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Reference:
Vanoutrive Thomas.- Commuting, spatial mismatch, and transport demand management : the case of gatew ays
Case studies on transport policy / WCTR Society - ISSN 2213-624X - 7:2(2019), p. 489-496
Full text (Publisher's DOI): https://doi.org/10.1016/J.CSTP.2018.12.011
To cite this reference: https://hdl.handle.net/10067/1559640151162165141

Commuting, Spatial Mismatch and Transport Demand Management: the Case of Gateways

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Published as:

Vanoutrive, T. (In Press) *Commuting, Spatial Mismatch and Transport Demand Management: the Case of Gateways*. Case Studies on Transport Policy. https://doi.org/10.1016/j.cstp.2018.12.011

Abstract

Ports and airports, which are often referred to as gateways, are spatial concentrations of jobs outside city centres. Their structure and location leads to distinctive commuting patterns and to spatial mismatch-related problems. An analysis of Belgian gateways reveals that car driving and carpooling are more popular than elsewhere and that several large employers successfully run a private bus service, which is rather exceptional in this country. Public transport, however, plays no significant role in the port areas under investigation. This paper lists several Transport Demand Management projects that aim to improve the accessibility of gateways, and analyses the mobility measures taken by employers. The discussion points to a number of dilemmas: the promotion of cycling when traffic conditions are dangerous, the limited environmental benefits of carpooling, and the success of private busses in areas characterised by an underinvestment in public transport.

Key words: Commuting; Gateway; Transport Demand Management (TDM)

1. Introduction

Policy makers in several countries see employers as mediating institutions that connect individuals with public policy concerns. Illustrative is the case of workplace (or employer) transport plans and Transport Demand Management (TDM) which are promoted as instruments that contribute to improved job accessibility, less congestion and less pollution (Cairns et al., 2010; DeHart-Davis and Guensler, 2005). There is a small but growing literature on the role of employers in transport policy (Giuliano et al., 1993; Potter et al., 2006; Rye, 2002; Vanoutrive, 2014), and researchers investigate which and why measures are taken by employers, the attitudes of employers towards mobility measures and the impact of employer-based programs (Cairns et al., 2008; Ding et al., 2014; Meyer, 1999; Moser and Bamberg, 2008; Rye, 1999a; Vonk Noordegraaf and Annema, 2012). In this literature, workplace travel plans are commonly seen as interventions designed to change employee travel behaviour, in particular the share of Single Occupant Vehicle (SOV) commuters. For many years, it has been acknowledged that travel choices of employees are influenced by site environmental factors, intra-organisational characteristics and personal characteristics (Giuliano et al. 1993). Furthermore, it has been suggested that these factors might have an impact on the nature of transport-related incentives offered by employers, and it is generally recommended to take into account these site and employee characteristics when developing a travel plan (Dickinson et al., 2003; Enoch, 2012).

A variety of reasons motivate companies to invest in TDM, among them recruitment problems, lack of parking, tax avoidance, environmental concerns and corporate social responsibility (Roby, 2010; Rye, 1999a, b). It is hypothesised that accessibility-related problems induce employers to invest in TDM and to establish an employer transport plan,. However,previous studies in Belgium suggested that there is no clear relationship between accessibility-related problems reported by employers and the measures taken to overcome these problems (Van Malderen et al., 2012; Vanoutrive et al., 2010). This paper seeks to provide a better understanding of these findings by analysing a particular case, gateways in Belgium, or more specifically, Brussels Airport and the seaports of Antwerp, Bruges and Ghent.

Gateways such as port areas and major airports are seen as strategic engines of economic development, notably in spatial planning documents. This is the case, for example, in the region of Flanders, Belgium, in its Spatial Structure Plan for Flanders (Ministerie Vlaamse Gemeenschap, 1998) and more recently, the White Paper of the Spatial Policy Plan (RV, 2017). These documents argue that gateways are important concentrations of employment that connect the region to the rest of the world. However, gateways are exemplary for the suburbanisation of jobs and related mobility challenges, that is a major reason why gateways were chosen as case studies in this paper.

In the last decades, jobs which were traditionally located in or near city centres have been suburbanised. Large office parks, retail clusters, warehouses and factories can now be found outside cities. Although American-style edge cities are not present in Belgium, employment subcentres can be observed in large cities (Bontje and Burdack, 2005; Riguelle et al., 2007). Transport and infrastructure nodes such as motorway exits, airports, railway stations and seaports have attracted suburban employment. In the past, port terminals were located near city centres, and the first generation airports were established in proximity of urban cores. Especially ports lost their physical connection with cities. Jacobs et al. (2010, p.97) summarise the reasons as follows:

> '*Ports have become increasingly disconnected from cities. Spatially, the increased intensity of port-industrial activity, in combination with urban growth, lack of available land for further expansion, and environmental constraints have led to the move of port facilities away from city centres*'

Similarly, logistic facilities have suburbanised (Dablanc and Rakotonarivo, 2010) and 'airport cities' have emerged outside cities, and host hotels, congress facilities, offices of producer services, headquarters and logistic service providers (Appold and Kasarda, 2013).

