Application of ALBATROSS to aging and mobility scenarios for the year of 2020

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Preface

Aging is the most important driving force behind the demographic developments that will take place in the next decades in the Netherlands (as well as other countries). To assess the mobility effects of these developments, the KIM (Netherlands Institute for Transport Policy Analysis) initiated a research project consisting of two phases. The aim of the first phase is to identify the demographic developments and investigate existing trends in activitity patterns and travel behavior of elderly over the last decades in the Netherlands. On the basis of revealed trends several variants of behavior of the elderly of the future are derived. The aim of the second phase, then, is to assess likely mobility effects of scenarios based on a model-based analysis, thereby taking into account these behavioral variants. An activity-based model is particularly suited to analyse mobility effects in the context of complete daily activity patterns and, therefore, Albatross was chosen to be used for the second phase of the study. This report focuses on the second phase and describes the results of applying the Albatross model. The research is conducted by Eirass in commission of KIM. Peter Jorritsma and Marie-José Olde Kalter (KIM), and Arnout Schoemakers (at the time, RWS-AVV) provided valuable inputs to this study in terms of data preparations, specifications of research questions and approach, and feedback on results and texts.

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1 Introduction

As many other developed countries, The Netherlands is experiencing a rapid growth in its elderly population, and this trend is expected to continue. By 2030, about 25% of the Dutch will be over the age of 65. The growing number and proportion of older people will have significant impacts for different facets of society. Little however is known about the impact on transportation of an aging society. The elderly of the future may not behave in the same way as the elderly of today, as they represent a different cohort that has grown up in a different time period and, hence, developed preferences and habits under influence of different cultural, social and economical circumstances. Jorritsma and Olde Kalter (2007) analysed behavioral trends in the mobility of elderly over the last decades. They conclude that significant changes are likely to occur in three areas of behavior. In specific, the elderly of the future are likely to (1) engage more often in activities out-of-home, (2) try to avoid peak hours in the timing of their activities and (3) increasingly choose their residence in less dense urban areas (55-64 yr) or more dense urban areas (65+ yr).

Such behavioral changes do not occur in isolation, but take place in the context of economic and spatial changes that will have implications for mobility as well. In a recent joint study, the CPB (Netherlands Bureau for Economic Policy Analysis), MNP (Netherlands Environmental Assessment Agency) and RPB (Netherlands Institute for Spatial Research) developed a number of scenarios of future developments of The Netherlands until the year of 2040 (Janssen et al., 2007). The scenarios are referred to as WLO scenarios (Welvaart and Leefomgeving scenarios) and describe changes in demography, economy and the physical environment depending on assumptions of economic, political and demographic developments on a European scale. Furthermore, investments in road infrastructure and road-pricing policies are anticipated and will have substantial effects on mobility.

The purpose of the present study is to assess mobility effects of the aging population of the Netherlands in a foreseeable future based on a series of future-developments on all these levels. We use the Albatross model system to micro-simulate daily activity-travel patterns behaviour of individuals and predict mobility consequences for a series of scenarios and behavioural variants of elderly. Albatross was developed by Eirass commissioned by RWS-AVV (‘verkeer en adviesdienst van rijkswaterstaat’, currently DVS). Albatross is an activity-based model of travel demand and this means that, unlike trip and tour based models, it focuses on comprehensive daily activity-travel patterns and time use. The model has officially been adopted as a policy evaluation tool by RWS-DVS and is one of the first and most comprehensive activity-based model world wide. The sensitivity and validity of the model have been analyzed and tested extensively in the development phase of the model (Arentze and Timmermans, 2000, 2004, 2005). The application described in this research is the first ‘real’ application of the model and, even, one of the first applications of an activity-based model worldwide. Thus, apart from the contents of the predictions, the study is also interesting from the point of view of demonstrating or at least evaluating the added value of an activity-based model for such applications compared to trip-based or tour-based models. In the discussion section of this report we will also discuss results from that latter perspective.

The report is structured as follows. First, Section 2 provides an overview of the scenarios and behavioral variants considered in this study and describes the set-up of

the analysis. Section 3 focuses on Albatross highlighting the way scenarios are implemented in the model. Scenarios and variants are implemented in steps to assess the separate effects of various developments. Section 4 describes in detail the assumptions of the basic WLO scenarios, the price policy and how they are implemented in Albatross and Section 5 considers the results of predictions based on these scenarios with and without the price policy. Section 6 considers the mobility effects of behavioral variants in the context of a the Global Europe scenario, which ic considered to be the most likely WLO scenario, and discusses the assumptions, implementation and results of predictions. Finally, the report is concluded by discussing the major conclusions.

2 Overview of scenarios and behavioral variants

Four WLO scenarios were formulated by CPB, MNP and RPB for the period 2000 to 2040 based on different sets of assumptions (Jansen et al. 2007). The so-called Global Economy and Strong Europe scenarios assume a strong international orientation of economies and big (Global Economy) or moderate (Strong Europe) reforms of the collective sector in European countries. On the other hand, the so-called Regional-Communities and Transatlantic-Market scenarios assume stronger national orientation of the economies, whereby market-enhancing reforms in the collective sector will not (Regional-Communities) or will take place (Transatlantic-Market). Apart from political and economic developments, the scenarios also make different assumptions on demographic developments and, in particular, growth rate and aging.

In the present study, we consider two WLO scenarios that are supposedly most relevant for describing possible futures, namely the Global Economy (GE) and Regional Communities (RC) scenario. Given our objective to assess mobility effects for a foreseeable future we take the year 2020 as the forecast year and 2000 as the base year. Pairing of the two WLO scenarios (GE and RC) with yes or no implementation of a road pricing policy results in four scenarios. A road pricing policy can be specified in several ways. We assume here Variant 5 of the committee Nouwen. This variant involves a congestion plus a flat km price.

By a trend analysis of trip-diary data across recent years, Jorritsma and Olde Kalter (2007) generated quantified predictions of behavioral changes of elderly in 2020 compared to the elderly of today. These predictions are considered in this study as behavioral variants of the basic WLO and pricing-policy scenarios. Three behavioral variants are considered: elderly of the future (1) engage more often in activities out-of-home, (2) try to avoid peak hours in the timing of their activities and (3) increasingly choose their residence in less dense urban areas (55-64 yr) or more dense urban areas (65+ yr).

We conduct the scenario analyses in two major steps. At first, we consider the effects of the basic Global Economy (GE) and Regional Communities (RC) scenarios. For both scenarios predictions are generated with and without the road price policy. Next, we consider the behavioral variants. This part of the analyses will be based on the GE scenario, which is considered to be the most likely scenario for the future. Rather than considering all three variants at once, we add one variant at a time to the basic scenario and report the results of each step. In this way, the incremental effect of each scenario as well as their overall mobility effects are revealed. Table 2.1 gives a

summary of the scenarios and variants involved. Table 2.2 gives an overview of all scenario analyses that are reported in this study. The first two columns indicate in which Appendix the results are represented and in which section of this report the results are discussed. The next columns indicate the details of the scenario/variants compared and the effect that is revealed by the comparison.

Tabel 2.1. Scenarios and behavioral variants considered

	Price policy Variant 5 Nouwen (= congestion + flat charge)	
	Yes	No
Baseline 2000		X
Global Economy 2020	X	X
Regional Communities 2020	X	X
VAR1	X	X
VAR2		X
VAR3		X
VAR1+VAR2		X
VAR1+VAR2+VAR3	X	X

VAR1 increase out-of-home
VAR2 elderly peak
VAR3 spatial diversity

3 The ALBATROSS model

Before discussing the implementation of scenarios and results of predictions, in this section we first discuss some relevant aspects of the Albatross model. The discussion is arranged in several sections. First, we briefly describe the refinements that were implemented in the model to better meet information requirements for the present study. Next, we give an overview of the database and finally we discuss methods of scenario implementation.

3.1 Refinements of the model

For the present analyses, the age variable is of particular significance. In Albatross, age is an attribute of a household. Taking the oldest member of a household as indicator, the model uses a classification into 4 categories, namely < 25 yr, 25 – 44 yr, 45 – 64 yr and 65+ yr. For the aging scenarios considered here, however, this classification is too course, first, because age groups are defned at household rather than person level and, second, because it does not differentiate between age groups within the group of elderly that are important in the scenarios. Therefore, to improve the sensitivity of the model, we added an age-attribute at person level and refined the age classification used, resulting in the following 5-way classification: < 35 yr, 35 – 54 yr, 55 – 64 yr, 65 – 74 yr, 75++ yr.

Tabel 2.2. Overview of scenario analyses conducted

Section	Append.	Scenario			Reference			Effect
		Main	Variant	Price policy	Main	Variant	Price policy	
5.2	1	GE 2020	None		Base 2000			Basic scenario
5.3	2	RC 2020	None		Base 2000			Basic scenario
5.4	3	GE	None	X	GE	None		Price policy
5.4	4	RC	None	X	RC	None		Price policy
6.1	5	GE	VAR1		GE	None		VAR1
6.1	6	GE	VAR1	X	GE	VAR1		Price policy
6.2	7	GE	VAR1+VAR2		GE	VAR1		VAR2 given VAR1
6.3	9	GE	VAR1+VAR2+VAR3		GE	VAR1+VAR2		VAR3 given VAR1 and VAR2
6.4	8	GE	VAR 2		GE	None		VAR2 separately
6.4	10	GE	VAR 3		GE	None		VAR3 separately
6.5	11	GE	VAR1+VAR2+VAR3		Base 2000	None		Scenario+Vars
6.5	12	GE	VAR1+VAR2+VAR3	X	Base 2000	None		Scenario+Vars + Price policy

To implement this change, Albatross was re-estimated using the MON 2004 data rather than the activity-diary data set on which previous versions of Albatross were estimated. The MON data like its predecessor the OVG is a trip database, but unlike its predecessor, provides more detailed information of activities conducted at the destination of trips. Thanks to this enrichment, the data can be reformatted into an activity-diray database that meets the information requirements for estimating an activity-based model such as Albatross. The advantage of using the MON data set rather than the special-purpose activity-diary dataset is twofold. First, it includes a larger sample of households and provides better coverage of the elderly age groups in the refined age classification. Second, the survey offers a better coverage of the different regions in the Netherlands. Considering these advantages it was decided to re-estimate Albatross on the MON 2004 data and use this new version for scenario analysis in the present study. The activity classification needed to be adapted slightly as there is no one-to-one relationship between the orginal activity classification and the activity classification used in the MON survey ('activiteit op bestemming'). Table 3.1 shows the old and new classification.

Table 3.1. Activity classification used in the new version (based on MON data) and original version of Albatross

Original version	New version
Work	Work
Voluntary work	Business
School	Bring or get
Bring or get	Shop one store
Daily shopping	Shop multiple stores
Non-daily shopping	Service
Service	Social
Social	Leisure
Leisure	Touring
Other	Other

3.2 Databases

Albatross is a micro-simulation model meaning that it predicts for each person of a studied population the activity-travel pattern for a designated day. To be more precise, Albatross predicts the activity-travel schedules only of those persons that perform the role of household head in a household. This excludes children and other persons (e.g., a grandparent) that live in the household but are not responsible for running the household. Thus, for example, according to this definition, single-person and single-parent households count 1 head, and two-person households without children and two-parent households count 2 heads. Albatross considers only households where members have family relationships with each other. This means that forms of group housing such as student housing are excluded.

Table 3.2. Attributes at household and person level considered in Albatross

Attribute	Levels
Household composition	Single, no worker; Single, one worker; Double, one worker; Double, two worker; Double, no worker
Household income	Minimum, Low, Medium, High
Household age oldest member	< 35 yr; 35 – 44 yr; 45 – 54 yr; 55 – 64 yr; 65 – 74 yr; 75+ yr
Household children	No children; < 6 yr; 6 -< 12 yr; 12-< 17 yr
Household number of cars	No car; One car; Two or more cars
Person, gender	Male; Female
Person, work status	No, Full time, Part time
Person, age	< 35 yr; 35 – 44 yr; 45 – 54 yr; 55 – 64 yr; 65 – 74 yr; 75+ yr

Because Albatross' study area consists of the whole of the Netherlands, the entire Dutch population needs to be synthesized first before predictions of activity-patterns can be generated. Synthesis means that households and persons within households (i.e., the heads) are created with determined levels of household and person attributes (Table 3.2). The Albatross population-synthesis module uses the following two data sources as input: 1) demographic data by zone and 2) attribute data of a national sample of households. The zones correspond to LMS subzones of which there are 1308 in the Netherlands (note: for predictions Albatross uses a finer zoning system of 3987 postcode areas). Sample data are taken from the MON 2004 survey, i.e. the same data set that was also used to (re-)estimate the refined Albatross model. This data set includes a total of 29,221 households. 28,600 Of these households match the Albatross' definition of a household and are used for the synthesis (and estimation). The population-synthesis model uses two parameters that need to be set by the user. These include the female-single ratio (number of single females as a ratio of total number of females in the population) and female-living-in ratio (number of non-household-head females – mostly children – as a ratio of total number of females). These parameters allow the model to fully specify so-called relation matrices that are used to link persons into households, as part of the population synthesis (Arentze et al., 2008).

Furthermore, Albatross uses national databases describing the land-use and transport system. The spatial database of Albatross includes the following files:

1. A postcode-area file:
    a. Number of employees by employment sector
    b. Number of paid and free parking places, average price of paid parking places
2. A postcode-area by postcode-area file:
    a. Travel distance by car
    b. Travel time by car
    c. Travel time by slow mode
3. An LMS-subzone by LMS-subzone file:
    a. Car travel time delay ratios by trip purpose for morning peak and afternoon peak
    b. Car distance detour ratios by trip purpose for morning peak and afternoon peak

   c. Car congestion charge by trip purpose for morning peak and afternoon peak
   d. Bus/tram/metro travel time and tariffs
   e. Train travel times for access, in-vehicle and egress stages
   f. Variable train costs
4. Opening hours of daily and non-daily shopping facilities

The postcode-based data provide distances and travel times that hold for non-peak hours. The LMS-subzone based data provide ratios that are applied to adjust car travel distances and car travel times to traffic conditions in morning and afternoon peaks respectively. Obviously, travel speeds are lower and, hence, travel times are longer during peak hours. Since route choice is to some extent sensitive to travel times and travel costs, also travel distance may be dependent on time of day. Detour ratios are used to take effects of adaptive route choice behavior into account. Finally, the charges relate to a price that travelers have to pay for using roads at times when they are congested. Because congestion pricing does not exist in the Netherlands at present, these charges are zero for the baseline situation. The charges have positive values in future scenarios that include road pricing.

3.3 Implementing scenarios

Complex scenarios such as WLO scenarios define changes in several areas of reality including the following:

1. Demographic changes
2. Changes in the transportation system
3. Changes in the land-use system
4. Economic developments (prices and income)
5. Activity-travel choice behavior

How the specific WLO scenarios, price policy scenario and behavioral variants are implemented in Albatross exactly is discussed in later sections. In this section, we discuss in general terms how changes can be implemented for each of these categories in turn.

Demographic changes
Changes in size, composition and spatial distribution of the population are defined in terms of the input data for the population synthesis module. This may relate to the zonal data, sample data or both data sets. The zonal data define for each LMS-subzone the population in terms of total number of males and females in each age caterogy, the total number of males and females having a job, the total number of males and females working parttime and the total number of households. Thus, changes in demographic variables regarding work status, age, gender and household composition are implemented in the zonal data file. Changes on the level of the remaining attributes, i.e. car possession, income class and presence and age of children in the household are implemented in the sample data. To implement changes in the sample data, a so-called transition matrix is used. A transition matrix relates to an attribute on which a change occurs and defines for each pair of classes *i* and *j* for that attribute the probability that a person or household of class *i* will change to class *j*. Whether a particular household or

person in the sample undergoes the change given the transition probability is determined by means of Monte-Carlo simulation.

Changes in the transportation system
Changes in level-of-service characteristics affecting travel times, travel distances or travel costs can be implemented in the matrices representing travel times, travel distances and travel costs by mode (car, train and BTM) and by time of day (morning peak, evening peak and restday). Changes in availability and price of parking places can be implemented in the postcode area file.

Changes in the land-use system
Albatross uses employment data by sector and postcode area (4 digit) to assess the feasibility and attractiveness of locations for particular activities. Thus, scenarios involving a change in size, sectorial composition or spatial distribution of employment can be implemented in a straight-forward way as changes in this data file. On the other hand, land-use developments that involve a change of the spatial distribution of the population are implemented through the zonal population data and, hence, will be reflected in the synthetic population.

Economic developments
Scenarios describing income and price changes are implemented at different levels in Albatross. First, income developments are dealt with in the generation of a synthetic population. This is done by simulating income class transitions of the households in the sample file. For example, if income increases, a certain proportion of households will experience a transition towards a higher income class. The adpated sample file and, next, the new synthetetic population will reflect the income change. Second, general price changes affecting variable costs for car, train and BTM not location-specific are implemented through price indices. Changes in variable costs that are road-link specific, on the other hand, are implemented through the LMS-zone by LMS-zone matrices. For example, a general fuell price increase or a flat road price are generic and, hence, are implemented by changing the price index for car use as a system parameter. As another example, a congestion pricing scenario would imply price changes that are relation and time specific (e.g., only those roads and times where congestion occurs). Therefore, such changes are implemented in the zonal level-of-service data. Third, changes in parking tariffs for paid parking places can be implemented in the postcode area file.

Activity-travel choice behavior
Changes in choice behavior, such as an increase in out-of-home activities (first variant) or avoidance of peak hours (second variant), are implemented in the process of generating activity schedules. This is done by manipulating results of a decision step during this process either by changing (conditionally) predicted probabilities of decision options before making the decision or by changing the state of the evolving schedule after having made the decision. The first behavioral variant – increase of out-of-home activities – is an example of the first method. Here predicted probabilities of activity selection decisions are manipulated (for the segment considered) before making a decision through Monte Carlo simulation. On the other hand, the second behavioral variant – avoiding morning peak hours – is implemented by moving activities after they have been scheduled to later time slots if needed to avoid traveling during the morning peak. We emphasize that in both cases subsequent scheduling

decisions are generally sensitive to such changes meaning that secondary scheduling effects of the primary adaptation behaviors can be predicted as well.

4 The GE and RC scenario for 2020: assumptions and implementation

In this section, we discuss how the GE and RC scenarios for 2020 are defined and implemented in Albatross.

4.1 Demographic developments

Prognoses of demographic developments for the WLO scenarios are defined on the level of LMS subzones. Table 4.1 gives an overview of the assumed developments in terms of national totals for the baseline situation in 2000 and the GE and RC 2020 scenarios. As the table indicates, the GE scenario assumes the following population developments to take place in the period from 2000 to 2020: a population growth of 13%, an even stronger growth of number of households of 26%, a relatively strong increase of 29% of participation of women in the labor force, a shift from full-time to part-time work for males and an increase of older age groups with 60% (65-74 years) and 40% (75+ years). In the RC-scenario, the population growth rate is smaller (+4.1% versus +13%), the increase of women in the labor force much less (+2.0% versus +29%), the growth of 65-74 yr group of comparable size (+57% versus +60%) and the increase of the 75+ yr group also of the same order of magnitude (+33% versus +40%). In the RC scenario, the population in the < 35 yr group even declines.

Furthermore, the distribution of households across household types is an important characteristic of a population (Table 4.2). In the GE scenario, the proportion of single-head households increases compared to the baseline from 39.6% to 50.9%, whereas in the RC-scenario this proportion increases only marginally (to 41.8%). The proportion of single-head households is implemented through setting the female-single-ratio parameter. For the scenarios the values of this ratio are calculated as follows:

- Base 2000: $r_{s\text{-}f} = N_s \times p_f / N_f = 2704 \times 0.51 / 8014 = 0.172$
- GE 2020: $r_{s\text{-}f} = N_s \times p_f / N_f = 4388 \times 0.51 / 9114 = 0.246$
- RC 2020: $r_{s\text{-}f} = N_s \times p_f / N_f = 3097 \times 0.51 / 8423 = 0.186$

where

$r_{s\text{-}f}$ is the single-female ratio
N_s is number of single-head households (× 1000)
N_f is total number of females (× 1000)
p_f is the probability that the head of a single-head household is female

Table 4.1. Population data in the baseline and 2020 scenarios

	Base 2000	GE 2020	RC 2020
Number of workers - male	4,190,926	4,284,575	3,734,775
Number of workers - female	2,695,602	3,477,341	2,748,535
Number of males 0-34 years	3,729,015	3,865,064	3,388,737
Number of males 35-54 years	2,433,557	2,359,076	2,213,548
Number of males 55-64 years	800,553	1,200,621	1,173,705
Number of males 65-74 years	490,345	790,444	773,970
Number of males 75+ years	389,082	554,725	527,294
Number of females 0-34 years	3,587,420	3,720,143	3,261,955
Number of females 35-54 years	2,372,608	2,301,346	2,157,687
Number of females 55-64 years	781,467	1,171,391	1,144,420
Number of females 65-74 years	704,425	1,127,179	1,104,827
Number of females 75+ years	567,658	793,894	754,162
Number of households	6,830,390	8,625,632	7,361,133
Number of persons	15,856,130	17,883,883	16,500,305
Number of parttime workers – male	313,054	378,347	329,785
Number of parttime workers – female	1,439,453	1,856,914	1,467,715

A second parameter in the synthesis module is the number of females living in a household (but not being a head of the household) as a ratio of the total number of females. The values of this ratio were calculated as follows:

- Base 2000: $r_{i\text{-}f} = [N_f - (N_s \times p_f + N_d)] / N_f = [8014 - (2704 \times 0.51 + 4098)] / 8014 = 0.317$
- GE 2020: $r_{i\text{-}f} = [N_f - (N_s \times p_f + N_d)] / N_f = [9114 - (4388 \times 0.51 + 4227)] / 9114 = 0.291$
- RC 2020: $r_{i\text{-}f} = [N_f - (N_s \times p_f + N_d)] / N_f = [8423 - (3079 \times 0.51 + 4280)] / 8423 = 0.305$

where

$r_{i\text{-}f}$ is the female-living-in ratio
N_s is number of single-head households (× 1000)
N_d is number of double-head households (× 1000)
N_f is total number of females (× 1000)
p_f is the probability that the head of a single-head household is female

Table 4.2. Households by type (× 1000)

	Base 2000	GE 2020	RC 2020
Single-person households	2319	3861	2675
Single-parent households	385	527	404
Total single-head households	2704 (39.6%)	4388 (50.9%)	3079 (41.8%)
Two-person households without children	2016	2181	2250
Two-parent households	2082	2046	2030
Total double-head households	4098 (60.2 %)	4227 (49.1%)	4280 (58.2%)
Other	28	10	2
Total	6802	8615	7359

Source: Hilderink et al. (2005)

4.2 Work status distribution across age groups

Zonal demographic data discussed above define for each scenario and for each zone the number of part-time workers and number of full-time workers in the population of that zone. Apart from total counts, however, the scenarios also involve changes regarding the distribution of workers across age groups. Table 4.3 shows CBS prognoses for age-group labor-particpation rates for the baseline, GE-2020 and RC-2020 situations. In synthesing a population, Albatross reproduces the labor-participation rates of age groups that exist in the sample while creating a population that meet the total counts specified in the zonal data (for each zone). The table also represents the resulting rates in the synthetic populations generated by Albatross.

As it appears, labor participation rates in the synthetic population differ somewhat from the prognosed values. This occurs for the baseline as well as the 2020 scenarios. In case of the baseline, the number of workers in the 55-65 yr age group is overpredicted for males as well as females. This indicates that workers of this age group are slightly oversampled in the MON survey after correcting for the total number of workers. Furthermore, in every scenario, Albatross seems to overpredict the percentage of workers in the youngest age group (< 35 yr). It should be noted, however, that the Albatross percentages do not relate to the entire population, but only to the subset of household heads. This difference will have consequences especially for the youngest age group. Since we may expect to find workers among young adults that are still living in with their parents, not all workers in the youngest age group are represented in the Albatross population. Thus, the higher percentage of workers in the youngest age group in the Albatross population may simply indicate that household heads have a higher probability of being a worker than young adults of the same age group that still live in their parent's home. This is indeed the case if young adults tend to start a household of their own at the moment they get a job. We emphasize, therefore, that a difference in percentage of workers in the youngest age group does not indicate an error, but simply is a consequence of the fact that Albatross represents household heads only.

Having said this, some adjustments are needed for the baseline, to correct for sampling error in the MON survey and, for the 2020 scenarios, to take into account prognosed shifts by CBS. Note that the latter shifts differ for GE 2020 and RC 2020. In

the GE scenario, the percentage of workers decreases in the youngest age group (< 35 yr) and increases in the older age groups (55-65 yr and 65-75 yr). In the RC scenario, the percentage of workers only increases in the youngest age group and does not increase in the older age groups. In that sense the RC scenario resembles the baseline situation much more than the GE scenario does.

The corrections were implemented by applying transition probabilities to the work status of individuals in the sample. It is important to note that the possibility to manipulate labor participation rates is limited. Because the total number of workers (among household heads) is fixed by the zonal demographic data, the percentage of workers can be chosen freely for all but one age groups. We assume that approximately all persons in the 35+ yr age groups are household heads so that in these age groups the Albatross population corresponds to the entire population. Consequently, the target labor-participation percentages for these age groups were set to the values reported by the CBS (Table 4.3). The target percentage for the youngest age group was calculated based on the constraint that the number of workers in this age group equals the given overall total number of workers minus the total number of workers across the 35+ yr age groups. The resulting transition probabilities for the baseline, and the GE and RC scenario are represented in matrix form in Figures 4.1a, 4.1b and 4.1c, respectively.

Table 4.3. Labor participation rates in age groups: before adjustment

	Base 2000		GE 2020		RC 2020	
	Alb	CBS	Alb	CBS	Alb	CBS
Male						
< 35 yr	0.79	0.73	0.77	0.68	0.75	0.66
35-55 yr	0.87	0.90	0.85	0.90	0.84	0.84
55-65 yr	0.55	0.48	0.57	0.58	0.55	0.50
65-75 yr	0.06	0.05	0.08	0.10	0.06	0.05
75+ yr	0.03		0.03		0.02	
Female						
< 35 yr	0.71	0.62	0.80	0.61	0.75	0.58
35-55 yr	0.62	0.61	0.74	0.79	0.68	0.66
55-65 yr	0.30	0.20	0.44	0.55	0.38	0.37
65-75 yr	0.03	0.01	0.05	0.06	0.04	0.04
75+ yr	0.01		0.01		0.01	

Alb Albatross' synthetic population of household heads
CBS National statistics entire population (after correction for unemployment)

Male

< 35 yr

Existing	New: no work	New: part time	New: full time
no work	1	0	0
part time	0.005	0.995	0
full time	0.005	0	0.995

35-55 yr

Existing	New: no work	New: part time	New: full time
no work	0.780	0.011	0.208
part time	0	1	0
full time	0	0	1

55-65 yr

Existing	New: no work	New: part time	New: full time
no work	1	0	0
part time	0.120	0.880	0
full time	0.120	0	0.880

65-75 yr

Existing	New: no work	New: part time	New: full time
no work	1	0	0
part time	0.176	0.824	0
full time	0.176	0	0.824

Female

< 35 yr

Existing	New: no work	New: part time	New: full time
no work	0.658	0.146	0.196
part time	0	1	0
full time	0	0	1

35-55 yr

Existing	New: no work	New: part time	New: full time
no work	1	0	0
part time	0.007	0.993	0
full time	0.007	0	0.993

55-65 yr

Existing	New: no work	New: part time	New: full time
no work	1	0	0
part time	0.321	0.679	0
full time	0.321	0	0.679

65-75 yr

Existing	New: no work	New: part time	New: full time
no work	1	0	0
part time	0.688	0.312	0
full time	0.688	0	0.312

Figure 4.1a. Work status transition probabilities for Base 2000

Male

< 35 yr

Existing	New: no work	New: part time	New: full time
no work	1	0	0
part time	0.050	0.950	0
full time	0.050	0	0.950

35-55 yr

Existing	New: no work	New: part time	New: full time
no work	0.855	0.008	0.136
part time	0	1	0
full time	0	0	1

Female

< 35 yr

Existing	New: no work	New: part time	New: full time
no work	1	0	0
part time	0.126	0.874	0
full time	0.126	0	0.874

35-55 yr

Existing	New: no work	New: part time	New: full time
no work	0.794	0.127	0.078
part time	0	1	0
full time	0	0	1

Figure 4.1b. Work status transition probabilities for GE 2020 (Cont'd next page)

55-65 yr

Existing		New: no work	New: part time	New: full time
	no work	0.783	0.032	0.185
	part time	0	1	0
	full time	0	0	1

55-65 yr

Existing		New: no work	New: part time	New: full time
	no work	0.715	0.159	0.125
	part time	0	1	0
	full time	0	0	1

65-75 yr

Existing		New: no work	New: part time	New: full time
	no work	0.957	0.021	0.022
	part time	0	1	0
	full time	0	0	1

65-75 yr

Existing		New: no work	New: part time	New: full time
	no work	0.990	0.007	0.003
	part time	0	1	0
	full time	0	0	1

Figure 4.1b. Work status transition probabilities for GE 2020 (Cont'd)

Male

< 35 yr

Existing		New: no work	New: part time	New: full time
	no work	0.720	0.016	0.264
	part time	0	1	0
	full time	0	0	1

35-55 yr

Existing		New: no work	New: part time	New: full time
	no work	1	0	0
	part time	0.005	0.995	0
	full time	0.005	0	0.995

55-65 yr

Existing		New: no work	New: part time	New: full time
	no work	1	0	0
	part time	0.090	0.910	0.000
	full time	0.090	0	0.910

65-75 yr

Existing		New: no work	New: part time	New: full time
	no work	1	0	0
	part time	0.171	0.829	0
	full time	0.171	0	0.829

Female

< 35 yr

Existing		New: no work	New: part time	New: full time
	no work	0.763	0.102	0.135
	part time	0	1	0
	full time	0	0	1

35-55 yr

Existing		New: no work	New: part time	New: full time
	no work	1	0	0
	part time	0.024	0.976	0.000
	full time	0.024	0.000	0.976

55-65 yr

Existing		New: no work	New: part time	New: full time
	no work	1	0	0
	part time	0.014	0.986	0.000
	full time	0.014	0.000	0.986

65-75 yr

Existing		New: no work	New: part time	New: full time
	no work	1	0	0
	part time	0	1	0
	full time	0	0	1

Figure 4.1c. Work status transition probabilities for RC 2020

The adjusted sample for each scenario was used to re-generate synthetetic populations. Table 4.4 shows the results. As it appears, the percentages now closely match the target figures. For the 35+ yr groups the figures correspond to those of the CBS. For the < 35 yr group the differences in percentages between Albatross and CBS reflect the difference in population. In general, the Albatross percentages are higher, as we would expect. However, the difference is much bigger for the RC scenario than the GE scenario. This indicates that in the RC scenario more than in the GE scenario young adults tend to stay with their parents as long as they don't have a job and leave the parental home as soon as they get a job. This explains why the share of workers in this age category is larger among household heads in this scenario.

