SCHOOL TRAVEL BEHAVIOUR EXPLAINED; A COMPARATIVE STUDY OF THE NETHERLANDS AND FLANDERS

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ABSTRACT

School travel is highly neglected in transport science. It contributes little to today's most envisaged transport problems but it generates its own problems. The paper presents results of a study on travel behaviour of pupils travelling to primary and secondary schools. The study focuses on two aspects: home-to-school distances and modal choice. Analyses are performed for two countries, the Netherlands and Flanders. Educational policies and geographic conditions are similar in both countries. Differences in findings might be the result of differences in socio-cultural factors. Descriptive analyses demonstrate significant differences in distance distributions and modal splits in the two countries. In Flanders, distances to primary schools are on average considerably larger than in the Netherlands. Distances to secondary schools are more similar. The bicycle is the dominant mode for Dutch pupils at both shorter and longer distances (<5 km and >5 km). Flemish pupils use the bicycle predominantly at shorter distances. They are travelling larger distances more frequently by car, even to secondary schools, and they are more inclined to use public transport. Analyses of influencing variables for both home-to-school distance and modal choice prove that these are mainly explained by 'hard' factors, like locations of home and school for distances and quality of the transport modes for modal choice. However, other factors play a role as well. Their role appears to be larger for the Flemish than for the Dutch. Gender in particular is a significant variable for explaining modal choice of the Flemish. Boys are more inclined to use the bicycle than girls, while the latter more frequently use public transport. Additionally, household income has a substantial influence on modal choice of the Flemish pupils, unlike for the Dutch. Increasing income enlarges the probability of car use.

Keywords: school, home-to-school distance, modal choice, international comparison

INTRODUCTION

School travel is highly neglected in transport science. The reason might be that it contributes little to the most envisaged transport problems: car congestion and air pollution. The share of school travel is modest while usage of the car is low. Still, there are reasons why school travel should have a more prominent position in transport research. First, pupils are in the teaching phase of their lives and travelling to school can contribute to the growth to maturity, especially training to travel independently. Second, school travel generates its own problems, threatening independency. One of those relates to traffic safety: younger pupils are playful and sometimes do not have an eye for the dangers of traffic. This problem is aggravated by car congestion at school locations caused by parents who take their children by car to school and back to home. Traffic safety is the most frequently studied topic in the field of school travelling (see for instance Transportation Research Board, 2002; Jensen and Hummer, 2002).

Actual school travel is the result of school choice and choices at trip level, in particular modal choice. A school can only be chosen if school choice is free. In some countries pupils are obliged to visit the nearest school of a certain denomination. In other countries choice of the non nearest school is allowed but implies suspending subsidy for travel costs. In that case school 'choice' is mainly determined by distance (Gorard, 1999; Whittey, 2005). Studies in the Netherlands, where the 'freedom of education' principle is anchored in the national constitution, prove that most important variables for primary school choice are accessibility (in particular by foot), quality of the school, and religious orientation (Herweijer and Vogels, 2004; de Boer and Blijie, 2006). De Boer and Blijie found that two accessibility aspects play a significant role: distance and number of traffic barriers on the route. The assessment of the different variables is dependent on income.

A Dutch study on modal choice of pupils travelling to secondary schools more than 5 km from home demonstrates that home-to-school distance is also the most influential variable for this choice (de Boer et al, 1992). Second in importance is season. When the temperature is pleasant the willingness to cycle long distances to school is substantially larger than in cold seasons.

Where different degrees of freedom in different countries lead to differences in school choice, statistics demonstrate that modal choice in school travelling varies widely among countries as well (De Boer en van Goeverden, 2007). For instance, the bicycle is the most important mode for travelling to school by Dutch pupils while British pupils hardly use the bicycle. Differences can be explained by different travel conditions like the presence of dedicated bicycle infrastructure, flatness of the route, and provision of special school bus transport. However, socio-cultural factors may play a role as well.

The intention of this paper is to increase the understanding in school choice and modal choice, both for primary and secondary education. Our interest is the influence of household, person and trip characteristics as well as cultural factors on both choices. The cultural influence is assessed by performing the analysis for two countries that have comparable

general conditions for making the choices. Possible differences in findings might then be due to socio-cultural factors. The two countries are the Netherlands and Flanders. The latter is not a full country, being the Dutch speaking community of Belgium, but it has a kind of national identity. The countries have a similar freedom in school choice and a competitive school system with religious and non religious schools. Population and school densities are similar; the surface is mainly flat in both countries; provision of school transport is comparable; and both countries have a cycling culture (de Boer, 2010). Supply of public transport is comparable as well. In both countries regular hourly or more frequent bus and rail services are provided in daytime, where the buses serve nearly all larger settlements (over 1000 inhabitants). Still, de Boer (2010) points out that there are some differences in the general conditions as well. The urbanization is more scattered in Flanders than in the Netherlands; this might affect distances to eligible schools. Additionally, the Netherlands have more and better dedicated bicycle infrastructure than Flanders; this might affect modal choice. Apart from that, the cultural differences between the two countries are relatively small but still existent. In spite of the noticed differences in general conditions and the relatively similarity of the national cultures, the analyses might both contribute to general knowledge about school travelling and give understanding about the influence of socio-cultural differences between countries.

The analyses are based on data from the national travel surveys of the two countries. These databases provide most of the demanded data. However, they do not allow for analyzing school choice directly. Choice of a certain school is dependent on supply factors (school locations and quality of the transport system) and demand factors (type of eligible schools, preferences regarding educational quality, and preferences regarding spending time and money on travelling). In this paper, our interest is mainly the influence of preferences regarding educational quality on school choice. However, we have no complete data about school locations and school qualities, and, if we had this information, this would not be sufficient because the survey data give no evidence about which schools are eligible for the individual respondents. The only variable that gives an idea about eligibility of schools is age. This variable is a rough indication for participation in primary versus secondary education. However, within the category of primary schools, we do not know whether parents exclude certain schools from the choice set, for instance because these have the wrong denomination. And, within the category of secondary schools, we do not know which type of secondary school is relevant for a responding pupil.

Though the data may give not all necessary information about the input factors for school choice, they give one important output factor: the distance between home and school. This distance depends on the preferences regarding educational quality and travelling, among other factors. On individual level the other factors, in particular which schools are eligible and where are they located, have an important influence as well. But, for a large group, the values of the other factors will tend towards an average. Variables that affect school selectivity will then be related to the home-to-school distance. In this paper, we analyse home-to-school distances in order to find explanatory variables for school choice. The analysis does not explain whether a variable influences distance by affecting preferences for educational quality or by affecting the resistance of distance (or both). The kind of influence

may be derived from the character of a variable. Education level of the pupils' parents, for instance, might influence home-to-school distances by affecting preferences for school quality, while car ownership is more likely to influence distances by affecting the resistance of distance.

The analyses are performed separately for the two study areas and for primary and secondary education. Next section describes the data sources and the way they are used for the analyses. The subsequent sections discuss home-to-school distances and modal splits in both countries. The discussion includes both a descriptive analysis of both quantities and an assessment of the influence of explanatory variables. Some conclusions are drawn in the final section.