This suburbanisation of jobs has caused side effects. First, it is argued that less dense and more polynucleated urban areas generate more traffic (Newman and Kenworthy, 1989); in the Netherlands for example, more polycentric daily urban systems are characterised by higher levels of car use and larger commuting distances (Schwanen et al., 2004). Second, there is the problem of what has been called 'spatial mismatch' (Gobillon et al., 2007; Jeekel, 2014; Taylor and Ong, 1995). The 'spatial mismatch' thesis suggests that the outmigration of jobs decreases access to jobs for residents of city centres, where low-skilled labour and minority groups are generally overrepresented. The case of gateways is relevant here, since many job opportunities for these groups can be found in ports (Hall et al., 2013) and airports (Dietz et al., 2013). Several authors emphasise that distance is only one of the reasons why job vacancies do not match with unemployed persons, and use the term 'transport mismatch' or 'modal mismatch' when a lack of public transport causes the mismatch, or 'skill mismatch' when the skills of the unemployed do not match with the required capabilities (Fan, 2012; Taylor and Ong, 1995). Such mismatches have negative effects for employees and job seekers, but also for employers since workplace accessibility might affect staff recruitment and retention. As a result, both employers and governments invest in measures to make commuting easier, and these measures are often part of an employer transport plan, which also aims to reduce the environmental footprint of the workplace (Roby, 2010; Rye, 1999a).

The present paper investigates how employers located in gateways invest in TDM measures and discusses the role of public policy. Section 2 introduces the case and Section 3 lists some examples of employer initiatives, examines why employers invest in particular measures, and estimates the potential effects of five types of TDM measures. Section 4 discusses the results , the implementation of TDM in gateways in general, and highlights some dilemmas. Finally, Section 5 concludes the paper.

2. Introducing the Case: Gateways in Belgium

Belgium is located in North-Western Europe in the economic core area characterised by high population densities, high levels of accessibility and a concentration of economic activity. From a port economic geography perspective, the seaports in the north of the country are part of the Hamburg-Le Havre range, the largest concentration of port activity in Europe (Notteboom, 2010). Regarding airports, Belgium is the location of several regional and one national airport, Brussels. Despite the location in the FLAP area dominated by the airports of Frankfurt, London, Amsterdam and Paris, Belgian airports are smaller than these major hubs (Kupfer and Lagneaux, 2009). This paper focuses on the largest gateways, Brussels Airport and the ports of Antwerp, Ghent and Bruges (Zeebrugge), which are depicted on the map in Figure 1.

Figure 1: Overview map

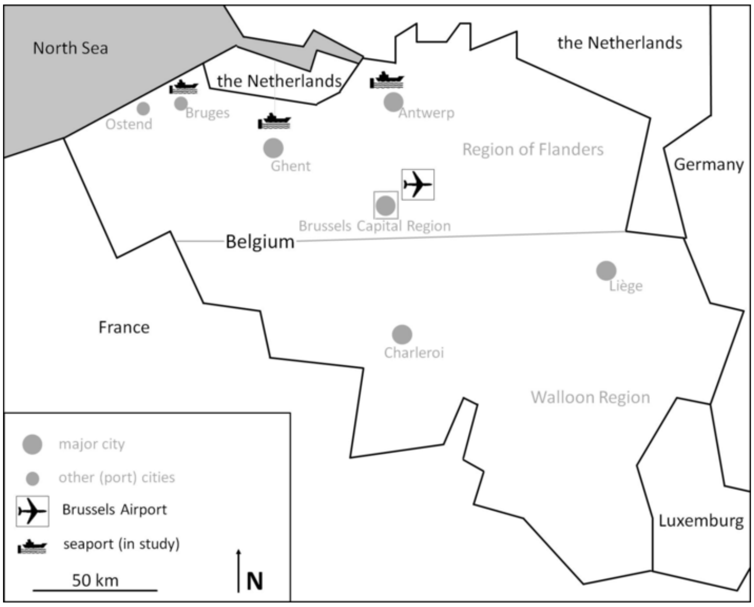

Table 1 shows descriptives of the cases and Belgium as a whole. Employment figures are based on data from the National Bank of Belgium (Mathys, 2013), while the data on transport used in this paper stems from a mandatory questionnaire for large employers in Belgium on travel behaviour, accessibility problems and TDM measures carried out in 2014. All employers with at least 100 employees should fill in the survey for each workplace with at least 30 employees. It is also mandatory to put the questionnaire on the agenda of the works council, and as a consequence, several actors are able to check the responses. Furthermore, the Federal Public Service Mobility and Transport did some quality checks (for more information on this survey, see Pauwels and Andries, 2016; Vanoutrive et al., 2010). Following subpopulations were selected: workplaces located in the port areas of (1) Antwerp, (2) Ghent and (3) Zeebrugge (Bruges), and (4) Brussels Airport. The port of Ostend is not selected since less than ten workplaces are present in the database. Data were collected at the workplace level and as a result, no sociodemographic data at the individual level were available.

Table 1: Descriptive statistics of the subpopulations (2014)

Variable	Antwerp port	Ghent port	Zeebrugge port	Brussels Airport	Belgium
FTE	60 010	26 638	9 943	17 618	4.6 mio
Subpopulation sizes					
# workplaces	89	55	20	37	8774
# employees	25 979	13 162	2475	12 074	1 504 586
Work schedules (% employees)					
Fixed	45.1	34.7	47.4	23.3	38.8
Flexible	18.4	20.7	17.4	12.7	28.4
Shift	34.5	41.9	21.1	32.9	15.3
Irregular	2.0	2.8	14.1	31.2	17.5
Commuting mode (% employees)					
Car (SOV)	68.1	73.9	77.8	83.6	65.5
Carpool	8.8	4.7	4.6	2.9	2.9
Rail	1.7	0.3	2.7	8.3	11.0
MTB	0.6	0.3	1.4	2.7	6.9
Employer tr.	12.6	3.7	1.3	0.0	0.8
Bicycle	6.3	14.4	8.5	1.5	9.4
Motorbike	1.8	2.5	3.4	1.0	1.2
Walk	0.1	0.2	0.3	0.1	2.3

Note: 'MTB' = metro, tram or bus; 'Employer tr.' = transport organised by the employer; 'SOV' = Single Occupant Vehicle; Source of FTE figures: ports: figures for 2011 in Mathys (2013); airport: figures for 2006 in Kupfer and Lagneaux (2009); Belgium: National accounts 2011.

