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Commuting-related fringe benefits in the Netherlands: Interrelationships and company, employee and location characteristics

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ABSTRACT

Mobility management measures taken by firms could potentially result in more sustainable transport choices and hence reduce traffic congestion and emissions. Fringe benefits offered to employees are a means to implement those measures. This paper explores the most common commuting-related fringe benefits currently provided by employers in the Netherlands, namely telework, flextime and allowance types like public transport passes, bicycle contribution, company cars and general financial compensation. By using the Dutch National Time Use Survey (TBO) 2005/2006, interrelationships among fringe benefits and correlations between company, employee, and (home and work) location characteristics and those employee benefits could be investigated. Logistic regressions and Tobit models are used for several estimations indicating the provision and the use of fringe benefits. The results show that relationships among fringe benefits exist, mainly between telework and flextime, but also between those flexible work arrangements and some types of commuting allowance. Furthermore, numerous job, person and geographical variables affect the probability of receiving and using the fringe benefits. For example, in the non-profit and the public sector sustainable commuting benefits are more often provided, the use of fringe benefits is strongly influenced by household composition and several allowance types show a significant correlation with the number of cars in the household. Moreover, firm location, in particular firm density, is highly related to mobility management measures taken by firms.

1. Introduction

Traffic jams, mainly during rush hours, are still an everyday problem. The behaviour of firms, by means of mobility management policies, directly or indirectly affects employees' commuting frequency, time of commuting and transport mode choice. There are several ways in which firms can offer fringe benefits to their staff. Some of them have a positive effect on traffic congestion during peak hours, like the spreading of workers' starting times, flexible working hours (Saleh and Farrell, 2005), telework (Mokhtarian et al., 1998, 2004), public transport allowances, and projects which stimulate bicycle

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usage, like the National Bicycle Scheme in the Netherlands (Dutch Tax Authority, 2013). Others negatively affect commuting flows, for example, company cars and employer-paid parking (Van Ommeren et al., 2006).

The effects of telework have been extensively discussed over the last decades (e.g., Mokhtarian et al., 1998, 2004). Flexible work schedules and company cars were studied as well, although to a lesser extent (e.g., Golden, 2001; Alexander et al., 2010; Gutiérrez-i-Puigarnau and Van Ommeren, 2011; Shiftan et al., 2012). However, public transport allowance, bicycle contribution, and general monetary benefits for commuting hardly received attention, except for some explorative studies on travel plans in the UK (Rye, 2002; Dickinson et al., 2003). Moreover, relationships among fringe benefits have barely been studied. Only Vanoutrive et al. (2010) explored a large quantity of mobility management measures taken by firms in Belgium. However, this paper and most studies on fringe benefits in general (Van Ommeren et al., 2006; Vanoutrive et al., 2010) do not or just to a limited extent include socioeconomic and demographic characteristics of employees.

Therefore, this paper is aimed at exploring which person, firm, and geographical factors affect the probability of receiving specific types of fringe benefits for commuting and investigating possible interrelationships among those mobility management measures. The analyses will focus on telework, work schedule flexibility, and four types of commuting-related allowance, namely company cars, public transport allowance, bicycle contribution, and general monetary allowance for commuting. This study uses the Dutch National Time Use Survey 2005/2006 which is representative of the national population. By using this dataset, person and household characteristics as well as company, job and commuting data could be taken into account. The results will provide insight into the combinations of fringe benefits which strengthen or weaken each other and into which types of companies and jobs and which types of employees are offering/accepting the particular forms of commuting-related fringe benefits. Consequently, this could be used to improve and tailor policies to promote traffic flow friendly alternatives among firms and workers who are not participating in rush hour avoidance programs yet.

The organisation of this paper is straightforward. First, a literature review illustrating each of the commuting-related fringe benefits will be shown. Second, we will describe the dataset and the variables used for the analyses. This is followed by a discussion of the results. The paper is completed with a conclusion and discussion of the main findings of the study and on future topics of research.

2. Literature

In the Netherlands several initiatives have been launched to reduce peak hour traffic. The Platform 'Slim Werken, Slim Reizen' (SWSR, Smart working, smart travelling) started in 2011. Fifty leading companies, called the B50, together with the national and regional governments, civil society organisations and employee associations have joined forces to work together on the whole package of mobility management measures (working from home, work schedule flexibility, bicycle and public transport promotion, mobility budgets covering all transport modes). The campaign called 'Het Nieuwe Werken' (HNW, the new way of working) was initiated to bring about a cultural shift in changing traditional commuting patterns and to make the advantages and opportunities of HNW known to the general public (Slim Werken and Slim Reizen, 2012). Given these initiatives, it is important to gain more insight into the effects of fringe benefits both nationally and internationally.

Therefore, this section will describe the state-of-the-art in research on each of the commuting-related fringe benefits. A literature review of company cars, some information on public transport allowances, an explanation of the Dutch National Bicycle Scheme, and a brief review of the exhaustive literature on telework and work schedule flexibility will be shown. This section concludes with a discussion on interrelationships between fringe benefits.

2.1. Company cars

Company provided cars are either cars administered and financed by companies themselves or leased cars owned by car lease companies. Nowadays, company cars in the Netherlands and Belgium are used as an incentive to attract motivated staff (Gutiérrez-i-Puigarnau and Van Ommeren, 2011; De Borger and Wuyts, 2011). On the whole, the car can be used for both professional and private trips, while fuel expenses are often paid for by the employer. Due to the heavy tax burden on workforces and the fiscal advantageous treatment of company cars, employers are often triggered to fund a company car rather than a salary increase which brings about the same financial benefit for the employee. In Britain, company provided cars comprise about 10% of the total British car fleet (Dargay and Hanly, 2007). Of all passenger cars in the Netherlands in 2011, 11% was classified as a company car. Furthermore, 42% of all new cars purchased in 2011 were registered as employer-provided cars (Statistics Netherlands, 2012).

