Does working from home lead to longer commutes?

Exploring the impact of working from home conditions on commuting time valuation

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By

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Preface

This thesis[1] marks the end of my studies at the faculty of Technology, Policy, and Management. After completing primary and secondary school in Delft, I am proud to have also finished my studies of Complex Systems Engineering and Management at the Delft University of Technology.

I want to thank everyone who helped me on this journey. First, thanks to my graduation committee for their guidance during my master's thesis. Eric Molin, thank you for your quick responses and critical reflections. Ibo van de Poel, thank you for your open attitude and refreshing perspectives. Marije Hamersma, thank you for all the time and effort you dedicated to me. Roel Faber, thank you for sharing your knowledge and patience when answering my questions.

Besides that, I want to thank all employees of KiM Netherlands Institute for Transport Policy Analysis for their warm welcome and help with my thesis. I appreciate that you gave me the opportunity to conduct my research at your office.

Moreover, I want to thank everyone close to me in the past period. My parents, brothers, and sisters who always supported me. My roommates, Maarten and Michiel, for their reminders to take breaks and dragging me away from my desk. All my other friends, with whom I have laughed in the past years. And finally, my fiancé Lieneke, for her never-ending love and support.

“I can do all this through him who gives me strength.”
(Philippians 4:13)

Timon van Eeken
Delft, March 2025

[1] Use of artificial intelligence: ChatGPT is only used to debug the code in *R*. No artificial intelligence is used to write the text of this thesis.

Summary

Commuting contributes significantly to congestion and pollution, as an average Dutch citizen travels the most distance for commuting. For a long time, working from home (WFH) has been seen as a promising alternative to reduce congestion, pollution, and energy consumption. People who work from home full-days do not have to travel to work, and those who work from home part-days can avoid rush hours. This effect was visible during the COVID-19 pandemic, which stimulated people to work from home. During that period, the number of people working from home increased massively, and traffic jams dropped significantly. A contrasting pattern appeared after the pandemic. Whereas the number of people working from home remained high, congestion increased again to high levels. A possible explanation is that people who can work from home accept longer commuting times when they are not working from home.

This study addresses a gap in the existing literature, as no research has been done yet on the trade-offs people make between commuting time and working from home conditions. Besides this scientific contribution, the study has societal relevance. Insight into the trade-offs between working from home conditions and commuting time can help the government and employers design more effective policies about working from home. This study tries to answer the following research question:

How do individuals value commuting time under different working from home conditions?

A stated preference survey is conducted to answer the research question. The target population of this survey was all Dutch people aged 18 years or older who live in the Netherlands, perform paid work, and have the opportunity to work at least one full day per week from home. The survey was distributed to a panel, which resulted in a sample of 960 usable respondents. The survey consisted of a choice experiment and questions about the respondents' backgrounds. In the choice experiment, respondents had to choose between two jobs. The presented jobs varied in commuting time, number of days working from home, salary, working from home flexibility, working from home reimbursement and working from home culture. The data is analyzed using a Multinomial Logit Model (MNL) and a Latent Class Choice Model (LCCM). The advantages of an LCCM are that it can account for panel effects and heterogeneity between people.

The key findings are as follows:

(1) Some people are willing to accept an increased commuting time when they can work from home. The LCCM revealed four distinct classes of respondents with different commuting time valuations. The characteristic labels of these classes are time-sensitive commuters, WFH skeptics, WFH enthusiasts, and salary seekers. WFH enthusiasts prefer a maximum of 3 days working from home and are willing to accept a longer one-way commuting time of nearly 44 minutes in exchange for this, as opposed to 0 days WFH. Time-sensitive commuters prefer 2 days working from home and want to accept a longer commuting time of 10 minutes in exchange. The results reveal that people who can work from home value an increased commuting time less negatively than when they cannot work from home.
(2) The willingness to accept longer commutes does not increase the weekly commuting time. This statement is true under a set of assumptions. The first assumption is that everyone will work one extra day from home. The second assumption is that people have already accepted a longer commute based on their current pattern of working from home.

(3) Respondents value flexibility in working from home. In this study, WFH flexibility refers to the ability to decide on which days someone can work from home by themselves, given the maximum number of days they may work from home per week. WFH enthusiasts are willing to accept an increase of 19 minutes in exchange for this flexibility. This willingness is much shorter for time-sensitive commuters and WFH skeptics, around 5 minutes.
(4) WFH enthusiasts value a WFH reimbursement and a WFH culture in which many colleagues work at least one day per week from home. They are willing to accept an increase in one-way commuting time of 7 minutes in exchange for a reimbursement of €2.35 per WFH day. This is the reimbursement that employers can offer their employees untaxed. The effect of a WFH reimbursement and WFH culture is minimal for people of other classes.
(5) Some background characteristics and attitudes of people can explain the probability of belonging to a particular class. People who do mind if their commuting time increases by 20 minutes and who have positive WFH experiences are likelier to be time-sensitive commuters. Compared to time-sensitive commuters, WFH enthusiasts are more likely to already work from home and have a high income. Besides, they are likelier to have a good home office and are not annoyed when colleagues regularly work from home. WFH skeptics are likelier to have a low or middle education level, while salary seekers generally have negative WFH experiences.

The results have several policy implications for the government and employers. First, WFH enthusiasts are willing to accept a substantial increase in their daily commuting time when they can work some days from home. As a result, the congestion and pollution will get worse on the days that these people do not work from home. When the government wants to lower congestion and pollution levels by stimulating working from home, they should pay attention to the distribution of working from home over the week. Second, the results imply that many colleagues who regularly work from home are not valued much higher than only a few who regularly work from home. This result indicate that it is hard for the government and employers to manage WFH based on the WFH culture. On top of that, the results question the effectiveness of a WFH reimbursement. A WFH reimbursement is particularly valued by WFH enthusiasts who are most willing to increase their commuting time. A WFH reimbursement is not highly valued by respondents, indicating it is not a very useful tool for the government or employers to stimulate WFH.

From a mobility perspective, it is important to encourage time-sensitive commuters to work from home. They prefer working from home, indicating working from home potential. Furthermore, they are only willing to accept a slight increase in commuting time in return for WFH conditions. Therefore, they potentially contribute more to a drop in congestion than WFH enthusiasts.

Future research could broaden the scope and investigate other forms of teleworking than working from home. Investigating the differences in commuting time valuation between various forms of teleworking could offer new insights. In addition, further research could investigate WFH flexibility in more depth because this research only focused on one form of flexibility. Third, a qualitative study can help to get more insight into people's class membership. Another recommendation is to validate the assumptions made when calculating the net effect of WFH. More robust claims can be made about the impact of WFH on the total commuting time by further investigating if and how people changed their commuting patterns. Another interesting perspective is investigating employers' preferences concerning working from home. Stimulating people to work from home is ineffective when their employers would not allow them. A final recommendation is to conduct similar studies in other countries to investigate differences and similarities across countries because the literature shows that commuting time valuation can differ between countries.

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1 Introduction

1.1 Problem statement

“As early as the 1970s, researchers expressed the hope that teleworking could reduce commuting and thus lower congestion, pollution, and energy consumption” (Rüger et al., 2024, p. 1). Teleworking can be defined as “working from somewhere other than the workplace, and in particular from home” (Wöhner, 2022, p.2). Of all trips, an average Dutch citizen travels the most kilometers for commuting (Ministry of Infrastructure and Water Management, 2023). The basic assumption is that teleworking reduces the need to commute, as full-day teleworkers do not have to travel to work. Besides that, teleworking changes travel patterns because part-day teleworkers can avoid rush hours. Both forms of teleworking reduce congestion. Reducing congestion positively affects the environment, as traffic congestion can lead to 5-9 times higher emissions (Chen et al., 2022). Teleworking gained momentum during the COVID-19 pandemic because people were stimulated or forced to work from home. Dutch people working almost entirely from home increased from 6% before to 39% during the pandemic (De Haas et al., 2020). Less commuting contributed to a drop in traffic jams, with 63% in 2020 and 57% in 2021 compared to 2019 in the Netherlands (NOS, 2021).

During the pandemic, about 55% to 70% of the people working from home expressed positive experiences (Hamersma et al., 2020). Besides that, organizations stimulated teleworking as 70% to 90% improved the possibility of working from home (Hamersma et al., 2020). After the pandemic, teleworking remained popular as the number of hours worked from home in May 2022 increased by approximately 100% compared to before the pandemic (De Haas et al., 2022). However, a contrasting development is that the peak commute traffic load has increased after the pandemic. In 2023, road congestion reached a record-breaking level in the Netherlands (Müller, 2024). Besides that, the occupation rate in trains during peak hours sometimes exceeded 100%, as opposed to 30% off-peak (Nadram & Dekker, 2023).

Hence, there is uncertainty about the impact of teleworking on commuting. Despite the rise of working from home, peak hours have become busier, and nearly half of the commuters suffer from congestion on Tuesdays and Thursdays (Heersink, 2023). A hypothesis is that teleworkers tend to work the same days at the office due to fixed meetings or managers’ requirements (Heersink, 2023). Another hypothesis is that people are willing to accept longer commutes for some days because they can work from home on other days. Longer commutes by car are undesirable, as they contribute to congestion and emissions and offset the intended benefits of teleworking. On the other hand, shorter commutes make the choice for more sustainable modes of transport more attractive, which can relieve peak hour traffic on road and rail.

An interesting question is what preferences people have concerning commuting and working from home. In particular, the extent to which people weigh working from home conditions and commuting time is valuable information for the government and employers when designing teleworking policies. For employers, it is interesting what working from home conditions are important to their employees. For the government, insight into commuters’ trade-offs between working from home conditions and commuting time is interesting to counter congestion. If commuting times become longer due to working from home, other ways to reduce congestion may be needed. To conclude, insights into the impact of teleworking on commuting are needed to provide recommendations for teleworking. This can help lower congestion, pollution, and energy consumption and, therefore, preserve the benefits of teleworking.

1.2 Literature overview and research gap

Research has been done for a long time on the impact of teleworking on travel behavior. Studies have shown that teleworking can decrease the weekly travel time spent on commuting (Melo & de Abreu e Silva, 2017; Rüger et al., 2024). However, other studies found that teleworking resulted in longer weekly commuting distances (Melo & de Abreu e Silva, 2017) or more non-work-related travel (Wöhner, 2022). These effects can offset the time saved by teleworking, assuming that longer distances and more trips lead to increased travel time. The constant travel time budget theory is a possible explanation for this. This theory suggests that “at the aggregate level, for example, all people in a state or country, have a stable travel time budget, generally on average about 60-75 minutes per person per day” (Milakis & Van Wee, 2018, p. 113). In light of teleworking, this could mean that teleworkers are willing to make more non-work-related trips to replace the saved commuting time (Faber et al., 2023). Another assumption, mentioned in the introduction, is that teleworkers are willing to accept a longer daily commute time if it is only for a few days a week and they can work the other days from home.

Research has already been done on the travel time an individual is willing to accept for commuting. The acceptable travel time is determined by the utility derived from benefits related to the travel itself and benefits related to the trip’s destination (Milakis et al., 2015). For example, someone derives utility from a trip as it helps to clear the mind (the travel) and as it gets you to a certain activity (the destination). Unraveling the factors affecting acceptable commuting times can help by understanding the choices people make when selecting a job and, therefore, the relations between working from home conditions and commuting time. Many studies have identified acceptable commuting times, such as Hamersma & Roeleven (2024) recently in the Netherlands. The acceptable commute time can be affected by socio-demographics (Milakis et al., 2015), job (Rouwendal & Meijer, 2001), housing (Rouwendal & Meijer, 2001) and travel characteristics (Milakis & Van Wee, 2018). Finally, research showed that teleworking conditions can affect acceptable commute times. People with a positive attitude towards working from home have higher acceptable travel times (Hamersma & Roeleven, 2024). De Vos et al. (2018) found that Dutch homeworkers accept 5% longer daily commuting times on average. This is in line with the theory of constant travel time budget. As mentioned, longer daily commute times are undesirable because they offset the time saved by working from home.

To conclude, the current literature is mainly focused on the impact of teleworking on travel behavior and acceptable commuting times. However, these studies do not pay attention to the impact of different teleworking conditions other than the number of days working from home. Besides, the trade-offs people make between working from home conditions and commuting time are unknown. To my best knowledge, no research has yet been done on commuting time valuation under different working from home conditions. Working from home conditions are of interest because employers and the government can influence these. This study aims to examine the value of commuting time under different working conditions. Hereby, trade-offs between working from home conditions and commuting time are analyzed, even as explanatory factors and the differences among commuters.

1.3 Scientific and societal relevance

This study addresses a research gap in the existing literature by focusing on people’s considerations when choosing a certain job arrangement consisting of commuting time and different working from home conditions. Investigating the trade-offs people make between such working conditions contributes to understanding the impact of teleworking. By examining the value of commuting time under different working from home conditions, this study aims to gain information into the factors that influence individuals’ preferences for teleworking and commuting times.

Besides the scientific contribution of this research, the study also has societal relevance. Insight into the trade-offs between working from home conditions and commuting time can help the government and employers design more effective policies about working from home. The government and employers can use this knowledge to determine whether or not working from home should be stimulated. On top of that, this study tries to analyze what working from home conditions people prefer. Besides that, the identified heterogeneity between people can be used to develop tailor-made policies for groups of people with certain shared characteristics.

1.4 Main research question and scope

This research investigates the importance of commuting time under different working from home conditions. The following main research question is researched to reach this aim:

How do individuals value commuting time under different working from home conditions?

The research will be conducted in the Netherlands and will be focused on the Dutch employed labor force. In this research, the Dutch employed labor force is defined as all people aged 18 years or older who live in the Netherlands and perform paid work. Because the interest is in working from home conditions, the research population will be limited to people who can work from home at least one full day per week. This means that occupations such as painters and chauffeurs are excluded because, by definition, they cannot work from home. In 2019, 37.5% of the Dutch employed labor force had the opportunity to work from home (Statistics Netherlands, 2020). However, this share has grown as a result of the COVID-19 period. According to the KiM Netherlands Institute for Transport Policy Analysis, about 50% to 60% of workers have some extent of working from home opportunities (Hamersma et al., 2021). Finally, forms of teleworking other than working from home, such as working from a cafeteria, are not taken into account in this study.

1.5 Research approach and sub-research questions

There is a lack of understanding of the trade-offs between commuting time and the conditions to work from home. A choice modeling approach is suitable to address this research gap. A discrete choice model can describe a decision-maker's choices among alternatives (Train, 2009). This method yields various advantages. First, one can infer the weights that decision-makers attach to different characteristics (Chorus & Van Cranenburgh, 2020). As a result, one can explore the factors that lead to a certain decision and, therefore, the behavior of a decision-maker. Finally, one can infer the levels of unobserved heterogeneity across decision-makers (Chorus & Van Cranenburgh, 2020). The main research question will be answered by addressing the following two sub-questions:

1. *What trade-offs do people make between working from home conditions and commuting time?*

A survey is constructed to understand the trade-offs people make concerning working from home conditions and commuting time. Two types of data can be collected for a choice model. The first is called revealed-preference (RP) data, which relates to decisions that individuals make in real life. The second is called stated-preference (SP) data, which relates to choices between hypothetical situations that are laid out to individuals by the researcher. According to Train (2009), both RP and SP data have their advantages and limitations. A big advantage of RP data is that it reflects the actual choices of individuals. This is not the case for SP data, which may suffer from bias as the hypothetical preferences of an individual may not be the same as their preferences in real life. A downside of RP data is that it is limited to already existing choice situations and that there could be insufficient variation in these choice situations. SP data overcomes these problems allowing a high degree of variation in attributes and attribute levels, even beyond existing values. A last advantage of SP data over RP data is that fewer

respondents are needed, as multiple choices from a single respondent can be observed. Because of these reasons, this study uses SP data.

In the choice experiment, respondents indicate their preference for one of two jobs. The respondents have to imagine that they are looking for a new job. Hereby, the respondents are asked to image that everything of their current job remains the same, except for the six factors varied in the choice experiment. By doing this, the respondents can relate well to the choice situation because the reference point is their current situation. Another advantage is that only the factors of interest can be included in the analysis. The factors that will characterize the jobs and thus are included in the choice experiment are based on a literature review. Examples of these factors are commuting time, salary, and the number of days working from home.

2. *To what extent do these trade-offs differ between people?*

Individuals can make different decisions because every individual is unique. However, this different behavior may be explained by shared characteristics of people. For example, certain socio-demographic characteristics can impact the trade-offs an individual makes. By including such characteristics in the model, differences between groups can be accounted for. A Latent Class Choice Model is used to study this heterogeneity.

1.6 Relation to CoSEM program

This master thesis is part of the specialization Transport & Logistics in the master's program Complex Systems Engineering and Management (CoSEM). A CoSEM thesis is focused on research in complex sociotechnical systems and designing effective interventions in real-world decision-making processes. This thesis is focused on identifying trade-offs between working from home conditions and commuting times to design more effective policies concerning working from home. This research fits perfectly in this program because interactions between technical, institutional, and social processes play a role in these trade-offs. Such a multidisciplinary approach is typical for a CoSEM thesis. Finally, scientific research methods learned in the master's program are used.

1.7 Thesis structure

The structure of this thesis is as follows. Chapter 2 provides a theoretical framework in which a literature review is done and a conceptual model is presented. This is followed by Chapter 3 in which all methodological choices are explained. Chapters 2 and 3 together form the research design phase. The results of the analyses are presented in Chapter 4. Finally, the conclusions, implications, and limitations are provided in Chapter 5. In Figure 1, the structure of this thesis is visually presented in a research flow diagram. The different research phases are indicated next to the chapters, related output, and corresponding research questions.

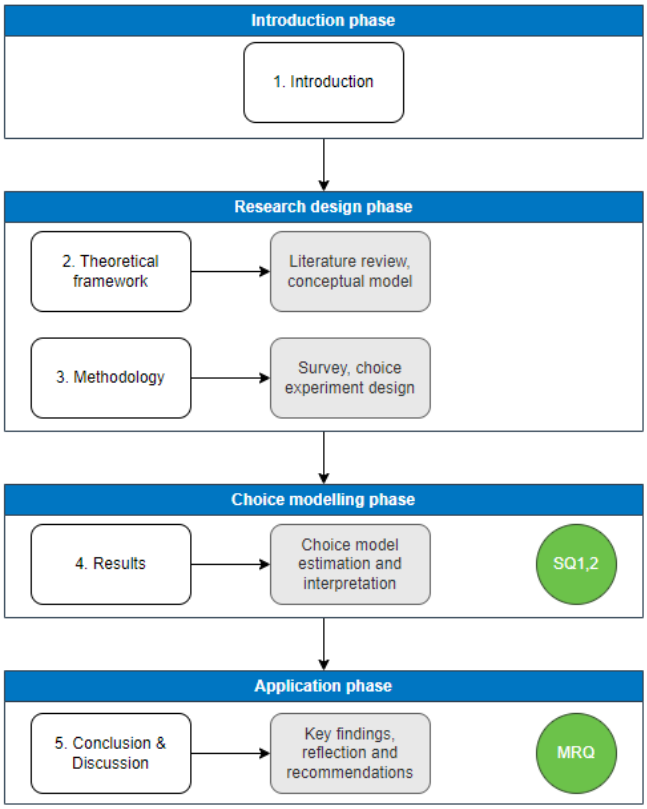

Figure 1: Research flow diagram

2 Theoretical framework

The second chapter of this thesis is dedicated to forming a theoretical framework. Section 2.2 explains the literature search process. This is followed by the literature review in section 2.3. Factors that were not found in the literature review but are still relevant are discussed in section 2.4. After that, the attribute selection is explained in section 2.5. Section 2.6 closes with the presentation of a conceptual model.

2.1 Introduction

This research investigates the hypothesis that people accept longer commuting times when they can work from home. Therefore, looking at the factors that impact commuting time valuation is interesting. What is already known in the literature about the impact of working from home conditions on commuting time valuation is relevant to know when designing the choice experiment. The identified factors can be included in the choice experiment. Commuting time and working from home conditions are embedded in the work environment because they are both inseparably linked to someone's job. For this reason, attention is also paid to job characteristics. A literature review was conducted to answer the following three questions:

1. *What factors influence the commuting time valuation of people?*
2. *What factors influence the decision of people to choose a job?*
3. *What factors influence the decision of people to work from home?*

It is helpful to explore the factors that influence commuting time valuation in the first place before looking at the impact of different working from home conditions on commuting time valuation. The first question is therefore focused on unraveling such factors. Besides that, it is relevant to get some insights into the factors that play a role when people search for a new job. These factors will be identified by answering the second question. Finally, there is a special interest in working from home conditions. The third question identifies the exact conditions of these working from home conditions. The most relevant factors will be included as attributes in the choice experiment.

2.2 Literature search process

Van Wee & Banister (2016) strongly recommend to explicitly explain the methodologies used in a literature review. Therefore, the literature search process is explained in this section. The reasoned approach for reporting a literature review methodology is used to be as transparent as possible (Van Wee & Banister, 2023). The search for academic articles was performed in September and October 2024 on Scopus because the interest was in scientific articles only. Different synonyms are used in the search strings because not all articles use the same terms. The search terms and used synonyms are presented in Table 1.

Table 1: Search terms

Concept	Synonym(s)
Commut* time	Travel time
Commuting	Travel to work, journey to work
Driver	Stimulate, incentiv*
Value of time	Value of travel time, value of commuting time
Working from home	Telework*, telecommut*
Job search	Job seeking, job characteristics, work characteristics
Choice experiment	Choice modelling, stated preference

The search terms are combined in search strings to find all relevant literature. These are presented in Table 2. Also, the number of search results and the number of selected articles are indicated in the table. The papers are selected based on titles, keywords, and abstracts. An article is included in the literature review if it can help answer the questions asked in section 2.1. For example, articles focused on autonomous driving, departure times, or mode choice do not meet this criterion and are therefore excluded. Only scientific papers written in the English language were considered.

Table 2: Final search strings

Topic	Search string	Results	Selected
Travel time valuation	"value of time" OR "value of travel time" OR "value of commuting time" AND commuting OR "travel to work" OR "journey to work"	148	11
Teleworking	"working from home" OR telework* OR telecommut* AND "commut* time" OR "travel time"	127	8
	"working from home" OR telework* OR telecommut* AND stimulate OR incentiv* OR driver	162	5
Job search	"job search" OR "job seeking" OR "job characteristics" OR "work characteristics" AND "choice experiment" OR "choice modelling" OR "stated preference"	60	3

Ultimately, 27 articles are selected for the literature review. Table 3 shows an overview of the articles included. The table presents the author(s) and year of publication, main research method, and country of study. The articles are clustered into the corresponding search topic and listed alphabetically by author.

Table 3: Overview of included articles

Nr.	Author(s)	Method	Country
Articles related to travel time valuation			
1	Asensio & Matas (2007)	Choice experiment	Spain
2	Beck & Hess (2016)	Choice experiment	Sweden
3	Ettema & Verschuren (2010)	Choice experiment	The Netherlands
4	Hensher & Li (2012)	Choice experiment	Australia
5	Hensher et al. (2021)	Choice experiment	Australia
6	Kou et al. (2016)	Choice experiment	China
7	Lara-Pulido & Martinez-Cruz (2023)	Choice experiment	Mexico
8	Rouwendal & Meijer (2001)	Choice experiment	The Netherlands
9	Shires & De Jong (2009)	Meta-analysis	European Union
10	Swärdh & Algers (2016)	Choice experiment	Sweden
11	Van Landeghem et al. (2024)	Choice experiment	Belgium
Articles related to teleworking			
12	Caulfield (2015)	Case study	Ireland
13	De Andrés-Sánchez & Belzunegui-Eraso (2023)	Survey	Spain
14	De Vos et al. (2018)	Survey	The Netherlands
15	Drucker & Khattak (2000)	Survey	United States
16	Ecke et al. (2022)	Survey	Germany
17	Huang et al. (2023)	Survey	Switzerland

18	Illegems et al. (2001)	Survey	Belgium
19	Mokhtarian & Salomon (1997)	Survey	United States
20	Motte-Baumvol & Schwanen (2024)	Survey	United Kingdom
21	O'Keefe et al. (2016)	Survey	Ireland
22	Ollo-Lopez et al. (2020)	Multilevel models	Europe
23	Robèrt & Börjesson (2006)	Choice experiment	Sweden
24	Stiles & Smart (2021)	Survey	United States
Articles related to job search			
25	Demel et al. (2018)	Choice experiment	Spain, Czech Republic, Germany
26	Morejón Cabrera & Mariel (2023)	Choice experiment	Spain, Colombia, Ecuador
27	Non et al. (2022)	Choice experiment	The Netherlands

2.3 Literature review

2.3.1 Factors related to travel time valuation

Much research related to travel time valuation is dedicated to determining the value of time. The value of time can be defined as "the amount of money travelers are willing to spend to achieve one unit travel time saving, or to prevent a one unit travel time loss" (Ettema & Verschuren, 2010, p.1). In other words, someone with a high value of time is willing to pay more money to reduce their travel time than someone with a low value of time. The terms 'value of time', 'value of travel time', and 'value of travel time savings' are often used interchangeably. Henceforth, the term 'value of time' (VOT) will be used. An overview of the factors that impact travel time valuation is presented in Table 4.

The factor found to be significant in most articles is salary or income. Rouwendal & Meijer (2001) found that Dutch people with a higher income have a lower VOT. They relate this to the statement that workers with a high income generally have longer commutes. Ettema & Verschuren (2010) found the opposite, as a lower income increases the importance of travel costs and lowers the VOT. Other research found that people are willing to travel longer for an increase in salary or vice versa (Beck & Hess, 2016; Van Landeghem et al., 2024). In general, the mean estimate of the VOT appears to be over 12% higher after the COVID-19 pandemic in Australia (Hensher et al., 2021). The VOT is also higher for individuals who work more days from home (Hensher et al., 2021). De Vos et al. (2018) found that working from home allows Dutch people to accept, on average, 5% longer daily commuting times. The final job characteristic that impacts travel time valuation is the flexibility of the working schedule. Van Landeghem et al. (2024) found that people are willing to increase their commuting time by 30 minutes per day if they can choose between a few fixed working schedules instead of having no say in their schedule.

Travel characteristics can also affect the VOT. Dutch research found an effect of transport mode, as train travelers obtained a lower VOT than car drivers (Ettema & Verschuren, 2010). Other Dutch research found that train commuters who can conduct activities while commuting reduce the VOT by approximately 30% (Molin et al., 2020). The VOT is higher for commuters conducting work or study-related activities and slightly lower for commuters listening to music. Travel time variability is also related to the VOT. Asensio & Matas (2008) state: "The concept of travel time variability refers to the commuter's inability to forecast how long this trip will last" (p. 1075). Asensio & Matas researched this concept in Barcelona, Spain, and found that the value of time variability highly depends on the time restrictions an individual is up against. This is supported by evidence from Beijing, China (Kou et al., 2017). Kou et al. (2017) even found that travel variability can be more critical for commuters than travel time. Finally, longer commuting times or distances lead to higher VOTs (Hensher et al., 2021; Shires & De Jong,

2009). Results from Lara-Pulido & Martinez-Cruz (2023) also indicate a disutility from time spent commuting.

Housing characteristics also have an impact on the commuting time valuation. Rouwendal & Meijer (2001) studied the preferences of Dutch commuters. They found that respondents are willing to accept longer commutes to move to a more desirable type of housing. Respondents preferred detached houses over nondetached houses, houses with a garden over houses without, and single-family dwellings to apartments. Also, an improved housing location and owner occupation are desirable factors for which respondents are willing to increase their commuting time. Generally, people prefer a small town in the countryside over a large city center.

Several studies found significant relations between personal characteristics and travel time valuation. Age affects travel time valuation as commuters below 40 have a VOT that is 78% higher (Ettema & Verschuren, 2010). Commuters with a middle to higher education level have a higher VOT, and singles with children even have an extremely high VOT (Ettema & Verschuren, 2010). Concerning gender, both men and women tend to value women's commuting time more than men's commuting time (Swärdh & Algers, 2016). Beck & Hess (2016) found that the heterogeneity in commuting preferences is more considerable for females than males. Finally, Shires & De Jong (2009) found that people in Southern and Eastern countries have higher VOTs than other European countries, all other things being equal.

Table 4: Overview of identified factors that impact travel time valuation

Category	Identified factor	Found in
Job characteristics	Working from home	5, 11, 14
	Flexibility	11
	Salary	2, 6, 8, 9, 11
Travel characteristics	Commuting time	5, 7, 9, 10
	Multitasking during travel	3
	Transport mode	3, 6
	Travel time variability	1, 4, 6
Housing characteristics	Housing location	8
	Housing ownership	8
	Housing type	8
Personal characteristics	Age	3
	Country	9
	Education level	3
	Gender	2, 10
	Household composition	3

2.3.2 Factors related to teleworking

Table 5 presents an overview of the identified factors that impact teleworking. In the reviewed literature, the concepts ‘teleworking’, ‘telecommuting’, and ‘working from home’ are sometimes used interchangeably but with different definitions. In this thesis, the term ‘teleworking’ is used when someone is working from somewhere other than the workplace, and ‘working from home’ (WFH) is used when someone is not working from their workplace but specifically from home.