Table 4.4. Labor participation rates in age groups: after adjustment

	Base 2000		GE 2020		RC 2020	
	Alb	CBS	Alb	CBS	Alb	CBS
Male						
< 35 yr	0.79	0.73	0.67	0.68	0.78	0.66
35-55 yr	0.89	0.90	0.91	0.90	0.84	0.84
55-65 yr	0.51	0.48	0.57	0.58	0.52	0.50
65-75 yr	0.05	0.05	0.10	0.10	0.06	0.05
75+ yr	0.03		0.02		0.02	
Female						
< 35 yr	0.77	0.62	0.63	0.61	0.80	0.58
35-55 yr	0.60	0.61	0.79	0.79	0.66	0.66
55-65 yr	0.22	0.20	0.50	0.55	0.37	0.37
65-75 yr	0.01	0.01	0.05	0.06	0.04	0.04
75+ yr	0.01		0.00		0.01	

Alb Albatross' synthetic population of household heads
CBS National statistics entire population (after correction for unemployment)

4.3 Income

Both the GE and RC scenario assume a general increase of household income (in real terms) compared to the baseline year (see Olde Kalter 2007). In the GE scenario, the assumed increase is 63% and in the RC scenario this is 17%. In Albatross, household income is represented by a four-level attribute variable. In Euros per year, the levels correspond to the following income ranges: 0 - 16,250, 16,251 – 23,750, 23,751 – 38,750 and 38,750+. Economic growth is implemented by changing the sample file based on transition probabilities for the income attribute of households. To determine

transition probabilities that correspond to a given economic growth rate, we make the following assumptions:

1. Incomes are distributed equally within income groups
2. The income range of the lowest income group is bounded by a reasonable minimum (set as 5,000 Euro)

Given these assumptions, transition probabilities can be derived as follows. Let X_i^{min} and X_i^{max} be the lowest and highest income in the *i*-th income group in the old situation and Y_i^{min} and Y_i^{max} be the lowest income and highest income of the same group in the new situation. Then, the new income ranges can be derived from the old ones as follows:

$$Y_i^{min} = (1 + y) \times X_i^{min}$$
$$Y_i^{max} = (1 + y) \times X_i^{max}$$

where *y* is the percentage growth of income (in real terms). Given the assumption that incomes are uniformly distributed within income classes, the probability that a household in some income class *i* will shift one income class up can be calculated as:

$$P_i(i+1) = 0 \quad \text{if } Y_i^{min} > X_{i+1}^{min}$$
$$P_i(i+1) = 1 \quad \text{if } Y_i^{min} > X_{i+1}^{min} \text{ and } Y_i^{max} < X_{i+1}^{max}$$
$$P_i(i+1) = (X_{i+1}^{max} - X_{i+1}^{min}) / (Y_i^{max} - Y_i^{min}) \quad \text{if } Y_i^{min} < X_{i+1}^{min} \text{ and } Y_i^{max} > X_{i+1}^{max}$$
$$P_i(i+1) = (Y_i^{max} - X_{i+1}^{min}) / (Y_i^{max} - Y_i^{min}) \quad \text{if } Y_i^{min} < X_{i+1}^{min} \text{ and } Y_i^{max} < X_{i+1}^{max}$$

and the probability that a household from class *i* in general will shift *j* income classes up:

$$P_i(i+j) = 0 \quad \text{if } Y_i^{min} > X_{i+j}^{min}$$
$$P_i(i+j) = 1 \quad \text{if } Y_i^{min} > X_{i+j}^{min} \text{ and } Y_i^{max} < X_{i+j}^{max}$$
$$P_i(i+j) = (X_{i+j}^{max} - X_{i+j}^{min}) / (Y_i^{max} - Y_i^{min}) \quad \text{if } Y_i^{min} < X_{i+j}^{min} \text{ and } Y_i^{max} > X_{i+j}^{max}$$
$$P_i(i+j) = (Y_i^{max} - X_{i+j}^{min}) / (Y_i^{max} - Y_i^{min}) \quad \text{if } Y_i^{min} < X_{i+j}^{min} \text{ and } Y_i^{max} < X_{i+j}^{max}$$

For the 63% increase of household incomes in the GE scenario this results in the following transition probabilities:

$$Y_1^{min} = 1.63 \times 5000 = 8150 \qquad Y_1^{max} = 1.63 \times 16250 = 26487.5$$
$$Y_2^{min} = 1.63 \times 16250 = 26487.5 \qquad Y_2^{max} = 1.63 \times 23750 = 38712.5$$
$$Y_3^{min} = 1.63 \times 23750 = 38712.5 \qquad Y_3^{max} = 1.63 \times 38750 = 63162.5$$
$$Y_4^{min} = 1.63 \times 38750 = 63162.5$$

$$P_1(1) = (16250 - 8150) / (26487.5 - 8150) = 0.4417$$
$$P_1(2) = (23750 - 16250) / (26487.5 - 8150) = 0.4090$$

$P_1(3) = (26487.5 – 23750) / (26487.5 – 8150) = 0.1493$
$P_2(2) = 0$
$P_2(3) = 1$
$P_2(4) = 0$
$P_3(3) = (38750 – 38712.5) / (63162.5 – 38712.5) = 0.0015$
$P_3(4) = (63162.5 – 387750) / (63162.5 – 38712.5) = 0.9985$

For the 17% increase of household income in the RC scenario this leads to the following transition probabilities:

$Y_1^{min} = 1.17 \times 5000 = 5850$ $Y_1^{max} = 1.17 \times 16250 = 19012.5$
$Y_2^{min} = 1.17 \times 16250 = 19012.5$ $Y_2^{max} = 1.17 \times 23750 = 27787.5$
$Y_3^{min} = 1.17 \times 23750 = 27787.5$ $Y_3^{max} = 1.17 \times 38750 = 45337.5$
$Y_4^{min} = 1.17 \times 38750 = 45337.5$

$P_1(1) = (16250 – 5850) / (19012.5 – 5850) = 0.790$
$P_1(2) = (19012.5 – 16250) / (19012.5 – 5850) = 0.210$
$P_1(3) = 0$
$P_2(2) = (23750 – 19012.5) / (27787.5 - 19012.5) = 0.540$
$P_2(3) = (27787.5 – 23750) / (27787.5 - 19012.5) = 0.460$
$P_2(4) = 0$
$P_3(3) = (38750 – 27787.5) / (45337.5 – 27787.5) = 0.625$
$P_3(4) = (45337.5 – 387750) / (45337.5 – 27787.5) = 0.375$

Figure 4.1 summarizes the sets of transition probabilities for the two scenarios in matrix form and Table 4.5 shows the resulting distribution of households across income classes in the generated synthetic population for the baseline and 2020 scenarios.

GE 2020

		Income class – new			
		Minimum	Low	Medium	High
Income class–exisiting	Minimum	0.4417	0.4090	0.1493	0
	Low	0	0	1	0
	Medium	0	0	0.0015	0.9985
	High	0	0	0	1

RC 2020

		Income class – new			
		Minimum	Low	Medium	High
Income class–exisiting	Minimum	0.790	0.210	0	0
	Low	0	0.540	0.460	0
	Medium	0	0	0.625	0.375
	High	0	0	0	1

Figure 4.1. Household-income transition probabilities

Table 4.5. Number of households by income group (× 1000)

	Base 2000	GE 2020	RC 2020
Minimum	1814 (26.5%)	1157 (13.4%)	1664 (22.6%)
Low	1665 (24.3%)	1089 (12.6%)	1432 (19.4%)
Medium	1454 (21.3%)	2478 (28.7%)	1773 (24.1%)
High	1904 (27.8%)	3913 (45.3%)	2500 (33.9%)
Total (households)	6838	8637	7369

4.4 Car possession

In 2000, there are 409 cars per 1000 inhabitants. In the GE scenario, this number increases to 514 cars per 1000 inhabitants in 2020 and in the RC scenario it increases more modestly to 461 cars per 1000 inhabitants in 2020 (see Olde Kalter 2007). In Albatross, the number of cars in a household is a three-level attribute where the levels represent 'no cars', 'one car' and '2 or more cars'. Just as income, we implement a change in car-possession by changing the attribute of each household in the sample (used for the population synthesis) with transition probabilities that are consistent with the assumptions of the scenario. To determine car-possession transition probabilities, we make the following assumptions:

1. The probability of changing from one car to more than one car is zero in single-head households and bigger than zero in 2-heads households.
2. In 2-heads households, the probability of a change from no car to one car is equal to the probability of a change from one car to two cars.

It is noted that although Albatross does not differentiate between having 2 cars or 3 cars (or more), this differentiation is needed in order to calculate appropriate transition probabilities. Therefore, we first calculate transition probabilities for a 4-way classification and then merge the probabilities related to the 2-car and 3-car cases to obtain the probabilities for the Albatross 3-way classification. We use the following variables for the calculations:

N^S is the number of single households (i.e., 1-adult households) in the scenario
N^D is the number of double households (i.e., 2-adults households) in the scenario
P^S is the proportion of single households in the population in the scenario
P^D is the proportion of double households in the population in the scenario ($P^S+P^D = 1$)
P_i^S is the probability of a single household having i cars in 2000 (i = 0, 1, 2, 3)
P_i^D is the probability of a double household having i cars in 2000 (i = 0, 1, 2, 3)
$P_i^S(j)$ is the transition probability for a single household from i to j cars (j = 0, 1, 2, 3)
$P_i^D(j)$ is the transition probability for a double household from i to j cars (j = 0, 1, 2, 3)

Given the assumption that the number of cars in a household never increases with more than one car, the number of households in each car-possession category in the new situation can be found by the following equations.

Number of households having 1 car in the new situation:

$$M_1 = N^S [P_0^S P_0^S(1) + P_1^S P_1^S(1)] + N^D [P_0^D P_0^D(1) + P_1^D P_1^D(1)]$$

Number of households having 2 cars in the new situation:

$$M_2 = N^S [P_1^S P_1^S(2) + P_2^S P_2^S(2)] + N^D [P_1^D P_1^D(2) + P_2^D P_2^D(2)]$$

Number of households having 3 or more cars in the new situation:

$$M_{3+} = N^S [P_2^S P_2^S(3) + P_3^S P_3^S(3)] + N^D [P_2^D P_2^D(3) + P_3^D P_3^D(3)]$$

The number of cars per 1000 households (assuming that the probability of a household having more than 3 cars is approximately zero):

$$m = 1000 \times (M_1 + 2 \times M_2 + 3 \times M_{3+}) / (N^S + N^D)$$

Based on the earlier assumptions, we furthermore know:

$$P_0^S(1) = P_0^D(1) = P_1^D(2)$$
$$P_1^S(2) = P_2^S(3) = 0$$

We need to find the values of the transition probabilities $P_0^S(1) = P_0^D(1) = P_1^D(2)$ and $P_2^D(3)$ such that m is equal to the assumed number of cars in the scenario. (Again, we note that although $P_2^D(3)$ does not imply a change in terms of the car-possession attribute in Albatross, it should be considered here in order to find the transition probabilities that do imply a change).

Figure 4.2 shows the sets of transition probabilities that are consistent with the assumed car-possession rates for the GE and RC scenario respectively. This can be shown by applying the transition probabilities and the above settings of the population variables in the equations above. The base rates, which are derived from the result of a population synthesis run in Albatross based on the zonal population data for this scenario, are as follows:

$P_0^S = 0.475$
$P_1^S = 0.482$
$P_2^S = 0.042$
$P_3^S = 0$
$P_0^D = 0.069$
$P_1^D = 0.578$
$P_2^D = 0.334$
$P_3^D = 0.019$

For the GE scenario the population variables are:

$N^S = 4{,}388{,}000$
$N^D = 4{,}227{,}000$

GE 2020

Single

Car posession -existing	Car possession - New: No car	1 car	2 cars	3+ cars
No car	0.79	0.21	0	0
1 car	0	1	0	0
2 cars	0	0	1	0
3+ cars	0	0	0	1

Double

Car posession -existing	Car possession - New: No car	1 car	2 cars	3+ cars
No car	0.79	0.21	0	0
1 car	0	0.79	0.21	0
2 cars	0	0	0.85	0.15
3+ cars	0	0	0	1

RC 2020

Single

Car posession -existing	Car possession - New: No car	1 car	2 cars	3+ cars
No car	0.940	0.060	0	0
1 car	0	1	0	0
2 cars	0	0	1	0
3+ cars	0	0	0	1

Double

Car posession -existing	Car possession - New: No car	1 car	2 cars	3+ cars
No car	0.940	0.060	0	0
1 car	0	0.940	0.060	0
2 cars	0	0	0.96	0.04
3+ cars	0	0	0	1

Figure 4.2. Transition probability matrices for car-possession changes

The number of households having 1 car in the new situation:

4,388,000 [0.475×0.21 + 0.482×1] + 4,227,000 [0.069×0.21 + 0.578×0.79] = 4,544,101

The number of households having 2 cars in the new situation:

4,388,000 [0.482×0 + 0.042×1] + 4,227,000 [0.578×0.21 + 0.334×0.849]
=1,896,003

The number of households having 3 or more cars in the new situation:

4,388,000 [0.042×0 + 0×1] + 4,227,000 [0.334×0.151 + 0.019×1] =293,498

The total number of cars in the new situation then is (assuming that households with more than 3 cars in the 3-or-more category is approximately zero):

$$4{,}544{,}101 \times 1 + 1{,}896{,}003 \times 2 + 293{,}498 \times 3 = 9{,}216{,}559 \text{ cars}$$

Given a size of the population (i.e., number of inhabitants) of 17,883,883 in the GE scenario, 9,216,559 cars correspond to 515 cars per 1000 inhabitants, which approximately matches the target figure.

For the RC scenario the population variables are:

$N^S = 3{,}079{,}000$
$N^D = 4{,}280{,}000$

Then, the number of households having 1 car in the new situation:

$$3{,}079{,}000\ [0.475 \times 0.06 + 0.482 \times 1] + 4{,}280{,}000\ [0.069 \times 0.06 + 0.578 \times 0.94] = 3{,}914{,}958$$

The number of households having 2 cars in the new situation:

$$3{,}079{,}000\ [0.482 \times 0 + 0.042 \times 1] + 4{,}280{,}000\ [0.578 \times 0.06 + 0.335 \times 0.96] = 1{,}654{,}196$$

The number of households having 3 or more cars in the new situation:

$$3{,}079{,}000\ [0.042 \times 0 + 0 \times 1] + 4{,}280{,}000\ [0.334 \times 0.04 + 0.019 \times 1] = 138{,}500$$

The total number of cars in the new situation then is (again, assuming that households with more than 3 cars in the 3-or-more category is approximately zero):

$$3{,}914{,}958 \times 1 + 1{,}654{,}196 \times 2 + 138{,}500 \times 3 = 7{,}638{,}850 \text{ cars}$$

Given a size of the population (i.e., number of inhabitants) of 16,500,305 persons in the RC scenario, 7,638,850 cars correspond to 463 cars per 1000 inhabitants, which approximately matches the target figure.

4.5 Driving-license possession

In Albatross, possession of a driving license is an attribute of a person, which is used to determine whether a particular person can use a car for specific activities if a car is available. Considering this use of the attribute, changes in driving-license possession are implemented in direct relation to implemented changes in car possession. That is, each time a car is added to a household, as a consequence of a transition, a driving license is added if needed to be able to use the car, using the following rule:

- If the household possesses one car after transition and there are no drivers in the household, then one person in the household will become a driver (arbitrarily the male person in case of a double household).

- If the household possesses two or more cars after transition and there is only a single driver in the household, then the non-driver will become a driver.

4.6 Land-use data

Employment-prognosis data for the two 2020 scenarios are available on the level of LMS subzones for agriculture, the service sector, retailing ('detailhandel') and total. Furthermore, prognosis data on number of pupils and students in schools and universities are available on this level. These data do not exactly match the land-use data used in Albatross. Albatross uses a somewhat finer classification of sectors: the retail sector is split up in a daily and non-daily sector and, furthermore, 'horeca' (cafés and restaurants) and services (banks, post offices, etc.) are distinct sectors. Therefore, to derive estimates of land-use data for the 2020 scenarios, an interpolation method was used. This method assumes that employment in each sector and postcode area increases proportionally with the corresponding sector in the corresponding subzone. Thus, ratios between 2020 and 2000 were calculated for each subzone by sector and used as multipliers of Albatross baseline data. Daily and non-daily shopping sector were both supposed to increase proportionally with the retailing sector. For horeca we assumed that the employment in this sector grows proportionally with the population in the corresponding subzone. As for services, total employment and education, the data matches one-to-one with sectors for which prognosis data are available.

Table 4.6 shows summary statistics of the land-use data across postcode areas for the baseline, GE and RC scenarios, to give an indication of the direction and size of the changes. In the GE scenario, the total number of employees per postcode area on average increases with 15%. The average number of students/pupils increases with 4% and averages in the service-related sectors increase with 20 to 28% depending on the specific sector. In the RC scenario, the total number of employees per postcode area on average decreases with 4.0%. The average number of students/pupils increases with 12.1% and averages in the service-related sectors stay approximately the same except that employment in the 'horeca' sector increases with 14.3%.

Table 4.6. Land-use data: averaged across postcode areas (standard deviation between brackets)

	Baseline	GE-2020	RC-2020
Total number of employees	1468 (2440)	1691 (2824)	1409 (2375)
Number of pupils/students	406 (472)	422 (526)	357 (423)
Number of employees in the daily-good sector	49 (90)	59 (112)	48 (88)
Number of employees in the non-daily-good sector	81 (192)	98 (229)	79 (185)
Number of employees in 'horeca'	35 (110)	45 (175)	40 (144)
Number of employees in banks and post offices	50 (233)	61 (267)	52 (232)
Size of residence population	1632 (1759)	1824 (2079)	1695 (1838)

4.7 Travel-time and congestion-charge data

The scenarios also take changes of travel times by car into account between the years 2000 and 2020 that follow from changes in traffic flows between origin-destination relations and new investments in road infastructure. Specifically, the WLO scenarios assume an investment package of in total 14.5 billion Euro in road infra structure. Furthermore, possible price policies will have an influence on travel costs and indirectly also on travel times. In scenarios and variants that include a price policy, we consider variant 5 of the Nouwen committee. This variant assumes a flat road price of 3.4 cent per traveled kilometer and a congestion price of 11.2 cent per kilometer.

Travel-time and congestion-charge prognoses for 2020 by transport mode and time of day (morning-peak, afternoon-peak and off-peak hours) are available at the level of LMS subzone-by-subzone relations for each scenario both with and without taking the price policy into account. In the following we use the labels GEC and RCC for the GE and RC scenarios with price policy and the original labels, GE and RC, for the scenarios without price policy. An important notion is that travel time and congestion charge (if any) for a given OD relation depends on the chosen route which in turn depends on a trade-off between time and (monetary) costs. For example, travelers could consider taking a longer route to avoid congestion charge. Since value of time of travelers differ across trip purposes, route choice may differ across trip purposes as well. To account for this, travel-time and congestion-charge prognoses were differentiated by trip purpose distinguishing work trips, business trips and other (Bakker, 2008).

To give an indication of the effects of scenarios, Table 4.7 shows average travel times and congestion charges across all OD relationships broken down by time of day and trip purpose for each scenario and scenario variant. A number of observations are relevant. First, regarding travel times there is a clear effect of price policy. With congestion charging travel times are shorter on average as one would expect. Furthermore, there is an effect of scenario, GE versus RC. On average, the travel times under the RC scenario are somewhat shorter due to smaller traffic flows between OD relations in this scenario. Even if no congestion pricing is implemented, average travel times do not increase in the GE scenario and even slightly decrease in the RC scenario compared to the baseline, which can be attributed to the foreseen expansion of road infrastructure. Finally, there is a small effect of trip purpose. Average travel times are slightly shorter for business and work trips compared to other trips due to the fact that value ot time for these trips is higher (and hence put more weight in generalized time). Compared to work trips, travel times for business trips tend to be slightly shorter, but the difference on average is only very small.

As for congestion charge, we see a notable difference between the GE and RC scenario. The GE scenario is characterized by a larger average charge across OD-relations for morning as well as afternoon peak. This reflects the fact that on average roads are less congested (due to smaller traffic flows between OD relations) in the RC scenario. Furthermore, trip purpose has a bigger effect on congestion charge compared to travel time. On average, congestion price is higher for business trips given the fact that it has a lower relative weight in route choice and, hence, routes with relatively high congestion charge are to a lesser extent avoided by drivers.

Finally, the table shows averages related to traveled distances. For business trips the average length of shortest paths (in generalized time) is slightly longer. This

indicates that taking faster routes (i.e., highways) on average also means traveling a longer distance in to paying a higher congestion charge.

Table 4.7. Level of service data for the car: averages across LMS subzone-subzone relations

		Base	GEC	GE	RCC	RC
		Travel time (min.)				
Off peak	Work	91.9	89.6	91.6	87.4	88.4
	Business	91.7	89.5	91.5	87.3	88.3
	Other	92.1	89.6	91.7	87.4	88.5
AM peak	Work	103.5	96.1	103.3	93.7	96.5
	Business	103.2	95.6	103.1	93.6	96.4
	Other	103.7	96.3	103.3	93.7	96.6
PM peak	Work	104.4	97.3	104.9	95.1	98.8
	Business	104.2	96.7	104.7	94.9	98.7
	Other	104.6	97.5	104.9	95.1	98.9
		Distance (km)				
Off peak	Work	128.7	127.9	128.4	128.1	128.4
	Business	129.3	128.3	128.9	128.5	128.8
	Other	128.4	127.8	128.3	128.0	128.3
AM peak	Work	128.7	128.4	128.7	128.2	128.6
	Business	129.4	129.0	129.2	128.6	129.0
	Other	128.3	128.2	128.6	128.1	128.5
PM peak	Work	128.6	128.3	128.8	128.1	128.5
	Business	129.3	128.9	129.3	128.6	129.1
	Other	128.3	128.2	128.8	128.1	128.5
		Congestion charge (Euro)				
AM peak	Work	0.0	1.33	0.0	0.06	0.0
	Business	0.0	1.46	0.0	0.07	0.0
	Other	0.0	1.30	0.0	0.06	0.0
PM peak	Work	0.0	1.81	0.0	0.13	0.0
	Business	0.0	1.99	0.0	0.14	0.0
	Other	0.0	1.77	0.0	0.13	0.0

GEC GE-2020 scenario with price policy
RCC RC-2020 scenario with price policy

In addition to car-related level of service data, Albatross uses travel time data for train and BTM on a same LMS-subzone basis. Table 4.8 shows average travel times for train and BTM across OD relations for the baseline and GE and RC scenarios. The travel times virtually stay the same, whereas the ratios of access/egress time tend to decrease, at least for the train, namely from 16.0 to 15.3 (train). In addition, the

scenarios assume changes in tariffs for train and BTM. These will be discussed in the next section.

Table 4.8. Level of service data for train and BTM: averages across LMS subzone-subzone relations (standard deviations between brackets)

	Baseline	GE-2020	RC-2020
Total train travel time (min)	157.3 (63.7)	151.6 (65.9)	151.6 (65.9)
Train access/egress time ratio of total	16.0 (13.9)	15.3 (13.7)	15.3 (13.7)
Distance train (km)	151.2 (78.7)	151.5 (80.1)	151.5 (80.1)
Travel time BTM (min)	297.2 (129.1)	294.0 (128.3)	294.0 (128.3)
BTM access/egress time ratio of total	6.5 (5.7)	6.5 (5.7)	6.5 (5.7)
Number of BTM tariff zones	23.3 (12.6)	23.3 (12.7)	23.3 (12.7)

4.8 General variable costs

In the 2020 scenarios, the average fuel price decreases (in real terms) and so does the average fuel use of cars per km (cars become more efficient). The resulting reduction in variable car costs is somewhat larger in the RC scenario. When the price policy is implemented, the variable costs increase with the flat road price charged, which is 3.4 cent per km traveled (in variant 5 of Nouwen). Table 4.9 shows the exact values of assumed costs changes in the GE and RC scenarios with and without the price policy. Note that the price indices shown do not include congestion prices as these extra costs are specified on the level of OD-relations, as explained in the previous section.

As for public transport, the scenarios assume that tariffs for train passengers increase, as a result of price policy of the NS. The price increase is larger in the morning peak hours (before 9 am) than in the rest of the day. Furthermore, an increase in tariffs for bus, train and metro are anticipated. These price changes have consequences for variable costs of transport modes by time of day. In sum, Table 4.9 shows the price indices for the GE and RC scenarios. The costs changes are as such implemented in Albatross.

Table 4.9. Assumed price indices (Base 2000 is 100)

	GE	GEC	RC	RCC
Car flat km costs	92.5	135.5	86.25	129.2
Train costs - Before 9 am	119		119	
Train costs - After 9 am	114		114	
BTM costs - Younger 65 years	108.4		108.4	
BTM costs - 65 years or older	108.4		108.4	
Parking tariffs	124.0		124.0	

4.9 Parking tariffs

Finally, parking tariffs change in the two future scenarios. In both scenarios, it is assumed that these tariffs increase in real terms with 124% compared to 2000. This change is implemented in Albatross as well. However, we should note that the model is only to a limited extent sensitive for this price variable (as opposed to price variables affecting variable travel costs).

5 The 2020 scenarios: results

Albatross was applied to synthesize a population and predict activity-travel patterns (activity schedules) for the baseline and the two 2020 scenarios with and without price policy. In this section, we discuss the results of the synthesis and predictions. To reveal effects of scenarios we consistently compare results for a scenario with a reference scenario. For the 2020 scenarios without price policy the reference is the Base 2000 and for the 2020 scenarios with price policy we consider the same 2020 scenarios without price policy as reference.

5.1 Structure of the output

A random fraction of 2% of the total population was synthesized for the baseline and the 2020 scenarios. This resulted in the synthesis of 136,753, 172,739 and 147,380 households for the baseline, GE and RC scenario respectively. As said, Albatross generates the activity schedule of maximally two adult persons in a household (i.e., the household heads). The total number of individuals synthesized equals 218,203 (baseline), 256,092 (GE) and 232,377 (RC). Thus, the average number of household heads per household equals 1.60 (baseline), 1.48 (GE) and 1.58 (RC). A day of the week is assigned to each synthetic household with equal probability, so that each day of the week is equally represented in the schedules generated. Albatross predicts an activity-travel schedule for each individual within households.

The output of Albatross runs (synthesis and prediction) are shown in the Appendix. Appendices 1 and 2 show results of the GE-2020 and RC-2020 scenarios without the price policy and Appendices 3 and 4 show the results of these scenarios with price policy. The output is arranged in three groups of tables. Tables A1-A8 represent frequency distributions related to attributes of households and persons of the synthesized population. Tables B1-B7 show summary information of predicted schedules in terms of a standard set of mobility indicators. The tables relate to different segments: all cases (B1), groupings by day of the week (weekdays versus weekend days) and groupings by age groups (< 55 yr, 55-64 yr, 65-74 yr and 75+). Finally, Tables C1.1 – C8.4 represent frequency distributions related to various choice facets of activity-travel patterns. Where this is of interest, frequency tables are also shown separately for the different age groups.

In each table, the first column represents the results for the reference scenario (m0) and the second column displays the results for the scenario considered (m1). The

third column shows the difference between the scenario and reference as a percentage of the reference. The last column displays the significance level of the difference. Significance levels are relevant because predictions in Albatross are based on Monte Carlo simulation. The number of stars indicate the significance level of the t-value of an independent samples t-test. One star means the difference is significantly different from zero on a 5% alpha level and two stars means that the difference is also significant on a 2.5% alpha level.

All numbers shown in tables represent quantities after having changed the basis from the fraction of the population synthesized to the entire population, i.e. after multiplying the predicted number by the inverse of the sample fraction. What is shown are multiples of 1000 (i.e., outcomes divided by 1000).

5.2 The GE scenario without price policy

5.2.1 Synthetic population (Appendix 1: Tables A1-8)

The results indicate the following changes compared to the baseline.

- The number of households increases with 26.3% (see Total row of Tables A1-A5) and the number of persons (i.e., household heads) increases with 17.4% (see Total row of Tables A6-A8).

- Table A1: the number of Single, no-worker and Single, 1-worker households increases more strongly (+59.7 % and +64.3%) than the total number of households (+26.3%).

- Table A2: a shift towards higher incomes occurs. The number of households in the highest income group even doubles.

- Table A3 and Table A8 represent a household-level and person-level frequency distribution across age groups. Household age is defined as the age of the oldest member of the household. The person-level distribution (Table A8) is more informative. As it appears, the size of younger age groups stays approximately constant, whereas the older age groups increase with 51.5 (55-64 yr), 60.4 (65-74 yr) and 41.5% (75+ yr).

- Table A4: despite the growth of the population, the number of households with children decreases slightly. The number of households without children increases above proportionally with 39.8%.

- Table A5: the number of households that possess no car grows less than the total number households. The number of households having one car increases with 26.9% and the number of households having two or more cars increases with 36.7%.

- Table A6: in the baseline scenario, the number of females is slightly bigger than the number of males, as one would expect. In the GE scenario, the difference in number increases somewhat, which is an expected consequence of an (further) aging population.

- Table A7: the number of non-workers and number of parttime workers both increase in the scenario.

To summarize, in the GE scenario for 2020 we see an above proportional increase of the elderly (aging), households without children, households with more than 1 car, non-workers, part-time workers and high income groups. Particularly, the participation of females in the labor force increases. The fact that, nevertheless, the number of non-workers increases with a higher rate than the population is an effect of aging, i.e. increase of age groups where persons have retired. Consequently, the number of workers per capita of the population decreases in the GE scenario.

5.2.2 Mobility indicators (Appendix 1: Tables B1-7)

Table B1 indicates that the total distance travelled equals 398,908,000 km on average per day (which is 145.6 billion km on a year basis). In 2000, these numbers are 336,848,000 km per day and 123.0 billion km a year. Hence, the model predicts an increase in total travel distance of 18.4%. In percentage, this increase is slightly higher than the increase of the population (+17.4%) suggesting that the average distance travelled per capita increases only very modestly. The total number of trips equals 37,867,000 on average per day which comes down to 2.96 trips per person per day. Compared to the baseline the number of trips increases with 17.2% which is almost exactly the same as the percentage increase of the population, indicating that the average number of trips per person stays constant. The number of tours increases with approximately the same percentage (+17.2%). The ratio between number of trips and number of tours equals 2.27. The increase of this ratio compared to the baseline is not significantly different from zero meaning that there is no evidence of an increase in trip-chaining. Compared to the baseline situation, small shifts in the distribution of km travelled across transport modes occur. The distance travelled by car increases somewhat more strongly (+21.2%) than the total travel distance across all modes (+18.4%), whereas distances travelled by slow modes (+14.1%) and public transport (+8.3%) increase much less. This means that the model predicts a shift particularly from public-transport to car-driver mode. Also, distance traveled as car passenger increases less than distance traveled as car driver (+8.9 versus +21.2%) indicating that car occupation decreases in the scenario. Travel times increase approximately with the same rates as travel distances indicating that travel speeds stay approximately constant (except perhaps speed of public transport increases somewhat).

The next tables show segmentations of these results for weekdays and weekend days, on the one hand, and different age groups, on the other.

- Weekday versus weekday (Tables B2-3): comparison of these two tables indicates that the mobility effects of the GE scenario are strongest in the weekend in terms of total distance travelled, distance travelled as car-driver and number of trips.

- Age groups (Tables B4-7): comparison of these four tables clearly shows that the increase in mobility is largely due to increase in total distance and car distance travelled in the older age groups. Primarily, this is due to the fact that the elderly groups increase most strongly. However, mobility increases more

strongly than the population for the 55-64 yr, 65-74 yr and 75+ yr groups indicating that also the mobility per capita has increased in these groups.

5.2.3 Activity and travel choice (Appendix 1, Tables C1.2-8.4)

Underlying the changes in mobility are the activity and trip choices people make. The C-series of tables represents frequency distributions for choice facets of activities, tours and days (of persons). The results indicate the following.

- Table C1.1: the total number of out-of-home activities increases with 17.3% (see Total row). This means that activities increase with approximately the same percentage as the number of persons implying that the number of activities per capita stays approximately constant. This is consistent with the earlier finding that the average number of trips per person does not change. There are, however, relatively strong shifts in the distribution of activities across activity types. Almost all activity categories increase more than proportionally with number of persons, except work, shopping-multiple-stores and bring/get. The number of bring/get activities even decreases.

- Tables C1.2-1.4: these tables show activity frequenties specifically for the three elderly age groups, namely 55-64 yr, 65-74 yr and 75+ yr. The number of activities in these groups increases strongly primarily due to the fact that these groups increase strongly in size. However, also if we correct for population growth in these groups there are more out-of-home activities. In the 55-64 yr and 65-74 yr this is caused by an increased labor participation (strong increase in work activities). In the 75+ yr group there are more out-of-home activities in approximately every category other than work-related and shop-one-store. In the 65-74 yr group we see in addition an increase of touring activities.

- Table C2: there are some significant changes in duration choice for activities, but these changes are relatively small: in every duration group, the increase is more or less proportional with the increase in number of activities.

- Table C3.1: the distribution of activities across start times shows an almost uniform growth of activities across times-of-day, except that the number of activities in the earliest episode of the day (before 10 am) increases a little less.

- Tables C3.2-3.4: in the older age groups, the number of activities starting before 10 am increases more strongly compared to the other episodes of the day. This is related to the increase in labor participation.

- Table C4: the number of Single-stop activities increases (+17.0%) with approximately the same rate as the overall number of activities (+17.3%). This indicates that there is no evidence of an increase or decrease in the amount of trip-chaining.

- Tables C5.1-5.2: there is a clear and consistent shift in distribution of activities towards locations of a higher order outside the home municipality. This suggest

that on average more distant locations are chosen as trip destinations. This is consistent with the earlier finding that the average trip length increases. The shift is also visible within the subset of work activities.

- Table C6.1: the number of days including more than 3 tours increases with 8.6%, whereas the number of persons increases with 17.4%. Hence, we see that the the share of days having a relatively large number of tours decreases a little.

- Table C6.2-6.4: in the elderly groups, we see a modest shift from days with a low to days with a higher number of tours. This indicates that compared to the baseline, elderly in 2020 tend to be engaged more frequently in out-of-home activities. Yet, the share of days that include a large number of tours is still smaller in elderly groups compared to younger age groups. This means that the increase in size of elderly groups can explain the decrease in share of days with more than 3 tours that we see in the population overall.

- Table C7: the distribution of tours across number of activities conducted on a tour does not show clear changes, except that the share of tours with more than 4 activities decreases at the expense of tours including 4 activities. This is consistent with the earlier finding that trip-chaining does not increase or decrease.