Recently, some studies were carried out in order to find the impact of company cars on travel behaviour. Frenkel et al. (2014) found that the provision of car-related fringe benefits in Israel is linked to high car ownership, high car use intensity, non-sustainable transport modes, and high annual mileage caused by long commute distances and high frequency of long-distance trips. De Witte and Macharis (2010) established that company car drivers in Belgium are predominantly higher educated males, aged less than 50 years, and are occupying a board or management function. Ramaekers et al. (2010) observed that in their survey, 20% of the company car trips conducted on a reference day were made for private purposes. On top of that, Gutiérrez-i-Puigarnau and Van Ommeren (2011) found that the vast majority (approximately 80% in their

data) of employer-paid cars in the Netherlands are not used for business purposes. Thus, company cars are mainly provided to employees as a bonus on top of their salary (o.c.).

Shiftan et al. (2012) investigated whether altering the taxation of company cars as well as changing the employer's policy towards company car usage, would affect transport mode choice and reduce the annual mileage of cars. The results of their stated preference survey, carried out in Israel, showed that if company car drivers had to use a private car instead of an employer-provided car, almost half of them would make fewer trips and about 40% stated that they would prefer alternative transport modes. Similarly, De Witte and Macharis (2010) asked their Belgian subjects to indicate how they would commute if they did no longer have a company car at their disposal. Approximately 75% of the company car users would still use a car to go to work. The train (about 10%) and walking or cycling (also around 10%) were less popular. However, the number of company car drivers changing the mode when an employer-provided car is no longer available is still substantial. The main motives why they preferred a private car more than public transport are related to service and quality (e.g., inadequate network coverage, speed and timetable issues, poor connections and unavailability of stops). Costs do not seem to be a primary concern.

2.2. Public transport allowance

The train is only used in 2% of all trips in the Netherlands in 2012 and bus, tram and metro have a share of 2% as well. When looking at commuting trips exclusively, the train is the main transport mode in 4% of the home-work trips and bus, tram and metro are used in 2% of the cases (Statistics Netherlands, 2012). Thus, public transportation in the Netherlands is more frequently used for commuting (6%) than for all trip purposes in general (4%, including home-work travel).

Higher educated travellers make more trips by train, but fewer trips by bus, tram and metro compared to lower educated individuals in the Netherlands, probably due to differences in commuting distance. The number of bus, tram or metro trips decrease when income increases, whereas train travel remains steady, except for the lowest income group. Persons with an income less than 10,000 Euros per year travel considerably more often by public transport. Probably students with a free pass for all modes of public transportation are the explanation for this frequent public transport use, as young adults (18–25 years old) show by far the most train, bus, tram and metro trips (Statistics Netherlands, 2012).

The government can (more or less) steer the costs of public transport and also a modification in taxation policy might change the economic incentives of firms to offer transport-related fringe benefits (Potter et al., 2006). The Dutch government allows that companies can offer tax-deductible allowances to a maximum of 0.19 Euros per kilometre. However, this compensation is independent of the transport mode used. On the other hand, the government of the Netherlands provides an income tax benefit to employees who commute by public transport and do not get the full travel costs reimbursed by their employer. The amount which can be deducted from income is based on commuting distance and the number of working days per week (Dutch Tax Authority, 2013).

2.3. National bicycle scheme

The Netherlands has an ideal landscape for cycling, the country is flat and the bicycle infrastructure is extensive and relatively safe. The Dutch modal split shows that approximately 28% of all trips and 26% of all commuting trips are done by bike (Statistics Netherlands, 2012), which is considerably higher than the share of the bicycle in the neighbouring countries (10% in Germany, 8% in Belgium and 2% in the UK (KiM, 2012)).

In countries with a large modal share of the bicycle, no real gender differences in cycling behaviour were found. Nevertheless, women seem to be more distance-sensitive when it comes to commuting by bike (Heinen et al., 2013). When looking at other socioeconomic variables in the Netherlands, we see that the number of cycling trips per day decreases when income increases (Witlox and Tindemans (2004) found this effect in Belgium as well), whereas individuals with a higher education level appear to travel by bicycle more frequently than lower educated persons (Statistics Netherlands, 2012).

Governments are able to promote cycling in various ways. An example is the National Bicycle Scheme in the Netherlands. As an encouragement to commute by bike the Dutch government makes it possible for employees to save up to 52% (depending on the income tax scale) on the purchase of a new bicycle when the company they work for participates in this bicycle project. This counts for a maximum value of 749 Euros. Employees can apply for this incentive once every three years when at least 50% of their commuting trips are made by bicycle (Dutch Tax Authority, 2013).

2.4. Flextime and telework

Telework and flexible working hours are assumed to be the key fringe benefits to lessen the number and length of traffic jams in the busiest hours of the day. Individuals with inflexible work schedules will have to travel during rush hours, whilst workers with flexibility in their schedules may be able to avoid peak hours by altering their departure time to work accordingly. The level of flexibility will differ between individuals, as also non-work activities can make the work schedule inflexible. Examples of those non-working conditions are commitments to driving children/partners to school/work, carpooling, regular activities before or after work, and the opportunity for teleworking (Saleh and Farrell, 2005).

In terms of socioeconomic and work-related characteristics of workers having flexible work schedule arrangements, Yeraguntla and Bhat (2005) found that individuals living in highly urbanised areas or Central Business Districts seem to have greater work schedule flexibility than residents of suburban or other lower density areas. In addition, Alexander et al. (2010) found that the probability of having work schedule flexibility in the Netherlands increases with age, income, the frequency of train use, and the more often work-related calls are made and work-related emails are send outside working hours. Also being a high-level professional positively affects this probability. On the other hand, no significant effects were found in case of children in the household. This is inconsistent with the expectation that parents of dependent children, especially mothers, opt for flexible work arrangements in order to achieve a better work-life balance, since they have to cope with more space–time constraints and are more likely to schedule household duties around their paid work activities (Hinze, 2000; Kwan, 2000; Presser, 2003; Peters et al., 2009; Hubers et al., 2011).