Only large workplaces are included in the dataset and as a consequence, these numbers are not based on a representative sample of all employees that commute to a gateway. For instance, the port of Ghent is more manufacturing-oriented than Zeebrugge, and to a lesser extent Antwerp. Due to the larger size of manufacturing plants, the Ghent subpopulation is relatively larger than its share in total employment (see Table 1). Note that the National Bank of Belgium employs a somewhat different definition of port areas since a 'functional' criterion (NACE activity sector) is used besides the geographical criterion. However, the figures are representative for large workplaces due to the mandatory character of the transport survey.

Table 1 confirms that gateways are concentrations of employment and it reveals that many workers are employed on a shift system, and that at Brussels Airport more than 30% of the employees are on an irregular work schedule. Compared to Belgium as a whole, employees in gateways commute more often by car or in a carpool arrangement, while they make less use of public transport. In Antwerp and Ghent, bus services of employers attract a non-negligible share of the workforce, and the bicycle is less popular for commuting trips to gateways, except in the Ghent port area where the figure is close to the share of the bicycle in the northern part of the country (in the region of Flanders, see Figure 1, the share is 14.9%).

As mentioned in the introduction, the location of gateways outside city centres might cause accessibility-related problems, and Table 2 lists issues reported by employers located in Belgian gateways. A large number of workplaces located in a port have no public transport stop in the neighbourhood or are poorly served by public transport Interestingly, access by public transport at Brussels Airport, which is above average according to the first two variables in Table 2, does not match the expectations of employers and employees, as is indicated by the large share of employers that indicate that service does not match work hours. These findings support the idea that irregular work schedules and shifts reduce the potential of standard public transport. Compared to Belgium as a whole, employers in gateways more often indicate that dangerous traffic or congestion is a problem, with the exception of the port of Zeebrugge (Bruges), while a lack of parking space is not considered an issue in the gateways under study. Finally, a considerable group of employers face problems in recruiting staff due to the limited accessibility of their workplaces. These figures indicate that mechanisms identified in the spatial mismatch literature may be present in gateways.

Table 2: Share of employers that report an accessibility-related problem

Variable	Antwerp port	Ghent port	Zeebrugge port	Brussels airport	Belgium
No or insufficient PT service	75.3%	65.5%	45.0%	18.9%	27.3%
Large distance to PT stop	40.4%	40.0%	60.0%	8.1%	15.0%
PT not adapted to work hours	50.6%	49.1%	30.0%	43.2%	28.9%
Dangerous traffic (for cyclists)	66.3%	63.6%	50.0%	70.3%	37.7%
Congestion	59.6%	38.2%	20.0%	62.2%	27.2%
Lack of parking	3.4%	1.8%	5.0%	8.1%	25.0%
Recruiting problems	11.2%	7.3%	15.0%	8.1%	4.2%

PT = public transport

3. Initiatives that Increase Access to Gateways

As was described in the previous section, particular accessibility-related problems are present in gateways, and this can stimulate employers to implement specific TDM measures. This section starts with an overview of some characteristic examples of TDM in gateways (3.1). Subsequently, a quantitative analysis groups TDM measures on the basis of a factor analysis, and attempts to reveal which workplace characteristics are associated with these groups of measures (3.2). Finally, a regression model estimates the share of SOV and gives an indication of the effect of TDM (3.3).

3.1 A Qualitative Description of some TDM Initiatives in Gateways

This section lists some typical examples of initiatives intended to make commuting to gateways easier and greener. In Belgium, several initiatives encompass the organisation of a bus service to bring workers to gateways. For example, in the port of Zeebrugge (Bruges), a ‘port bus’ was launched in 2008 after a test phase. Small busses and vans transport employees from Bruges and surrounding municipalities to companies located in the port. The project is coordinated by the Development Agency of the province of Western Flanders and is supported by the port authority, the subregional platforms of Bruges and Ostend and a cooperation of temporary employment agencies. The main focus is on temporary employees since it is supposed that they have less access to cars. However, non-temporary employees can make use of the bus services as well. The project ended in 2012 but financial support is now offered by the development agency, one of the subregional platforms and the Flemish government (De Havenbus, 2015). The bus services are free to employees and their employers pay part of the cost. The former is a requirement to benefit from tax deductibility (120%).

Initiatives similar to the ‘port bus’ in Bruges were initiated by Max Mobiel (2015) in cooperation with some other partners. Also in these cases, vans are used to bring employees to remote locations, but this time in the port of Ghent and the ‘Waasland port’, i.e. that part of the port of Antwerp located on the left bank of the river Scheldt,. The largest project in financial terms (with a € 2.5 mio subsidy from the Flemish government) focuses however on the right bank of the Scheldt in Antwerp where six large petrochemical plants set up the ‘industry bus’, or ‘i-bus’. A central hub is built and bus services collect commuters at bus stops which are sometimes located up to 20km or more from the workplaces. In the past, companies ran their own bus service network, which is now rationalised through cooperation (i-bus, 2015). However, the largest employer in the Antwerp port area, BASF, has organised its own bus service since 1966 and did not join the i-bus consortium. During a typical day in 2008, this company had 25 busses for the day tour and 10 busses for employees engaged in shift work. It can be considered a success since 44% of the employees make use of this service. The cost is around € 2.5 mio a year (Gazet van Antwerpen, 2008).