Several travel characteristics have an impact on WFH. Illegems et al. (2001) found that workers who mainly commute intraregional instead of interregional in Brussels are a barrier for companies to implement teleworking. Under the assumption that, in general, intraregional commutes are shorter than

interregional commutes, this supports the finding of Ollo-Lopez et al. (2020) that workers who live far away from their workplace are more likely to work from home. In their research, they used data from 28 countries in Europe. Drucker & Khattak (2000) state that longer commuting times tend to discourage WFH, based on the US's 1995 Nationwide Personal Transportation Study. According to the authors, this may be due to variables such as job type and residential tenure, which were unavailable in the data set. They also found that WFH is significantly higher for people who have to pay to park at work. People with poor public transport connectivity are more likely to work from home in the Greater Dublin Area (Caulfield, 2015). O'Keefe (2016) supports this statement concerning bus connectivity but found no significant result for train connectivity. On the contrary, Drucker & Khattak (2000) found that rail and subway availability tend to encourage WFH, while they also state that this effect is probably more dependent on other city traits.

Besides travel characteristics, some work-related characteristics impact an individual's decision to work from home. The organization's or manager's support has a positive effect (De Andrés-Sánchez & Belzunegui-Eraso, 2023; O'Keefe, 2016). Also, self-employment (Motte-Baumvol & Schwanen, 2024), working part-time (Drucker & Khattak, 2000; Motte-Baumvol & Schwanen, 2024), and a high level of empowerment (Ollo-Lopez et al., 2020) have a positive effect on WFH. People with a professional/managerial occupation are more likely to work from home (Motte-Baumvol & Schwanen, 2024; Stiles & Smart, 2021). Also, people with occupations in information and communication, finance, real estate, and administration are more likely to work from home, according to Caulfield (2015). However, Stiles & Smart (2021) state that people with an administrative position are less likely to work from home. Concerning connectivity, Robèrt & Börjesson (2006) found that access to a company laptop positively affects WFH. On a more aggregate level, ICT infrastructure at the country level positively affects WFH (Ollo-Lopez et al., 2020). Illegems et al. (2000) studied barriers and drivers for teleworking from a firm's perspective in Brussels. They found that a high number of employees and a high level of electronic communication are drivers to implement teleworking. In contrast, a substantial number of employees with temporary contracts is a barrier.

Specific housing characteristics can impact the decision to work from home. According to Robèrt & Börjesson (2006), slow computer equipment is an important constraint for preferring more teleworking. The suitability of ICT facilities and high broadband internet coverage positively influence WFH (Caulfield, 2015; De Andrés-Sánchez & Belzunegui-Eraso, 2023). Population density is another significant factor. Research has found that living in an area with low population density is positively associated with WFH (Caulfield, 2015; O'Keefe, 2016). Finally, the residential area is related to WFH. Drucker & Khattak found that people living in rural areas are more likely to work from home than those in urban neighborhoods. This is supported by De Andrés-Sánchez & Belzunegui-Eraso (2023), as they found that residing in an administrative capital negatively impacts WFH. People in more affluent areas are also more likely to work from home than those in more deprived areas (Caulfield, 2015; O'Keefe, 2016).

Finally, personal characteristics can impact WFH. Generally, age is positively associated with WFH (Drucker & Khattak, 2000). Studies show that people older than 35 (O'Keefe, 2016) and those between 45 and 64 (Caulfield, 2015) are most likely to telework. A high education level also positively affects WFH (Caulfield, 2015; Drucker & Khattak, 2000; Ecke et al., 2022; Huang et al., 2023; Illegems et al., 2001; O'Keefe, 2016; Stiles & Smart, 2021). Additionally, a high income positively influences WFH (Drucker & Khattak, 2000; Huang et al., 2023; Motte-Baumvol & Schwanen, 2024; Stiles & Smart, 2021). In line with this, Ecke et al. (2022) found that people with a low economic status obtain low levels of WFH. Concerning gender, females work from home less often than males (Drucker & Khattak, 2000; Huang et al., 2023; O'Keefe, 2016). Individuals in a household with children are more likely to telework than those without (Caulfield, 2015; Drucker & Khattak, 2000; Motte-Baumvol & Schwanen, 2024; O'Keefe, 2016; Robèrt & Börjesson, 2006). Caulfield (2015) found that single people were most likely

to live in an area with the highest levels of WFH, and Drucker & Khattak (2000) found that single adults without children tend to work from home more often. This contrasts with O'Keefe (2016), who found that married individuals are more likely to telework than singles. The availability of multiple vehicles positively influences WFH (Drucker & Khattak, 2000). Caulfield (2015) and O'Keefe (2016) acknowledged this for car availability.

Mokhtarian & Salomon (1997) investigated the drives and constraints of telecommuting in San Diego. They found that attitudes contribute significantly to the explanatory power of the model and conclude that socio-demographic characteristics are too narrow to represent persons in discrete choice models. They also conclude that factors more subject to policy influence need to be further studied.

Table 5: Overview of identified factors that impact teleworking

Category	Identified factor	Found in
Travel characteristics	Access to public transport	12, 15, 21
	Commuting time	15, 18, 22
	Parking costs	15
Job characteristics	Attitude of manager	13, 21
	Company structure	22
	Connectivity at work	18, 22, 23
	Contract type	18
	Employment status	15, 20
	Number of employees	18
	Occupational status	12, 18, 20, 24
	Self-employment	20
Housing characteristics	Connectivity at home	12, 13, 23
	Residential density	12, 21
	Residential area	12, 13, 15, 21
Personal characteristics	Age	12, 15, 17, 21, 23
	Attitudes	19
	Economic status	16
	Education level	12, 15, 16, 17, 18, 21, 24
	Gender	15, 17, 21, 24
	Household structure	12, 15, 20, 21, 22, 23
	Income	15, 17, 20, 24
	Marital status	21
	Vehicle ownership	12, 15, 21, 23

2.3.3 Factors related to job search

Much research is done on the job preferences of people working in the healthcare sector. However, people in this sector generally cannot work from home. Therefore, the focus is on three studies that studied the job preferences of business, economics, science, and engineering students. Table 6 shows the identified factors in these studies.

Non et al. (2022) studied the job preferences of science and engineering students in the Netherlands. They found that a company's mission has an impact on its popularity. Respondents preferred to work in a commercial organization focused on innovation, corporate social responsibility, or sustainability. Organizations that only focused on making a profit appeared to be the least popular. Van Landeghem et al. (2024) also found that people have a substantial willingness to pay to have a social impact. Besides

that, a high level of autonomy, working in multidisciplinary teams, a high salary, and no regular overtime are positively valued (Non et al., 2022). Finally, a permanent contract is valued higher than a temporary one (Demel et al., 2018; Morejón Cabrera & Mariel, 2023; Rouwendal & Meijer, 2001; Van Landeghem et al., 2024).

Demel et al. (2018) studied the job preferences of business and economics students in Spain, Czech Republic, and Germany. This study was redone by Morejón Cabrera & Mariel (2023) in Spain, Colombia, and Ecuador. Both studies identified that students, independent of country and university, most value long-term career opportunities. After that, training or education opportunities are valued the highest. The contract type is highly valued in Spain but low in the Czech Republic and Germany (Demel et al., 2018). Morejón Cabrera & Mariel (2023) also found a positive valuation of contract type in Spain, Ecuador, and Colombia, but they found this is higher for public students than private universities. The company structure and flexible schedules are also positively valued, but generally to a lesser extent than other factors. Finally, a longer commuting time is a factor that is associated with disutility in all five countries, especially in Spain (Demel et al., 2018; Morejón Cabrera & Mariel, 2023).

Table 6: Overview of identified factors that impact job selection

Category	Identified factor	Found in
Job characteristics	Autonomy	27
	Company structure	25, 26
	Contract type	8, 11, 25, 26, 27
	Flexible schedule	25, 26
	Focus of the company	11, 27
	Long-term career prospects	25, 26
	Salary	25, 26, 27
	Teamwork	27
	Training opportunities	25, 26
	Workload	27
Travel characteristics	Commuting time	25, 26

2.4 Other possible relevant factors

In the previous sections, many factors identified in the literature are discussed. However, some factors that were not found in the selected literature could still be interesting to consider and include in the choice experiment.

First, **travel reimbursement** can be a factor that affects travel time valuation. The expectation is that someone who receives a travel reimbursement from the employer will accept longer commutes as the travel costs are (at least partially) accounted for. In contrast, someone who does not receive a travel reimbursement might prefer shorter commutes to avoid travel costs. Working from home can enhance this effect because working from home one day reduces the commuting costs for that day to zero.

Second, the **share of colleagues who work from home** can affect an individual's decision to work from home. For instance, if more colleagues decide to work from home, the barrier to arranging meetings online could be lowered. However, if no other colleagues work from home, a homeworker might feel uncomfortable meeting online or feel excluded from social interactions with colleagues. On the other hand, in a job where cooperation between employees is important, it can be unpleasant when many people work from home. In conclusion, a high share of colleagues working from home can be a barrier or a driver to also work from home, depending on the company structure and someone's preferences.

Third, **flexibility** regarding WFH can affect the decision to work from home. There are many forms of flexibility. Employers can have different ways of dealing with WFH schedules. For example, employees may or may not decide by themselves how many days per week they can work from home. Another form of flexibility could be that employees may decide which days in the week they can work from home. For instance, someone may want to work from home on a Wednesday and Friday and go to the office on the other days. For one organization, the days employees may work from home can be fixed, while for others, employees can decide on their own.

Finally, WFH allowances such as a **WFH reimbursement** or a **WFH budget** can impact WFH. In 2022, the Dutch government implemented a WFH reimbursement of €2 per day, which employers can pay untaxed to their employees to stimulate WFH[2]. This reimbursement will be raised to €2,35 in 2024. An employer is not obligated to pay this reimbursement, and an employer is not allowed to disburse both a WFH reimbursement and a travel reimbursement on the same day[3]. Some employers also offer their employees a WFH budget. This budget is meant to help improve the home office with, for example, a new desk.

2.5 Attribute selection

Table 7 presents a complete overview of all identified factors and, thus, all potential attributes. The factors that were identified outside the literature review are shown in italics. However, not all possible attributes can be included in the choice experiment as the choice would be too complex and overwhelming for respondents. As a reference, a study that reviewed choice experiments in the health sector found that 70% of the studies used three to seven attributes (Marshall et al., 2012). Bridges et al. (2011) formulated three criteria to determine the attributes that should be included: (1) relevance to the research question, (2) relevance to the decision context, and (3) whether attributes are related to one another. These criteria are used to select the attributes.

Table 7: Overview of attributes

Attribute category	Travel related	Job related	Working from home (WFH) related	Housing related
Attributes	Acces to public transport	Autonomy	Amount of days WFH	Connectivity
	Commuting time	Company structure	Attitude of the manager	Housing location
	Multitasking during travel	Connectivity	*WFH budget*	Housing ownership
	Parking costs	Contract type	*WFH flexibility*	Housing type
	Transport mode	Employment status	*WFH reimbursement*	Residential density
	Travel time variability	Flexibility	*Share of colleagues WFH*	
	Travel reimbursement	Focus of the company		
		Long-term prospects		
		Number of employees		

[2] *Kamerstukken II* 2021/22, 35927, nr. 3, p. 16 (MvT).
[3] *Kamerstukken II* 2021/22, 35927, nr. 3, p. 17 (MvT).

	Occupational status
	Salary
	Self-employment
	Teamwork
	Training opportunities
	Workload

The concepts of commuting time and WFH are central to the research question. Thus, commuting time is the most important factor among the travel-related factors. Therefore, only commuting time will be included as an attribute. Housing-related factors are not part of the research question. Besides that, the aim is to formulate policy recommendations concerning WFH for the government and employers. It is much more difficult for employers to impact housing-related factors than job-related ones. Therefore, the focus of the choice experiment will be on job choice rather than housing choice, and housing-related factors will be excluded from the choice experiment.

Bridges et al. (2011) emphasize that attributes central to the decision context must be included or held constant. This is the case for the job-related factors. Only salary will be included to determine the willingness to trade off salary and working from home conditions. All other job-related factors will be held constant. This will be done in an attempt not to let these factors influence people's choices. For example, the literature review showed that people strongly prefer a permanent contract over a temporary one. Suppose the contract type is included as an attribute. In that case, there is a possibility that people will always choose the alternative with a permanent contract because this is so important to them. To prevent this, the respondents will be explained what they must assume and what remains the same as their current situation.

The third criterion of Bridges et al. (2011) states that attributes that relate to each other can be included. That is the case for some WFH attributes. For instance, the WFH only applies to the days that someone is WFH. The WFH reimbursement is considered to be more relevant than the WFH budget as there currently is an untaxed reimbursement that employers can offer to employees. Therefore, the reimbursement will be included as an attribute, and the WFH budget will not. For respondents, it is hard to interpret the meaning of a negative attitude of the manager in combination with the possibility to work some days from home. The manager's attitude is not included, as this is represented in the number of days someone can work from home per week. To indicate the WFH culture, the number of colleagues that regularly work from home is included as an attribute. Finally, WFH flexibility is included as an attribute in the choice experiment.

2.6 Conclusion and conceptual model

This chapter tried to identify the factors influencing commuting time valuation, the decision to choose a job, and the decision to work from home. Ultimately, only a few attributes can be included in the choice experiment. However, some other factors can be used as explanatory factors, which the survey will ask about.

Based on the literature review and the selected attributes, a conceptual model is built, as shown in Figure 2. The assumption is that an individual will choose the job with the highest utility (arrow a). This utility is derived from various attributes. First, an individual derives a certain amount of utility from their commuting time (arrow b). Second, WFH conditions provide a certain amount of utility. The number of days that someone is allowed to WFH generates utility. As there is an interest in the impact of WFH on commuting time valuation, an interaction effect is included between commuting time and the number of

days WFH. This interaction effect is presented by arrow d. Other WFH conditions that are included are WFH flexibility (arrow e), WFH reimbursement (arrow f), and WFH culture (arrow g). The other work-related attribute included is the job's salary (arrow h). Finally, background characteristics are considered as explanatory factors (arrow f).

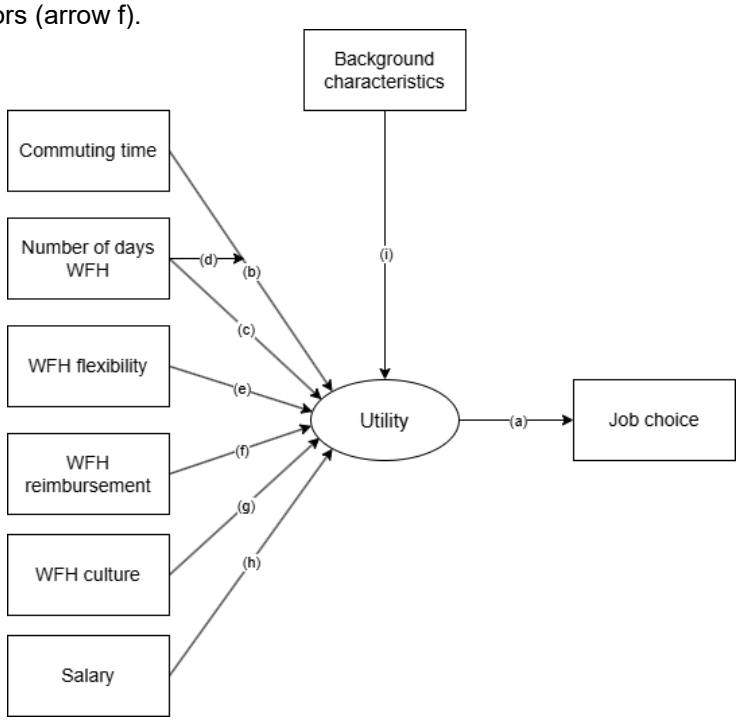

Figure 2: Conceptual model

3 Methodology

The goal of this third chapter is to describe and motivate all methodological decisions that have been made. Section 3.1 describes the use of discrete choice models. After that, the pilot choice experiment is described in section 3.2. This is followed by the operationalization of the final choice experiment in section 3.3 and the operationalization of the survey in section 3.4. Finally, section 3.5 describes the data estimation procedure.

3.1 Discrete choice models

3.1.1 Introduction to choice models

"Discrete choice models describe decision-makers' choices among alternatives" (Train, 2009, p.15). The alternatives that are available to the decision-maker in a certain choice are called the choice set. An alternative consists of certain attributes that characterize this alternative. Such an attribute can have different values, which are called attribute levels. In Figure 3, an example of a simple choice set is provided, and examples of the just-introduced terms are indicated.

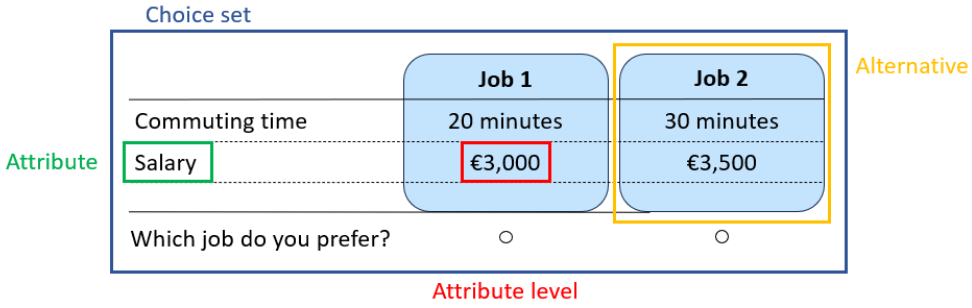

Figure 3: Example of a choice set

Most discrete choice models assume that the decision-maker has utility-maximizing behavior (Train, 2009). Such models are called random utility models (RUM), and this means that a decision-maker will choose the alternative with the highest utility. For example, a decision-maker n will only choose alternative i if the utility of alternative i is greater than the utility of alternative j and alternative i and j are not the same. This is expressed in Equation 1.

$$U_{ni} > U_{nj} \quad \forall\, i \neq j \tag{1}$$

The utility of an alternative consists of two parts. The first part represents the share of utility that can be related to factors that can be observed by the researcher. An example of an observable factor is travel time. The second part represents the part of utility that cannot be observed by the researcher. This can be due to randomness in choices or to differences between people. The unobserved utility is also referred to as the error term. For example, the utility of decision-maker n of alternative i consists of the observed utility V and the unobserved utility ε. This is expressed in Equation 2.

$$U_{ni} = V_{ni} + \varepsilon_{ni} \tag{2}$$

An alternative consists of several attributes from which a decision-maker derives utility. In other words, the decision-maker will trade-off attributes to determine the utilities of alternatives in a choice set. Therefore, every attribute gets a weight factor. This weight is represented as a beta (β). These betas

are estimated by the model, given the data. The observed utility of an alternative i consists of the sum of the marginal utility of attribute m multiplied by the level of attribute m in alternative i. This is expressed in Equation 3.

$$V_{ni} = \sum_m \beta_m X_{im} \tag{3}$$

Equation 3 can be inserted into Equation 2 to obtain the final equation for the RUM model, presented in Equation 4.

$$U_{ni} = \sum_m \beta_m X_{im} + \varepsilon_i \tag{4}$$

Where:
i = alternative i
n = decision-maker n
$\mathrm{U_{ni}}$ = utility of alternative i of decision-maker n
β_m = attribute weight of attribute m
$\mathrm{x_{im}}$ = attribute level of attribute m for alternative i
ε_i = unobserved utility of alternative i

3.1.2 Multinomial Logit Model

A model that is based on the RUM model is the Multinomial Logit (MNL) model. This is the most used discrete choice model because it is based on two assumptions that provide a very convenient form of the choice probability (Train, 2009). The assumptions relate to the distribution of the error term ε. First, the MNL model assumes that this error term is Extreme Value Type I distributed. Second, the MNL model assumes that this error term is independent and identically distributed across alternatives, choice tasks, and decision-makers (i.i.d.). Because of the distribution of the error term, choices can only be predicted up to a probability. The equation to determine this choice probability is presented in Equation 5.

$$P_{ni} = \frac{e^{V_{ni}}}{\sum_j e^{V_{nj}}} \tag{5}$$

Where:
P_{ni} = probability that decision-maker n chooses alternative i
V_{ni} = observed utility of decision-maker n of alternative i
V_{nj} = observed utility of decision-maker n of alternative j

The RUM-MNL model uses maximum likelihood estimation to estimate the attribute weights. This means that the model is trying to find the attribute weights that make the collected data most likely. The software package *Apollo* in *R* is used for this estimation (Hess & Palma, 2019).

3.1.3 Latent Class Choice Model

A downside of the RUM-MNL model is that the i.i.d. assumption is often unrealistic. First, it assumes that all respondents are homogenous and thus have the same preferences. In reality, respondents are heterogeneous as individuals have unique preferences. Second, it does not account for panel behavior. Multiple observations of the same individual do not provide the same information as single observations of a lot of individuals. SP data will be used in this research, which means that one respondent will provide multiple observations. This phenomenon is also referred to as panel behavior. A way to overcome these downsides is to use another model, such as Latent Class Choice Model (LCCM). This model is suited to capture unobserved heterogeneity and panel effects (Greene & Hensher, 2003). The LCCM will be particularly used because this model can explain patterns of heterogeneity (Hess et al., 2011). This is helpful by answering the second sub-research question.

The LCCM captures heterogeneity by assuming that respondents can be categorized into several classes based on certain characteristics. Each respondent has a probability of belonging to a specific class. A class thus reflects a group of respondents with preferences based on unobserved factors that differ from another class. The probability that a decision-maker n belongs to class s is calculated in the class membership model (Equation 6). The strength of the LCCM is that it can explain class membership based on observed variables, such as socio-demographic characteristics. These observed variables are indicated by Z_n. The class-specific constant δ_s and the parameters γ_{sq} are estimated by the model.

$$\pi_{ns} = \frac{e^{\delta_s + g(\gamma_{sq}, z_n)}}{\sum_{l=1..S} e^{\delta_l + g(\gamma_{lq}, z_n)}} \tag{6}$$

The LCCM is also able to capture panel effects. The assumption is that the preferences of an individual are the same across the observations. Therefore, it has to account for the fact that data is collected on the level of the individual instead of on the level of observation. The LCCM models the sequence of choices of the respondent. It estimates the likelihood of observing the sequence of choices for decision-maker n, conditional on model parameters β. The formula to do this is shown in Equation 7.

$$L_n(i_t, .. i_T | \beta) = \sum_{s=1}^{S} \pi_{ns} \left(\prod_{t=1}^{T} P_n(i_t \mid \beta_s) \right) \tag{7}$$

3.2 Pilot choice experiment

Before the survey is conducted, a pilot study is done. The goal of the pilot study is to test the choice experiment and to improve the experimental design for the final experiment. The pilot is distributed among employees of KiM Netherlands Institute for Transport Policy Analysis (KiM) and friends and family of the researcher.

3.2.1 Choice context

Before respondents start with the choice experiment, it is important that they have the right state of mind. As explained before, an alternative consists of hypothetical attributes and attribute levels. Therefore, it is important to make clear what these mean and, perhaps even more important, what respondents have to assume about job-related factors that are not included in the choice experiment. Unclarities can lead to biases or different interpretations across respondents, which harm the results.

A short text is presented to the respondents to make sure it is clear what they have to assume and what not. Only a short description of the attributes is provided as the expectation is that all people are familiar with the attributes. This text can be found in the pilot survey, which is included in Appendix D.

3.2.2 Building alternatives

An alternative represents a certain job with certain attributes. This alternative can be labeled or unlabeled. By a labeled alternative, the label represents a characteristic that is not varied in the experiment. In the case of jobs, this could be a specific organization, such as ASML or Philips. This allows the researcher to investigate different attributes per label. In this research, respondents are asked to imagine that their employer and related job activities stay the same. Therefore, unlabeled alternatives are applicable, as the alternative names do not represent a specific characteristic. The alternatives are named ‘Job 1’ and ‘Job 2’. Based on the literature review, an alternative is characterized by six attributes: commuting time, salary, number of days WFH, WFH reimbursement, WFH flexibility, and number of colleagues WFH.

It is important to mention that there are two versions of the choice experiment. In a choice experiment, it is crucial that individuals are familiar with the attributes (Ben-Akiva et al., 2019). For an individual with a current commuting time of 10 minutes, it may be hard to imagine what it is like to have a commuting time of more than 60 minutes. On top of that, a change of 5 minutes in commuting time might have a different value to an individual with a current commuting time of 10 minutes in contrast with an individual with a current commuting time of 60 minutes. To capture this, two choice experiments are used in which the attribute levels of the commuting time are varied.

Version 1 is specified for people with a current commuting time of 30 minutes or less. The attribute levels of the change in daily commuting time for version 1 are respectively minus 5, 0, plus 5, or plus 10 minutes. Version 1 will be referred to as 'short commuters'. Version 2 is specified for people with a current commuting time of more than 30 minutes. For version 2, this change is respectively minus 10, 0, plus 10, or plus 20 minutes. Version 2 will be referred to as 'long commuters'. An overview of the attributes and attribute levels is presented in Table 8.

Table 8: Pilot attributes and attribute levels

Attribute	# levels	Attribute levels
Daily commuting time (one-way trip)	4	Current commuting time – 5 min* Current commuting time Current commuting time + 5 min Current commuting time + 10 min
Monthly net salary	4	Current salary – €200 Current salary – €100 Current salary + €100 Current salary + €200
Amount of days working from home	4	0 1 2 3
Working from home reimbursement	2	None €2,35 per day
Working from home flexibility	2	Your employer allows you to work from home on fixed days You may choose which days you work from home
Working from home culture	2	A few colleagues work from home regularly Many colleagues work from home regularly

Notes: *The attribute levels presented here are applicable for version 1 of the experiment (short commuters). For version 2 (long commuters), the following attribute levels are applicable: current commuting time – 10 min, current commuting time, current commuting time + 10 min, current commuting time + 20 min

The attribute **daily commuting time** is specified as the change in daily commuting time for a one-way trip. Earlier research used attribute levels of 15, 30, 45, and 60 minutes (Demel et al. 2018; Morejón Cabrera & Mariel, 2023; Lara-Pulido & Martinez-Cruz, 2023). However, a change in commuting time relative to the actual commuting time is much more relatable for respondents. Some studies used relative attribute levels, such as plus 10 or plus 25 minutes (Beck & Hess, 2016; Swärdh & Algers, 2016) or minus 15 minutes, no change and plus 15 minutes (Van Landeghem et al., 2024). To make it even more relatable for respondents, a respondent is allocated to one of two experiments based on their actual commuting time. The four attribute levels of the choice experiment for short commuters are minus

5, no change, plus 5 and plus 10 minutes. For long commuters, these are minus 10, no change, plus 10 and plus 20 minutes.

The attribute **monthly net salary** consists of four attribute levels. Earlier research used annual salary (Demel et al. 2018; Morejón Cabrera & Mariel, 2023) or monthly salary (Non et al., 2022). Other research used a change in salary in comparison with the actual salary. For example, an increase in salary of 500 or 1000 SEK (at the point of data collection in 2005 this equaled approximately 45 and 90 euro) (Beck & Hess, 2016; Swärdh & Algers, 2016) or between 1 and 1,5 times the actual salary (Van Landeghem et al., 2024). For the pilot, the attribute levels are chosen to be minus 200, minus 100, plus 100, and plus 200 euro.

The attribute **amount of days working from home** also has four levels. The general accepted amount of working days per week is five. As not all people work full-time and it is not likely to have a job where you can work all days from home, the attribute levels chosen are 0, 1, 2, and 3.

WFH reimbursement consists of three levels. As mentioned in section 2.4, the untaxed reimbursement that employers can offer is €2.35 per day in 2024. This is taken as an attribute level, besides the double €4.70 and no reimbursement.

WFH flexibility has two attribute levels. This is in line with earlier research from Demel et al. (2018) and Morejón Cabrera & Mariel (2023). Research from Van Landeghem et al. (2024) used four attribute levels to measure flexibility: ‘you have no say in your schedule’, ‘you can choose from different fixed schedules’, ‘you can at all times ask permission to change your schedule’ and ‘you can determine your schedule yourself’. The attribute levels are labeled as ‘your employer allows you to work from home on fixed days’ and ‘you may choose which days you work from home’.

In earlier research, the **WFH culture** is mostly labeled as the attitude of the manager. In this experiment, this is partly reflected in the attribute of the maximum allowed amount of days working from home. Therefore, the WFH culture is specified as the number of colleagues that work from home at least one day a week. The attribute levels are defined as ‘a few colleagues work from home regularly’ and ‘many colleagues work from home regularly’.

3.2.3 Experimental design

The experimental design is aimed at creating a set of choice tasks with as much statistical information as possible (Bridges et al., 2011). The pilot choice experiment is designed using an orthogonal design. An orthogonal design is a design in which the attributes are uncorrelated (Bridges et al., 2011). This means that all attribute levels are independent of each other.