Teleworkers in the Netherlands are more likely to be higher educated, older (aged 45 years and over), and usually have a longer commuting time (Peters et al., 2004). Mokhtarian and Salomon (1996) found that teleworkers in the USA have a higher probability of occupying a management position and of having children under the age of 6 in their household. Employees who preferred to telecommute were significantly younger than non-preferrers and their one-way commuting distance was longer. Furthermore, females tend to prefer working from home more often than men. Bailey and Kurland (2002) argue that it is still not clear who teleworks (sociodemographics differ between studies) and how often teleworkers work from home (i.e., using number of days or hours per week instead of the yes/no question).

2.5. Interrelationships

Relationships among commuting-related fringe benefits can either strengthen or weaken the positive or negative effects of the fringe benefits on traffic congestion. For example, the combination of bicycle compensation and flexible starting and ending times can allow potential cyclists to wait till after a rain shower to go cycling to work rather than taking the car. A rainy morning rush hour in the Netherlands often results in many traffic jams, both during morning and afternoon peak hours, since bicycle commuters tend to take the car when the weather is bad. Another positive combination of fringe benefits concerns public transport allowance and flextime. The ability to adjust work schedules to timetables of public transport services affords an increase in the number of commuting trips made by public transportation. Also delayed trains could be less problematic. Furthermore, commuting by train makes working during the daily commute possible (this is more effective when telework and flextime are allowed). In this way travelling becomes productive working time rather than a waste of time, as argued by Lyons and Urry (2005). Finally, combinations between the provision of company cars and telework and/or flextime might soften the negative effects of company cars on traffic flows. When company car commuters are allowed to work from home they do not commute on teleworking days or they can, e.g., work from home in the morning or late in the afternoon to avoid rush hours. Flexible working schedules will stimulate the company car driver to commute before or after peak hours as well. Hence, telework and flextime can potentially reduce the negative effects of the provision of company cars on traffic flows.

All in all, the existing literature gives us some indications of which employee and employer characteristics affect the probability of receiving one of the commuting-related fringe benefits. However, hardly any research was carried out on public transport allowance and bicycle contribution. Even the difference between workers with or without a type of commuting allowance was neglected. Furthermore, interrelationships among fringe benefits were barely studied in the past. Finally, we expect that more detailed characteristics of both work and residential location will have an influence on which fringe benefits a company offers and which type of allowance the employee chooses.

3. Conceptual framework

Fig. 1 shows the conceptual framework that underlies the study described in this paper. The fringe benefits that affect commuting behaviour are divided into three types, namely transport-related fringe benefits (monetary allowance, company car, public transport allowance and bicycle compensation), telework and flextime. The arrows between the fringe benefits indicate interrelationships between telework, flextime and the transport-related fringe benefits as discussed in Section 2.

The employer determines which fringe benefits are offered to the employees. This most likely depends on the activity sector of the company, the type of occupation and the location of the firm (Vanoutrive et al., 2010). With regard to company characteristics, the type of organisation (profit or non-profit) and the type of industry (government, manufacturing, health, finance, education) will have different perceptions on which fringe benefits to provide. For example, for-profit corporations seem to offer company cars frequently in order to attract skilled staff and some industries tend to be more progressive when it comes to changing traditional work patterns. Job characteristics, such as computer use and working hours, will also have an influence on the fringe benefits provided. Finally, the location of the firm might affect the types of commuting allowance offered by companies as well. Firms located in the vicinity of highway exits, where parking lots are relatively cheap, will be more focussed on providing car-related bonuses. Whereas, when a company is situated in a city centre, where accessibility by bicycle or public transportation is better than by car, employers will be more inclined to offer public transport passes or bicycle contribution.

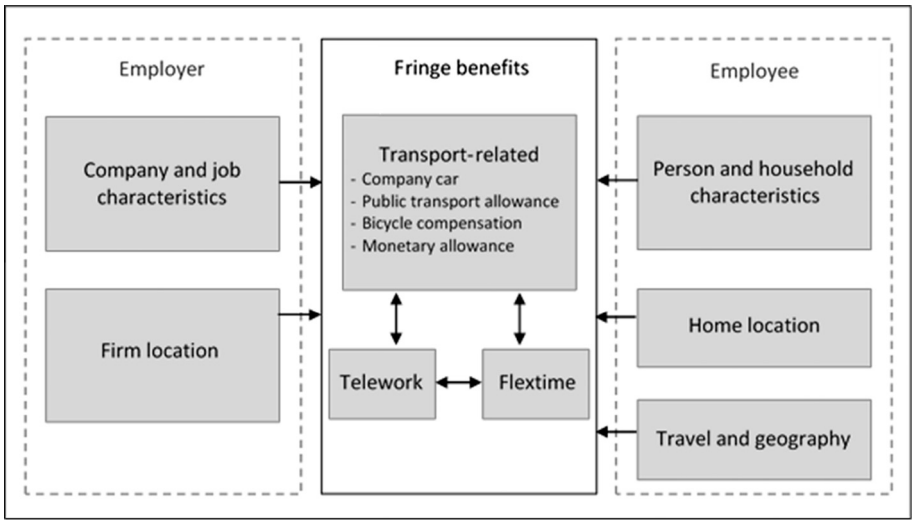

Fig. 1. Conceptual framework.

Given the commuting-related fringe benefits offered by the employer, employees will accept or choose the benefits they prefer, based on their personal situations, household circumstances and the location of their dwelling with respect to the work location. Concerning person and household characteristics, we expect that household composition, in particular the presence of young children in the household and whether the partner is working as well, might affect fringe benefits used by employees as these affect their flexibility (Oakil et al., 2015). The geographical context of the home location of employees, like the proximity to bus stops, train stations and highway exits, also influences commuting mode choice and consequently the allowance type chosen. Furthermore, since the majority of Dutch companies usually do not pay any allowance when employees reside close to their jobs (e.g., often a threshold of 10 km is applied), commuting distance must be a significant factor. Moreover, commuting distance is rather decisive for the transport mode chosen and it affects the use of the possibility to telecommute (Mokhtarian and Salomon, 1996; Peters et al., 2004).