Besides traditional busses, a pilot project has recently commenced to transport commuters using a ‘waterbus’. Such waterborne public transport is already operational in the port cities of Rotterdam and Hamburg, and when a similar project was announced by the Antwerp Port Authority in October 2015, it was argued that it offers a congestion-free service to employees. Users of the waterbus will be able to take their bike with them to bridge the last mile between the mooring place and their workplace (Antwerpen.be, 2015). Furthermore, the Antwerp Port Authority as well as other public agencies invest in bicycle paths in the port area and distributes a bicycle map (Port of Antwerp, 2015), and near Brussels Airport, a bicycle bridge is constructed over a major motorway. Nevertheless, in many parts of the gateways under study, cycling is considered dangerous (see e.g. Nieuwsblad, 2014; and Table 2).

Several of these and similar projects are subsidised through the ‘Commuting Fund’ of the Flemish government. Since 2007, the Flemish government subsidises mobility management initiatives of companies within the framework of the Commuting Plan. The Commuting Fund subsidises up to 50% of the costs of sustainable commuting measures. Approximately 30% of the budget is granted to projects with a direct focus on port areas (situation end 2012). Besides busses, the projects that are subsidised by the Commuting Fund invest in measures that promote carpooling and cycling. Note that the Commuting Fund is separate from the budget allocated to the official regional public transport provider De Lijn, whose bus services play only a marginal role in port areas. In contrast to the ‘Commuting Fund’ approach, the number of regular bus services to Brussels Airport was increased (including off-peak services), and this was part of a strategy to counterbalance job losses as a consequence of the bankruptcy of the Belgian national airline company and after a major employer (DHL) moved away (START, 2015). ,

Belgium is no exception. In several ports in other countries similar initiatives have been undertaken to bring workers to remote areas. In Amsterdam, 22 companies located in the port are connected via busses to the transit hub Sloterdijk. About 950 employees make use of this service consisting of 95 bus lines (Westpoortbus, 2015). In Rotterdam, the municipal government, Rotterdam Metropolitan Region, the Ministry of Transport and Port of Rotterdam Authority established ‘De Verkeersonderneming’ (‘the traffic enterprise’) in 2008. This institution coordinates a wide range of projects in order to guarantee the accessibility of the Rotterdam region, including the promotion of cycling, carpooling, bus transport and telework (De Verkeersonderneming, 2015). The port is the main focus of ‘De Verkeersonderneming’, especially during the road works on the A15. The initiative could built on the networks established in the framework of a broader project that was set up to develop an integrated vision on the A15 and its surroundings and which dealt with topics such as mobility, urban planning, economic development and the environment (Geerlings and Kuipers, 2013).

3.2 Quantitative Analysis: the Uptake of TDM measures

The database on commuting introduced in Section 2 provides, among other things, information on the TDM measures taken by employers, and a selection of 17 measures was examined further using factor analysis. Only measures with sufficient variation were retained (present at min. 10% and max. 90% of the workplaces). The results shown in Table 3 indicate that two factors (F2 and F6) represent bicycle-oriented measures, two other factors (F3 and F5) cover the promotion of public transport, while the two remaining factors represent, on the one hand, consultation with public agencies (F1), and on the other, the promotion of a carpool and employer-provided shuttles (F4).

Table 3: Results of factor analysis

	factor loadings							analysed
Variable	F1	F2	F3	F4	F5	F6	h²	further in
secured bicycle storage	0.25	**0.60**	0.02	-0.06	0.13	0.10	0.46	model A
covered bicycle storage	0.01	**0.59**	0.07	0.08	-0.18	0.25	0.46	model A
changing room for cyclists	-0.01	**0.78**	-0.20	0.11	0.58	-0.03	1.00	model A
showers	0.00	**0.96**	-0.14	0.21	0.08	-0.09	1.00	model A
cycling fee	0.14	0.12	-0.08	0.06	-0.19	**0.79**	0.71	model A
bike promotion campaign	0.40	0.38	0.20	0.09	0.20	**0.45**	0.60	model A
carpool database	0.15	0.08	0.11	**0.89**	-0.02	0.40	1.00	model B
providing information on carpooling	0.19	0.08	0.10	**0.87**	0.20	-0.06	0.85	model B
employer transport	0.28	0.12	0.01	**0.41**	0.00	-0.12	0.28	model C
free public transport	0.02	-0.18	**0.96**	0.13	0.13	0.11	1.00	model D
providing information on PT	0.26	-0.07	**0.67**	0.15	0.22	-0.25	0.66	model D
encouraging PT for work trips	0.14	0.10	**0.81**	-0.01	-0.10	0.02	0.69	model D
regular consultation with PT provider	0.31	0.20	0.26	0.20	**0.83**	-0.26	1.00	model E
collaboration with other employers or chamber of commerce	**0.64**	0.00	0.02	0.18	-0.01	0.09	0.45	model E
collaboration with regional government	**0.93**	0.11	0.27	0.02	0.04	0.22	1.00	model E
coll. with municipal government	**0.86**	0.20	0.08	0.27	0.20	-0.08	0.90	model E
employee transport coordinator	**0.57**	-0.02	0.28	0.40	0.25	0.16	0.65	model E

Note: software: package ‘psych’ in R (R Core Team, 2017, Revelle, 2017); results varimax rotated; all variables are binary, therefore the analysis is based on the polychoric correlations between variables; highest factor loading in bold and underlined; PT = Public Transport; h² = communality

On the basis of the factor analysis reported in Table 3, five sets of measures were selected to explore whether workplace characteristics are related to investments in particular measures. The first set includes pro-bicycle measures and was analysed using a standard regression model estimating the number of measures implemented at a workplace. For the other groups of measures, binary logistic regressions were chosen since more than half of the observations has a value of zero. Following independent variables were taken into consideration:

-the accessibility problems reported in Table 2, except lack of parking space since this is reported by a very limited number of workplaces;

-the size of the workplace, measured as the number of employees (logarithm);

-share of the workforce with flexible working hours, a fixed work schedule, or working on shifts;

-activity sector (NACE 2008 classification): manufacturing and similar sectors (NACE codes C, D and E; n=81), transport and storage (NACE code H; n=71), and other activities (n=49);

-the location of a workplace in a particular gateway, with the port of Antwerp as reference.