The six attributes are included in the utility function as main effects. With these effects, the trade-offs people make between these attributes can be investigated. The main interest of this research is the impact of working from home conditions on commuting time valuation. To see how the commuting time valuation changes when the number of days WFH increases, an interaction effect between these two attributes is also included in the utility function. This interaction effect can help analyzing the hypothesis whether or not people are willing to accept a longer commuting time when they can work from home. The utility function that is used in the experimental design can be found in Appendix A.

There are two ways in which choice sets can be constructed: sequentially and simultaneously. The alternatives and choice sets are constructed at the same time by simultaneous construction. This method can be used with labeled alternatives. This research comprises unlabeled alternatives, thus

sequential construction is used. This means that the alternatives are constructed first, after which they are randomly placed into choice sets. The software *Ngene* is used to generate the choice sets (ChoiceMetrics, 2018). The *Ngene* syntax that is used is added in Appendix A. *Ngene* found a design with 12 choice sets. This design is orthogonal as the attributes within the alternative are not correlated. The design is also attribute level balanced, which means that each attribute level appears the same number of times (Bridges et al., 2011). The design and the corresponding correlations can be found in Appendix B.

In the design, some unrealistic alternatives occurred. When the number of days working from home is equal to zero, the three other working from home related attributes are not applicable. For example, it makes no sense when an individual is not allowed to work from home but receives a working from home reimbursement. An orthogonal design is not able to deal with such restrictions. Therefore, the attribute levels with unrealistic values are manually replaced by zero. A downside of this method is that the design is no longer orthogonal, as it introduces some correlations. However, these correlations are relatively low and, therefore, not problematic. The changed correlation matrix can be found in Appendix B. Due to the changes to some attribute levels, not all attributes have attribute level balance. Finally, there is one choice set where there is a dominant alternative (under the premise that working from home is valued positively). This means that all attributes of one alternative are the same or better than the other alternative. This choice set is not removed because this would further harm the correlations and attribute level balance.

3.2.4 Pilot structure

The pilot survey starts with an introduction of the topic and goal of the pilot. This is followed by an informed consent statement. As the goal of the pilot is to only test the choice experiment, background questions are not included in the survey, besides one question about the current commuting time. Based on the answer to this question, respondents are allocated to version 1 or version 2 of the choice experiment. After this allocation question, the respondents are faced with the choice experiment. This starts with an introduction text where the choice context is explained. After that, the 12 choice sets are presented. The pilot survey with the 12 choice sets can be found in Appendix D. Finally, an open question is included where respondents have the option to leave comments, clarifications, or suggestions for improvement.

3.2.5 Pilot results

58 surveys are distributed, and 37 complete responses are collected. This is a response rate of 64%. 51% of the respondents have a commuting time of more than 30 minutes. The remaining 49% have a commuting time of 30 minutes or less. This indicates that the separation at the 30-minute limit is chosen well.

An MNL model is estimated to analyze the pilot data. In Table 9, the results of the final model are presented. The table shows the parameters, estimates, robust standard errors, robust t-ratios, and information about the model fit. The analysis started with a simple model, which is gradually expanded. Quadratic components are added to test for non-linearity. The quadratic components were statistically significant for *b_time*, *b_salary* and *b_days*. As there is special interest in the effect of working from home, *b_days* is dummy-coded. By doing this, the experiment design can be optimized for testing the non-linear behavior of this parameter. The effects for *b_time* and *b_salary* were very small, and as there is no special interest in these parameters, the design does not need to be optimized for this.

Table 9: Results pilot

Parameter	Estimate	Rob.std.err.	Rob.t-ratio
asc_1	0.074	0.131	0.569
b_time	-0.134***	0.021	-6.342
b_salary	0.011***	0.001	8.417
b_days1	3.151***	0.462	6.820
b_days2	3.766***	0.501	7.524
b_days3	2.619***	0.344	7.610
b_reimbursement	0.006	0.155	0.040
b_flexibility	-0.599	0.502	-1.194
b_culture	-0.877**	0.389	-2.256
b_time_days	0.024**	0.010	2.508
Rho-squared	0.4581		
Adj. Rho-squared	0.4287		
LL(final)	-166.15		

Notes: significance of robust t-ratio: *** p=0.01, ** p=0.05

All parameters are statistically significant, except for *asc_1*, *b_reimbursement* and *b_flexibility.* Since the sample of the pilot is very small, not too much value should be attached to this statistical significance. What is noteworthy is that the estimate signs of *b_flexibility* and *b_culture* are not as expected. Besides that, the effects of *b_days1, b_days2* and *b_days3* are quite large. As the goal of this pilot is only to optimize the experimental design, the estimates will not be further interpreted. A description of the meaning of the rho-squared values can be found in section 3.5.2.

From the 37 respondents, 13 left a comment on the last question. Besides that, some respondents provided feedback through an e-mail or phone message. The comments varied from pointing out unclarities to explaining the respondents' current situation. First, for some respondents, it was unclear whether or not the question about current commuting time was about a one-way trip or a return. Second, there was confusion about the term flexibility and what it exactly relates to. This could be an explanation for the fact that the sign of the estimate is not as expected. Respondents had divergent views about the attribute salary. For one respondent, the differences were too small to make a large impact, while another respondent stated that it was a great difference. The same holds for the attribute about WFH culture. One respondent stated that culture played no role in the decisions, while another respondent stated that culture is of great importance. Multiple respondents suggested that the differences in commuting time were somewhat too small. A respondent stated: "For me, this [change in commuting time] falls within the fluctuation I have in my current situation with road or public transport congestion." Finally, some respondents indicated that there was a question where one alternative was more favorable for all attributes than the second alternative.

3.3 Operationalization of the final choice experiment

The quantitative estimates and qualitative feedback retrieved from the pilot study are used to change and optimize the experimental design. Changes are made to the formulation of the attributes, the attributes and the experimental design.

3.3.1 Changes to attributes and attribute levels

The choice tasks in the pilot contained a lot of text. This made it hard for respondents to easily spot the differences between the two jobs. To make this more clear, the text has been moved to the description of the attribute as much as possible. By doing this, the respondent gets a clear overview of the attribute

levels and can easier make a choice. The reframed attributes and corresponding attribute levels are presented in Table 10.

Table 10: Final experiment: Attributes and attribute levels

Attribute	# levels	Attribute levels
Change in daily commuting time (one-way trip)	4	– 5 minutes* No change + 10 minutes + 20 minutes
Change in monthly net salary	4	– €100 No change + €100 + €200
Maximum weekly number of days working from home	4	0 1 2 3
Working from home reimbursement per day	3	None €2,35 €4,70
You may decide on which days you work from home yourself	2	Yes No
Amount of colleagues who work from home at least one day a week	2	Only a few Many

Notes: *The attribute levels presented here are applicable for version 1 of the experiment (short commuters). For version 2 (long commuters), the following attribute levels are applicable: - 10 minutes, no change, + 20 minutes, + 40 minutes

Based on the pilot feedback, the attribute levels of a change in commuting time are enlarged. The four attribute levels of the choice experiment for short commuters are minus 5, no change, plus 10 and plus 20 minutes. For long commuters, these are minus 10, no change, plus 20 and plus 40 minutes. To avoid situations in which the change in commuting time results in a negative time, equidistance between attribute levels is not preserved for this attribute.

In the pilot, two attribute levels of the change in monthly net salary represented a reduction in salary. However, people do not often get a reduction in salary. In general, the opposite is true as one gets paid more as they get older and get more experience. Therefore, the attribute levels are changed to – 100, no change, + 100, and + 200 euro.

After the pilot, it became clear that people have different frame of references concerning a WFH reimbursement. For some people, a reimbursement per day is relatable, while others are more familiar with a monthly amount. To avoid confusion, both the daily and the monthly reimbursements are shown to the respondent. The reimbursement per month is calculated by multiplying the daily reimbursement by the maximum amount of days someone is allowed to work from home and by the number of weeks per month (and rounded upward). The number of weeks per month is assumed to be 4.35. Table 11 shows an overview of the amounts per month.

Table 11: WFH reimbursement per month

Days	Reimbursement (€/month)	
	€2,35 per day	**€4,70 per day**
0	0	0
1	11	21
2	21	41
3	31	62

3.3.2 Changes to the experimental design

While the pilot choice experiment had an orthogonal design, the final choice experiment has an efficient design. An efficient design has several advantages over an orthogonal design, such as avoiding dominant alternatives, reducing the number of choice sets, and improving performance. An efficient design minimizes the standard errors of the estimated model parameters (Walker et al., 2018). The D-efficient design is chosen as it minimizes all attribute variances and covariances. An S-efficient would be preferred if there was a special interest in the parameter that is least reliable. An efficient design needs prior information about the parameters as a best guess (Walker et al., 2018). The outcomes of the pilot choice experiment are used to obtain these priors. In most cases, the estimates of the pilot are acquired directly as a prior. The estimate signs of the parameters *b_flex* and *b_culture* are not as expected. If the sign of the parameters is unclear, the prior value can be set to zero (ChoiceMetrics, 2018). Therefore, the prior value is set to zero for these parameters.

Another advantage of an efficient design is that constraints can be added. This means that specific attribute level combinations can be excluded. The attribute levels of the two attributes WFH reimbursement and WFH flexibility, do not have to be manually corrected but will be automatically set to 0 when the maximum amount of days working from home is also 0. Only the WFH culture still has to be manually altered, so the design is not optimized for this. A downside is that constraints make the design less efficient.

The utility function consists of six main effects and an interaction effect. The attributes flexibility and culture are dummy-coded because these are nominal variables. The attribute WFH days is also dummy-coded to be able to get insight into non-linear behavior. The dummy-coding scheme of these three variables is provided in Table 12. The software *Ngene* is used to construct the choice sets (ChoiceMetrics, 2018). The *Ngene* syntax can be found in Appendix A, and the constructed experimental design in Appendix C. The design found contains twelve choice sets. There are correlations between some attributes, which can also be seen in Appendix C. This poses no problem as orthogonality is not a prerequisite for an efficient design. Because of the constraints, attribute level balance is not achieved for every attribute.

Table 12: Dummy-coding of variables

Attribute level	**Label**	**Coding**		
Maximum weekly number of days working from home				
		WFH days 3	WFH days 2	WFH days 1
3	3 days	1	0	0
2	2 days	0	1	0
1	1 day	0	0	1
0	0 days	0	0	0
You may decide on which days you work from home yourself				

1	Yes	1
0	No	0
Amount of colleagues who work from home at least one day a week		
1	Many	1
0	Only a few	0

3.3.3 Presentation of choice sets

An example of a choice task that a respondent is facing is presented in Figure 4. This example is in English, while the choice tasks laid to the respondents were written in Dutch. All choice tasks in Dutch can be found in Appendix E. For both versions of the choice experiment, ten random sequences of choice tasks are produced. At the start of the survey, each respondent will be randomly allocated to one version (considering the actual commuting time of the respondent, as explained in section 3.2.2).

	Job 1	Job 2
Change in daily commuting time (one-way trip)	– 5 minutes	+ 10 minutes
Change in monthly net salary	– €100	– €100
Maximum weekly number of days working from home	1	2
Working from home reimbursement per day (per month when working from home all allowed days)	€2,35 (€11)	€2,35 (€21)
You may decide on which days you work from home yourself	No	No
Amount of colleagues who work from home at least one day a week	Many	Only a few

Figure 4: Presentation of a choice set

3.4 Operationalization of the survey

As the survey is conducted by KiM, the survey is designed with the help of KiM software. The survey is set up in Dutch as the target group of the survey is the Dutch population. The next three paragraphs clarify the survey structure, testing, and distribution.

3.4.1 Survey structure

The survey is divided into the following seven parts:

1. Introduction and informed consent statement
2. Questions about the current commute
3. Questions about the current job
4. Questions about the current working from home conditions
5. Choice experiment
6. Questions about perceptions and attitudes
7. Questions about socio-demographic characteristics

The survey starts with a short introduction of the topic and the goal of the survey. This is followed by a first question about consent. The survey ends here for people who do not want to participate.

To get a better understanding of the values, motivations and feelings of the respondent, questions about attitudes are included. The questions concern attitudes towards commuting and working from home. The attitudes are operationalized as statements and a 5-point Likert Scale is used to determine the

possible responses. The response options were: strongly disagree, disagree, neutral, agree, strongly agree. By the statements about working from home, the option ‘not applicable’ was also available because there may be respondents who currently do not work from home. Respondents were given four statements about commuting and four about working from home.

3.4.2 Survey testing

The survey is tested to ensure that the formulation of the questions is clear and that all questions can be answered. To get insights from different people and perspectives, the survey is tested by some employees of KiM and by some people from the researcher’s inner circle. Note that this is not the same as the pilot because the supplementary questions were not part of the pilot. As a result, some questions are reformulated. Besides that, some instructions on how to answer the question are added to ensure that every respondent uses the same format. This also includes adding restrictions to the answers. For example, a question can only be answered by filling in a number between x and y to avoid unrealistic or even impossible answers.

3.4.3 Survey distribution

The survey was administered to a GfK panel. GfK is the largest market research firm in the Netherlands (GfK, n.d.). It consists of a large online platform that people can sign up for to fill in surveys in return for a small reward. The GfK panel was suggested and funded by KiM Netherlands Institute for Transport Policy Analysis. The panel is filtered by GfK on people who can work at least one full day per week at home. The goal was to get 1,000 respondents. The distribution of surveys is done by GfK between December 12 and 18, 2024.

3.5 Data estimation procedure

3.5.1 Data cleaning and preparation

Before the analyses can be done, the data needs to be cleaned and prepared. This is done in *R,* and the syntax can be found in Appendix G. An output statistic that is automatically generated is the time that a respondent actively spent completing the questionnaire. The average active time was 7 minutes and 35 seconds, with a minimum of 66 seconds and a maximum of approximately 28 minutes. All respondents with a time of less than 3 minutes were excluded from the analysis. 3 minutes is considered to be a reasonable minimum to thoroughly read and answer all questions. In total, 44 respondents completed the questionnaire in under 3 minutes. Besides that, there is one respondent who mentioned being incapacitated for work. This respondent is also excluded as incapacitated persons are not the target group of this study. Next to that, two respondents answered that they were born in 2024. These respondents are kept in the analyses, but these values are considered as missing values. Finally, all missing values are automatically represented with the value 99998. These values are replaced with ‘NA’.

After cleaning the data, the data is prepared for the analyses. As explained in section 3.3.4, there are 20 versions of the choice experiment, each with a different sequence of choice sets. These sequences have to be converted back to one sequence to analyze the choices. Therefore, the corresponding variables for each sequence are merged into one variable. Each row in the dataset represents a respondent. For the analyses, every row must represent a choice instead of a respondent, so this change is made. Finally, the choice sets are connected to the corresponding attribute levels to give meaning to the choices the respondents made.

3.5.2 Working towards an MNL model

Different MNL models are estimated and compared to decide which model will be used. To assess the performance of the model, model fit indicators can be used. The final log-likelihood indicates how well the estimated model fits the data. The rho-square is a measure to test whether or not the estimated

model is better than a null model. A null model is a model that randomly chooses an alternative from a choice set. The rho-square is a value between 0 and 1, where 0 indicates that the estimated model is not better than the null model, and 1 indicates a perfect model fit. Adding more variables to a model leads to a higher rho-squared. To take this into account, the adjusted rho-square can be used. This adjusted rho-square penalizes models for the number of parameters. For nested models, the Likelihood Ratio Test can be used to test whether or not a model is statistically speaking better than another model. Model A is a nested model when model A is a special case of model B. The equation to calculate the Likelihood Ratio Score (LRS) is provided in Equation 8. In Table 13, the different models and information about the model fit are provided. The last column of Table 13 shows the BIC value. The calculation of the BIC value is explained in the next section.

$$LRS = -2 \cdot (LL_A - LL_B) \quad (8)$$

Where:
LL_A = null model
LL_B = estimated model

Table 13: Model fit MNL

Model	Parameters	LL(null)	LL(final)	Adj. ρ^2	BIC
1: MNL base model	7	-7985.06	-7133.98	0.1032	14333.42
2: MNL dummy_days	11	-7985.06	-7066.82	0.1112	14236.51
3: MNL dummy_days, interaction_commuting_time	12	-7985.06	-7046.89	0.1136	14205.99

The base model consists of the six main effects and one interaction effect between commuting time and working from home days. An Alternative Specific Constant (ASC) is added to the model to check for left-to-right bias. This bias means that respondents may have a preference for the alternative that they first read. Dutch people read from left to right, thus, this would be the left alternative (Job 1). However, the ASC was found to be insignificant, so it was removed from the model.

The interest of this research is in the change of commuting time valuation based on working from home conditions. This relationship can be studied more deeply by dummy-coding the *b_days* parameter. By doing this, the non-linear behavior of this parameter can be investigated. In Model 2, the parameter *b_days* is dummy coded.

A final step is made in Model 3. In the choice experiment, two attributes are included as relative changes from the respondent's current situation: a change in commuting time and a change in salary. Two interaction effects are included to investigate whether or not the estimates of the MNL model differ based on someone's current commuting time or salary. The first interaction is between the current salary and the parameter of change in salary. This interaction effect was not statistically significant and is therefore removed from the model.

The second interaction is between the current commuting time and the parameter of change in commuting time. Another reason for including this interaction is that the choice experiment consisted of two versions: the first for short commuters and the second for long commuters (recall section 3.2.1). The expectation is that short commuters value commuting time differently than long commuters. This interaction effect can help investigate this. The variable of the current commuting time is dummy-coded into two categories: 0 when the current commuting time is 30 minutes or less and 1 when the current commuting time is more than 30 minutes. This interaction effect was statistically significant and is therefore kept in Model 3.

Table 14: Model comparison

Comparison	LRS	Parameter difference	Chi-square threshold (0.01 level)
Model 1 vs. null model	1702.16	7	18.48
Model 2 vs. Model 1	134.32	4	13.28
Model 3 vs. Model 2	39.86	1	6.63

The Likelihood Ratio Test is used to determine whether or not one model outperforms another model. From Table 14, it can be obtained that the LRS of the base model (Model 1) exceeds the Chi-square threshold. Thus, it can be stated that with 99% certainty, the base MNL model does perform better than throwing a dice. The expanded models with a dummy variable and extra interaction effect also perform significantly better than the base model. Therefore, Model 3 is selected as the main MNL model. The utility function that is used in this model is shown in the equation below. The *Apollo* syntax of the estimation of the selected MNL model can be found in Appendix G.

$$
\begin{aligned}
V_{Job} = {} & \beta_{time} \cdot TIME \\
& + \beta_{salary} \cdot SALARY \\
& + \beta_{days0} \cdot (DAYS == 0) \\
& + \beta_{days1} \cdot (DAYS == 1) \\
& + \beta_{days2} \cdot (DAYS == 2) \\
& + \beta_{days3} \cdot (DAYS == 3) \\
& + \beta_{reimbursement} \cdot REIMBURSEMENT \\
& + \beta_{flexibility} \cdot FLEXIBILITY \\
& + \beta_{culture} \cdot CULTURE \\
& + \beta_{time_{days1}} \cdot TIME \cdot (DAYS == 1) \\
& + \beta_{time_{days2}} \cdot TIME \cdot (DAYS == 2) \\
& + \beta_{time_{days3}} \cdot TIME \cdot (DAYS == 3) \\
& + \beta_{time\_currenttime} \cdot TIME \cdot CURRENT\_TIME
\end{aligned}
$$

3.5.3 Working towards an LCCM

The utility function of the selected MNL model is also used in the LCCM, without the interaction effect between the change in commuting time and the current commuting time. The current commuting time can be added as covariate to the LCCM, so using an interaction effect is not necessary. The number of classes in an LCCM has to be defined by the researcher. The LRS can be used, but for LCCMs, the Bayesian Information Criterion (BIC) is preferred (Greene & Hensher, 2003). The BIC formula is presented in Equation 9. The model is run with a different number of classes. This is done before covariates are added to the model. In general, the model with the lowest BIC is the preferred model. However, if a large number of classes complicates the interpretation, the researcher can decide to select a smaller number of classes.

$$BIC = -2 \cdot LL + k \cdot \ln(N) \tag{9}$$

Where:
LL = log-likelihood of the estimated model
k = number of parameters
N = number of observations

In Table 15, the data about the model fit of the LCCMs is provided. First, LCCMs are estimated separately for version 1 and version 2 of the choice experiment. Based on the BIC value, this resulted in an LCCM with four classes for version 1 and three for version 2. However, the interpretation of the classes turned out to be difficult, especially for version 2. Therefore, only one LCCM is estimated with all data included (n=960). Model 6, an LCCM with 5 classes, has the highest final log-likelihood. Nevertheless, Model 5 has the lowest BIC value, despite having a lower final log-likelihood than Model 6. This model with four classes is therefore selected. The LCCM is also performed using the software package *Apollo* in *R,* and the syntax can be found in Appendix G.

Table 15: Model fit LCCM

Model	Parameters	LL(null)	LL(final)	Adj. ρ^2	BIC
3: LCCM with 2 classes	23	-7985.06	-6766.83	0.1475	13748.75
4: LCCM with 3 classes	35	-7985.06	-6551.69	0.1731	13430.69
5: LCCM with 4 classes	47	-7985.06	-6441.45	0.1856	13322.43
6: LCCM with 5 classes	59	-7985.06	-6392.16	0.1904	13336.08

3.5.4 Adding covariates to the LCCM

In the final step, covariates are added to the model with four classes. Only covariates found to be statistically significant are kept in the model. To keep the model parsimonious, some covariates are re-coded to reduce the number of categories. The covariates found to be statistically significant are:

- Education level
- Degree of urbanization
- Income
- Job sector
- Working from home experience.
- Attitude: I do not mind traveling during rush hour
- Attitude: I do not mind if my commute time increases by 20 minutes
- Attitude: I have positive experiences with working from home
- Attitude: I have a good workplace to work from home
- Attitude: I experience good support from my employer to work from home
- Attitude: I find it annoying when colleagues regularly work from home

A list of covariates that were tested but removed from the model can be found in Appendix F. Table 16 shows the model fit of the LCCM with covariates that were statistically significant (Model 7).

Table 16: Model fit LCCM with covariates

Model	Parameters	LL(null)	LL(final)	Adj. ρ^2	BIC
7: LCCM with covariates	92	-7985.06	-6171.19	0.2139	13202.76

4 Results

This chapter presents the results of the analyses. In section 4.1, the background characteristics of the research sample are presented. Section 4.2 describes the results of the MNL model. This is followed by the results of the LCCM in section 4.3, which also answers the two sub-research questions.

4.1 Background characteristics

In the survey, some questions are asked to reveal the background characteristics of the respondents. These characteristics are divided into five categories. Consecutively, the following background characteristics will be presented: socio-demographic characteristics, commuting characteristics, job characteristics, working from home experience, and attitudes. The software *IBM SPSS Statistics 29* is used to analyze the background characteristics and obtain output such as frequency tables.

4.1.1 Socio-demographic characteristics

Table 17 shows the socio-demographic characteristics of the sample. Generally speaking, the characteristics are distributed as expected. The youngest respondent is 21 years old, while the oldest is 83 years old. There are relatively many respondents with a high education level (HBO/university bachelor or higher). However, this might be explained by the selection criteria of the respondents of being able to work from home at least one full day a week. Most respondents (52.5%) are part of a multi-person household, while 26.3% are part of a household with children. The most frequently occurring salary (per person) is between €3.000 and €3.900 net per month. It is worth noticing that 20.5% of the respondents did not want to indicate their salary. The degree of urbanization is based on the four-digit zip code or municipality (if someone did not want to share their zip code). Data from Statistics Netherlands (CBS) is used to link the municipalities (CBS, 2024a) or zip codes (CBS, 2024b) to the corresponding degree of urbanization. 9.4% of the respondents would not share their zip code or municipality.

Table 17: Socio-demographic characteristics (n=960)

Characteristic	Category	Observations	Percentage
Age	<30	34	3.5%
	30-44	213	22.2%
	45-59	391	40.7%
	60-74	310	32.3%
	>75	12	1.3%
Gender	Male	460	47.9%
	Female	499	52.0%
	Other	1	0.1%
Education level	No education	0	0.0%
	Primary education	3	0.3%
	LBO/VBO/VMBO (kader- en beroepsgerichte leerweg)	42	4.4%
	MAVO/first 3 year HAVO and VWO/VMBO (theoretische en gemengde leerweg)	56	5.8%
	Secondary vocational education (MBO)	231	24.1%

	Senior general secondary education/pre-university education (HAVO/VWO)	121	12.6%
	HBO/university bachelor	341	35.5%
	University master/PhD	166	17.3%
Household composition	Single-person household	205	21.4%
	Multi-person household (only adults)	504	52.5%
	With children (youngest under age 5)	59	6.1%
	With children (youngest under age 13)	102	10.6%
	With children (youngest under age 18)	90	9.4%
Monthly net salary	Less than €999	12	1.3%
	€1.000 - €1.999	85	8.9%
	€2.000 - €2.999	235	24.5%
	€3.000 - €3.999	254	26.5%
	€4.000 - €4.999	113	11.8%
	€5.000 - €5.999	30	3.1%
	€6.000 - €6.999	16	1.7%
	More than €7.000	18	1.9%
	I would rather not say	197	20.5%
Degree of urbanisation	Extremely urbanized	178	17.7%
	Strongly urbanized	294	29.3%
	Moderately urbanized	159	15.8%
	Hardly urbanized	151	15.0%
	Not urbanized	129	12.8%
	I would rather not say	94	9.4%

4.1.2 Commuting characteristics

Table 18 shows the commuting characteristics of the respondents. In total, 67.6% have a daily commuting time between 0 and 30 minutes. These respondents are allocated to version 1 of the choice experiment (see section 3.2.1). The remaining 32.4% of respondents with a commuting time of more than 30 minutes are allocated to version 2. The difference in size between the two groups was much smaller in the pilot. 48.9% of the respondents do not experience congestion. The average congestion time of the respondents who do experience congestion is 12 minutes. The car is by far the most used main transportation mode to work with 58.9%, followed by the bicycle and electric bicycle. 36.0% of the respondents do not have to pay any travel costs for commuting by themselves. Most respondents (63.6%) do not conduct activities during their commute, while 13.8% conduct work-related activities and/or 28.1% conduct leisure activities. Finally, the large majority of 75.2% have a car available at any time.

Table 18: Commuting characteristics (n=960)

Characteristic	Category	Observations	Percentage
Daily commuting time (one-way trip, in minutes)	0-15	332	34.6%
	16-30	317	33.0%
	31-45	169	17.6%
	46-60	69	7.2%
	61-75	21	2.2%
	76-90	24	2.5%
	> 90	28	2.9%

Amount of days congestion	0	469	48.9%
	1	175	18.2%
	2	124	12.9%
	3	86	9.0%
	4	52	5.4%
	5	49	5.1%
	6	3	0.3%
	7	2	0.2%
Average congestion time (in minutes)	0-10	324	33.8%
	11-20	124	12.9%
	21-30	38	4.0%
	> 30	9	0.9%
Main transport mode to work	Car	565	58.9%
	Bus/tram/metro	30	3.1%
	Train	60	6.3%
	Moped/scooter	6	0.6%
	Bicycle (including mobility scooter)	138	14.4%
	Electric bicycle	100	10.4%
	Walking (including wheelchair)	42	4.4%
	Other	19	2.0%
Travel costs paid by yourself	Yes, completely	230	24.0%
	Yes, partially	356	37.1%
	No, by my employer	346	36.0%
	I don't know	28	2.9%
Activities during commuting*	Yes, work-related	132	13.8%
	Yes, for leisure	270	28.1%
	No	611	63.6%
Car availability	Yes, whenever I want	722	75.2%
	No, I have to check with people within my household	152	15.8%
	No, but I can sometimes use the car of family/friends/a shared car	17	1.8%
	No, (almost) never but I do have a driver's license	29	3.0%
	No, never, I don't have a driver's license	40	4.2%

Note: *this was a multiple choice question, so the percentages exceed 100%

4.1.3 Job characteristics

The current job characteristics of the sample are displayed in Table 19. The respondents work in a wide variety of sectors. The two greatest sectors among respondents are health care (20.0%) and education and science (10.9%). 82.6% of the respondents have a permanent contract. Respondents with a contract other than permanent or temporary indicated that they are self-employed, temporary workers, have a zero-hours contract, or are on a trial period. Respondents had to indicate how many hours they work a week. In Table 19, this is divided into two categories: part-time and full-time, which is almost fifty-fifty in the sample. Finally, two questions are asked about flexibility. First, respondents are asked whether or not their work situation provides the opportunity to avoid peak hours. Second, respondents are asked whether or not their home situation provides this opportunity. In general, the work situation is more restrictive than the home situation to avoid the rush hours.