DATA USED FOR THE ANALYSIS

The analyses are based on data from the Dutch and Flemish national travel surveys, the Dutch 'Mobiliteitsonderzoek Nederland' (MON) and the Flemish 'Onderzoek Verplaatsingsgedrag' (OVG). All Dutch MON-databases (years 2004-2007) and Flemish OVG-databases (1994 and 2000) that were available at the time of the analysis are explored. Both surveys are on household level: a sample of households is selected and the members of the households are asked about their trips in a predefined period. This period is one day in the Dutch MON survey and two days in the Flemish OVG survey. In addition to trip data, data about the persons and households are recorded. There is a few years difference between the surveyed periods in both countries. Findings of differences between the countries might partly be the result of the time difference. We do not expect that this is a real problem because the driving forces behind travel behaviour are likely to be rather stable in time. These forces are connected to cultural and environmental factors that usually are constant or change slowly in time. A high stability is suggested as well by findings on Travel Time Budget (see for instance Schafer, 1998) and by the development of the modal split of a certain group in time. For instance, the observed modal split of the Dutch is highly stable in the whole period of the Dutch NTS, starting at 1978, and does not show a trend in the market share of any mode (own data analysis and statistics provided at www.cbs.nl).

The Flemish analyses are at first based on the 2000 data. However, because the samples of the Flemish OVG-surveys are relatively small (the 1994 and 2000 surveys together include 22,350 persons as against 236,300 persons in the 4 Dutch MON-surveys), we partly use also the 1994 data, despite the fact that these are rather dated. The latter will only be used if a misrepresentation of current reality due to major changes between 1994 and 2000 is not likely. For the separate analyses described in the next sections, we will indicate and motivate whether we use the 1994 data or not.

The Flemish OVG-database of 2000 is an accumulation of data of a Flemish survey and data of a survey in the city of Gent region. Both surveys have roughly the same sample size. For the reason of small Flemish samples we decided to use both the Flemish and the Gent data. The much higher sample density in the urbanized Gent region will basically not lead to biased results in our analyses. In the descriptive analyses of the next section differences in

sample densities are corrected by the projection factors. In the analyses of the influences of variables (the subsequent section) that are based on unweighed observations, differences in sample sizes may not produce systematically wrong results though sample densities will affect the accuracy of results.

The Flemish OVG records home-to-school distances and mode use on both person and trip levels. In the person survey, children visiting school are asked about the distance to school and the mode they generally use for travelling to school. The trip survey registers actually travelled distances and modes used by pupils who travel to school on one of the enquiry days. We will use for the separate analyses always only one of the two sources and will indicate and motivate which source we use. A general argument for using the data on person level is a larger sample. All pupils that filled in these data in the enquiry are included, whereas the trip-based data includes only the pupils that travel to school on one of the two enquiry days. The latter make up only 60-65% of the former. A general argument for using data on trip level is comparability with the Dutch MON that provides only distance and modal information at trip level.

When data on trip level are used for the analyses, only the first observed home-to-school or school-to-home trip of each pupil in the survey is selected. All other registered trips between home and school are skipped. Therefore, the analyses are on personal level though they are based on trip data. Figures on trip level that would be based on all trips between home and school would show a relatively higher frequency of shorter distances and modes particularly used for these distances. The reason is that pupils are inclined to travel more frequently between home and school when distances become shorter, especially for having lunch at home.

A distinction will be made between primary and secondary education, because travel behaviour is likely to be different. However, information about the kind of education enjoyed by the pupils is lacking in the surveys. As a proxy for the distinction between primary and secondary school, a distinction will be made between age classes. Pupils from 6 to11 years old are assumed to visit primary schools and those from 12 to 17 years old are assumed to visit secondary schools.

SCHOOL TRAVEL CHARACTERISTICS IN THE NETHERLANDS AND FLANDERS

This section gives some descriptive figures regarding actual distances travelled to school and modal split in school travel. These give information about actual travel behaviour and may be helpful for interpretation of the results of the analysis of the influence of explanatory variables in a later section. The figures in this section show travel behaviour in one period of time, being the most recent period that can be represented with the MON- and OVG-data. The developments in time are in principle no subject of this paper. Information about these can be found in De Boer en van Goeverden (2008). This section deals consecutively with distances and modal splits in school travel.

Home-to-school distances

Primary schools are widely spread and they are present in many smaller settlements. Therefore, home-to-school distances in primary education might be expected to be generally short, less than 5 km. Yet some pupils in the age of 6-11 may be faced with (substantially) larger distances, particularly when they visit special schools or when they opt for either education of a specific denomination (like Roman Catholic) or of a distinct approach like Montessori. Secondary education is generally provided only in the regional or higher centres. Distances to secondary schools are likely to be significantly larger than those to primary schools.

These expectations are confirmed by the Figures 1 and 2, showing the frequency distributions of home-to-school distances for Dutch and Flemish pupils. Figure 1 relates to pupils under 12 years old, Figure 2 to the older pupils. The Flemish figures are based on the person enquiry of the OVG 2000. The curves of the person-based data are very close to the curves of the trip-based data; however, the former are smoother, probably due to the larger number of observations. The 1994 data are not used, because these produce quite different curves; the curve for those under 12 years old shifted considerably to the right since 1994, the curve for the older pupils shifted somewhat to the left.

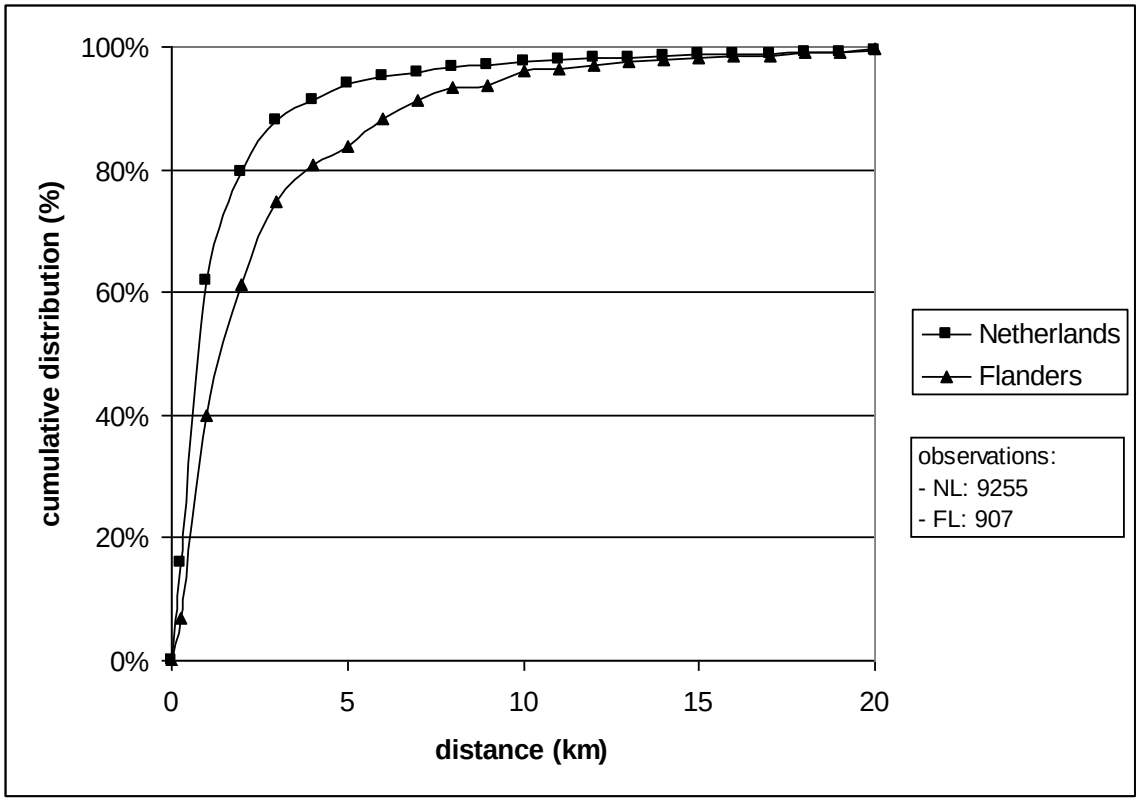

Figure 1 – Home-to-school distances for pupils 6-11 years old

The distributions of travel distances for the young pupils differ substantially between the Netherlands and Flanders. Flemish pupils travel longer distances, on average 1.5 times longer then the Dutch (3.0 versus 2.0 km). Possible explanations for this difference are differences in the distances to be travelled to the nearest school and differences in the

selectiveness of parents in choosing a school for their children. Larger distances to the nearest school in Flanders are probable because of the more scattered urbanization.