In each model, 15 different covariates were considered in a stepwise regression until all estimates were statistically significant at the 10% level. As Table 4 reveals, this resulted in a major reduction of the number of independent variables.

Table 4: Results of regression models: in what mobility measures do employers invest

variable	Model A	Model B	Model C	Model D	Model E
Dependent variable: (see Table 3)	number of bike measures	promotion of carpooling 0/1	employer transport 0/1	promotion of PT 0/1	collaboration 0/1
Intercept	2.81 (0.44)	-2.74 (0.93)	-4.30 (1.02)	-0.31 (0.32)	-2.89 (0.90)
Accessibility					
Insufficient PT service	-	-	-	-	-0.69 (0.37)
PT doesn't match work hours	-	-	-0.75 (0.39)	-	-
Dangerous traffic	0.47 (0.19)	-	-	-	1.00 (0.38)
Congestion	-	-	-	-	0.61 (0.35)
Workplace characteristics					
log(Size)	0.27 (0.09)	0.37 (0.18)	0.94 (0.22)	-	0.42 (0.16)
% Flexible work hours	-	-	-	-	0.016 (0.006)
NACE C/D/E	-	-	-0.77 (0.46)	-1.14 (0.41)	-
NACE H	-0.61 (0.19)	-2.25 (0.62)	-1.17 (0.52)	-0.98 (0.44)	-1.22 (0.39)
Location					
Brussels Airport	-	-	-2.64 (0.82)	2.45 (0.49)	-
Port Ghent	-	-	-0.78 (0.43)	-	-
Port Bruges	-	-	-	0.90 (0.51)	-1.32 (0.70)
Adjusted R²	0.13				
McFadden r²	-	0.13	0.20	0.17	0.19
Type of model	OLS	logit	logit	logit	logit
n	201	201	201	201	201

Note: software: R (R Core Team, 2017)

The analysis confirms that accessibility-related problems are not strong predictors of investments in TDM measures. The most remarkable finding is that workplaces that report ‘dangerous traffic’, also invest more in bicycle promotion. Dangerous traffic is also positively correlated with collaboration with governments and other employers, as is the case with congestion. The most consistent findings are that more measures are taken at large workplaces, while less commuting-oriented initiatives are taken in the activity sector ‘transport and storage’. When compared to port areas, employers at Brussels Airport invest less in own bus services, but more in the promotion of public transport.

3.3 Quantitative analysis: share of SOV

One of the main objectives of TDM measures and workplace transport plans is to reduce the share of SOV. A regression model was estimated to explore the potential impact of TDM measures on mode choice at workplaces in gateways in Belgium. The same variables as used in Section 3.2 were included in a stepwise regression, which also included the five types of TDM measures examined above in Section 3.2. Given our focus on the potential effects of TDM measures, these variables were not excluded from the model when they were not significant at the 10% level. Table 5 shows the results and it is interesting that all accessibility-related problems were not significant, and thus removed from the model. It is apparent from this table that, on average, the share of SOV is 8% higher in the activity sector ‘transport and storage’. While at Brussels Airport and in the port of Bruges the share of SOV is higher (see Table 1), the model results indicate that this higher level of SOV can be explained by the other variables in the model as the estimates indicate that SOV is, ceteris paribus, some 7% lower at these locations. Finally, the higher the share of employees that works on shifts, the lower the percentage of car users at a workplace.

Table 5: Results of regression model: share of SOV

variable	Estimate (standard error)
Intercept	82.29 (3.96)
Number of bike measures	1.61 (0.81)
Promotion of carpooling	-1.15 (2.73)
Employer transport	-12.21 (2.51)
Promotion of PT	-4.25 (2.48)
Collaboration	-0.67 (2.36)
NACE H	7.99 (2.48)
Brussels Airport	-7.28 (3.26)
Port Bruges	-6.44 (3.61)
% shift	-0.16 (0.04)
Dependent variable:	% SOV
Adjusted R^2	0.26
Type of model	OLS
n	201

Note: software: R (R Core Team, 2017)

The most interesting variables are the five types of TDM measures. The estimates for the promotion of carpooling and collaboration with governments and other employers were not significant at the 10% level. Although not significant at the 5% level, workplaces that promote public transport have on average 4% less SOV commuters. The most striking result is the effect of employer-provided bus services, which is associated with 12% less SOV. Finally, the number of bicycle measures is positively associated with car use, a finding which will be discussed below.

4. Discussion

We now turn to a discussion of some issues relevant for policy. We discuss both the environmental as well as the social dimension of commuting to gateways. Commuting trips to these areas are predominantly made by car. This car-dependency and the reported accessibility problems indicate that both spatial and modal mismatch may be present in gateways. As the modal split figures in Table 1 suggest, some other modes of transport offer an alternative to some degree. We discuss the particularities of each mode in the following subsections.