4. Research design

For analysing which factors affect the probability of receiving one of the commuting-related fringe benefits, we use the National Time Use Survey of the Netherlands (TBO). In the Dutch National Time Use Survey, respondents were asked whether they received any form of allowance for their commuting trips and, if so, which type of transport-related fringe benefit they obtained. Note that the transport-related benefits are operationalized as being mutually exclusive, due to the way they were treated in the TBO survey. In practice, however, combinations of bicycle compensation and public transport allowance or bicycle compensation and monetary allowance are possible. Questions on telework and flextime were also part of the TBO survey. In the case of telework, respondents were asked the number of hours per week they were allowed to work from home by the employer and the number of hours per week they were actually working from home. Flextime was measured in two steps. First, to what extent work schedule flexibility was allowed (not, somewhat or completely). Second, when flextime was somewhat or completely allowed, the question "how often do you use this possibility? (never, sometimes or often)" was asked.

The TBO dataset provides details on the type of firm the respondents work for, their job characteristics, socioeconomics, and residential location. The National Time Use Survey of the Netherlands is carried out once every five years. Currently, the most recent data available to scientist are the years 2006 and 2005. The 2006 survey was conducted following the HETUS guidelines (Eurostat, 2000) which aimed at harmonising the Time Use Surveys of the European countries. The Time Use Survey of 2005, the old version, is therefore slightly different than the one of 2006. However, in order to obtain more respondents, especially for the groups of employees participating in the National Bicycle Scheme and the ones receiving public transport allowance, the two datasets were combined for the analyses. The consequence is that only variables that exist in both surveys can be used. Since the postal code of the work location is known solely in the 2006 dataset, a separate analysis considering the geographical context was carried out on the 2006 data only.

The sample of the Dutch National Time Use Survey (TBO) is aimed to be a reflection of the national population. Out of the 4079 TBO 2005 and 2006 respondents, 2077 were working and indicated whether they received some kind of commuting-related fringe benefit. About 45% of the respondents did not receive an allowance for commuting at all and approximately 40% obtains a general financial compensation for travelling between their place of residence and place of work. A company car, bicycle contribution, or public transport allowance is only provided to respectively 7%, 4%, and 3%

of the working respondents of the National Time Use Survey. About 20% of the workers in the dataset were allowed to work from home at least some hours per week and 51% had flexible starting and ending times to a certain extent.

The TBO questionnaire contains an abundance of variables on time use. Variables of interest to this study were classified into four groups, namely fringe benefits, company and job characteristics, person and household characteristics, and travel and geography variables. Table 1 shows the TBO variables which were considered for the analyses. Nominal and ordinal variables were dummy coded. Other variables like commuting distance, age, number of cars in the household, household size, and number of working hours per week were incorporated as continuous variables in the analyses. For commuting distance we also included a variable representing the natural logarithm (i.e., ln(commuting distance + 1)) of the home-work distance, as in this way the very long distances do not have a disproportionate impact on the results. Only one of the two variables was incorporated in each analyses and the one with the highest gain in ρ^2 was finally included.

Since the 2006 TBO dataset contains the 4-digit postal code (i.e. neighbourhood level) of the work location as well as the residential location of the respondents, a number of variables indicating the geographical context of the work and the home location of employees can be elicited from postal code data available on Statline, the website of Statistics Netherlands (statline.cbs.nl). In this way, variables like distance to the nearest railway station, distance to the closest highway exit, and number of companies per hectare were obtained. At the municipality level, train and intercity stations were manually added to municipalities with railway stations and address density per municipality was also available on Statline. The variables 'railway station in both municipalities' and 'work in the same municipality' were obtained by comparing the home municipality and the municipality were the respondent works. 'Multiple work locations' was a variable only available in the 2006 TBO dataset, therefore, we included this potentially significant indicator in this final estimation.

For the analyses concerning whether or not a fringe benefit was provided binary logistic regression models were used, since the dependent variable had only two categories. The estimations indicating the use/choice of the benefits were multinomial logistic regressions. An exception is the number of hours per week the respondent works from home. In this particular case a Tobit model was estimated, because of the large number of zeroes in the data (a considerable number of employees work zero hours per week from home). We used the continuous variable 'number of teleworking hours per week', since this provides more detailed information than the dummy variable which is commonly used in existing literature, as argued by Bailey and Kurland (2002) and Vanoutrive et al. (2010). Independent variables were checked for multicollinearity, i.e. high correlation among the variables.

Due to a large amount of variables available for the analyses, we decided to first explore the possible significant variables using the backward and forward stepwise regression methods. This was followed by estimations in which only the potential significant indicators were included, each time leaving out the least significant variables until the results showed only significant ($p < 0.1$) variables.

5. Results

In this section the results of eleven multivariate analyses will be shown. Six of them are represented in Table 2 and indicate interrelationships among fringe benefits and correlations between company, job, person and household characteristics and those employee benefits. The following commuting-related fringe benefits were taken into account: several types of allowance (money, company car, public transport pass or bicycle contribution), flextime and telework. For each of the benefits two estimations were carried out, namely one indicating whether the fringe benefit is allowed/provided by the employer and another one representing the use/choice of the employee. Table 3 demonstrates the results of five multivariate analyses which are similar to Table 2, however, specific variables concerning the geographical context of the residential and the work location were incorporated in the analyses. Note that the estimations shown in Table 3 are based on TBO 2006 data only, as this year of the Time Use Survey provided postal codes of home and work locations.