The two distance curves to secondary schools are similar (Figure 2). Dutch pupils travel slightly more frequently on short distances (<10 km) and also more frequently on large distances (>15 km). The average distances are comparable (7.1 and 7.3 km for the Dutch and Flemish respectively). The differences in land use mentioned before might explain the observed differences in the shorter distances. Possibly, the small differences in the longer distances can be explained by a small difference in the density of school locations, corresponding to slightly different population densities. The population density is a bit lower in the Netherlands than in Flanders. The question whether also school densities are lower can not be answered because of lack of data.

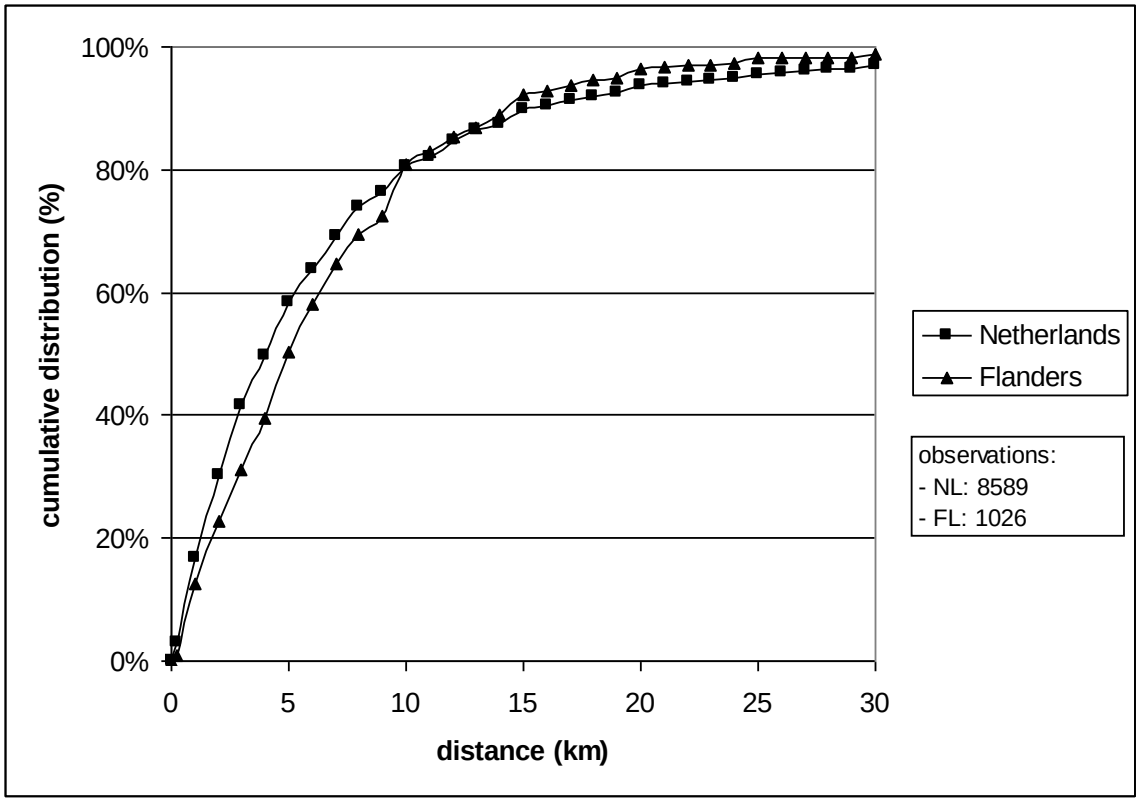

Figure 2 – Home-to-school distances for pupils 12-17 years old

Modal split

The discussion of modal use of pupils is important. Children should preferably travel independently to school and use slow transport modes, walking or cycling. Independent travelling contributes to the growth to maturity; using slow modes will train them to practice moving in traffic.

Modal choice is dependent on the relative quality of the available travel modes. The relative quality is strongly related to distance. Walking is only a feasible mode for short distance trips

while public transport is only an option on longer distances. Therefore, the modal split figures are presented for two distance classes: <= 5 km and > 5 km.

The Flemish figures are based on trip data of both the 1994 and 2000 surveys. The choices for data on trip level and for including the 1994 data are based on next findings:

- The classification of travel modes is less detailed in the person survey than in the trip survey. For instance, in the 1994 person survey the moped is not distinguished as a separate mode while a category 'other' is lacking. Pupils usually travelling by moped presumably will have filled in 'bicycle', being the most resembling mode.
- In 1994, the modal split calculated from the person data is similar to the modal split calculated from the trip data.
- In 2000, both modal splits are similar for persons under 12 but deviating considerably for the older pupils. The trip-based data exhibit a much higher share of the car at the expense of the shares of the slow modes.
- Comparing 1994 and 2000, two major changes seem to have occurred. Both the person- and the trip-based data show a considerable decrease in walking shares on distances <= 5 km. The second change regards the share of pupils 12-17 years old carried to school by car. Results are now confusing. Using the person-based data, car share decreased between 1994 and 2000 by 16% and 25% for distances <= 5 km and > 5 km respectively, while according to the trip-based data car share remained stable on the shorter distances and increased by 20% on distances > 5 km.

We decided to use trip-based data because of a) the more detailed registration of modes, and b) the feeling that in a society with increasing car ownership the increase in car use reported by the trip-based data is a better representation of reality than the decrease reported by the person-based data. The reason for including the 1994 data is the feeling that then reality in 2000 regarding car use is better represented. The 1994 results are between the two deviant 2000 results and could be closer to the actual 2000 situation than each of the 2000 figures. However, using the 1994 data has the disadvantage of overestimating walking shares in 2000. These shares are overestimated by 30-40 % for the young pupils and by 15-20 % for the older pupils.

The modal splits are displayed by Figure 3. Public transport (PT) in the figure includes special school buses. The observation numbers are large (thousands for the Dutch and hundreds for the Flemish) except for the relatively small group of pupils aged 6-11 travelling > 5 km. Figures for this group are based on 742 and 108 observations for the Dutch and Flemish respectively.

The figure shows large differences in modal splits. Dutch pupils are more inclined to travel by bike, where Flemish pupils more frequently are carried by car and use public transport. The differences are more pronounced for the larger distances. The high share of the 'other' mode for Dutch pupils 6-11 travelling > 5 km is mainly due to an extensive use of the taxi. Most of them travel presumably to special schools. Remarkable results are that, in contrast to the Netherlands, in Flanders a) hardly any pupil younger than 12 will use the bicycle for distances > 5 km, and b) it is still rather common to carry pupils older than 11 to school by

car. The general impression is that Dutch pupils travel more independently to school than Flemish pupils.