4.1 Bicycle

Workplaces in gateways are located relatively far from residential areas. As a consequence, it is unlikely that the bicycle will become the dominant mode of transport since commuting distance is a major determinant of bicycle use (Heinen et al., 2010). Bicycle facilities are more common in suburbanised workplaces due to the availability of land (Vanoutrive et al., 2009). How laudable the objectives may be, one should not expect that investments in bicycle sheds have large effects on bicycle use in gateways (see also Dickinson et al., 2003). Nevertheless, on the basis of the literature on social justice and transport (Martens, 2006), one could argue that it is unfair to deny cyclists some basic facilities. It is, besides walking, the most environmentally friendly mode of transport and is an option for a substantial number of commuters without access to a car. The increased popularity of electric bicycles and the use of the bicycle as egress mode further justify investments in bicycle infrastructure.

Dangerous traffic conditions regularly occur in and around gateways. The positive correlation between bicycle promoting measures and unsafety feels problematic. One potential explanation may be that employers who promote cycling are more aware of traffic conditions, which might be mediated by high levels of cycling in the workforce. Furthermore, road safety is mainly a task of government agencies (less of employers) and it is their responsibility to guarantee safe routes. Finally, the more cyclists there are, the lower the risk (Vandenbulcke et al., 2009).

4.2 Carpool

Carpooling is an alternative for locations where other alternatives to the car are not present. Another reason why ridesharing is popular among employees in the manufacturing sector is the large share of fixed work schedules, i.e. workers enter and leave the workplace at the same moment. However, from an environmental perspective, carpooling might be only slightly less polluting since it involves the use of a car, and picking up a passenger might require a detour (Morency, 2007; Rietveld et al., 1999). For these reasons, it is advisable to check whether carpooling is not overpromoted or oversubsidised (Vanoutrive et al., 2012; Wang, 2011). Although we do not expect that this is the case in our case study area, policy makers should not be blinded by the positive connotations of carpooling.

4.3 Bus services of employers

For several large employers, the organisation of own bus services has been seen as a necessity to attract and retain staff, and the results in Table 5 indicate that employer-provided bus services are associated with less car use. The investments and scale needed for this kind of initiatives limits the implementation to large manufacturing companies, and private bus services are present where public transport is absent. In these locations, the two main travel modes are the car and employer transport. In a case study of one company located in the port of Antwerp, Van Hees (2013) found no significant differences between blue-collar workers and other employees. Furthermore, neither age nor the type of work schedule were statistically significant. There was however a significant positive correlation between commuting distance and the probability that an employee chooses to travel by bus. Bus services of employers are thus a substitute for long distance commuting by public transport. A major difference with public services is the focus of private bus networks on suburb-to-gateway commutes. Research on employer-provided private shuttles in Silicon Valley suggests that it enables employees to live farther away from their workplace (Dai and Weinzimmer, 2014).

Private busses have some advantages. Delays can be seen as the responsibility of the employer, work schedules and bus timetables are likely to match and bus stops are located on the company plant location. However, public transport can be seen as a public service and one can argue that the public sector should be involved. Now, subsidies are rather ad hoc, besides the 120% tax deductibility for employers. The difference with residential areas is striking. The Flemish region, where the gateways under investigation are located, has a decree on 'basic mobility' which guarantee a bus stop within 500m in urban areas (650m in small cities) and 750m outside these areas. An equivalent for job concentrations outside cities is less developed. The suburbanisation of jobs is there, and it might be advisable to devise a strategy on the role of public transport in gateways (especially ports).

4.4 Rail

Passenger rail is not a real option for the majority of employees in gateways. However, in the port of Ghent plans were made to connect some large workplaces with a railway station using existing tracks, which are abundantly available in ports (Ververs, 2012). Passenger rail can be developed but there are some limitations. Passenger trains have priority over freight trains and the latter are considered essential for the functioning of a port. Although gateways are concentrations of jobs, densities are lower than in city centres (especially in Europe; Bontje and Burdack, 2005). However, rail has the advantage that it is well-placed to connect cities to gateways.

4.5 Location

One can question whether all (office) employees must be physically present in the port. For historical reasons, some workplaces located in port areas have little to do with port activities. A proper location policy can keep the number of ‘wrongly’ located activities minimal. Further research can shed light on these issues.

7. Conclusion

Gateways such as seaports and airports offer many job opportunities. However, a mismatch might be present between the location of labour and the location of job. Although employer organisations see in the first place a skills mismatch (Sertyn, 2013), transport may play a decisive role. Furthermore, the majority of commuting trips to gateways is made using the more polluting modes of transport. This paper analyses measures which are taken by employers to change employee commuting behaviour. It seems that the public transport vacuum is filled by carpooling and private bus services, which may perform less well in terms of emissions and public service provision.

Passenger mobility towards gateways has received considerable attention from employers and governments. The style and content of the mobility strategies corresponds to those of other mobility management strategies by their focus on soft measures (Cairns et al., 2008; Vanoutrive et al., 2010). Carrots are preferred over sticks and include carpool databases, bicycle sheds, promotion campaigns and the like. ‘Hard’ infrastructural measures, although present, and restrictive measures on car use (paid parking, taxation) are less prominent.

References

Antwerpen.be (2015) 'https://www.antwerpen.be/nl/info/564eec85b0a8a7dc6c8b4577/volgend-jaar-waterbussen-op-de-schelde access date 14/12/2015'.