5.1. Interrelationships among fringe benefits

One of the aims of this paper was exploring possible correlations between fringe benefits. The first part of Table 2 describes the relationships among the commuting-related benefits. The results show that a strong interrelationship between telework and flextime exists. When telework is part of the work agreement, flexible starting and ending times are often possible as well, and vice versa. Regarding the use of the telework and flextime possibilities, we found positive relationships between working at least some hours per week from home and often making use of the flextime opportunity, and between a completely flexible working schedules and the number of hours telework per week. Negative correlation effects were identified between working from home and not using the possibility of work schedule flexibility, and between the number of teleworking hours per week and flextime not allowed.

Some allowance types were significantly correlated to telework and flextime as well. First, employees with company cars seem to have the most flexible work arrangements. Company car drivers have a higher probability of working from home at least a couple of hours a week and a completely flexible working schedule is more often part of the work agreement. Negative correlation effects were observed between company cars and no flextime opportunities, and between those employer-paid cars and never using the flextime opportunity. Second, employees who receive public transport allowance appear to have more flexibility in their work schedules than workers with general commuting allowance. This is convenient

Table 1
Independent variables considered for the analyses (*base levels in italics*).

Variable	Description/range (*base levels in italics*)	Variable	Description/range (*base levels in italics*)
Fringe benefits		***Person characteristics***	
No allowance (offered)	No allowance	Gender	Male
	Allowance		*Female*
Allowance types (use)	Company car	Age	Continuous
	Public transport	Education level	Low
	Bicycle		*Average*
	General allowance		High
No flextime (allowed)	No flexibility	Individual income	Low income
	Somewhat-completely flexible		*Average*
Flextime (use)	Often		High income
	Never	Driving license	No driving license
	Sometimes		*Driving license*
No telework (allowed)	0 h per week	***Household characteristics***	
	>0 h per week	Number of cars	Continuous
Telework (use)	h/week, continuous	Number of persons	Continuous
Flextime (allowed, rows)	No flextime	Single person household	1 person in household
	Flextime completely		*>1 persons in household*
	Somewhat flexible	Child age < 6 years old	Child < 6 in household
Company characteristics			*No children < 6 years old*
Sector	Non-profit sector	Dwelling type	Flat, apartment
	For-profit sector		*House*
Type of company	Government	Partner works	Yes
	Retail, Wholesale		*No or no partner*
	Health	***Geographical context***	
	Education	Residential density	Very high >= 2500 addresses km^2
	Financial industry		*High-low (500–2500)*
	Manufacturing industry		Very low < 500 addresses per km^2
	Other type of industry	Commuting distance (km)	Continuous
Type of employment	Self-employed/agency/secondment	Commuting distance (ln)	ln(km + 1), continuous
	Employed by company	***Travel characteristics***	
Job characteristics		Commuting mode	Car/*Other*
Type of job	Legislators, managers		Bicycle/*Other*
	Service providers		Public transport/*Other*
	Professionals	Table 3	
	Technicians	*Municipality level*	
	Servants and other	Number of train stations	Continuous
Works in weekend	Often	Intercity station	Yes/*No*
	Sometimes	Address density	Continuous
	Never	Train station in both mun.	Yes/*No*
Works in evening	Often	Work in same municipal.	Yes/*No*
(Between 7 and 12 pm)	*Sometimes*	*Postal code level*	
	Never	Distance to train station	Continuous
Working hours per week	Continuous	Distance to highway exit	Continuous
Uses computer at work	>=2 h a day	Companies per hectare	Continuous
	<2 h a day	Multiple work locations	Yes/*No*

since trains and busses are often delayed and timetables do not always match work starting and ending times. A negative relationship was found between public transport allowance and not having the opportunity to alter work starting and ending times. Finally, employees without some kind of transport allowance for commuting have flexible work schedules less frequently than persons with financial compensation.

5.2. Commuting allowance

5.2.1. No allowance versus commuting allowance

In order to find significant differences between persons receiving commuting-related fringe benefits and employees to whom those benefits are not provided, a binary logistic regression model was estimated. The second column of Table 2 demonstrates the outcome of the final estimation. When looking at the results, we see that individuals who are self-employed, working in education, the retail sector or for the government have a higher probability of not obtaining an allowance for commuting. Furthermore, those employees without a form of allowance often work in the weekend. On the other hand, persons with commuting allowance need to spend more working time in front of a computer and they more frequently work in the financial industry.

The likelihood of receiving some kind of allowance for commuting trips grows with commuting distance. This is in line with our expectations, since often a minimum distance of 10 km is used. Persons commuting by car or public transport and

Table 2
Estimation results fringe benefits.

	Possibility	*Use*			*Possibility*	*Use*		*Possibility*	*Use*
TBO 2005 and 2006	**No allowance** (n = 876)	**Company car** (n = 77)	**Public transport** (n = 59)	**Bicycle allowance** (n = 60)	**No flextime** (n = 1017)	**Flextime often** (n = 443)	**Flextime never** (n = 180)	**No telework** (n = 781)	**Telework h/ week** (n = 278)
Base level	*Allowance*	*General monetary allowance*			*Flextime*	*Flextime sometimes*		*>1 h./wk*	*Continuous*
Variable	*β*	*β*	*β*	*β*	*β*	*β*	*β*	*β*	*β*
Constant	3.961***	−6.362***	−4.375***	1.604	0.572***	−1.290***	−0.577	0.612*	−24.552***
Fringe benefits									
Telework		0.663**			−1.122***	0.365**	−0.682***	–	–
No flextime	0.350**				–	–	–	1.002***	−3.829***
Flextime completely		0.590*	0.723*		–	–	–	−0.613***	5.473***
Company car	–	–	–	–	−0.502**		−0.876**		
Public transport allowance	–	–	–	–	−0.645*				
Company and job									
Non-profit	−0.317*	−1.555**		1.026**					
Retail	0.360*								
Government	0.454**	−2.364**	2.394***	1.925***	−0.558***				
Education	0.762***				1.231***			−1.202***	8.188***
Health and social work		−2.164*			0.393***				
Financial industry	−1.040***		1.072**						
Manufacturing industry									
Professionals		0.811**		1.361***	−0.707***		−0.707***	0.633***	1.777*
Managers, legislators		1.006**			−0.949***				
Technicians					−0.699***				
Self-employed/ employment agency	1.690***				−1.058***	1.194***			
Works in weekend often	0.441***	−0.977**			0.443***				
Works in evening never		−0.545*						0.738***	−5.566***
Works in evening often						0.411**			
Working hours per week	−0.015**	0.063***	0.041*		0.011**				0.212***
Computer use at work >2 h a day	−0.258*				−0.921***	0.298*	−0.388*	−0.631***	1.711*
Person and household									
Age	−0.012**	−0.032*				0.020***			0.132***
Gender (male)		1.481***							−1.575*
Education level low	0.557***				0.335**			0.826**	
Education level high			−0.676*		−0.429***			−0.702***	4.664***
Income low									5.183***
Income high						0.455**			
No driving license	0.680**								−3.410*
Household type single				−1.527**			0.716***		−2.569**
Partner works	−0.413***		0.793*	−1.352***					
Child(ren) <6 years old		1.186***			−0.231*	0.390**			
Number of cars in Household		0.714***	−1.228***	−1.110***					
Travel and geography									
Commuting distance (km)	−1.339***			−0.263***				−0.005*	0.031*
Residential density low					−0.563***				
Residential density high									2.356**
Mode car	−0.439***	–	–	–					
Mode public transport	−0.640**	–	–	–			0.586*		