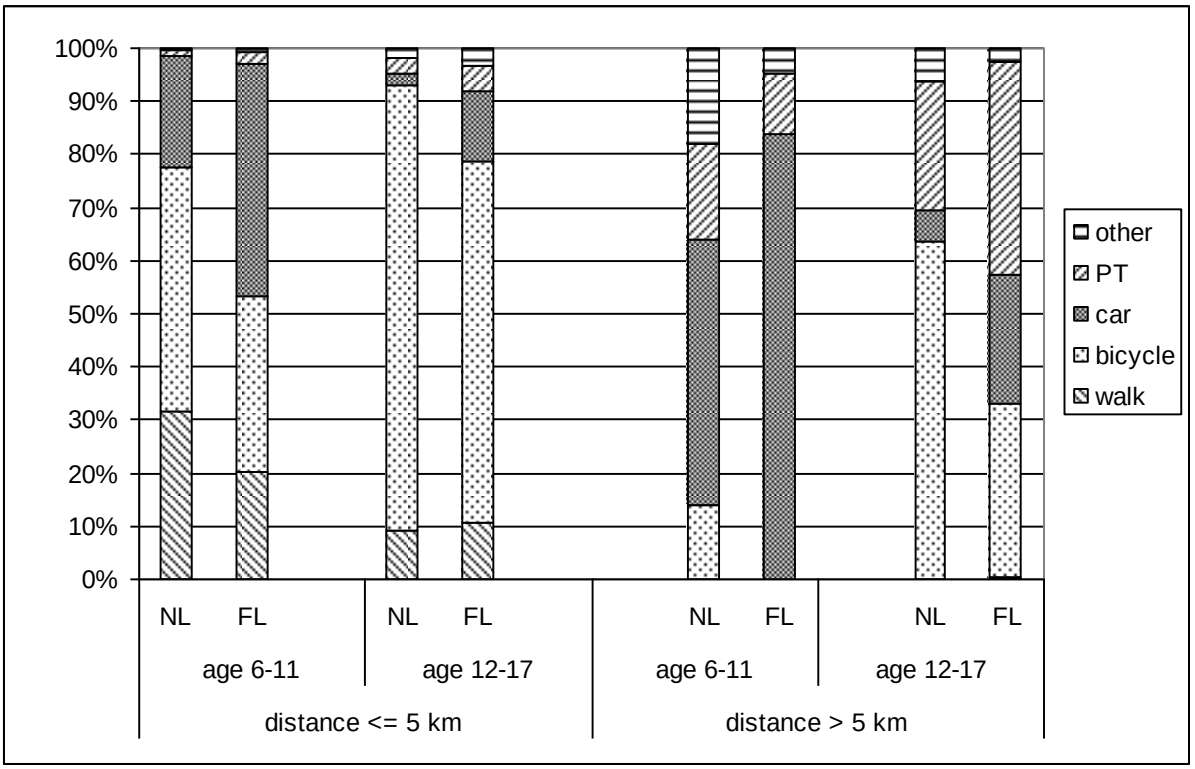

Figure 3 – Modal choice in home-to-school trips in the Netherlands (NL) and Flanders (FL)

ANALYSIS OF INFLUENCING VARIABLES

This section explores which variables explain significantly the home school-to-distance and the modal choice in travelling to school. The analysis should clarify to which extent choices are determined by hard factors like the locations of schools for explaining distance and the availability and quality of travel modes for explaining modal choice, and to which extent socio-economic factors play a role. By comparing two countries with their own cultural traditions, the influence of culture can be assessed as well.

The analysis is based on trip data in the surveys of both the Netherlands and Flanders. Using the Flemish person-based data would exclude the possibility to assess the influence of trip-related variables. For Flanders, both the 1994 and 2000 data are used. We assume that the disadvantage of old data is small in this kind of analyses because the driving forces behind travel behaviour are constant in time or changing only slowly as we stated before.

Factors affecting home-to-school distances

The distance a pupil has to cover is the result of a number of factors. One important factor is the distance to the nearest eligible school(s), given type of education, preferences regarding religious denomination, etc. This distance varies widely for individual pupils and its influence

can not be assessed directly because the data give no information about which schools are eligible for the responding pupils. However, an indirect assessment is possible, using data about variables that partly explain the distance to the nearest school(s). These are:

- population density. Distances may be larger when pupils are living and receiving education in less densely populated areas. This is because the distances to the nearest schools will on average be larger.
- age of the pupil. Older pupils will have to travel larger distances because of the lower density of secondary school types.
- gender. Boys enjoy special education to a much higher extent than girls; the ratio is about 2:1 for Flanders and 2.5:1 for the Netherlands (van Goeverden and de Boer, 2009). Because the density of special education facilities is very low compared to the normal school density (especially in primary education), boys will on average have to travel larger distances.

These variables can be considered as hard variables. They determine partly the 'choice-set' of distances.

In addition, one can hypothesize that next variables may affect home-to-school distances at given choice sets, by affecting either selectiveness in school choice or the influence of distance:

- education level of the parents. High educated parents may be more selective in school choice.
- household income. A higher income also might increase selectiveness in school choice.
- religious orientation. Parents who prefer education of a certain religious denomination for their children will be more selective in school choice.
- size of the household. The more children are visiting schools, the more difficult is organizing transport to distant schools.
- car ownership. Higher car ownership increases the opportunity to choose a more distant school.

The data give information about all variables mentioned except for religious orientation. Therefore, the influence of this variable will not be analysed.

In the assessment, two variables indicating population density are used: provinces of the home address, and degrees of urbanization of both the home and school municipalities. Most of the Dutch provinces can be characterized as either mainly rural or highly urbanized. In the case of Flanders there is not such a clear distinction between rural and urbanized provinces. For both the Netherlands and Flanders degrees of morphological urbanization by municipality are published, though these seem to be defined in different ways. Additionally, for Flanders figures about the functional hierarchy of municipalities are published. We found that, if both Flemish urbanization indicators are included in the same model, never more than one has a significant influence for either the home or school municipalities. Based on this finding, we decided to include only one urbanization indicator in each model. Selection of the indicator is based on significance in the model when both indicators are examined together. The result is selection of functional hierarchy for both home and school municipalities in the distance analyses, and morphological urbanization for the home municipality as well as

functional hierarchy for the school municipality in the modal choice analyses in the next section.

In the model a variable reflecting the year of the survey is added. Though in this paper we are not interested in the development of distance in time, data of several years are used and the location patterns of homes and schools can change during these years. The time impact may be neutralized by including a time variable in the model. The time variable is defined as the year of the survey minus 2000. The rationale of subtracting 2000 from the value of the year is to prevent very large values for the constants and to get more accurate t-values for them. Using the original high values for the years, the t-values of the constants are close to the t-values of the year variable.

The influence of the variables is examined simultaneously using linear regression. This rather simple method can be used because the dependent variable (distance) is continuous. It assumes linear relationships between the explanatory variables and the dependent variable. We did not test whether these relationships are linear. Therefore, one should be careful in applying the estimated models in predicting distances in extraordinary situations. Calculated distances can even be negative. Nevertheless, for the purpose of our analysis, assessing which variables have a significant impact on the distance, the method can be useful. The applicability of the model is supported by the plausibility of the results.

Parameters of the following model are estimated:

$$y = b_0 + \sum_k (b_k * x_k) \qquad (1)$$

where:

y : dependent variable

x_k : k[th] explanatory variable

b_k : parameter describing the influence of x_k

b_0 : constant

The dependent variable is home-to-school distance, expressed in kilometres. The other variables mentioned above are the explanatory variables. Categorical variables are redefined by a set of dichotomous variables each indicating whether a certain class of the categorical variable is valid or not. For reasons of redundancy, one class of a categorical variable is not represented by a dichotomous variable; this class has the function of reference class. This means that the values of the parameters are relative to that assumed for the reference class (always taken as zero). If a variable is ordinal, one of the two extreme classes is chosen as the reference class, in principle the extreme with the largest number of observations. The provinces are ranked according to increasing average degree of urbanization where the most urbanized province is chosen as the reference.

Table 1 presents the results for the Dutch situation. Parameters that have a significant influence on a 5% level are displayed in boldface. The parameter of a continuous variable indicates the distance increase in km if the variable increases by one unit (ceteris paribus).