Appold, S.J., Kasarda, J.D. (2013) 'The Airport City Phenomenon: Evidence from Large US Airports', *Urban Studies*, 50(6), pp. 1239-1259

Bontje, M., Burdack, J. (2005) 'Edge Cities, European-style: Examples from Paris and the Randstad', *Cities*, 22(4), pp. 317-330

Cairns, S., Newson, C., Davis, A. (2010) 'Understanding successful workplace travel initiatives in the UK', *Transportation Research Part A-Policy and Practice*, 44(7), pp. 473-494

Cairns, S., Sloman, L., Newson, C., Anable, J., Kirkbride, A., Goodwin, P. (2008) 'Smarter choices: Assessing the potential to achieve traffic reduction using 'soft measures'', *Transport Reviews*, 28(5), pp. 593-618

Dablanc, L., Rakotonarivo, D. (2010) 'The impacts of logistics sprawl: How does the location of parcel transport terminals affect the energy efficiency of goods' movements in Paris and what can we do about it?', *Procedia Social and Behavioral Sciences - The Sixth International Conference on City Logistics*, 2(pp. 6087-6096

Dai, D., Weinzimmer, D. (2014) 'Riding First Class: Impacts of Silicon Valley Shuttles on Commute & Residential Location Choice', Paper presented at the WSTLUR Conference 24-27/6/2014, Delft, The Netherlands.

De Havenbus (2015) 'http://www.dehavenbus.be/; access date 14/12/2015'.

De Verkeersonderneming (2015) 'http://www.verkeersonderneming.nl/home access date 14/12/2015'.

DeHart-Davis, L., Guensler, R. (2005) 'Employers as Mediating Institutions for Public Policy: The Case of Commute Options Programs', *Policy Studies Journal*, 33(pp. 675-697

Dickinson, J.E., Kingham, S., Copsey, S., Hougie, D.J.P. (2003) 'Employer travel plans, cycling and gender: will travel plan measures improve the outlook for cycling to work in the UK?', *Transportation Research Part D: Transport and Environment*, 8(1), pp. 53-67

Dietz, M., Hall, P., Jacobs, K. (2013) *Course Correction: Reversing Wage Erosion to Restore Good Jobs at American Airports*. UC Berkeley Center for Labor Research and Education, Berkeley.

Ding, C., Liu, C., Lin, Y., Wang, Y. (2014) 'The impact of employer attitude to green commuting plans on reducing car driving: a mixed method analysis', *Promet - Traffic&Transportation*, 26(2), pp. 109-119

Enoch, M. (2012) *Sustainable Transport, Mobility Management and Travel Plans*. Ashgate, Farnham, Surrey.

Fan, Y.L. (2012) 'The Planners' War against Spatial Mismatch: Lessons Learned and Ways Forward', *J Plan Lit*, 27(2), pp. 153-169

Gazet van Antwerpen (2008) 'http://www.vlaanderen-in-actie.be/nlapps/data/docattachments/GvA_dossier_logmob.pdf Access date 1/12/2010'.

Geerlings, H., Kuipers, B. (2013) 'Smart governance and the management of sustainable mobility: an illustration of the application of policy integration and transition management in the Port of Rotterdam', in Vanoutrive, T., Verhetsel, A. (eds) *Nectar Ser Transp*, Edward Elgar, Cheltenham, UK.

Giuliano, G., Hwang, K., Wachs, M. (1993) 'Employee trip reduction in Southern California: First year results', *Transportation Research Part A: Policy and Practice*, 27(2), pp. 125-137

Gobillon, L., Selod, H., Zenou, Y. (2007) 'The mechanisms of spatial mismatch', *Urban Studies*, 44(12), pp. 2401-2427

Hall, P., Farahani, A., Johnston, K., Ming-Yeak, C. (2013) *Pathways to Immigrant Employment in the Port-Logistics Sector*. Metropolis British Columbia Centre of Excellence for Research on Immigration and Diversity Working Paper Series, Vancouver.

Heinen, E., van Wee, B., Maat, K. (2010) 'Commuting by Bicycle: An Overview of the Literature', *Transport Reviews*, 30(1), pp. 59-96

i-bus (2015) 'http://www.i-bus.be/ access date 14/12/2015'.

Jacobs, W., Ducruet, C., De Langen, P. (2010) 'Integrating world cities into production networks: the case of port cities', *Global Networks-A Journal of Transnational Affairs*, 10(1), pp. 92-113

Jeekel, H. (2014) 'Social exclusion, vulnerable groups and driving forces: Towards a social research based policy on car mobility', *Case Studies on Transport Policy*, 2(2), pp. 96-106

Kupfer, F., Lagneaux, F. (2009) 'Economic Importance of Air Transport and Airport Activities in Belgium', National Bank of Belgium, Brussels.

Martens, K. (2006) 'Basing Transport Planning on Principles of Social Justice', *Berkeley Planning Journal*, 19(1), pp. 1-17

Mathys, C. (2013) 'Economic Importance of the Belgian Ports: Flemish maritime ports, Liège port complex and the port of Brussels – Report 2011', *National Bank of Belgium Working Papers*, National Bank of Belgium Working Paper n° 242, Brussels.

Max Mobiel (2015) 'http://www.max-mobiel.be/ access date 14/12/2015'.

Meyer, M.D. (1999) 'Demand management as an element of transportation policy: using carrots and sticks to influence travel behavior', *Transportation Research Part A-Policy and Practice*, 33(7-8), pp. 575-599

Ministerie Vlaamse Gemeenschap (1998) *Ruimtelijk Structuurplan Vlaanderen (Spatial structure plan for Flanders)*. Ministerie Vlaamse Gemeenschap, Brussels.

