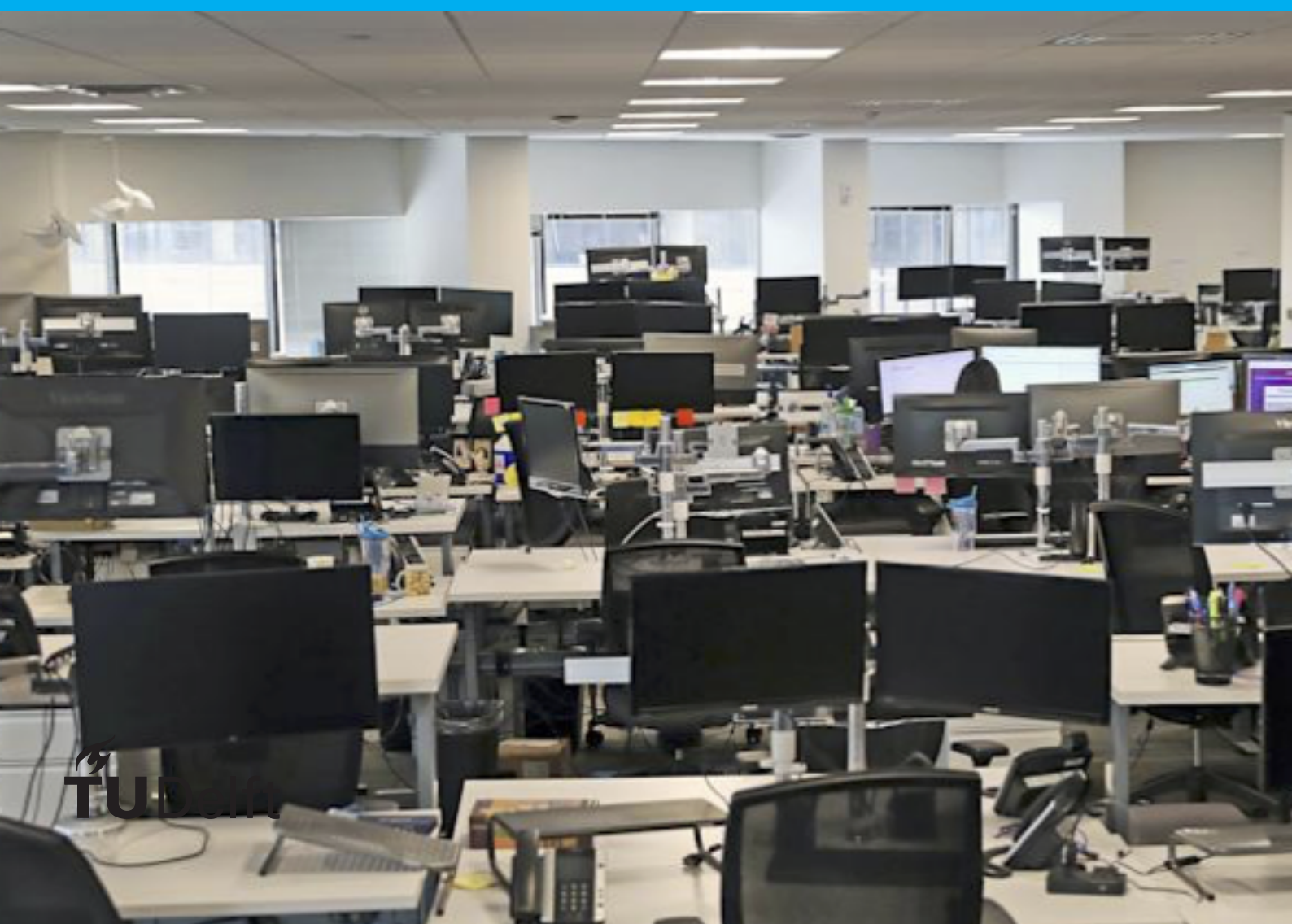


Changes in work from home behaviour due to COVID-19

An analysis of the influence of the state of the pandemic and teleworking policies

T. Töns



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by

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Executive summary

The thesis discusses the impact of COVID-19 on work patterns, particularly the shift towards working from home. It highlights that teleworking was slow to adapt before the pandemic but became the norm during COVID-19. The thesis also mentions the potential long-term effects on travel behaviour, public transport use, and preferences for working from home.