- Table C8.1: the number of car-driver tours increases more strongly than the total number of tours across all modes. All other modes seem to be almost equally affected by this relative increase of car. When we compare the percentage increases of tour modes with distances traveled by mode (Table A1), we see that public transport and to a lesser extent car passenger mode increase more strongly on a tour basis than on a distance basis. This indicates that public transport and car passenger are particularly more often chosen for shorter distance trips (e.g., BTM instead of train).

- Tables C8.1-8.4: in terms of mode choice for tours elderly age groups respond quite differently on the scenario. Percentage-wise, the 65-75 yr and 75+ yr groups use the car (car driver) much more often and the 55-65 yr group use public-transport more often compared to the baseline.

5.2.4 Discussion of results

What we see is a slightly bigger increase in total travel demand (mobility) than we would expect based on the increase of the population. The increase in travel demand per capita is due to an increase in the average trip length, as the number of out-of-home activities and trips stays approximately constant. The change in average trip length is caused by several factors. First, although the number of activities per capita stays the same, the distribution of activities across activity categories change considerably. The changes at this level are driven by demographic changes. Although the participation of women in the labor force increases, the percentage of workers overall decreases slightly because population growth takes place primarily in older age groups (where the percentage of workers is still lower). In combination with an increase of households without children, this explains the fact that work activities (to a modest extent) and

bring-get activities (to a larger extent) are replaced by activities in other categories. Work activities tend to generate relatively long-distance trips, so that we would expect from this change alone that the average trip length would decrease rather than increase. However, at the same time, a decrease of variable costs of car (due to decreased fuell consumption), increase of car-possession, and increase in income all favor higher-order and more distant locations for conducting out-of-home activities. Also, the land-use changes may have an impact. The change in location choice resulting from all this explains the increase of average trip length.

The total distance travelled by car driver increases somewhat more strongly than the total distance travelled across all transport modes. Car has become more attractive as a consequence of the decrease of per-km travel costs. The increased car possession, rise in incomes (due to economic growth) and increase of train tariffs also work in favor of the car. The shift in activity choice related by demographic changes, on the other hand, have opposite effects. Replacing work trips buy other trips tends to reduce average trip distance. On the other hand, distance traveled by public transport increases much less than the overall mobility. The increase of price of public transport is probably responsible for this. Interestingly, this does not hold for the 55-64 yr group, which does not decrease the distance traveled by public transport mode and even increase the trips travled by this mode. The probable explanation for this is that the increase in labor partciptaion in the 55-64 group and, in particular the increase of double-worker households in this age category, works in favor of public transport.

The average number of trips per person stays the same, because the total number of out-of-home activities stays the same and trip-chaining does not increase or decrease. As for trip-chaining, there are two counter-balancing factors at work. Car mode favors trip-chaining and an increase in use of the car would, hence, increase a trip-chaining tendency. On the other hand, the decrease of work activities (per capita) reduces this tendency. The overall result is that the trip-tour ratio stays constant.

In terms of the temporal spread of activities and travel, we see some changes as well. First, the decrease in share of activities starting before 10 o'clock in the morning is without any doubt related to the shift in the distribution of acitivites across activity types. Work activities tend to start early and, hence, a decrease of the percentage of work activities leads to a decrease of the share of activities that start in the early morning episode. The mobility increase is larger in weekend days than weekdays. Probably, this is due to the fact that a decrease in number of work activities (per capita) compensates for the increase in average trip length, while this does not occur in the weekend.

5.3 RC-2020 scenario

5.3.1 Synthetic population (Appendix 2: Tables A1-8)

The A-series of tables indicate the following population changes in the RC scenario compared to the baseline.

- The number of households increases with 7.8% (see Total row of Tables A1-A5) and the number of persons (household heads) increases with 6.5% (see Total row of Tables A6-A8). (Note: the total population including household heads and non-household heads increases with 4.1% in the RC scenario. The prediction that the number of household heads increases more strongly reflects

the fact that, in an aging population, a larger proportion of persons have a position as household head).

- Table A1: there is a substantial increase of double, no-worker households and single, no-worker households. The number of single, 1-worker households decreases in a relative sense and the number of double, 1 or 2 worker households even decreases in an absolute sense.

- Table A2: the number of households in higher income classes increases and the number of households in lower income classes decreases.

- Tables A3 and A8 represent the distribution of households (A3) and persons (A8) across age groups. As Table A8 indicates, there is a substantial shift in age distribution towards older age groups. The number of (adult) persons in the younger age groups - < 35 yr and 35 – 54 yr - even decreases.

- Table A4: the households without children increase strongly (+17.6%). Despite the population growth, households with children and particularly with young children (younger than 6 yr) even decrease.

- Table A5: there is no substantial change in the distribution of households in terms of car-possession: households with no car increase more than average and households with 2 or more cars less than average. The 1-car group increases with approximately the same rate as the overall population.

- Table A6: the number of male household heads and female household heads increases with approximately the same number.

- Table A7: the number of non-workers increases with 19.2%, the number of parttime workers with 2.8% and the number of full time workers even decreases (-5.7%).

In summary, the synthesized population clearly reflects the assumptions of the RC-scenario in the sense that 1) the percentages of single and double head households stay approximately the same, 2) older-age groups increase strongly while younger age groups and households with children decrease, 3) the percentage of workers decreases, 4) car-possession follows approximately the demographic changes and 5) general income level increases. Compared to the GE scenario, there are less workers, less households in high income groups, less people in younger age groups and fewer households with 1 and 2 or more cars.

5.3.2 Mobility indicators (Appendix 2: Tables B1-7)

The effects of the scenario on mobility indicators are represented in Table B1. As it appears, the total distance traveled on an average day increases from 336,848,000 km to 360,682,000 km or 7.1%. The growth in travel demand differs between transport modes. The growth rates are positive for car driver (+9.6%) and slow modes (+3.0%) and negative for car passenger (-0.1%) and public transport (-6.1%). The number of trips increases less (+4.4%) than the total travel distance (+7.1%) indicating that the average trip length increases somewhat. The ratio between trips and tours stays

approximately the same (at 2.27) implying that the scenario has no consequences for the amount of trip chaining. Total travel time increases to a smaller extent (+2.5%) than total travel distance (+7.1%) idicating that the average travel speed increases.

Tables B2 and B3 show a disaggregation of these figures to weekdays and weekend days. As it appears, percentage-wise the increase in total travel distance traveled is somewhat bigger on weekend days (+8.7%) than weekdays (+6.6%), whereas the number of trips increases approximately with the same percentage (+4.5% versus +4.1%). The shift in modal split in favor of car driver is more pronounced in weekend days compared to weekdays.

Finally, Tables B4-7 show results for these indicators disaggregated to age groups. In general we see that mobility in terms of distance traveled as well as number of trips increase strongly for each of the three older age groups. Largely, this reflects the increase of population in these age groups. However, the increases are larger than population growth in each group indicating that also on a per capita basis mobility of the elderly increases somewhat.

5.3.3 Activity and travel choice (Appendix 2, Tables C1.2-8.4)

In this section, we consider changes in underlying activity-travel choices as revealed by the frequency tables of the C-series. The results indicate the following.

- Table C1.1: the total number of out-of-home activities on an average day increases with 4.5%. This increase is a little less than the growth of the population (+6.5%) implying that people in this scenario conduct out-of-home activities less frequently. The extent to which activity frequency increases differs considerably across activity types. Work and bring/get activities even decrease (-2.7% and -12.0%, respectively). All other other activity categories and in particular shopping one store, service related activities and touring, show an above-average increase.

- Tables C1.2-1.4: in the 55-64 yr, 65-74 yr and 75+ yr groups, out-of-home activities increase more strongly than the number of persons in these groups. In other words, engagement in out-of-home activities increases also on a per capita basis in these groups. Responsible for this growth are mainly work and business activities. In the 75+ yr group the increase of work activities is less important and growth in other activities is more diverse.

- Table C2: there are no notable changes in the distribution of activities across duration classes.

- Table C3.1: Despite the overall increase in out-of-home activies, the number of activities starting before 10 am does not increase, whereas activities starting after the morning peak hours and before the afternoon peak increase above average.

- Tables C3.2-3.4: these tables indicate that no big shifts occur in the distribution of activities across start times for the elderly groups, except that the number of activities trips in the earliest episodes increases somewhat above average in the 55-64 yr and 65-74 yr groups.

- Table C4: the increase of activities is approximately evenly distributed across trip-chaining categories implying that the scenario has no measurable effects on trip-chaining.

- Tables C5.1-5.2: overall activity categories (C5.1) we see a slight increase of activities conducted outside the home municipality in higher-order municipalities, that is to say the bigger cities. This also holds for the subset of work activities (C5.2).

- Table C6.1: the number of times no tour occurs on a day increases more strongly than the number of persons meaning that more than in the baseline situation people stay at home all day. The number of days with 3 tours increases less than proportionally, whereas the number of days with more than 3 tours even decreases.

- Table C6.2-6.4: For the elderly groups the pattern is opposite. Here we see as a tendency a shift from zero or low towards higher number of tours on a day.

- Tables C7: the number of activities per tour does not show important changes, which is consistent with the earlier finding that trip-chaining does not increase or decrease.

- Table C8.1: a shift in transport-mode choice on a tour basis occurs. Overall, the number of tours increases with 4.4%. The increase in number of tours by slow mode (+3.6%), public transport (+1.4%) and car passenger (+2.9%) are less than average and the increase of car driver (+5.6%) is more than average. It is striking that the increase in public-transport mode on a per-tour basis (+1.4%) is larger than on a per-km basis (-6.1%, see table B1). The same holds to a lesser extent also for car passenger (+2.9% versus -0.1%). This indicates that use of public transport and car passenger decreases particularly in the segment of long-distance trips.

- Tables C8.2-8.4: as a tendency the pattern of mode shifts that we see overall also occurs at the level of each of the older age groups: car-driver increases above average and the other modes and in particular public transport increase less than average.

In sum, the most important effect of the scenario is that the number of out-of-home activities increases less than one would expect based on the population growth. Work activities and bring/get activities even decrease in absolute numbers. Although there is no significant change in trip-chaining, the number of long-distance trips increases more strongly than the number of short-distance trips and the number of tours by car-driver mode increases more strongly than the number of tours by other modes. In particular, the use of public transport decreases. The scenario has also consequences for the timing of activities. More activities start after the morning peak and before the afternoon peak. On almost all choice facets responses differ between elderly and non-elderly as well as within elderly age groups.

5.3.4 Discussion of results

In the scenario, the total amount of kilometers traveled increases with a higher percentage than the population (+7.1% versus +6.5%). On the other hand, the number of trips increases with a lower percentage than the population (+4.4% versus +6.5%). There is no increase in trip-chaining. Rather, individuals make less trips because they perform less out-of-home activities in this future scenario. This is a consequence of the fact that aging leads to a decrease in number of workers and, hence, a decrease of work activities. Furthermore, a decrease of the number of households with young children means in addition a (substantial) decline in bring/get activities. The decreases in these categories are only partly compensated by increases in shop-one-store, service-related, social and touring activities. Probably, because car-possession per household does not significantly increase in this scenario, the demographic and economic developments lead to a decline overall in out-of-home activities per capita.

Whereas persons make less trips, the average trip length increases. The shift in distribution of activities across activity categories – less work and bring/get activities and more activities in maintenance, social and leisure categories – do not provide a plausible explanation for this. Trips for work activities tend to be longer and trips for bring/get activities shorter than social and leisure trips and, hence, the overall effect of this activity substitution on average trip length is at best modest. The decrease in per-km costs of car and increase in income provides a more likely explanation for the increase in distance traveled per trip. In terms of transport mode, car-driver has become more attractive and public transport less attractive largely because of price effects (train tariffs increase whereas costs of car per km decreases). In sum, although many factors play a role in this scenario, the growth in mobility on a per-person basis is modest and mainly due to ecomomic developments.

The scenario also has consequences for the timing of activities in terms of time of day as well as day of week. First, the increase in mobility is somewhat larger on weekend days than on weekdays. On weekdays the growth in distance traveled (+6.6%) is approximately proportional to the population growth (+6.5%). This means that the mobility growth on a per capita basis is primarily related to weekend activities. This has to do with the mentioned substitution of activities. The decrease of work activities counter-balances the travel-generation effect of reduced costs of traveling on weekdays, whereas it does not play a role on weekend days. The shift in activities also means that the increase in travel is not evenly distributed across times of day. Work activities and bring/get activities are responsible for most of the activities taking place before 10 am, whereas maintenance, social and leisure activities are more often conducted during later times of the day. Travel during morning peak hours even decreases slightly. In that sense, the scenario may favor an even spreading of traffic across the day.

5.4 Effects of price policy in the GE and RC scenarios

In this section we compare predictions where we introduce in the GE and RC scenario the price policy. To increase the sensitivity of the model, a larger random fraction (10 % instead of 2%) of the population was synthesized for both the GE and RC scenario. To reveal the effect of the price policy, the GE and RC scenario without price policy are taken as the reference in each scenario. Note however that to realize the increased fraction, the population synthesis and prediction were re-run for the scenarios, so that

the results for the scenarios without price policy reported here need not be exactly the same as in the foregoing.

5.4.1 GE scenario: effects of price policy

The results for the GE scenario are shown in Appendix 3. The major effects of the price policy in this scenario can be summarized as follows.

- The policy has a substantial effect on total travel demands: the total distance traveled decreases with 13.9% across all transport modes and with 22.1% for the car-driver mode. There clearly occurs a shift in modal split. In absolute terms, public transport ans car passenger modes show the largest increase (each of around +3.4 million km on average per day). Distance traveled by slow mode increases to a lesser extent in relative (+5.8%) as well as absolute terms (+0.8 million km). The number of trips decreases with 1.6%. Given that the total travel distance decreases with a larger percentage (-13.9%), this means that average trip length has decreased. Furthermore, the decrease of the ratio between number of trips and number of tours (-0.17%) indicates that the amount of trip-chaining has decreased.
- The elderly groups largely respond in the same way in terms of these mobility indicators except that the reduction in number of trips and shift in modal split are somewhat stronger.
- For the population at large, the number of out-of-home activities decreases with 2.0%. The reductions are largest for social and leisure activities but also visible in work-related activities. Maintenance activities (bring/get, service and shopping) are least affected. For the elderly groups the patterns are largely the same.
- In terms of activity locations, we see a clear increase of activities conducted in the home municipality and a decrease of activities conducted at higher-order locations (e.g., bigger cities) outside the home location. This explains the decrease in average trip length.
- As for transport mode choice, the number of car-driver tours decreases with 9.3% largely in favor of public-transport tours which increase with 21.6%. For elderly groups, the patterns of change are largely the same.

The order of magnitude of the reduction in car kilometers is in line with what we would expect. Roughly speaking if approximately half of the distance traveled by car is subject to the congestion charge of +11.2 cent, then the variable costs including the flat road price of +3.4 cent increases on average with 9 cent. Compared to the base scenario of GE 2020, this roughly means a doubling of variable costs. A decrease of the order of magnitude of 20% of distance traveled by car, thus, corresponds to a price elasticity of the order of magnitude of 0.2 which is consistent with estimates and findings of existing studies on road pricing (invluding those based on LMS) (cf. Lam and Small, 2001). Albatross predicts that this decrease in car travel demand is the result of several effects: activity generation (a decrease of approximately 2% of out-of-home activities), activity location choice (reduction of long-distance travel), transport mode choice (a substantial shift from car to public transport) and joint traveling (a shift from car driver to car passenger mode). Interestingly, also the degree of trip-chaining is affected by the scenario. However, rather than an increase (as one may expect at first thought) the model predicts a slight decrease in trip chaining. Probably, this is related to the shift

from car to public transport. Public transport offers less opportunities for trip chaining and, hence, substituting car by public transport leads to a reduction of trip chaining.

5.4.2 RC scneario: effects of price policy

The results for the RC scenario are shown in Appendix 4. In main lines, the effects of the price policy are largely the same. The number of activities and trips, average trip lengths, amount of trip chaining and modal split undergo changes in the same directions and of the same order of magnitude as in the GE case. In that sense, we can conclude that there are no major interaction effects between WLO scenario (GE versus RC) and price policy, although of course on a more detailed level the results do show differences.

5.5 Discussion of results: GE versus RC scenario

Predicted mobility effects are quite different between the GE and RC scenario. The GE-scenario leads to an increase of travelers kilometers of 18.4% and the RC-scenario to an increase of travelers kilometers of 7.1%. In the GE scenario, the population (in Albatross) increases with 17.4% and in the RC scenario the population increases with 6.5%. Thus, in both scenarios travel demands increase with a slightly higher rate than the population. However, there is an important difference between the two scenarios. Where the number of trips per capita hardly changes in the GE scenario, this number decreases significantly in the RC scenario. It is particularly because of the increased participation in the labor force that the GE scenario generates more activities than the RC scenario. The RC-scenario shows a stronger increase in average trip length. This is caused by the fact that variable costs and average travel time by car decreases more strongly in the RC scenario compared to the GE scenario. There are many subtle differences between the scenarios in terms of assumptions as well as predicted behavior, which are apparent from the discussion of results in the above sections. However, the bottom line in terms of main effects is that the GE scenario in comparison to the RC scenario generates 1) more mobility because of the larger population size, 2) more activities per capita due to larger participation of women in the labor force and 3) less long-distance trips on average due to relatively higher variable costs of car.

6 Behavioral variants of the GE-2020 scenario

Behavioral variants of the GE 2020 scenario are analysed in this section under the condition that the price policy is *not* effective. To make sure that relatively small effects of scenario changes are visible in predictions, the sample size used to synthesize a population for the behavioral scenarios was increased from 2 to 10%, as before. This means that the results described in this section, as in the case of the price policy analysis, are based on a total of 863,850 households (and 1,278,589 persons). The computation time required for each prediction run for this population size is of the order of maginitude of 12 hours on a standard PC. The variants are applied incrementally. This means that we consider successively the following cases: Variant 1

(Section 6.1), Variants 1 + 2 (Section 6.2) and Variants 1+2+3 (Section 6.3). Next we consider the effects of Variant 2 and Variant 3 when occurring in isolation (Section 6.4).

6.1 Variant 1: increase of out-of-home activities

6.1.1 Assumptions and implementation

Current trends suggest that especially elderly who have no paid work and relatively high income increasingly engage in out-of-home activities in particular for leisure and social purposes. To account for this trend, the scenario considered in this section assumes increased probabilities of out-of-home activities for individuals who are 55 years of age or older, do not have paid work (work status is 'no work') and belong to a household with medium or high income according to the Albatross classification (SEC is medium or high). The assumed increases differ between age groups within the group of elderly. A distinction is made between 55-64, 65-74 and 75+ year age groups. Furthermore, the probabilities are differentiated dependent on the activity schedule. The probability of a maintenance activity increases only if no work or other fixed activities occur in the schedule. The probability of a social/leisure activity increases in schedules that already include a social/leisure activity as well as those that currently do not have an activity of this category.

The scenario is implemented in the activity-scheduling model of Albatross. In Albatross, decisions to include activities in a schedule (for a person and a day) are made in a sequential order. In main lines, three decision steps are involved:

1. Selection of fixed activities (work, business, bring/get, other fixed)
2. Selection of maintenance, social and leisure activities (shopping 1-store, shopping n-stores, services, social visit, touring, leisure)

Maintenance, social and leisure activities involved in the second step are referred to as flexible activities. The two-step procedure means that at the moment maintenance, social and leisure activities are considered, fixed activities, if any, have already been scheduled. Flexibile activities are added through the following stepwise decision process. For each flexible activity category in a predefined order of priority, which corresponds to the listed order above, the model makes a decision whether an activity of that category is added or not. If the decision is positive the activity is added and the model considers the decision whether a next activity of the same category is added, and so on. When no more activities are added, the model proceeds with the next activity category and repeats the same procedure. This is repeated until all categories have been processed.

Depending on the decision moment, the present variant distinguishes the following conditions:

- Condition 1: the current schedule does not include an out-of-home activity
- Condition 2: the current schedule includes an out-of-home activity, but not a social/leisure activity
- Condition 3: the schedule includes a social/leisure activity

Table 6.1: Assumptions of Variant 1: increase of number activities per 100 person-days by activity category and age group

Age group	Activity	Non-worker, medium or high SEC		
		Condition 1	Condition 2	Condition 3
55 – 64 year	Shop one store	3.49	0	0
	Shop multiple stores	0.67	0	0
	Service	0.84	0	0
	Social	1.85	5.56	5.56
	Leisure	1.84	5.52	5.52
	Touring	1.31	3.92	3.92
	Total maintenance	5.0	0	0
	Total social/leisure	5.0	15.0	15.0
65 – 74 year	Shop one store	2.78	0	0
	Shop multiple stores	0.53	0	0
	Service	0.69	0	0
	Social	1.38	5.19	5.19
	Leisure	1.43	5.37	5.37
	Touring	1.18	4.44	4.44
	Total maintenance	4.0	0	0
	Total social/leisure	4.0	15.0	15.0
75 + year	Shop one store	1.74	0	0
	Shop multiple stores	0.34	0	0
	Service	0.42	0	0
	Social	0.81	3.24	3.24
	Leisure	0.85	3.39	3.39
	Touring	0.84	3.37	3.37
	Total maintenance	2.5	0	0
	Total social/leisure	2.5	10.0	10.0

Table 6.1 shows assumed changes in activity-selection probabilities by age group, activity type and condition. In terms of main activity categories, this can be summarized as follows:

- If at the decision moment the schedule does not include an out-of-home activity (Condition 1), then the probability of both a maintenance activity and a social/leisure activity increases with 5.0 percent points (55-64 yr), 4 percent points (65 – 74 yr) and 2.5 percent points (75+ yr)
- If at the decision moment the schedule does include an out-of-home activity (Condition 2 or 3), then the probability of a social/leisure activity increases with 15.0 percent points (55-64 yr and 65-74 yr) and 10 percent points (75+ yr).

In terms of the Albatross activity classification, maintenance activities include Shop-one-store, Shop multiple stores and Service activities; social/leisure activities include Social, Leisure (in a more narrow sense) and Touring activities. The percentages increase per activity group were disaggregated to this more detailed classification level in such a way that existing probabilities of activities within the group keep constant. For example, for maintenance activities this means that a 5 percent points increase is distributed as 3.49, 0.67 and 0.84 percent points increases across Shopping one store, Shopping multiple stores and Service respectively, where 5 = 3.49 + 0.67 + 0.84 and 3.49 : 0.67 : 0.84 correspond to the existing ratios of activity frequencies across these activities.

The changes are implemented in Albatross by applying a correction of activity-selection probabilities generated by the decision tree used for these decisions in the activity-scheduling process. The correction is straight-forward: if the person belongs to category *i* and the activity belongs to category *j* then the probability of selecting the activity is increased by x_{ij} percentage points, where *i* is a particular combination of age-condition group and x_{ij} is the change of percentage defined in Table 4.1 for that group and activity. In processing cases, the probabilities calculated in this way rarely fell outside the allowable range of [0, 1]. Those that did were set to the minimum of zero (if smaller to zero) or to the maximum of unity (if bigger than one).

6.1.2 Results

This variant is run for a GE 2020 scenario with and without price policy. Note that this scenario does not assume any demographic changes so that the same synthetic population is used. Appendix 5 shows the results for this variant in the GE scenario *without* price policy and Appendix 6 shows the results for the same variant in the same scenario *with* price policy.

First, we consider the results for the scenario *without* price policy. Appendix 5 shows results in terms of mobility indicators (Tables A1-6) and activity-travel choice frequency distributions (Tables B1.1-8.4) in comparison to Scenario 1. The indicators show the following.

- Table A1: the total distance travelled increases with 8,896,000 km on average per day, which is an increase of 2.2% of the total traffic volume. The total number of trips increases with approximately a same percentage, namely +2.3%. The ratio between trips and tours increases slightly indicating that an increase of trip-chaning occurs. The increase in distance travelled is not equally distributed across modes. The distance travelled as car driver increases less than average (+2.1% or 6,393,000 km on average per day), whereas the distance travelled as car passenger, percentage-wise, increases more than average (+3.6%). Also, the distance travelled by slow increases more than average (+2.5%). Km traveled by public transport does not change significantly.
- Tables A2-3: the impact of this scenario on total distance travelled is somewhat larger on weekend days compared to weekdays (+3.4 versus +1.9). Furthermore, the shift in distribution of kilometers across travel modes seems to be a bit more pronounced.
- Tables A4-A6: as expected, the impacts differ between age groups distinguished in the variant. The increase in total distance travelled (on an average day) is +3,226,000 km (55-64 yr), 4,339,000 km (65-74 yr) and

1,462,000 km (75+ yr). Expressed per person-day, the increases are +1.04 km (55-64 yr), +1.71 km (65-74 yr), +0.82 km (75+ yr) on average. Hence, the impact is largest for the 65-74 years. The reason is that, compared to the 75+ group, the percentage increase of the activities was assumed to be higher and, compared to the 55-64 group, the share of non-workers, and hence the subgroup to which the scenario applies, is larger. Expressed in percentages of the distance travelled in the baseline (in this case, GE 2020 base scenario), the impacts are +4.4 % (55-64 yr), +10.4 % (65-74 yr) and +6.3 % (75+ yr). The number of trips increases approximately with the same rate in case of the younger elderly group (55-64 yr) suggesting that the average trip length stays approximately the same. This is however not the case for the 65-74 yr and 75+ yr groups where the total number of trips increases less than distance travelled (+ 8.7% versus +10.3%, 65-74 yr, and + 4.7% versus +6.3%, 75+ yr) suggesting that in these groups the average trip length increases as a consequence of the scenario. In terms of modal split, the percentage increase of traveled distance is almost the same for each transport mode in the two younger elderly groups. In the 75+ group, however, distance travelled by slow mode increases less than average and distance traveled as car passenger more than average. Thus, in the 75+ group the increase in average trip length coincides with an increase of car-passenger mode. The ratio between trips and tours increases in all three groups. However, the effect is largest by far in the 65-74 group suggesting that this group in particular makes more single-stop trips.

Tables B1.1-8.4 show the impact of the scenario on the underlying activity and travel choices.

- Table B1.1: this table shows the direct effects of the manipulation: maintenance activities (in particular shopping one-store) and social/leisure activities both increase in number. Within the maintenance category, Shopping multiple stores and Service do not increase significantly, due to the small percentages increase assumed for these activities. Shopping-one-store increases with 1.7% (83,000 activities on an average day). The social/leisure activities, which include Social visits, Leisure and Touring, all increase with approximately the same percentages in the range of 5.7 – 7.5 %. In total, the number of out-of-home activities increases with 2.6 %, which corresponds to an extra number of 548,000 activities on an average day.
- Tables B1.2-1.4: these tables show impacts on activity generation for the different elderly age groups separately. As a result of the scenario, the total number of out-of-home activities increases with 4.7 %, 9.8 % and 5.3 % for the 55-64, 65-74 and the 75+ groups respectively. This corresponds largely to the increases in trip rates that we saw before on the level of indicators (Tables A4-6).
- Table B2: in terms of activity duration, the extra activities lead to an increase of both short-duration and long-duration activities.
- Table B3.1: this table clearly shows that the extra activities are not distributed equally across start-time categories. The number of early activities (before 10 am) does hardly increase, whereas the number of late activities (after 6 pm) increases above average. The other times of day receive approximately equal

shares of the new activities, although the afternoon somewhat more than before noon.

- Tables B3.2-3.4: these tables show what is obvious: the shifts in start-time of activities are bigger for the age groups that undergo the changes assumed in the scenario.
- Table B4: the number of Single-stop activities grows less than the number of activities on an After, Before or Between stop. This is consistent with the earlier observation that trip-chaining increases.
- Table B5: the scenario has virtually no effect on the distribution of activities across location types: for each location category the number of activities increases with approximately the same percentage as the total number of activities. This is consistent with the earlier finding that average trip length does not change much.
- Table B6.1: an increasing number of days has a relatively high number of tours. The number of person-days where no out-of-home activities are conducted decreases with -3.1% in the population at large.
- Tables B6.2-6.4: the above shift is particular strong in the 65-74 age group, which is consistent with earlier findings.
- Table B7: there is a modest but clearly visible change in the distribution of tours across numbers of activities conducted on a tour. An increasing number of tours include multiple activities. This is consistent with the earlier observation that trip-chaining increases.
- Tables B8.1-8.4: the car-passenger transport mode increases more than average in all elderly age groups.

Appendix 6 shows the results when the *price policy is* implemented. The results indicate the following. Overall there are no large differences in the effects of the variant on mobility indicators compared to the situation without price policy. The number of activities increase with the same rates obviously by assumption of the variant. However, a difference that we do see is that trips in the short-distance categories increase more strongly and trips in the long-distance categories less strongly compared to the situation without price policy. Furthermore, a clear difference is that public transport use shows a much bigger increase and car use a much smaller increase on a trip/tour basis as wel as on a per-km basis compared to the without price policy case. This suggests that, as a response to the increased price of car use, the extra out-of-home activities are conducted to a larger extent at locations and with transport modes where they incur less car-based travel.

6.1.4 Discussion

This scenario involves an increase of out-of-home activities of elderly who do not work and have a medium to high income level (at household level). Although maintenance activities increase as well, by far the largest growth is assumed to take place in the social/leisure category. The change of behavior is smaller in the 75+ age group compared to the 55-64 and 65-74 age groups. The variant was considered both in a GE 2020 where the price policy is not and where it is implemented. First, the results in case without price policy can be summarized and interpreted as follows.

As it turns out, the total number of out-of-home activities in the population at large increases by 2.6 % which amounts to an increase of 548,000 out-of-home activities on average per day. The number of trips increases a little less due to the fact

that activities are more often conducted together with other activities in a same tour (trip-chaining). The increase in trip-chaining probably is an activity type effect: social and leisure activities tend to be combined more often with each other and with other activities on a same trip. Overall, the average trip length decreases slightly, whereas in the group of elderly, which generate the extra activities, the average trip length increases somewhat. This means that in terms of their length the trips induced by social/leisure activities of elderly are below average in the population at large and above average for the elderly. On both a per-tour and per-km basis, the car-driver mode increases to a lesser extent than the other transport modes. In particular, the car-passenger mode displays a relatively strong growth. Most probably, this shift in transport mode is an activity-type effect as well: social and leisure activities are more often conducted jointly with other persons in or outside the same household, which leads to an increased proportion of joint traveling. Alternatively, it could be an age effect: elderly more often choose a car-passenger mode for traveling. However, as it appears the shift in transport mode is also strongly present within the elderly groups which means that it is related to a selective increase of one particular activity category (namely social/leisure). As a result of all these changes, the distance traveled across all transport modes increases with 2.2%, whereas the distance traveled as car driver increases with 2.1%.

The additional activities are not distributed equally across times of day. The number of activities starting in the evening (after 6 pm) increases more than average, whereas the number of activities starting in the early episode of the day (before 10 am) stays almost constant. This means that the variant probably does not lead to an increase of trips during the morning peak and, given the duration of the activities, neither to a substantial increase of trips in the afternoon peak. The distribution of activities across days of the week, however, is less strongly affected. The growth in activities is fairly equally distributed across days of the week, except that Sundays exhibit a larger-than average growth. As shown in Table 6.2, the increase of out-of-home activities varies in the range of 2 – 4% increase. The percentage increase is largest on Sundays (4.0%). Probably, the day-of-the-week effect of the variant is weak, because the assumed increase in activities is confined to people who have no work activity.

Table 6.2. Number of activities (x 1000) by day of the week

Day	Ge 2020 base	Variant 1	Increase (%)
Monday	2968	3043	2.56
Tuesday	3214	3280	2.05
Wednesday	3196	3274	2.46
Thursday	3300	3382	2.49
Friday	3338	3400	1.88
Saturday	3123	3228	3.38
Sunday	1949	2026	3.98
Total	21086	21634	2.60

The 65-74 yr group displays the largest changes, simply because the scenario applies to a larger number of persons within this group (compared to the 55-64 yr

group) and has a stronger affected by it (compared to the 75+ yr group). The share of car-passenger modes shows a significant increase in all elderly groups.

The price policy has as an effect that the extra car traffic generated by the assumed increase of out-of-home activities reduces. The new activities are conducted at less distant locations and more often with another mode than car (in particular, public transport mode is used as a substitute). In sum, the price policy reduces the impact the assumed change of behavior of the elderly of the future have on mobility.

6.2 Variant 1 + Variant 2: the elderly peak

6.2.1 Assumptions and implementation of Variant 2

This variant assumes (in addition) that flexible activities of non-working elderly that involve a trip during the morning peak (between 7 – 9 am) are shifted towards the late morning hours (10 am - noon), to avoid travelling during peak hours. Flexible activities include shopping-one store, shopping multiple-stores, services, social activities, touring and leisure activities (other than touring). Elderly – in the context of this scenario – include people of 65 years of age or older. Activity schedules should remain internally consistent in the sense that no time overlaps and time gaps between activity and travel episodes arise.

