The relationship between young people's transit use and their perceptions of equity concepts in transit service provision

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A B S T R A C T

This study investigates the effect of price and travel mode fairness and spatial equity in transit provision on the perceived transit service quality, willingness to pay, and habitual frequency of use. Based on the theory of planned behavior, we developed a web-based questionnaire for revealed preferences data collection. The survey was administered among young people in Copenhagen and Lisbon to explore the transit perceptions and use under different economic and transit provision conditions. The survey yielded 499 questionnaires, analyzed by means of structural equation models. Results show that higher perceived fairness relates positively to higher perceived quality of transit service and higher perceived ease of paying for transit use. Higher perceived spatial equity in service provision is associated with higher perceived service quality. Higher perceived service quality relates to higher perceived ease of payment, which links to higher frequency of transit use.

1. Introduction

Growing numbers of consumers are increasingly concerned about fairness for themselves as well as others through socially responsible consumption (e.g., Arnot et al., 2006; Reinstein and Song, 2012; Webb et al., 2008). Evidence shows that customer loyalty, willingness to pay and purchase intentions are associated with perceived fairness, because consumers are willing to pay higher prices, associate higher quality and switch to products that are linked to social corporate responsibility and fair trade (e.g., Martin et al., 2009; Reinstein and Song, 2012; e.g., Lotz et al., 2013). Moreover, consumers are willing to punish firms for perceived unfair prices (Schein, 2002) and socially irresponsible behavior (Arredondo Trapero et al., 2010). Consumers' consideration of fairness grows stronger in times of economic recession due to increasing frustration over salary erosion and need to face higher prices and shrinkage of products and services (Ferguson, 2014).

Perceived fairness is also highly relevant to the implementation of transport policies. Studies from the last decade show that perceived fairness relates to the acceptability of road pricing schemes and that the findings are replicated across countries in Europe, United States and Asia (Viegas, 2001; Fujii et al., 2004; Cools et al., 2011; Di Ciommo et al., 2013; Kim et al., 2013). A recent study in Scandinavia found fairness relevant to the implementation of safety policy measures (Eriksson and Bjørnskau, 2012). Two studies investigated the role of price fairness in the context of transit: Eriksson et al. (2006) found that fairness relates positively to the acceptability of reduced fair prices in transit in Sweden; Drevs et al. (2014) found that in Germany information about transit subsidies lead to higher willingness to pay.

This study focuses on the effect of perceived fairness (i.e., horizontal equity) and corporate social responsibility in spatial service provision (i.e., spatial equity) on habitual transit use. We address price and travel mode fairness. Price fairness is defined according to Xia et al. (2004) as individual feelings while considering price acceptability and justifiability. Price acceptability results from the individual's internal comparison of a price of a product or service to the reference price of the individual's comparable others (e.g., a reference population group with whom the individual finds similarities, identifies, or compares him/herself). Price justifiability results from the price difference between the price paid by the individual and the reference group. Individuals may have multiple internal reference groups and prices, latent or observed, and these reference groups and prices may vary across individuals. The reference price may be explicit, reflecting an observed price, or implicit, reflecting norms or beliefs (Xia et al., 2004). Within the transport context, travel time is a

highly valued resource and hence in this study we suggest to explore travel mode fairness in an analogous manner to price fairness. Travel mode fairness in this study refers to the perceived travel time by transit in comparison with travel time by car between the same origin and destination as the reference travel mode. Corporate social responsibility (CSR) can be defined as the consideration by companies of the effects of their actions on relevant others (e.g., customers, community), their commitment to improving the well-being of their customers, and their actions towards maximizing long-run societal benefits (Webb et al., 2008). As a measure of CSR in the transport sector, we propose spatial equity in service provision to the population of young people across the metropolitan area, because the consideration of social impacts and distributional effects by transit operators fundamentally relates to the quality of life and the social well-being of individuals and communities in urban and peripheral areas (e.g., Geurs et al., 2009; Jones and Lucas, 2012).

We investigated six hypotheses regarding the effect of price fairness, travel mode fairness, and spatial equity in transit provision, on the perception of transit service quality, willingness to pay and habitual frequency of use. Framing the analysis within the theory of planned behavior (TPB), we developed a custom-designed web-based questionnaire for data collection. The questionnaire elicited the frequency of transit use, individual socio-economic characteristics, and latent variables comprising attitudes, subjective norms and perceived difficulties associated with transit use. The attitudes related to the perceived price fairness, travel mode fairness compared to the car, and equity in transit between north and south and between metropolitan core and periphery. The subjective norms referred to car-, transit- and bicycle-oriented behavior of family and friends. The difficulties were associated with service quality (e.g, availability, frequency, operating hours, comfort), lack of personal security, and difficulties associated with the monetary burden of paying for transit.