Table 19: Job characteristics (n=960)

Characteristic	Category	Observations	Percentage
Sector	Automation and ICT	69	7.2%
	Construction	25	2.6%
	Culture	12	1.3%
	Financial services	50	5.2%
	Health care	192	20.0%
	(Retail)trade	60	6.3%
	Hospitality and housekeeping	16	1.7%
	Industry and production	76	7.9%
	Agriculture, fisheries and animal husbandry	6	0.6%
	Nature and environment	6	0.6%
	Education and science	105	10.9%
	Public administration, security and justice	82	8.5%
	Storage and transport	38	4.0%
	Other	130	13.5%
	Human resources, organization and strategy	12	1.3%
	Sport and personal care	7	0.7%
	Language, media and communication	18	1.9%
	Engineering	29	3.0%
	Tourism and recreation	12	1.3%
	Real estate and brokerage	15	1.6%
Contract type	Permanent contract	793	82.6%
	Temporary contract	71	7.4%
	I am an entrepreneur	90	9.4%
	Other	6	0.6%
Working hours	Part-time (<36 hours)	483	50.3%
	Full-time (>=36 hours)	477	49.7%
Rush hour avoidance (work situation)*	Yes, I can commute before morning rush hour	418	43.5%
	Yes, I can commute after morning rush hour	280	29.2%
	Yes, I can commute before evening rush hour	293	30.5%
	Yes, I can commute after evening rush hour	236	24.6%
	No	366	38.1%
Rush hour avoidance (home situation)*	Yes, I can commute before morning rush hour	459	47.8%
	Yes, I can commute after morning rush hour	323	33.6%
	Yes, I can commute before evening rush hour	373	38.9%
	Yes, I can commute after evening rush hour	285	29.7%
	No	311	32.4%

Note: *this was a multiple choice question, so the percentages exceed 100%

4.1.4 Working from home experience

The results of the working from home experiences are presented in Table 20. Many respondents get a working from home reimbursement or budget. Note that there can be an overlap between these two categories. 43% do not get any reimbursement, while 15% do not know. The results show that many respondents have a flexible working from home schedule. 31.4% of the respondents are not allowed to work from home. In 36.9% of the cases, working from home at work is rare or non-existent. However, almost half of the respondents experience that working from home is normal and that many employees work from home at least one day a week.

Table 20: Working from home experience (n=960)

Characteristic	Category	Observations	Percentage
WFH reimbursement*	A work from home reimbursement	367	38.2%
	A budget to set up my home office	156	16.3%
	No	416	43.3%
	I don't know	148	15.4%
Flexibility: amount of days WFH	Yes, I may determine this myself	216	22.5%
	In part, in agreement with my employer	307	32.0%
	No, the amount is fixed	136	14.2%
	My employer won't allow me to WFH	301	31.4%
Flexibility: which days WFH	Yes	214	22.3%
	Yes, but this depends on physical work meetings	289	30.1%
	No, but I can always ask for permission to change my schedule	114	11.9%
	No, I am only allowed to work from home on certain set days	42	4.4%
WFH culture	WFH is rare or non-existent	354	36.9%
	WFH is special, only a few employees WFH at least one day a week	128	13.3%
	WFH is normal, many employees WFH at least one day a week	478	49.8%

Note: *this was a multiple choice question, so the percentages exceed 100%

Respondents are also asked to share how many days a week they work and where. These results are provided in Table 21. Most respondents work four (32.2%) or five (39.8%) days per week. The three questions about the distribution of workplaces should be interpreted more carefully, as a significant share of respondents provided illogical answers. An answer is labeled as illogical when the sum of days working only from home, partly at home, partly away from home, and away from home is greater than the answer to the question ‘how many days a week do you work?’ With this in mind, the results show that 53% do not work from home at all, meaning that 47% to some extent work from home.

Table 21: Distribution of workplaces (n=960)

Question	Amount of days							
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
How many days a week do you work?	5.1%	1.7%	3.2%	14.6%	32.2%	39.8%	2.1%	1.4%
How many days a week do you work only from home?	53.0%	17.4%	13.4%	9.0%	4.0%	2.1%	0.3%	0.8%

How many days a week do you work partly at home, partly away from home?	72.5%	13.2%	6.6%	3.2%	2.0%	2.0%	0.3%	0.2%
How many days a week do you work away from home?	14.4%	10.8%	15.9%	18.6%	20.8%	18.1%	1.0%	0.2%

4.1.5 Preferences and attitudes

First, a multiple-choice question is asked about the preferences concerning working from home. Specifically, how many days a respondent would prefer to work from home. The results are displayed in Figure 5. 28.5% of the respondents indicated that they would rather not work from home at all. This means that 71.5% prefer some form of working from home, where two days is most preferred at 25.8%.

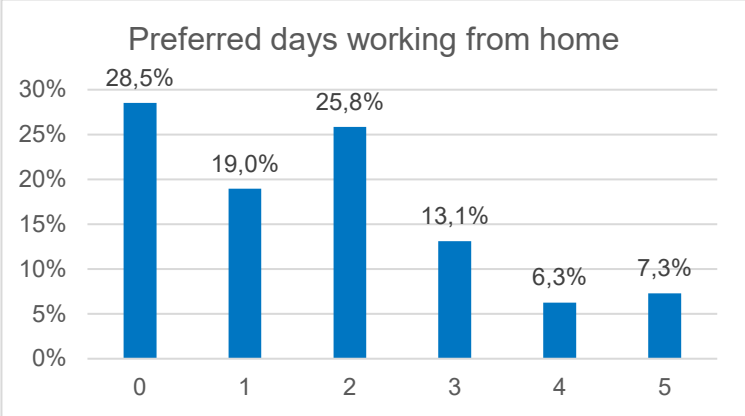

Figure 5: Preferred days working from home (n=960)

Second, the attitudes of respondents are investigated regarding commuting and working from home. The eight statements about commuting and working from home and the corresponding results are presented in Table 22. In general, respondents are satisfied with their current commuting time. Only 10.7% disagree or strongly disagree with the statement. People are even more satisfied with their current transportation mode. More division prevails on travelling during rush hour, as 34.4% of the respondents do not mind travelling during rush hour, as opposed to 37.7% who do mind. Finally, a majority of people would mind if their commuting time increases by 20 minutes.

On the whole, respondents have a very positive attitude towards working from home. Most respondents have had positive experiences with working from home. Next, most respondents have a good workplace to work from home and experience good support from their employer. Only 15.0% of respondents agree or strongly agree with the statement that it is annoying when colleagues regularly work from home.

Table 22: Attitudes (n=960)

Nr.	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	NA
1	I am satisfied with my current commuting time	2.1	8.6	16.6	35.0	37.7	
2	I am satisfied with the transportation mode by which I now (usually) travel to work	1.0	1.5	8.8	41.0	47.7	
3	I do not mind traveling during rush hour	14.9	22.8	27.9	21.6	12.8	

4	I do not mind if my commute time increases by 20 minutes	26.3	35.4	24.4	10.4	3.5	
5	I have positive experiences with working from home	3.8	4.7	13.9	21.7	36.0	20.0
6	I have a good workplace to work from home	4.9	6.3	9.7	26.9	35.9	16.4
7	I experience good support from my employer to work from home	6.7	5.5	16.0	21.7	24.5	25.6
8	I find it annoying when colleagues regularly work from home	20.3	23.5	19.3	10.6	4.4	21.9

4.2 MNL model

The MNL model can help answer the first sub-question: *What trade-offs do people make between working from home conditions and commuting time?*

4.2.1 Interpretation of the parameters

The results of the MNL model are presented in Table 23. The estimates, robust standard errors, and robust t-ratios are shown. What stands out is that all parameters are statistically significant at the 99% level.

Table 23: Multinomial Logit Model estimates

MNL model (n=960)			
Parameter	**Estimate**	**Rob.std.err.**	**Rob.t-ratio**
b_time	-0.097***	0.005	-18.229
b_salary	0.009***	0.000	21.988
b_days1	0.654***	0.111	5.902
b_days2	1.165***	0.128	9.102
b_days3	0.904***	0.103	8.751
b_flexibility	0.582***	0.031	19.046
b_reimbursement	0.081***	0.006	13.010
b_culture	-0.120***	0.034	-3.551
b_time_days1	0.047***	0.006	8.288
b_time_days2	0.021***	0.005	4.074
b_time_days3	0.041***	0.003	11.856
b_time_long	0.015***	0.003	4.923

Note: Significance of robust t-ratio: ***p=0.01

The estimate sign of ***b_time*** is negative, which means that a longer commuting time is perceived negatively. This is in line with expectations. This also holds for the positive estimate sign of ***b_salary***. The results show that a higher salary leads to an increase in utility. In other words, longer commuting time has a negative impact on the choice for a job, while a higher salary has a positive impact.

The attribute maximum weekly number of days WFH was dummy-coded as ***b_days***. Hereby, the reference category is 0 days. The estimates of *b_days1*, *b_days2*, and *b_days3* should be interpreted relative to this reference category. All estimates have a positive sign, indicating that 0 days working from home is valued the lowest. Respondents have the strongest preference for 2 days working from home. A non-linear effect appears as WFH 1 day and 3 days both have a lower utility than WFH 2 days. In

Figure 6, this non-linear behavior is made visible. Respondents value 3 days working from home slightly higher than only 1 day.

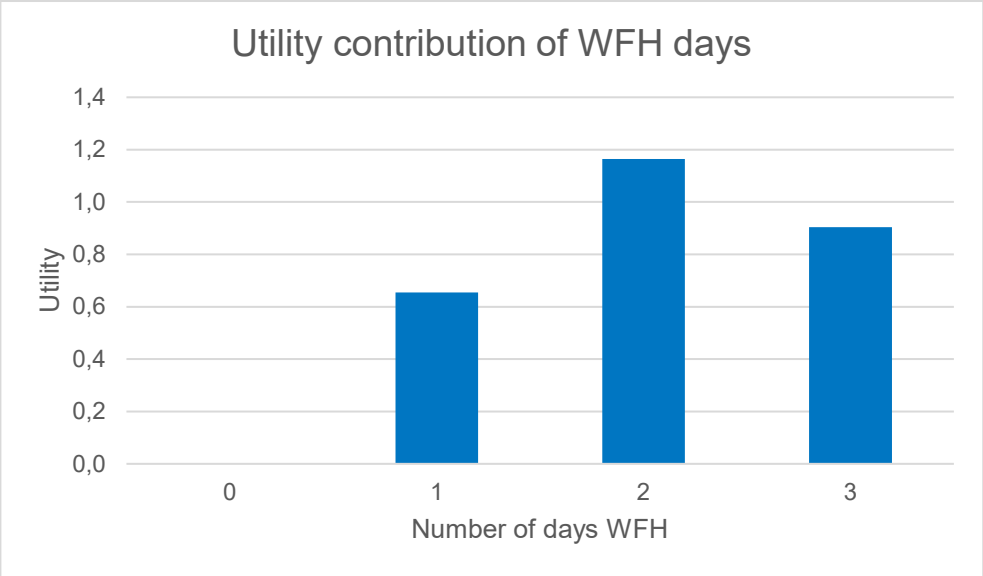

Figure 6: Utility contribution of WFH days (MNL model)

The interaction effects between a change in commuting time and the maximum weekly number of days WFH are also statistically significant. The part of the utility function involving the interaction effects is presented in Equation 10.

$$(-0.097 + 0.047 \cdot 1DAY + 0.021 \cdot 2DAYS + 0.041 \cdot 3DAYS + 0.015 \cdot LONG) \cdot TIME \qquad (10)$$

The results show that the coefficient of a change in commuting time becomes less negative when one can work from home. The effect is most substantial for 1 day WFH and only slightly less strong for 3 days WFH. An interesting result is that the interaction effect for 2 days WFH is much weaker than the effect for 1 or 3 days WFH. Besides that, the interaction effect between the change in commuting time and the current commuting time of the respondent is statistically significant. The estimate has a positive sign, which means that long commuters value a change in commuting time less negatively than short commuters. Recall that short commuters are people with a current commuting of 30 minutes or less, while long commuters have a current commuting time of more than 30 minutes.

The impact of the number of days WFH on the commuting time valuation for short commuters is presented in Figure 7. Keep in mind that 0 days WFH is the reference category. The figure shows that when the change in commuting time is zero, the utility is also zero when the number of days WFH is 0. A longer commuting time lowers utility, while a shorter commute increases utility. This makes sense as people generally do not like to have a long commute. The first thing to notice is that the lines representing 1, 2, and 3 days WFH all generate a higher utility than 0 days WFH. This shows that working from home is valued positively. The second important thing to notice is that the steepness of the lines differs. Because of the interaction effects, the lines representing 1, 2 and 3 days WFH are less steep than 0 days WFH. This shows that respondents who can work from home value an increase in commuting time less negatively. Because this effect is less strong for 2 days than for 1 and 3 days WFH, these lines intersect. When the commuting time increases to approximately 15 minutes, 2 days WFH is valued highest. An even higher increase in commuting time means that 1 and 3 days WFH are valued the highest. However, the differences between 1, 2, and 3 days WFH are minimal, especially between 1 and 3 days.

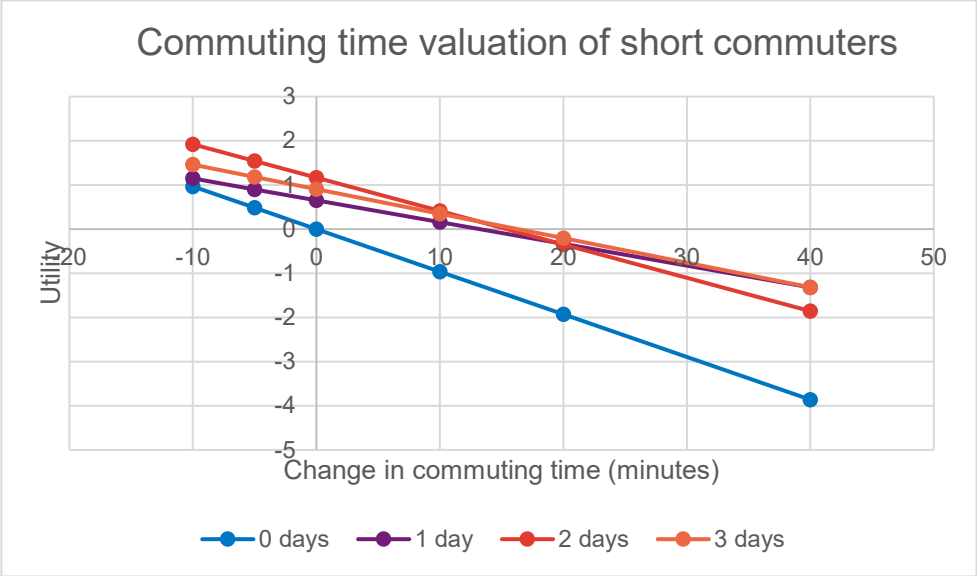

Figure 7: Commuting time valuation of short commuters

The impact of the number of days WFH on the commuting time valuation for long commuters is presented in Figure 8. The interpretation is almost the same as the commuting time valuation for short commuters. The only difference is that long commuters value an increase in commuting time slightly less negatively compared to short commuters. In Figure 8, this can be seen by the steepness of the lines. Compared with short commuters, the lines for long commuters are less steep.

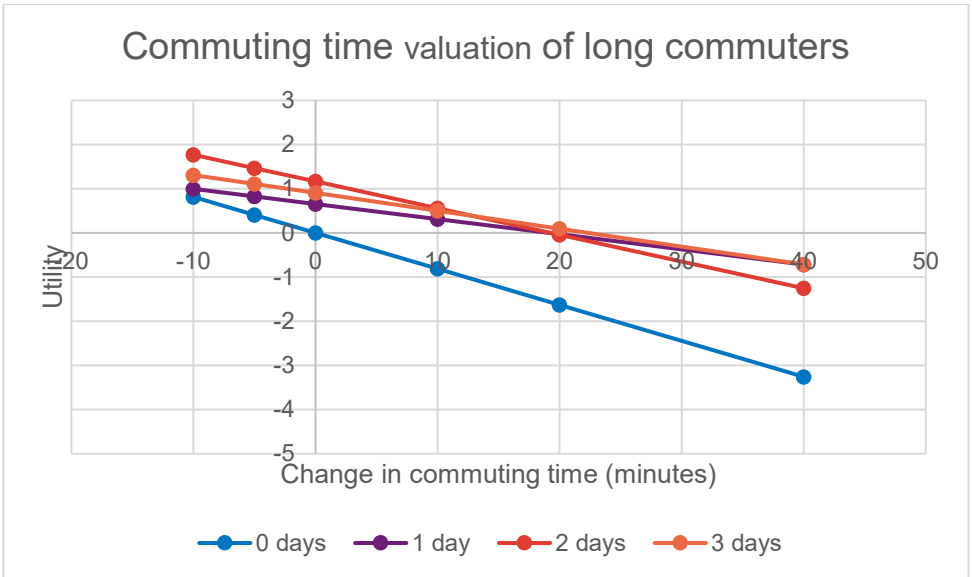

Figure 8: Commuting time valuation of long commuters

The parameter ***b_flexibility*** is also statistically significant. This attribute is formulated as: 'you may decide on which days you work from home yourself'. The reference category is 'no'. The estimate sign of *b_flexibility* is positive, which means that when the answer is 'yes', utility increases. Likewise, the estimate of the parameter ***b_reimbursement*** is positive and statistically significant. This means that an increase in WFH reimbursement per day increases utility. The final main effect, ***b_culture***, is also statistically significant. However, the estimate sign is negative, which is not as expected. This negative

sign means that respondents derive more utility when only a few colleagues work from home at least one day a week as opposed to many colleagues.

4.2.2 Willingness to accept a longer commuting time

The ratios of parameters can be used to obtain information about the willingness to accept (WTA) longer commuting times. These estimates are presented in Table 24, alongside the corresponding equation and robust t-ratio. All estimates are statistically significant at the 0.01 level.

Table 24: Willingness to accept a longer commuting time (MNL model)

WTA	Equation	Estimate	Rob.t-ratio
1 day WFH	$\beta_{days1}/\beta_{time}$	-6.8***	-5.9
2 days WFH	$\beta_{days2}/\beta_{time}$	-12.1***	-8.9
3 days WFH	$\beta_{days3}/\beta_{time}$	-9.4***	-8.4
Flexibility	$\beta_{flexibility}/\beta_{time}$	-6.0***	-17.2
Reimbursement	$\beta_{reimbursement}/\beta_{time}$	-0.8***	-13.6
Many colleagues WFH	$\beta_{culture}/\beta_{time}$	1.2***	3.5

Notes: Significance of robust t-ratio: ***p=0.01

The results show that people are willing to accept the most additional commuting time when they can work 2 days from home. In this case, they are willing to accept a longer one-way commuting time of more than 12 minutes. People are willing to commute almost 7 minutes longer in return for 1 day WFH and over 9 minutes for 3 days WFH. Remember that these values are relative to the reference category of 0 days WFH. The relative change in commuting time is calculated to understand the magnitude of the changes better. The average current commuting time of a respondent is 29.3 minutes. When someone can work a maximum of 2 days per week from home, this person is willing to accept a commute that is 41% longer. For 1 day WFH, this increase is 23%, and for 3 days, it is 32%. While the absolute numbers might not seem very large, the relative rise in commuting time is substantive.

People are also willing to increase their commuting time in return for other working from home conditions. Respondents will accept, on average, a 6-minute longer commute when they can decide which days they work from home. This is an increase of 21%. The willingness to accept a longer commuting time is much lower for a WFH reimbursement. Someone is willing to accept 0.8 minutes of additional commuting time for a WFH reimbursement of 1 euro per day. Translated to the standard WFH reimbursement of €2.35 per day, this is an increase of 2 minutes per one-way trip. Finally, people value only a few colleagues regularly working from home higher than many. This leads to the unexpected result that people are not willing to increase their commuting time when many colleagues regularly work from home. The opposite is true because the results imply that people want a shorter commuting time of 1.2 minutes when many colleagues work from home regularly instead of only a few.

4.3 LCCM

The Latent Class Choice Model distinguishes four classes. The LCCM helps to find a more nuanced answer to the first sub-question because every class values commuting time differently. The LCCM is also used to investigate heterogeneity between the classes. This helps to answer the second sub-question: *To what extent do these trade-offs differ between people?*

4.3.1 Interpretation of the classes

Table 25 shows the results of the LCCM with four classes. The classes are labelled as ‘time-sensitive commuters’, ‘WFH enthusiasts’, ‘WFH skeptics’ and ‘salary seekers’. Time-sensitive commuters is the

largest class, as in total, 33.6% of the respondents is assigned to this class. This is followed by respectively WFH skeptics at 29.6%, WFH enthusiasts at 23.2% and finally, the salary seekers at 13.6%.

Table 25: Latent Class Choice Model estimates

	Class 1: Time-sensitive commuters	**Class 2: WFH enthusiasts**	**Class 3: WFH skeptics**	**Class 4: Salary seekers**
Class size	33.6%	23.2%	29.6%	13.6%
b_time	-0.198***	-0.056***	-0.139***	0.043
	(0.019)	(0.015)	(0.032)	(0.040)
b_salary	0.011***	0.005***	0.017***	0.003*
	(0.001)	(0.001)	(0.003)	(0.002)
b_days1	1.259***	0.580*	-0.043	0.236
	(0.336)	(0.304)	(0.313)	(0.463)
b_days2	1.955***	1.778***	0.348	0.154
	(0.378)	(0.377)	(0.352)	(0.520)
b_days3	1.305***	2.434***	-0.125	-0.464
	(0.268)	(0.396)	(0.295)	(0.375)
b_flexibility	0.823***	1.072***	0.784***	-0.087
	(0.087)	(0.124)	(0.178)	(0.180)
b_reimbursement	0.076***	0.172***	0.137***	-0.055
	(0.021)	(0.021)	(0.027)	(0.041)
b_culture	0.097	0.431***	-0.129	-0.954***
	(0.100)	(0.109)	(0.163)	(0.359)
b_time_days1	0.066***	0.042***	0.130***	-0.066
	(0.016)	(0.014)	(0.027)	(0.048)
b_time_days2	0.066***	0.039***	0.070***	-0.098**
	(0.019)	(0.014)	(0.017)	(0.046)
b_time_days3	0.063***	0.022**	0.095***	-0.042
	(0.010)	(0.010)	(0.018)	(0.030)

Notes: Significance of robust t-ratio: *p=0.1, **p=0.05, ***p=0.01, robust standard errors in parentheses

Class 1: Time-sensitive commuters

A primary characteristic of time-sensitive commuters is that, from all classes, they value a longer commuting time most negatively. This can be obtained from the estimate for *b_time.* Time-sensitive commuters would rather work from home to some extent than not at all. They value a maximum of 2 days WFH per week the highest. A maximum of 1 or 3 days WFH per week provides approximately the same amount of utility, which is lower than for 2 days WFH. The utility contributions are visualized in Figure 10. The interaction effects between a change in commuting time and WFH days are all statistically significant. The effects are positive and almost equal in size. The relevant part of the utility function is provided in Equation 11.

$$(-0.198 + 0.066 \cdot 1DAY + 0.066 \cdot 2DAYS + 0.063 \cdot 3DAYS) \cdot TIME \quad (11)$$

The equation shows that time-sensitive commuters value a longer commuting less negatively when they can work 1, 2, or 3 days from home. The interaction effects are shown in Figure 9. The time sensitivity

can be recognized by the steepness of the lines. However, the lines for 1, 2, and 3 days of WFH are less steep than the line that represents 0 days of WFH. This indicates that people who can work from home value a longer commuting time less negatively. The graph shows that the difference between 1 and 3 days WFH is minimal, while 2 days WFH provides the greatest utility.

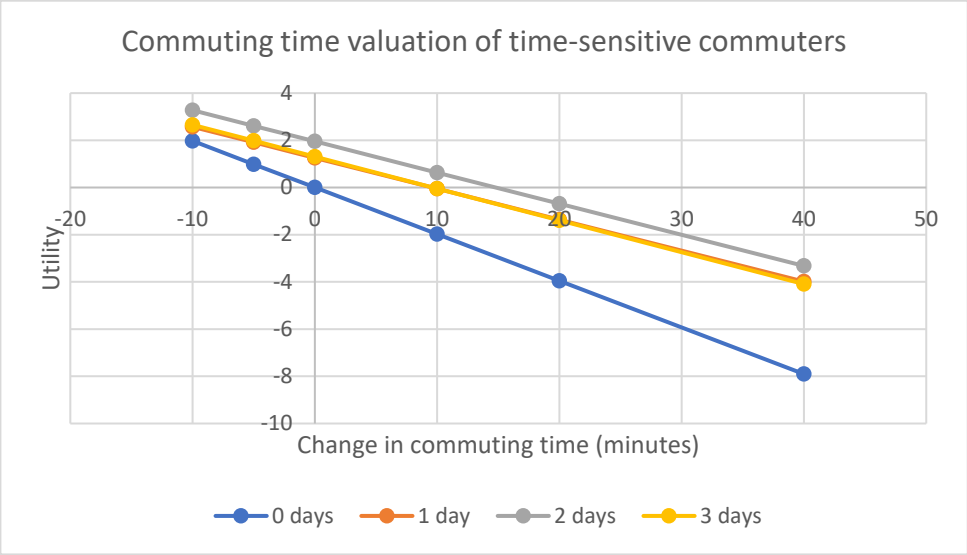

Figure 9: Commuting time valuation of time-sensitive commuters

A salary raise increases utility, as expected. The same holds for an increase in WFH reimbursement. Besides that, time-sensitive commuters value the opportunity to decide which days they can work from home by themselves. The only parameter that is not statistically significant is *b_culture*. So, the situation in which many colleagues work from home at least one day a week is equally valued as when only a few colleagues do this.

The ratios between parameters provide information about the willingness to accept longer commutes. As people in this class are very time-sensitive, they are not willing to increase their commuting time much for working from home conditions. Table 26 presents an overview of the willingness to accept a longer commuting time for all classes. Time-sensitive commuters are willing to accept a longer commuting time of nearly 10 minutes when they can work from home a maximum of 2 days per week, as opposed to 0 days. This is lower for 1 and 3 days, around 6.5 minutes. When time-sensitive commuters can decide which days they work from home, they are willing to accept a longer commute of just over 4 minutes. The effect of a WFH reimbursement is minimal, as time-sensitive commuters are willing to commute 0.4 minutes longer for a daily WFH reimbursement of 1 euro.

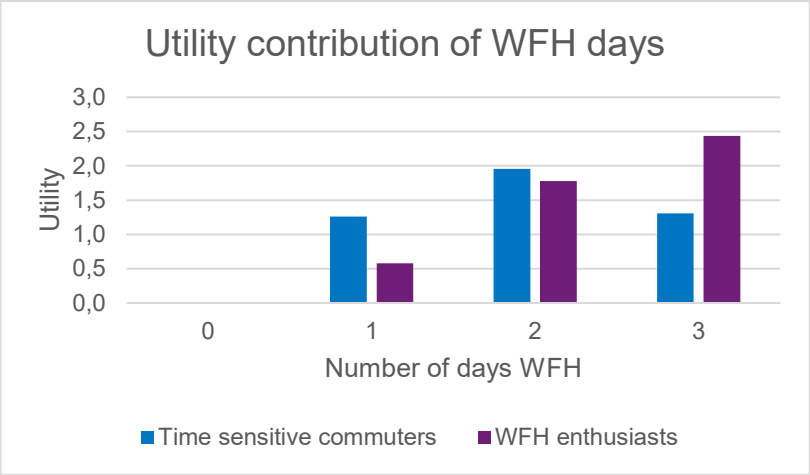

Figure 10: Utility contribution of WFH days (LCCM)

Class 2: WFH enthusiasts

Respondents in class 2 are labeled as 'WFH enthusiasts' because they value working from home most positively. WFH enthusiasts value a maximum of 3 days WFH per week mostly, followed by 2 days and 1 day. Remember that 0 days WFH is the reference category. The utility contribution of the number of days WFH is visually shown in Figure 10. Also for WFH enthusiasts, the interaction effects are significant. The formula is shown in Equation 12.

$$(-0.056 + 0.042 \cdot 1DAY + 0.039 \cdot 2DAYS + 0.022 \cdot 3DAYS) \cdot TIME \quad (12)$$

The estimate of *b_time* is negative but less strong than the estimate for time-sensitive commuters. Hence, WFH enthusiasts care less if their commuting time increases. Equation 12 shows that the coefficient of a change in commuting time becomes less negative when WFH enthusiasts can work from home. This effect is strongest for 1 day WFH. While the difference with 2 days WFH is minimal, the interaction effect for 3 days WFH is weaker. The interaction effects are visualized in Figure 11.