This scenario was implemented by means of a manipulation of timing decisions in the activity-scheduling phase. In Albatross, the timing of flexible activities is the output of a single decision tree that operates after having selected flexible activities and determined their durations and before making trip-chaining choices and activity sequencing decisions. The options for the timing decision tree are based on a subdivision of a day into six episodes: < 10 am, 10 – 12 am, 12 – 2 pm, 2 – 4 pm, 4 – 6 pm and > 6 pm. The rule used is straight-forward: for each flexible activity: if the person is 65+ years of age and has no work and the early episode (< 10 am) was chosen for the start time of the acitivity then change the timing to the earliest feasible *next* episode. An episode is feasible if the activity fits in the time slot. The latter depends on earlier timing decisions. For example, if an activity has already been assigned to the same time slot, as an outcome of an earlier decision, then it depends on the durations of the activity whether it would fit in that time slot. In this way, it is made sure that flexible activities originally scheduled for the < 10 am episode shift towards the earliest possible later episode of the day such that the schedule remains consistent and timing decisions made earlier in the process are unaffected.

It is noted that in approximately all instances the earliest later episode (i.e., 10-12 am) was indeed feasible so that effectively flexible acitivities during < 10 am shifted towards the 10-12 am period. Thus, although it is possible, theoretically, that an activity needs to be postponed to the afternoon, this appears to happen only very rarely. It is also noted that all subsequent decisions in the scheduling process (e.g., location, transport mode) may undergo an influence of a change of timing. For example, if individuals prefer another destination or transport mode of a trip when the activity takes place after the morning peak, then the location or transport mode choice may change as well if the activity moves to a later time slot. Such secondary effects are realistic and can be predicted by the model.

6.2.2 Results

Appendix 7 shows the prediction results for this variant. Compared are the case 'Variants 1 + 2' with the previous case 'Variant 1, only'. Because no demographic changes are involved, only mobility indictaors and activity-travel related frequency distributions are included.

The mobility indicators indicate the following.

- Table A1-5: the variant has several impacts on mobility indicators. First, the distance travelled as car passenger increases (+3.7%) in the 65-74 yr group and the number of single-stop tours as a ratio of the overall number of tours decreases in all elderly groups. This suggest that elderly more often share a car and more often link multiple trips in a tour.

On the level of activity-travel choice, the results indicate the following.

- Table B1: there are no changes in activity frequencies (as we would expect).
- Table B2: this table shows the direct impact of the variant: the number of activities starting in the early morning episode decreases with 5.7% and the number of activities starting in the late morning episode increases with 8.7%. In absolute terms, this comes down to 302,000 activities per day shifting from the early morning episode to the late morning or early afternoon.
- Tables 2.2-2.3: these tables show the direct effects of the variant specifically for the age groups groups concerned, i.e. 65-74 and 75+ groups. The number of activities in the earliest episode of the day (before 10 am) decreases with 48% (65-74 yr) and – 64% (75+). The patterns also reveal secondary effects in the sense that activities in later episodes also shift to (even) later moments.
- Table B3: there is a small decrease of Single-stop activities, which would suggest an increase of trip chaining. However, the decrease is not significant.
- Table B4: there no significant changes in the distribution of activities across location types except a slight decline of locations within the home municipality.
- Tables B5.1-5.3: there are no significant changes in the distribution of das across number of tours conducted.
- Table B6: the tours including only one activity decreases and tours including two activities increases somewhat, which is consistent with a finding that trip-chaining increases.
- Tables 7.1-7.3: the changes in timing do not seem to have any implications for transport mode choice except that the choice of car-passenger mode increases in the 65-74 yr group.

6.2.3 Discussion

The variant causes a shift of a total of 302,000 activities from the early morning to, mainly, the late morning time of day. Schedule effects appear but it to a limited extent. As tendencies, both trip-chaining and the car-passenger mode increases. These changes are well interpretable as activity-scheduling effects. Moving to later moments of the

day increases opportunities to combine activities in a single tour (trip-chaining) and to travel together (car passenger).

6.3 Variant 1 + Variant 2 + Variant 3: spatial diversity

6.3.1 Assumptions and implementation

This variant assumes (in addition) a shift in residential location choice of elderly. A certain fraction of the 55-64 yr group currently residing in high-density urban areas move to low-density areas, whereas a smaller fraction of the 65-74 yr group moves in the opposite direction. For other age groups no changes are assumed. Table 6.3 shows the assumptions of the variant in quantitative terms. After the change, the 55-64 yr group is distributed as 30 : 70 between high urban density area (codes 1 and 2) and low urban density area (codes 1 and 2), whereas the 65-74 group is distributed as 50 : 50 on this scale.

Table 6.3. Assumption of Variant 3: distribution of persons across urban density categories

	Before change		After change	
Urban density	55-64 yr	65-74 yr	55-64 yr	65-74 yr
1 (high)	0.144	0.146	0.090	0.160
2	0.212	0.211	0.140	0.225
3	0.231	0.228	0.231	0.228
4	0.229	0.231	0.300	0.210
5 (low)	0.184	0.185	0.240	0.170

This scenario was implemented in the zonal population data file by increasing or decreasing the sizes of population groups in each zone. A straight-forward rule was used: if the (LMS) zone has urban density *i* then multiply the number of persons in age group *j* by a factor x_{ij}, where $x_{ij} = g_{ij}/f_{ij}$ and f_{ij} and g_{ij} are the proportions in the *ij*-th cell of Table 4.3 for the baseline (GE 2020) and new situation (Variant 3).

We emphasize that this manipulation should not have implications for totals across zones, since it only involves transfers of persons between zones. However, within zones it will have implications for other population variables such as total number of persons (obviously), total number of households and total number of workers and part-time workers in each gender category. The number of households after the change in each zone was calculated as:

$$H_i^{new} = H_i^{old} + \sum_k h_k \times dX_{ik} \qquad k \in \{55\text{-}64 \text{ yr}, 65\text{-}74 \text{ yr}\}$$

Where H_i^{new} is the new number of households in zone *i*, H_i^{old} is the existing number of households in zone *i*, dX_{ik} is the change in number of persons in age category *k* in zone *i* and h_k is the average number of households per person in age category *k*. In a similar way, the new number of part-time workers and total number of workers in each zone was calculated as:

$$P_{ig}^{new} = P_{ig}^{old} + \sum_k p_{kg} \times dX_{ikg} \qquad g \in \{\text{male, female}\}$$
$$W_{ig}^{new} = W_{ig}^{old} + \sum_k w_{kg} \times dX_{ikg}$$

where P_{ig}^{new} is the number of part-time workers in category g in zone i after the change, W_i^{new} is the number of workers (part-time or full-time) in category g in zone i after the change, P_i^{old} and W_i^{old} are the existing numbers of the same variables, p_{kg} is the average number of part-time workers per person in category kg, w_{kg} is the average number of workers per person in category kg, and dX_{ikg} is the change in number of persons in category kg in zone i. The ratios were calculated based on totals across zones (implying that they represent national averages). The values of the ratios found in this way were:

$h_k = 0.637$	k = 55-64 yr	
$h_k = 0.695$	k = 65-74 yr	
$p_{kg} = 0.082$	k = 55-64 yr	g = male
$p_{kg} = 0.281$	k = 55-64 yr	g = female
$p_{kg} = 0.050$	k = 65-74 yr	g = male
$p_{kg} = 0.041$	k = 65-74 yr	g = female
$w_{kg} = 0.491$	k = 55-64 yr	g = male
$w_{kg} = 0.223$	k = 55-64 yr	g = female
$w_{kg} = 0.049$	k = 65-74 yr	g = male
$w_{kg} = 0.014$	k = 65-74 yr	g = female

6.3.2 Results

Appendix 9 shows the predicted consequences of this variant by comparing the GE scenario under Variants 1+2+3 to the same scenario under Variants 1+2. On the outset, it is worth noting that the population synthesis may lead to demograhic changes beyond the location changes. This happens if socio-economic attributes of households, such as for example car-possession, are related to urban density. Then redistributing population across urban and non-urban areas also lead to changing such attributes. Regarding the synthetic population, Appendix 9 only includes those frequency tables where significant changes occurred. As a direct consequence of the variant, this occurred for urban-density (stedelijkheidsgraad) of the residential location (Table A2). The number of households in highest-density areas decreases with 3.5% and the number of households in second-highest density areas decreases with 4.5%. The population in low density areas increases with 4.7 % (density = 4) and 5.1% (density = 5). As a secondary effect, a small change in car-possession occurs (Table A1). The number of households without a car decreases with -1.1%.

The impacts of the scenario on mobility indicators are as follows.

- Table B1-2: at the level of the entire population mobility effects appear not to be significant or very small.
- Tables B4-5: as expected, impacts on mobility indicators are more clearly visible in the age-group of 55-64 where most of the change occurs in the scenario. Within this group, the distance traveled as car-driver increases with 3.1% and the distance traveled by slow modes decreases with 5.2%. In the 65-74 group, on the other hand, the only significant change is a decrease of car-passenger mode (-3.1%).

The impacts on underlying activity and travel choices are as follows:

- Tables C1.1-C1.3: although the total number of activities does not change significantly, we do see changes in activity-type choice. For the 55-64 age group a decrease in the number of shopping activities (-2.8%, multiple-store shopping) and an increase of work activities (+2.9%) occur. For the 65-74 age group there are no significant changes in activity choice.
- Tables C2: there are no significant changes in activity duration choice.
- Tables C3.1-3.3: in the 55-64 yr group we see a small increase of activities starting before 10 am (+2.2%), a small increase of activities starting in the late afternoon (+1.1%) and evening (+1.2%). In the 65-74 yr group we see no clear significant changes.
- Table C4: there are no significant changes in trip-chaining.
- Tables C5-6: the number of activities conducted in the own postcode area increases slightly (+0.9%) and the number of activities conducted outside the own municipality increases (in particular munipalities of order 1 and 2). The shifts are more clearly visible if we look at the subset of work activities only.
- Tables C7-8: there are no significant changes in the distribution of days across number of tours on a day. The number of activities on a tour also stays approximately constant.
- Tables C9.1-9.3: the 55-64 yr group shows an increase of choice of car-driver mode (+2.6%) at the expenses of slow (-1.4%) and public-transport mode (-8.8%). In the 65-74 yr group, we see an increase of public-transport tours.

6.3.3 Discussion

As predicted by the model, a move of part of the 55-64 group from urban to non-urban areas leads to an increase of total distance traveled as car-driver of 3.1% in this age group. This increase coincides with decreases in distance traveled by slow modes. The number of shopping activities decreases, but this is compensated by an increase of out-of-home work-related activities. As a result, the total number of activities stays approximately constant. As there is no increase or decrease of trip-chaining, the number of trips stays the same as well. There is a small shift in destination choice. The activities conducted in the own postcode area and outside the own municipality both increase. The increase of activities in the own postcode area is perhaps unexpected, but may be explained by the fact that postcode areas in non-urban areas tend to be larger than postcode areas in urban areas. If we correct for this, we note that the average trip length increases, as more activities are conducted outside the municipality where the individual lives. The increase in activities starting in the early morning hours may reflect a characteristic of rural life or possibly reflect less congested traffic conditions on roads in rural areas during morning peak hours. On the other hand, changes predicted for the 65-74 groups tend to be not significant, probably, because the scenario assumes only a very small re-distribution for this group. The only significant difference occurring is an increase in car-passenger mode (on a per km basis) and an increase of public transport mode (on a per-tour basis). This suggests that the elderly who move to high urban density areas use car-passenger more often for long-distant trips and public-transport more often for short-distance trips.

In sum, according to the model, a movement from urban to non-urban areas of part of the 55-64 yr group leads to: increase of car possession, decrease of shopping activities, increase of work-related activities, increase of car-driver mode, possibly an increase of average trip length and an increase of traffic in morning-peak hours. A move in opposite direction of part of the 65-74 yr groups, on the other hand, leads to an increase of car-passenger km and public-transport use.

6.4 The separate effects of Variants 2 and 3

The foregoing sections considered the effects of behavioral variants 2 and 3 when added successively to a growing scenario including earlier assumed variants. In theory, the effect of a given variant may be different when it is added to a baseline situation compared to when it is added to a scenario including other variants. This occurs when there are interaction effects between the manipulations involved. To examine such effects, in this section, we analyse the separate effects of behavioral variants, i.e. the impacts when the variant occurs in isolation. Appendix 8 shows the results of GE plus Variant 2 compared to the baseline GE scenario and Appendix 10 shows the results of GE plus Variant 3 compared to the baseline GE scenario.

6.4.1. Variant 2 separately

Appendix 8 shows results for the same set of indicator and frequency tables as used in the earlier case where the variant was considered in a cumulative scenario (Appendix 7). This means that Appendix 7 and Appendix 8 can be compared in a one-to-one fashion. As it appears, the signs and magnitudes of effects are largely the same indicating that by and large there are no important interaction effects between avoiding morning peak hours (Variant 2) and increased out-of-home activities (Variant 1). There is only one exception. The increase of trip chaining is somewhat stronger in the scenario where Variant 1 is not included compared to the scenario where Variant 1 is included. All other effects of Variant 2 are approximately independent of presence of Variant 1.

6.4.2. Variant 3 separately

The results shown in Appendix 10 (Variant 3 seperately) can be directly compared to the results represented in Appendix 9 (Variant 3 cumulative), except that Tables A1 and A2, which represent demographic variables, are not repeated in Appendix 10 (as one and the same population is used in both analyses). As it appears, there are no major differences in effects except that mobility effects for the 55-64 yr group are slightly amplified (Table B4, Table C9.1). That is to say, the increase in the total km traveled and, particularly, the increase in km traveled as car driver is stronger in a setting where the elderly do not increase their out-of-home activities and avoid the morning peak. To put it in another way, displaying more out-of-home activities and delaying activities (til after the morning peak) reduces somewhat the increase of car-driver mode and overall mobility that is caused by a shift in residence location to less density urban areas.

6.4.3. Discussion

The effects of Variant 2 and Variant 3 do not change substantially when they would occur in isolation rather than in the context of other behavioral changes. As a tendency a trip-chaining effect of Variant 2 and the mobility increase of Variant 3 are both slightly stronger. This indicates that the increase of out-of-home activities decreases somewhat the relative impacts of avoiding morning peak and changing residence location.

6.5 GE-2020-Variants 1+2+3 compared to the baseline 2000 scenario

In this section, we compare the GE-2020 scenario including all three behavioral variants with the baseline situation in 2000, to investigate overall impacts across all anticipated changes. We make this comparison both without (Appendix 11) and with the price policy (Appendix 12). The analyses in foregoing sections already revealed the effects of the cumulative variants and price policy. Therefore, rather than discussing the results represented in Appendices 11 and 12 in much detail, we consider here a summary of these results on a selection of most important mobility indicators, given in Table 6.4. This table is structured as follows. The first column shows the numbers in absolute quantities for the Baseline situation in 2000 as reference. The next three columns show the percentage change of these baseline numbers for three variants of the GE 2020 scenario: the scenario without behavioral variants and without price policy (Base), the scenario with behavioral variants and without price policy, and the scenario with behavioral variants and with price policy. So, successively the impact of the set of variants and the impact of price policy are added to the basic 2020 scenario. Note that the figures in the table relate to an aggregate across all age groups (so not just the elderly).

The results indicate the following effects. First, the behavioral change of the elderly accounts for a further increase of the total distance traveled from +18.4 to +21.2 % in 2020 compared to 2000. So, the cohort effect is responsible for an increase of 2.8 percent points in total travel demand. For distance traveled as car driver this figure is 2.6 percent point (from +21.2 to +23.8%) and for distance traveled by public transport it is 2.1 percent point. The number of out-of-home activities increases from +17.3 to +20.1% as a consequence of the increased mobility of the elderly and, while trip-chaining does not change substantially, a similar increase holds for the number of trips. When we add the predicted effects of price policy (see the last column) the mobility developments between 2000 and 2020 change dramatically. The total distance traveled then increases with only 4.7% (without price policy this is 21.2%) and the distance traveled as car driver even decreases (-3.2%). Thus, despite the population growth and increased mobility of elderly, car mobility in 2020 would be slightly lower than in 2000 if the price policy is implemented. Other transport modes receive an extra impulse. Car passenger mode on a per km basis increases from +13.0 to +26.2% when the policy is implemented and public transport on a per km basis increases from +10.4 to +45.1%. Apart from a change in transport mode choice, the price policy has a surpressing effect on activity generation. The growth in out-of-home activities decreases from +20.1 to +17.6% when the policy is implemented and a similar effect is observed for number of trips. To conclude, the model predicts that the price policy can make a substantial

contribution to reducing car kilometers by promoting public transport mode and car sharing, by reducing frequency of out-of-home activities and through the location choice of activities.

Table 6.4. Summary of mobility effects of the GE 2020 and main variants

	Base 2000	GE 2020 (% increase)		
		Base 2020	Vars 1+2+3	Vars 1+2+3 C
Number of trips	32298	17.24	19.63	17.37
Ratio trips-tours	2.269	0.05	0.44	0.22
Total travel distance (km)	336848	18.42	21.17	4.74
Distance car driver (km)	252667	21.24	23.80	-3.24
Distance car passenger (km)	48384	8.78	13.01	26.18
Distance slow (km)	20259	14.06	16.20	22.13
Distance public transport (km)	15538	8.29	10.43	45.08
# Out-of-home activities	18063	17.29	20.05	17.57
# Car driver tours	6612	21.79	23.50	12.31
# Slow mode tours	5556	13.72	15.33	20.36
# Public transport tours	520	11.85	13.83	39.08
# Car passenger tours	1518	10.22	14.33	17.43

7 Conclusions and discussion

7.1 Summary

Scenarios and variants

This report has presented the results of a scenario-based simulation study of future activity-travel patterns. Existing WLO scenarios describing demographic, economic and spatial developments for the Netherlands were taken as a starting point. We focused on the so-called Global Europe (GE) and Regional Communities (RC) WLO scenarios and, furthermore, took into account possible behavioral changes of elderly and a possible road-price policy. Three behavioral variants state that elderly of the future compared to elderly of today are likely to 1) conduct out-of-home activities more often with most growth occurring in social/leisure activity category, 2) try to avoid morning peak hours by re-scheduling their flexible activities and 3) increasingly choose to live in lowly-urbanized areas (when 65 – 74 years of age) or in highly-urbanized area

(when 75 years of age or older). On the other hand, the price policy considered is specified according to what is known as the fifth variant of Nouwen. This policy includes a flat as well as a congestion charge per car km. In all scenarios and variants the year 2020 was taken as the forecast year and the year 2000 as the baseline.

To reveal effects of WLO scenarios, behavioral variants and price policy separately, the analyses where performed in steps. First, to assess the impacts of the GE and RC scenarios as such, the two WLO scenarios were compared to the base line both in a situation with and without the price policy. Next, the separate effects of the behavioral variants were considered by adding them successively to the basic 2020 scenario. The GE scenario is considered the most likely scenario and therefore was taken as a baseline for this set of analyses. Finally, the scenario including all three behavioral variants with and without the price policy was compared to the baseline 2000, to reveal mobility effects over all anticipated changes for 2020 (with and without price policy). The results of predictions can be summarized as follows.

WLO scenarios

First, the GE and RC scenarios imply quite strong differences in activity and travel choice and resulting travel demands. In the GE scenario, total travel demand (mobility) increases with 18.4%, which is somewhat stronger than the increase of the population (+17.4% on the level of household heads). The per-capita increase in mobility is due to an increase in average trip length. Individuals make longer trips in this scenario due to increased car possession, income growth and a decrease of variable costs of car. This also means that distance traveled by car grows more strongly (+21%). The mobility effects would have been stronger if the population would not age. Although elderly participate increasingly in the labor force, the average number of workers among elderly is still lower than average, meaning that per capita the number of work activities and, with that, the number of relatively long trips decreases.

In case of the RC scenario, the increase in mobility (total distance traveled) is considerably lower (+7.1%). This is largely due to the smaller growth of the population (+6.5% on the level of household heads) and absence of growth of participation of women in the labor force. Individuals make less trips because they perform less out-of-home activities in this future scenario. Whereas persons make less trips, the average trip length increases, as a consequence of a decrease in per-km costs of car and increase in income. The increase in average trip length is stronger for the RC scenario because variable costs of car are lower in this scenario. In both scenarios, km traveled as car-driver increases more than average and distance traveled by public transport increases less than average. Furthermore, aging in both scenarios lead to considerable shifts in activity choice (less work, less bring/get and more social and leisure activities). There are also notable shifts in the timing of activities related to these shifts (less activities during morning peak hours and more activities in weekends).

Behavioral variants

Behavioral variants have additionally substantial impacts on mobility. The total number of out-of-home activities increases with 2.6 % in the population at large. However, mobility grows with a lower rate because 1) activities are more often conducted together implying that the number of trips increases a little less and 2) the new activities, on average, are conducted somewhat closer to home than other activities. The car-driver mode increases to a lesser extent than the other transport modes. In particular, the car-passenger mode displays a relatively strong increase. As a result of all these changes, the distance traveled across all transport modes increases with 2.2%,

whereas the distance traveled as car driver increases with 2.1%. Also, the new activities have hardly any effect on morning-peak traffic as they tend to be conducted on later times of the day and for a substantial proportion in the weekend. The latter tendency is enhanced by the second variant where elderly try to avoid morning peak hours. This causes an additional shift of a total of 302,000 activities from early morning to, mainly, late morning. In the population at large, this reduces the number of activities starting in the early morning with 5.7%. Schedule effects appear but to a limited extent. As scheduling effects, trip-chaining and car-passenger mode increase a little. The spatial re-distribution of elderly of 2020 has several additional effects. In the 55-64 group, a shift from urban to non-urban areas leads to an increase of total distance traveled as car-driver with 3.1%, a decrease of use of slow modes and a modest increase of average trip length. On the other hand, in the 65-74 age group, the shift towards choosing residence in high urban density area is only very small and generates no significant mobility effects on the indicators considered.

In sum, what we see from the variants is a total growth of mobility in terms of passenger kilometres - especially the car -, travel time and trips with approximately 3% due to changing behaviour of the elderly people. So, the elderly of the future will contribute to a higher level of mobility.

Price policy

The price policy measure, if it were implemented, has substantial additional effects as well. The reduction in car kilometers is of the order of magnitude of 20% in GE and RC scenarios, which roughly corresponds to a price elasticity of the order of magnitude of 0.2 which is in line with existing empirical findings. The decrease in car travel demand is the combined result of several effects: activity generation (2% decrease of out-of-home activities), activity location choice (reduction of long-distance travel), transport mode choice (a substantial shift from car to public transport) and joint traveling (a shift from car-driver to car-passenger mode). The rate of trip-chaining decreases slightly, probably, as a side-effect of the shift from car to public-transport use. The effects of the price policy are, in relative terms, by and large the same for the different WLO scenarios and behavioral variants. In that sense, we see no significant interaction effects.

Overall

Comparison of a scenario that includes all anticipated changes – all three behavioral variants – simultaneously with the reference year gives an indication of likely mobility changes from 2000 to 2020. The model predicts that distance traveled across all modes increases with 4.7% (if road pricing is implemented) and with 21.2 % (if road pricing is not implemented). The effects are stronger for the different modes. Distance traveled as car driver *decreases* with 3.2% (with road pricing) and *increases* with 23.8% (without road pricing). For kilometers traveled by public transport these figures are 45.1 % (with) and 10.4% (without). At least partly, these mobility effects are generated by activity generation. The total number of out-of-home activities increases with 17.6% (with road pricing) and 20.1% (without road pricing). The increases are not equally distributed across days of the week and times of the day. Given the aging of the population and behavioral changes of the elderly group, it is expected that most growth in activities and trips takes place after the morning peak and in the weekend.

7.2 Discussion

Policy implications

The WLO scenarios and assumed behavioral changes of elderly in the future have substantial impacts on the total size of traffic volumes as well as distributions of this traffic across transport modes, times of day, days of the week and space. The aging of the population, on the one hand, has a decreasing effect on mobility simply because elderly on average participate less than average in out-of-home activities and, especially, in work activities. For the year 2020, however, the elderly become substantially more mobile, first, because of an increased participation in work (more women and postponed retirement) and due to an increased participation especially in outdoor social and leisure activities. The increase of outdoor leisure and social activities and, to a lesser extent, shopping activities is a cohort effect (assumed by variant 1) and is further enhanced by increased wealth (income growth), car possession and lower fuel use of future cars. Also due to a simultaneous price increase of train, car mobility increases particularly strongly, whereas the share of public transport hardly changes in most scenarios and variants. The growth of social and leisure activities together with a shift in starting times of activities from the morning peak to the late morning (in variant 2), however, reduces the load on highways during morning peak hours. Furthermore, the increase in traffic, percentage wise, will be stronger in the weekend than on weekdays. On the other hand we see an increase of activities starting between 4-6 pm, which affects the afternoon peak hour. Finally, destination choice of trips for social and leisure trips undergo an influence. Increased car use, increased income and decrease of fuel costs all work in favor of longer distance trips. Since higher order locations (i.e., larger cities) will be chosen for an increasing number of trips, this means that not only the traffic volume but also the spatial distribution of the trips will change. The latter will be enhanced by the shift in spatial distribution of residences of elderly in Variant 3. All in all, it is to be expected that aging, in scenarios such as GE and under the behavioral variants, will have an increasing impact on the afternoon traffic peak, whereas the morning peak will hardly be affected. A pricing policy such as Variant 5 of Nouwen, according to the model, effectively surpresses the car mobility effects in terms of both volume and spatial and temporal distributions. Finally, we note that scheduling effects of changes assumed in Variants 1 and 2 are, according to the model, only very modest. This means that a policy focused on reducing outdoor activities before 10 am (like congestion pricing) can have an impact on congestion during the morning peak in 2020 without producing unfavorable secondary effects.

The activity-based approach

Activity-based models have only recently started to make the transition to practice implying that experiences with applications of these models are still very limited to date. Apart from the substantial findings, this study adds to this experience. The predictions showed clear activity scheduling effects implying that a behavioral change on one facet often entails changes on other facets of activity patterns as well. For example, in predictions we often see that increases of activities in one category are partly or fully compensated by decreases of activities in other categories with as a result that the number of trips displays a tendency to stay more constant than one would expect if these compensatory effects are not taken into account. As another example, in predictions of the model, shifts in the distribution of activities across activity categories tend to have effects on many other facets of activity patterns such as start times,

locations, trip-chaining and transport-mode choice. Using a relatively fine classification of activities, Albatross is highly sensitive to effects of such shifts. The results of scenario analyses showed many other examples of secondary responses, which would not be revealed by trip-based models. Finally, we note that the detailed information that an activity-based model such as Albatross provides about activity patterns helps to built a comprehensive and coherent view of the behavioral changes underlying changes in mobility patterns which is a prerequisite for effective policy making.

Future model developments

This scenario study revealed the specific strengths of the activity-based approach in general and Albatross in specific. Neverthelees, there are several aspects of the model that could be improved in future research. First, the current model generates activity-travel schedules only for a subset of individuals in a population, namely the household heads. Since it may not be assumed that children behave in the same way as adults, this means that it is not straight-forward to generalize and assess quantitatively what the predicted effects would imply for the full population. Therefore, extension of the model such that it also can generate activity-travel schedules of children would improve the usefulness of the model. Second, in the present model there is no feedback of travel-time on activity-travel choice behavior. In reality, however a shift in, for example, the timing of activities, when it is substantial, may, through alleviating or enhacing congestion on certain routes, change travel times between relations and these changes in travel time may affect activity-travel choices, and so on. It seems worth while to explore a system where a traffic assignment model is linked to the activity-based model in a dynamic loop.

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Appendix 1: GE-2020 scenario compared to baseline 2000

	Base-2000 (× 1000)	GE-2020 (× 1000)	GE-Base	GE-Base
A1 Household composition (All cases)				
	m0	m1	m1-m0 (%)	sign
Single, no worker	1545	2467	59.65	**
Single, one worker	1220	2002	64.13	**
Double, one worker	1224	1071	-12.54	**
Double, two worker	1830	1978	8.08	**
Double, no worker	1018	1119	9.9	**
Total (households)	6838	8637	26.31	**
A2 Household SEC (All cases)				
	m0	m1	m1-m0 (%)	sign
Minimum	1814	1157	-36.21	**
Low	1665	1089	-34.63	**
Medium	1454	2478	70.49	**
High	1904	3913	105.45	**
Total (households)	6838	8637	26.31	**
A3 Household age (All cases)				
	m0	m1	m1-m0 (%)	sign
< 35 yr	1473	1705	15.77	**
35-<55 yr	2799	2900	3.62	**
55-<65 yr	983	1520	54.60	**
65-<75 yr	791	1338	69.05	**
75+ yr	791	1173	48.35	**
Total (households)	6838	8637	26.31	**
A4 Household children (All cases)				
	m0	m1	m1-m0 (%)	sign
No children	4904	6854	39.75	**
< 6 yr	904	796	-11.94	**
6-<12 yr	541	515	-4.92	**
12-<17 yr	488	472	-3.20	*
Total (households)	6838	8637	26.31	**
A5 Number of cars (All cases)				
	m0	m1	m1-m0 (%)	sign
No car	1371	1539	12.29	**
One car	3824	4852	26.88	**
2 or more	1643	2246	36.70	**
Total (households)	6838	8637	26.31	**

	Base-2000 (× 1000)	GE-2020 (× 1000)	GE-Base	GE-Base

A6 Gender (All cases)

	m0	m1	m1-m0 (%)	sign
Male	5419	6322	16.66	**
Female	5491	6483	18.06	**
Total (persons)	10910	12805	17.36	**

A7 Person work status (All cases)

	m0	m1	m1-m0 (%)	sign
No	4806	5776	20.18	**
Part time	1616	2070	28.13	**
Full time	4488	4959	10.47	**
Total (persons)	10910	12805	17.36	**

A8 Person age (All cases)

	m0	m1	m1-m0 (%)	sign
< 35 yr	2561	2691	5.10	**
35-<55 yr	4680	4544	-2.92	**
55-<65 yr	1533	2322	51.49	**
65-<75 yr	1186	1902	60.39	**
75+ yr	950	1345	41.53	**
Total (persons)	10910	12805	17.36	**

B1 Indicators (All cases)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	490025	572857	16.90	**
Travel time car driver (min)	238922	293981	23.04	**
Travel time public transport (min)	51883	52707	1.59	
Travel time slow (min)	149727	170423	13.82	**
Travel time car passenger (min)	48591	53994	11.12	**
Number of tours	14235	16682	17.18	**
Number of trips	32298	37867	17.24	**
Ratio trips-tours	2.269	2.27	0.05	
Ratio single stop tours - all tours	0.803	0.802	-0.18	
Total travel distance (km)	336848	398908	18.42	**
Distance car driver (km)	252667	306343	21.24	**
Distance car passenger (km)	48384	52633	8.78	**
Distance slow (km)	20259	23107	14.06	**
Distance public transport (km)	15538	16826	8.29	**

	Base-2000 (× 1000)	GE-2020 (× 1000)	GE-Base	GE-Base
B2 Indicators (Weekdays)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	381499	445010	16.65	**
Travel time car driver (min)	186219	227984	22.43	**
Travel time public transport (min)	42725	44086	3.19	
Travel time slow (min)	116552	131869	13.14	**
Travel time car passenger (min)	35247	39535	12.17	**
Number of tours	10810	12634	16.88	**
Number of trips	24530	28696	16.99	**
Ratio trips-tours	2.269	2.271	0.09	
Ratio single stop tours - all tours	0.806	0.804	-0.26	
Total travel distance (km)	260166	306808	17.93	**
Distance car driver (km)	195967	235780	20.32	**
Distance car passenger (km)	35302	38781	9.86	**
Distance slow (km)	16013	18180	13.54	**
Distance public transport (km)	12884	14067	9.18	**

B3 Indicators (Weekend)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	108525	127847	17.80	**
Travel time car driver (min)	52703	65996	25.22	**
Travel time public transport (min)	9158	8621	-5.87	*
Travel time slow (min)	33176	38554	16.21	**
Travel time car passenger (min)	13344	14459	8.36	
Number of tours	3426	4048	18.16	**
Number of trips	7769	9171	18.05	**
Ratio trips-tours	2.268	2.266	-0.09	
Ratio single stop tours - all tours	0.795	0.796	0.10	
Total travel distance (km)	76683	92100	20.10	**
Distance car driver (km)	56700	70562	24.45	**
Distance car passenger (km)	13083	13852	5.88	
Distance slow (km)	4246	4927	16.02	**
Distance public transport (km)	2654	2759	3.97	