For example, if the age of a young pupil increases by one year, the distance to the primary school increases by 0.099 km. In the case of a categorical variable, the parameter of a certain category indicates the difference between this category and the reference category (again ceteris paribus). For example, the distance to the secondary school travelled by a pupil living in the province of Flevoland exceeds by 3.886 km the home-to-school distance of a pupil living in Zuid-Holland (the reference).

Table 1 – Influence of explanatory variables on home-to-school distances of Dutch pupils

variable	class of categorical variable	6-11 years old			12-17 years old		
		param.	t-value	observ.	param.	t-value	observ.
province home address	Drenthe	**0.445**	2.06	394	**3.045**	4.82	304
	Friesland	0.359	1.75	458	**3.037**	5.06	368
	Zeeland	**0.544**	2.43	357	**3.615**	5.93	352
	Limburg	0.047	0.24	487	0.484	0.92	496
	Gelderland	0.231	1.39	835	**1.383**	2.96	751
	Groningen	0.078	0.35	345	**1.279**	2.14	331
	Overijssel	0.216	1.86	597	**2.502**	4.87	533
	Noord-Brabant	0.144	0.89	916	**1.019**	2.27	872
	Flevoland	**0.861**	4.06	387	**3.886**	6.55	349
	Utrecht	0.083	0.46	578	**1.821**	3.58	488
	Noord-Holland	-0.055	-0.36	884	**0.878**	2.08	836
	ref.: Zuid-Holland	0		1232	0		1120
degree of urbanization home municipality	very highly urb.	**-9.276**	-17.78	660	**-12.414**	-19.09	671
	highly urbanized	**-7.508**	-18.69	1890	**-9.534**	-20.51	1702
	fairly urbanized	**-5.469**	-14.40	1684	**-6.276**	-14.46	1560
	little urbanized	-0.651	-1.74	1907	**-3.246**	-7.55	1749
	ref.: not urbanized	0		1329	0		1118
degree of urbanization school municipality	very highly urb.	**9.753**	18.88	685	**12.697**	18.60	938
	highly urbanized	**7.732**	19.28	1919	**8.393**	15.06	2301
	fairly urbanized	**5.551**	14.60	1694	**4.456**	8.31	1784
	little urbanized	0.482	1.28	1878	**2.473**	4.31	1285
	ref.: not urbanized	0		1294	0		492
age		**0.099**	4.16		**1.277**	18.81	
gender	*ref.*: male	0		3807	0		3507
	female	**-0.303**	-3.71	3663	0.027	0.12	3293
car ownership household	*ref.*: no car	0		283	0		318
	1 car	0.199	0.84	3863	0.001	0.00	3630
	2 cars	0.325	1.31	3184	0.445	0.72	2601
	3 or more cars	**1.122**	2.94	140	**2.760**	3.31	251
annual income household (euro's)	< 7500	0.388	0.95	82	0.634	0.49	54
	7500-15000	**0.559**	2.51	340	0.351	0.57	288
	15000-22500	**0.327**	1.98	566	-0.192	-0.41	483
	22500-30000	**0.529**	4.09	932	0.474	1.29	785
	ref.: ≥ 30000	0		5550	0		5190
size of household	1 or 2 members	0.029	0.09	149	-0.499	-0.71	211
	3 members	-0.055	-0.37	768	-0.627	-1.73	964
	4 members	**-0.195**	-2.21	3671	**-0.849**	-3.41	3138
	ref.: > 4 members	0		2882	0		2487
education level parent(s)	primary school	-0.504	-1.20	76	-1.413	-1.49	103
	lower sec. school	-0.593	-0.45	1065	-0.198	-0.59	1169
	higher sec. school	-0.151	-1.65	2980	-0.051	-0.20	2646
	ref.: academic	0		3349	0		2882
year-2000		**0.091**	2.41		-0.034	-0.33	
constant		0.503	1.15	7470	**-12.016**	-8.46	6800
R^2		0.10			0.19		

A general conclusion from the results is that the variables that are related to the location of home and school and determine the choice sets of distances are by far the most influencing variables. The direction of their influences is in accordance with the hypotheses. Distances are relatively long for pupils living in rural provinces (in particular in secondary education), in low urbanized municipalities, for older pupils, and for boys (in primary education). There is one province with deviating results: Flevoland. Despite a relatively high degree of urbanization, the home-to-school distances are largest for both kinds of education. Flevoland has the special feature that its territory was reclaimed and developed just some decades ago. In newly planned residential areas school densities are lower than in areas where the school locations are the result of historical development (De Boer and Velstra, 2005).

The impact of the other variables is small or not significant.

- In conformance with the hypothesis regarding car ownership, the number of cars in a household increases home-to-school distance.
- For household income and size the results are opposite to the hypotheses. In low income households distances to primary schools are a bit larger, while distances to both primary and secondary schools are relatively large for pupils of households with more than 4 members. A possible but highly hypothetical explanation for the differences between hypothesized and observed influences is that income and size of the household affect the choice set of distances to relevant schools. It is conceivable that pupils visiting special schools are to a relatively large extent members of low income households. Additionally, an increasing number of household members raises the probability that one of the children needs special education.
- The education level of the parents has no significant effect.
- Finally, the analysis demonstrates that the distances to primary schools are growing over time.

The statistical performances of the models, measured by R^2, are low. This could mainly be due to the fact that the most important variable, the distance to the nearest relevant school(s), is not well described by the model. The estimation for secondary schools produces a large and highly significant negative constant, implying that one or more explanatory variables are missing. Again, the reason could be an insufficient inclusion of the choice set of distances in the model.

The variable “urbanization of the school municipality” deserves special attention. Its influence is opposite to that of the urbanization of the home municipality, while notably in the case of primary education the absolute values of the parameters and t-values are similar. Assuming that the urbanization of the school municipality is no input in the school choice but just output, we undertook also an analysis where we left out this variable. The results are striking. For distances to primary schools, the highly significant influence of the urbanization of the home municipality disappeared fully. For distances to secondary schools, this influence remained significant but both parameters and t-values decreased considerably. For both types of school, the values of R^2 were substantially reduced. The impacts of the other variables remained similar.

Table 2 shows the results for the Flemish pupils.

Table 2 – Influence of explanatory variables on home-to-school distances of Flemish pupils

variable	class of categorical variable	6-11 years old			12-17 years old		
		param.	t-value	observ.	param.	t-value	observ.
province home address	Limburg	-1.168	-1.53	53	-0.303	-0.31	67
	West-Vlaanderen	-1.021	-1.57	74	0.433	0.50	93
	Vlaams-Brabant	0.249	0.34	54	0.488	0.50	66
	Oost-Vlaanderen	-0.293	-0.59	292	0.682	0.98	346
	ref.: Antwerpen	0		131	0		126
functional hierarchy home municipality	high	**-2.955**	-4.59	255	**-5.422**	-9.39	325
	moderate	-0.682	-0.58	76	-1.468	-1.51	79
	ref.: low	0		273	0		294
functional hierarchy school municipality	high	**3.200**	4.96	277	**4.658**	6.18	497
	moderate	1.317	1.12	78	**2.485**	2.32	92
	ref.: low	0		260	0		109
age		-0.090	-0.79		**0.421**	2.92	
gender	*ref.*: male	0		314	0		365
	female	-0.102	-0.28	290	-0.155	-0.32	333
car ownership household	*ref.*: no car	0		25	0		38
	1 car	1.828	1.93	343	0.103	0.09	402
	2 cars	**2.537**	2.53	231	0.700	0.59	251
	3 or more cars	2.489	1.13	5	0.687	0.26	7
monthly income household (BEF)	≤ 75000	0.670	0.93	171	0.500	0.57	221
	75001-125000	0.326	0.57	335	0.628	0.89	354
	ref.: > 125000	0		98	0		123
size of household	1 or 2 members	0.400	0.26	9	**3.830**	2.25	16
	3 members	-0.869	-1.56	93	0.201	0.29	147
	4 members	-0.493	-1.21	281	0.837	1.49	284
	ref.: > 4 members	0		221	0		251
education level parent(s)	primary school	**4.976**	3.08	8	-1.581	-0.80	11
	lower sec. school	0.980	1.41	61	-0.151	-0.18	91
	higher sec. school	-0.496	-1.08	173	-0.198	-0.34	221
	ref.: academic	0		362	0		375
year-2000		0.099	1.23		-0.165	-1.60	
constant		1.934	1.20	604	-1.336	-0.50	698
R^2		0.10			0.16		