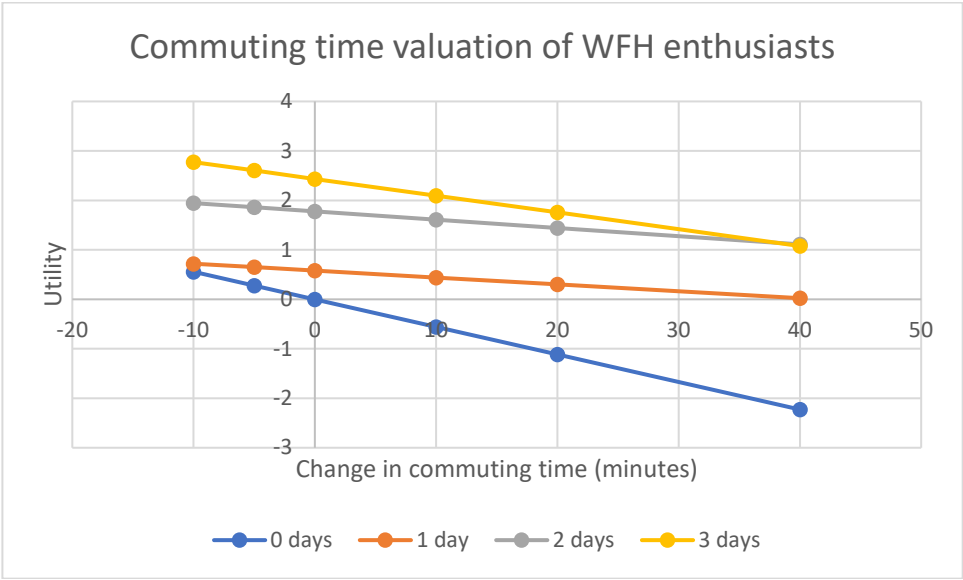

Figure 11: Commuting time valuation of WFH enthusiasts

The graph shows that in all situations, working from home provides more utility than not working from home. Next, the lines representing 1, 2, and 3 days WFH are less steep than 0 days WFH. This indicates that an increased commuting time is valued less negatively when WFH enthusiasts can work from home.

This result was also found for time-sensitive commuters. Because the interaction effect for 3 days WFH is less strong, this line intersects with 2 days WFH. 2 and 3 days WFH provides the same utility at a change in commuting time of approximately 40 minutes.

The parameters *b_flexibility*, *b_reimbursement,* and *b_culture* are also statistically significant. All estimate signs are as expected. An increase in WFH reimbursement increases utility. The utility also increases when WFH enthusiasts can decide on which days they work from home themselves. Finally, WFH enthusiasts value many colleagues who work from home at least one day a week more than only a few.

WFH enthusiasts consider commuting time less important than time-sensitive commuters. This can be recognized in the willingness to accept a longer commuting time. WFH enthusiasts are willing to accept an increase of over 10 minutes for a one-way trip to work when they can work 1 day per week from home. This acceptance increases to almost 32 minutes when the number of WFH days per week is 2. Ultimately, WFH enthusiasts are willing to accept an increase in one-way commuting time of nearly 44 minutes when they can work 3 days from home. WFH enthusiasts are also willing to increase their commuting time substantially to obtain more WFH flexibility. Specifically, respondents are willing to commute just over 19 minutes longer when they can decide which days they work from home. To a lesser extent, respondents are willing to commute further in exchange for a better WFH culture or reimbursement. For a culture where many colleagues work from home at least one day a week, WFH enthusiasts are willing to commute 7.7 minutes longer. A WFH reimbursement of 1 euro per WFH day is equally valued as 3.1 minutes of additional commuting time.

Class 3: WFH skeptics

Class 3 is labeled as ‘WFH skeptics’ because respondents in this class do not derive more utility from working from home. The estimates of *b_days1, b_days2,* and *b_days3* are not statistically significant, indicating that the utility does not differ from the reference category, which was 0 days WFH. An interesting result is that the interaction effects are statistically significant. The relevant part of the utility function is presented in Equation 13.

$$(-0.139 + 0.130 \cdot 1DAY + 0.070 \cdot 2DAYS + 0.095 \cdot 3DAYS) \cdot TIME \quad (13)$$

Again, the estimate of *b_time* is negative, showing that an increased commuting time lowers utility. Compared to the other classes, the interaction effects between the number of days WFH and a change in commuting time are relatively strong. This is especially the case for a maximum of 1 day WFH per week. The interaction effects are visually presented in Figure 12.

When there is no change in commuting time, the differences between all lines is minimal. This makes sense because the main effects of the number of days WFH are not statistically significant. The utility of 1, 2, or 3 days WFH does not significantly differ from that of 0 days WFH. The fact that the interaction effects are statistically significant seems odd at first sight. A possible explanation is that the interaction effect can be interpreted the other way around. Thus, WFH skeptics are not willing to increase their commuting time when they can work from home. Instead, when the commuting time of WFH skeptics increases, they are willing to work from home. With this explanation, it also makes sense that the interaction effect of 1 day WFH is the strongest. WFH skeptics rather do not work from home, so when their commuting time increases, they prefer just one day WFH.

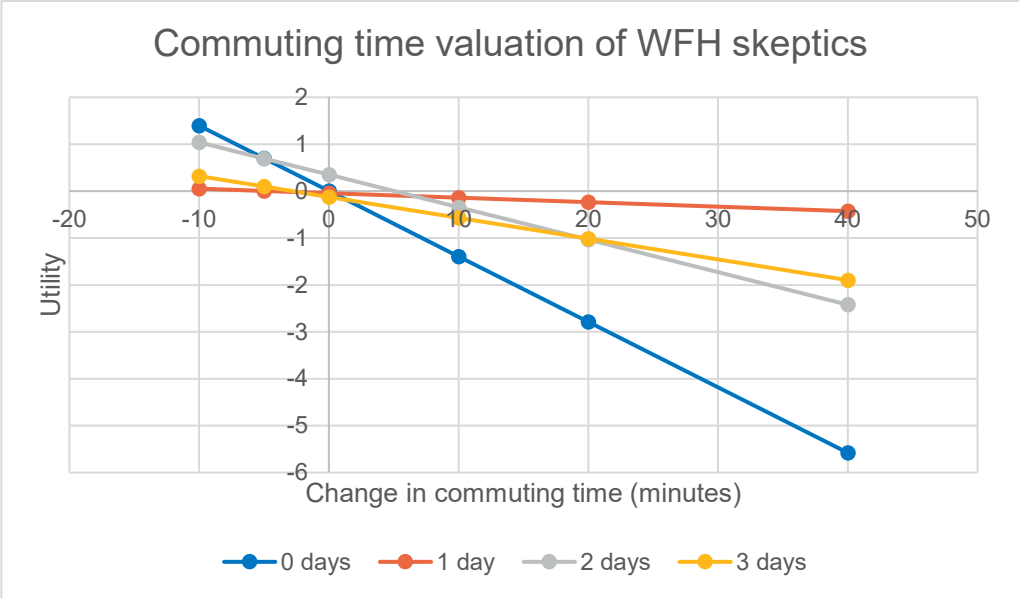

Figure 12: Commuting time valuation of WFH skeptics

A salary raise increases utility. Although the number of days WFH does not provide significant utility, WFH skeptics value WFH flexibility and a WFH reimbursement. Besides that, *b_culture* is not statistically significant either, indicating that respondents do not care about the number of colleagues working from home regularly.

WFH skeptics are unwilling to increase their commuting time when they can work certain days from home. However, they are willing to commute 5.6 minutes longer in exchange for more WFH flexibility. Concerning a WFH reimbursement, respondents value 1 minute of additional commuting time equal to 1 euro reimbursement per day they work from home.

Class 4: Salary seekers

Class 4 is the most challenging class to interpret because only two main effects are statistically significant. The statistically significant parameters are *b_salary* and *b_culture.* One could conclude that respondents of class 4 almost solely look at the salary when choosing a job. Therefore, this class is labeled as 'salary seekers'. A salary increase ensures a higher utility. However, this effect is not as strong as expected for people who only look at the salary of a job. The estimate of *b_culture* is negative, showing that salary seekers do not have a positive attitude towards colleagues WFH. They derive more utility when only a few colleagues work from home at least one day a week than when many colleagues do this.

The parameter of *b_time* is not statistically significant. Therefore, it can be stated that salary seekers do not care about a change in their commuting time. This result is unexpected because people generally do not like to commute longer. Because the parameter *b_time* is not statistically significant, it makes no sense to calculate the willingness to accept commuting times. The other working from home conditions, *b_flexibility* and *b_reimbursement,* are also not statistically significant.

Table 26: Willingness to accept a longer commuting time (LCCM)

WFH condition	Class 1: Time-sensitive commuters	Class 2: WFH enthusiasts	Class 3: WFH skeptics
1 day	-6.4***	-10.4*	0.3
2 days	-9.9***	-31.9***	-2.5

3 days	-6.6***	-43.7***	0.9
Flexibility	-4.2***	-19.2***	-5.6***
Reimbursement	-0.4***	-3.1***	-1.0***
Culture	-0.5	-7.7***	0.9

Notes: Significance of t-ratio: *p=0.1, **p=0.05, ***p=0.01

Table 26 shows the willingness to accept a longer commuting time for all classes. These results provide insight into the people's trade-offs between commuting time and working from home conditions. The results show that WFH enthusiasts are most willing to increase their commuting time for working from home conditions. Time-sensitive commuters and WFH enthusiasts are willing to have a longer commuting time when they can work from home a maximum of 1, 2, or 3 days per week. This effect is much more substantial for WFH enthusiasts. WFH skeptics are unwilling to increase their commuting time in exchange for WFH days. They value WFH flexibility and WFH reimbursement to a small extent. WFH enthusiasts are willing to increase their commuting time the most to obtain WFH flexibility, a WFH reimbursement, and a better WFH culture. Salary seekers are not at all willing to increase their commuting time in exchange for working from home conditions.

4.3.2 Explaining class membership

The class membership model is interpreted to better understand the background characteristics and attitudes that impact the likelihood of belonging to a class. The class membership estimates are provided in Table 27. It strikes attention that the current commuting time was insignificant, while it did play a role in the MNL model. This indicates that the respondents' current commuting time does not significantly differ between the four classes. Therefore, this covariate was removed from the model. The statistically significant covariates are described below.

Table 27: Class membership parameter estimates

	Class 2: WFH enthusiasts	**Class 3: WFH skeptics**	**Class 4: Salary seekers**
Delta	-3.936***	-0.990	-0.888
Education level: ref: low and middle			
High education	-0.620	-0.688***	-0.545
Degree of urbanization: ref: low and middle			
High degree of urbanization	-0.130	-0.271	-0.883**
Income: ref: low income			
Middle income	-0.139	-0.011	-0.652*
High income	0.807*	-0.041	-0.310
Already WFH	2.576***	-0.327	-0.151
Job sector: ref: education & science and industry & production			
Sector_ICT	1.462***	-0.530	-0.399
Sector_health	1.122*	-0.609*	0.204
Sector_public	1.769***	-0.909	-0.749
Sector_other	1.373***	-0.376	-0.321
Attitude_positive WFH experience	-0.009	-0.098	-0.806***
Attitude_good home office	0.492**	-0.131	-0.166
Attitude_good WFH support	-0.366*	-0.004	0.110
Attitude_annoying when colleagues WFH	-0.847***	-0.037	0.579***

Attitude_don't mind rush hour	-0.420***	0.060	0.018
Attitude_don't mind longer travel time	1.448***	1.225***	1.053***

Notes: The parameters for class 1 are fixed to zero because this is the reference class.
Significance of robust t-ratio: *p=0.1, **p=0.05, ***p=0.01

Class 1: Time-sensitive commuters
Class 1 is the reference class, so the parameters for this class are fixed to zero. However, by looking at the estimates of the other classes, characteristics of time-sensitive commuters can be inferred. Time-sensitive commuters have a higher probability of having a high education level compared to low or middle. Besides that, they are more likely to live in an area with a high degree of urbanization than a low or moderate one. In comparison with the other classes, time-sensitive commuters have positive working from home experiences, and they do mind if their commuting time increases by 20 minutes.

Class 2: WFH enthusiasts
Compared with time-sensitive commuters, WFH enthusiasts are significantly more likely to have a high income than a low income. Also, WFH enthusiasts are more likely to work in ICT & automation, health care, public administration, security & justice than in education & science or industry & production. WFH enthusiasts differentiate themselves from time-sensitive commuters in terms of attitudes. People with a good home office, and who do not find it annoying when colleagues regularly work from home are significantly more likely to belong to WFH enthusiasts than to time-sensitive commuters. However, the direction of the relationship can also be the other way around. For example, WFH enthusiasts are more likely to have a good home office. Interestingly, people who do not experience good support from their employer are also more likely to be a WFH enthusiast. Finally, WFH enthusiasts are more likely to mind traveling in peak hours, although they do not mind when their commuting time increases by 20 minutes.

Class 3: WFH skeptics
Not many explanatory factors significantly differ between WFH skeptics and time-sensitive commuters. WFH skeptics are more likely to have a low or middle education level than a high one. Next, they are less likely to work in health care than in education, science, or industry and production. Finally, WFH skeptics are significantly more likely to do not mind when their commuting time increases by 20 minutes, as opposed to time-sensitive commuters.

Class 4: Salary seekers
Salary seekers are more likely to live in an area with a low or middle degree of urbanization compared to time-sensitive commuters. They are also more likely to have a middle income than a low income. Finally, some attitudes of salary seekers significantly differ from those of time-sensitive commuters. Salary seekers are more likely to have negative WFH experiences. They also are more likely to find it annoying when colleagues regularly work from home.

4.3.3 Class probability of different profiles
Five profiles of respondents are constructed to get a better feeling of the impact of covariates on class membership. Table 28 shows three profiles based on socio-demographic characteristics. The first profile (marked green in Table 28) consists of someone who is highly educated, has a high income, lives in an highly urbanized area, and works in the ICT sector. Besides that, this person already works from home to some extent. Someone with this profile has a chance of 44% belonging to time-sensitive commuters and 52% to WFH enthusiasts. The probability of being a WFH skeptic or salary seeker is much lower.

Table 28: Profiles based on socio-demographic characteristics

Characteristic	Level	Time-sensitive commuters	WFH enthusiasts	WFH skeptics	Salary seekers
Education level	High	44%	52%	3%	2%
Income	High				
Urbanization	High				
Job sector	ICT				
Currently WFH	Yes				
Education level	High	82%	7%	7%	4%
Income	High				
Urbanization	High				
Job sector	ICT				
Currently WFH	No				
Education level	Low/middle	57%	3%	11%	29%
Income	Low				
Urbanization	Low/moderate				
Job sector	Health care				
Currently WFH	No				

Whether or not someone already works from home greatly impacts the probability of belonging to the WFH enthusiasts. The second profile (marked purple in Table 28) only differs from profile one regarding working from home. Someone in profile two does currently not work from home. Consequently, the probability of being a WFH enthusiast drops from 52% to 7%, while the probability of being a time-sensitive commuter rises to 82%.

The third profile (marked pink in Table 28) characterizes someone with a low or middle education level, a low income, living in a low or moderate degree of urbanization, working in the health care sector, and currently not working from home. Someone with these characteristics has a chance of 57% of being a time-sensitive commuter and a chance of 29% of being a salary seeker.

The final two profiles are constructed based on attitudes. Because the attitudes concern working from home, whether or not someone already works from home is also taken into account. These profiles are presented in Table 29. The fourth profile (marked blue in Table 29) represents someone who works from home and has a positive WFH experience. Besides that, this person has a good workplace at home, experiences good support from their employer, and is not annoyed when colleagues regularly work from home. Someone with this profile is most likely to be a time-sensitive commuter, at 83%. The probability of being a WFH enthusiast is 6%, a WFH skeptic 8%, and a salary seeker 3%.

The fifth profile is the opposite of the fourth profile. Profile five (marked orange in Table 29) represents someone with negative working from home experiences who currently does not work from home. This person does not have a good workplace at home and does not experience good working from home support from their employer. The probability of being a time-sensitive commuter or a WFH enthusiast declines with this profile, while the probability of being a salary seeker increases from 3% to 38%.

Table 29: Profiles based on attitudes

Attitude	Level	Time-sensitive commuters	WFH enthusiasts	WFH skeptics	Salary seekers
Positive WFH experience	Agree	83%	6%	8%	3%
Good workplace at home	Agree				

Good support employer	Agree				
Annoying when colleagues WFH	Disagree				
Currently WFH	Yes				
Positive WFH experience	Disagree	51%	0%	10%	38%
Good workplace at home	Disagree				
Good support employer	Disagree				
Annoying when colleagues WFH	Agree				
Currently WFH	No				

4.3.4 Net effect of working from home

The LCCM results tell us that people are, to some extent, willing to accept a longer commuting time on the days they are not working from home. Based on the survey results, the current commuting times, number of days working from home, and working days per week are known. Combining this information can provide insight into the net effect of working from home on the weekly commuting time.

Base scenario

The base scenario consists of the current situation of the respondents. In Table 30, the characteristics of this scenario per class are indicated. The current total commuting time per week is calculated by multiplying the current commuting time per day with the number of days someone is not working from home per week. Two simplifications were made in this calculation:

- Simplification 1: the current number of days WFH per week is rounded to full days
- Simplification 2: the current number of working hours per week is translated to full working days (by dividing the current working hours per week by 8)

Table 30: Base scenario

	Time-sensitive commuters	**WFH enthusiasts**	**WFH skeptics**	**Salary seekers**
Current commuting time (minutes)	28.7	37.9	25.7	24.3
Current number of days WFH	0.8	2.4	0.6	0.4
Current working hours per week	32.2	34.7	33.4	31.7
Current total commuting time per week (minutes)	**172**	**152**	**154**	**194**

In the base scenario, time-sensitive commuters have a total commuting time of 172 minutes per week. This is 152 minutes for WFH enthusiasts, 154 for WFH skeptics, and 194 for salary seekers.

Scenario 1

Table 30 shows that time-sensitive commuters already work 1 day from home, WFH enthusiasts 2, WFH skeptics 1, and salary seekers 0. The central assumption for scenario 1 is that everybody has already accepted a longer commuting time based on their current working-from-home situation. For example, time-sensitive commuters already commute 6.4 minutes longer for the 1 day they already work from home (see Table 26).

The second assumption is that everyone will work from home one extra day per week. Specifically, this means that time-sensitive commuters will work 2 days from home, WFH enthusiasts 3, WFH skeptics 2, and salary seekers 1. The extra day WFH means a decrease in commuting time because someone commutes 1 day less. However, commuting time is also increased because someone is willing to accept a longer commute when he/she is not working from home. The third assumption is that people who work

from home an extra day will actually commute longer when not working from home. This can, for example, mean that someone spends extra time in congestion, takes another job, or moves to another house further away. The new total commuting time per week for scenario 1 is presented per class in Table 31. The results show that, for all classes, the total commuting time per week decreases. It is important to keep in mind that these results are dependent on the three assumptions that were made.

Table 31: Scenario 1

	Time-sensitive commuters	**WFH enthusiasts**	**WFH skeptics**	**Salary seekers**
Decrease in commuting time because of extra day WFH	57.4	75.8	51.4	48.5
Increase in commuting time because of WTA longer commuting times	14.1	23.6	0.0	0.0
New total commuting time per week	143.0	99.4	102.8	145.6
Difference in total commuting time per week	**-29.2**	**-52.3**	**-51.4**	**-48.5**

Note: all numbers are presented in minutes

Scenario 2

A second scenario is included to show that different assumptions result in different outcomes. The central assumption of scenario 2 is that people did not already accept a longer commuting time based on their current working from home pattern. In other words, someone who started working from home 1 day per week did not increase his/her commuting time because of this. As for scenario 1, the second assumption is that everyone will work from home one extra day per week. The third assumption is that because of this extra day working from home, they will increase their commuting time on the days they are not working from home. For example, because they spend extra time in congestion or choose another job further away.

With these assumptions, the total commuting time per week changes. An extra day working from home reduces the total commuting time. On the other hand, the longer commutes on other days increase the total commuting time per week. Table 32 shows that the total commuting time per week increases for time-sensitive commuters and WFH enthusiasts compared with the base scenario. For WFH skeptics and salary seekers, the weekly commuting time is still less than the base scenario.

Table 32: Scenario 2

	Time-sensitive commuters	**WFH enthusiasts**	**WFH skeptics**	**Salary seekers**
Decrease in commuting time because of extra day WFH	57.4	75.8	51.4	48.5
Increase in commuting time because of WTA longer commuting times	39.6	87.4	0.0	0.0
New total commuting time per week	193.9	163.2	102.8	145.6
Difference in total commuting time per week	**21.7**	**11.6**	**-51.4**	**-48.5**

Note: all numbers are presented in minutes

It is important to interpret these results carefully and remember that they are based on assumptions. Besides, the effect of other trips than commuting is not taken into account. The literature overview

showed that teleworking can result in more non-work-related trips (Wöhner, 2022). Other trips than commuting should be included in the analysis to make statements about the impact of working from home on the total travel time per week. Besides that, it is important to note that scenario 1 uses the marginal effects for the increases in commuting time, while scenario 2 uses the total effect. Although both scenarios are possible, scenario 1 is more likely to be true because it takes the current working from home patterns into account more realistically.

5 Conclusion and discussion

Chapter 5 presents the conclusion and discussion of this research. Section 5.1 recalls the research approach by providing a short research overview. After that, section 5.2 presents a synthesis of the key findings. The results are discussed in light of the literature in section 5.3. Section 5.4 addresses the policy implications of the results. Section 5.5 provides a reflection of this research's limitations. The chapter closes with recommendations for further research in section 5.6.

5.1 Research overview

This research focused on the hypothesis that people who can work from home accept longer commuting times when they are not working from home. If the hypothesis is correct, it may be that working from home contributes to congestion instead of countering it. If the hypothesis is incorrect, knowing which working from home conditions can stimulate working from home is interesting information. Thus, insights into the relationship between commuting time and working from home conditions can help the government and employers design working from home policies. The following research question is formulated to examine the hypothesis:

How do individuals value commuting time under different working from home conditions?

A stated preference survey was conducted to answer the research question. The survey consisted of a choice experiment and questions about the respondents' backgrounds. Respondents had to indicate which job they would prefer in the choice experiment. The presented jobs varied in commuting time, number of working from home days, salary, working from home flexibility, working from home reimbursement and working from home culture. The additional questions were about socio-demographic characteristics, the current situation of the respondent, and attitudes. In total, 960 respondents are included in the analysis. The data is analyzed using a Multinomial Logit Model (MNL) and a Latent Class Choice Model (LCCM). Besides the six main effects of the attributes, the interaction effect between the number of days WFH and the change in commuting time is estimated. This interaction effect can help in understanding how the valuation of a change in commuting time changes when the number of days someone can work from home increases.

5.2 Key findings

The first key finding is that the LCCM results show that some people are willing to increase their commuting time when they can work from home. The LCCM revealed four distinct groups of respondents: time-sensitive commuters (33.6%), WFH enthusiasts (23.2%), WFH skeptics (29.6%), and salary seekers (13.6%). Only time-sensitive commuters and WFH enthusiasts are willing to increase their commuting time for WFH days. Generally, WFH enthusiasts are willing to increase their one-way commuting time by up to 44 minutes when they can work from home a maximum of 3 days per week, relative to 0 days WFH. Time-sensitive commuters prefer a maximum of 2 days WFH per week and are willing to increase their one-way commute by 10 minutes in return for this. The interaction effects show that people who can work from home value an increased commuting time less negatively than when they cannot work from home.

A second key finding is that this willingness to accept a longer commuting time does not increase the total weekly commuting time when everyone will work one extra day from home. This statement holds

under the assumption that people already commute longer based on their current working from home pattern. However, when this assumption is wrong, the results show that the total commuting time per week can increase relative to the respondent's current situation. This is specifically true for time-sensitive commuters and WFH enthusiasts.

A third key finding is related to another WFH condition, namely WFH flexibility. In this study, WFH flexibility is defined as the ability to decide which days people can work from home by themselves, given the maximum number of days they can work from home per week. For example, when someone can work from home 1 day per week, people can choose whether to do this on Monday or Tuesday. The results show that people value this flexibility relatively highly. Again, WFH enthusiasts are willing to accept the highest increase in commuting time to obtain WFH flexibility. Specifically, they are willing to accept an increase of 19 minutes in one-way commuting time. This willingness to accept is much lower for time-sensitive commuters and WFH skeptics, around 5 minutes.

A fourth key finding is that WFH reimbursement and the WFH culture do not significantly impact commuting time valuation. In 2024, employers can offer their employees an untaxed WFH reimbursement of €2.35 per WFH day. WFH enthusiasts are willing to increase their one-way commuting time by approximately 7 minutes in return for this amount. For other people, the effect is almost negligible. Almost the same holds for WFH culture, determined by the number of colleagues working from home at least one day a week. Only WFH enthusiasts are willing to accept a longer one-way commuting time of around 8 minutes when many colleagues WFH regularly, as opposed to only a few. Other people are indifferent regarding the number of colleagues who regularly work from home.

Finally, a key finding is that some background characteristics and attitudes can explain the probability of belonging to one of the four groups of respondents. Logically, people who do mind if their commuting time increases by 20 minutes are most likely to belong to the time-sensitive commuters. Besides that, time-sensitive commuters generally have positive working from home experiences. Characteristic features of WFH enthusiasts are people with a high income, people who are already WFH, and people who work in the ICT, health care, or public administration sector. Besides that, WFH enthusiasts indicate that they have a good home office and are not annoyed when colleagues regularly work from home. WFH skeptics are likelier to have a low or middle education level and work in education & science or industry & production (relative to the healthcare sector). People who have negative WFH experiences and find it annoying when colleagues regularly WFH are more likely to belong to the salary seekers.

5.3 Discussion

Some of the results found in this study align with what is already known in the literature, while others are different or new. To start with, previous studies showed that a longer commuting time is associated with disutility. Lara-Pulido & Martinez-Cruz (2023) found this result in Mexico, Demel et al. (2018) in Spain, the Czech Republic, and Germany, and Morejón Cabrera & Mariel (2023) in Spain, Colombia, and Ecuador. This research can confirm these findings, as the results show that an increased commuting time lowers utility.

Almost all studies investigating the impact of working from home only looked at the number of days working from home. This research expanded this view by including also WFH flexibility, WFH reimbursement, and WFH culture in the analyses. Earlier studies investigated the impact of flexible working schedules and found that these are positively valued. This was found true for students looking for a job by Demel et al. (2018) and Morejón Cabrera & Mariel (2023). Next, Van Landeghem et al. (2024) found that people are willing to accept a longer commuting time when they can choose between

working schedules. This research added to this body of knowledge by explicitly looking at working from home flexibility. In line with earlier research, this research showed that flexibility is valued positively, and people are willing to accept a longer commuting time in exchange for WFH flexibility.

One of the few studies that have already investigated the acceptance of longer commuting times in return for working from home is the study of De Vos et al. (2018). They found that, on average, people are willing to accept 5% longer daily commuting times. These results are far lower than the results that were found in this study. A possible explanation is that the study of De Vos et al. was conducted before the COVID-19 pandemic. As the number of people working from home increased drastically during that period, it is plausible that the willingness to accept longer commuting times also increased. Another explanation could be that De Vos et al. used a different research method. This research distinguished four different classes and found that some people were not at all willing to increase their commuting time while others would significantly. This contrasts with the study of De Vos et al., who presented only a generalized finding for the whole sample.

Many studies investigated characteristics of people that stimulate working from home. This research also investigates this by adding covariates to the LCCM and trying to explain class membership. The results showed that people with a high income are more likely to belong to WFH enthusiasts. This is in line with earlier research, as many other studies found that a high income positively influences WFH (Drucker & Khattak, 2000; Huang et al., 2023; Motte-Baumvol & Schwanen, 2024; Stiles & Smart, 2021). Other studies also showed that a high education level positively affects WFH (Caulfield, 2015; Drucker & Khattak, 2000; Ecke et al., 2022; Huang et al., 2023; Illegems et al., 2001; O'Keefe, 2016; Stiles & Smart, 2021). This is found to be true to some extent in this research. Time-sensitive commuters are willing to work from home and are more likely to have a high education level than WFH skeptics. However, this relationship is not found among WFH enthusiasts, who are most willing to work from home.

It stands out that some other explanatory factors were significant in earlier research but not in this research. For instance, earlier studies found that personal characteristics such as age, gender, and household composition affect the willingness to work from home. However, these relations were not found in this study. A possible explanation is that attitudes are included as covariates as well. These were found to be much more explanatory than other background characteristics, in line with the study of Mokhtarian & Salomon (1997). Concerning attitudes, earlier studies found that support from the organization or manager to work from home has a positive effect (De Andrés-Sánchez & Belzunegui-Eraso, 2023; O'Keefe, 2016). However, this research showed that WFH enthusiasts indicate that they do not experience good support from their employer to work from home. So, this is a contrasting result.

5.4 Policy implications

The results of this study have policy implications for the government and employers. The results revealed that a group of people, labeled as WFH enthusiasts, are willing to accept a considerable increase in their one-way commuting time when they can work from home. A positive note is that these people are willing to work some days per week from home. These days, the number of commuting trips is lower and because of that congestion and pollution decrease. On the other hand, there are serious adverse effects on the days these people are not working from home. Because of the increase in daily commuting time, the congestion and pollution on these days can even get worse. This result shows that the government and employers need to focus on the distribution of days when people work from home during the week to counter congestion.