	Base-2000 (× 1000)	GE-2020 (× 1000)	GE-Base	GE-Base
B4 Indicators (< 55 yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	364245	367790	0.97	
Travel time car driver (min)	184219	195172	5.95	**
Travel time public transport (min)	38702	35298	-8.80	*
Travel time slow (min)	106447	103800	-2.49	*
Travel time car passenger (min)	34150	32220	-5.65	**
Number of tours	10247	10260	0.12	
Number of trips	23342	23410	0.29	
Ratio trips-tours	2.278	2.282	0.17	
Ratio single stop tours - all tours	0.801	0.799	-0.30	
Total travel distance (km)	254759	261095	2.49	**
Distance car driver (km)	194426	203702	4.77	**
Distance car passenger (km)	34303	31739	-7.47	**
Distance slow (km)	14633	14373	-1.78	
Distance public transport (km)	11397	11282	-1.01	

B5 Indicators (55-64 yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	62527	102974	64.69	**
Travel time car driver (min)	31033	53090	71.08	**
Travel time public transport (min)	5564	8946	60.78	**
Travel time slow (min)	19051	30739	61.36	**
Travel time car passenger (min)	6764	9877	46.03	**
Number of tours	1899	3000	57.97	**
Number of trips	4301	6797	58.04	**
Ratio trips-tours	2.265	2.266	0.04	
Ratio single stop tours - all tours	0.801	0.803	0.22	
Total travel distance (km)	43847	72108	64.45	**
Distance car driver (km)	32814	55598	69.43	**
Distance car passenger (km)	6745	9501	40.85	**
Distance slow (km)	2527	4179	65.41	**
Distance public transport (km)	1762	2830	60.68	**

	Base-2000 (× 1000)	GE-2020 (× 1000)	GE-Base	GE-Base
B6 Indicators (65-74 yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	36967	63241	71.07	**
Travel time car driver (min)	15508	30454	96.37	**
Travel time public transport (min)	3509	4170	18.81	*
Travel time slow (min)	13394	20994	56.75	**
Travel time car passenger (min)	4512	7525	66.78	**
Number of tours	1252	2140	70.96	**
Number of trips	2796	4805	71.85	**
Ratio trips-tours	2.234	2.246	0.53	
Ratio single stop tours - all tours	0.812	0.806	-0.71	
Total travel distance (km)	23500	42304	80.02	**
Distance car driver (km)	16446	31072	88.93	**
Distance car passenger (km)	4287	7213	68.25	**
Distance slow (km)	1679	2638	57.17	**
Distance public transport (km)	1088	1381	26.88	

B7 Indicators (75+ yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	26286	38851	47.80	**
Travel time car driver (min)	8162	15264	87.02	**
Travel time public transport (min)	4107	4293	4.54	
Travel time slow (min)	10836	14890	37.41	**
Travel time car passenger (min)	3165	4371	38.13	**
Number of tours	837	1283	53.18	**
Number of trips	1859	2855	53.59	**
Ratio trips-tours	2.22	2.226	0.27	
Ratio single stop tours - all tours	0.822	0.817	-0.58	
Total travel distance (km)	14742	23401	58.73	**
Distance car driver (km)	8981	15971	77.83	**
Distance car passenger (km)	3050	4181	37.09	**
Distance slow (km)	1421	1916	34.89	**
Distance public transport (km)	1291	1333	3.27	

C1.1 Activity type (All cases)				
	m0	m1	m1-m0 (%)	sign
Work	3438	3966	15.36	**
Business	1135	1333	17.51	**
Bring or get	1537	1471	-4.27	
Shop one store	3985	4852	21.75	**
Shop multiple stores	813	951	17.03	**
Service	936	1140	21.79	**
Social	2197	2629	19.70	**
Leisure	2320	2802	20.76	**
Touring	1431	1718	20.07	**
Other	272	323	18.78	**
Total (activities)	18063	21185	17.29	**

	Base-2000 (× 1000)	GE-2020 (× 1000)	GE-Base	GE-Base
C1.2 Activity type (55-<65 yr)				
	m0	m1	m1-m0 (%)	sign
Work	330	699	111.65	**
Business	137	263	91.80	**
Bring or get	78	108	38.60	**
Shop one store	607	896	47.51	**
Shop multiple stores	125	176	41.77	**
Service	151	214	41.77	**
Social	335	492	47.00	**
Leisure	344	534	55.07	**
Touring	254	362	42.45	**
Other	40	53	29.79	**
Total (activities)	2402	3797	58.09	**

C1.3 Activity type (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
Work	25	60	139.64	**
Business	24	43	83.72	**
Bring or get	37	68	80.61	**
Shop one store	530	860	62.18	**
Shop multiple stores	101	159	57.23	**
Service	131	216	65.54	**
Social	205	366	78.38	**
Leisure	226	382	69.01	**
Touring	182	316	73.61	**
Other	22	47	108.99	**
Total (activities)	1483	2516	69.64	**

C1.4 Activity type (75+ yr)

	m0	m1	m1-m0 (%)	sign
Work	9	12	35.03	*
Business	9	18	86.32	**
Bring or get	13	35	169.50	**
Shop one store	376	579	54.24	**
Shop multiple stores	87	121	39.88	**
Service	85	137	60.89	**
Social	152	233	53.25	**
Leisure	164	248	51.68	**
Touring	122	178	45.29	**
Other	5	12	135.35	**
Total (activities)	1022	1573	53.94	**

	Base-2000 (× 1000)	GE-2020 (× 1000)	GE-Base	GE-Base

C2 Activity duration (All cases)

	m0	m1	m1-m0 (%)	sign
<= 10 min	3740	4243	13.46	**
11-20 min	1571	1806	14.96	**
21-30 min	2837	3407	20.08	**
31-45 min	244	274	11.95	**
46-60 min	417	492	17.96	**
61-80 min	1611	1953	21.25	**
81-120 min	2478	2958	19.40	**
> 120 min	5164	6052	17.19	**
Total (activities)	18063	21185	17.29	**

C3.1 Activity begin time (All cases)

	m0	m1	m1-m0 (%)	sign
<= 10 am	4644	5343	15.06	**
10-12 am	2500	2956	18.26	**
12-2 pm	2378	2786	17.19	**
2-4 pm	2994	3558	18.84	**
4-6 pm	2181	2561	17.38	**
> 6 pm	3366	3981	18.28	**
Total (activities)	18063	21185	17.29	**

C3.2 Activity begin time (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
<= 10 am	491	909	85.17	**
10-12 am	375	535	42.68	**
12-2 pm	341	498	45.93	**
2-4 pm	450	667	48.28	**
4-6 pm	296	467	57.92	**
> 6 pm	450	722	60.52	**
Total (activities)	2402	3797	58.09	**

C3.3 Activity begin time (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
<= 10 am	201	380	88.62	**
10-12 am	316	519	64.13	**
12-2 pm	245	414	69.06	**
2-4 pm	340	577	69.94	**
4-6 pm	181	308	70.28	**
> 6 pm	262	468	78.69	**
Total (activities)	1545	2666	72.57	**

	Base-2000 (× 1000)	GE-2020 (× 1000)	GE-Base	GE-Base
C3.4 Activity begin time (75+ yr)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	125	192	53.95	**
10-12 am	229	345	50.33	**
12-2 pm	165	263	58.75	**
2-4 pm	235	354	50.42	**
4-6 pm	113	175	55.27	**
> 6 pm	154	244	58.53	**
Total (activities)	1022	1573	53.94	**

C4 Activity trip pattern (All cases)				
	m0	m1	m1-m0 (%)	sign
Single stop	11433	13374	16.98	**
After stop	2803	3308	18.02	**
Before stop	2803	3308	18.02	**
Between stop	1025	1196	16.72	**
Total (activities)	18063	21185	17.29	**

C5.1 Activity location (All cases)				
	m0	m1	m1-m0 (%)	sign
home zone	5459	6276	14.98	**
home municipality	5198	6064	16.67	**
municipality order 1	2794	2976	6.52	**
municipality order 2	1655	2217	33.94	**
municipality order 3	1179	1346	14.12	**
municipality order 4	811	1053	29.82	**
municipality order 5	960	1228	27.90	**
Total (activities)	18063	21185	17.29	**

C5.2 Activity location (Work)				
	m0	m1	m1-m0 (%)	sign
home zone	380	415	9.18	**
home municipality	1078	1287	19.31	**
municipality order 1	630	663	5.29	**
municipality order 2	415	474	14.15	**
municipality order 3	358	427	19.31	**
municipality order 4	239	268	11.84	**
municipality order 5	331	408	23.28	**
Total (activities)	3438	3966	15.36	**

	Base-2000 (× 1000)	GE-2020 (× 1000)	GE-Base	GE-Base

C6.1 Number of tours (All cases)

	m0	m1	m1-m0 (%)	sign
0	2349	2710	15.35	**
1	4605	5451	18.36	**
2	2709	3208	18.40	**
3	897	1057	17.76	**
> 3	349	380	8.63	**
Total (person-days)	10910	12805	17.36	**

C6.2 Number of tours (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
0	367	488	32.92	**
1	630	994	57.75	**
2	382	589	54.12	**
3	119	194	62.43	**
> 3	35	58	67.83	**
Total (person-days)	1533	2322	51.49	**

C6.3 Number of tours (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
0	384	555	44.48	**
1	469	762	62.62	**
2	240	420	75.06	**
3	74	130	75.39	**
> 3	19	35	83.07	**
Total (person-days)	1186	1902	60.39	**

C6.4 Number of tours (75+ yr)

	m0	m1	m1-m0 (%)	sign
0	378	494	30.81	**
1	365	523	43.15	**
2	160	243	52.35	**
3	40	69	73.93	**
> 3	8	16	95.63	**
Total (person-days)	950	1345	41.53	**

C7 Number of activities per tour (All cases)

	m0	m1	m1-m0 (%)	sign
1	11433	13374	16.98	**
2	2075	2454	18.24	**
3	518	608	17.45	**
4	142	171	20.59	**
> 4	68	75	10.46	*
Total (tours)	14235	16682	17.18	**

	Base-2000 (× 1000)	GE-2020 (× 1000)	GE-Base	GE-Base

C8.1 First tour mode (All cases)

	m0	m1	m1-m0 (%)	sign
Car driver	6612	8052	21.79	**
Slow mode	5556	6318	13.72	**
Public transport	520	582	11.85	**
Car passenger	1518	1673	10.22	**
Total (tours)	14235	16682	17.18	**

C8.2 First tour mode (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
Car driver	884	1447	63.68	**
Slow mode	742	1135	53.01	**
Public transport	55	97	77.09	**
Car passenger	214	311	44.93	**
Total (tours)	1899	3000	57.97	**

C8.3 First tour mode (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
Car driver	472	937	98.37	**
Slow mode	583	898	54.12	**
Public transport	40	53	31.64	**
Car passenger	155	248	60.29	**
Total (tours)	1252	2140	70.96	**

C8.4 First tour mode (75+ yr)

	m0	m1	m1-m0 (%)	sign
Car driver	232	463	99.25	**
Slow mode	442	615	39.25	**
Public transport	53	58	9.79	**
Car passenger	110	145	32.06	**
Total (tours)	837	1283	53.18	**

Appendix 2: RC-2020 scenario compared to baseline 2000

	Base-2000 (× 1000)	RC-2020 (× 1000)	RC-Base	RC-Base
A1 Household composition (All cases)				
	m0	m1	m1-m0 (%)	sign
Single, no worker	1545	1851	19.82	**
Single, one worker	1220	1268	3.92	**
Double, one worker	1224	1161	-5.15	**
Double, two worker	1830	1732	-5.37	**
Double, no worker	1018	1357	33.26	**
Total (households)	6838	7369	7.77	**
A2 Household SEC (All cases)				
	m0	m1	m1-m0 (%)	sign
Minimum	1814	1664	-8.31	**
Low	1665	1432	-14.02	**
Medium	1454	1773	22.00	**
High	1904	2500	31.28	**
Total (households)	6838	7369	7.77	**
A3 Household age (All cases)				
	m0	m1	m1-m0 (%)	sign
< 35 yr	1473	1215	-17.52	**
35-<55 yr	2799	2522	-9.89	**
55-<65 yr	983	1386	41.00	**
65-<75 yr	791	1202	51.86	**
75+ yr	791	1043	31.93	**
Total (households)	6838	7369	7.77	**
A4 Household children (All cases)				
	m0	m1	m1-m0 (%)	sign
No children	4904	5765	17.55	**
< 6 yr	904	693	-23.35	**
6-<12 yr	541	459	-15.24	**
12-<17 yr	488	452	-7.36	**
Total (households)	6838	7369	7.77	**
A5 Number of cars (All cases)				
	m0	m1	m1-m0 (%)	sign
No car	1371	1505	9.82	**
One car	3824	4145	8.39	**
2 or more	1643	1719	4.62	**
Total (households)	6838	7369	7.77	**

	Base-2000 (× 1000)	RC-2020 (× 1000)	RC-Base	RC-Base
A6 Gender (All cases)				
	m0	m1	m1-m0 (%)	sign
Male	5419	5762	6.33	**
Female	5491	5857	6.66	**
Total (persons)	10910	11619	6.50	**

A7 Person work status (All cases)				
	m0	m1	m1-m0 (%)	sign
No	4806	5726	19.15	**
Part time	1616	1661	2.79	**
Full time	4488	4232	-5.72	**
Total (persons)	10910	11619	6.50	**

A8 Person age (All cases)				
	m0	m1	m1-m0 (%)	sign
< 35 yr	2561	2014	-21.34	**
35-<55 yr	4680	4247	-9.25	**
55-<65 yr	1533	2256	47.18	**
65-<75 yr	1186	1845	55.58	**
75+ yr	950	1256	32.16	**
Total (persons)	10910	11619	6.50	**

B1 Indicators (All cases)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	490025	502188	2.48	**
Travel time car driver (min)	238922	252767	5.79	**
Travel time public transport (min)	51883	46057	-11.23	**
Travel time slow (min)	149727	153915	2.80	**
Travel time car passenger (min)	48591	48397	-0.40	
Number of tours	14235	14862	4.40	**
Number of trips	32298	33730	4.43	**
Ratio trips-tours	2.269	2.27	0.03	
Ratio single stop tours - all tours	0.803	0.802	-0.13	
Total travel distance (km)	336848	360682	7.08	**
Distance car driver (km)	252667	276888	9.59	**
Distance car passenger (km)	48384	48335	-0.10	
Distance slow (km)	20259	20872	3.03	**
Distance public transport (km)	15538	14587	-6.12	*

	Base-2000 (× 1000)	RC-2020 (× 1000)	RC-Base	RC-Base
B2 Indicators (Weekdays)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	381499	389884	2.20	*
Travel time car driver (min)	186219	195630	5.05	**
Travel time public transport (min)	42725	38214	-10.56	**
Travel time slow (min)	116552	119308	2.36	*
Travel time car passenger (min)	35247	35849	1.71	
Number of tours	10810	11297	4.51	**
Number of trips	24530	25643	4.54	**
Ratio trips-tours	2.269	2.27	0.03	
Ratio single stop tours - all tours	0.806	0.805	-0.15	
Total travel distance (km)	260166	277350	6.61	**
Distance car driver (km)	195967	212789	8.58	**
Distance car passenger (km)	35302	36073	2.19	
Distance slow (km)	16013	16439	2.66	**
Distance public transport (km)	12884	12048	-6.49	**

B3 Indicators (Weekend)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	108525	112304	3.48	**
Travel time car driver (min)	52703	57137	8.41	**
Travel time public transport (min)	9158	7843	-14.36	**
Travel time slow (min)	33176	34608	4.32	
Travel time car passenger (min)	13344	12548	-5.97	
Number of tours	3426	3565	4.06	**
Number of trips	7769	8086	4.09	**
Ratio trips-tours	2.268	2.268	0.03	
Ratio single stop tours - all tours	0.795	0.794	-0.10	
Total travel distance (km)	76683	83333	8.67	**
Distance car driver (km)	56700	64099	13.05	**
Distance car passenger (km)	13083	12262	-6.27	
Distance slow (km)	4246	4433	4.40	
Distance public transport (km)	2654	2539	-4.33	

	Base-2000 (× 1000)	RC-2020 (× 1000)	RC-Base	RC-Base
B4 Indicators (< 55 yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	364245	314219	-13.73	**
Travel time car driver (min)	184219	162979	-11.53	**
Travel time public transport (min)	38702	31034	-19.81	**
Travel time slow (min)	106447	91691	-13.86	**
Travel time car passenger (min)	34150	27739	-18.78	**
Number of tours	10247	8875	-13.40	**
Number of trips	23342	20250	-13.25	**
Ratio trips-tours	2.278	2.282	0.17	
Ratio single stop tours - all tours	0.801	0.799	-0.28	
Total travel distance (km)	254759	229234	-10.02	**
Distance car driver (km)	194426	178483	-8.20	**
Distance car passenger (km)	34303	28161	-17.90	**
Distance slow (km)	14633	12771	-12.72	**
Distance public transport (km)	11397	9818	-13.85	**

B5 Indicators (55-64 yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	62527	93896	50.17	**
Travel time car driver (min)	31033	50464	62.61	**
Travel time public transport (min)	5564	6662	19.73	*
Travel time slow (min)	19051	26937	41.40	**
Travel time car passenger (min)	6764	9668	42.93	**
Number of tours	1899	2852	50.18	**
Number of trips	4301	6478	50.63	**
Ratio trips-tours	2.265	2.272	0.31	
Ratio single stop tours - all tours	0.801	0.801	-0.09	
Total travel distance (km)	43847	70407	60.58	**
Distance car driver (km)	32814	55093	67.90	**
Distance car passenger (km)	6745	9665	43.29	**
Distance slow (km)	2527	3576	41.54	**
Distance public transport (km)	1762	2073	17.71	

	Base-2000 (× 1000)	RC-2020 (× 1000)	RC-Base	RC-Base
B6 Indicators (65-74 yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	36967	58631	58.60	**
Travel time car driver (min)	15508	26653	71.86	**
Travel time public transport (min)	3509	3942	12.32	**
Travel time slow (min)	13394	21081	57.40	**
Travel time car passenger (min)	4512	6878	52.44	**
Number of tours	1252	1991	59.03	**
Number of trips	2796	4457	59.40	**
Ratio trips-tours	2.234	2.239	0.24	
Ratio single stop tours - all tours	0.812	0.809	-0.40	
Total travel distance (km)	23500	39544	68.27	**
Distance car driver (km)	16446	29084	76.84	**
Distance car passenger (km)	4287	6557	52.96	**
Distance slow (km)	1679	2671	59.12	**
Distance public transport (km)	1088	1232	13.22	**

B7 Indicators (75+ yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	26286	35442	34.83	**
Travel time car driver (min)	8162	12671	55.25	**
Travel time public transport (min)	4107	4419	7.59	
Travel time slow (min)	10836	14206	31.10	**
Travel time car passenger (min)	3165	4112	29.93	**
Number of tours	837	1145	36.75	**
Number of trips	1859	2544	36.88	**
Ratio trips-tours	2.22	2.222	0.08	
Ratio single stop tours - all tours	0.822	0.82	-0.13	
Total travel distance (km)	14742	21497	45.82	**
Distance car driver (km)	8981	14228	58.42	**
Distance car passenger (km)	3050	3952	29.58	**
Distance slow (km)	1421	1854	30.52	**
Distance public transport (km)	1291	1463	13.33	**

C1.1 Activity type (All cases)				
	m0	m1	m1-m0 (%)	sign
Work	3438	3345	-2.70	**
Business	1135	1140	0.48	
Bring or get	1537	1352	-11.98	**
Shop one store	3985	4363	9.48	**
Shop multiple stores	813	881	8.36	**
Service	936	1041	11.16	**
Social	2197	2380	8.33	**
Leisure	2320	2471	6.49	**
Touring	1431	1605	12.13	**
Other	272	291	7.12	**
Total (activities)	18063	18868	4.46	**

	Base-2000 (× 1000)	RC-2020 (× 1000)	RC-Base	RC-Base
C1.2 Activity type (55-<65 yr)				
	m0	m1	m1-m0 (%)	sign
Work	330	579	75.33	**
Business	137	234	70.49	**
Bring or get	78	104	33.14	**
Shop one store	607	893	47.09	**
Shop multiple stores	125	175	40.40	**
Service	151	210	39.09	**
Social	335	492	47.12	**
Leisure	344	515	49.46	**
Touring	254	373	46.74	**
Other	40	52	27.94	**
Total (activities)	2402	3627	50.99	**

C1.3 Activity type (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
Work	30	66	118.29	**
Business	24	43	79.67	**
Bring or get	40	65	61.24	**
Shop one store	520	811	55.96	**
Shop multiple stores	104	162	55.58	**
Service	120	199	65.78	**
Social	234	373	59.67	**
Leisure	249	387	55.31	**
Touring	201	319	58.77	**
Other	22	41	87.10	**
Total (activities)	1545	2467	59.70	**

C1.4 Activity type (75+ yr)				
	m0	m1	m1-m0 (%)	sign
Work	9	14	53.11	**
Business	9	10	3.16	
Bring or get	13	23	79.92	**
Shop one store	376	505	34.58	**
Shop multiple stores	87	112	29.08	**
Service	85	125	46.74	**
Social	152	217	42.28	**
Leisure	164	223	36.44	**
Touring	122	162	32.53	**
Other	5	9	77.78	**
Total (activities)	1022	1399	36.98	**

	Base-2000 (× 1000)	RC-2020 (× 1000)	RC-Base	RC-Base

C2 Activity duration (All cases)

	m0	m1	m1-m0 (%)	sign
<= 10 min	3740	3883	3.81	**
11-20 min	1571	1604	2.06	**
21-30 min	2837	3072	8.28	**
31-45 min	244	245	0.18	
46-60 min	417	440	5.65	*
61-80 min	1611	1760	9.23	**
81-120 min	2478	2668	7.68	**
> 120 min	5164	5196	0.63	
Total (activities)	18063	18868	4.46	**

C3.1 Activity begin time (All cases)

	m0	m1	m1-m0 (%)	sign
<= 10 am	4644	4615	-0.61	
10-12 am	2500	2692	7.68	**
12-2 pm	2378	2519	5.94	**
2-4 pm	2994	3245	8.37	**
4-6 pm	2181	2277	4.40	**
> 6 pm	3366	3519	4.56	**
Total (activities)	18063	18868	4.46	**

C3.2 Activity begin time (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
<= 10 am	491	798	62.62	**
10-12 am	375	539	43.52	**
12-2 pm	341	500	46.55	**
2-4 pm	450	656	45.90	**
4-6 pm	296	445	50.58	**
> 6 pm	450	689	53.26	**
Total (activities)	2402	3627	50.99	**

C3.3 Activity begin time (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
<= 10 am	201	332	64.78	**
10-12 am	316	493	55.98	**
12-2 pm	245	380	55.47	**
2-4 pm	340	556	63.68	**
4-6 pm	181	289	59.70	**
> 6 pm	262	416	59.07	**
Total (activities)	1545	2467	59.70	**

	Base-2000 (× 1000)	RC-2020 (× 1000)	RC-Base	RC-Base
C3.4 Activity begin time (75+ yr)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	125	172	38.15	**
10-12 am	229	302	31.65	**
12-2 pm	165	231	39.53	**
2-4 pm	235	320	35.85	**
4-6 pm	113	162	43.44	**
> 6 pm	154	213	38.22	**
Total (activities)	1022	1399	36.98	**

C4 Activity trip pattern (All cases)				
	m0	m1	m1-m0 (%)	sign
Single stop	11433	11920	4.26	**
After stop	2803	2942	4.98	**
Before stop	2803	2942	4.98	**
Between stop	1025	1063	3.80	
Total (activities)	18063	18868	4.46	**

C5.1 Activity location (All cases)				
	m0	m1	m1-m0 (%)	sign
home zone	5459	5627	3.08	**
home municipality	5198	5390	3.70	**
municipality order 1	2794	2852	2.06	*
municipality order 2	1655	1803	8.93	**
municipality order 3	1179	1170	-0.78	
municipality order 4	811	881	8.59	**
municipality order 5	960	1133	18.04	**
Total (activities)	18063	18868	4.46	**

C5.2 Activity location (Work)				
	m0	m1	m1-m0 (%)	sign
home zone	380	341	-10.17	**
home municipality	1078	1051	-2.57	
municipality order 1	630	598	-5.06	**
municipality order 2	415	402	-3.20	
municipality order 3	358	369	3.03	*
municipality order 4	239	222	-7.29	**
municipality order 5	331	350	5.85	**
Total (activities)	3438	3345	-2.70	**

	Base-2000 (× 1000)	RC-2020 (× 1000)	RC-Base	RC-Base

C6.1 Number of tours (All cases)

	m0	m1	m1-m0 (%)	sign
0	2349	2617	11.38	**
1	4605	4880	5.97	**
2	2709	2845	5.01	**
3	897	933	3.96	**
> 3	349	345	-1.37	
Total (person-days)	10910	11619	6.50	**

C6.2 Number of tours (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
0	367	512	39.52	**
1	630	939	49.01	**
2	382	570	49.31	**
3	119	180	50.69	**
> 3	35	55	59.42	**
Total (person-days)	1533	2256	47.18	**

C6.3 Number of tours (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
0	384	571	48.72	**
1	469	740	57.75	**
2	240	387	61.34	**
3	74	118	59.68	**
> 3	19	29	52.08	**
Total (person-days)	1186	1845	55.58	**

C6.4 Number of tours (75+ yr)

	m0	m1	m1-m0 (%)	sign
0	378	483	27.99	**
1	365	485	32.91	**
2	160	218	36.48	**
3	40	56	40.85	**
> 3	8	13	65.00	*
Total (person-days)	950	1256	32.16	**

C7 Number of activities per tour (All cases)

	m0	m1	m1-m0 (%)	sign
1	11433	11920	4.26	**
2	2075	2181	5.09	**
3	518	545	5.26	
4	142	150	5.28	
> 4	68	67	-1.18	
Total (tours)	14235	14862	4.40	**

	Base-2000 (× 1000)	RC-2020 (× 1000)	RC-Base	RC-Base

C8.1 First tour mode (All cases)

	m0	m1	m1-m0 (%)	sign
Car driver	6612	6980	5.57	**
Slow mode	5556	5757	3.61	**
Public transport	520	527	1.41	
Car passenger	1518	1563	2.92	
Total (tours)	14235	14862	4.40	**

C8.2 First tour mode (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
Car driver	884	1414	59.96	**
Slow mode	742	1043	40.62	**
Public transport	55	75	37.49	**
Car passenger	214	313	45.88	**
Total (tours)	1899	2852	50.18	**

C8.3 First tour mode (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
Car driver	472	802	69.85	**
Slow mode	583	890	52.78	**
Public transport	40	53	31.40	**
Car passenger	155	242	56.67	**
Total (tours)	1252	1991	59.03	**

C8.4 First tour mode (75+ yr)

	m0	m1	m1-m0 (%)	sign
Car driver	232	362	55.64	**
Slow mode	442	575	30.21	**
Public transport	53	62	16.48	**
Car passenger	110	145	32.38	**
Total (tours)	837	1145	36.75	**

Appendix 3: GE 2020 with (GEC) and without (GE) pricing policy

	GE-2020 (× 1000)	GEC -2020 (× 1000)	GEC - GE	GEC - GE
B1 Indicators (All cases)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	569951	549839	-3.53	**
Travel time car driver (min)	291815	240290	-17.66	**
Travel time public transport (min)	52702	70853	34.44	**
Travel time slow (min)	170106	179378	5.45	**
Travel time car passenger (min)	53679	57716	7.52	**
Number of tours	16600	16318	-1.70	**
Number of trips	37686	36979	-1.88	**
Ratio trips-tours	2.27	2.266	-0.18	**
Ratio single stop tours - all tours	0.802	0.804	0.24	**
Total travel distance (km)	396905	341817	-13.88	**
Distance car driver (km)	304126	236951	-22.09	**
Distance car passenger (km)	52510	58293	11.01	**
Distance slow (km)	23149	24565	6.12	**
Distance public transport (km)	17121	22008	28.55	**

B2 Indicators (< 55 yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	365149	353069	-3.31	**
Travel time car driver (min)	193519	161635	-16.48	**
Travel time public transport (min)	35203	47104	33.81	**
Travel time slow (min)	103582	109118	5.34	**
Travel time car passenger (min)	31631	34009	7.52	**
Number of tours	10201	10052	-1.46	**
Number of trips	23268	22889	-1.63	**
Ratio trips-tours	2.281	2.277	-0.17	*
Ratio single stop tours - all tours	0.799	0.801	0.22	*
Total travel distance (km)	258812	224404	-13.29	**
Distance car driver (km)	201939	160026	-20.75	**
Distance car passenger (km)	31078	34498	11.01	**
Distance slow (km)	14407	15248	5.84	**
Distance public transport (km)	11389	14632	28.47	**

	GE-2020 (× 1000)	GEC-2020 (× 1000)	GEC - GE	GEC - GE

B3 Indicators (55-64 yr)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	103964	99891	-3.92	**
Travel time car driver (min)	52832	43594	-17.49	**
Travel time public transport (min)	9114	12219	34.07	**
Travel time slow (min)	31281	32691	4.51	**
Travel time car passenger (min)	10435	11106	6.43	**
Number of tours	3009	2945	-2.12	**
Number of trips	6827	6670	-2.31	**
Ratio trips-tours	2.269	2.265	-0.20	**
Ratio single stop tours - all tours	0.802	0.804	0.25	
Total travel distance (km)	73114	63108	-13.68	**
Distance car driver (km)	55497	43538	-21.55	**
Distance car passenger (km)	10346	11269	8.92	**
Distance slow (km)	4275	4491	5.04	**
Distance public transport (km)	2995	3811	27.23	**

B4 Indicators (65-74 yr)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	62474	60244	-3.57	**
Travel time car driver (min)	30258	23711	-21.64	**
Travel time public transport (min)	4183	6084	45.44	**
Travel time slow (min)	20669	22340	8.08	**
Travel time car passenger (min)	7273	8020	10.26	**
Number of tours	2118	2079	-1.83	**
Number of trips	4758	4663	-1.99	**
Ratio trips-tours	2.247	2.243	-0.16	
Ratio single stop tours - all tours	0.806	0.807	0.21	
Total travel distance (km)	41832	35263	-15.70	**
Distance car driver (km)	30868	22534	-27.00	**
Distance car passenger (km)	6938	7987	15.11	**
Distance slow (km)	2595	2849	9.79	**
Distance public transport (km)	1431	1893	32.33	**

	GE-2020 (× 1000)	GEC-2020 (× 1000)	GEC - GE	GEC - GE

B5 Indicators (75+ yr)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	38358	36635	-4.49	**
Travel time car driver (min)	15207	11349	-25.36	**
Travel time public transport (min)	4202	5445	29.59	**
Travel time slow (min)	14574	15230	4.50	**
Travel time car passenger (min)	4340	4582	5.57	*
Number of tours	1273	1243	-2.40	**
Number of trips	2833	2757	-2.69	**
Ratio trips-tours	2.225	2.218	-0.30	
Ratio single stop tours - all tours	0.818	0.822	0.49	
Total travel distance (km)	23147	19041	-17.74	**
Distance car driver (km)	15822	10853	-31.41	**
Distance car passenger (km)	4148	4540	9.45	**
Distance slow (km)	1872	1977	5.61	*
Distance public transport (km)	1305	1672	28.10	**

C1.1 Activity type (All cases)

	m0	m1	m1-m0 (%)	sign
Work	3948	3913	-0.89	**
Business	1331	1270	-4.59	**
Bring or get	1487	1481	-0.45	
Shop one store	4802	4760	-0.88	**
Shop multiple stores	948	938	-1.06	
Service	1112	1110	-0.17	
Social	2630	2507	-4.65	**
Leisure	2779	2697	-2.95	**
Touring	1723	1684	-2.28	**
Other	326	301	-7.48	**
Total (activities)	21086	20661	-2.02	**

C1.2 Activity type (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
Work	707	698	-1.21	**
Business	264	249	-5.79	**
Bring or get	110	111	0.73	
Shop one store	894	888	-0.70	
Shop multiple stores	176	173	-1.54	
Service	210	208	-1.06	
Social	504	479	-4.96	**
Leisure	536	513	-4.31	**
Touring	366	359	-1.94	
Other	52	47	-8.89	**
Total (activities)	3819	3725	-2.46	**

	GE-2020 (× 1000)	GEC-2020 (× 1000)	GEC - GE	GEC - GE

C1.3 Activity type (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
Work	100	99	-0.95	
Business	51	50	-3.34	
Bring or get	71	71	-0.67	
Shop one store	860	851	-1.06	*
Shop multiple stores	166	163	-1.68	
Service	202	203	0.37	
Social	397	379	-4.41	**
Leisure	423	407	-3.77	**
Touring	323	317	-2.06	
Other	47	45	-3.12	*
Total (activities)	2640	2585	-2.12	**

