if the options are between normal public transport and DRT rather than between car usage and DRT. If the existing bus transport service is so bad that (female) customers rely either way on the car there would probably be no relevant added safety benefit of using a DRT system. This could explain why we could not find any significantly higher usage by female customers. The reported main reasons to use the EcoBus are depicted in Table 2.

Leisure being the most commonly reported reason to use the DRT system (41.04%). This may be due to the fact that the first EcoBus pilot phase took place in connection with the Gandersheim Cathedral Festival and was also explicitly advertised as a contributor to this major event.

Table 3 shows the respondents perception regarding their overall satisfaction with the DRT system. Most of the respondents were either

Table 2
Stated reason for using the EcoBus.

Reason	Freq	Perc
Leisure	87	41.04
Work	55	25.94
Medical Appointment	20	9.43
Studies/School	18	8.49
Shopping	14	6.6
Other	8	3.77
NA	10	4.72
Total	212	100

Table 3
Reported satisfaction levels.

Satisfaction	Freq	Perc
Very Satisfied	140	66.04
Rather Satisfied	46	21.7
Neutral	18	8.49
Rather Unsatisfied	4	1.89
Very Unsatisfied	2	0.94
Not Answered	2	0.94
Total	212	100

"very satisfied" (66.04%) or "rather satisfied" (21.7%) with the EcoBus system in general. The data shows some evidence that waiting times have an influence on perceived satisfaction levels. The mean satisfaction level of the two lowest waiting time with 4.53 on average is slightly higher than the mean value for longer waiting time categories with 4.14.

To investigate the determinants affecting satisfaction with an operating DRT service, we used an OLOGIT model. The modelling results along with the calculated odds ratios are presented in Table 4 standard errors are given in brackets. We specified two models with six, respective four, dependent variables. Both models show strong and statistically significant influence of waiting time, the ease of entry and age of respondents on overall satisfaction with the DRT service. Males seem to respond more negatively on their level of approval, this result has however no statistical significance. The presence of other guests inside the vehicle has, somewhat confusingly, a positive sign. Generally, we would assume that the presence of other guests would have a negative impact on satisfaction levels. Nevertheless, this determinant is also not significant. This result may seem puzzling at first. Considering that one of the main drawing features of car dependency is the privacy associated with being alone or with familiar people inside the vehicle (Beirão & Cabral, 2007). Overcrowding (i.e. other people being in the mode of transport) on the other hand is generally believed to decrease the perceived satisfaction of public transport users (Cantwell, Caulfield, & O'Mahony, 2009). A possible explanation for our findings might be a change in perceptions towards public transport or privacy. Since users and especially younger people, can create their own sense of privacy through the use of electronic devices, by listening to music or reading the news etc.

Table 4
Regression output.

	Model 1	Model 2	Odds ratio
Waiting time	−0.73**	−0.69**	0.5
	(0.22)	(0.21)	
Entry	1.28**	1.30**	3.67
	(0.24)	(0.23)	
Age	0.03**	0.03**	1.03
	(0.01)	(0.01)	
Car Ownership	−0.54	−0.64*	0.53
	(0.36)	(0.35)	
Other Guests	0.50		
	(0.35)		
Male	−0.22		
	(0.35)		
AIC	310.56	312.30	
BIC	343.39	338.64	
Log Likelihood	−145.28	−148.15	
Deviance	290.56	296.30	
Num. obs.	197	199	

* $p < 0.1$.
** $p < 0.01$.

Nevertheless, since the variable referring to gender and the presence of other guests show no signs of statistical significance, we excluded them from the model. Looking at our main model (model 2) we can see that the coefficient of waiting time is negative and highly significant at 1% level. The coefficients are scaled in terms of logs. To make the coefficients from the model easier to interpret we converted them into odds ratios (OR). To get the ORs we simply exponentiated the estimates. The proportional odds ratios can be interpreted for dummies, that for a one unit increase in the dummy, meaning going from 0 to 1 the odds of a higher level applying versus the one below applying combined are 'X' times greater, given that all other variables in the model are held constant. For continuous variables (such as age), we would interpret if the independent variable moves 1 unit, the odds of moving from the lower and middle categories to the high category are multiplied by the odds ratio coefficient. Holding all other variables constant, we find that for a one unit increase in waiting time, satisfaction is 0.5 times smaller. This finding is in line with our common understanding of longer waiting times having a severe and significant negative impact on satisfaction. Another factor with significance is the perceived ease of entry into the vehicle. We find a highly significant and positive impact on satisfaction with a one unit increase in the variable leading c.p. to 3.67 times increase in satisfaction. This factor might be especially relevant for older or walking impaired people who are not able (or no longer able) to operate a private car and are therefore reliant on public transport. Ease of entry therefore becomes quite important for these groups and thus the variable has significance for overall satisfaction. Next, as mentioned before, we found no clear evidence that the EcoBus is significantly more used by the older population Fig. 2. Furthermore, with increasing age respondents seem to show higher levels of satisfaction. An increase in age by one year is estimated to increase likelihood of higher satisfaction by a factor of 1.03. This might be related to the point mentioned before that older citizens are especially reliant on public transport since they are not able to drive a car. Hence, flexible transport options might be more appreciated by older generations. Finally, there is some evidence that car ownership might have a negative impact on the satisfaction level. This confirms the finding of Woldeamanuel and Cyganski (2012). Given the fact that our final sample of $N = 199$ is relatively small we would seek to verify our model in future studies with higher sample sizes.