Like for the Dutch, location related variables can have strong and significant influences that are in line with the hypotheses. A remarkable difference with the Dutch results is the lack of influence of the province variable. In primary education, the results suggest even a lower distance in rural provinces. Apart from that, morphological urbanization has no significant influence in Flanders in addition to the influence of functional urbanization, where in the Netherlands the influence of morphological urbanization is strong. One explanation is that the regional differences in urbanization are smaller in Flanders than in the Netherlands. A second possible explanation is that in Flanders the school densities are relatively high in rural areas.

The estimates for the other variables show:

- a positive relation between the number of cars in the household and distance to primary schools,

- a negative relation between size of the household and distance to secondary schools (which is contrary to the Dutch results but in accordance with the hypothesis), and
- relatively high distances to primary schools if the parents have just primary school education.

Only the latter result is opposite to the hypotheses. However, its significance is doubtful because it is based on only 8 observations.

Factors affecting modal choice

Modal choice can be hypothesized to be influenced by modal attributes describing the qualities of the separate modes, and by factors that influence mode choice via personal preferences. Data about modal attributes were not available and could not be analysed. However, some available variables are (strongly) related to modal qualities and might give an indication of their influences. These variables are:

- distance. The longer the distance to school, the more competitive are the faster modes.
- population density. In densely populated areas the quality of public transport is usually high, while the traffic conditions often are unfavourable for using slow modes for reasons of safety.
- temperature. Decreasing temperature will lower the probability of cycling and increase the probability of car and PT use.

Variables that may influence mode choice via personal preferences are:

- age. The older the pupil, the more independent he/she will be in using travel modes.
- gender. Girls may be travelling less independent than boys because they are exposed to higher security risks.
- education level of the parents. The higher the education of the parents, the more they may be aware of the merits of independent travelling of their children.
- household income. High income facilitates travelling with the relatively expensive motorized modes.
- size of the household. The larger the number of school visiting pupils, the lower the probability to be escorted by the parents. When pupils travel together to the same school, the need for escorting is smaller; when they travel to different schools, escorting all pupils is more difficult to practice.
- car ownership. Increasing car ownership will raise the probability of car use.

The influences of all listed variables are investigated. In the modal choice analysis, population density is represented only by the degrees of urbanization of the home and school municipalities. In the case of Flanders that publishes figures on both morphological urbanization and functional hierarchy, the morphological urbanization of the home municipality and the functional hierarchy of the school municipality are selected. These urbanization indicators are the only ones that prove to have a significant influence when both urbanization indicators are included together in the model. Temperature is represented by the period of the year. A distinction is made between cold, moderate and hot. In the Dutch analysis, these periods are represented by the months January, November, and May

respectively. Observations of the other months are not used. In the Flemish analysis, where rejection of a large part of the sample would be unfavourable, the periods are represented by the month ranges from December to February (cold), March-April and October-November (moderate), and May to September (hot).

The influence of the variables is examined simultaneously using binary logistic regression. Parameters of the following model are estimated:

$$p(m) = \frac{\exp(b_0 + \sum_k (b_k * x_k))}{1 + \exp(b_0 + \sum_k (b_k * x_k))} \qquad (2)$$

where:

$p(m)$: probability that mode m will be chosen (values are between 0 and 1)

x_k : k^{th} explanatory variable

b_k : parameter describing the influence of x_k

b_0 : constant

This model does not describe the full modal choice but just the choice for a specific mode as function of the explanatory variables. Therefore, separate analyses for each mode have to be performed. We will limit the analyses to the most frequently used modes. Which modes are selected depends on the case. As in the distance analysis in the preceding section, categorical explanatory variables are split into dichotomous variables where one class is the reference class. Whereas the results regarding categorical variables of the linear regression used for estimating distances relate only to the differences in influences between classes of the same variable, the binary logit procedure executed by SPSS gives also results about the significance of the whole variable and a ranking of variables with respect to their influence.

The analyses are performed for both the primary and secondary age classes of the pupils and two distance classes: <= 5 km and > 5 km. This is partly because of the differences in relative qualities of the modes, partly because of the fact that increasing distance may have opposite effects on the choice of a certain mode within short and long distance classes. Observations with distances exceeding 150 km are excluded. The results are presented in a condensed way. For each segment and choice for a certain mode just the variables that are included in the step-wise built model are listed with the direction of their influence and indications of their significance. The parameter values and their statistical significance are not shown because that would take too much space.

Tables 3 to 6 present the outcomes. For all analysed choices, the significant variables are listed, ordered according to the step-wise inclusion in the model; this ordering will reflect the ordering in decreasing importance. Behind the name of each variable, the direction of the influence on the analysed choice is indicated between brackets. Next two columns report the contribution to the X^2-value (that equals the change in -2 Log Likelihood) when the variable is added to the model, and the p-value of the variable. The contribution to the X^2-value indicates to which extent inclusion of the variable improves the model. The p-value is a

measure of significance of the variable. It indicates the probability that the null hypothesis is true, that is that the variable does not differ significantly from zero. Usually, a variable is assumed to have a significant influence if the p-value is lower than 0.05.

If the direction of the influence of a variable is ambiguous, both a '+' and a '-' symbol are shown. The first displayed symbol relates to the influence of low and high values of the variable, the second symbol to the middle values. For example, the '+/-' indication in Table 3 behind the variable 'size of household' for the choice for car use on distances > 5 km means that the intention to travel by car is high in both small and large households and low in households of a medium size.

Table 3 shows the results for the Dutch pupils in the primary school age. A note to the table is that modal choices for young pupils will often be made by the parents. This is especially obvious for car choice. Children are not allowed to drive a car by themselves. Therefore, a parent or other older person must be willing to carry them to school. The mode "collective transport" in the table includes both public transport and special school bus transport.

Table 3 – Significant variables influencing modal choice in school trips of Dutch pupils 6-11 years old

<= 5 km (n=1816)			> 5 km (n=109)		
variables	increase X^2-value	p_value	variables	increase X^2-value	p_value
choice for walking			*choice for walking*		
distance (-)	943.83	0.000	not analysed		
temperature (-)	14.54	0.000			
education level parents (-)	15.73	0.001			
urbaniz. home mun. (+)	10.09	0.041			
choice for bicycle			*choice for bicycle*		
age (+)	62.55	0.000	urbaniz. home mun. (+)	23.37	0.018
distance (+)	64.36	0.000	distance (-)	20.07	0.003
urbaniz. school mun. (-)	22.88	0.000	age (+)	5.55	0.032
car ownership (-)	21.37	0.000			
temperature (+)	11.70	0.003			
education level parents (+)	12.75	0.006			
choice for car			*choice for car*		
distance (+)	169.23	0.000	education level parents (+)	23.79	0.004
age (-)	92.55	0.000	size of household (+/-)	13.58	0.002
car ownership (+)	83.48	0.000	car ownership (+)	14.90	0.048
household income (-)	16.50	0.003	year (+)	4.87	0.026
size of household (-)	11.49	0.008	urbaniz. school mun. (-)	11.31	0.065
year (+)	4.68	0.030			
choice for coll. transport			*choice for coll. transport*		
not analysed			car ownership (-)	9.40	0.019
			urbaniz. school mun. (-)	15.07	0.125

Not surprising, the table shows many differences between the findings for the two distance classes. Looking at the results for trips <= 5 km, a lot of variables have significant influences:

- Distance has a significant influence on all analysed choices and is by far the most important variable for explaining walking and car use. Increasing distance seems to bring about a modal shift from walking to car use and, to a lesser extent, from walking to cycling.