The survey was administered among university students in Copenhagen and Lisbon to explore the transit perceptions and use by young people under various economic and transit provision conditions. In Portugal, the on-going recession is imposing a significant economic burden on young people in their twenties, who are among the most affected people by the economic crisis with high unemployment. Transit prices have increased dramatically in the last two years, the concessionary fares for teenagers and elderly have been canceled, and the supply has suffered significant reductions in frequencies and operating hours, in particular in the evening and early morning. Combined with high unemployment rates and reductions in the households' available income, this has resulted in heavy transit patronage in the Lisbon Metropolitan Area decreasing by 15% in the first trimester of 2013, continuing a trend from 2011. In Denmark, the economic crisis had a lesser effect on young people, concessionary fares are available for elderly and adolescents, and the transit provision is relatively equitable in terms of connectivity across the metropolitan area (Kaplan et al., 2014). Nevertheless, transit prices are relatively high, some areas where students reside suffer from connectivity gaps (Kaplan et al., 2014), and re-organization processes have led to a reduction of direct bus services in peripheral areas. According to national statistics, about 25% of the young Danes in their twenties travel to work by transit (Sigurdardottir et al., 2013).

The current study is free from the limitations of its predecessors. Firstly, the two aforementioned studies on fairness in transit provision investigated stated preferences in reaction to hypothetical scenarios describing a favorable policy, which are susceptible to incentive compatibility bias and strategic response bias (Wang et al., 2007). Instead, we elicited revealed preference of actual transit use frequency and perceived burden associated with actual transit expenditure, which are bias free. Secondly, previous studies disregarded the comparative nature of fairness, which refers to consumers' feelings as the result of a price comparison to explicit reference price of comparable others or to implicit price reflecting norms or beliefs (Xia et al., 2004). This study acknowledges the comparative nature of fairness in the design of the questionnaire items as comparative statements referring to reference population groups and transport modes. Thirdly, previous studies disregarded also the difference between fairness to oneself and for others, both translating into consumption patterns and preferences, as consumers begin to consider the public consequences of their actions and their ability to induce social change through their purchasing power (Xia et al., 2004; Webb et al., 2008). This study addresses price and travel mode fairness to one self, as well as equity in spatial transit provision for others. Last, previous studies considered only the monetary dimension, while this study accounts for the multiple dimensions influencing transit choices including prices, travel time, service quality and personal security.

The remainder of the paper is organized as follows. Section 2 focuses on methodological issues, namely the conceptual framework, the research hypotheses and the model estimation. Section 3 concentrates on data issues, including survey design, administration and sample characteristics. Section 4 describes the empirical results of the model estimation and Section 5 draws the conclusions.

2. Methodology

2.1. Research hypotheses

The behavioral framework to explore the research hypotheses on the relationship between perceived equity and transit use by young adults is loosely built upon the TPB (Ajzen, 1991), due to its established behavioral support in a wide variety of behaviors (e.g., Armitage and Conner, 2001). According to the TPB, favorable attitudes, perceptions and subjective norms, as well as greater perceived behavioral control (ease) of conducting the behavior, lead to stronger intentions to perform the behavior. These intentions will eventually transform into observed behavior, provided the availability of resources and the ability to choose one's own behavior. The TPB has been previously confirmed applicable for describing transit use intentions (e.g., Farag and Lyons, 2010; Chen and Chao, 2011). In this study, the TPB's attitudinal constructs comprise fairness (i.e., perceptions of horizontal equity) and CSR (i.e. perceptions of spatial equity), the perceived behavioral control consists of perceived service quality, personal security, and payment ease, the subjective norms include both pro-car and pro-bicycle norms, and transit use frequency serves as an indicator for habitual transit use behavior.

This study postulates that two equity concepts may have an impact on the decision to use transit. These concepts are fairness and corporate social responsibility (CSR), known to influence consumer satisfaction and purchase intentions of products in other industrial sectors (Xia et al., 2004; Webb et al., 2008). Previous empirical findings from other industrial sectors show that fairness perceptions explain consumer satisfaction, favorable attitudes towards the supplier (e.g., Webb et al., 2008), willingness to pay for goods or services (e.g., Chung et al., 2011), and eventually purchase intentions (e.g., Schein, 2002). Accordingly, we postulate three hypotheses about the linkage between fairness and transit use:

*H*1: Higher perceived price/travel mode fairness positively relates to higher perceived quality of transit service.
*H*2: Higher perceived price/travel mode fairness positively correlates higher perceived ease of monetary expenditure on transit use.

H3: Higher perceived price/travel mode fairness in transit is linked to higher frequency of transit use.

Previous empirical findings from other industrial sectors indicate that CSR relates to higher positive evaluation of product quality (Lotz et al., 2013), and higher willingness to pay (Arredondo Trapero et al., 2010), while they are also willing to penalize companies with socially irresponsible behavior (Arredondo Trapero et al., 2010). Therefore, we explore three hypotheses about the linkage between CSR and transit use:

H4: Higher perceived CSR is associated with higher perceived service quality.

H5: Higher perceived CSR relates to higher perceived ease of monetary expenditure on transit use.

H6: Higher perceived CSR correlates with higher frequency of transit use.