6. DRT satisfaction in time constrained groups

Generally, groups that are very prone to time constraints are thought to be more reliant on their car rather than public transport. The high levels of flexibility and reliability in terms of travel times when using a private car are often named as reasons for using a car. Hence, we tried to analyse whether there are some unique effects regarding the satisfaction of groups that are more time constrained. We identified those respondents as time constrained that answered as reasons for travelling as "Medical Appointment" "Work" or "Studying/School".

We declared those activities to be time constrained because they have a fixed starting time that is not moveable. All other respondents serve as a control group in this case. One might argue that nowadays with employees being able to work "flexitime workers do not really qualify as a strongly time constrained group. However, we decided to keep "work" in our time constrained group since manufacturing for example in the chemical industry is an important factor in the region. In

Table 5
Statistical models.

	Time constrained	Others
Waiting time	−0.45*	−1.07**
	(0.24)	(0.45)
Entry	0.87***	1.78***
	(0.29)	(0.37)
Age	0.03*	0.03**
	(0.02)	(0.01)
Car Ownership	−0.79	−1.05*
	(0.52)	(0.56)
AIC	187.41	136.04
BIC	207.13	157.79
Log Likelihood	−85.70	−60.02
Deviance	171.41	120.04
Num. obs.	87	112

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

these industries shift work and starting on time is probably more relevant. The given reasons for the control group are "leisure", "shopping" and "other reason". In theory, longer waiting times should have a high and significant negative impact on these groups since delays of their mode in transport might result in negative repercussions for the respondents.

Looking at Table 5 we can see that our previously stated assumption regarding the influence of higher waiting times in our time constrained groups did not have the expected result. As expected, the coefficient for waiting time shows a negative sign and some signs of statistical significance. However, the coefficient for waiting time shows a weaker influence on our satisfaction in comparison to the control group. This result might be somewhat confusing at first glance and might be due to the very high overall appreciation of the DRT service in our time constrained group that does not allow us to identify any real effects of longer waiting times on satisfaction. These high levels of satisfaction probably result from the fact that the public transport services in the region were, prior to the introduction of the DRT system, not very well liked. Therefore, the introduction of a new and flexible transport offer was highly appreciated. Thus, having a very poor existing public transport system as point of reference these people might be more willing to sustain longer waiting times and in turn rate their satisfaction levels at a higher level.

7. Conclusion

In our analysis we were able to show how statistical tools such as the OLOGIT regression model can be used to evaluate public transport survey data on a very detailed level. A better understanding of the determinants influencing overall satisfaction levels of public transport and specifically DRT systems can be useful to make future versions of rural transportation systems more viable to common citizens and eventually create a more efficient, cheap and environmentally friendly public transport offer. Our analysis provides insight on overall satisfaction levels with a real door to door DRT system and how waiting time, age of the respondents and the ease of entry into the vehicle affect the approval rates of the citizens. Our analysis of a more sophisticated door to door system offers the possibility for further research to compare satisfaction levels with other semi-fixed DRT services and gives information for public transport providers as to which elements of a DRT system have the most implications for the customers well-being.

Commonly known factors for customer satisfaction such as waiting times have been confirmed to have an important impact on overall satisfaction levels. Surprisingly, we could not establish any significant (negative) connection between the presence of other people in the vehicle and our satisfaction variable. We contributed this finding to a possible change in perception towards privacy by customers. Therefore, these results could be subject of further scientific research. Nevertheless, in our analysis we could not find any evidence that higher waiting times have a more severe effect on groups that are more time constrained. Furthermore, we could not verify the results from other works that that the examined DRT service was significantly more used by women. On of the implications of our work for managerial practice is that public transport service providers should focus more on the needs of older and walking impaired people, since these groups seem to be more reliant on public transport offers. Our work shows that the conduction of simple satisfaction survey can offer very useful information on closer inspection. However, since our sample size is relatively small and our trial area represents just two small rural areas there remains a large possibilities for future research.

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