(*continued on next page*)

Table 2 (*continued*)

	Possibility	*Use*			*Possibility*	*Use*		*Possibility*	*Use*
TBO 2005 and 2006	**No allowance** (n = 876)	**Company car** (n = 77)	**Public transport** (n = 59)	**Bicycle allowance** (n = 60)	**No flextime** (n = 1017)	**Flextime often** (n = 443)	**Flextime never** (n = 180)	**No telework** (n = 781)	**Telework h/ week** (n = 278)
Base level	*Allowance*	*General monetary allowance*			*Flextime*	*Flextime sometimes*		*>1 h./wk*	*Continuous*
Variable	β	β	β	β	β	β	β	β	β
Number of observations	1674			861	2006		1005	1057	1670
ρ^2 (Nagelkerke)	.538			.548	.304		.137	.378	
Tobit: pseudo ρ^2 (McFadden)									.134

'–': Variable not included in the estimation.
*** $p < .01$.
** $p < .05$.
* $p < .1$.

individuals who have a partner that works are more likely to get some kind of commuting-related compensation. Employees without an allowance seem to be younger, lower educated and they are less likely to hold a driving license.

5.2.2. Types of commuting allowance

The aim of the next estimation is to determine whether significant correlations exist between job, person, and travel characteristics of employees and the type of transport mode-related fringe benefit they receive. The following support categories are explored: bicycle contribution, public transport allowance, company cars, and general financial compensation. As the general allowance category has by far the most respondents and is the least explicit type of commuting-related allowance, this category was set as the base level. Table 2 shows the results of the multinomial logistic regression analysis.

When looking at the table we see that in the case of company cars more variables show significant effects compared to bicycle and, especially, public transport allowance. The company and job characteristics indicate that employees with a company car are more likely to be a professional or a manager than persons with general allowance. Furthermore, they work more hours per week and more often in the evening, but hardly at weekends. In the non-profit, public (government) and in the health and social work sector company cars are less frequently offered to employees. The person and household characteristics show that company car drivers seem to be younger than individuals who receive general compensation and young children are more often part of the household. Moreover, men have a higher probability of obtaining a company car compared to women. The latter outcomes are in line with the results found by De Witte and Macharis (2010) in Belgium. However, we did not find a significant effect of higher education level in our study. This might be caused by the impossibility of distinguishing between lease cars and company vans, as the vans are usually driven by lower educated workers with a profession in the building industry. Finally, the number of cars in the household is higher when a company car is part of the car fleet. This notion was established by other studies as well (Frenkel et al., 2014; Van Ommeren and Gutiérrez-i-Puigarnau, 2013).

Free public transport cards are more likely to be provided to employees working for the government. The financial industry also seems to provide more public transport passes. An explanation might be that banks and insurance companies are more often located in city centres where accessibility by train, bus, tram, or metro is high and parking lots are scarce and expensive. Compared to workers with general monetary allowance, employees receiving public transport compensation for their commuting trips seem to work more hours a week, their education level is less frequently high, and they usually have a partner who works as well. Lastly, the number of cars in the household is lower for employees with a free public transport pass.

Professionals and employees working for the government or in the non-profit sector seem to participate in the National Bicycle Scheme more frequently. The household characteristics show that employees living in multi-person households with a partner who does not work are more likely to receive a free bicycle from work. Moreover, the number of cars in the household is lower compared to households of employees receiving general allowance for commuting. Note that commuting distance is only significant in the case of bicycle contribution when comparing the mode-related allowance types to a general financial compensation.

Other variables that were not significant, contrary to our expectations, are income and urban density level. Personal income is closely related to education level, thus this variable might account for the effect. However, education level is only significant in the case of public transport allowance. Residential density (i.e., the number of addresses per km^2), as a dummy variable, did not seem to be a significant indicator for the type of allowance offered and chosen. Furthermore, we expected public transport allowance users and company car drivers to have longer commuting distances, however, no significant effects were found. This outcome might be caused by the fact that the mean distance for general allowance is relatively high (25.3 km compared to 33.2 km (company car) and 28.2 km (public transport allowance)) as a consequence of the 10 km threshold which is commonly applied.

5.3. Flextime and telework

The outcomes of the analyses on telework and flextime seem to be comparable to existing literature on those fringe benefits. With regard to telework, the results are similar to what was found by Peters et al. (2004) in the Netherlands in 2001 (i.e. effects of age, education level, frequency of computer use at work, and commuting time). In the current study, some additional variables were found to be significant. For example, employees working in the education sector are more often allowed to telework and they work more hours per week from home than workers in other industries. Furthermore, professionals seem to telework more frequently, whereas employees living in one-person households work fewer hours per week from home.