C1.4 Activity type (75+ yr)

	m0	m1	m1-m0 (%)	sign
Work	100	99	-0.95	
Business	51	50	-3.34	
Bring or get	71	71	-0.67	
Shop one store	860	851	-1.06	*
Shop multiple stores	166	163	-1.68	
Service	202	203	0.37	
Social	397	379	-4.41	**
Leisure	423	407	-3.77	**
Touring	323	317	-2.06	
Other	47	45	-3.12	*
Total (activities)	2640	2585	-2.12	**

C2 Activity trip pattern (All cases)

	m0	m1	m1-m0 (%)	sign
Single stop	13315	13121	-1.46	**
After stop	3285	3198	-2.66	**
Before stop	3285	3198	-2.66	**
Between stop	1201	1145	-4.68	**
Total (activities)	21086	20661	-2.02	**

C3.1 Activity location (All cases)

	m0	m1	m1-m0 (%)	sign
home zone	6263	6372	1.73	**
home municipality	6023	6104	1.34	**
municipality order 1	2947	2760	-6.36	**
municipality order 2	2202	2066	-6.19	**
municipality order 3	1347	1250	-7.23	**
municipality order 4	1051	959	-8.69	**
municipality order 5	1228	1125	-8.38	**
Total (activities)	21086	20661	-2.02	**

	GE-2020 (× 1000)	GEC-2020 (× 1000)	GEC - GE	GEC - GE

C3.2 Activity location (Work)

	m0	m1	m1-m0 (%)	sign
home zone	419	441	5.02	**
home municipality	1264	1296	2.52	**
municipality order 1	657	629	-4.38	**
municipality order 2	471	456	-3.20	**
municipality order 3	432	413	-4.29	**
municipality order 4	268	258	-3.84	**
municipality order 5	410	394	-3.94	**
Total (activities)	3948	3913	-0.89	**

C4.1 Number of tours (All cases)

	m0	m1	m1-m0 (%)	sign
0	2728	2804	2.77	**
1	5445	5498	0.98	**
2	3187	3112	-2.35	**
3	1047	1009	-3.65	**
> 3	379	363	-4.23	**
Total (person-days)	12786	12786	0.00	

C4.2 Number of tours (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
0	487	509	4.45	**
1	996	1003	0.67	
2	599	581	-3.01	**
3	191	184	-3.89	*
> 3	57	54	-5.14	*
Total (person-days)	2331	2331	0.00	

C4.3 Number of tours (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
0	561	572	1.99	**
1	766	770	0.51	
2	410	403	-1.52	*
3	129	123	-4.65	**
> 3	35	32	-8.24	**
Total (person-days)	1900	1900	0.00	

C4.4 Number of tours (75+ yr)

	m0	m1	m1-m0 (%)	sign
0	492	499	1.53	
1	518	526	1.58	
2	244	233	-4.38	*
3	68	64	-4.92	**
> 3	16	14	-10.65	*
Total (person-days)	1336	1336	0.00	

	GE-2020 (× 1000)	GEC-2020 (× 1000)	GEC - GE	GEC - GE

C5.1 First tour mode (All cases)

	m0	m1	m1-m0 (%)	sign
Car driver	8014	7270	-9.29	**
Slow mode	6284	6576	4.64	**
Public transport	587	714	21.63	**
Car passenger	1661	1706	2.71	**
Total (tours)	16600	16318	-1.70	**

C5.2 First tour mode (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
Car driver	1440	1305	-9.35	**
Slow mode	1143	1183	3.48	**
Public transport	99	122	22.72	**
Car passenger	316	325	2.84	**
Total (tours)	3009	2945	-2.12	**

C5.3 First tour mode (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
Car driver	936	829	-11.51	**
Slow mode	883	930	5.31	**
Public transport	54	67	24.66	**
Car passenger	241	250	3.61	**
Total (tours)	2118	2079	-1.83	**

C5.4 First tour mode (75+ yr)

	m0	m1	m1-m0 (%)	sign
Car driver	462	402	-12.89	**
Slow mode	605	625	3.23	**
Public transport	58	68	15.72	**
Car passenger	147	147	0.35	
Total (tours)	1273	1243	-2.40	**

Appendix 4: RC 2020 with (RCC) and without (RC) pricing policy

	RC-2020 (× 1000)	RCC-2020 (× 1000)	RCC - RC	RCC - RC

B1 Indicators (All cases)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	504786	486323	-3.66	**
Travel time car driver (min)	253676	209419	-17.45	**
Travel time public transport (min)	46087	60597	31.49	**
Travel time slow (min)	155319	163142	5.04	**
Travel time car passenger (min)	48650	52180	7.26	**
Number of tours	14905	14673	-1.56	**
Number of trips	33798	33213	-1.73	**
Ratio trips-tours	2.268	2.264	-0.18	**
Ratio single stop tours - all tours	0.803	0.806	0.29	**
Total travel distance (km)	362863	313715	-13.54	**
Distance car driver (km)	278451	218188	-21.64	**
Distance car passenger (km)	48510	53861	11.03	**
Distance slow (km)	21108	22286	5.58	**
Distance public transport (km)	14794	19381	31.01	**

B2 Indicators (< 55 yr)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	314867	304017	-3.45	**
Travel time car driver (min)	162972	136946	-15.97	**
Travel time public transport (min)	30881	40438	30.94	**
Travel time slow (min)	92328	96160	4.15	**
Travel time car passenger (min)	27930	29775	6.60	**
Number of tours	8874	8744	-1.47	**
Number of trips	20235	19907	-1.62	**
Ratio trips-tours	2.28	2.277	-0.16	**
Ratio single stop tours - all tours	0.8	0.802	0.28	**
Total travel distance (km)	229693	200585	-12.67	**
Distance car driver (km)	178733	143271	-19.84	**
Distance car passenger (km)	28217	31019	9.93	**
Distance slow (km)	12891	13454	4.37	**
Distance public transport (km)	9853	12841	30.33	**

	RC-2020 (× 1000)	RCC-2020 (× 1000)	RCC - RC	RCC - RC

B3 Indicators (55-64 yr)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	95095	91348	-3.94	**
Travel time car driver (min)	50730	41654	-17.89	**
Travel time public transport (min)	6857	9327	36.03	**
Travel time slow (min)	27533	29568	7.39	**
Travel time car passenger (min)	9788	10613	8.43	**
Number of tours	2870	2819	-1.76	**
Number of trips	6505	6375	-2.00	**
Ratio trips-tours	2.267	2.261	-0.24	**
Ratio single stop tours - all tours	0.803	0.806	0.38	**
Total travel distance (km)	71413	61318	-14.14	**
Distance car driver (km)	55693	43350	-22.16	**
Distance car passenger (km)	9813	10982	11.91	**
Distance slow (km)	3668	3993	8.87	**
Distance public transport (km)	2238	2993	33.73	**

B4 Indicators (65-74 yr)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	59392	56670	-4.58	**
Travel time car driver (min)	27051	21020	-22.29	**
Travel time public transport (min)	4099	5593	36.46	**
Travel time slow (min)	21295	22480	5.57	**
Travel time car passenger (min)	6865	7516	9.49	**
Number of tours	2008	1974	-1.72	**
Number of trips	4499	4413	-1.92	**
Ratio trips-tours	2.24	2.236	-0.21	**
Ratio single stop tours - all tours	0.809	0.812	0.30	**
Total travel distance (km)	40135	33605	-16.27	**
Distance car driver (km)	29513	21297	-27.84	**
Distance car passenger (km)	6556	7562	15.34	**
Distance slow (km)	2702	2880	6.59	**
Distance public transport (km)	1364	1867	36.89	**

	RC-2020 (× 1000)	RCC-2020 (× 1000)	RCC - RC	RCC - RC

B5 Indicators (75+ yr)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	35433	34288	-3.23	**
Travel time car driver (min)	12924	9799	-24.18	**
Travel time public transport (min)	4250	5240	23.28	**
Travel time slow (min)	14163	14935	5.45	**
Travel time car passenger (min)	4067	4276	5.14	**
Number of tours	1153	1137	-1.45	*
Number of trips	2558	2518	-1.56	**
Ratio trips-tours	2.218	2.215	-0.11	
Ratio single stop tours - all tours	0.823	0.824	0.12	
Total travel distance (km)	21621	18207	-15.79	**
Distance car driver (km)	14511	10270	-29.23	**
Distance car passenger (km)	3924	4298	9.55	**
Distance slow (km)	1847	1958	6.02	**
Distance public transport (km)	1339	1680	25.44	**

C1.1 Activity type (All cases)

	m0	m1	m1-m0 (%)	sign
Work	3338	3312	-0.77	*
Business	1145	1095	-4.36	**
Bring or get	1359	1345	-1.04	
Shop one store	4373	4345	-0.65	*
Shop multiple stores	877	876	-0.13	
Service	1022	1015	-0.65	
Social	2381	2269	-4.71	**
Leisure	2497	2435	-2.49	**
Touring	1610	1575	-2.14	**
Other	290	272	-6.13	**
Total (activities)	18893	18540	-1.87	**

C1.2 Activity type (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
Work	580	578	-0.39	
Business	235	220	-6.66	**
Bring or get	109	107	-1.68	
Shop one store	885	879	-0.73	
Shop multiple stores	176	176	0.29	
Service	213	213	0.24	
Social	497	470	-5.46	**
Leisure	522	503	-3.71	**
Touring	364	360	-1.07	*
Other	54	50	-7.12	*
Total (activities)	3635	3556	-2.19	**

	RC-2020 (× 1000)	RCC-2020 (× 1000)	RCC - RC	RCC - RC

C1.3 Activity type (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
Work	67	66	-1.21	
Business	42	39	-7.48	*
Bring or get	63	64	0.13	
Shop one store	822	816	-0.70	
Shop multiple stores	160	158	-1.60	*
Service	197	192	-2.14	*
Social	377	361	-4.26	*
Leisure	400	391	-2.20	*
Touring	323	314	-2.93	
Other	40	38	-3.32	
Total (activities)	2491	2439	-2.09	**

C1.4 Activity type (75+ yr)

	m0	m1	m1-m0 (%)	sign
Work	14	13	-2.20	
Business	13	11	-10.45	
Bring or get	23	23	-0.56	
Shop one store	513	511	-0.49	
Shop multiple stores	111	112	0.55	
Service	119	120	0.35	
Social	212	199	-5.82	**
Leisure	224	219	-1.99	
Touring	167	164	-1.93	
Other	9	9	0.34	
Total (activities)	1405	1382	-1.65	**

C2 Activity trip pattern (All cases)

	m0	m1	m1-m0 (%)	sign
Single stop	11975	11823	-1.27	**
After stop	2930	2851	-2.71	**
Before stop	2930	2851	-2.71	**
Between stop	1057	1016	-3.91	**
Total (activities)	18893	18540	-1.87	**

C3.1 Activity location (All cases)

	m0	m1	m1-m0 (%)	sign
home zone	5622	5745	2.18	**
home municipality	5411	5498	1.61	**
municipality order 1	2837	2651	-6.54	**
municipality order 2	1802	1675	-7.06	**
municipality order 3	1180	1107	-6.18	**
municipality order 4	890	812	-8.72	**
municipality order 5	1139	1040	-8.64	**
Total (activities)	18893	18540	-1.87	**

	RC-2020 (× 1000)	RCC-2020 (× 1000)	RCC - RC	RCC - RC

C3.2 Activity location (Work)

	m0	m1	m1-m0 (%)	sign
home zone	346	366	5.78	**
home municipality	1058	1083	2.38	**
municipality order 1	591	563	-4.69	**
municipality order 2	394	381	-3.44	**
municipality order 3	368	356	-3.18	**
municipality order 4	223	215	-3.62	**
municipality order 5	347	337	-2.71	*
Total (activities)	3338	3312	-0.77	*

C4.1 Number of tours (All cases)

	m0	m1	m1-m0 (%)	sign
0	2595	2660	2.50	**
1	4898	4934	0.73	*
2	2849	2792	-2.02	**
3	936	909	-2.94	**
> 3	346	330	-4.47	**
Total (person-days)	11624	11624	0.00	

C4.2 Number of tours (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
0	500	514	2.71	**
1	951	960	0.92	
2	567	555	-2.18	**
3	183	176	-3.72	**
> 3	55	52	-5.71	**
Total (person-days)	2257	2257	0.00	

C4.3 Number of tours (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
0	569	584	2.67	*
1	745	743	-0.25	
2	388	379	-2.37	
3	118	116	-2.37	
> 3	32	30	-4.25	
Total (person-days)	1851	1851	0.00	

C4.4 Number of tours (75+ yr)

	m0	m1	m1-m0 (%)	sign
0	487	494	1.37	**
1	489	489	0.01	
2	217	213	-1.94	
3	59	57	-3.41	
> 3	13	12	-3.84	
Total (person-days)	1265	1265	0.00	

	RC-2020 (× 1000)	RCC-2020 (× 1000)	RCC - RC	RCC - RC

C5.1 First tour mode (All cases)

	m0	m1	m1-m0 (%)	sign
Car driver	6989	6337	-9.32	**
Slow mode	5776	6045	4.65	**
Public transport	527	636	20.75	**
Car passenger	1578	1622	2.77	**
Total (tours)	14905	14673	-1.56	**

C5.2 First tour mode (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
Car driver	1411	1280	-9.27	**
Slow mode	1058	1110	4.91	**
Public transport	76	94	23.29	**
Car passenger	317	328	3.40	**
Total (tours)	2870	2819	-1.76	**

C5.3 First tour mode (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
Car driver	811	721	-11.13	**
Slow mode	898	935	4.11	**
Public transport	54	67	23.25	**
Car passenger	242	249	2.72	**
Total (tours)	2008	1974	-1.72	**

C5.4 First tour mode (75+ yr)

	m0	m1	m1-m0 (%)	sign
Car driver	370	321	-13.18	**
Slow mode	577	602	4.28	**
Public transport	60	68	14.00	**
Car passenger	145	144	-0.94	
Total (tours)	1153	1137	-1.45	*

Appendix 5: GE 2020 *without* pricing policy: Variant 1 vs Base

	GE 2020 (× 1000)	Var 1 (× 1000)	Var 1- GE	Var 1- GE
A1 Indicators (All cases)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	569951	582869	2.27	**
Travel time car driver (min)	291815	297414	1.92	**
Travel time public transport (min)	52702	53771	2.03	
Travel time slow (min)	170106	174440	2.55	**
Travel time car passenger (min)	53679	55771	3.90	**
Number of tours	16600	16924	1.95	**
Number of trips	37686	38559	2.32	**
Ratio trips-tours	2.27	2.278	0.36	**
Ratio single stop tours - all tours	0.802	0.797	-0.62	**
Total travel distance (km)	396905	405801	2.24	**
Distance car driver (km)	304126	310519	2.10	**
Distance car passenger (km)	52510	54406	3.61	**
Distance slow (km)	23149	23732	2.52	**
Distance public transport (km)	17121	17145	0.14	

A2 Indicators (Weekdays)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	443639	452027	1.89	**
Travel time car driver (min)	227039	230527	1.54	**
Travel time public transport (min)	44188	44890	1.59	
Travel time slow (min)	131813	134617	2.13	**
Travel time car passenger (min)	39164	40714	3.96	**
Number of tours	12593	12805	1.68	**
Number of trips	28607	29184	2.02	**
Ratio trips-tours	2.272	2.279	0.33	**
Ratio single stop tours - all tours	0.804	0.799	-0.57	**
Total travel distance (km)	306191	312022	1.90	**
Distance car driver (km)	235070	239165	1.74	**
Distance car passenger (km)	38541	39946	3.64	**
Distance slow (km)	18259	18636	2.06	*
Distance public transport (km)	14321	14276	-0.32	

	GE 2020 (× 1000)	Var 1 (× 1000)	Var 1- GE	Var 1- GE

A3 Indicators (Weekend)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	126306	130836	3.59	**
Travel time car driver (min)	64775	66887	3.26	**
Travel time public transport (min)	8514	8881	4.31	
Travel time slow (min)	38293	39823	4.00	**
Travel time car passenger (min)	14516	15056	3.72	**
Number of tours	4007	4120	2.80	**
Number of trips	9079	9375	3.26	**
Ratio trips-tours	2.266	2.276	0.44	**
Ratio single stop tours - all tours	0.796	0.79	-0.74	**
Total travel distance (km)	90714	93779	3.38	**
Distance car driver (km)	69056	71353	3.33	**
Distance car passenger (km)	13969	14460	3.52	**
Distance slow (km)	4890	5096	4.22	**
Distance public transport (km)	2799	2869	2.49	

A4 Indicators (55-64 yr)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	103964	108107	3.99	**
Travel time car driver (min)	52832	54980	4.07	**
Travel time public transport (min)	9114	9263	1.63	
Travel time slow (min)	31281	32520	3.96	**
Travel time car passenger (min)	10435	11078	6.16	**
Number of tours	3009	3116	3.58	**
Number of trips	6827	7116	4.22	**
Ratio trips-tours	2.269	2.283	0.62	**
Ratio single stop tours - all tours	0.802	0.794	-1.03	**
Total travel distance (km)	73114	76340	4.41	**
Distance car driver (km)	55497	58077	4.65	**
Distance car passenger (km)	10346	10857	4.94	**
Distance slow (km)	4275	4451	4.11	**
Distance public transport (km)	2995	2954	-1.37	

	GE 2020 (× 1000)	Var 1 (× 1000)	Var 1- GE	Var 1- GE

A5 Indicators (65-74 yr)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	62474	68735	10.02	**
Travel time car driver (min)	30258	33089	9.36	**
Travel time public transport (min)	4183	4811	15.02	**
Travel time slow (min)	20669	22649	9.58	**
Travel time car passenger (min)	7273	8084	11.14	**
Number of tours	2118	2271	7.26	**
Number of trips	4758	5169	8.65	**
Ratio trips-tours	2.247	2.276	1.29	**
Ratio single stop tours - all tours	0.806	0.789	-2.08	**
Total travel distance (km)	41832	46171	10.37	**
Distance car driver (km)	30868	34086	10.42	**
Distance car passenger (km)	6938	7667	10.50	**
Distance slow (km)	2595	2859	10.15	**
Distance public transport (km)	1431	1560	9.03	*

A6 Indicators (75+ yr)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	38358	40453	5.46	**
Travel time car driver (min)	15207	16078	5.73	**
Travel time public transport (min)	4202	4351	3.53	
Travel time slow (min)	14574	15272	4.79	**
Travel time car passenger (min)	4340	4711	8.54	**
Number of tours	1273	1325	4.03	**
Number of trips	2833	2967	4.74	**
Ratio trips-tours	2.225	2.24	0.68	**
Ratio single stop tours - all tours	0.818	0.808	-1.15	**
Total travel distance (km)	23147	24609	6.31	**
Distance car driver (km)	15822	16812	6.25	**
Distance car passenger (km)	4148	4518	8.92	**
Distance slow (km)	1872	1971	5.29	*
Distance public transport (km)	1305	1308	0.22	

B1.1 Activity type (All cases)

	m0	m1	m1-m0 (%)	sign
Work	3948	3946	-0.06	
Business	1331	1327	-0.27	
Bring or get	1487	1489	0.09	
Shop one store	4802	4885	1.71	**
Shop multiple stores	948	952	0.47	
Service	1112	1127	1.36	
Social	2630	2797	6.36	**
Leisure	2779	2937	5.68	**
Touring	1723	1852	7.49	**
Other	326	323	-0.96	
Total (activities)	21086	21634	2.60	**

	GE 2020 (× 1000)	Var 1 (× 1000)	Var 1- GE	Var 1- GE
B1.2 Activity type (55-<65 yr)				
	m0	m1	m1-m0 (%)	sign
Work	707	704	-0.33	
Business	264	260	-1.59	
Bring or get	110	111	1.07	
Shop one store	894	923	3.24	**
Shop multiple stores	176	177	0.77	
Service	210	213	1.56	**
Social	504	563	11.63	**
Leisure	536	587	9.58	**
Touring	366	408	11.58	**
Other	52	52	0.10	
Total (activities)	3819	3999	4.73	**

B1.3 Activity type (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
Work	100	100	-0.40	
Business	51	51	-1.01	
Bring or get	71	73	2.52	
Shop one store	860	895	4.09	**
Shop multiple stores	166	165	-0.60	
Service	202	209	3.24	*
Social	397	471	18.75	**
Leisure	423	502	18.78	**
Touring	323	384	18.90	**
Other	47	48	2.54	
Total (activities)	2640	2898	9.76	**

B1.4 Activity type (75+ yr)				
	m0	m1	m1-m0 (%)	sign
Work	12	12	4.38	
Business	16	16	-1.78	
Bring or get	35	32	-8.74	**
Shop one store	567	582	2.68	*
Shop multiple stores	120	120	-0.03	
Service	135	137	1.75	
Social	233	256	9.72	**
Leisure	250	270	8.08	**
Touring	179	205	14.22	**
Other	13	13	-1.02	
Total (activities)	1560	1642	5.32	**

	GE 2020 (× 1000)	Var 1 (× 1000)	Var 1- GE	Var 1- GE
B2 Activity duration (All cases)				
	m0	m1	m1-m0 (%)	sign
<= 10 min	4232	4346	2.69	**
11-20 min	1787	1860	4.12	**
21-30 min	3371	3481	3.25	**
31-45 min	270	279	3.16	**
46-60 min	491	494	0.62	
61-80 min	1949	1987	1.96	**
81-120 min	2952	3046	3.16	**
> 120 min	6033	6142	1.80	**
Total (activities)	21086	21634	2.60	**

B3.1 Activity begin time (All cases)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	5299	5324	0.48	**
10-12 am	2961	3021	2.04	**
12-2 pm	2797	2867	2.50	**
2-4 pm	3541	3649	3.04	**
4-6 pm	2536	2621	3.35	**
> 6 pm	3951	4151	5.07	**
Total (activities)	21086	21634	2.60	**

B3.2 Activity begin time (55-<65 yr)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	907	915	0.88	
10-12 am	545	564	3.46	**
12-2 pm	511	533	4.29	**
2-4 pm	658	694	5.48	**
4-6 pm	463	492	6.12	**
> 6 pm	735	803	9.17	**
Total (activities)	3819	3999	4.73	**

B3.3 Activity begin time (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	369	385	4.34	**
10-12 am	518	545	5.21	**
12-2 pm	416	453	8.86	**
2-4 pm	572	623	8.84	**
4-6 pm	309	344	11.43	**
> 6 pm	455	547	20.18	**
Total (activities)	2640	2898	9.76	**

	GE 2020 (× 1000)	Var 1 (× 1000)	Var 1- GE	Var 1- GE
B3.4 Activity begin time (75+ yr)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	188	195	3.53	**
10-12 am	337	348	3.42	**
12-2 pm	257	270	4.87	**
2-4 pm	357	373	4.62	**
4-6 pm	177	187	5.75	**
> 6 pm	244	269	10.50	**
Total (activities)	1560	1642	5.32	**

B4 Activity trip pattern (All cases)				
	m0	m1	m1-m0 (%)	sign
Single stop	13315	13491	1.32	**
After stop	3285	3433	4.51	**
Before stop	3285	3433	4.51	**
Between stop	1201	1277	6.33	**
Total (activities)	21086	21634	2.60	**

B5 Activity location (All cases)				
	m0	m1	m1-m0 (%)	sign
home zone	6263	6451	3.00	**
home municipality	6023	6152	2.15	**
municipality order 1	2947	3037	3.06	**
municipality order 2	2202	2264	2.84	**
municipality order 3	1347	1373	1.89	**
municipality order 4	1051	1071	1.95	*
municipality order 5	1228	1260	2.65	**
Total (activities)	21086	21634	2.60	**

B6.1 Number of tours (All cases)				
	m0	m1	m1-m0 (%)	sign
0	2728	2643	-3.14	**
1	5445	5398	-0.87	**
2	3187	3249	1.96	**
3	1047	1093	4.39	**
> 3	379	404	6.53	**
Total (person-days)	12786	12786	0.00	

B6.2 Number of tours (55-<65 yr)				
	m0	m1	m1-m0 (%)	sign
0	487	463	-4.93	**
1	996	977	-1.94	**
2	599	616	2.92	**
3	191	207	8.10	**
> 3	57	67	18.33	**
Total (person-days)	2331	2331	0.00	

	GE 2020 (× 1000)	Var 1 (× 1000)	Var 1- GE	Var 1- GE
B6.3 Number of tours (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
0	561	522	-6.98	**
1	766	739	-3.50	**
2	410	440	7.45	**
3	129	154	19.56	**
> 3	35	45	29.50	**
Total (person-days)	1900	1900	0.00	

B6.4 Number of tours (75+ yr)

	m0	m1	m1-m0 (%)	sign
0	492	474	-3.58	**
1	518	515	-0.52	
2	244	254	4.47	**
3	68	74	9.42	**
> 3	16	19	19.64	**
Total (person-days)	1336	1336	0.00	

B7 Number of activities per tour (All cases)

	m0	m1	m1-m0 (%)	sign
1	13315	13491	1.32	**
2	2430	2527	3.96	**
3	608	640	5.38	**
4	169	184	8.47	**
> 4	78	82	6.08	**
Total (tours)	16600	16924	1.95	**

B8.1 First tour mode (All cases)

	m0	m1	m1-m0 (%)	sign
Car driver	8014	8130	1.44	**
Slow mode	6284	6421	2.18	**
Public transport	587	597	1.62	
Car passenger	1661	1724	3.74	**
Total (tours)	16600	16924	1.95	**

B8.2 First tour mode (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
Car driver	1440	1481	2.85	**
Slow mode	1143	1184	3.63	**
Public transport	99	101	1.80	
Car passenger	316	339	7.40	**
Total (tours)	3009	3116	3.58	**

	GE 2020 (× 1000)	Var 1 (× 1000)	Var 1- GE	Var 1- GE
B8.3 First tour mode (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
Car driver	936	994	6.15	**
Slow mode	883	950	7.60	**
Public transport	54	59	9.82	*
Car passenger	241	265	9.76	**
Total (tours)	2118	2271	7.26	**

B8.4 First tour mode (75+ yr)				
	m0	m1	m1-m0 (%)	sign
Car driver	462	479	3.73	**
Slow mode	605	628	3.79	**
Public transport	58	60	2.12	
Car passenger	147	156	6.78	**
Total (tours)	1273	1325	4.03	**

Appendix 6: GE 2020 *with* pricing policy: Variant 1 vs Base

	GEC 2020 (× 1000)	Var 1 (× 1000)	Var 1- GEC	Var 1- GEC
A1 Indicators (All cases)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	549839	563174	2.43	**
Travel time car driver (min)	240290	245081	1.99	**
Travel time public transport (min)	70853	72499	2.32	*
Travel time slow (min)	179378	184011	2.58	**
Travel time car passenger (min)	57716	60167	4.25	**
Number of tours	16318	16665	2.13	**
Number of trips	36979	37883	2.45	**
Ratio trips-tours	2.266	2.273	0.31	**
Ratio single stop tours - all tours	0.804	0.8	-0.54	**
Total travel distance (km)	341817	350552	2.56	**
Distance car driver (km)	236951	242184	2.21	**
Distance car passenger (km)	58293	60640	4.03	**
Distance slow (km)	24565	25099	2.18	**
Distance public transport (km)	22008	22628	2.82	

A2 Indicators (55-64 yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	99891	104938	5.05	**
Travel time car driver (min)	43594	45270	3.84	**
Travel time public transport (min)	12219	12941	5.90	**
Travel time slow (min)	32691	34364	5.12	**
Travel time car passenger (min)	11106	12107	9.02	**
Number of tours	2945	3072	4.32	**
Number of trips	6670	7005	5.03	**
Ratio trips-tours	2.265	2.28	0.68	**
Ratio single stop tours - all tours	0.804	0.795	-1.18	**
Total travel distance (km)	63108	66478	5.34	**
Distance car driver (km)	43538	45384	4.24	**
Distance car passenger (km)	11269	12293	9.08	**
Distance slow (km)	4491	4680	4.23	**
Distance public transport (km)	3811	4121	8.13	*

	GEC 2020 (× 1000)	Var 1 (× 1000)	Var 1- GEC	Var 1- GEC

A3 Indicators (65-74 yr)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	60244	65660	8.99	**
Travel time car driver (min)	23711	25720	8.47	**
Travel time public transport (min)	6084	6727	10.57	**
Travel time slow (min)	22340	24059	7.70	**
Travel time car passenger (min)	8020	9057	12.93	**
Number of tours	2079	2235	7.52	**
Number of trips	4663	5068	8.68	**
Ratio trips-tours	2.243	2.267	1.08	**
Ratio single stop tours - all tours	0.807	0.793	-1.75	**
Total travel distance (km)	35263	38710	9.78	**
Distance car driver (km)	22534	24598	9.16	**
Distance car passenger (km)	7987	8962	12.21	**
Distance slow (km)	2849	3065	7.55	**
Distance public transport (km)	1893	2086	10.16	

A4 Indicators (75+ yr)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	36635	39057	6.61	**
Travel time car driver (min)	11349	12218	7.66	**
Travel time public transport (min)	5445	5737	5.36	
Travel time slow (min)	15230	16058	5.44	**
Travel time car passenger (min)	4582	5010	9.35	**
Number of tours	1243	1305	4.97	**
Number of trips	2757	2917	5.81	**
Ratio trips-tours	2.218	2.236	0.80	**
Ratio single stop tours - all tours	0.822	0.81	-1.38	**
Total travel distance (km)	19041	20639	8.39	**
Distance car driver (km)	10853	11765	8.41	**
Distance car passenger (km)	4540	5007	10.29	**
Distance slow (km)	1977	2086	5.54	*
Distance public transport (km)	1672	1781	6.51	

B1.1 Activity type (All cases)

	m0	m1	m1-m0 (%)	sign
Work	3913	3918	0.14	
Business	1270	1270	0.02	
Bring or get	1481	1474	-0.45	
Shop one store	4760	4848	1.84	**
Shop multiple stores	938	945	0.73	
Service	1110	1112	0.14	
Social	2507	2660	6.07	**
Leisure	2697	2875	6.59	**
Touring	1684	1817	7.95	**
Other	301	300	-0.63	
Total (activities)	20661	21218	2.70	**

	GEC 2020 (× 1000)	Var 1 (× 1000)	Var 1- GEC	Var 1- GEC
B1.2 Activity type (55-<65 yr)				
	m0	m1	m1-m0 (%)	sign
Work	698	700	0.27	
Business	249	250	0.48	
Bring or get	111	110	-0.86	
Shop one store	888	918	3.40	**
Shop multiple stores	173	177	2.21	**
Service	208	211	1.68	
Social	479	536	12.00	**
Leisure	513	580	13.01	**
Touring	359	403	12.33	**
Other	47	47	0.06	
Total (activities)	3725	3933	5.59	**

B1.3 Activity type (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
Work	99	97	-2.02	
Business	50	46	-6.93	
Bring or get	71	72	2.09	
Shop one store	851	886	4.17	**
Shop multiple stores	163	165	1.50	
Service	203	203	-0.06	
Social	379	444	17.12	**
Leisure	407	492	20.81	**
Touring	317	382	20.67	**
Other	45	45	-0.71	
Total (activities)	2585	2833	9.62	**

B1.4 Activity type (75+ yr)				
	m0	m1	m1-m0 (%)	sign
Work	12	12	2.74	
Business	15	14	-4.35	
Bring or get	34	33	-4.04	
Shop one store	560	578	3.18	**
Shop multiple stores	118	119	0.45	
Service	132	134	2.00	
Social	218	245	12.41	**
Leisure	238	267	11.99	**
Touring	176	200	13.63	**
Other	11	11	-3.99	
Total (activities)	1514	1612	6.50	**

	GEC 2020 (× 1000)	Var 1 (× 1000)	Var 1- GEC	Var 1- GEC
B2 Activity duration (All cases)				
	m0	m1	m1-m0 (%)	sign
<= 10 min	4171	4287	2.78	**
11-20 min	1745	1820	4.32	**
21-30 min	3301	3404	3.12	**
31-45 min	263	270	2.75	
46-60 min	477	480	0.75	
61-80 min	1919	1966	2.45	**
81-120 min	2868	2964	3.34	**
> 120 min	5918	6027	1.85	**
Total (activities)	20661	21218	2.70	**

B3 Activity trip pattern (All cases)				
	m0	m1	m1-m0 (%)	sign
Single stop	13121	13327	1.57	**
After stop	3198	3339	4.41	**
Before stop	3198	3339	4.41	**
Between stop	1145	1214	6.04	**
Total (activities)	20661	21218	2.70	**

B4 Activity location (All cases)				
	m0	m1	m1-m0 (%)	sign
home zone	6372	6572	3.14	**
home municipality	6104	6240	2.22	**
municipality order 1	2760	2837	2.82	**
municipality order 2	2066	2119	2.58	**
municipality order 3	1250	1279	2.32	**
municipality order 4	959	984	2.54	**
municipality order 5	1125	1161	3.23	**
Total (activities)	20661	21218	2.70	**