There is a research gap in understanding the factors influencing the choice to work from home and how this shift affects commuting patterns, social behaviour, and public transport. The thesis outlines the main research questions and sub-questions that the study aims to answer, focusing on employer policies, personal characteristics, attitudes, and scenario-related attributes that influence the decision to work from home.

Literature study

From literature explored consisting of research conducted before and during the pandemic it follows that the choice is influenced by different factors. The factors influencing teleworking include individual attributes like socio-economic characteristics (e.g., age, gender, education, and wage), the organization's policies (e.g., remote work arrangements), job suitability for remote work, and home and family circumstances (e.g., household members and home office setup).

Working from home was already gaining popularity before the pandemic, driven by technological improvements and the availability of online work environments. It also highlights the potential positive impact of reduced work-related travel on mobility and the environment. Additionally, it seems the shift in working from home behaviour during the pandemic, with some expectations, will continue as a supplementary option to office work.

The conceptual framework proposed, is used to understand the choice between different working schemes, considering factors such as office policies, the number of days working from home, and flexible work hours. The framework encompasses various elements, including organizational policies, job suitability, individual and family characteristics, and the influence of the pandemic, and outlines how these factors will be included in the survey for further study.

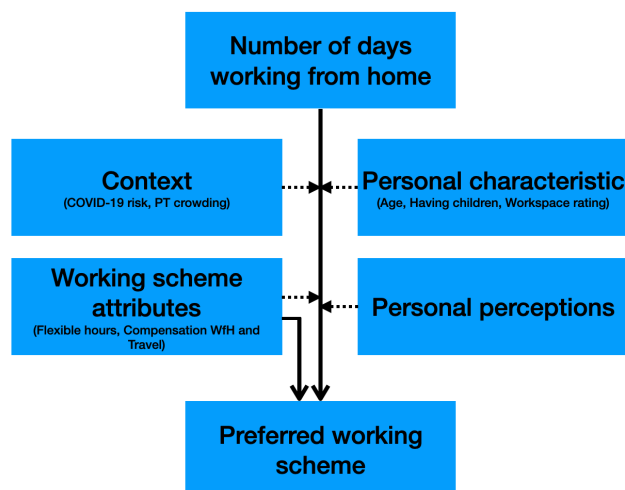


Figure 1: The conceptual model

Research method

The methodology used for understanding the preferences of employees in their decision to work from home is a stated preference experiment for data collection and using a choice model construction with the inclusion of attitudinal variables. The survey is targeted at participants who work at least four days a week and have the option to work from home within their job. To ensure a specific focus, participants should primarily commute to the office using public transport, enabling the study to understand the influence on public transport choices.

To study working from home behaviour under different COVID-19 situations, the survey integrates these COVID-19 risks as a context. Another context that is considered is crowding in public transport. The contexts are rotated over different participant groups to ensure that each alternative is presented within every scenario. Efforts are made to reduce the number of choices in the survey by presenting trade-off options instead of all possible combinations. An efficient survey design is used, guided by prior expectations or variables found in literature or a pilot study.

The survey requires participants to choose between alternative working from home schedules based on attributes, including the number of days working from home, travel and work from home contributions, and the ability to work flexible hours. This methodology allows for a comprehensive understanding of employees' work from home preferences, accounting for various factors and attitudes to provide valuable insights into their choices.