Concerning flexible working schedules, the results show that flextime is less frequently allowed by firms in the education, health and social work sectors, whereas individuals who work for the government, professionals, managers, legislators, technicians and self-employed persons are more likely to have work schedule flexibility. Employees that are lower educated, work more hours or work often in the weekend have a higher probability of not having a flexible working schedule, whilst workers who have a higher education level, use a computer at work or have small children in the household are more frequently allowed to start working earlier or later on a day. Somewhat contradictory to Yeraguntla and Bhat (2005), who found that employees living in high residential density areas and Central Business Districts in the USA have greater work schedule flexibility, our results show that workers living in very low urbanized neighbourhoods (<500 addresses per km^2) have flextime more often compared to individuals residing in medium or high density areas. This discrepancy might be caused by differences in urban structure between the two countries.

When looking at the usage of flextime (given that flextime is allowed), we see that the use increases with age, income, computer use at work (consistent with results found by Alexander et al., 2010) and frequency of working in the evening. Furthermore, self-employed persons and employees with young children in the household tend to use the flextime opportunity more often. The latter result is in line with expectations indicated by Hinze (2000), Kwan (2000), Presser (2003) and Hubers et al. (2011) in that flextime enables parents to combine work and caring responsibilities. On the contrary, singles (i.e., employees living in one-person households) seem not to use the possibility to start working earlier or later more frequently than workers living with a partner and/or children.

5.4. Geographical context

Table 3 shows the results of the estimation on the geographical context of the residential and the work location of the employee. It should be noted that the number of respondents in especially the public transport and the bicycle category is somewhat small due to the use of TBO 2006 only (since postal codes were provided solely in the 2006 dataset). Furthermore, note that the estimation of the possibility to telework (sixth column in Table 2) is not included in Table 3, since in the 2006 questionnaire only respondents who indicated to work from home received this question. The results show that the geographical variables of the residential location of the employee hardly have an impact on the fringe benefits they receive. One of the exceptions is the presence of an intercity train station in the case of using the opportunity to participate in the National Bicycle Scheme. When intercity trains stop at a railway station in the municipality of the home location of the employee (i.e., the worker lives in a (fairly) large city in the Netherlands), this person is less likely to receive bicycle contribution from work. When looking at the home locations of employees without a form of commuting-related allowance, we see that the higher the number of railway stations in the municipality, the lower the likelihood of receiving no allowance at all. On the other hand, a closer proximity of the residential location (postal code level) to the nearest railway station results in a higher probability of not obtaining an allowance for commuting.

Firm location shows several significant factors. Address density is significant for employees with bicycle contribution. When the company is located in a town with lower urban density, the bicycle scheme is more often offered to employees. This finding might be caused by the poorer level of public transport in towns with lower levels of urbanisation. In addition to this effect, the presence of an intercity station in the municipality (i.e., relatively large city) has a positive effect on receiving bicycle contribution. Thus, when the firm is located in a bigger city, bicycles are more often paid for. This could indicate that, as a solution to congestion and parking problems, companies located in the larger cities of the Netherlands started to offer some kind of bicycle allowance to promote commuting by bike. Another interpretation might be that larger firms are more often located in the main cities of a country and bigger companies can provide fringe benefits, like the National Bicycle Scheme, more easily than smaller companies. The presence of an intercity train station in the municipality of the firm location also affects the probability of receiving commuting allowance. When the company is located in a relatively large city, the employees are less likely to obtain a form of allowance for their commuting trips. Another interesting variable which is significant in several cases is the number of companies per hectare at the postal code level of the firm. The larger this number the more frequently employees receive public transport allowance and bicycle contribution. Furthermore, the possibility of flexible working schedules is more frequently used. Hence, in industrial or office areas where traffic is dense, predominantly during rush hours, commuting by bicycle or by public transportation is stimulated by employers in order to stay accessible. Moreover, employees working in those high company density areas seem to make use of the flextime opportunity more often in order to avoid traffic congestion.

The existence of at least one railway station at both the residential and the working municipality has a positive influence on public transport allowance. In addition, the presence of train stations in both towns increases the chance of obtaining an

Table 3
Estimation results fringe benefits including geographical context home and work location.

	Possibility	*Use*			*Possibility*		*Use*	*Use*
Geographical context TBO 2006	**No allowance** (n = 451)	**Company car** (n = 44)	**Public transport** (n = 29)	**Bicycle allowance** (n = 23)	**No flextime** (n = 399)	**Flextime often** (n = 202)	**Flextime never** (n = 72)	**Telework hrs./ week** (n = 149)
Base level	*Allowance*	*General monetary allowance*			*Flextime*		*Flextime sometimes*	*Continuous*
Variable	β	β	β	β	β	β	β	β
Constant	0.784*	−4.744**	−10.526***	−3.957	0.480	−1.376*	−0.107	−23.519***
Home location								
Municipality level								
Number of railway stations	−0.164*							
Intercity station				−4.090*				
Address density								
Postal code level								
Distance to railway station	−0.116***							
Distance to highway exit								
Firm location								
Municipality level								
Number of railway stations								
Intercity station	0.623**			4.572**				
Address density				−0.004***				
Postal code level								
Distance to railway station								
Distance to highway exit								
Companies per hectare			0.112*	0.183*		0.068*		
Geography								
Railway station both municipalities	−0.623**		1.585*					
Work in same municipality	1.714***			5.201***				
Multiple work locations	−0.789**	1.300**						3.669**
Fringe benefits								
Telework					−1.340***	0.617**		–
No flextime					–	–	–	−6.261***
Flextime completely					–	–	–	1.973*
Company car	–	–	–	–			−1.370*	
Public transport allowance	–	–	–	–				
Company and job								
Non-profit	−0.588***				0.697***			
Retail								
Government		−2.232**	2.596***	3.872***	−0.730**	0.724*		
Education	0.627*				1.015***			5.109***
Health and social work		−2.453*						
Financial industry	−1.533***							
Manufacturing industry	−0.614**							
Professionals				2.519**	−0.543**		−1.126**	3.623***
Managers, legislators		1.340**			−1.041***			
Service providers	−0.540**							2.476*
Technicians					−1.201***			
Self-employed/ employment agency	2.599***				−1.178***	0.982*		
Works in weekend often	0.462**	−1.245*			0.426**			