B5.1 Number of tours (All cases)				
	m0	m1	m1-m0 (%)	sign
0	2804	2714	-3.23	**
1	5498	5436	-1.14	**
2	3112	3192	2.59	**
3	1009	1058	4.91	**
> 3	363	386	6.32	**
Total (person-days)	12786	12786	0.00	

B5.2 Number of tours (55-<65 yr)				
	m0	m1	m1-m0 (%)	sign
0	509	475	-6.69	**
1	1003	984	-1.87	*
2	581	606	4.34	**
3	184	201	9.63	**
> 3	54	64	18.42	**
Total (person-days)	2331	2331	0.00	

	GEC 2020 (× 1000)	Var 1 (× 1000)	Var 1- GEC	Var 1- GEC
B5.3 Number of tours (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
0	572	533	-6.72	**
1	770	742	-3.61	**
2	403	433	7.19	**
3	123	149	21.10	**
> 3	32	43	35.33	**
Total (person-days)	1900	1900	0.00	

B5.4 Number of tours (75+ yr)

	m0	m1	m1-m0 (%)	sign
0	499	483	-3.32	**
1	526	513	-2.34	*
2	233	250	7.30	**
3	64	73	13.13	**
> 3	14	17	24.55	**
Total (person-days)	1336	1336	0.00	

B6 Number of activities per tour (All cases)

	m0	m1	m1-m0 (%)	sign
1	13121	13327	1.57	**
2	2382	2472	3.78	**
3	580	616	6.16	**
4	163	174	6.89	**
> 4	73	77	5.35	**
Total (tours)	16318	16665	2.13	**

B7.1 First tour mode (All cases)

	m0	m1	m1-m0 (%)	sign
Car driver	7270	7382	1.55	**
Slow mode	6576	6719	2.18	**
Public transport	714	731	2.36	
Car passenger	1706	1780	4.32	**
Total (tours)	16318	16665	2.13	**

B7.2 First tour mode (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
Car driver	1305	1343	2.90	**
Slow mode	1183	1239	4.77	**
Public transport	122	127	4.07	**
Car passenger	325	353	8.56	**
Total (tours)	2945	3072	4.32	**

	GEC 2020 (× 1000)	Var 1 (× 1000)	Var 1- GEC	Var 1- GEC
B7.3 First tour mode (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
Car driver	829	882	6.47	**
Slow mode	930	995	7.04	**
Public transport	67	74	9.13	**
Car passenger	250	281	12.28	**
Total (tours)	2079	2235	7.52	**

B7.4 First tour mode (75+ yr)				
	m0	m1	m1-m0 (%)	sign
Car driver	402	422	4.87	**
Slow mode	625	651	4.26	**
Public transport	68	71	4.58	
Car passenger	147	159	8.33	**
Total (tours)	1243	1305	4.97	**

Appendix 7: GE 2020 *without* pricing policy: Vars 1+2 vs Var 1

	Var 1 (× 1000)	Var 2 (× 1000)	Var 2-Var 1	Var 2-Var 1
A1 Indicators (All cases)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	582869	583628	0.13	
Travel time car driver (min)	297414	298130	0.24	
Travel time public transport (min)	53771	53732	-0.07	
Travel time slow (min)	174440	174308	-0.08	
Travel time car passenger (min)	55771	55949	0.32	
Number of tours	16924	16926	0.01	
Number of trips	38559	38566	0.02	
Ratio trips-tours	2.278	2.279	0.01	
Ratio single stop tours - all tours	0.797	0.796	-0.08	**
Total travel distance (km)	405801	407377	0.39	
Distance car driver (km)	310519	311654	0.37	
Distance car passenger (km)	54406	54578	0.32	
Distance slow (km)	23732	23729	-0.01	
Distance public transport (km)	17145	17415	1.58	

A2 Indicators (Weekdays)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	452027	452989	0.21	
Travel time car driver (min)	230527	231551	0.44	
Travel time public transport (min)	44890	44594	-0.66	
Travel time slow (min)	134617	134624	0.00	
Travel time car passenger (min)	40714	40923	0.51	
Number of tours	12805	12813	0.07	
Number of trips	29184	29209	0.09	
Ratio trips-tours	2.279	2.28	0.02	
Ratio single stop tours - all tours	0.799	0.799	-0.09	
Total travel distance (km)	312022	313804	0.57	
Distance car driver (km)	239165	240502	0.56	
Distance car passenger (km)	39946	40194	0.62	
Distance slow (km)	18636	18636	0.00	
Distance public transport (km)	14276	14472	1.38	

	Var 1 (× 1000)	Var 2 (× 1000)	Var 2-Var 1	Var 2-Var 1
A3 Indicators (Weekend)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	130836	130639	-0.15	
Travel time car driver (min)	66887	66579	-0.46	
Travel time public transport (min)	8881	9138	2.89	
Travel time slow (min)	39823	39684	-0.35	
Travel time car passenger (min)	15056	15027	-0.20	
Number of tours	4120	4112	-0.18	
Number of trips	9375	9357	-0.19	
Ratio trips-tours	2.276	2.275	-0.01	
Ratio single stop tours - all tours	0.79	0.79	-0.07	
Total travel distance (km)	93779	93573	-0.22	
Distance car driver (km)	71353	71152	-0.28	
Distance car passenger (km)	14460	14384	-0.53	
Distance slow (km)	5096	5093	-0.05	
Distance public transport (km)	2869	2943	2.58	

A4 Indicators (65-74 yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	68735	68915	0.26	
Travel time car driver (min)	33089	33319	0.70	
Travel time public transport (min)	4811	4677	-2.80	
Travel time slow (min)	22649	22462	-0.83	
Travel time car passenger (min)	8084	8356	3.37	**
Number of tours	2271	2269	-0.12	
Number of trips	5169	5167	-0.05	
Ratio trips-tours	2.276	2.277	0.07	
Ratio single stop tours - all tours	0.789	0.787	-0.25	*
Total travel distance (km)	46171	46899	1.58	
Distance car driver (km)	34086	34533	1.31	
Distance car passenger (km)	7667	7948	3.67	**
Distance slow (km)	2859	2827	-1.12	
Distance public transport (km)	1560	1592	2.03	

	Var 1 (× 1000)	Var 2 (× 1000)	Var 2-Var 1	Var 2-Var 1
A5 Indicators (75+ yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	40453	40720	0.66	
Travel time car driver (min)	16078	16127	0.31	
Travel time public transport (min)	4351	4492	3.25	
Travel time slow (min)	15272	15281	0.05	
Travel time car passenger (min)	4711	4778	1.42	
Number of tours	1325	1327	0.18	
Number of trips	2967	2978	0.38	
Ratio trips-tours	2.24	2.244	0.20	**
Ratio single stop tours - all tours	0.808	0.804	-0.50	**
Total travel distance (km)	24609	24890	1.14	
Distance car driver (km)	16812	16923	0.66	
Distance car passenger (km)	4518	4591	1.62	
Distance slow (km)	1971	1967	-0.17	
Distance public transport (km)	1308	1408	7.61	

B1 Activity type type (All cases)				
	m0	m1	m1-m0 (%)	sign
Work	3946	3944	-0.03	
Business	1327	1329	0.08	
Bring or get	1489	1488	-0.04	
Shop one store	4885	4889	0.10	
Shop multiple stores	952	945	-0.74	
Service	1127	1129	0.15	
Social	2797	2785	-0.42	
Leisure	2937	2946	0.31	
Touring	1852	1861	0.52	
Other	323	323	0.04	
Total (activities)	21634	21640	0.03	

B2.1 Activity type begin time (All cases)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	5324	5022	-5.68	**
10-12 am	3021	3283	8.65	**
12-2 pm	2867	2895	0.98	**
2-4 pm	3649	3671	0.60	**
4-6 pm	2621	2615	-0.26	
> 6 pm	4151	4155	0.09	
Total (activities)	21634	21640	0.03	

	Var 1 (× 1000)	Var 2 (× 1000)	Var 2-Var 1	Var 2-Var 1
B2.2 Activity type begin time (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	385	199	-48.34	**
10-12 am	545	695	27.41	**
12-2 pm	453	464	2.38	**
2-4 pm	623	635	1.85	
4-6 pm	344	351	1.98	*
> 6 pm	547	555	1.40	
Total (activities)	2898	2898	0.00	
B2.3 Activity type begin time (75+ yr)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	195	70	-64.11	**
10-12 am	348	455	30.81	**
12-2 pm	270	277	2.75	**
2-4 pm	373	382	2.40	**
4-6 pm	187	190	1.46	
> 6 pm	269	277	2.74	**
Total (activities)	1642	1651	0.54	
B3 Activity type trip pattern (All cases)				
	m0	m1	m1-m0 (%)	sign
Single stop	13491	13481	-0.08	
After stop	3433	3445	0.34	
Before stop	3433	3445	0.34	
Between stop	1277	1270	-0.55	
Total (activities)	21634	21640	0.03	
B4 Activity type location (All cases)				
	m0	m1	m1-m0 (%)	sign
home zone	6451	6434	-0.26	
home municipality	6152	6149	-0.05	
municipality order 1	3037	3037	0.01	
municipality order 2	2264	2278	0.58	**
municipality order 3	1373	1374	0.09	
municipality order 4	1071	1080	0.87	
municipality order 5	1260	1262	0.13	
Total (activities)	21634	21640	0.03	

	Var 1 (× 1000)	Var 2 (× 1000)	Var 2-Var 1	Var 2-Var 1
B5.1 Number of tours (All cases)				
	m0	m1	m1-m0 (%)	sign
0	2643	2642	-0.04	
1	5398	5394	-0.06	
2	3249	3253	0.10	
3	1093	1095	0.18	
> 3	404	402	-0.31	
Total (person-days)	12786	12786	0.00	

B5.2 Number of tours (55-<65 yr)				
	m0	m1	m1-m0 (%)	sign
0	463	460	-0.69	
1	977	977	0.03	
2	616	619	0.40	
3	207	207	0.37	
> 3	67	67	-0.45	
Total (person-days)	2331	2331	0.00	

B5.3 Number of tours (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
0	522	522	0.15	
1	739	738	-0.19	
2	440	442	0.44	
3	154	153	-0.51	
> 3	45	44	-1.12	
Total (person-days)	1900	1900	0.00	

B5.4 Number of tours (75+ yr)				
	m0	m1	m1-m0 (%)	sign
0	474	476	0.32	
1	515	510	-0.87	
2	254	256	0.51	
3	74	77	3.31	
> 3	19	18	-4.16	
Total (person-days)	1336	1336	0.00	

B6 Number of activities per tour (All cases)				
	m0	m1	m1-m0 (%)	sign
1	13491	13481	-0.08	
2	2527	2542	0.59	**
3	640	638	-0.30	
4	184	184	0.02	
> 4	82	81	-1.82	
Total (tours)	16924	16926	0.01	

	Var 1 (× 1000)	Var 2 (× 1000)	Var 2-Var 1	Var 2-Var 1
B7.1 First tour mode (All cases)				
	m0	m1	m1-m0 (%)	sign
Car driver	8130	8125	-0.06	
Slow mode	6421	6417	-0.07	
Public transport	597	598	0.27	
Car passenger	1724	1731	0.44	
Total (tours)	16924	16926	0.01	

B7.2 First tour mode (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
Car driver	994	988	-0.63	
Slow mode	950	946	-0.41	
Public transport	59	58	-1.92	
Car passenger	265	273	3.11	*
Total (tours)	2271	2269	-0.12	

B7.3 First tour mode (75+ yr)				
	m0	m1	m1-m0 (%)	sign
Car driver	479	478	-0.18	
Slow mode	628	628	-0.04	
Public transport	60	61	2.23	
Car passenger	156	158	1.23	
Total (tours)	1325	1327	0.18	

Appendix 8: GE 2020 *without* pricing policy: Vars 2 vs Baseline GE

	GE 2020 (× 1000)	Var 2 (× 1000)	Var 2-GE	Var 2-GE
A1 Indicators (All cases)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	569951	570465	0.09	
Travel time car driver (min)	291815	291280	-0.18	
Travel time public transport (min)	52702	52982	0.53	
Travel time slow (min)	170106	170705	0.35	
Travel time car passenger (min)	53679	53847	0.31	
Number of tours	16600	16606	0.04	
Number of trips	37686	37725	0.10	
Ratio trips-tours	2.27	2.272	0.06	**
Ratio single stop tours - all tours	0.802	0.801	-0.14	*
Total travel distance (km)	396905	396453	-0.11	
Distance car driver (km)	304126	303463	-0.22	
Distance car passenger (km)	52510	52517	0.01	
Distance slow (km)	23149	23279	0.56	
Distance public transport (km)	17121	17195	0.43	

A2 Indicators (Weekdays)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	443639	443452	-0.04	
Travel time car driver (min)	227039	226425	-0.27	
Travel time public transport (min)	44188	44089	-0.22	
Travel time slow (min)	131813	132107	0.22	
Travel time car passenger (min)	39164	39381	0.56	
Number of tours	12593	12585	-0.06	
Number of trips	28607	28606	0.00	
Ratio trips-tours	2.272	2.273	0.06	*
Ratio single stop tours - all tours	0.804	0.803	-0.13	
Total travel distance (km)	306191	305702	-0.16	
Distance car driver (km)	235070	234326	-0.32	
Distance car passenger (km)	38541	38695	0.40	
Distance slow (km)	18259	18328	0.38	
Distance public transport (km)	14321	14354	0.23	

	GE 2020 (× 1000)	Var 2 (× 1000)	Var 2-GE	Var 2-GE
A3 Indicators (Weekend)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	126306	127010	0.56	
Travel time car driver (min)	64775	64855	0.12	
Travel time public transport (min)	8514	8892	4.44	**
Travel time slow (min)	38293	38598	0.80	
Travel time car passenger (min)	14516	14466	-0.34	
Number of tours	4007	4021	0.34	
Number of trips	9079	9119	0.43	
Ratio trips-tours	2.266	2.268	0.10	**
Ratio single stop tours - all tours	0.796	0.795	-0.17	*
Total travel distance (km)	90714	90751	0.04	
Distance car driver (km)	69056	69137	0.12	
Distance car passenger (km)	13969	13822	-1.05	
Distance slow (km)	4890	4951	1.26	
Distance public transport (km)	2799	2841	1.48	

A4 Indicators (65-74 yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	62474	62994	0.83	
Travel time car driver (min)	30258	30030	-0.75	
Travel time public transport (min)	4183	4380	4.69	
Travel time slow (min)	20669	21107	2.12	**
Travel time car passenger (min)	7273	7387	1.56	
Number of tours	2118	2114	-0.15	
Number of trips	4758	4759	0.02	
Ratio trips-tours	2.247	2.251	0.17	
Ratio single stop tours - all tours	0.806	0.803	-0.32	*
Total travel distance (km)	41832	41908	0.18	
Distance car driver (km)	30868	30737	-0.42	
Distance car passenger (km)	6938	7026	1.26	
Distance slow (km)	2595	2680	3.27	**
Distance public transport (km)	1431	1465	2.39	

	GE 2020 (× 1000)	Var 2 (× 1000)	Var 2-GE	Var 2-GE
A5 Indicators (75+ yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	38358	38303	-0.14	
Travel time car driver (min)	15207	14946	-1.71	
Travel time public transport (min)	4202	4342	3.33	
Travel time slow (min)	14574	14581	0.05	
Travel time car passenger (min)	4340	4401	1.39	
Number of tours	1273	1265	-0.63	
Number of trips	2833	2824	-0.33	
Ratio trips-tours	2.225	2.231	0.30	
Ratio single stop tours - all tours	0.818	0.813	-0.61	*
Total travel distance (km)	23147	22955	-0.83	
Distance car driver (km)	15822	15476	-2.19	
Distance car passenger (km)	4148	4209	1.47	
Distance slow (km)	1872	1886	0.76	
Distance public transport (km)	1305	1384	6.07	

B1 Activity type type (All cases)

	m0	m1	m1-m0 (%)	sign
Work	3948	3946	-0.06	
Business	1331	1344	0.96	
Bring or get	1487	1485	-0.14	
Shop one store	4802	4813	0.22	
Shop multiple stores	948	948	-0.02	
Service	1112	1114	0.17	
Social	2630	2634	0.17	
Leisure	2779	2786	0.27	
Touring	1723	1725	0.13	
Other	326	323	-0.75	
Total (activities)	21086	21118	0.15	

B2.1 Activity type begin time (All cases)

	m0	m1	m1-m0 (%)	sign
<= 10 am	5299	4995	-5.74	**
10-12 am	2961	3213	8.50	**
12-2 pm	2797	2820	0.81	*
2-4 pm	3541	3565	0.67	**
4-6 pm	2536	2553	0.67	**
> 6 pm	3951	3973	0.54	**
Total (activities)	21086	21118	0.15	

	GE 2020 (× 1000)	Var 2 (× 1000)	Var 2-GE	Var 2-GE
B2.2 Activity type begin time (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	369	193	-47.67	**
10-12 am	518	662	27.62	**
12-2 pm	416	425	2.06	**
2-4 pm	572	582	1.64	**
4-6 pm	309	318	2.88	**
> 6 pm	455	465	2.20	
Total (activities)	2640	2644	0.15	
B2.3 Activity type begin time (75+ yr)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	188	68	-63.88	**
10-12 am	337	440	30.64	**
12-2 pm	257	264	2.35	
2-4 pm	357	364	2.16	*
4-6 pm	177	177	0.21	
> 6 pm	244	245	0.61	
Total (activities)	1560	1558	-0.09	
B3 Activity type trip pattern (All cases)				
	m0	m1	m1-m0 (%)	sign
Single stop	13315	13302	-0.10	
After stop	3285	3305	0.60	*
Before stop	3285	3305	0.60	*
Between stop	1201	1207	0.53	
Total (activities)	21086	21118	0.15	
B4 Activity type location (All cases)				
	m0	m1	m1-m0 (%)	sign
home zone	6263	6282	0.30	
home municipality	6023	6034	0.18	
municipality order 1	2947	2949	0.08	
municipality order 2	2202	2210	0.38	
municipality order 3	1347	1343	-0.29	
municipality order 4	1051	1048	-0.29	
municipality order 5	1228	1227	-0.06	
Total (activities)	21086	21118	0.15	

	GE 2020 (× 1000)	Var 2 (× 1000)	Var 2-GE	Var 2-GE
B5.1 Number of tours (All cases)				
	m0	m1	m1-m0 (%)	sign
0	2728	2722	-0.23	
1	5445	5451	0.11	
2	3187	3185	-0.04	
3	1047	1049	0.21	
> 3	379	378	-0.24	
Total (person-days)	12786	12786	0.00	

B5.2 Number of tours (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
0	487	491	0.74	
1	996	992	-0.46	
2	599	597	-0.34	
3	191	193	0.96	
> 3	57	58	2.04	
Total (person-days)	2331	2331	0.00	

B5.3 Number of tours (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
0	561	559	-0.32	
1	766	768	0.31	
2	410	412	0.51	
3	129	128	-0.88	
> 3	35	33	-4.48	
Total (person-days)	1900	1900	0.00	

B5.4 Number of tours (75+ yr)

	m0	m1	m1-m0 (%)	sign
0	492	491	-0.15	
1	518	524	1.16	
2	244	240	-1.33	
3	68	67	-1.23	
> 3	16	14	-7.65	
Total (person-days)	1336	1336	0.00	

B6 Number of activities per tour (All cases)

	m0	m1	m1-m0 (%)	sign
1	13315	13302	-0.10	
2	2430	2442	0.50	
3	608	613	0.94	
4	169	173	2.10	*
> 4	78	76	-2.26	*
Total (tours)	16600	16606	0.04	

	GE 2020 (× 1000)	Var 2 (× 1000)	Var 2-GE	Var 2-GE
B7.1 First tour mode (All cases)				
	m0	m1	m1-m0 (%)	sign
Car driver	8014	7998	-0.20	
Slow mode	6284	6293	0.14	
Public transport	587	591	0.58	*
Car passenger	1661	1671	0.60	
Total (tours)	16600	16606	0.04	

B7.2 First tour mode (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
Car driver	936	926	-1.08	**
Slow mode	883	885	0.31	
Public transport	54	55	1.65	
Car passenger	241	245	1.39	
Total (tours)	2118	2114	-0.15	

B7.3 First tour mode (75+ yr)

	m0	m1	m1-m0 (%)	sign
Car driver	462	457	-0.97	
Slow mode	605	599	-1.00	
Public transport	58	60	2.53	
Car passenger	147	148	0.71	
Total (tours)	1273	1265	-0.63	

Appendix 9: GE 2020 *without* pricing policy: Var. 1+2+3 vs Var. 1+2

	Var 2 (× 1000)	Var 3 (× 1000)	Var 3 – Var 2	Var 3 – Var 2
A1 Number of cars (All cases)				
	m0	m1	m1-m0 (%)	sign
No car	1548	1530	-1.15	**
One car	4856	4854	-0.05	
2 or more cars	2234	2255	0.94	
Total (households)	8639	8639	0.01	

A2 Household urban density (All cases)				
	m0	m1	m1-m0 (%)	sign
1 (high)	1771	1710	-3.46	**
2	1974	1886	-4.45	**
3	1873	1875	0.10	
4	1721	1802	4.73	**
5 (low)	1293	1359	5.12	**
Total (households)	8639	8639	0.01	

B1 Indicators (All cases)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	583628	583723	0.02	
Travel time car driver (min)	298130	299405	0.43	
Travel time public transport (min)	53732	53286	-0.83	
Travel time slow (min)	174308	173474	-0.48	*
Travel time car passenger (min)	55949	56056	0.19	
Number of tours	16926	16956	0.18	
Number of trips	38566	38639	0.19	
Ratio trips-tours	2.279	2.279	0.01	
Ratio single stop tours - all tours	0.796	0.796	0.00	
Total travel distance (km)	407377	408173	0.20	
Distance car driver (km)	311654	312795	0.37	
Distance car passenger (km)	54578	54677	0.18	
Distance slow (km)	23729	23542	-0.79	
Distance public transport (km)	17415	17159	-1.47	

	Var 2 (× 1000)	Var 3 (× 1000)	Var 3 – Var 2	Var 3 – Var 2
B2 Indicators (Weekdays)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	452989	453508	0.11	
Travel time car driver (min)	231551	232549	0.43	
Travel time public transport (min)	44594	44444	-0.34	
Travel time slow (min)	134624	134244	-0.28	
Travel time car passenger (min)	40923	40973	0.12	
Number of tours	12813	12843	0.23	
Number of trips	29209	29286	0.26	
Ratio trips-tours	2.28	2.28	0.03	
Ratio single stop tours - all tours	0.799	0.798	-0.04	
Total travel distance (km)	313804	314514	0.23	
Distance car driver (km)	240502	241378	0.36	
Distance car passenger (km)	40194	40210	0.04	
Distance slow (km)	18636	18535	-0.54	
Distance public transport (km)	14472	14392	-0.56	

B3 Indicators (Weekend)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	130639	130214	-0.33	
Travel time car driver (min)	66579	66856	0.42	
Travel time public transport (min)	9138	8842	-3.24	
Travel time slow (min)	39684	39230	-1.14	*
Travel time car passenger (min)	15027	15083	0.37	
Number of tours	4112	4113	0.01	
Number of trips	9357	9353	-0.04	
Ratio trips-tours	2.275	2.274	-0.05	
Ratio single stop tours - all tours	0.79	0.791	0.14	
Total travel distance (km)	93573	93659	0.09	
Distance car driver (km)	71152	71417	0.37	
Distance car passenger (km)	14384	14467	0.58	
Distance slow (km)	5093	5007	-1.69	*
Distance public transport (km)	2943	2767	-5.98	

B4 Indicators (55-64 yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	108729	109239	0.47	
Travel time car driver (min)	55424	57054	2.94	**
Travel time public transport (min)	9348	8813	-5.72	*
Travel time slow (min)	32524	31687	-2.57	*
Travel time car passenger (min)	11131	11384	2.28	
Number of tours	3122	3138	0.53	
Number of trips	7131	7164	0.46	
Ratio trips-tours	2.284	2.283	-0.07	*
Ratio single stop tours - all tours	0.794	0.795	0.13	*
Total travel distance (km)	77131	78834	2.21	**
Distance car driver (km)	58686	60475	3.05	**
Distance car passenger (km)	10926	11292	3.35	
Distance slow (km)	4458	4229	-5.15	**
Distance public transport (km)	3061	2837	-7.31	

	Var 2 (× 1000)	Var 3 (× 1000)	Var 3 – Var 2	Var 3 – Var 2
B5 Indicators (65-74 yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	68915	68944	0.04	
Travel time car driver (min)	33319	33016	-0.91	
Travel time public transport (min)	4677	4824	3.14	*
Travel time slow (min)	22462	22818	1.59	
Travel time car passenger (min)	8356	8185	-2.05	*
Number of tours	2269	2269	0.00	
Number of trips	5167	5172	0.11	
Ratio trips-tours	2.277	2.28	0.11	
Ratio single stop tours - all tours	0.787	0.785	-0.20	
Total travel distance (km)	46899	46281	-1.32	
Distance car driver (km)	34533	34108	-1.23	
Distance car passenger (km)	7948	7704	-3.08	*
Distance slow (km)	2827	2905	2.78	
Distance public transport (km)	1592	1563	-1.78	

C1.1 Activity type (All cases)				
	m0	m1	m1-m0 (%)	sign
Work	3944	3970	0.65	*
Business	1329	1354	1.90	*
Bring or get	1488	1488	0.00	
Shop one store	4889	4882	-0.14	
Shop multiple stores	945	945	-0.04	
Service	1129	1131	0.24	
Social	2785	2786	0.02	
Leisure	2946	2950	0.14	
Touring	1861	1855	-0.34	
Other	323	322	-0.28	
Total (actvities)	21640	21683	0.20	

C1.2 Activity type (55-<65 yr)				
	m0	m1	m1-m0 (%)	sign
Work	702	723	2.92	**
Business	267	277	3.74	*
Bring or get	111	110	-0.86	
Shop one store	924	919	-0.54	
Shop multiple stores	177	172	-2.75	**
Service	213	216	1.03	
Social	560	561	0.14	
Leisure	593	598	0.83	
Touring	411	401	-2.54	
Other	51	50	-1.73	
Total (actvities)	4009	4025	0.41	

	Var 2 (× 1000)	Var 3 (× 1000)	Var 3 – Var 2	Var 3 – Var 2
C1.3 Activity type (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
Work	101	99	-1.49	
Business	52	52	-0.38	
Bring or get	72	71	-0.86	
Shop one store	895	899	0.44	
Shop multiple stores	164	167	1.85	
Service	207	211	1.96	
Social	466	469	0.61	
Leisure	505	500	-0.98	
Touring	389	387	-0.43	
Other	47	48	1.36	
Total (actvities)	2898	2904	0.19	

C2 Activity duration (All cases)				
	m0	m1	m1-m0 (%)	sign
<= 10 min	4352	4354	0.05	
11-20 min	1862	1869	0.36	
21-30 min	3479	3489	0.27	
31-45 min	280	283	1.26	
46-60 min	493	496	0.67	
61-80 min	1994	1984	-0.54	
81-120 min	3043	3042	-0.04	
> 120 min	6137	6167	0.49	
Total (actvities)	21640	21683	0.20	

C3.1 Activity begin time (All cases)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	5022	5040	0.36	
10-12 am	3283	3281	-0.06	
12-2 pm	2895	2896	0.02	
2-4 pm	3671	3678	0.19	
4-6 pm	2615	2628	0.52	
> 6 pm	4155	4161	0.14	
Total	21640	21683	0.20	

C3.2 Activity begin time (55-<65 yr)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	918	938	2.19	**
10-12 am	565	558	-1.32	**
12-2 pm	538	534	-0.88	
2-4 pm	698	692	-0.90	
4-6 pm	490	496	1.09	**
> 6 pm	799	809	1.17	**
Total (actvities)	4009	4025	0.41	

	Var 2 (× 1000)	Var 3 (× 1000)	Var 3 – Var 2	Var 3 – Var 2
C3.3 Activity begin time (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	199	196	-1.63	
10-12 am	695	701	0.87	*
12-2 pm	464	463	-0.11	
2-4 pm	635	637	0.46	
4-6 pm	351	352	0.37	
> 6 pm	555	554	-0.18	
Total (actvities)	2898	2904	0.19	

C4 Activity trip pattern (All cases)				
	m0	m1	m1-m0 (%)	sign
Single stop	13481	13505	0.18	
After stop	3445	3451	0.18	
Before stop	3445	3451	0.18	
Between stop	1270	1277	0.57	
Total (activities)	21640	21683	0.20	

C5 Activity location (All cases)				
	m0	m1	m1-m0 (%)	sign
Home zone	6434	6489	0.85	*
Home municipality	6149	6075	-1.21	**
Municipality order1	3037	3071	1.11	**
Municipality order2	2278	2297	0.86	*
Municipality order3	1374	1387	0.91	
Municipality order4	1080	1087	0.65	
Municipality order5	1262	1251	-0.86	
Total (activities)	21640	21683	0.20	

C6 Activity location (Work)				
	m0	m1	m1-m0 (%)	sign
home zone	419	434	3.58	**
Home municipality	1259	1248	-0.85	*
Municipality order1	655	664	1.51	**
Municipality order2	474	480	1.43	*
Municipality order3	429	436	1.67	
Municipality order4	271	278	2.27	
Municipality order5	413	403	-2.43	*
Total (activities)	3944	3970	0.65	*

C7 Number of tours (All cases)				
	m0	m1	m1-m0 (%)	sign
0	2642	2642	0.00	
1	5394	5400	0.10	
2	3253	3255	0.08	
3	1095	1099	0.42	
> 3	402	404	0.38	
Total (person-days)	12786	12800	0.11	

	Var 2 (× 1000)	Var 3 (× 1000)	Var 3 – Var 2	Var 3 – Var 2
C8 Number of activities per tour (All cases)				
	m0	m1	m1-m0 (%)	sign
1	13481	13505	0.18	
2	2542	2543	0.07	
3	638	642	0.50	
4	184	184	0.32	
> 4	81	81	0.71	
Total (tours)	16926	16956	0.18	

C9.1 First tour mode (All cases)				
	m0	m1	m1-m0 (%)	sign
Car driver	8125	8166	0.50	
Slow mode	6417	6407	-0.15	
Public transport	598	592	-1.06	
Car passenger	1731	1736	0.27	
Total (tours)	16926	16956	0.18	

C9.2 First tour mode (55-<65 yr)				
	m0	m1	m1-m0 (%)	sign
Car driver	1486	1524	2.55	**
Slow mode	1182	1165	-1.43	**
Public transport	102	93	-8.80	*
Car passenger	341	345	1.15	
Total (tours)	3122	3138	0.53	

C9.3 First tour mode (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
Car driver	988	986	-0.16	
Slow mode	946	948	0.16	
Public transport	58	61	4.32	**
Car passenger	273	271	-0.79	
Total (tours)	2269	2269	0.00	

Appendix 10: GE 2020 *without* pricing policy: Var. 3 vs Baseline GE

	GE 2020 (× 1000)	Var 3 (× 1000)	Var 3-GE	Var 3-GE
B1 Indicators (All cases)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	583628	583723	0.02	
Travel time car driver (min)	298130	299405	0.43	
Travel time public transport (min)	53732	53286	-0.83	
Travel time slow (min)	174308	173474	-0.48	*
Travel time car passenger (min)	55949	56056	0.19	
Number of tours	16926	16956	0.18	
Number of trips	38566	38639	0.19	
Ratio trips-tours	2.279	2.279	0.01	
Ratio single stop tours - all tours	0.796	0.796	0.00	
Total travel distance (km)	407377	408173	0.20	
Distance car driver (km)	311654	312795	0.37	
Distance car passenger (km)	54578	54677	0.18	
Distance slow (km)	23729	23542	-0.79	
Distance public transport (km)	17415	17159	-1.47	

B2 Indicators (Weekdays)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	443639	443452	0.13	
Travel time car driver (min)	227039	226425	0.47	
Travel time public transport (min)	44188	44089	-1.98	**
Travel time slow (min)	131813	132107	-0.14	
Travel time car passenger (min)	39164	39381	1.31	**
Number of tours	12593	12585	0.18	
Number of trips	28607	28606	0.19	
Ratio trips-tours	2.272	2.273	0.01	
Ratio single stop tours - all tours	0.804	0.803	-0.03	
Total travel distance (km)	306191	305702	0.52	
Distance car driver (km)	235070	234326	0.63	
Distance car passenger (km)	38541	38695	1.23	*
Distance slow (km)	18259	18328	-0.47	
Distance public transport (km)	14321	14354	-1.86	