The study also includes questions about different attributes used to define working from home alternatives, participants' personal situations, and their responses to COVID-19 and Working from Home (WfH) statements. Attitudes and perceptions about COVID-19 are gauged using a Likert scale, helping to understand participants' concerns regarding the pandemic.

Demographic information like age, gender, income, and education is collected, along with household characteristics such as household size, day-care and study room availability. These details provide insights into the individual and home-related factors influencing the decision to work from home. Additionally, participants are asked about their past work from home behaviour before February to assess changes in behaviour due to COVID-19.

Results

The data collected from a survey shows a total of 138 respondents participated, with 68 meeting the specific criteria such as the ability to work from home in their respective occupations, working at least four days a week, and predominantly using public transport for commuting. The resulting data corresponds with the user group expected to have responded to the survey, due to the filters and the manner of distribution. The analysis of the data of the respondents reveals an income distribution, which aligns with the expected profile of most respondents (aged 20-39 with higher education). The composition of households is also examined, distinguishing between those living alone and those sharing a household, including those with children and is in line with the expectation for the group described.

The changes in remote work patterns resulting from the COVID-19 pandemic are illustrated with a substantial increase in the number of days respondents work from home, with the average shifting from one day per week before the pandemic to nearly three days per week during the survey in March 2022. The availability of travel and work-from-home contributions provided by employers on the number of days worked from home is evaluated. It is noted that participants receiving work-from-home contributions on average work more days from home.

An exploratory factor analysis aimed at understanding the participants' perceptions concerning COVID-19 identified two key factors: "Protect" and "Control," representing the respondents' attitudes regarding the risk and control aspects of COVID-19.

Various models are estimated to determine the factors influencing participants' choices concerning remote work. The model chosen incorporates personal characteristics, contextual factors (state of the COVID-19 pandemic and public transport crowding), and attitudinal variables (Protect and Control) and is found to provide the most comprehensive explanation of the data.

To better understand the implications of various factors a simulation is performed. This simulation predicts the probability of an employee choosing an hypothetical alternative over the base alternative, which is defined as a €2 WfH contribution, a travel compensation and working two days from home. The findings of these simulations are useful in understanding how these attributes influence employee' choices.

The simulation shows a notable inclination for a €4.00 daily compensation, even when no days are worked from home. A €2.00 daily compensation leads to a preference for working more days from home. The absence of compensation makes all options less favourable than the standard schedule with a €2.00 compensation. Additionally, the impact of travel contributions is evident, with a lack of payment for commuting increasing the likelihood of working from home. Flexible office hours are slightly preferred, making any option more attractive.

On personal characteristics it can be noted that age affects the preference for working from home, with older individuals showing a lower preference. Participants with children tend to favour more days of remote work, while the quality of the work environment impacts choices.

Contextual factors, such as the state of the pandemic and crowding in public transport, play a significant role. A credible threat of COVID-19 infection leads to a higher likelihood of choosing more days of remote work. Surprisingly, participants tend to choose more office work when public transport is crowded.

When considering the perceptions of the participants, those who worry less about their loved ones' safety are more inclined to work from home. Similarly, individuals who are less concerned about their own safety prefer remote work.

In summary, the thesis provides insights into the multifaceted factors influencing employees' choices regarding remote work, including office policies, personal characteristics, contextual elements, and individual perceptions. These factors collectively shape individual preferences and decisions related to remote work.

Conclusion

This research explores the decision-making process of employees regarding working from home, examining the influence of employer policies, personal characteristics, and attitudes towards teleworking. The identified employer policies include compensations for working from home and commuting, along with the option for flexible working hours. While these policies impact the attractiveness of different work arrangements, further research is needed to understand more specific implications.

Personal characteristics such as age, gender, and having children are found to significantly influence the choice to work from home. However, the study acknowledges limitations in participant homogeneity, recommending replication with a more diverse group to better understand the impact of distinct social and economic conditions.