While the aforementioned hypotheses are based on empirical findings from other fields, their exploration within the context of travel choices and transit use is far from trivial due to three reasons. Firstly, transit is a public service and thus essentially differs from private sector products and services. In regulated or franchised transit systems, users cannot choose between different suppliers of the same service, but rather decide whether to use the service and with which frequency. Secondly, transit operators do not brand their systems with respect to price fairness or CSR, so the perception of transit as fair or equitable is intrinsic and based on individual knowledge and social awareness. Nevertheless, price fairness and short-term impacts of CSR are highly visible in transit. Consumers are aware of prices and concessionary fares for different population groups, and can experience the level of service and accessibility for their own activity patterns as well as for others.

2.2. Estimated models

The behavioral model structure representing the research hypotheses was investigated by applying structural equation modeling (SEM) because of the need to model simultaneously endogenous latent constructs, their relationship with exogenous observed variables, and their correlation pattern. Hankins et al. (2000) provide statistical guidelines including general assumptions, sample size, estimation methods and goodness-of-fit for the application of SEM to explore TPB-based behavioral frameworks. Applications of SEM in travel behavior research over three decades were reviewed by Golob (2003).

The model in this study contained three sets of equations: measurement equations Eq. (1) associating indicators to the latent constructs, structural equations Eq. (2) linking the latent constructs to individual socioeconomic characteristics, and structural equations Eq. (3) relating the latent constructs to transit use in accordance with the path diagram of the hypothesized behavioral model shown in Fig. 1 and discussed in the previous section.

$$I_{rn} = Z^*_{ln}\alpha_r + \upsilon_{rn} \quad \text{and} \quad \upsilon_n \sim N(0, \Sigma_\upsilon) \quad \text{for } r = 1, \ldots, R \tag{1}$$

$$Z^*_{ln} = S_{ln}\beta_l + \omega_{ln} \quad \text{and} \quad \omega_n \sim N(0, \Sigma_\omega) \quad \text{for } l = 1, \ldots, L \tag{2}$$

$$I_{in} = Z^*_{ln}\beta_z + S_{ln}\beta_s + \xi_{in} \quad \text{and} \quad \xi_n \sim N(0, \Sigma_\xi) \quad \text{for } i = 1, \ldots, I \tag{3}$$

where I_{rn} is the value of an indicator r of the latent construct Z^*_{ln} as perceived by individual n, Z^*_{ln} is the value of latent construct l for individual n, S_{ln} is a vector of M individuals' observed characteristics, and I_{in} is a vector of indicators of individuals' transit use (i.g., frequency). Error terms are expressed as elements ω_{ln}, υ_{rn} and ξ_{in} of the vectors following a normal distribution with respective covariance matrix Σ_ω, Σ_υ and Σ_ξ, while parameters to be estimated are α_r, β_l, β_z, and β_s. Considering R indicators translates into writing R measurement equations and estimating an $(R \times 1)$ vector α of parameters (i.e., one parameter is estimated for each equation), while considering L latent constructs translates into writing L structural equations and estimating an $(M \times L)$ matrix of β parameters (i.e., M parameters are estimated for each equation).

The parameters of the three sets of equations were estimated simultaneously by Bayesian Estimation (Byrne, 2010) that accommodates satisfactorily the non-normal Likert items in the measurement equations and uses Markov Chain Monte Carlo simulation for obtaining the posterior distribution of the parameters. Confidence intervals were obtained in the estimation and were consistent with any sample size and data distribution. Alongside the traditional descriptive measure of chi-square test of absolute model fit, maximum likelihood estimation has been performed to obtain the Comparative Fit Index (CFI) and the Root

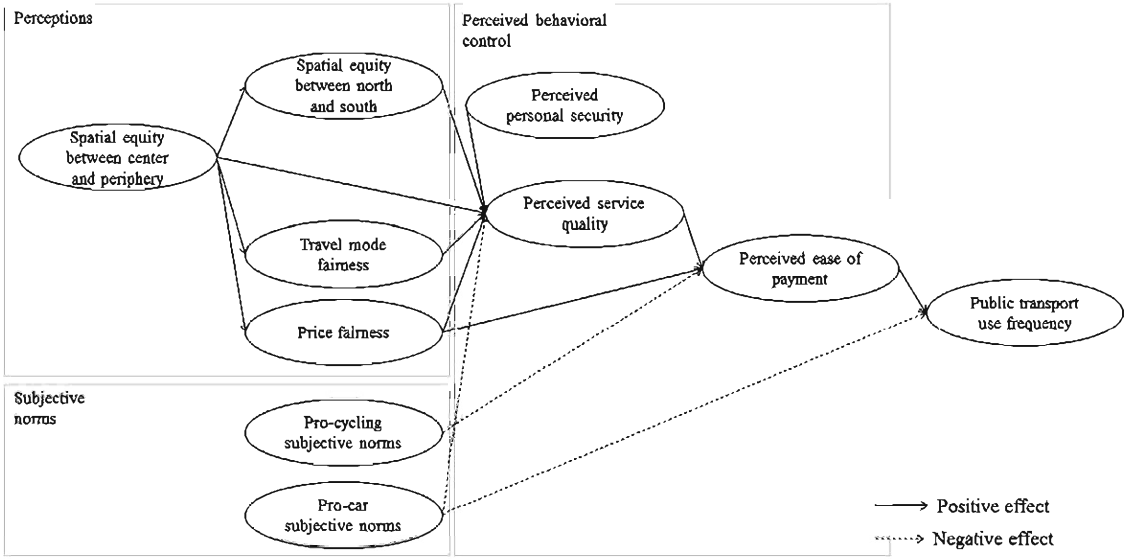

Fig. 1. Path diagram of the structural relationships among the latent constructs.