The WFH culture is related to the distribution of days when people work from home. A hypothesis is that employees tend to work the same days at the office. This can be due to fixed meetings, managers' requirements, or the need for social interaction. However, the results of this research cannot confirm this hypothesis. Generally, the share of colleagues working from home did not significantly impact the willingness to accept a longer commuting time. This result implies that it is hard for the government and employers to manage working from home based on the WFH culture, as the WFH culture is not highly valued.

One government instrument that stimulates working from home is the untaxed WFH reimbursement employers can offer their employees. However, the results show that WFH enthusiasts particularly value this reimbursement. WFH enthusiasts are most willing to increase their commuting time for WFH conditions. As explained in the introduction, longer commutes are undesirable. Thus, this result questions the effectiveness of a WFH reimbursement.

The results also showed that a group of people is willing to work from home but only to increase their commuting time a bit in return. These people are time-sensitive and highly value a short commuting time. From a mobility perspective, it is important to encourage these people to work from home for two reasons. First, they value working from home, so there is a high potential that they are actually going to work from home. Second, they potentially contribute more to a drop in congestion than WFH enthusiasts because of their time sensitivity.

Besides the government, the results of this study provide relevant insights for employers. Generally, the results show that people attach more value to WFH flexibility than to a WFH reimbursement or many colleagues who regularly work from home. In other words, offering employees flexibility concerning working from home is a good way to stimulate working from home. Another interesting finding is that generally, people who do not experience good support from their employer when working from home are more likely to belong to WFH enthusiasts than time-sensitive commuters. This result suggests that no good WFH support from their employer is no reason not to work from home. Another possibility is that no good support enhances the willingness to work from home.

5.5 Limitations

It is important to note that this research has some limitations. When interpreting the results, these should be kept in mind because they might have influenced them. The first limitation is related to the scope of the research. This research only focused on working from home, while other forms of teleworking exist. Teleworking forms such as working from a cafeteria or on the go were not considered, although they could also impact commuting time valuation.

Moreover, there are some limitations related to the data collection process. First, the data is collected using an external panel (as described in section 3.4.3). Members of this panel get a small reward in exchange for completing the questionnaire. This resulted in some questionnaires being filled out exceptionally quickly. A plausible explanation is that respondents rushed through the questionnaire without looking at the content to get the reward. All respondents who completed the questionnaire in less than 3 minutes were removed from the analysis. However, this is an arbitrary cut-off point, and it is possible that other respondents in the sample provided irrational answers. Second, the two versions of the choice experiment are separated by 30 minutes of commuting time (as described in section 3.2.1). The pilot resulted in a distribution of almost 50% short and 50% long commuters. However, the actual experiment resulted in a distribution of 68% (649 respondents) short and 32% (311 respondents) long commuters. The cut-off point at 30 minutes as a separation of the two versions is also arbitrary.

Furthermore, there are some limitations related to the setup of the choice experiment. First, there was some sloppiness in the pilot analysis. An ASC was added to the utility function in the analysis to test for left-to-right bias. However, as this ASC turned out to be insignificant, it could have been removed from the model. Next, only one linear parameter was estimated for the interaction effect between a change in commuting time and the number of days working from home. To test for non-linearity, the number of days working from home was dummy-coded into three indicator variables. Therefore, including three interaction effects in the utility function should have optimized the design better. Avoiding these small mistakes could have improved the prior values and, therefore, the final experimental design.

Second, only six attributes are included in the choice experiment to limit the complexity of the choice tasks, while many more factors were identified in the literature review. This study does not address these other factors that potentially influence commuting time valuation. An example is the travel reimbursement. Employers are not allowed to disperse WFH and travel reimbursements on the same day. However, a WFH reimbursement was included in the choice experiment, while a travel reimbursement was not. Some factors not included in the choice experiment are included in the analyses as explanatory factors to account for some factors not included in the choice experiment.

Finally, some limitations regarding the research method should be considered. First, stated preference data might be biased as hypothetical preferences might not correspond to real-life preferences (as described in section 3.1.1). However, the choice experiment was set up very carefully, and everything was done to ensure the hypothetical situations were relatable to the respondents. Second, the discrete choice model assumes a utilitarian view where people maximize utility (as described in section 3.1.2). However, other aspects, such as emotions, might affect people's choices. Another possibility is that people choose based on their intention instead of the derived utility.

5.6 Recommendations for further research

This research opens avenues for further research, which could also be used to overcome its limitations. The first recommendation is to broaden the scope and investigate how other forms of teleworking, such as working from home, impact commuting time valuation. It would be interesting to see if and how commuting time valuation differs between various forms of teleworking.

The second recommendation is related to WFH flexibility. The results show that respondents value flexibility around working from home relatively high. In this study, WFH flexibility entails the freedom to choose which day someone works from home, given the number of days to work from home. This is even more simplified into a yes or no statement. Further research could enlarge this range by exploring flexibility more nuancedly. Besides that, other forms of flexibility can be investigated, such as the effect of flexibility on the number of days WFH per week.

A third recommendation is related to the four identified classes. The membership of a particular class can be calculated up to a probability. The LCCM results showed that some background characteristics and attitudes of the respondents can explain class membership. A study that explores people's attitudes regarding working from home in more depth could be enriching and provide more insights into the types of people willing to commute longer in exchange for working from home conditions. Besides that, further studies could investigate whether or not the classes are a given because people have different personalities. Or could, for example, a WFH skeptic become a WFH enthusiast, and how? A qualitative study can enrich this research direction.

Some assumptions were made by calculating the net effect of working from home on the total commuting time. A fourth recommendation is to validate these assumptions. The primary assumption that can be further investigated is whether or not people have already increased their commuting time since they started working from home. For instance, have they relocated to a new home, accepted a new job, or changed their departure times? These insights can help by making more robust claims about the impact of working from home on the total commuting time per week. To make statements about the effect of working from home on the total travel time, further research could investigate and include the effect of non-commuting trips.

This research focused on employees' perspectives regarding WFH conditions and commuting time valuation. A fifth recommendation for further research is to delve into employers' perspectives. For instance, not all companies want to encourage WFH, while others do. Insight into these employers' perspectives can help the government identify which companies do and do not encourage WFH. Stimulating people to work from home is ineffective when their employers would not allow them.

The final recommendation relates to the research population. This research is conducted in the Netherlands. It would be interesting to conduct similar studies in other countries to see the similarities and differences. The literature review showed that people in other countries also have different travel time valuations. This research suggests that the impact of working from home conditions on commuting time valuation might also be different.

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Appendix A: Ngene syntax

Syntax pilot choice experiment

```
?Pilot
design
;alts = A, B
;rows = 8
;orth = seq
;model:
U(A) = b1 * tijd[20,40,60,80] +
       b2 * salaris[-400,-200,200,400] +
       b3 * dagen[0,1,2,3] +
       b4 * flex[0,1] +
       b5 * vergoeding[0,2.35] +
       b6 * cultuur[0,1] +
       b7 * tijd * dagen /
U(B) = b1 * tijd +
       b2 * salaris +
       b3 * dagen +
       b4 * flex +
       b5 * vergoeding +
       b6 * cultuur +
       b7 * tijd * dagen
$
```

Syntax final choice experiment

```
?Experiment
design
;alts = A, B
;rows = 12
;eff = (mnl, d)
;cond: if(A.dagen=0, A.vergoeding=0),
       if(A.dagen=0, A.flex=0),
       if(B.dagen=0, B.vergoeding=0),
       if(B.dagen=0, B.flex=0)
;model:

U(A) = b1[-0.1337] * tijd[-5,0,10,20] +
       b2[0.0113] * salaris[-100,0,100,200] +
       b3.dummy[2.6190|3.7662|3.1508] * dagen[3,2,1,0] +
       b4[0.0062] * vergoeding[0,2.35,4.70] +
       b5.dummy[0] * flex[1,0] +
       b6.dummy[0] * cultuur[1,0] +
       b7[0.0238] * tijd * dagen /
U(B) = b1 * tijd +
       b2 * salaris +
       b3.dummy * dagen +
       b4 * vergoeding +
       b5.dummy * flex +
       b6.dummy * cultuur +
       b7 * tijd * dagen
$
```

Appendix B: Experimental design pilot

B1: Experimental design Ngene output

	A (job 1)						B (job 2)					
	time	**salary**	**days**	**reimb**	**flex**	**culture**	**time**	**salary**	**days**	**reimb**	**flex**	**culture**
1	10	-100	1	0	0	0	0	-100	0	2.35	0	1
2	0	-100	0	2.35	0	1	10	200	3	2.35	1	1
3	5	100	1	2.35	0	0	10	100	0	0	1	1
4	10	100	0	0	1	1	10	-100	1	0	0	0
5	-5	200	0	0	1	0	5	-200	2	0	0	1
6	-5	-200	1	2.35	1	1	-5	200	3	0	0	1
7	-5	200	3	0	0	1	5	-100	2	2.35	1	0
8	5	-200	2	0	0	1	0	-200	3	0	1	0
9	0	100	2	2.35	0	0	-5	-200	1	2.35	1	1
10	0	-200	3	0	1	0	0	100	2	2.35	0	0
11	5	-100	2	2.35	1	0	-5	200	0	0	1	0
12	10	200	3	2.35	1	1	5	100	1	2.35	0	0

B2: Correlations design Ngene output

	A (job 1)					
Attribute	**time**	**salary**	**days**	**reimb**	**flex**	**culture**
a.time	1	0	0	0	0	0
a.salary	0	1	0	0	0	0
a.days	0	0	1	0	0	0
a.reimbursement	0	0	0	1	0	0
a.flexibility	0	0	0	0	1	0
a.culture	0	0	0	0	0	1
b.time	0.200	0.471	-0.400	-0.149	-0.149	0.298
b.salary	0	-0.367	0.047	0.632	0.316	0.105
b.days	-0.600	-0.330	-0.067	-0.149	0	0.596
b.reimbursement	0	0.105	0.447	0	-0.333	0
b.flexibility	-0.149	0	0.149	0.333	-0.667	0
b.culture	-0.298	0	-0.596	0.333	-0.333	-0.333

	B (job 2)					
Attribute	**time**	**salary**	**days**	**reimb**	**flex**	**culture**
a.time	0.200	0	-0.600	0	-0.149	-0.298
a.salary	0.471	-0.367	-0.330	0.105	0	0
a.days	-0.400	0.047	-0.067	0.447	0.149	-0.596
a.reimbursement	-0.149	0.632	-0.149	0	0.333	0.333
a.flexibility	-0.149	0.316	0	-0.333	-0.667	-0.333
a.culture	0.298	0.105	0.596	0	0	-0.333
b.time	1	0	0	0	0	0
b.salary	0	1	0	0	0	0
b.days	0	0	1	0	0	0
b.reimbursement	0	0	0	1	0	0
b.flexibility	0	0	0	0	1	0
b.culture	0	0	0	0	0	1

B3: Manually adapted experimental design

	A (job 1)						B (job 2)					
	time	**salary**	**days**	**reimb**	**flex**	**culture**	**time**	**salary**	**days**	**reimb**	**flex**	**culture**
1	10	-100	1	0	0	0	0	-100	0	0	0	0
2	0	-100	0	0	0	0	10	200	3	2.35	1	1
3	5	100	1	2.35	0	0	10	100	0	0	0	0
4	10	100	0	0	0	0	10	-100	1	0	0	0
5	-5	200	0	0	0	0	5	-200	2	0	0	1
6	-5	-200	1	2.35	1	1	-5	200	3	0	0	1
7	-5	200	3	0	0	1	5	-100	2	2.35	1	0
8	5	-200	2	0	0	1	0	-200	3	0	1	0
9	0	100	2	2.35	0	0	-5	-200	1	2.35	1	1
10	0	-200	3	0	1	0	0	100	2	2.35	0	0
11	5	-100	2	2.35	1	0	-5	200	0	0	0	0
12	10	200	3	2.35	1	1	5	100	1	2.35	0	0

B4: Correlations manually adapted design

	A (job 1)					
Attribute	**time**	**salary**	**days**	**reimb**	**flex**	**culture**
a.time	1	0	0	0.076	0	-0.158
a.salary	0	1	0	0.107	-0.335	0
a.days	0	0	1	0.227	0.474	0.474
a.reimbursement	0.076	0.107	0.227	1	0.478	0.12
a.flexibility	0	-0.335	0.474	0.478	1	0.25
a.culture	-0.158	0	0.474	0.12	0.25	1
b.time	0.2	0.471	-0.4	-0.378	-0.474	-0.158
b.salary	0	-0.367	0.047	0.428	.671	0
b.days	-.600	-0.33	-0.067	-0.378	0	0.474
b.reimbursement	-0.227	0.214	0.529	-0.029	0.12	0.12
b.flexibility	-0.316	0	0.158	-0.239	-0.5	0.25
b.culture	-.632	0	-0.474	0.12	-0.125	-0.125

	B (job 2)					
Attribute	**time**	**salary**	**days**	**reimb**	**flex**	**culture**
a.time	0.2	0	-.600	-0.227	-0.316	-.632
a.salary	0.471	-0.367	-0.33	0.214	0	0
a.days	-0.4	0.047	-0.067	0.529	0.158	-0.474
a.reimbursement	-0.378	0.428	-0.378	-0.029	-0.239	0.12
a.flexibility	-0.474	.671	0	0.12	-0.5	-0.125
a.culture	-0.158	0	0.474	0.12	0.25	-0.125
b.time	1	0	0	0.076	0	-0.158
b.salary	0	1	0	0.107	-0.335	0
b.days	0	0	1	0.227	0.474	0.474
b.reimbursement	0.076	0.107	0.227	1	0.478	0.12
b.flexibility	0	-0.335	0.474	0.478	1	0.25
b.culture	-0.158	0	0.474	0.12	0.25	1

Appendix C: Experimental design final experiment

C1: Final experimental design Ngene output

	A (job 1)						B (job 2)					
	time	**salary**	**days**	**reimb**	**flex**	**culture**	**time**	**salary**	**days**	**reimb**	**flex**	**culture**
1	-5	100	3	2.35	0	0	20	200	3	2.35	1	1
2	10	200	3	0	0	1	0	0	1	4.7	1	0
3	10	0	2	0	1	0	-5	-100	3	2.35	0	1
4	0	100	1	0	0	0	0	100	2	4.7	1	1
5	-5	-100	1	2.35	0	1	10	-100	2	2.35	0	0
6	-5	-100	2	4.7	1	1	20	200	2	0	0	0
7	20	200	3	4.7	0	0	-5	0	2	0	1	1
8	20	200	0	0	0	1	20	-100	3	0	0	0
9	10	-100	2	4.7	0	0	10	0	1	0	1	1
10	0	0	2	0	0	1	0	200	3	4.7	1	0
11	20	100	1	2.35	1	1	-5	100	0	0	0	0
12	0	0	3	0	1	0	10	100	1	4.7	0	1

C2: Correlations final design Ngene output

	A (job 1)					
Attribute	**time**	**salary**	**days**	**reimb**	**flex**	**culture**
a.time	1	0.602	-0.216	0.039	0	0.043
a.salary	0.602	1	0.039	-0.315	-0.316	0
a.days	-0.216	0.039	1	0.184	0.062	-0.437
a.reimbursement	0.039	-0.315	0.184	1	0	-0.101
a.flexibility	0	-0.316	0.062	0	1	0
a.culture	0.043	0	-0.437	-0.101	0	1
b.time	-0.424	-0.252	-0.125	0.196	-0.092	0.130
b.salary	-0.485	-0.133	0.352	0.135	0.158	0
b.days	-0.262	0.039	-0.099	-0.237	-0.309	-0.087
b.reimbursement	-0.491	0.043	0.296	-0.729	-0.137	-0.097
b.flexibility	-0.043	0.298	0.437	0.101	-0.707	-0.333
b.culture	-0.043	0	0.437	0.101	0	-1

	B (job 2)					
Attribute	**time**	**salary**	**days**	**reimb**	**flex**	**culture**
a.time	-0.424	-0.485	-0.262	-0.491	-0.043	-0.043
a.salary	-0.252	-0.133	0.039	0.043	0.298	0
a.days	-0.125	0.352	-0.099	0.296	0.437	0.437
a.reimbursement	0.196	0.135	-0.237	-0.729	0.101	0.101
a.flexibility	-0.092	0.158	-0.309	-0.137	-0.707	0
a.culture	0.130	0	-0.087	-0.097	-0.333	-1
b.time	1	0.175	0.284	-0.239	-0.217	-0.130
b.salary	0.175	1	-0.039	0.216	0.298	0
b.days	0.284	-0.039	1	0.093	0.087	0.087
b.reimbursement	-0.239	0.216	0.093	1	0.290	0.097
b.flexibility	-0.217	0.298	0.087	0.290	1	0.333
b.culture	-0.130	0	0.087	0.097	0.333	1

C3: Manually adapted final experimental design

	A (job 1)						B (job 2)					
	time	**salary**	**days**	**reimb**	**flex**	**culture**	**time**	**salary**	**days**	**reimb**	**flex**	**culture**
1	-5	100	3	2.35	0	0	20	200	3	2.35	1	1
2	10	200	3	0	0	1	0	0	1	4.7	1	0
3	10	0	2	0	1	0	-5	-100	3	2.35	0	1
4	0	100	1	0	0	0	0	100	2	4.7	1	1
5	-5	-100	1	2.35	0	1	10	-100	2	2.35	0	0
6	-5	-100	2	4.7	1	1	20	200	2	0	0	0
7	20	200	3	4.7	0	0	-5	0	2	0	1	1
8	20	200	0	0	0	0	20	-100	3	0	0	0
9	10	-100	2	4.7	0	0	10	0	1	0	1	1
10	0	0	2	0	0	1	0	200	3	4.7	1	0
11	20	100	1	2.35	1	1	-5	100	0	0	0	0
12	0	0	3	0	1	0	10	100	1	4.7	0	1

C4: Correlations final manually adapted design

	A (job 1)					
Attribute	**time**	**salary**	**days**	**reimb**	**flex**	**culture**
a.time	1	0.602	-0.216	0.039	0	-0.198
a.salary	0.602	1	0.039	-0.315	-0.316	-0.227
a.days	-0.216	0.039	1	0.184	0.062	-0.103
a.reimbursement	0.039	-0.315	0.184	1	0	0.051
a.flexibility	0	-0.316	0.062	0	1	0.120
a.culture	-0.198	-0.227	-0.103	0.051	0.120	1
b.time	-0.424	-0.252	-0.125	0.196	-0.092	-0.110
b.salary	-0.485	-0.133	0.352	0.135	0.158	0.227
b.days	-0.262	0.039	-0.099	-0.237	-0.309	-0.281
b.reimbursement	-0.491	0.043	0.296	-0.729	-0.137	0.082
b.flexibility	-0.043	0.298	0.437	0.101	-0.707	-0.169
b.culture	-0.043	0	0.437	0.101	0	-0.845

	B (job 2)					
Attribute	**time**	**salary**	**days**	**reimb**	**flex**	**culture**
a.time	-0.424	-0.485	-0.262	-0.491	-0.043	-0.043
a.salary	-0.252	-0.133	0.039	0.043	0.298	0
a.days	-0.125	0.352	-0.099	0.296	0.437	0.437
a.reimbursement	0.196	0.135	-0.237	-0.729	0.101	0.101
a.flexibility	-0.092	0.158	-0.309	-0.137	-0.707	0
a.culture	-0.110	0.227	-0.281	0.082	-0.169	-0.845
b.time	1	0.175	0.284	-0.239	-0.217	-0.130
b.salary	0.175	1	-0.039	0.216	0.298	0
b.days	0.284	-0.039	1	0.093	0.087	0.087
b.reimbursement	-0.239	0.216	0.093	1	0.290	0.097
b.flexibility	-0.217	0.298	0.087	0.290	1	0.333
b.culture	-0.130	0	0.087	0.097	0.333	1

Appendix D: Pilot survey

Pilotonderzoek naar thuiswerken en acceptabele reistijd

U wordt uitgenodigd om deel te nemen aan een pilotonderzoek over thuiswerken. Deze pilot wordt uitgevoerd door Timon van Eeken van de TU Delft in samenwerking met het Kennisinstituut voor Mobiliteitsbeleid.

In deze pilot verzamelen we geen persoonlijke data. De resultaten zullen worden gebruikt voor een master thesis onderzoek, dat zal worden gepubliceerd in de TU Delft repository. Uw deelname aan de pilot is volledig vrijwillig en u kunt zich op elk moment terugtrekken zonder reden op te geven.

Door deel te nemen geeft u uitdrukkelijk toestemming om deze gegevens voor onderzoeksdoeleinden te gebruiken.

Wilt u aan dit onderzoek meewerken en de vragenlijst invullen?

○ Ja
○ Nee

vorige volgende

Wat is uw huidige reistijd naar uw werk?

Ga hierbij uit van de reistijd van deur-tot-deur voor een gemiddelde dag.

○ 30 minuten of minder
○ Meer dan 30 minuten

vorige volgende

Bij de volgende vragen zullen er 12 hypothetische situaties aan u worden voorgelegd. Hierbij wordt u gevraagd zich in te leven in de volgende situatie:

Stelt u zich voor dat u moet wisselen van baan. Gelukkig blijft heel veel hetzelfde als in uw huidige situatie. **Alleen de reistijd, het salaris en de thuiswerkmogelijkheden veranderen. U kunt dus aannemen dat alle andere kenmerken van de baan hetzelfde blijven als bij uw huidige baan.**

In elke hypothetische situatie worden er twee banen aan u voorgelegd. Vervolgens wordt u gevraagd om aan te geven welke van de twee banen uw voorkeur zou hebben. Klik op 'volgende' om naar de eerste keuzesituatie te gaan.

vorige volgende

(1/12) Welke van de twee banen heeft uw voorkeur?

	Baan 1	Baan 2
Dagelijkse reistijd (enkele reis)	Huidige reistijd	Huidige reistijd + 10 min
Maandelijks netto salaris	Huidig salaris – €100	Huidig salaris + €200
Aantal thuiswerkdagen	3	0
Thuiswerkvergoeding	Geen	-
Thuiswerkflexibiliteit	U mag van uw werkgever op vaste dagen thuiswerken	-
Thuiswerkcultuur	Enkele collega's werken regelmatig thuis	-

○ Baan 1
○ Baan 2

vorige volgende

(2/12) Welke van de twee banen heeft uw voorkeur?

	Baan 1	Baan 2
Dagelijkse reistijd (enkele reis)	Huidige reistijd + 10 min	Huidige reistijd + 5 min
Maandelijks netto salaris	Huidig salaris + €200	Huidig salaris – €100
Aantal thuiswerkdagen	0	2
Thuiswerkvergoeding	-	€2,35 per dag
Thuiswerkflexibiliteit	-	U mag van uw werkgever op vaste dagen thuiswerken
Thuiswerkcultuur	-	Veel collega's werken regelmatig thuis

○ Baan 1
○ Baan 2

vorige volgende

(3/12) Welke van de twee banen heeft uw voorkeur?

	Baan 1	Baan 2
Dagelijkse reistijd (enkele reis)	Huidige reistijd + 5 min	Huidige reistijd – 5 min
Maandelijks netto salaris	Huidig salaris – €200	Huidig salaris + €100
Aantal thuiswerkdagen	1	3
Thuiswerkvergoeding	Geen	€2,35 per dag
Thuiswerkflexibiliteit	U mag zelf bepalen op welke dagen u thuiswerkt	U mag zelf bepalen op welke dagen u thuiswerkt
Thuiswerkcultuur	Veel collega's werken regelmatig thuis	Enkele collega's werken regelmatig thuis

○ Baan 1
○ Baan 2

vorige volgende

(4/12) Welke van de twee banen heeft uw voorkeur?

	Baan 1	Baan 2
Dagelijkse reistijd (enkele reis)	Huidige reistijd	Huidige reistijd + 10 min
Maandelijks netto salaris	Huidig salaris + €100	Huidig salaris + €200
Aantal thuiswerkdagen	0	3
Thuiswerkvergoeding	-	€2,35 per dag
Thuiswerkflexibiliteit	-	U mag zelf bepalen welke dagen u thuiswerkt
Thuiswerkcultuur	-	Veel collega's werken regelmatig thuis

○ Baan 1
○ Baan 2

vorige volgende

(5/12) Welke van de twee banen heeft uw voorkeur?

	Baan 1	Baan 2
Dagelijkse reistijd (enkele reis)	Huidige reistijd + 5 min	Huidige reistijd + 5 min
Maandelijks netto salaris	Huidig salaris – €100	Huidig salaris – €200
Aantal thuiswerkdagen	2	1
Thuiswerkvergoeding	€2,35 per dag	Geen
Thuiswerkflexibiliteit	U mag van uw werkgever op vaste dagen thuiswerken	U mag zelf bepalen welke dagen u thuiswerkt
Thuiswerkcultuur	Veel collega's werken regelmatig thuis	Veel collega's werken regelmatig thuis

○ Baan 1
○ Baan 2

vorige volgende

(6/12) Welke van de twee banen heeft uw voorkeur?

	Baan 1	Baan 2
Dagelijkse reistijd (enkele reis)	Huidige reistijd – 5 min	Huidige reistijd
Maandelijks netto salaris	Huidig salaris + €100	Huidig salaris – €200
Aantal thuiswerkdagen	3	2
Thuiswerkvergoeding	€2,35 per dag	Geen
Thuiswerkflexibiliteit	U mag zelf bepalen welke dagen u thuiswerkt	U mag zelf bepalen welke dagen u thuiswerkt
Thuiswerkcultuur	Enkele collega's werken regelmatig thuis	Veel collega's werken regelmatig thuis

○ Baan 1
○ Baan 2

vorige volgende

(7/12) Welke van de twee banen heeft uw voorkeur?

	Baan 1	Baan 2
Dagelijkse reistijd (enkele reis)	Huidige reistijd + 5 min	Huidige reistijd – 5 min
Maandelijks netto salaris	Huidig salaris + €100	Huidig salaris + €200
Aantal thuiswerkdagen	2	1
Thuiswerkvergoeding	Geen	Geen
Thuiswerkflexibiliteit	U mag van uw werkgever op vaste dagen thuiswerken	U mag van uw werkgever op vaste dagen thuiswerken
Thuiswerkcultuur	Enkele collega's werken regelmatig thuis	Veel collega's werken regelmatig thuis

○ Baan 1
○ Baan 2

vorige volgende

(8/12) Welke van de twee banen heeft uw voorkeur?

	Baan 1	Baan 2
Dagelijkse reistijd (enkele reis)	Huidige reistijd	Huidige reistijd – 5 min
Maandelijks netto salaris	Huidig salaris – €200	Huidig salaris – €100
Aantal thuiswerkdagen	2	0
Thuiswerkvergoeding	Geen	-
Thuiswerkflexibiliteit	U mag zelf bepalen welke dagen u thuiswerkt	-
Thuiswerkcultuur	Veel collega's werken regelmatig thuis	-

○ Baan 1
○ Baan 2

vorige volgende

(9/12) Welke van de twee banen heeft uw voorkeur?

	Baan 1	Baan 2
Dagelijkse reistijd (enkele reis)	Huidige reistijd – 5 min	Huidige reistijd
Maandelijks netto salaris	Huidig salaris + €200	Huidig salaris + €100
Aantal thuiswerkdagen	1	0
Thuiswerkvergoeding	Geen	-
Thuiswerkflexibiliteit	U mag van uw werkgever op vaste dagen thuiswerken	-
Thuiswerkcultuur	Veel collega's werken regelmatig thuis	-

○ Baan 1
○ Baan 2

vorige volgende

(10/12) Welke van de twee banen heeft uw voorkeur?

	Baan 1	Baan 2
Dagelijkse reistijd (enkele reis)	Huidige reistijd + 10 min	Huidige reistijd + 5 min
Maandelijks netto salaris	Huidig salaris – €200	Huidig salaris + €100
Aantal thuiswerkdagen	1	2
Thuiswerkvergoeding	€2,35 per dag	Geen
Thuiswerkflexibiliteit	U mag van uw werkgever op vaste dagen thuiswerken	U mag van uw werkgever op vaste dagen thuiswerken
Thuiswerkcultuur	Enkele collega's werken regelmatig thuis	Enkele collega's werken regelmatig thuis

○ Baan 1
○ Baan 2

vorige volgende

(11/12) Welke van de twee banen heeft uw voorkeur?

	Baan 1	Baan 2
Dagelijkse reistijd (enkele reis)	Huidige reistijd – 5 min	Huidige reistijd + 10 min
Maandelijks netto salaris	Huidig salaris – €100	Huidig salaris – €200
Aantal thuiswerkdagen	0	1
Thuiswerkvergoeding	-	€2,35 per dag
Thuiswerkflexibiliteit	-	U mag van uw werkgever op vaste dagen thuiswerken
Thuiswerkcultuur	-	Enkele collega's werken regelmatig thuis

○ Baan 1
○ Baan 2

vorige volgende

(12/12) Welke van de twee banen heeft uw voorkeur?