- The second most important variable is age. Increasing age lowers car use to the benefit of the bicycle.
- Car ownership is an important variable for explaining car use. Increasing car ownership seems mainly to convert bicycle trips into car trips. This will have to do with the fact that both modes are competitive for the larger distances (even within the short distance segment) where walking takes too much time.
- Increasing temperature seems to induce a shift from walking to cycling.
- If the education level of the parents is high, pupils more frequently use a bicycle to the detriment of walking.
- Increasing urbanization level of the school municipality decreases bicycle use and effects a smaller increase of walking. A possible increase in patronage of PT is not analysed.
- Increasing household income decreases car use. One should note that this result excludes the influence of car ownership that might be related to income, because both variables are included in the model.
- Increasing household size decreases car use.
- Car use increases over time. This finding is in line with the observed long term increase by de Boer and van Goeverden (2007).

Most findings confirm the hypotheses, others describe not hypothesized relationships (influences of temperature and education level of the parents), and one conflicts with the hypotheses. The latter is the influence of household income on car use. The assumed positive relation proves to be negative. Possibly the assumed higher awareness of parents regarding the merits of independently travelling relates more to income than to education level of the parents.

Let us now have a look at the trips > 5 km of pupils in the primary school age. This is a relatively small segment with possibly a high share of pupils enjoying special education. The estimation procedure included one variable into the model that is not significant on a 5% level (urbanization school municipality, for both the choices for car and collective transport). Next significant influences are observed:

- Distance has a significant influence on bicycle choice only. In contrast to the trips <= 5 km, the influence is negative. Where at small distances the bicycle has to compete with walking, at larger distances it has to compete with the faster motorised modes.
- The urbanization of the home municipality has an opposite (positive) influence on bicycle choice compared to the smaller distances.
- Higher age again increases bicycle use.
- Car ownership increases car use to the detriment of collective transport.
- The education level of the parents increases car use.
- Size of the household has an ambiguous influence on car use. Car use is high in both small and large households.
- Finally, car use increases over time, similar to the development in the trips <= 5 km.

Some observed relationships are in accordance with the assumed ones. However, several findings are the opposite. These regard the influence of urbanization on the choice for the

bicycle, the influence of parental education on car use, and the finding that car use is high in large households. We have no explanation for these. However, the significance of the influences is never high and the number of observations is rather low. More observations in this segment as well as the possibility to exclude special education might produce deviant results.

Table 4 presents the results for the Dutch pupils in the secondary school age.

Table 4 – Significant variables influencing modal choice in school trips of Dutch pupils 12-17 years old

<= 5 km (n=1077)			> 5 km (n=828)		
variables	increase X^2-value	p_value	variables	increase X^2-value	p_value
choice for walking			*choice for walking*		
distance (-)	283.58	0.000	not analysed		
age (-)	18.12	0.000			
size of household (-/+)	8.34	0.050			
choice for bicycle			*choice for bicycle*		
distance (+)	56.50	0.000	distance (-)	314.23	0.000
urbaniz. home mun. (-/+)	15.53	0.007	age (-)	26.27	0.000
age (+)	5.67	0.019	car ownership (+/-)	24.54	0.000
household income (+)	10.40	0.027	urbaniz. home mun. (-)	15.11	0.001
			education level parents (+)	14.32	0.006
			temperature (+)	10.03	0.007
choice for car			*choice for car*		
not analysed			not analysed		
choice for coll. transport			*choice for coll. transport*		
not analysed			distance (+)	310.13	0.000
			education level parents (-)	17.31	0.001
			urbaniz. school mun. (+)	24.78	0.005
			urbaniz. home mun. (+)	13.09	0.017
			temperature (-)	7.70	0.015
			size of household (-)	9.36	0.027
			age (+)	4.43	0.036

Findings for these pupils are:

- Distance is by far the most important variable for all choices. Increasing distance induces a shift from walking to cycling on the short distances and from bicycle to collective transport on the longer distances.
- Age influences all choices as well, and in the same direction as distance.
- The urbanization of the home municipality is the third variable with a rather wide influence. For short distance trips, bicycle use is high in medium sized cities. For long distance trips, an increasing degree of urbanization brings about a shift from bicycle to collective transport.
- The urbanization of the school municipality has only a significant influence on collective transport use on the longer distances. The effect is positive, just like the effect of the urbanization of the home municipality.
- Increasing temperature is conducive for bicycle use at the longer distances to the detriment of collective transport.
- The education level of the parents has a similar effect as temperature.

- The size of the household has an ambiguous and hardly significant effect on walking and a negative influence on collective transport use. The probability of walking is highest in medium sized households.
- Household income has a positive effect on cycling on short distances.
- Car ownership affects the choice for bicycle use at longer distances in an ambiguous way. Bicycle use is highest if there is no car or if there are several cars in the household.

Most findings are in line with the hypotheses. Unexpected results are the influence of age for long distance trips, the low probability for walking by pupils of large households, the positive impact of household income on bicycle use, and the high bicycle use at longer distances when car ownership is high. The main reason for decreasing bicycle use when pupils grow older may be that they are permitted to travel by moped from the age of 16. It is unclear why use of collective transport increases at the same time. Possibly there is a statistical reason. When pupils grow older, the average distance to school increases as we noticed before. Increasing distances raise the use of collective transport. The modal choice analysis assesses simultaneously the influences of distance and age on the use of collective transport. It is thinkable that a part of the influence of the distance is erroneously ascribed to the correlating variable age. A possible and highly hypothetical explanation for the increasing bicycle use on short distances at increasing income is that in fact not income but the related variable ‘culture’ plays a role. Non-natives are in the Netherlands not so familiar with cycling as natives, while many of the non-natives earn low incomes. For the other two unexpected results we have no explanation.

The influences for the young Flemish pupils are displayed in Table 5.

Table 5 – Significant variables influencing modal choice in school trips of Flemish pupils 6-11 years old

<= 5 km (n=521)			> 5 km (n=82)		
variables	increase X^2-value	p_value	variables	increase X^2-value	p_value
choice for walking			*choice for walking*		
distance (-)	202.92	0.000	not analysed		
urbaniz. home mun. (+)	36.19	-			
car ownership (-)	24.07	0.000			
hierarchy sch. mun. (+/-)	7.41	0.000			
-/- urbaniz. home mun.	-3.31	-			
choice for bicycle			*choice for bicycle*		
age (+)	12.77	0.000	not analysed		
urbaniz. home mun. (-)	12.63	-			
temperature (+)	9.52	0.001			
distance (-)	8.89	0.002			
hierarchy sch. mun. (-/+)	6.87	0.000			
-/- urbaniz. home mun.	-2.18	-			
car ownership (+)	9.95	0.200			
choice for car			*choice for car*		
distance (+)	135.50	0.000	household income (+)	12.33	0.004
car ownership (+)	36.22	0.004	gender (female +)	6.87	0.019
age (-)	12.15	0.001			
temperature (-)	12.17	0.009			
education level parents (+)	11.59	0.018			
urbaniz. home mun. (-/+)	7.06	0.031			
choice for coll. transport			*choice for coll. transport*		
not analysed			household income (-)	14.68	0.009
			gender (male +)	7.55	0.013
			age (+)	5.28	0.039
			education level parents (+)	9.49	0.466

During the estimation process of the choices for walking and cycling on distances <= 5 km, the variable ‘urbanization home municipality’ was added to the model and in a later step removed again. This is very unusual. In both choices, the removal happened after including the hierarchy of the school municipality. On short distances, where the home and school municipalities usually are the same, both variables are highly correlated. Possibly, in the estimation procedure, the influence of urbanization was first wrongly assigned to the home municipality where it should have been assigned to the school municipality.