Mean Square of Approximation (RMSEA) (Browne and Cudeck, 1993).

3. Data

3.1. Target population

The chosen sample population for the study were university students as prospective highly skilled knowledge-workers, because their attraction and retention as facilitators of regional growth and innovation are key in the transition from recession to prosperity. In addition, a key element towards facilitating the transition to more sustainable transport modes lies in a better understanding of the needs and preferences of young people who are in the initial stages of developing transport-related habits (Sigurdardottir et al., 2013).

The sample population comprised university networks of young people in Copenhagen and Lisbon. In Lisbon, the study was conducted among students in the two campuses of the Instituto Superior Técnico and in Copenhagen the study targeted students at the Technical University of Denmark, the Copenhagen Business School and the University of Copenhagen. In the two cities, the different campuses vary in their degree of accessibility to the city center and industrial parks, and from different residential zones of the metropolitan area.

3.2. Survey design

The data were collected by means of a tailor-made web-based questionnaire that elicited transit use frequency, willingness to pay, service quality, perceived fairness and CSR, subjective norms and individual socio-economic characteristics. The survey was administered in Portuguese, Danish and English. The variables and measurement scales are provided in Table 1.

Transit frequency use was elicited for traveling to university and leisure activities as habitual destinations. Perceived monetary burden or difficulties to pay associated with transit costs were considered as surrogate measure of willingness to pay because willingness to pay is very difficult to measure for regulated transit systems. Perceived quality of service was elicited for the preferred transit mode from the residential location to the habitual destinations of the university and leisure activities. Perceived quality of service concerns one's subjective evaluation of travel time in minutes and perceived quality of travel time, as well as perceived difficulties to use transit due to factors associated with service quality (i.e., walking distance, travel time, frequency, operating hours and crowding, personal security).

The price fairness factor was explored via comparative statements regarding prices paid by young adults with respect to prices paid by multiple reference groups that possibly have concessionary fares (i.e., elderly, teenagers) or are perceived to have higher purchase

Table 1
Latent constructs, variable name, description and measurement scale.

Latent construct	Variable name	Variable description	Measurement unit
Spatial equity in transit service provision between the north and the south	a4stud_south_saf	Students in southern areas feel less safe when traveling in the evening (R)	5 points Likert scale from highly disagree to highly agree
	a4stud_south_dir	Students in southern areas have less direct transit services (R)	
	a4stud_south_info	Students in southern areas have less real-time information at bus stops (R)	
	a4stud_south_wlk	Students in southern areas have longer walking distance for transit (R)	
	a4stud_south_wt	Students in southern areas have longer waiting times for transit (R)	
	a4stud_south	Students in southern areas have a worse transit service (R)	
Spatial equity in transit service provision between the center and the periphery	a3stud_perif	Students in peripheral areas have a worse transit service (R)	
	a3stud_perif_dir	Students in peripheral areas have less direct transit services (R)	
	a3stud_perif_info	Students in peripheral areas have less real-time information at bus stops (R)	
	a3stud_perif_wlk	Students in peripheral areas have longer walking distance for transit (R)	
	a3stud_perif_wt	Students in peripheral areas have longer waiting times for transit (R)	
Price fairness of students with respect to other population groups	a2diff_stud_fort	Students have more difficulties to pay the cost compared to adults in their forties (R)	
	a2diff_stud_old	Students have more difficulties to pay the cost compared to elderly (R)	
	a2diff_stud_teen	Students have more difficulties to pay the cost compared to teenagers (R)	
	a2stud_old	The cost for students is higher than for elderly (R)	
	a2stud_teen	The cost for students is higher than for teenagers (R)	
Transit service quality	a6pt_wlkfar	The walking distance to the nearest transit stop is too far for me (R)	
	a6pt_longtime	The travel times by transit are too long for me (R)	
	a6pt_endsearly	The transit operating hours on weekdays are too short for me (R)	
	a6pt_crowd	The transit is too crowded for me (R)	
	a6pt_freqlow	The transit frequency is too low for me (R)	
	a6pt_schedule	The transit time table does not fit my schedule (R)	
Ease of payment for transit	a6pt_nexpensive	Transit is not expensive for me	
	a6byke_cheapr	Riding a bicycle is cheaper than using transit (R)	
	a6pt_cheap	Transit is cheaper than using the car	
	a6savemoneyr	I try to avoid using transit in order to save money	
Social norms of car use	a5friendcar	Most of my friends travel by car	
	a5friendpt	Most of my friends travel by transit (R)	
	a5scirclept	People of my social circle do not usually use transit	
Social norms of bicycle use	a5friendbyke	Most of my friends travel by bicycle	
	a5fambyke	Most of my family members travel by bicycle	
	a5carcool	My friends think that driving a car is cool	
	a5bykecool	My friends think that riding a bicycle is cool	
Personal security in transit	a6pt_harassed	I feel insecure in transit because I am afraid to be harassed (R)	
	a6pt_pickpocketing	I feel insecure in transit because of pick-pocketing (R)	
	a6pt_ridesaft	I feel insecure riding transit at night (R)	
	a6pt_walksaft	I feel insecure walking/waiting to transit at night (R)	
Travel mode fairness	q_ttime_u	Quality of travel time to the university	5-point Likert scale ranging from very poor to very good
	ctt_car_univ	Quality of travel time by transit compared to travel time by car to the university	
	ctt_car_leis	Quality of travel time by transit compared to travel time by car to leisure activities	