Table 3 (*continued*)

Geographical context TBO 2006	*Possibility* **No allowance** (n = 451)	*Use* **Company car** (n = 44)	**Public transport** (n = 29)	**Bicycle allowance** (n = 23)	*Possibility* **No flextime** (n = 399)	**Flextime often** (n = 202)	*Use* **Flextime never** (n = 72)	*Use* **Telework hrs./ week** (n = 149)
Base level	*Allowance*	*General monetary allowance*			*Flextime*		*Flextime sometimes*	*Continuous*
Variable	β	β	β	β	β	β	β	β
Works in evening never			1.136*					−5.227***
Works in evening often								
Working hours per week			0.090**		0.025***			0.127**
Computer use at work >2 h a day	−0.374*				−1.094***			
Person and household								
Age		−0.058**	0.063*			0.019*		0.187***
Gender (male)		2.966***		2.184*				
Education level low	0.476**							
Education level high					−0.694***			5.091***
Income low	0.947***			3.100**				5.112**
Income high		0.810*		2.258**				
No driving license								
Household type single								
Partner works			1.584*	−2.381**		−0.618**	−0.618*	
Child(ren) <6 years old		1.171**						
Number of cars in Household		0.822**	−1.750***	−1.929***		0.636***	0.562**	
Travel								
Commuting distance (km)	−0.030***							0.047*
Mode car	−0.614***	–	–	–				
Mode public transport	−1.391**	–	–	–				
Number of observations	814			444	793		408	797
ρ^2 (Nagelkerke)	.530			.648	.343		.198	
Tobit: pseudo ρ^2 (McFadden)								.145

'–': Variable not included in the estimation
*** $p < .01$.
** $p < .05$.
* $p < .1$.

allowance in general. When employees work in the same municipality as they live, the probability of not obtaining an allowance and the likelihood of receiving bicycle contribution are considerably higher. These results can be attributed to commuting distance and the kilometre threshold for commuting compensation which is commonly applied by employers. Employees with multiple working locations more frequently obtain a company car, which makes sense since they have to travel for their job. Moreover, those workers are more likely to receive a form of commuting-related allowance in general. Finally, employees with multiple work locations for one job tend to work more hours per week from home.

6. Conclusions and discussion

This paper showed the results of an explorative study to understand which person, firm, and geographical factors affect the probability of receiving specific types of fringe benefits for commuting and investigate possible interrelationships among those mobility management measures. The fringe benefits for commuting we explored in this paper are telework, work schedule flexibility, and four types of commuting-related allowance, namely company cars, public transport allowance, bicycle contribution, and general monetary allowance (not mode-related) for commuting.

The results suggest a number of conclusions with important theoretical and policy implications. First, interrelationships among commuting-related fringe benefits exist. Telework and flextime showed a very strong relationship. When an employee is allowed to work from home, flexible working hours are part of the work agreement as well. Positive correlations

were also found between company cars and working from home, between employer-paid cars and completely flexible working schedules, and between public transport allowance and flextime. Second, the public and non-profit sector are more inclined to support sustainable commuting initiatives (i.e. hardly any company cars are offered to employees and, on the other hand, public transport and bicycle allowances are provided frequently). Third, the probability of receiving a form of allowance grows with commuting distance and car and public transport commuters are more likely to receive an allowance. Fourth, offering company cars is accompanied by a higher number of cars in the household, whereas households of employees receiving a public transport pass or bicycle contribution from work own fewer cars compared to households of workers receiving general allowance. Fifth, person and household characteristics (in particular, age, one-person households and small children in the household) are related to the use of fringe benefits to a considerable extent. Finally, firm location particularly affects the probability of obtaining fringe benefits, while home location characteristics hardly have an effect. Especially, employees working for companies located in areas with a high number of companies per hectare seem to receive public transport allowance and bicycle contribution more often. Moreover, those workers tend to use the opportunity of work schedule flexibility more frequently. Probably due to the high traffic load during rush hours in firm-dense areas, these measures to reduce the number of car commuters have already been taken.

The results of this study help directing governments and firms towards more sustainable mobility management. First, we argue that combinations of commuting-related fringe benefits may lead to better results. For example, negative impacts of company cars on traffic flows could be mitigated by also allowing telework and flextime (i.e., company car drivers can avoid rush hour travelling). Furthermore, when offering public transport allowances, flexible starting and ending times should be permitted as well, since this enables employees to adapt their working schedules to timetables of public transport services and delays are less problematic. Second, it is not unreasonable to presume that mode-specific allowances could show sustainability effects (i.e. the number of cars in the household is lower when a household member receives public transport or bicycle allowance and higher when a company car is provided). Therefore, allowances explicitly for bicycle and public transportation should be encouraged, whereas the provision of company cars should be constrained. Third, firm location plays an important role in which type of commuting-related fringe benefits a company offers. Firms faced with congestion problems in the vicinity of the firm already took sustainable measures. Hence, companies located in better accessible areas should implement those measures as well to improve accessibility elsewhere. Further research is needed to confirm these statements.

The effects of mobility management measures on commuting behaviour and activity-travel patterns should be further explored and proven in future research. Using the perspective of employees makes it possible to see to what extent commuting-related fringe benefits will affect mobility and activity agendas of workers. When travel diaries of family members are available as well, even the effects of commuting benefits on activity-travel schedules of household members can be determined. We plan to investigate whether and to what extent fringe benefits influence not only commuting behaviour, but also travel patterns for other activities, like leisure, and travel behaviour of partners and children.

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