Morency, C. (2007) 'The ambivalence of ridesharing', *Transportation*, 34(2), pp. 239-253

Moser, G., Bamberg, S. (2008) 'The effectiveness of soft transport policy measures: A critical assessment and meta-analysis of empirical evidence', *Journal of Environmental Psychology*, 28(1), pp. 10-26

Newman, P.W.G., Kenworthy, J.R. (1989) 'Gasoline Consumption and Cities: A Comparison of U.S. Cities with a Global Survey', *Journal of the American Planning Association*, 55(1), pp. 24-37

Nieuwsblad (2014) 'http://www.nieuwsblad.be/sportwereld/cnt/dmf20140219_00989114 access date 14/12/2015'.

Notteboom, T.E. (2010) 'Concentration and the formation of multi-port gateway regions in the European container port system: an update', *Journal of Transport Geography*, 18(4), pp. 567-583

Pauwels, C., Andries, P. (2016) *Diagnostic des déplacements domicile - lieu de travail 2014*. Federal Public Service Mobility and Transport, Brussels.

Port of Antwerp (2015) 'http://www.portofantwerp.com/en/cycling-port access date 14/12/2015'.

Potter, S., Enoch, M., Rye, T., Black, C., Ubbels, B. (2006) 'Tax treatment of employer commuting support: An international review', *Transport Reviews*, 26(2), pp. 221-237

R Core Team (2017) *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/

Revelle, W. (2017) psych: Procedures for Personality and Psychological Research, Northwestern University, Evanston, Illinois, USA, https://CRAN.R-project.org/package=psych Version = 1.7.5.

Rietveld, P., Zwart, B., van Wee, B., van den Hoorn, T. (1999) 'On the relationship between travel time and travel distance of commuters - Reported versus network travel data in the Netherlands', *Annals of Regional Science*, 33(3), pp. 269-287

Riguelle, F., Thomas, I., Verhetsel, A. (2007) 'Measuring urban polycentrism: a European case study and its implications', *Journal of Economic Geography*, 7(2), pp. 193-215

Roby, H. (2010) 'Workplace travel plans: past, present and future', *Journal of Transport Geography*, 18(pp. 23-30

RV (2017) *White Paper Spatial Policy Plan*. Ruimte Vlaanderen, Brussels.

Rye, T. (1999a) 'Employer attitudes to employer transport plans: a comparison of UK and Dutch experience', *Transport Policy*, 6(3), pp. 183-196

Rye, T. (1999b) 'Employer transport plans - a case for regulation?', *Transport Reviews*, 19(1), pp. 13-31

Rye, T. (2002) 'Travel plans: do they work?', *Transport Policy*, 9(4), pp. 287-298

Schwanen, T., Dieleman, F.M., Dijst, M. (2004) 'The Impact of Metropolitan Structure on Commute Behavior in the Netherlands: A Multilevel Approach', *Growth and Change*, 35(3), pp. 304-333

Sertyn, P. (2013) 'Haven symbool van mismatch op arbeidsmarkt', *De Standaard*, 3/10/2013(pp. 26

START (2015) 'http://docu.vlaamserand.be/ned/webpage.asp?WebpageId=722 access date 14/12/2015'.

Taylor, B.D., Ong, P.M. (1995) 'Spatial Mismatch or Automobile Mismatch - an Examination of Race, Residence and Commuting in Us Metropolitan-Areas', *Urban Studies*, 32(9), pp. 1453-1473

Van Hees, L. (2013) 'Woon-werkverkeer in de Haven van Antwerpen', *Department of Transport and Regional Economics*, University of Antwerp, Antwerp.

Van Malderen, L., Jourquin, B., Thomas, I., Vanoutrive, T., Verhetsel, A., Witlox, F. (2012) 'On the mobility policies of companies: What are the good practices? The Belgian case', *Transport Policy*, 21(pp. 10-19

Vandenbulcke, G., Thomas, I., de Geus, B., Degraeuwe, B., Torfs, R., Meeusen, R., Panis, L.I. (2009) 'Mapping bicycle use and the risk of accidents for commuters who cycle to work in Belgium', *Transport Policy*, 16(2), pp. 77-87

Vanoutrive, T. (2014) 'Workplace Travel Plans: Can they be evaluated effectively by experts?', *Transportation Planning and Technology*, 37(8), pp. 757-774

Vanoutrive, T., Van De Vijver, E., Van Malderen, L., Jourquin, B., Thomas, I., Verhetsel, A., Witlox, F. (2012) 'What determines carpooling to workplaces in Belgium: location, organisation, or promotion?', *Journal of Transport Geography*, 22(pp. 77-86

Vanoutrive, T., Van Malderen, L., Jourquin, B., Thomas, I., Verhetsel, A., Witlox, F. (2009) ''Let the business cycle!' A spatial multilevel analysis of cycling to work', *Belgeo*, 2009(2), pp. 217-232

Vanoutrive, T., Van Malderen, L., Jourquin, B., Thomas, I., Verhetsel, A., Witlox, F. (2010) 'Mobility Management Measures by Employers: Overview and Exploratory Analysis for Belgium', *European Journal of Transport and Infrastructure Research*, 10(2), pp. 121-141

Ververs, D. (2012) 'Passagierstrein Gent-Zelzate kan zeker rendabel zijn', *Het Nieuwsblad 20 april 2012*.

Vonk Noordegraaf, D.M., Annema, J.A. (2012) 'Employer Attitudes towards Peak Hour Avoidance', *European Journal of Transport and Infrastructure Research*, 12(4), pp. 373-390

Wang, R. (2011) 'Shaping carpool policies under rapid motorization: the case of Chinese cities', *Transport Policy*, 18(4), pp. 631-635

Westpoortbus (2015) 'http://www.wbus.nl/ access date 14/12/2015'.