power (i.e., adults in their forties). Because concessionary fares apply to single, multiple, and monthly tickets, price fairness was investigated relatively to the individual's habitual fare. Similarly to Di Ciommo et al. (2013), direct questions about the feeling of fairness were avoided because they could induce social desirability bias. Instead, the statements referred to both the perceived difference in the price and the difference related to difficulties to pay the price. Price fairness is strongly related to both price equity of the same product/service across consumers with different characteristics, and the individual's own economic difficulties (Ferguson, 2014).

Travel mode fairness was elicited by requesting respondents to rate on a 5-point likert scale the quality of their travel time ranging from poor to excellent by transit in comparison with the time by car as the reference travel mode to university and leisure activities. Greater difference between an attribute (i.e., quality of travel time) of the chosen alternative (i.e., transit) versus the foregone alternative (i.e., car) is naturally associated with a higher level of expected regret (Chorus, 2010; Prato, 2014), which is a counterfactual thought that is strongly related to the perception of fairness (Nicklin et al., 2011).

Spatial equity in service provision was investigated with respect to students, as a reference group who share the same travel needs (e.g., going to the university campus, city center and employment centers). Hence, the spatial equity in service provision was investigated by comparing students who reside in peripheral versus central neighborhoods, and students who reside in the northern versus the southern part of the metropolitan area. The comparative statements targeted the service quality aspects of transit service (i.e., travel time, walking distance, information provision, service frequency) in the urban core versus the metropolitan periphery and in the north versus the south of the metropolitan area as geographical areas typically associated with different socio-economic levels.

Individual information comprised age, gender, having children, home ownership, residential location and building type, employment status, having a scholarship for tuition or living, education level and income of the respondents and related family members. Subjective norms referred to the norms resulting from the behavior of family and friends and regarded car, transit and bicycle use.

The survey was anonymous. In order to verify the sample reliability, the respondents were offered to participate in a raffle of 5 "iPod Shuffle" music players as an incentive for providing their contact details at the end of the survey.

4. Results

4.1. The socio-economic characteristics of the survey respondents

The survey responses comprise 499 completed questionnaires (42.7% completion rate from the respondents who started the survey), of which 54.1% were participants from Lisbon. The sample characteristics in Lisbon and Copenhagen are detailed in Table 2. The respondents' characteristics the two cities reasonably agree with the characteristics of enrolled students and the general population of students according to available data sources.

In Copenhagen, the average age is 23.9 years (SD=2.6) and 40.6% are male. Of the respondents, 49.6% are undergraduate students, 38.3% are master students and 12.1% are doctoral students. Of the respondents in Copenhagen, 23.0% have a part time job, 1.2% have a full time job and another 1.4% receive a scholarship. 28.4% reside in the dormitories and another 48.9% in a shared rental arrangement. 43.7% reported a monthly household income of 1000 Euro or less. On a daily basis, 33.6% of the respondents in Copenhagen use public transport, 76.0% cycle and only 5.7% drive a car. 79.5% of the respondents reside in the

Table 2
Sample characteristics

Variable	City					
Gender (male/female)		Male	Female			
	Lisbon	57.0	43.0			
	Copenhagen	40.6	59.4			
Age (in years)		Average	Std.			
	Lisbon	22.4	3.0			
	Copenhagen	23.9	2.6			
		No	Yes			
Children (yes/no)	Lisbon	97.3	2.7			
	Copenhagen	95.9	4.1			
Employment status (categorical)		None	Scholarship	Part-time job	Full-time job	
	Lisbon	82.8	6.6	5.8	4.8	
	Copenhagen	74.3	1.4	23.0	1.2	
Residencial status (categorical)		Dormitories	Rent alone	Rent share	Own alone	With family
	Lisbon	1.1	5.9	17.8	2.6	70.0
	Copenhagen	28.4	9.6	48.9	4.4	8.7
Household income (in thousand Euros)		<0.5	0.5–1	1–1.5	1.5–2	>2
	Lisbon	4.1	17.4	16.7	13.0	48.9
	Copenhagen	6.1	37.6	14.8	11.8	29.7
Car use frequency (in number of trips)		Rarely	2–3 times Monthly	Once a week	2–3 times weekly	Daily
	Lisbon	21.5	15.2	12.6	16.7	34.1
	Copenhagen	67.7	16.6	6.1	3.9	5.7
Transit use frequency (in number of trips)		Rarely	2–3 times Monthly	Once a week	2–3 times weekly	Daily
	Lisbon	14.1	5.2	8.2	12.6	60.0
	Copenhagen	6.6	19.7	18.8	21.4	33.6
Bicycle use frequency (in number of trips)		Rarely	2–3 times Monthly	Once a week	2–3 times weekly	Daily
	Lisbon	21.9	6.3	3.0	14.1	54.8
	Copenhagen	3.1	3.5	4.4	13.1	76.0

northern part of the metropolitan area and 45.0% reside in centrally located neighborhoods.