Just as for the Dutch, a lot of variables explain the choices on the short distances:

- Distance is by far the most influencing variable for walking and car use. It has also a small influence on cycling. Increasing distance decreases walking and cycling, and increases car use.
- Increasing age lowers car use to the benefit of the bicycle.
- Car ownership raises car use to the detriment of walking.
- When temperature goes up Flemish pupils seem to shift from car to bicycle.
- The education level of the parents is positively related to car use.
- Pupils living in medium sized cities are more frequently carried by car.
- Those travelling to a school in a city of regional importance are more inclined to use the bike instead of walking than those travelling to schools in rural areas or in large cities.

Unexpected results are the small positive influence of car ownership on bicycle use, the positive relation between education level of the parents and car use, and the low car *and* bicycle use in low urbanized areas. We have no explanation for these findings.

Modal choice at the longer distances is significantly influenced by only three variables:

- Most important is household income. Increasing income raises car use and lowers use of collective transport.
- Second in importance is gender. Girls are more frequently carried by car, while boys more frequently use collective transport.
- Age has a positive influence on the use of collective transport.

Assuming that the higher use of collective transport at higher ages is due to a shift from car use, all results are in line with the hypotheses.

Finally, Table 6 shows the results for the older Flemish pupils.

Table 6 – Significant variables influencing modal choice in school trips of Flemish pupils 12-17 years old

<= 5 km (n=327)			> 5 km (n=368)		
variables	increase X^2-value	p_value	variables	increase X^2-value	p_value
choice for walking			*choice for walking*		
distance (-)	80.35	0.000	not analysed		
car ownership (-)	7.64	0.062			
choice for bicycle			*choice for bicycle*		
gender (male +)	5.85	0.016	distance (-)	50.44	0.000
			hierarchy sch. mun. (-/+)	14.94	0.001
			gender (male +)	9.18	0.003
choice for car			*choice for car*		
household income (+)	19.36	0.021	household income (+)	8.99	0.008
car ownership (+)	9.61	0.420	age (-)	5.39	0.018
			urbaniz. home mun. (-)	6.42	0.041
choice for coll. transport			*choice for coll. transport*		
not analysed			distance (+)	24.18	0.000
			gender (female +)	13.68	0.001
			hierarchy sch. mun. (+/-)	9.52	0.011

The number of significant variables is smaller than for the young pupils. They include:

- Distance; this has a strong negative influence on walking, while in the larger distance class increasing distance brings about a shift from bicycle to collective transport.
- Gender; boys are more inclined to use the bicycle than girls, while girls more frequently use collective transport. Gender is the only significant variable that explains bicycle use on short distances.
- Household income; this is the most influencing variable for car choice, both for the short and the longer distance classes. Increasing income increases the probability of car use.
- Age; increasing age decreases car use on longer distances.
- Hierarchy of the school municipality; when travelling to a school in a municipality that is high or low in the hierarchical ranking, the use of collective transport is relatively

high. Pupils travelling to a municipality in the middle of the ranking are more inclined to use the bicycle.
- Urbanization of the home municipality; increasing urbanization decreases car use on the longer distances.

One result is opposite to the hypothesized relationships. This is the finding that for longer distance trips to schools in low urbanized municipalities the use of collective transport is relatively high and bicycle use is low. Possibly collective transport to these municipalities is to a large extent special school transport, where the high collective transport use to the large cities is mainly due to public transport patronage.

The finding that above a certain age boys are more inclined to use the bicycle where girls more frequently use PT is additional to the hypotheses. The difference seems not so much to be attributed to spontaneous behaviour of girls and boys, but, as far as girls are concerned, to enforced behaviour on command of worried parents. The Belgian Institute for Traffic Safety (BIV) stated on our request that girls were unjustly restricted in participation in travel, in spite of the fact that they behave more carefully than boys and are less involved in accidents. Arguments might be either the vulnerability of girls with regard to security or the problems with female clothing in cycling.

When comparing the results for the Dutch with those for the Flemish, one will find many similarities. For both groups of pupils, distance has an important influence on modal choice. Increasing distance decreases the probability of walking on short distances and cycling on longer distances, while it increases the probability of car use on short distances and use of collective transport on longer distances. Age has a strong influence for young pupils on short distances. When pupils grow older they will be carried by car to a lesser extent and use more frequently the bicycle. Car ownership generally increases the probability of car use. High urbanization of the school municipality is conducive for use of collective transport. In medium-sized cities bicycle use is high. A final common result is that increasing temperature raises bicycle use of young pupils on short distances.

There are also several differences between the Dutch and the Flemish. Noticeable differences are:
- Gender is an important explanatory variable for the Flemish, whereas it has no significant influence for the Dutch.
- The influence of distance on bicycle use on short distance trips is positive for the Dutch and negative for the Flemish
- When temperature goes up the young Dutch pupils seem to shift from walk to bicycle while the Flemish shift from car to bicycle.
- The increase of car use on short distance trips due to an increase of car ownership seems to be to the detriment of the bicycle for the Dutch and walking for the Flemish.
- Increasing household income decreases car use on short distances for the Dutch (young pupils) while it increases car use for the Flemish (older pupils).
- If the parents are highly educated, Dutch pupils are more inclined to use the bicycle while Flemish pupils tend to travel more by car (young pupils at short distances)

- Car use increases significantly over time for the Dutch young pupils in the short period 2004-2007, while no significant influence can be noted for the Flemish in the longer period 1994-2000. This observation might be due to a smaller number of observations for the Flemish. Another explanation is that the initial higher car share in Flanders had reached a saturation level.

The general conclusion is that many variables have significant impacts on modal choice, but only a few dominate the impacts. The most important variable is distance. Distance is strongly related to the quality of the several modes. For those travelling to primary schools, age is a second highly influential variable. For Flemish pupils travelling to secondary schools, gender and household income have substantial impacts as well. Boys are more inclined to use the bike and less inclined to use collective transport than girls, while increasing income raises car use.

CONCLUSION AND DISCUSSION

Does the analysis of this paper contribute sensibly to the knowledge on school travelling? First it can be noticed that many results are in line with the results of other studies. The main merits are the high level of detail combined with comprehensiveness of the analysis, and the comparison between countries.

Generally, the analysis demonstrates that factors determining the objective choice conditions (hard factors) are dominant in the choices that are made. These factors are the choice set of distances to relevant schools in the case of school choice, and the relative quality of the available modes in the case of mode choice. Other factors play a minor role though their influences still can be statistically significant.

The strong influence of hard factors implies that there are good opportunities for policy makers to influence travel behaviour. Home-to-school distances can be influenced by a policy that affects the density of school locations. Modal choice can be influenced by improving the quality of one or more selected modes. The Flemish ambition to create a coherent bicycle network and to ban the car from school transport (van Goeverden and de Boer, 2009) will bring bicycle and car use of Flemish pupils closer to the Dutch situation. However, even if the travel conditions in Flanders are made equal to those in the Netherlands, differences in modal use will continue to exist. Other, soft factors play a role as well, and they differ for the two countries. The analysis of this paper suggests that such factors play a more pronounced role in Flanders than in the Netherlands. In particular, the differences between the influence of gender on modal split as well as the willingness to cycle more than 5 km by young pupils are striking.

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