	Baan 1	Baan 2
Dagelijkse reistijd (enkele reis)	Huidige reistijd + 10 min	Huidige reistijd
Maandelijks netto salaris	Huidig salaris + €200	Huidig salaris – €100
Aantal thuiswerkdagen	3	3
Thuiswerkvergoeding	€2,35 per dag	Geen
Thuiswerkflexibiliteit	U mag zelf bepalen welke dagen u thuiswerkt	U mag van uw werkgever op vaste dagen thuiswerken
Thuiswerkcultuur	Veel collega's werken regelmatig thuis	Enkele collega's werken regelmatig thuis

○ Baan 1
○ Baan 2

vorige volgende

Heeft u tot slot nog opmerkingen over deze vragenlijst, zoals onduidelijkheden of suggesties voor verbeteringen?

☐ Nee, ik heb geen opmerkingen

vorige volgende

Dit is het einde van de vragenlijst. Hartelijk dank voor uw deelname!

Klik op 'verstuur' om de vragenlijst af te ronden.

vorige verstuur

Appendix E: Final survey

Onderzoek naar thuiswerken en reistijd

U wordt uitgenodigd om deel te nemen aan een vragenlijst over thuiswerken en reistijd. Het doel van dit onderzoek is inzicht te krijgen in de afwegingen die mensen maken tussen eigenschappen van een baan en reistijd. De data zal gebruikt worden voor onderzoek van het Kennisinstituut voor Mobiliteitsbeleid (KiM).

Uw antwoorden worden vertrouwelijk behandeld en zijn niet naar u als persoon te herleiden. **Uw deelname aan dit onderzoek is volledig vrijwillig en u kunt zich op elk moment terugtrekken zonder reden op te geven.**

Als u de vragenlijst invult, geeft u toestemming aan ons om de gegevens voor onderzoeksdoeleinden te gebruiken. Wilt u de vragenlijst invullen?

- ○ Ja, ik wil de vragenlijst invullen
- ○ Nee, ik wil niet deelnemen

vorige volgende

De volgende vragen gaan over uw huidige woon-werkverkeer.

Wat is uw gemiddelde reistijd naar uw werk **(in minuten)**?

Ga hierbij uit van een enkele reis van deur-tot-deur
Als u meerdere werklocaties heeft, ga dan uit van de locatie waar u het meest werkt

vorige volgende

Hoeveel dagen per week ondervindt u vertraging onderweg naar uw werk?

Ga hierbij uit van een gemiddelde week

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7

vorige volgende

Hoe lang is de gemiddelde vertraging die u ondervindt onderweg naar uw werk **(in minuten)**?

- ☐ Ik ondervind geen vertraging

vorige volgende

Welke vervoerswijze gebruikt u het meest om naar uw werk te reizen?

Ga hierbij uit van de vervoerswijze die u tijdens een rit naar uw werk de langste tijd gebruikt

- ○ Auto (als bestuurder of passagier)
- ○ Bus/tram/metro
- ○ Trein
- ○ Bromfiets/snorfiets (inclusief scooter)
- ○ Fiets (inclusief scootmobiel)
- ○ Elektrische fiets
- ○ Lopen (inclusief rolstoel)
- ○ Overig

vorige volgende

Moet u de reiskosten voor uw woon-werkverkeer zelf betalen?

- ○ Ja, volledig
- ○ Ja, gedeeltelijk
- ○ Nee, mijn werkgever betaalt die volledig/ik krijg een volledige vergoeding
- ○ Weet ik niet

vorige volgende

Voert u met regelmaat activiteiten uit onderweg naar uw werk?

Meerdere antwoorden mogelijk

- ☐ Ja, werk-gerelateerde activiteiten
- ☐ Ja, voor mijn plezier (denk aan lezen, muziek luisteren, etc.)
- ☐ Nee

vorige volgende

De volgende vragen gaan over uw huidige werk.

In welke sector werkt u?

Als u werkzaam bent in meerdere sectoren, beantwoord deze vraag dan met de sector waaraan u de meeste uren besteedt.

- ○ Automatisering en ICT
- ○ Bouw
- ○ Cultuur
- ○ Financiële dienstverlening
- ○ Gezondheidszorg
- ○ (Detail)handel
- ○ Horeca en huishouding
- ○ Industrie en productie
- ○ Landbouw, visserij en veeteelt
- ○ Natuur en milieu
- ○ Onderwijs en wetenschap
- ○ Openbaar bestuur, veiligheid en rechtspraak
- ○ Opslag en transport
- ○ Personeel, organisatie en strategie
- ○ Sport en persoonlijke verzorging
- ○ Taal, media en communicatie
- ○ Techniek
- ○ Toerisme en recreatie
- ○ Vastgoed en makelaardij
- ○ Overig

vorige volgende

Wat voor type contract heeft u?

- ○ Een vast contract
- ○ Een tijdelijk contract
- ○ Ik ben ondernemer
- ○ Overig, namelijk

vorige volgende

Hoeveel uur per week werkt u op dit moment gemiddeld (inclusief betaald en onbetaald (over)werk)?

Indien nodig, afronden op een heel getal.

vorige volgende

Biedt uw werksituatie de mogelijkheid om de spits te mijden?

Neem hierbij uw thuissituatie niet mee. Meerdere antwoorden mogelijk

- ☐ Ja, ik kan meestal voor de ochtendspits naar werk reizen
- ☐ Ja, ik kan meestal na de ochtendspits naar werk reizen
- ☐ Ja, ik kan meestal voor de avondspits naar huis reizen
- ☐ Ja, ik kan meestal na de avondspits naar huis reizen
- ☐ Nee

vorige volgende

Biedt uw thuissituatie de mogelijkheid om de spits te mijden?

Meerdere antwoorden mogelijk

- ☐ Ja, ik kan meestal voor de ochtendspits naar werk reizen
- ☐ Ja, ik kan meestal na de ochtendspits naar werk reizen
- ☐ Ja, ik kan meestal voor de avondspits naar huis reizen
- ☐ Ja, ik kan meestal na de avondspits naar huis reizen
- ☐ Nee

vorige volgende

De volgende vragen gaan over uw huidige situatie met betrekking tot thuiswerken.

Kunt u aangeven op hoeveel dagen per week u werkt en op hoeveel dagen daarvan u thuiswerkt?

Ga hierbij uit van een gemiddelde week

	0 dagen	1 dag	2 dagen	3 dagen	4 dagen	5 dagen	6 dagen	7 dagen
Hoeveel dagen per week werkt u?	○	○	○	○	○	○	○	○
Hoeveel dagen per week werkt u enkel thuis?	○	○	○	○	○	○	○	○
Hoeveel dagen per week werkt u deels thuis, deels buitenshuis?	○	○	○	○	○	○	○	○
Hoeveel dagen per week werkt u enkel buitenshuis?	○	○	○	○	○	○	○	○

vorige volgende

Biedt uw werkgever een vergoeding aan voor mensen die thuiswerken?

Meerdere antwoorden mogelijk

- ☐ Ja, een thuiswerkvergoeding
- ☐ Ja, een budget om mijn thuiswerkplek in te richten
- ☐ Nee
- ☐ Weet ik niet

vorige volgende

Kunt u zelf kiezen hoeveel dagen u per week wel of niet thuiswerkt?

- ○ Ja, ik mag dit zelf bepalen
- ○ Ten dele, in overleg met mijn werkgever
- ○ Nee, dit aantal staat vast
- ○ Ik mag van mijn werkgever niet thuiswerken

vorige volgende

Kunt u zelf kiezen op welke dagen van de week u wel of niet thuiswerkt?

- ○ Ja
- ○ Ja, maar dit is wel afhankelijk van fysieke werkbijeenkomsten
- ○ Nee, maar ik kan wel altijd om toestemming vragen om mijn schema te veranderen
- ○ Nee, ik mag van mijn werkgever alleen op bepaalde vaste dagen thuiswerken

vorige volgende

Wat is de thuiswerkcultuur op uw huidige werk?

- ○ Thuiswerken komt zelden of niet voor
- ○ Thuiswerken is bijzonder, slechts enkele werknemers werken wekelijks minimaal één dag thuis
- ○ Thuiswerken is normaal, veel werknemers werken wekelijks minimaal één dag thuis

vorige volgende

Bij de volgende vragen zullen er 12 hypothetische situaties aan u worden voorgelegd. Hierbij wordt u gevraagd zich in te leven in de volgende situatie:

Stelt u zich voor dat u moet wisselen van baan. Gelukkig blijft heel veel hetzelfde als in uw huidige situatie. **Alleen de dagelijkse reistijd, het salaris en de thuiswerkmogelijkheden veranderen. U kunt dus aannemen dat alle andere kenmerken van de baan hetzelfde blijven als bij uw huidige baan.** De kenmerken die wel veranderen zijn:

1. De reistijd naar uw werk, ten opzichte van uw huidige reistijd.
2. Uw persoonlijke salaris, ten opzichte van uw huidige salaris.
3. Het maximaal aantal dagen dat u van uw werkgever mag thuiswerken in een week.
4. De vergoeding die u krijgt als u een dag thuiswerkt. Tussen haakjes wordt het bedrag weergegeven dat u in een maand zou krijgen als u alle toegestane dagen thuiswerkt.
5. Of u zelf mag bepalen op welke dagen (bijvoorbeeld maandag en woensdag) u thuiswerkt.
6. Het aantal collega's dat minimaal één dag per week thuiswerkt.

Er worden steeds twee banen aan u voorgelegd. Vervolgens wordt u gevraagd om aan te geven welke van de twee uw voorkeur zou hebben. Klik op 'volgende' om naar de eerste keuzesituatie te gaan.

vorige volgende

Welke van deze banen heeft uw voorkeur?

	Baan 1	Baan 2
Verandering in dagelijkse reistijd (enkele reis)	– 5 minuten	+ 10 minuten
Verandering in maandelijks netto salaris	– €100	– €100
Maximaal wekelijks aantal thuiswerkdagen	1	2
Thuiswerkvergoeding per dag (per maand bij alle toegestane dagen thuiswerken)	€2,35 (€11)	€2,35 (€21)
U mag zelf bepalen welke dagen u thuiswerkt	Nee	Nee
Aantal collega's dat wekelijks minimaal één dag thuiswerkt	Veel	Slechts enkele

○ Baan 1
○ Baan 2

Welke van deze banen heeft uw voorkeur?

	Baan 1	Baan 2
Verandering in dagelijkse reistijd (enkele reis)	– 5 minuten	+ 20 minuten
Verandering in maandelijks netto salaris	+ €100	+ €200
Maximaal wekelijks aantal thuiswerkdagen	3	3
Thuiswerkvergoeding per dag (per maand bij alle toegestane dagen thuiswerken)	€2,35 (€31)	€2,35 (€31)
U mag zelf bepalen welke dagen u thuiswerkt	Nee	Ja
Aantal collega's dat wekelijks minimaal één dag thuiswerkt	Slechts enkele	Veel

○ Baan 1
○ Baan 2

Welke van deze banen heeft uw voorkeur?

	Baan 1	Baan 2
Verandering in dagelijkse reistijd (enkele reis)	+ 20 minuten	+ 20 minuten
Verandering in maandelijks netto salaris	+ €200	– €100
Maximaal wekelijks aantal thuiswerkdagen	0	3
Thuiswerkvergoeding per dag (per maand bij alle toegestane dagen thuiswerken)	-	Geen
U mag zelf bepalen welke dagen u thuiswerkt	-	Nee
Aantal collega's dat wekelijks minimaal één dag thuiswerkt	-	Slechts enkele

○ Baan 1
○ Baan 2

Welke van deze banen heeft uw voorkeur?

	Baan 1	Baan 2
Verandering in dagelijkse reistijd (enkele reis)	+ 10 minuten	+ 10 minuten
Verandering in maandelijks netto salaris	– €100	Geen verandering
Maximaal wekelijks aantal thuiswerkdagen	2	1
Thuiswerkvergoeding per dag (per maand bij alle toegestane dagen thuiswerken)	€4,70 (€41)	Geen
U mag zelf bepalen welke dagen u thuiswerkt	Nee	Ja
Aantal collega's dat wekelijks minimaal één dag thuiswerkt	Slechts enkele	Veel

○ Baan 1
○ Baan 2

Welke van deze banen heeft uw voorkeur?

	Baan 1	Baan 2
Verandering in dagelijkse reistijd (enkele reis)	Geen verandering	Geen verandering
Verandering in maandelijks netto salaris	+ €100	+ €100
Maximaal wekelijks aantal thuiswerkdagen	1	2
Thuiswerkvergoeding per dag (per maand bij alle toegestane dagen thuiswerken)	Geen	€4,70 (€41)
U mag zelf bepalen welke dagen u thuiswerkt	Nee	Ja
Aantal collega's dat wekelijks minimaal één dag thuiswerkt	Slechts enkele	Veel

○ Baan 1
○ Baan 2

Welke van deze banen heeft uw voorkeur?

	Baan 1	Baan 2
Verandering in dagelijkse reistijd (enkele reis)	+ 10 minuten	Geen verandering
Verandering in maandelijks netto salaris	+ €200	Geen verandering
Maximaal wekelijks aantal thuiswerkdagen	3	1
Thuiswerkvergoeding per dag (per maand bij alle toegestane dagen thuiswerken)	Geen	€4,70 (€21)
U mag zelf bepalen welke dagen u thuiswerkt	Nee	Ja
Aantal collega's dat wekelijks minimaal één dag thuiswerkt	Veel	Slechts enkele

○ Baan 1
○ Baan 2

Welke van deze banen heeft uw voorkeur?

	Baan 1	Baan 2
Verandering in dagelijkse reistijd (enkele reis)	Geen verandering	Geen verandering
Verandering in maandelijks netto salaris	Geen verandering	+ €200
Maximaal wekelijks aantal thuiswerkdagen	2	3
Thuiswerkvergoeding per dag (per maand bij alle toegestane dagen thuiswerken)	Geen	€4,70 (€62)
U mag zelf bepalen welke dagen u thuiswerkt	Nee	Ja
Aantal collega's dat wekelijks minimaal één dag thuiswerkt	Veel	Slechts enkele

○ Baan 1
○ Baan 2

Welke van deze banen heeft uw voorkeur?

	Baan 1	Baan 2
Verandering in dagelijkse reistijd (enkele reis)	+ 20 minuten	– 5 minuten
Verandering in maandelijks netto salaris	+ €100	+ €100
Maximaal wekelijks aantal thuiswerkdagen	1	0
Thuiswerkvergoeding per dag (per maand bij alle toegestane dagen thuiswerken)	€2,35 (€11)	-
U mag zelf bepalen welke dagen u thuiswerkt	Ja	-
Aantal collega's dat wekelijks minimaal één dag thuiswerkt	Veel	-

○ Baan 1
○ Baan 2

Welke van deze banen heeft uw voorkeur?

	Baan 1	Baan 2
Verandering in dagelijkse reistijd (enkele reis)	+ 10 minuten	– 5 minuten
Verandering in maandelijks netto salaris	Geen verandering	– €100
Maximaal wekelijks aantal thuiswerkdagen	2	3
Thuiswerkvergoeding per dag (per maand bij alle toegestane dagen thuiswerken)	Geen	€2,35 (€31)
U mag zelf bepalen welke dagen u thuiswerkt	Ja	Nee
Aantal collega's dat wekelijks minimaal één dag thuiswerkt	Slechts enkele	Veel

○ Baan 1
○ Baan 2

Welke van deze banen heeft uw voorkeur?

	Baan 1	Baan 2
Verandering in dagelijkse reistijd (enkele reis)	– 5 minuten	+ 20 minuten
Verandering in maandelijks netto salaris	– €100	+ €200
Maximaal wekelijks aantal thuiswerkdagen	2	2
Thuiswerkvergoeding per dag (per maand bij alle toegestane dagen thuiswerken)	€4,70 (€41)	Geen
U mag zelf bepalen welke dagen u thuiswerkt	Ja	Nee
Aantal collega's dat wekelijks minimaal één dag thuiswerkt	Veel	Slechts enkele

○ Baan 1
○ Baan 2

Welke van deze banen heeft uw voorkeur?

	Baan 1	Baan 2
Verandering in dagelijkse reistijd (enkele reis)	+ 20 minuten	– 5 minuten
Verandering in maandelijks netto salaris	+ €200	Geen verandering
Maximaal wekelijks aantal thuiswerkdagen	3	2
Thuiswerkvergoeding per dag (per maand bij alle toegestane dagen thuiswerken)	€4,70 (€62)	Geen
U mag zelf bepalen welke dagen u thuiswerkt	Nee	Ja
Aantal collega's dat wekelijks minimaal één dag thuiswerkt	Slechts enkele	Veel

○ Baan 1
○ Baan 2

Welke van deze banen heeft uw voorkeur?

	Baan 1	Baan 2
Verandering in dagelijkse reistijd (enkele reis)	Geen verandering	+ 10 minuten
Verandering in maandelijks netto salaris	Geen verandering	+ €100
Maximaal wekelijks aantal thuiswerkdagen	3	1
Thuiswerkvergoeding per dag (per maand bij alle toegestane dagen thuiswerken)	Geen	€4,70 (€21)
U mag zelf bepalen welke dagen u thuiswerkt	Ja	Nee
Aantal collega's dat wekelijks minimaal één dag thuiswerkt	Slechts enkele	Veel

○ Baan 1
○ Baan 2

vorige volgende

De volgende vragen gaan over uw voorkeuren met betrekking tot thuiswerken en de reistijd naar uw werk.

Hoeveel dagen zou u het liefst thuiswerken?

○ 0
○ 1
○ 2
○ 3
○ 4
○ 5

vorige volgende

In hoeverre bent u het eens of oneens met de volgende stellingen?

	Helemaal mee oneens	Mee oneens	Niet oneens/ niet eens	Mee eens	Helemaal mee eens
Ik ben tevreden met mijn huidige reistijd naar mijn werk	○	○	○	○	○
Ik ben tevreden met de vervoerswijze waarmee ik nu (meestal) naar mijn werk reis	○	○	○	○	○
Ik vind het niet erg om in de spits te reizen	○	○	○	○	○
Ik vind het niet erg als mijn reistijd naar mijn werk 20 minuten langer wordt	○	○	○	○	○

vorige volgende

In hoeverre bent u het eens of oneens met de volgende stellingen?

	Helemaal mee oneens	Mee oneens	Niet oneens/ niet eens	Mee eens	Helemaal mee eens	Niet van toepassing
Ik heb positieve ervaringen met thuiswerken	○	○	○	○	○	○
Ik heb een goede werkplek om thuis te werken	○	○	○	○	○	○
Ik ervaar goede ondersteuning van mijn werkgever om thuis te werken	○	○	○	○	○	○
Ik vind het vervelend als collega's regelmatig thuiswerken	○	○	○	○	○	○

vorige volgende

Tot slot stellen we u enkele vragen over uw achtergrond, zodat wij de resultaten goed kunnen analyseren.

Wat is uw geboortejaar?

Vermeld het jaartal in vier cijfers

vorige volgende

Wat is uw geslacht?

- ○ Man
- ○ Vrouw
- ○ Anders

vorige volgende

Wat is uw hoogst afgeronde opleiding?

- ○ Geen onderwijs
- ○ Basisonderwijs
- ○ LBO / VBO / VMBO (kader- en beroepsgerichte leerweg)
- ○ MAVO / eerste 3 jaar HAVO en VWO / VMBO (theoretische en gemengde leerweg)
- ○ MBO
- ○ HAVO en VWO bovenbouw / WO en HBO propedeuse
- ○ HBO / WO-bachelor of kandidaats
- ○ WO-doctoraal of master

vorige volgende

Hoe ziet uw huishouden eruit?

- ○ Eenpersoonshuishouden
- ○ Meerpersoonshuishouden (alleen volwassenen)
- ○ Huishouden met jongste kind onder de 5 jaar
- ○ Huishouden met jongste kind onder de 13 jaar
- ○ Huishouden met jongste kind onder de 18 jaar

vorige volgende

Wat is uw netto persoonlijk maandinkomen?

- ○ Minder dan €999
- ○ €1.000 - €1.999
- ○ €2.000 - €2.999
- ○ €3.000 - €3.999
- ○ €4.000 - €4.999
- ○ €5.000 - €5.999
- ○ €6.000 - €6.999
- ○ Meer dan €7.000

- ○ Wil ik echt niet zeggen

vorige volgende

Wat zijn de vier cijfers van uw postcode?

☐ Wil ik liever niet zeggen

vorige volgende

U heeft aangegeven uw postcode niet te willen delen. Wilt u wel aangeven in welke gemeente u woont? U kunt deze hieronder invullen.

☐ Wil ik liever niet zeggen

vorige volgende

Heeft u op elk gewenst moment de beschikking over een auto?

- ○ Ja, wanneer ik dat maar wil
- ○ Nee, dat moet ik afstemmen met mensen binnen mijn huishouden
- ○ Nee, maar ik kan soms gebruikmaken van de auto van familie/vrienden/kennissen/een deelauto
- ○ Nee, (vrijwel) nooit, ik heb wel een rijbewijs
- ○ Nee, nooit, ik heb geen rijbewijs

vorige volgende

Dit is het einde van de vragenlijst. Hartelijk dank voor uw deelname! Uw beloning wordt binnenkort uitgekeerd.

Klik op 'verstuur' om de vragenlijst af te ronden.

vorige verstuur

Appendix F: Covariates

List of covariates that are added to the LCCM but were found to be insignificant (sorted alphabetically):

- Activity during commute
- Age
- Attitude 5 (satisfied with current commuting time)
- Attitude 6 (satisfied with current transportation mode)
- Avoiding rush hour based on work situation
- Avoiding rush hour based on private situation
- Car availability
- Current commuting time
- Gender
- Household composition
- Transportation mode
- Travel reimbursement
- WFH culture
- WFH reimbursement
- WFH budget
- WFH flexibility (which days)
- WFH flexibility (number of days)
- Working hours

Appendix G: Apollo syntax

G1: Data cleaning and preparation

```
library(tidyverse)
library(dplyr)

# Inlezen data
data = read.csv('Experiment/Data/databestand_kopie_v2.csv', sep = ';')
attributen_keuzeset = read.csv('Experiment/Data/attributen_keuzesets.csv', sep = '
;')

# Ongewenste respondenten filteren uit de dataset
data = data %>%
  filter(DUUR_ACTIVITEIT_VRAGENLIJST >= 180,
         MPN_RESPONDENT_ID != 6654)

# Alle waarden 99998 vervangen
data = data %>%
  mutate(across(
    matches("^(Kort|Lang)"),
    ~ ifelse(. == 99998, NA, .)))

# Kolommen van dezelfde keuzeset samenvoegen
data = data %>%
  mutate(Keuze1 = coalesce(Kort16, Kort28, Kort312, Kort42, Kort56, Kort67, Kort72
, Kort812, Kort912, Kort102, Lang11, Lang28, Lang32, Lang410, Lang512, Lang68, Lan
g76, Lang85, Lang912, Lang1012),
         Keuze2 = coalesce(Kort14, Kort24, Kort37, Kort46, Kort53, Kort61, Kort74,
Kort81, Kort98, Kort1012, Lang110, Lang29, Lang35, Lang48, Lang510, Lang67, Lang78
, Lang86, Lang910, Lang107),
         Keuze3 = coalesce(Kort12, Kort210, Kort32, Kort49, Kort512, Kort611, Kort
73, Kort810, Kort91, Kort1011, Lang19, Lang27, Lang37, Lang42, Lang51, Lang63, Lan
g74, Lang82, Lang96, Lang109),
         Keuze4 = coalesce(Kort11, Kort22, Kort311, Kort45, Kort54, Kort63, Kort75
, Kort86, Kort99, Kort109, Lang14, Lang24, Lang33, Lang41, Lang53, Lang65, Lang71,
Lang83, Lang91, Lang1010),
         Keuze5 = coalesce(Kort112, Kort25, Kort33, Kort41, Kort510, Kort69, Kort7
7, Kort811, Kort93, Kort106, Lang15, Lang26, Lang34, Lang43, Lang59, Lang62, Lang7
11, Lang810, Lang94, Lang108),
         Keuze6 = coalesce(Kort110, Kort26, Kort39, Kort410, Kort59, Kort65, Kort7
12, Kort85, Kort95, Kort107, Lang112, Lang23, Lang36, Lang412, Lang56, Lang611, La
ng710, Lang811, Lang95, Lang101),
         Keuze7 = coalesce(Kort18, Kort29, Kort38, Kort411, Kort52, Kort612, Kort7
1, Kort89, Kort910, Kort108, Lang18, Lang22, Lang38, Lang411, Lang55, Lang64, Lang
712, Lang81, Lang97, Lang1011),
         Keuze8 = coalesce(Kort17, Kort27, Kort310, Kort43, Kort55, Kort610, Kort7
9, Kort84, Kort92, Kort103, Lang13, Lang25, Lang310, Lang46, Lang58, Lang610, Lang
72, Lang88, Lang98, Lang106),
         Keuze9 = coalesce(Kort15, Kort212, Kort36, Kort44, Kort511, Kort66, Kort7
6, Kort83, Kort94, Kort1010, Lang12, Lang210, Lang31, Lang49, Lang54, Lang66, Lang
77, Lang812, Lang99, Lang104),
         Keuze10 = coalesce(Kort13, Kort211, Kort31, Kort47, Kort58, Kort62, Kort7
8, Kort88, Kort96, Kort105, Lang17, Lang21, Lang312, Lang45, Lang511, Lang61, Lang
79, Lang87, Lang92, Lang103),
         Keuze11 = coalesce(Kort19, Kort21, Kort34, Kort48, Kort57, Kort68, Kort71
1, Kort87, Kort911, Kort104, Lang111, Lang211, Lang39, Lang47, Lang52, Lang69, Lan
```

```
g75, Lang89, Lang93, Lang105),
         Keuze12 = coalesce(Kort111, Kort23, Kort35, Kort412, Kort51, Kort64, Kort
710, Kort82, Kort97, Kort101, Lang16, Lang212, Lang311, Lang44, Lang57, Lang612, L
ang73, Lang84, Lang911, Lang102))

# Kolommen hercategoriseren
data = data %>%
  mutate(OPLEIDING_recode = case_when(
           OPLEIDING %in% c(1,2,3,4) ~ 1,
           OPLEIDING %in% c(5,6) ~ 2,
           OPLEIDING %in% c(7,8) ~ 3),
         INKOMEN_recode = case_when(
           INKOMEN %in% c(1,2) ~ 1,
           INKOMEN %in% c(3,4) ~ 2,
           INKOMEN %in% c(5,6,7,8) ~ 3,
           INKOMEN == 9 ~ 9),
         STEDELIJKHEID_recode = case_when(
           STEDELIJKHEID == 0 ~ 0,
           STEDELIJKHEID %in% c(1,2) ~ 1,
           STEDELIJKHEID == 3 ~ 2,
           STEDELIJKHEID %in% c(4,5) ~ 3),
         ERVARING = case_when(
           WERKLOCATIEDAGENTHUIS == 0 ~ 0,
           WERKLOCATIEDAGENTHUIS %in% c(1,2,3,4,5,6,7) ~ 1),
         SECTOR_recode = case_when(
           SECTOR == 11 ~ 11,
           SECTOR == 4 ~ 4,
           SECTOR == 16 ~ 16,
           SECTOR == 12 ~ 12,
           SECTOR == 1 ~ 1,
           SECTOR %in% c(2,3,5,6,7,8,9,10,11,13,14,15,17,18,19,20) ~ 0),
         ATTITUDES1 = case_when(
           THUISWERKEN_STELLINGENS1 == 1 ~ 1,
           THUISWERKEN_STELLINGENS1 == 2 ~ 2,
           THUISWERKEN_STELLINGENS1 %in% c(3,6) ~ 3,
           THUISWERKEN_STELLINGENS1 == 4 ~ 4,
           THUISWERKEN_STELLINGENS1 == 5 ~ 5),
         ATTITUDES2 = case_when(
           THUISWERKEN_STELLINGENS2 == 1 ~ 1,
           THUISWERKEN_STELLINGENS2 == 2 ~ 2,
           THUISWERKEN_STELLINGENS2 %in% c(3,6) ~ 3,
           THUISWERKEN_STELLINGENS2 == 4 ~ 4,
           THUISWERKEN_STELLINGENS2 == 5 ~ 5),
         ATTITUDES3 = case_when(
           THUISWERKEN_STELLINGENS3 == 1 ~ 1,
           THUISWERKEN_STELLINGENS3 == 2 ~ 2,
           THUISWERKEN_STELLINGENS3 %in% c(3,6) ~ 3,
           THUISWERKEN_STELLINGENS3 == 4 ~ 4,
           THUISWERKEN_STELLINGENS3 == 5 ~ 5),
         ATTITUDES4 = case_when(
           THUISWERKEN_STELLINGENS4 == 1 ~ 1,
           THUISWERKEN_STELLINGENS4 == 2 ~ 2,
           THUISWERKEN_STELLINGENS4 %in% c(3,6) ~ 3,
           THUISWERKEN_STELLINGENS4 == 4 ~ 4,
           THUISWERKEN_STELLINGENS4 == 5 ~ 5))

# Alleen de relevante kolommen behouden
data_selected = data %>%
  select(MPN_RESPONDENT_ID, DUUR_ACTIVITEIT_VRAGENLIJST, REISTIJD, starts_with("Ke
```

```
uze"),
         GESLACHT_ingevuld, GEBOORTEJAAR_ingevuld, OPLEIDING_recode, HUISHOUDEN_re
code, INKOMEN, INKOMEN_recode, STEDELIJKHEID_recode,
         UREN, VERVOERSWIJZE_recode, REISVERGOEDING_recode, AUTO_recode, REISTIJD_
recode, ACTIV_3,
         ERVARING, CULTUUR_recode, SPITS_WERK_5, SPITS_THUIS_5, SECTOR_recode,
         TW_VERGOEDING_1, TW_VERGOEDING_2, VOORKEUR_THUISWERKEN, FLEX_HOEVEEL_reco
de, FLEX_WELKE_recode,
         ATTITUDES1, ATTITUDES2, ATTITUDES3, ATTITUDES4,
         VERKEER_STELLINGENS1, VERKEER_STELLINGENS2, VERKEER_STELLINGENS3, VERKEER
_STELLINGENS4)

# Een rij per keuze ipv een rij per respondent
data_long = data_selected %>%
  pivot_longer(cols = starts_with("Keuze"),
               names_to = 'keuzeset',
               values_to = 'keuze') %>%
  mutate(keuzeset = str_remove(keuzeset, 'Keuze'),
         keuzeset = as.integer(keuzeset),
         REISTIJD_test = case_when(
           REISTIJD <= 30 ~ "kort",
           REISTIJD > 30 ~ "lang"))

# Koppelen attribuutniveaus
data_combined = data_long %>%
  left_join(attributen_keuzeset,
            by = join_by(keuzeset == KEUZETAAK, REISTIJD_test == HUIDIGEREIS))

# Databestand opslaan
data_combined %>%
  write.csv('Experiment/Data/combined_data.csv')
```