Data regarding students in Copenhagen is available for the year 2012 regarding age, gender and the degree of studies. The average age of the enrolled students is 25.7 years, 47.0% are male, 53.3% are undergraduate students, 39.0% are master students and 7.7% are doctoral students (Ministry of Education, 2014). While data regarding income, residential arrangement and transport mode is not available from university records or the ministry of education, according to the Danish National Travel Survey for young people between the age of 19–29 who are students, 32% reside in a shared rental arrangement and 26% in a non-shared rental apartment, the average income is about 1140 Euros and 32% travel daily by public transport on weekdays.

In Lisbon, the average age is 22.4 years (SD=3.0) and 57.0% are male. Of the respondents, 35.2% are undergraduate students, 55.8% are master students and 9.0% are doctoral students. Of the respondents in Lisbon, only 5.8% have a part time job, 4.8% have a full time job and another 6.6% receive a scholarship. 70.0% reside with their parents and another 17.8% in a shared rental arrangement. 21.5% reported a monthly household income of 1000 Euro or less and 48.9% reported a household income of over 2000 Euros, which is possibly the parents' income due to the high share of students who reside with their parents. On a daily basis, 60.0% of the respondents in Lisbon use public transport, 54.8% cycle and only 34.1% drive a car. 91.9% of the respondents reside in the northern part of Lisbon and 39.3% reside in centrally located neighborhoods.

Data regarding students at IST Lisbon for the 2013/2014 academic year shows that the average age is 24.5 years and the percentage of men is 73%. From the 11,500 students enrolled at IST, 55.8% are undergraduate students, 34.7% are master students and 9.5% are doctoral students. Data regarding the residential arrangement, household income, and mode choice of students or young people in Lisbon are unavailable. Nevertheless, the percentage of IST students with at least one parent with a university degree is 61% compared to 63% in the current sample. Considering the parents' education as a proxy for income, the results agree with the relatively high household income (a household income of over 2000 Euros for 48.9% of the survey participants in Lisbon).

4.2. Model estimation results

Fig. 1 illustrates the path diagram of the structural relationships among the latent constructs obtained in the estimated model, and Tables 3 through 5 detail the direct effects of the structural equations, and the estimated covariance structure from the Bayesian estimation. Table 3 presents the measurement equations. Table 4 shows the linkage between individual characteristics and the TPB constructs. Table 5 complements Fig. 1 by describing the

Table 3
Measurement equations

Questionnaire item	Factor	Mean	S.E.	95% Lower bound	95% Upper bound
A3stud_perif	Spatial equity between the center and the periphery	1.000	–	–	–
a3stud_perif_dir		0.815	0.002	0.704	0.937
a3stud_perif_info		0.759	0.003	0.630	0.894
a3stud_perif_wlk		0.854	0.002	0.748	0.959
a3stud_perif_wt		0.924	0.002	0.824	1.040
a4stud_south_saf	Spatial equity between the north and the south	1.000	–	–	–
a4stud_south_dir		1.362	0.005	1.179	1.580
a4stud_south_info		1.134	0.004	0.975	1.330
a4stud_south_wlk		1.176	0.004	1.015	1.364
a4stud_south_wt		1.435	0.005	1.245	1.657
a4stud_south		1.287	0.004	1.118	1.493
a2diff_stud_fort	Price fairness	1.000	–	–	–
a2diff_stud_old		1.148	0.006	0.941	1.378
a2diff_stud_teen		1.245	0.004	1.025	1.495
a2stud_old		1.281	0.005	1.063	1.558
a2stud_teen		1.353	0.006	1.118	1.641
Ctt_car_univ	Travel mode fairness	1.000	–	–	–
ttime_min		−9.265	0.038	−11.935	−6.947
q_ttime_u		0.729	0.002	0.595	0.890
ctt_car_leis		0.695	0.003	0.558	0.859
a6pt_wlkfar	Transit service quality	1.000	–	–	–
a6pt_longtime		1.266	0.005	1.060	1.535
a6pt_endsearly		1.049	0.004	0.853	1.297
a6pt_crowd		0.642	0.003	0.473	0.855
a6pt_freqlow		1.459	0.004	1.225	1.717
a6pt_schedule		1.313	0.005	1.078	1.579
a6pt_nexpensive	Ease of payment	1.000	–	–	–
a6byke_cheapr		0.446	0.003	0.294	0.616
a6pt_cheap		1.111	0.005	0.866	1.417
a6savemoneyr		1.271	0.009	0.938	1.685
a6pt_harassed	Perceived personal security	1.000	–	–	–
a6pt_pickpocketing		1.332	0.003	1.167	1.521
a6pt_ridesaft		1.774	0.004	1.595	1.996
a6pt_walksaft		1.700	0.003	1.520	1.921
a5friendcar	Pro-car subjective norms	1.000	–	–	–
a5friendpt		−0.970	0.004	−1.169	−0.789
a5scirclept		0.937	0.003	0.775	1.148
a5friendbyke	Pro-cycling subjective norms	1.000	–	–	–
a5fambyke		0.539	0.001	0.475	0.603
a5carcool		−0.390	0.002	−0.460	−0.326
a5bykecool		0.692	0.001	0.636	0.748