	GE 2020 (× 1000)	Var 3 (× 1000)	Var 3-GE	Var 3-GE

B3 Indicators (Weekend)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	126306	127010	0.85	**
Travel time car driver (min)	64775	64855	0.77	
Travel time public transport (min)	8514	8892	1.44	
Travel time slow (min)	38293	38598	1.29	
Travel time car passenger (min)	14516	14466	-0.26	
Number of tours	4007	4021	0.44	
Number of trips	9079	9119	0.47	
Ratio trips-tours	2.266	2.268	0.02	
Ratio single stop tours - all tours	0.796	0.795	-0.11	
Total travel distance (km)	90714	90751	0.65	
Distance car driver (km)	69056	69137	0.87	
Distance car passenger (km)	13969	13822	-0.75	
Distance slow (km)	4890	4951	1.65	*
Distance public transport (km)	2799	2841	0.37	

B4 Indicators (55-64 yr)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	103964	104060	0.45	
Travel time car driver (min)	52832	52911	4.03	**
Travel time public transport (min)	9114	9216	-8.45	**
Travel time slow (min)	31281	31189	-2.85	**
Travel time car passenger (min)	10435	10432	-0.28	
Number of tours	3009	3011	0.55	
Number of trips	6827	6828	0.45	
Ratio trips-tours	2.269	2.268	-0.10	
Ratio single stop tours - all tours	0.802	0.803	0.17	
Total travel distance (km)	73114	73222	2.92	**
Distance car driver (km)	55497	55672	4.88	**
Distance car passenger (km)	10346	10280	-0.91	
Distance slow (km)	4275	4240	-4.92	**
Distance public transport (km)	2995	3029	-8.95	*

	GE 2020 (× 1000)	Var 3 (× 1000)	Var 3-GE	Var 3-GE
B5 Indicators (65-74 yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	62474	62994	0.55	
Travel time car driver (min)	30258	30030	-0.09	
Travel time public transport (min)	4183	4380	4.32	
Travel time slow (min)	20669	21107	1.22	
Travel time car passenger (min)	7273	7387	-0.95	
Number of tours	2118	2114	0.03	
Number of trips	4758	4759	-0.03	
Ratio trips-tours	2.247	2.251	-0.06	
Ratio single stop tours - all tours	0.806	0.803	-0.02	
Total travel distance (km)	41832	41908	-0.04	
Distance car driver (km)	30868	30737	0.15	
Distance car passenger (km)	6938	7026	-1.95	
Distance slow (km)	2595	2680	2.00	*
Distance public transport (km)	1431	1465	1.62	

C1.1 Activity type (All cases)				
	m0	m1	m1-m0 (%)	sign
Work	3948	3946	0.27	
Business	1331	1344	1.07	
Bring or get	1487	1485	-0.10	
Shop one store	4802	4813	0.34	
Shop multiple stores	948	948	-0.56	
Service	1112	1114	0.59	
Social	2630	2634	0.66	
Leisure	2779	2786	0.24	
Touring	1723	1725	-0.53	
Other	326	323	-0.25	
Total (actvities)	21086	21118	0.26	*

C1.2 Activity type (55-<65 yr)				
	m0	m1	m1-m0 (%)	sign
Work	707	703	2.06	*
Business	264	266	2.26	
Bring or get	110	113	-0.02	
Shop one store	894	892	-0.51	
Shop multiple stores	176	176	-3.04	
Service	210	210	1.04	
Social	504	503	0.76	
Leisure	536	535	-0.13	
Touring	366	366	-0.57	
Other	52	52	0.29	
Total (actvities)	3819	3817	0.37	

	GE 2020 (× 1000)	Var 3 (× 1000)	Var 3-GE	Var 3-GE
C1.3 Activity type (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
Work	100	99	-2.96	
Business	51	52	-0.64	
Bring or get	71	71	-0.06	
Shop one store	860	861	0.50	
Shop multiple stores	166	164	-0.22	
Service	202	202	0.03	
Social	397	399	0.32	
Leisure	423	422	-0.40	
Touring	323	327	-0.88	
Other	47	48	1.15	
Total (actvities)	2640	2644	-0.08	

C2 Activity duration (All cases)				
	m0	m1	m1-m0 (%)	sign
<= 10 min	4232	4234	-0.06	
11-20 min	1787	1796	0.32	
21-30 min	3371	3380	0.61	
31-45 min	270	277	2.20	
46-60 min	491	491	0.37	
61-80 min	1949	1951	0.29	
81-120 min	2952	2943	0.31	
> 120 min	6033	6046	0.14	
Total (actvities)	21086	21118	0.26	*

C3.1 Activity begin time (All cases)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	5299	4995	0.23	*
10-12 am	2961	3213	0.29	
12-2 pm	2797	2820	0.41	
2-4 pm	3541	3565	0.08	
4-6 pm	2536	2553	0.33	
> 6 pm	3951	3973	0.30	
Total	21086	21118	0.26	*

C3.2 Activity begin time (55-<65 yr)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	907	905	1.47	**
10-12 am	545	544	-0.85	
12-2 pm	511	509	-0.06	
2-4 pm	658	657	-0.02	
4-6 pm	463	465	0.38	
> 6 pm	735	738	0.54	
Total (actvities)	3819	3817	0.37	

	GE 2020 (× 1000)	Var 3 (× 1000)	Var 3-GE	Var 3-GE
C3.3 Activity begin time (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	369	193	0.01	
10-12 am	518	662	0.18	
12-2 pm	416	425	0.40	
2-4 pm	572	582	-0.22	
4-6 pm	309	318	-0.30	
> 6 pm	455	465	-0.55	
Total (actvities)	2640	2644	-0.08	

C4 Activity trip pattern (All cases)				
	m0	m1	m1-m0 (%)	sign
Single stop	13315	13302	0.19	
After stop	3285	3305	0.45	
Before stop	3285	3305	0.45	
Between stop	1201	1207	-0.02	
Total (activities)	21086	21118	0.26	*

C5 Activity location (All cases)				
	m0	m1	m1-m0 (%)	sign
Home zone	6263	6282	1.00	**
Home municipality	6023	6034	-1.40	**
Municipality order1	2947	2949	1.14	**
Municipality order2	2202	2210	1.35	**
Municipality order3	1347	1343	0.16	
Municipality order4	1051	1048	0.52	
Municipality order5	1228	1227	0.45	
Total (activities)	21086	21118	0.26	*

C6 Activity location (Work)				
	m0	m1	m1-m0 (%)	sign
home zone	419	422	2.52	*
Home municipality	1264	1264	-1.90	**
Municipality order1	657	653	1.12	
Municipality order2	471	472	0.83	
Municipality order3	432	430	1.08	
Municipality order4	268	271	1.85	*
Municipality order5	410	409	0.66	
Total (activities)	3948	3946	0.27	

C7 Number of tours (All cases)				
	m0	m1	m1-m0 (%)	sign
0	2728	2722	0.02	
1	5445	5451	0.01	
2	3187	3185	0.18	
3	1047	1049	0.27	
> 3	379	378	1.12	*
Total (person-days)	12786	12786	0.11	

	GE 2020 (× 1000)	Var 3 (× 1000)	Var 3-GE	Var 3-GE
C8 Number of activities per tour (All cases)				
	m0	m1	m1-m0 (%)	sign
1	13315	13302	0.19	
2	2430	2442	0.53	
3	608	613	0.18	
4	169	173	1.85	
> 4	78	76	-2.72	
Total (tours)	16600	16606	0.24	*

C9.1 First tour mode (All cases)				
	m0	m1	m1-m0 (%)	sign
Car driver	8014	7998	0.38	
Slow mode	6284	6293	0.02	
Public transport	587	591	-1.48	**
Car passenger	1661	1671	1.04	**
Total (tours)	16600	16606	0.24	*

C9.2 First tour mode (55-<65 yr)				
	m0	m1	m1-m0 (%)	sign
Car driver	1440	1439	2.76	**
Slow mode	1143	1141	-1.55	**
Public transport	99	101	-10.60	**
Car passenger	316	319	1.18	
Total (tours)	3009	3011	0.55	

C9.3 First tour mode (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
Car driver	936	926	-0.25	
Slow mode	883	885	0.40	
Public transport	54	55	2.24	
Car passenger	241	245	-0.74	
Total (tours)	2118	2114	0.03	

Appendix 11: GE 2020-Var. 1+2+3 *without* pricing policy versus Base 2000

	Base 2000 (× 1000)	Var 3 (× 1000)	Var 3 - Base	Var 3 - Base
A1 Household composition (All cases)				
	m0	m1	m1-m0 (%)	sign
Single, no worker	1545	2478	60.36	**
Single, one worker	1220	2001	63.99	**
Double, one worker	1224	1065	-13.02	**
Double, two worker	1830	1992	8.85	**
Double, no worker	1018	1104	8.41	**
Total (households)	6838	8639	26.35	**
A2 Household SEC (All cases)				
	m0	m1	m1-m0 (%)	sign
Minimum	1814	1173	-35.33	**
Low	1665	1099	-34.04	**
Medium	1454	2471	69.98	**
High	1904	3897	104.60	**
Total (households)	6838	8639	26.35	**
A3 Household children (All cases)				
	m0	m1	m1-m0 (%)	sign
No children	4904	6841	39.49	**
< 6 yr	904	811	-10.32	**
6-<12 yr	541	511	-5.54	**
12-<17 yr	488	476	-2.44	
Total (households)	6838	8639	26.35	**
A4 Number of cars (All cases)				
	m0	m1	m1-m0 (%)	sign
no car	1371	1530	11.65	**
one car	3824	4854	26.93	**
2 or more cars	1643	2255	37.26	**
Total (households)	6838	8639	26.35	**
A5 Household urban density (All cases)				
	m0	m1	m1-m0 (%)	sign
1 (high)	1531	1710	11.69	**
2	1521	1886	24.00	**
3	1391	1875	34.85	**
4	1336	1802	34.91	**
5 (low)	1055	1359	28.89	**
Total (households)	6838	8639	26.35	**

	Base 2000 (× 1000)	Var 3 (× 1000)	Var 3 - Base	Var 3 - Base
A6 Person work status (All cases)				
	m0	m1	m1-m0 (%)	sign
no	4806	5751	19.65	**
part time	1616	2084	28.99	**
full time	4488	4965	10.62	**
Total (persons)	10910	12800	17.32	**

A7 Person age (All cases)				
	m0	m1	m1-m0 (%)	sign
< 35 yr	2561	2690	5.05	**
35-<55 yr	4680	4537	-3.07	**
55-<65 yr	1533	2334	52.27	**
65-<75 yr	1186	1899	60.13	**
75+ yr	950	1340	41.00	**
Total (persons)	10910	12800	17.32	**

B1 Indicators (All cases)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	490025	583723	19.12	**
Travel time car driver (min)	238922	299405	25.31	**
Travel time public transport (min)	51883	53286	2.70	
Travel time slow (min)	149727	173474	15.86	**
Travel time car passenger (min)	48591	56056	15.36	**
Number of tours	14235	16956	19.11	**
Number of trips	32298	38639	19.63	**
Ratio trips-tours	2.269	2.279	0.44	**
Ratio single stop tours - all tours	0.803	0.796	-0.83	**
Total travel distance (km)	336848	408173	21.17	**
Distance car driver (km)	252667	312795	23.80	**
Distance car passenger (km)	48384	54677	13.01	**
Distance slow (km)	20259	23542	16.20	**
Distance public transport (km)	15538	17159	10.43	**

B2 Indicators (Weekdays)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	381499	453508	18.88	**
Travel time car driver (min)	186219	232549	24.88	**
Travel time public transport (min)	42725	44444	4.02	
Travel time slow (min)	116552	134244	15.18	**
Travel time car passenger (min)	35247	40973	16.24	**
Number of tours	10810	12843	18.81	**
Number of trips	24530	29286	19.39	**
Ratio trips-tours	2.269	2.28	0.49	**
Ratio single stop tours - all tours	0.806	0.798	-0.93	**
Total travel distance (km)	260166	314514	20.89	**
Distance car driver (km)	195967	241378	23.17	**
Distance car passenger (km)	35302	40210	13.90	**
Distance slow (km)	16013	18535	15.75	**
Distance public transport (km)	12884	14392	11.70	**

	Base 2000 (× 1000)	Var 3 (× 1000)	Var 3 - Base	Var 3 - Base
B3 Indicators (Weekend)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	108525	130214	19.98	**
Travel time car driver (min)	52703	66856	26.85	**
Travel time public transport (min)	9158	8842	-3.45	
Travel time slow (min)	33176	39230	18.25	**
Travel time car passenger (min)	13344	15083	13.03	*
Number of tours	3426	4113	20.05	**
Number of trips	7769	9353	20.40	**
Ratio trips-tours	2.268	2.274	0.29	**
Ratio single stop tours - all tours	0.795	0.791	-0.48	**
Total travel distance (km)	76683	93659	22.14	**
Distance car driver (km)	56700	71417	25.96	**
Distance car passenger (km)	13083	14467	10.58	*
Distance slow (km)	4246	5007	17.92	**
Distance public transport (km)	2654	2767	4.27	

B4 Indicators (55-64 yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	62527	109239	74.71	**
Travel time car driver (min)	31033	57054	83.85	**
Travel time public transport (min)	5564	8813	58.38	**
Travel time slow (min)	19051	31687	66.33	**
Travel time car passenger (min)	6764	11384	68.31	**
Number of tours	1899	3138	65.28	**
Number of trips	4301	7164	66.56	**
Ratio trips-tours	2.265	2.283	0.78	**
Ratio single stop tours - all tours	0.801	0.795	-0.84	**
Total travel distance (km)	43847	78834	79.79	**
Distance car driver (km)	32814	60475	84.30	**
Distance car passenger (km)	6745	11292	67.42	**
Distance slow (km)	2527	4229	67.37	**
Distance public transport (km)	1762	2837	61.07	**

B5 Indicators (65-74 yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	36967	68944	86.50	**
Travel time car driver (min)	15508	33016	112.89	**
Travel time public transport (min)	3509	4824	37.45	**
Travel time slow (min)	13394	22818	70.36	**
Travel time car passenger (min)	4512	8185	81.39	**
Number of tours	1252	2269	81.26	**
Number of trips	2796	5172	84.97	**
Ratio trips-tours	2.234	2.28	2.05	**
Ratio single stop tours - all tours	0.812	0.785	-3.26	**
Total travel distance (km)	23500	46281	96.94	**
Distance car driver (km)	16446	34108	107.39	**
Distance car passenger (km)	4287	7704	79.71	**
Distance slow (km)	1679	2905	73.07	**
Distance public transport (km)	1088	1563	43.64	**

	Base 2000 (× 1000)	Var 3 (× 1000)	Var 3 - Base	Var 3 - Base
B6 Indicators (75+ yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	26286	40424	53.79	**
Travel time car driver (min)	8162	15882	94.59	**
Travel time public transport (min)	4107	4569	11.24	**
Travel time slow (min)	10836	15320	41.37	**
Travel time car passenger (min)	3165	4615	45.84	**
Number of tours	837	1323	57.99	**
Number of trips	1859	2968	59.63	**
Ratio trips-tours	2.22	2.243	1.04	**
Ratio single stop tours - all tours	0.822	0.805	-1.99	**
Total travel distance (km)	14742	24344	65.13	**
Distance car driver (km)	8981	16531	84.07	**
Distance car passenger (km)	3050	4401	44.32	**
Distance slow (km)	1421	1977	39.15	**
Distance public transport (km)	1291	1435	11.12	*
C1.1 Activity type (All cases)				
	m0	m1	m1-m0 (%)	sign
Work	3438	3970	15.46	**
Business	1135	1354	19.32	**
Bring or get	1537	1488	-3.15	
Shop one store	3985	4882	22.52	**
Shop multiple stores	813	945	16.26	**
Service	936	1131	20.87	**
Social	2197	2786	26.83	**
Leisure	2320	2950	27.15	**
Touring	1431	1855	29.64	**
Other	272	322	18.41	**
Total (activities)	18063	21683	20.05	**
C1.2 Activity type (55-<65 yr)				
	m0	m1	m1-m0 (%)	sign
Work	330	723	118.92	**
Business	137	277	101.47	**
Bring or get	78	110	41.00	**
Shop one store	607	919	51.28	**
Shop multiple stores	125	172	38.21	**
Service	151	216	42.78	**
Social	335	561	67.63	**
Leisure	344	598	73.55	**
Touring	254	401	57.48	**
Other	40	50	24.75	**
Total (activities)	2402	4025	67.58	**

	Base 2000 (× 1000)	Var 3 (× 1000)	Var 3 - Base	Var 3 - Base
C1.3 Activity type (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
Work	30	99	226.43	**
Business	24	52	115.64	**
Bring or get	40	71	76.60	**
Shop one store	520	899	72.90	**
Shop multiple stores	104	167	61.01	**
Service	120	211	76.37	**
Social	234	469	100.58	**
Leisure	249	500	100.67	**
Touring	201	387	92.43	**
Other	22	48	115.93	**
Total (activities)	1545	2904	87.98	**

C1.4 Activity type (75+ yr)				
	m0	m1	m1-m0 (%)	sign
Work	9	12	32.77	**
Business	9	16	63.58	**
Bring or get	13	35	173.51	**
Shop one store	376	578	54.02	**
Shop multiple stores	87	121	40.16	**
Service	85	136	59.24	**
Social	152	254	66.62	**
Leisure	164	272	66.37	**
Touring	122	208	70.25	**
Other	5	13	153.54	**
Total (activities)	1022	1645	60.98	**

C2 Activity duration (All cases)				
	m0	m1	m1-m0 (%)	sign
<= 10 min	3740	4354	16.43	**
11-20 min	1571	1869	18.92	**
21-30 min	2837	3489	22.96	**
31-45 min	244	283	15.94	**
46-60 min	417	496	18.99	**
61-80 min	1611	1984	23.13	**
81-120 min	2478	3042	22.75	**
> 120 min	5164	6167	19.43	**
Total (activities)	18063	21683	20.05	**

C3.1 Activity begin time (All cases)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	4644	5040	8.54	**
10-12 am	2500	3281	31.24	**
12-2 pm	2378	2896	21.78	**
2-4 pm	2994	3678	22.83	**
4-6 pm	2181	2628	20.48	**
> 6 pm	3366	4161	23.63	**
Total (activities)	18063	21683	20.05	**

	Base 2000 (× 1000)	Var 3 (× 1000)	Var 3 - Base	Var 3 - Base
C3.2 Activity begin time (55-<65 yr)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	491	938	91.14	**
10-12 am	375	558	48.66	**
12-2 pm	341	534	56.54	**
2-4 pm	450	692	53.77	**
4-6 pm	296	496	67.57	**
> 6 pm	450	809	79.85	**
Total (activities)	2402	4025	67.58	**

C3.3 Activity begin time (65-<75 yr)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	201	196	-2.76	
10-12 am	316	701	121.61	**
12-2 pm	245	463	89.38	**
2-4 pm	340	637	87.71	**
4-6 pm	181	352	94.65	**
> 6 pm	262	554	111.55	**
Total (activities)	1545	2904	87.98	**

C3.4 Activity begin time (75+ yr)				
	m0	m1	m1-m0 (%)	sign
<= 10 am	125	69	-44.85	**
10-12 am	229	449	95.62	**
12-2 pm	165	274	65.82	**
2-4 pm	235	385	63.52	**
4-6 pm	113	191	69.28	**
> 6 pm	154	277	79.92	**
Total (activities)	1022	1645	60.98	**

C4 Activity trip pattern (All cases)				
	m0	m1	m1-m0 (%)	sign
Single stop	11433	13505	18.12	**
After stop	2803	3451	23.13	**
Before stop	2803	3451	23.13	**
Between stop	1025	1277	24.63	**
Total (activities)	18063	21683	20.05	**

C5.1 Activity location (All cases)				
	m0	m1	m1-m0 (%)	sign
home zone	5459	6489	18.87	**
home municipality	5198	6075	16.87	**
municipality order 1	2794	3071	9.91	**
municipality order 2	1655	2297	38.80	**
municipality order 3	1179	1387	17.59	**
municipality order 4	811	1087	34.01	**
municipality order 5	960	1251	30.36	**
Total (activities)	18063	21683	20.05	**

	Base 2000 (× 1000)	Var 3 (× 1000)	Var 3 - Base	Var 3 - Base
C5.2 Activity location (Work)				
	m0	m1	m1-m0 (%)	sign
home zone	380	434	14.22	**
home municipality	1078	1248	15.76	**
municipality order 1	630	664	5.47	**
municipality order 2	415	480	15.67	**
municipality order 3	358	436	21.82	**
municipality order 4	239	278	15.92	**
municipality order 5	331	403	21.85	**
Total (activities)	3438	3970	15.46	**

C6.1 Number of tours (All cases)

	m0	m1	m1-m0 (%)	sign
0	2349	2642	12.45	**
1	4605	5400	17.25	**
2	2709	3255	20.16	**
3	897	1099	22.54	**
> 3	349	404	15.61	**
Total (person-days)	10910	12800	17.32	**

C6.2 Number of tours (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
0	367	455	23.94	**
1	630	981	55.65	**
2	382	621	62.57	**
3	119	210	76.36	**
> 3	35	67	94.46	**
Total (person-days)	1533	2334	52.27	**

C6.3 Number of tours (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
0	384	519	35.25	**
1	469	741	57.96	**
2	240	444	85.00	**
3	74	152	104.40	**
> 3	19	44	129.38	**
Total (person-days)	1186	1899	60.13	**

C6.4 Number of tours (75+ yr)

	m0	m1	m1-m0 (%)	sign
0	378	479	26.79	**
1	365	514	40.82	**
2	160	254	59.01	**
3	40	75	88.07	**
> 3	8	18	125.25	**
Total (person-days)	950	1340	41.00	**

	Base 2000 (× 1000)	Var 3 (× 1000)	Var 3 - Base	Var 3 - Base
C7 Number of activities per tour (All cases)				
	m0	m1	m1-m0 (%)	sign
1	11433	13505	18.12	**
2	2075	2543	22.57	**
3	518	642	23.98	**
4	142	184	29.83	**
> 4	68	81	19.73	**
Total (tours)	14235	16956	19.11	**

C8.1 First tour mode (All cases)

	m0	m1	m1-m0 (%)	sign
Car driver	6612	8166	23.50	**
Slow mode	5556	6407	15.33	**
Public transport	520	592	13.83	**
Car passenger	1518	1736	14.33	**
Total (tours)	14235	16956	19.11	**

C8.2 First tour mode (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
Car driver	884	1524	72.34	**
Slow mode	742	1165	57.11	**
Public transport	55	93	70.60	**
Car passenger	214	345	60.75	**
Total (tours)	1899	3138	65.28	**

C8.3 First tour mode (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
Car driver	472	986	108.72	**
Slow mode	583	948	62.61	**
Public transport	40	61	50.28	**
Car passenger	155	271	75.21	**
Total (tours)	1252	2269	81.26	**

C8.4 First tour mode (75+ yr)

	m0	m1	m1-m0 (%)	sign
Car driver	232	478	105.83	**
Slow mode	442	628	42.01	**
Public transport	53	62	15.97	**
Car passenger	110	154	40.63	**
Total (tours)	837	1323	57.99	**

Appendix 12: GE 2020-Var. 1+2+3 *with* pricing policy versus Base 2000

	Base 2000 (× 1000)	Var 3C (× 1000)	Var 3C - Base	Var 3C - Base
B1 Indicators (All cases)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	490025	563054	14.90	**
Travel time car driver (min)	238922	247165	3.45	**
Travel time public transport (min)	51883	72127	39.02	**
Travel time slow (min)	149727	181632	21.31	**
Travel time car passenger (min)	48591	60508	24.53	**
Number of tours	14235	16672	17.11	**
Number of trips	32298	37908	17.37	**
Ratio trips-tours	2.269	2.274	0.22	*
Ratio single stop tours - all tours	0.803	0.799	-0.48	**
Total travel distance (km)	336848	352821	4.74	**
Distance car driver (km)	252667	244484	-3.24	**
Distance car passenger (km)	48384	61053	26.18	**
Distance slow (km)	20259	24742	22.13	**
Distance public transport (km)	15538	22542	45.08	**
B2 Indicators (55-64 yr)				
	m0	m1	m1-m0 (%)	sign
Total travel time (min)	62527	104658	67.38	**
Travel time car driver (min)	31033	46894	51.11	**
Travel time public transport (min)	5564	12232	119.82	**
Travel time slow (min)	19050	32893	72.66	**
Travel time car passenger (min)	6764	12345	82.52	**
Number of tours	1899	3087	62.57	**
Number of trips	4301	7021	63.24	**
Ratio trips-tours	2.265	2.274	0.41	**
Ratio single stop tours - all tours	0.801	0.799	-0.27	
Total travel distance (km)	43847	68106	55.33	**
Distance car driver (km)	32814	47218	43.90	**
Distance car passenger (km)	6745	12616	87.05	**
Distance slow (km)	2526	4440	75.73	**
Distance public transport (km)	1762	3832	117.55	**

	Base 2000 (× 1000)	Var 3C (× 1000)	Var 3C - Base	Var 3C - Base

B3 Indicators (65-74 yr)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	36967	66196	79.07	**
Travel time car driver (min)	15509	25797	66.34	**
Travel time public transport (min)	3510	7027	100.22	**
Travel time slow (min)	13394	24213	80.78	**
Travel time car passenger (min)	4512	9070	101.00	**
Number of tours	1252	2230	78.16	**
Number of trips	2796	5077	81.55	**
Ratio trips-tours	2.234	2.277	1.91	**
Ratio single stop tours - all tours	0.812	0.788	-2.98	**
Total travel distance (km)	23500	38894	65.51	**
Distance car driver (km)	16446	24642	49.84	**
Distance car passenger (km)	4287	8965	109.13	**
Distance slow (km)	1679	3107	85.13	**
Distance public transport (km)	1088	2179	100.21	**

B4 Indicators (75+ yr)

	m0	m1	m1-m0 (%)	sign
Total travel time (min)	26286	39018	48.44	**
Travel time car driver (min)	8162	12061	47.77	**
Travel time public transport (min)	4107	5899	43.63	**
Travel time slow (min)	10836	16067	48.27	**
Travel time car passenger (min)	3165	4957	56.65	**
Number of tours	837	1297	54.86	**
Number of trips	1859	2906	56.31	**
Ratio trips-tours	2.22	2.241	0.93	**
Ratio single stop tours - all tours	0.822	0.807	-1.79	**
Total travel distance (km)	14742	20365	38.14	**
Distance car driver (km)	8981	11565	28.77	**
Distance car passenger (km)	3050	4930	61.68	**
Distance slow (km)	1421	2092	47.24	**
Distance public transport (km)	1291	1778	37.68	**

C1.1 Activity type (All cases)

	m0	m1	m1-m0 (%)	sign
Work	3438	3929	14.28	**
Business	1135	1276	12.49	**
Bring or get	1537	1472	-4.20	
Shop one store	3985	4833	21.27	**
Shop multiple stores	813	939	15.61	**
Service	936	1124	20.09	**
Social	2197	2657	20.98	**
Leisure	2320	2877	24.01	**
Touring	1431	1823	27.41	**
Other	272	304	11.89	**
Total (activities)	18063	21236	17.57	**

	Base 2000 (× 1000)	Var 3C (× 1000)	Var 3C - Base	Var 3C - Base

C1.2 Activity type (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
Work	330	716	116.98	**
Business	137	255	85.69	**
Bring or get	78	107	37.83	**
Shop one store	607	908	49.60	**
Shop multiple stores	125	171	37.45	**
Service	151	216	42.91	**
Social	335	535	59.70	**
Leisure	344	579	68.24	**
Touring	254	398	56.28	**
Other	41	48	19.51	*
Total (activities)	2402	3934	63.77	**

C1.3 Activity type (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
Work	30	96	217.69	**
Business	24	48	98.51	**
Bring or get	40	71	77.54	**
Shop one store	520	893	71.81	**
Shop multiple stores	104	166	60.04	**
Service	120	206	72.19	**
Social	234	447	91.11	**
Leisure	249	489	95.89	**
Touring	201	386	91.86	**
Other	22	44	99.50	**
Total (activities)	1545	2847	84.30	**

C1.4 Activity type (75+ yr)

	m0	m1	m1-m0 (%)	sign
Work	9	12	34.80	**
Business	9	15	54.42	**
Bring or get	13	33	157.37	**
Shop one store	376	575	53.03	**
Shop multiple stores	87	118	36.18	**
Service	85	134	57.64	**
Social	152	242	59.19	**
Leisure	164	266	62.66	**
Touring	122	202	65.11	**
Other	5	12	142.42	**
Total (activities)	1022	1609	57.50	**

	Base 2000 (× 1000)	Var 3C (× 1000)	Var 3C - Base	Var 3C - Base

C2 Activity duration (All cases)

	m0	m1	m1-m0 (%)	sign
<= 10 min	3740	4298	14.92	**
11-20 min	1571	1813	15.36	**
21-30 min	2837	3400	19.84	**
31-45 min	244	266	8.71	**
46-60 min	417	486	16.62	**
61-80 min	1611	1956	21.39	**
81-120 min	2478	2973	19.97	**
> 120 min	5164	6045	17.06	**
Total (activities)	18063	21236	17.57	**

C3 Activity trip pattern (All cases)

	m0	m1	m1-m0 (%)	sign
Single stop	11433	13325	16.55	**
After stop	2803	3347	19.41	**
Before stop	2803	3347	19.41	**
Between stop	1025	1218	18.84	**
Total (activities)	18063	21236	17.57	**

C4.1 Activity location (All cases)

	m0	m1	m1-m0 (%)	sign
home zone	5459	6600	20.91	**
home municipality	5198	6143	18.18	**
municipality order 1	2794	2881	3.10	**
municipality order 2	1655	2136	29.04	**
municipality order 3	1179	1294	9.73	**
municipality order 4	811	997	22.89	**
municipality order 5	960	1160	20.84	**
Total (activities)	18063	21236	17.57	**

C4.2 Activity location (Work)

	m0	m1	m1-m0 (%)	sign
home zone	380	450	18.44	**
home municipality	1078	1273	18.09	**
municipality order 1	630	641	1.79	
municipality order 2	415	459	10.44	**
municipality order 3	358	418	16.68	**
municipality order 4	239	266	11.07	**
municipality order 5	331	397	20.07	**
Total (activities)	3438	3929	14.28	**

	Base 2000 (× 1000)	Var 3C (× 1000)	Var 3C - Base	Var 3C - Base

C5.1 Number of tours (All cases)

	m0	m1	m1-m0 (%)	sign
0	2349	2722	15.87	**
1	4605	5434	18.01	**
2	2709	3201	18.16	**
3	897	1058	17.95	**
> 3	349	384	9.87	**
Total (person-days)	10910	12800	17.32	**

C5.2 Number of tours (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
0	367	471	28.40	**
1	630	986	56.49	**
2	382	610	59.60	**
3	119	203	70.22	**
> 3	35	64	85.83	**
Total (person-days)	1533	2334	52.27	**

C5.3 Number of tours (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
0	384	532	38.64	**
1	469	743	58.39	**
2	240	436	81.99	**
3	74	146	96.26	**
> 3	19	42	120.05	**
Total (person-days)	1186	1899	60.13	**

C5.4 Number of tours (75+ yr)

	m0	m1	m1-m0 (%)	sign
0	378	489	29.38	**
1	365	514	40.81	**
2	160	249	55.98	**
3	40	72	79.42	**
> 3	8	17	107.13	**
Total (person-days)	950	1340	41.00	**

C6 Number of activities per tour (All cases)

	m0	m1	m1-m0 (%)	sign
1	11433	13325	16.55	**
2	2075	2476	19.31	**
3	518	621	19.92	**
4	142	175	23.08	**
> 4	68	75	11.15	*
Total (tours)	14235	16672	17.11	**

	Base 2000 (× 1000)	Var 3C (× 1000)	Var 3C - Base	Var 3C - Base

C7.1 First tour mode (All cases)

	m0	m1	m1-m0 (%)	sign
Car driver	6612	7426	12.31	**
Slow mode	5556	6687	20.36	**
Public transport	520	723	39.08	**
Car passenger	1518	1783	17.43	**
Total (tours)	14235	16672	17.11	**

C7.2 First tour mode (55-<65 yr)

	m0	m1	m1-m0 (%)	sign
Car driver	884	1382	56.34	**
Slow mode	742	1219	64.37	**
Public transport	55	118	115.44	**
Car passenger	214	357	66.77	**
Total (tours)	1899	3087	62.57	**

C7.3 First tour mode (65-<75 yr)

	m0	m1	m1-m0 (%)	sign
Car driver	473	880	86.20	**
Slow mode	583	992	70.16	**
Public transport	41	76	87.17	**
Car passenger	155	280	80.93	**
Total (tours)	1252	2230	78.16	**

C7.4 First tour mode (75+ yr)

	m0	m1	m1-m0 (%)	sign
Car driver	232	419	80.09	**
Slow mode	442	648	46.71	**
Public transport	53	72	35.35	**
Car passenger	110	157	43.06	**
Total (tours)	837	1297	54.86	**