G2: Multinomial Logit Model

```
# ################################################################# #
#### LOAD LIBRARY AND DEFINE CORE SETTINGS                       ####
# ################################################################# #

### Clear memory
rm(list = ls())

### Load Apollo library
library(apollo)

### Initialise code
apollo_initialise()

### Set core controls
apollo_control = list(
  modelName       = "MNL_model",
  modelDescr      = "MNL model with dummy and interactions",
  indivID         = "MPN_RESPONDENT_ID",
  outputDirectory = "Experiment/Output"
)

# ################################################################# #
#### LOAD DATA AND APPLY ANY TRANSFORMATIONS                     ####
# ################################################################# #

### Loading data from package
database = read.csv("Experiment/Data/combined_data.csv")

# ################################################################# #
#### DEFINE MODEL PARAMETERS                                     ####
# ################################################################# #

### Vector of parameters, including any that are kept fixed in estimation
apollo_beta=c(b_time          = 0,
              b_salary        = 0,
              b_days0         = 0,
              b_days1         = 0,
              b_days2         = 0,
              b_days3         = 0,
              b_flexibility   = 0,
              b_reimbursement = 0,
              b_culture       = 0,
              b_time_days1    = 0,
              b_time_days2    = 0,
              b_time_days3    = 0,
              b_time_long     = 0)

### Vector with names (in quotes) of parameters to be kept fixed at their starting
value in apollo_beta, use apollo_beta_fixed = c() if none
apollo_fixed = c("b_days0")

# ################################################################# #
#### GROUP AND VALIDATE INPUTS                                   ####
# ################################################################# #

apollo_inputs = apollo_validateInputs()
```

```
# ################################################################# #
#### DEFINE MODEL AND LIKELIHOOD FUNCTION                        ####
# ################################################################# #

apollo_probabilities=function(apollo_beta, apollo_inputs, functionality="estimate"
){

  ### Attach inputs and detach after function exit
  apollo_attach(apollo_beta, apollo_inputs)
  on.exit(apollo_detach(apollo_beta, apollo_inputs))

  ### Create list of probabilities P
  P = list()

  ### List of utilities: these must use the same names as in mnl_settings, order i
s irrelevant
  V = list()
  V[["job1"]]  = b_time * REISTIJD1 +
                 b_salary * SALARIS1 +
                 b_days0 * (THUISWERKEN1==0) +
                 b_days1 * (THUISWERKEN1==1) +
                 b_days2 * (THUISWERKEN1==2) +
                 b_days3 * (THUISWERKEN1==3) +
                 b_reimbursement * VERGOEDING1 +
                 b_flexibility * FLEXIBILITEIT1 +
                 b_culture * CULTUUR1 +
                 b_time_days1 * REISTIJD1 * (THUISWERKEN1==1) +
                 b_time_days2 * REISTIJD1 * (THUISWERKEN1==2) +
                 b_time_days3 * REISTIJD1 * (THUISWERKEN1==3) +
                 b_time_long * REISTIJD1 * (REISTIJD_recode=="lang")

  V[["job2"]]  = b_time * REISTIJD2 +
                 b_salary * SALARIS2 +
                 b_days0 * (THUISWERKEN2==0) +
                 b_days1 * (THUISWERKEN2==1) +
                 b_days2 * (THUISWERKEN2==2) +
                 b_days3 * (THUISWERKEN2==3) +
                 b_reimbursement * VERGOEDING2 +
                 b_flexibility * FLEXIBILITEIT2 +
                 b_culture * CULTUUR2 +
                 b_time_days1 * REISTIJD2 * (THUISWERKEN2==1) +
                 b_time_days2 * REISTIJD2 * (THUISWERKEN2==2) +
                 b_time_days3 * REISTIJD2 * (THUISWERKEN2==3) +
                 b_time_long * REISTIJD2 * (REISTIJD_recode=="lang")

  ### Define settings for MNL model component
  mnl_settings = list(
    alternatives  = c(job1=1, job2=2),
    avail         = list(1),
    choiceVar     = keuze,
    utilities     = V
  )

  ### Compute probabilities using MNL model
  P[["model"]] = apollo_mnl(mnl_settings, functionality)

  ### Take product across observation for same individual
  P = apollo_panelProd(P, apollo_inputs, functionality)
```

```
  ### Prepare and return outputs of function
  P = apollo_prepareProb(P, apollo_inputs, functionality)
  return(P)
}

# ################################################################# #
#### MODEL ESTIMATION                                            ####
# ################################################################# #

model = apollo_estimate(apollo_beta, apollo_fixed, apollo_probabilities, apollo_in
puts)

# ################################################################# #
#### MODEL OUTPUTS                                               ####
# ################################################################# #

# ----------------------------------------------------------------- #
#---- FORMATTED OUTPUT (TO SCREEN)                                 ----
# ----------------------------------------------------------------- #

apollo_modelOutput(model, modelOutput_settings=list(printPVal=2))

#Willingness to accept
deltaMethod_settings=list(expression=c(WTP_reisduur = "b_time/b_salary",
                                       WTA_1day = "b_days1/b_time",
                                       WTA_2days = "b_days2/b_time",
                                       WTA_3days = "b_days3/b_time",
                                       WTA_flex = "b_flexibility/b_time",
                                       WTA_reim = "b_reimbursement/b_time",
                                       WTA_cult = "b_culture/b_time"))

result = apollo_deltaMethod(model, deltaMethod_settings)
result_df = as.data.frame(result)
write.csv(result_df, file = "delta_method_results_mnl.csv", row.names=FALSE)

# ----------------------------------------------------------------- #
#---- FORMATTED OUTPUT (TO FILE, using model name)                 ----
# ----------------------------------------------------------------- #

apollo_saveOutput(model)
```

G3: Latent Class Choice Model

```
# ################################################################# #
#### LOAD LIBRARY AND DEFINE CORE SETTINGS                       ####
# ################################################################# #

### Clear memory
rm(list = ls())

### Load Apollo library
library(apollo)

### Initialise code
apollo_initialise()

### Set core controls
apollo_control = list(
  modelName       = "4LC_with_covariates",
  modelDescr      = "LC model, with covariates, four classes",
  indivID         = "MPN_RESPONDENT_ID",
  nCores          = 2,
  outputDirectory = "Experiment/Output"
)

# ################################################################# #
#### LOAD DATA AND APPLY ANY TRANSFORMATIONS                     ####
# ################################################################# #

### Loading data from package
database = read.csv("Experiment/Data/combined_data.csv")

# ################################################################# #
#### DEFINE MODEL PARAMETERS                                     ####
# ################################################################# #

### Vector of parameters, including any that are kept fixed in estimation
apollo_beta = c(b_time_a    = 0,
                b_time_b    = 0,
                b_time_c    = 0,
                b_time_d    = 0,
                b_salary_a  = 0,
                b_salary_b  = 0,
                b_salary_c  = 0,
                b_salary_d  = 0,
                b_days0_a   = 0,
                b_days0_b   = 0,
                b_days0_c   = 0,
                b_days0_d   = 0,
                b_days1_a   = 0,
                b_days1_b   = 0,
                b_days1_c   = 0,
                b_days1_d   = 0,
                b_days2_a   = 0,
                b_days2_b   = 0,
                b_days2_c   = 0,
                b_days2_d   = 0,
                b_days3_a   = 0,
                b_days3_b   = 0,
                b_days3_c   = 0,
                b_days3_d   = 0,
```

```
                b_flexibility_a = 0,
                b_flexibility_b = 0,
                b_flexibility_c = 0,
                b_flexibility_d = 0,
                b_reimbursement_a = 0,
                b_reimbursement_b = 0,
                b_reimbursement_c = 0,
                b_reimbursement_d = 0,
                b_culture_a = 0,
                b_culture_b = 0,
                b_culture_c = 0,
                b_culture_d = 0,
                b_time_days1_a = 0,
                b_time_days2_a = 0,
                b_time_days3_a = 0,
                b_time_days1_b = 0,
                b_time_days2_b = 0,
                b_time_days3_b = 0,
                b_time_days1_c = 0,
                b_time_days2_c = 0,
                b_time_days3_c = 0,
                b_time_days1_d = 0,
                b_time_days2_d = 0,
                b_time_days3_d = 0,
                delta_a         = 0,
                delta_b         = 0,
                delta_c         = 0,
                delta_d         = 0,
                gamma_laagopgeleid_a = 0,
                gamma_laagopgeleid_b = 0,
                gamma_laagopgeleid_c = 0,
                gamma_laagopgeleid_d = 0,
                gamma_middenopgeleid_a = 0,
                gamma_middenopgeleid_b = 0,
                gamma_middenopgeleid_c = 0,
                gamma_middenopgeleid_d = 0,
                gamma_hoogopgeleid_a = 0,
                gamma_hoogopgeleid_b = 0,
                gamma_hoogopgeleid_c = 0,
                gamma_hoogopgeleid_d = 0,
                gamma_nietsted_a = 0,
                gamma_nietsted_b = 0,
                gamma_nietsted_c = 0,
                gamma_nietsted_d = 0,
                gamma_sted_a = 0,
                gamma_sted_b = 0,
                gamma_sted_c = 0,
                gamma_sted_d = 0,
                gamma_zeersted_a = 0,
                gamma_zeersted_b = 0,
                gamma_zeersted_c = 0,
                gamma_zeersted_d = 0,
                gamma_laaginkomen_a = 0,
                gamma_laaginkomen_b = 0,
                gamma_laaginkomen_c = 0,
                gamma_laaginkomen_d = 0,
                gamma_middeninkomen_a = 0,
                gamma_middeninkomen_b = 0,
                gamma_middeninkomen_c = 0,
```

```
                gamma_middeninkomen_d = 0,
                gamma_hooginkomen_a = 0,
                gamma_hooginkomen_b = 0,
                gamma_hooginkomen_c = 0,
                gamma_hooginkomen_d = 0,
                gamma_ervaring_a = 0,
                gamma_ervaring_b = 0,
                gamma_ervaring_c = 0,
                gamma_ervaring_d = 0,
                gamma_ict_a = 0,
                gamma_ict_b = 0,
                gamma_ict_c = 0,
                gamma_ict_d = 0,
                gamma_health_a = 0,
                gamma_health_b = 0,
                gamma_health_c = 0,
                gamma_health_d = 0,
                gamma_education_a = 0,
                gamma_education_b = 0,
                gamma_education_c = 0,
                gamma_education_d = 0,
                gamma_industry_a = 0,
                gamma_industry_b = 0,
                gamma_industry_c = 0,
                gamma_industry_d = 0,
                gamma_public_a = 0,
                gamma_public_b = 0,
                gamma_public_c = 0,
                gamma_public_d = 0,
                gamma_overig_a = 0,
                gamma_overig_b = 0,
                gamma_overig_c = 0,
                gamma_overig_d = 0,
                gamma_attitude1_a = 0,
                gamma_attitude1_b = 0,
                gamma_attitude1_c = 0,
                gamma_attitude1_d = 0,
                gamma_attitude2_a = 0,
                gamma_attitude2_b = 0,
                gamma_attitude2_c = 0,
                gamma_attitude2_d = 0,
                gamma_attitude3_a = 0,
                gamma_attitude3_b = 0,
                gamma_attitude3_c = 0,
                gamma_attitude3_d = 0,
                gamma_attitude4_a = 0,
                gamma_attitude4_b = 0,
                gamma_attitude4_c = 0,
                gamma_attitude4_d = 0,
                gamma_attitude7_a = 0,
                gamma_attitude7_b = 0,
                gamma_attitude7_c = 0,
                gamma_attitude7_d = 0,
                gamma_attitude8_a = 0,
                gamma_attitude8_b = 0,
                gamma_attitude8_c = 0,
                gamma_attitude8_d = 0
                )
```

```
### Vector with names (in quotes) of parameters to be kept fixed at their starting
value in apollo_beta, use apollo_beta_fixed = c() if none
apollo_fixed = c("delta_a",
                 "b_days0_a", "b_days0_b", "b_days0_c", "b_days0_d",
                 "gamma_laagopgeleid_a", "gamma_laagopgeleid_b", "gamma_laagopgele
id_c", "gamma_laagopgeleid_d", "gamma_middenopgeleid_a", "gamma_middenopgeleid_b",
"gamma_middenopgeleid_c", "gamma_middenopgeleid_d", "gamma_hoogopgeleid_a",
                 "gamma_nietsted_a", "gamma_nietsted_b", "gamma_nietsted_c", "gamm
a_nietsted_d", "gamma_sted_a", "gamma_sted_b", "gamma_sted_c", "gamma_sted_d","gam
ma_zeersted_a",
                 "gamma_laaginkomen_a", "gamma_laaginkomen_b","gamma_laaginkomen_c
", "gamma_laaginkomen_d", "gamma_middeninkomen_a", "gamma_hooginkomen_a",
                 "gamma_ervaring_a",
                 "gamma_education_a", "gamma_education_b", "gamma_education_c", "g
amma_education_d", "gamma_ict_a", "gamma_health_a", "gamma_overig_a", "gamma_indus
try_a", "gamma_industry_b", "gamma_industry_c", "gamma_industry_d", "gamma_public_
a",
                 "gamma_attitude1_a", "gamma_attitude2_a", "gamma_attitude3_a", "g
amma_attitude4_a", "gamma_attitude7_a", "gamma_attitude8_a"
                 )

apollo_beta=apollo_readBeta(apollo_beta,apollo_fixed,"Experiment/Output/4LC_no_cov
ariates",overwriteFixed=FALSE)

# ################################################################# #
#### DEFINE LATENT CLASS COMPONENTS                                 ####
# ################################################################# #

apollo_lcPars=function(apollo_beta, apollo_inputs){
  lcpars = list()

  lcpars[["b_time"]]          = list(b_time_a, b_time_b, b_time_c, b_time_d)
  lcpars[["b_salary"]]        = list(b_salary_a, b_salary_b, b_salary_c, b_salary_
d)
  lcpars[["b_days0"]]         = list(b_days0_a, b_days0_b, b_days0_c, b_days0_d)
  lcpars[["b_days1"]]         = list(b_days1_a, b_days1_b, b_days1_c, b_days1_d)
  lcpars[["b_days2"]]         = list(b_days2_a, b_days2_b, b_days2_c, b_days2_d)
  lcpars[["b_days3"]]         = list(b_days3_a, b_days3_b, b_days3_c, b_days3_d)
  lcpars[["b_flexibility"]]   = list(b_flexibility_a, b_flexibility_b, b_flexibili
ty_c, b_flexibility_d)
  lcpars[["b_reimbursement"]] = list(b_reimbursement_a, b_reimbursement_b, b_reimb
ursement_c, b_reimbursement_d)
  lcpars[["b_culture"]]       = list(b_culture_a, b_culture_b, b_culture_c, b_cult
ure_d)
  lcpars[["b_time_days1"]]     = list(b_time_days1_a, b_time_days1_b, b_time_days1
_c, b_time_days1_d)
  lcpars[["b_time_days2"]]     = list(b_time_days2_a, b_time_days2_b, b_time_days2
_c, b_time_days2_d)
  lcpars[["b_time_days3"]]     = list(b_time_days3_a, b_time_days3_b, b_time_days3
_c, b_time_days3_d)

  V=list()
  V[["class_a"]] = delta_a +
    gamma_laagopgeleid_a * (OPLEIDING_recode==1) + gamma_middenopgeleid_a * (OPLEI
DING_recode==2) + gamma_hoogopgeleid_a * (OPLEIDING_recode==3) +
    gamma_nietsted_a * (STEDELIJKHEID_recode==1) + gamma_sted_a * (STEDELIJKHEID_r
ecode==2) + gamma_zeersted_a * (STEDELIJKHEID_recode==3) +
    gamma_laaginkomen_a * (INKOMEN_recode==1) + gamma_middeninkomen_a * (INKOMEN_r
ecode==2) + gamma_hooginkomen_a * (INKOMEN_recode==3) +
```

```
    gamma_ervaring_a * (ERVARING==1) +
    gamma_overig_a * (SECTOR_recode==0) + gamma_ict_a * (SECTOR_recode==11) + gamm
a_health_a * (SECTOR_recode==4) + gamma_education_a * (SECTOR_recode==12) + gamma_
public_a * (SECTOR_recode==1) + gamma_industry_a * (SECTOR_recode==16) +
    gamma_attitude1_a * ATTITUDES1 +
    gamma_attitude2_a * ATTITUDES2 +
    gamma_attitude3_a * ATTITUDES3 +
    gamma_attitude4_a * ATTITUDES4 +
    gamma_attitude7_a * VERKEER_STELLINGENS3 +
    gamma_attitude8_a * VERKEER_STELLINGENS4

  V[["class_b"]] = delta_b +
    gamma_laagopgeleid_b * (OPLEIDING_recode==1) + gamma_middenopgeleid_b * (OPLEI
DING_recode==2) + gamma_hoogopgeleid_b * (OPLEIDING_recode==3) +
    gamma_nietsted_b * (STEDELIJKHEID_recode==1) + gamma_sted_b * (STEDELIJKHEID_r
ecode==2) + gamma_zeersted_b * (STEDELIJKHEID_recode==3) +
    gamma_laaginkomen_b * (INKOMEN_recode==1) + gamma_middeninkomen_b * (INKOMEN_r
ecode==2) + gamma_hooginkomen_b * (INKOMEN_recode==3) +
    gamma_ervaring_b * (ERVARING==1) +
    gamma_overig_b * (SECTOR_recode==0) + gamma_ict_b * (SECTOR_recode==11) + gamm
a_health_b * (SECTOR_recode==4) + gamma_education_b * (SECTOR_recode==12) + gamma_
public_b * (SECTOR_recode==1) + gamma_industry_b * (SECTOR_recode==16) +
    gamma_attitude1_b * ATTITUDES1 +
    gamma_attitude2_b * ATTITUDES2 +
    gamma_attitude3_b * ATTITUDES3 +
    gamma_attitude4_b * ATTITUDES4 +
    gamma_attitude7_b * VERKEER_STELLINGENS3 +
    gamma_attitude8_b * VERKEER_STELLINGENS4

  V[["class_c"]] = delta_c +
    gamma_laagopgeleid_c * (OPLEIDING_recode==1) + gamma_middenopgeleid_c * (OPLEI
DING_recode==2) + gamma_hoogopgeleid_c * (OPLEIDING_recode==3) +
    gamma_nietsted_c * (STEDELIJKHEID_recode==1) + gamma_sted_c * (STEDELIJKHEID_r
ecode==2) + gamma_zeersted_c * (STEDELIJKHEID_recode==3) +
    gamma_laaginkomen_c * (INKOMEN_recode==1) + gamma_middeninkomen_c * (INKOMEN_r
ecode==2) + gamma_hooginkomen_c * (INKOMEN_recode==3) +
    gamma_ervaring_c * (ERVARING==1) +
    gamma_overig_c * (SECTOR_recode==0) + gamma_ict_c * (SECTOR_recode==11) + gamm
a_health_c * (SECTOR_recode==4) + gamma_education_c * (SECTOR_recode==12) + gamma_
public_c * (SECTOR_recode==1) + gamma_industry_c * (SECTOR_recode==16) +
    gamma_attitude1_c * ATTITUDES1 +
    gamma_attitude2_c * ATTITUDES2 +
    gamma_attitude3_c * ATTITUDES3 +
    gamma_attitude4_c * ATTITUDES4 +
    gamma_attitude7_c * VERKEER_STELLINGENS3 +
    gamma_attitude8_c * VERKEER_STELLINGENS4

  V[["class_d"]] = delta_d +
    gamma_laagopgeleid_d * (OPLEIDING_recode==1) + gamma_middenopgeleid_d * (OPLEI
DING_recode==2) + gamma_hoogopgeleid_d * (OPLEIDING_recode==3) +
    gamma_nietsted_d * (STEDELIJKHEID_recode==1) + gamma_sted_d * (STEDELIJKHEID_r
ecode==2) + gamma_zeersted_d * (STEDELIJKHEID_recode==3) +
    gamma_laaginkomen_d * (INKOMEN_recode==1) + gamma_middeninkomen_d * (INKOMEN_r
ecode==2) + gamma_hooginkomen_d * (INKOMEN_recode==3) +
    gamma_ervaring_d * (ERVARING==1) +
    gamma_overig_d * (SECTOR_recode==0) + gamma_ict_d * (SECTOR_recode==11) + gamm
a_health_d * (SECTOR_recode==4) + gamma_education_d * (SECTOR_recode==12) + gamma_
public_d * (SECTOR_recode==1) + gamma_industry_d * (SECTOR_recode==16) +
    gamma_attitude1_d * ATTITUDES1 +
```

```
    gamma_attitude2_d * ATTITUDES2 +
    gamma_attitude3_d * ATTITUDES3 +
    gamma_attitude4_d * ATTITUDES4 +
    gamma_attitude7_d * VERKEER_STELLINGENS3 +
    gamma_attitude8_d * VERKEER_STELLINGENS4

  classAlloc_settings = list(
    classes      = c(class_a=1, class_b=2, class_c=3, class_d=4),
    utilities    = V
  )

  lcpars[["pi_values"]] = apollo_classAlloc(classAlloc_settings)

  return(lcpars)
}

# ############################################################### #
#### GROUP AND VALIDATE INPUTS                                  ####
# ############################################################### #

apollo_inputs = apollo_validateInputs()

# ############################################################### #
#### DEFINE MODEL AND LIKELIHOOD FUNCTION                       ####
# ############################################################### #

apollo_probabilities=function(apollo_beta, apollo_inputs, functionality="estimate"
){

  ### Attach inputs and detach after function exit
  apollo_attach(apollo_beta, apollo_inputs)
  on.exit(apollo_detach(apollo_beta, apollo_inputs))

  ### Create list of probabilities P
  P = list()

  ### Define settings for MNL model component that are generic across classes
  mnl_settings = list(
    alternatives = c(job1=1, job2=2),
    avail        = list(job1=1, job2=1),
    choiceVar    = keuze)

  ### Loop over classes
  for(s in 1:4){
    ### Compute class-specific utilities
    V=list()
    V[["job1"]] = b_time[[s]] * REISTIJD1 +
      b_salary[[s]] * SALARIS1 +
      b_days0[[s]] * (THUISWERKEN1==0) +
      b_days1[[s]] * (THUISWERKEN1==1) +
      b_days2[[s]] * (THUISWERKEN1==2) +
      b_days3[[s]] * (THUISWERKEN1==3) +
      b_flexibility[[s]] * FLEXIBILITEIT1 +
      b_reimbursement[[s]] * VERGOEDING1 +
      b_culture[[s]] * CULTUUR1 +
      b_time_days1[[s]] * REISTIJD1 * (THUISWERKEN1==1) +
      b_time_days2[[s]] * REISTIJD1 * (THUISWERKEN1==2) +
      b_time_days3[[s]] * REISTIJD1 * (THUISWERKEN1==3)
```

```
    V[["job2"]] = b_time[[s]] * REISTIJD2 +
      b_salary[[s]] * SALARIS2 +
      b_days0[[s]] * (THUISWERKEN2==0) +
      b_days1[[s]] * (THUISWERKEN2==1) +
      b_days2[[s]] * (THUISWERKEN2==2) +
      b_days3[[s]] * (THUISWERKEN2==3) +
      b_flexibility[[s]] * FLEXIBILITEIT2 +
      b_reimbursement[[s]] * VERGOEDING2 +
      b_culture[[s]] * CULTUUR2 +
      b_time_days1[[s]] * REISTIJD2 * (THUISWERKEN2==1) +
      b_time_days2[[s]] * REISTIJD2 * (THUISWERKEN2==2) +
      b_time_days3[[s]] * REISTIJD2 * (THUISWERKEN2==3)

    mnl_settings$utilities = V
    #mnl_settings$componentName = paste0("Class_",s)

    ### Compute within-class choice probabilities using MNL model
    P[[paste0("Class_",s)]] = apollo_mnl(mnl_settings, functionality)

    ### Take product across observation for same individual
    P[[paste0("Class_",s)]] = apollo_panelProd(P[[paste0("Class_",s)]], apollo_inp
uts ,functionality)
  }

  ### Compute latent class model probabilities
  lc_settings   = list(inClassProb = P, classProb=pi_values)
  P[["model"]] = apollo_lc(lc_settings, apollo_inputs, functionality)

  ### Prepare and return outputs of function
  P = apollo_prepareProb(P, apollo_inputs, functionality)
  return(P)
}

# ################################################################# #
#### MODEL ESTIMATION                                            ####
# ################################################################# #

### Estimate model
model = apollo_estimate(apollo_beta, apollo_fixed,
                        apollo_probabilities, apollo_inputs)

### Show output in screen
apollo_modelOutput(model, modelOutput_settings=list(printPVal=2))

#Willingness to pay
deltaMethod_settings=list(expression=c(WTA_class1_1day = "b_days1_a/b_time_a",
                                       WTA_class1_2day = "b_days2_a/b_time_a",
                                       WTA_class1_3day = "b_days3_a/b_time_a",
                                       WTA_class1_flex = "b_flexibility_a/b_time_a
",
                                       WTA_class1_reim = "b_reimbursement_a/b_time
_a",
                                       WTA_class1_cult = "b_culture_a/b_time_a",
                                       WTA_class2_1day = "b_days1_b/b_time_b",
                                       WTA_class2_2day = "b_days2_b/b_time_b",
                                       WTA_class2_3day = "b_days3_b/b_time_b",
                                       WTA_class2_flex = "b_flexibility_b/b_time_b
",
                                       WTA_class2_reim = "b_reimbursement_b/b_time
_b",
```

```
                                      WTA_class2_cult = "b_culture_b/b_time_b",
                                      WTA_class3_1day = "b_days1_c/b_time_c",
                                      WTA_class3_2day = "b_days2_c/b_time_c",
                                      WTA_class3_3day = "b_days3_c/b_time_c",
                                      WTA_class3_flex = "b_flexibility_c/b_time_c
",
                                      WTA_class3_reim = "b_reimbursement_c/b_time
_c",
                                      WTA_class3_cult = "b_culture_c/b_time_c",
                                      WTA_class4_1day = "b_days1_d/b_time_d",
                                      WTA_class4_2day = "b_days2_d/b_time_d",
                                      WTA_class4_3day = "b_days3_d/b_time_d",
                                      WTA_class4_flex = "b_flexibility_d/b_time_d
",
                                      WTA_class4_reim = "b_reimbursement_d/b_time
_d",
                                      WTA_class4_cult = "b_culture_d/b_time_d"))

result=apollo_deltaMethod(model, deltaMethod_settings)

result_df = as.data.frame(result)
write.csv(result_df, file="delta_method_results.csv", row.names=FALSE)

### Save output to file(s)
apollo_saveOutput(model)

# ################################################################# #
##### POST-PROCESSING                                             ####
# ################################################################# #

### Print outputs of additional diagnostics to new output file (remember to close
file writing when complete)
apollo_sink()
```