Table 4
The linkage between individual characteristics and the TPB constructs

Variable name Regression weights	Variable name	Mean	S.E.	95% Lower bound	95% Upper bound
Lisbon	Spatial equity center – periphery	−0.257	0.003	−0.395	−0.107
Residence near the city center		0.154	0.003	0.015	0.293
Lisbon	Spatial equity north–south	−0.766	0.004	−0.972	−0.560
Living in the north of Lisbon		0.590	0.004	0.387	0.795
Lisbon	Price fairness	0.375	0.003	0.262	0.505
Low-income		0.117	0.002	−0.244	0.003
Residence near the city center	Travel mode fairness	0.302	0.004	0.217	0.588
Male		−0.268	0.004	−0.458	−0.097
Transport expenditure from total		−0.009	0.000	−0.014	−0.004
Lisbon	Perceived personal security	−0.704	0.003	−0.853	−0.585
Male		0.245	0.002	0.129	0.364
Lisbon	Pro-cycling subjective norms	−2.459	0.003	−2.608	−2.308
Childyes	Pro-car subjective norms	0.471	0.008	0.043	0.827
Covariates					
North of Lisbon and Lisbon		0.233	0.001	0.205	0.266
Transport expenditure and residence in the city center		−1.834	0.017	−2.621	−1.141
Transport expenditure and residence in Lisbon		3.931	0.019	3.126	4.871
North of Lisbon and residence in the city center		0.018	0.000	0.009	0.027
Transport expenditure from total and North of Lisbon		3.094	0.019	2.335	3.955

Table 5
The linkage between fairness, spatial equity, service quality, payment ease and frequency of transit use

Explanatory factor	Explained factor	Mean	S.E.	95% Lower bound	95% Upper bound
Spatial equity center – periphery	Spatial equity north–south	0.193	0.001	0.135	0.260
Spatial equity center – periphery	Price fairness	0.129	0.001	0.051	0.222
Spatial equity center – periphery	Travel mode fairness	0.372	0.003	0.234	0.511
Spatial equity north–south	Service quality	0.094	0.002	−0.031	0.227
Spatial equity center – periphery		0.136	0.002	0.044	0.230
price_fairness		0.171	0.002	0.073	0.284
mode_fairness		0.374	0.002	0.283	0.478
Personal security		0.162	0.002	0.079	0.253
Pro-car social norms		−0.132	0.002	−0.219	−0.051
Price fairness	Ease of payment	0.236	0.003	0.098	0.395
Transit service quality		0.266	0.003	0.147	0.406
Pro-bike social norms		−0.157	0.001	−0.209	−0.108
Ease of payment	Frequency of transit use	1.049	0.009	0.737	1.403
Pro-car social network		−0.606	0.005	−0.829	−0.42

magnitude of the linkage between fairness, spatial equity, service quality, payment ease and frequency of transit use. Goodness-of-fit indices reveal that the model fits very well, as the CFI is 0.881, the ratio between chi-square and degrees of freedom is 2.19 (χ^2=2310.99, DF=1055), well below the maximum acceptable value recommended by Ullman (1996), and the RMSEA is equal to 0.049, which indicates a close fit of the model in relation to the degrees of freedom.

The results confirm hypotheses *H*1 and *H*4 at the 0.05 significance level. The perceived transit service quality increases with higher perceived price and travel mode fairness, and higher perceived spatial equity.

The results confirm hypotheses *H*2 and *H*5 at the 0.05 significance level. Higher perceived ease of payment directly relates to higher perceived price fairness and to higher perceived quality of service. Higher perceived ease of payment indirectly relates to higher perceived mode fairness, and higher perceived spatial equity.

The results confirm hypotheses *H*3 and *H*6 at the 0.05 significance level. Higher frequency of transit use is directly related to the perceived ease of payment, and indirectly related to the hypothesized fairness and equity constructs. Higher frequency of transit use is indirectly related to higher perceived price and travel mode fairness, and higher perceived spatial equity.

The perceived fairness and spatial equity in transit provision are associated with individual characteristics. Students with low income (earning less than 1000 Euros a month) perceive lower price fairness. Students residing in Lisbon perceive lower spatial fairness between the north and the south and between the core and the periphery, while they perceive higher price fairness than the students in Copenhagen. This result is reasonable because the two cities differ in their price scheme and spatial connectivity. The transit in Copenhagen is characterized by high equity in service provision because of the finger plan (Kaplan et al., 2014), and provides concessionary fares for adolescents and elderly, while young people in their twenties do not enjoy concessionary fares. The transit in Lisbon is characterized by lower equity in transit provision, in particular between the north and the south due to the natural boundary between them, but different age groups pay the same because the concessionary fares have been recently canceled. Students residing in the center of the metropolitan area in both cities perceive better spatial fairness between the core and the periphery and higher mode fairness, likely because they enjoy a high level of service and connectivity. Students living in the northern part of Lisbon perceive better spatial fairness between the north and the south of the metropolitan area, possibly because this part of the metropolitan area enjoys high connectivity.

5. Conclusions

This study focuses on the effect of perceived fairness and corporate social responsibility on habitual transit use. Framed

within the TPB, we investigated six hypotheses regarding the effect of price fairness, travel mode fairness and spatial equity in transit provision on the perception of transit service quality, willingness to pay and habitual frequency of transit use. The study was conducted among young people in Lisbon and Copenhagen to explore transit perceptions and use under different economic and transit provision conditions. The results extend findings from previous studies on fairness in transit (Eriksson et al., 2006; Drevs et al., 2014) by extending the concept of fairness also to travel time, considering fairness to oneself and for others, and confirming the research hypotheses on revealed preference data.

The results confirm the six postulated hypotheses by showing that young transit users in their twenties are concerned about price and travel mode fairness for themselves as well as spatial equity between north and south and between core and peripheral areas in transit service provision. In particular, higher perceived fairness relate positively to higher perceived quality of transit service and higher perceived ease of paying for transit use. Higher perceived spatial equity in service provision is associated with higher perceived service quality. Higher perceived service quality relates to higher perceived ease of payment, which links to higher frequency of transit use. The results largely agree with the results for consumption of products and services in other industrial sectors (e.g., Arredondo Trapero et al., 2010; Lotz et al., 2013; Webb et al., 2008; Xia et al., 2004). The agreement is non-trivial because transit is a regulated public service and thus essentially differs from private sector products and services.

A word of caution is warranted in interpreting the results for policy implications. Firstly, while the respondents' characteristics in the two cities reasonably agree with the characteristics of enrolled students and the general population of students according to available data sources, the sample cannot be considered as a representative population sample. Therefore, the results should be viewed as an indicative or diagnostic tool, rather than a statistical analysis of the prevalence of the identified themes across the population of young adults. Moreover, the results cannot be readily extended to older population groups, nor to regions that are characterized by income inequity outside the considered range of Gini coefficients between 0.24 (in Copenhagen) and 0.40 (in Lisbon). Secondly, the research hypotheses were investigated based on a static dataset, in which no change of behavior or attitudes were observed. Therefore, the established relationship between the perceptions and the behavior by estimating the SEM represents correlation rather than causality. According to the cognitive dissonance theory first proposed by Festinger (1957), people experience the feeling of stress and discomfort when they hold simultaneously contradicting attitudes and behavior, and will either change their behavior to match their attitudes or vice versa. While the existence of cognitive dissonance has been recently explored in the context of mode choice from panel data in which changes in modes and attitudes were observed (Wang and Chen, 2012), from the results of the current study it is equally plausible that price/mode fairness and spatial equity motivate higher transit use, or that frequent users of transit convince themselves that transit is price/mode fair and spatially equitable in order to justify their choice. Accordingly, while establishing the aforementioned correlation is important for designing policy measures to maintain high public transport ridership among young people, it is difficult to determine whether the results could better contribute to promoting behavioral change towards switching to public transport from other modes, or for maintaining transit users loyalty and discouraging them from switching from public transport to other modes.

The results bear important policy implications. Firstly, the results show that while transit providers currently do not brand or market their systems as fair or equitable, transit users, and particularly young people, are sensitive to fairness and equity considerations. Transit operators could consider this issue in their branding strategy, as transit users can experience the level of service and accessibility for their own activity patterns as well as for others. Secondly, the results show that the Copenhagen finger plan is highly efficient not only in terms of its objective functionality in service provision, but also in promoting the perceived equity in service provision. Thirdly, the results show that in Lisbon young people associated higher fairness to the pricing scheme compared to young people in Copenhagen, which in turn is associated with higher perceived service quality, payment ease and transit use. Possibly, the reason lies in the recent cancellation of concessionary fares in Lisbon, while in Copenhagen young people in their twenties are aware of the concessionary fares to adolescents and perceive their own purchase power as lower than older adult groups. Ironically, while the cancellation of the concessionary fares raised the prices paid by elderly and adolescents, young people perceive it as more equitable. Transit operators could consider extending the concessionary fares to students, as well as improving the justifiability of the concessionary fares as a market strategy for increasing the perceived price fairness. Last, the results are stable across countries with different economic conditions and transit provision in terms of level of service, comfort and information. A possible policy implication could be that higher level of service and connectivity are related to higher expectations for service availability, quality, reliability and comfort, which in turn affect the fairness and spatial equity perception. Transit operators could consider providing their users with benchmarking information of the transit service as part of their marketing strategy.

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