In conclusion, the thesis corroborates existing literature findings and recognizes new aspects, such as the relative rating of home and office workspaces. The influence of COVID-19 perceptions on choices is noted, but further studies are cautioned due to the evolving landscape. Compensations for travel and working from home, along with flexible hours, significantly impact respondent behavior and can be used by governments addressing peak hour crowdedness, and employers offering proper travel cost compensation to influence employee behavior effectively.

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Introduction

At the time of the research, spring 2022, COVID-19 had been influencing our day-to-day life for almost two years. After the initial outbreak in late 2019, it reached Europe and the Netherlands in March 2020. This meant that travel restrictions and work from home order were introduced by the government. All of a sudden teleworking was the norm, even though previously the adaptation of working from home had been slow before the outbreak of the pandemic.

Between the COVID-19 waves, as infection and hospitalization rates were low, we might have gotten a glimpse of how life after the pandemic might be. For now, the use of public transport during low infection periods has stayed below the pre-COVID-19 baseline (Molloy et al., 2021; Astroza et al., 2020). What remains to be seen, is if people will stay working from home now, as the virus is almost completely gone and it was shown that teleworking is feasible. This study is meant to understand the decision to work from home by employees, as well as the policies that influence teleworking that could be implemented by employers, and compare the perception of teleworking to earlier studies.

1.1. Working from Home

Working from home has been a topic of research for over three decades now (Hamer et al., 1991; Sullivan et al., 1993; Mokhtarian and Salomon, 1994; Baruch and Nicholson, 1997; Peters et al., 2010). While most studies found that teleworking has significant benefits, they also note that adaptation is slow, as the organisation has to support the use of teleworking completely (Peters et al., 2010). This boundary has hindered adoption of teleworking in organisations.

The pandemic forced organisations to properly set up teleworking support for their employees. Now most companies and employees have the experience of teleworking it is interesting to see as COVID-19 subdues, if they will completely switch back to work from the office or if they will find some hybrid form of working from the office as well as from home. Initial studies have so far concluded that working from home is here to stay (Rijksoverheid, 2021; Bloom, 2021; NOS, 2021).

Another aspect that altered travel behaviour of people is the social distancing needed to prevent the spread of COVID-19. This has led to a lower use of public transport than before the pandemic. The effect of COVID-19 on public transport is summed up by Tirachini and Cats (2020). People's perceptions and preferences of public transport may have changed due to the virus, as people's wariness for groups might influence the travel behaviour of users for quite some time.

The rise of variants might prolong the COVID-19 era for a longer time than first was anticipated (Charumilind et al., 2021). With higher vaccination rate however, this could lead to a period where there is more freedom to travel and work at the office compared to the beginning of the pandemic. This will lead to situations where infection rates could influence the decision to work from home. People might choose sooner to work from home when there is a higher infection rate or when a new variant spreading that causes more hospitalizations.

The period of COVID-19 so far could also have changed our preference of going to public places will being sick or whilst having an ordinary cold. Where people used to go to work whilst having a cold

or even being sick, people post-COVID-19 might choose to work from home faster than before the pandemic as organisations are more adapted (Martinez and Ferreira (2012)).

1.2. Research gap and relevance

Understanding Working from Home (WfH) behaviour can help us understand commuting patterns, as well as provide insight in people's stance on being amongst groups of people. This is why it's important to understand this behaviour for the future. The latter part might even help us understand commuting patterns, but also provides insight in people's stance of being among groups of people. This latter part might answer questions about how we will use office space or public transport post-COVID-19.

Budd and Ison (2020) coined the term 'responsible transport' to describe other aspects to be considered in designing transport systems and policies besides just designing for demand. This is an agenda for designing transport policy that considers the impact of mobility on the commuters themselves, the environment and other people. These points are heavily influenced by the amount of travel undertaken, which in turn is dependent on the choice to work from home.

Delventhal et al. (2020) give three examples of how our cities might change due to WfH behaviour. Some of these changes are that our jobs will move to city centres, the residents to the periphery and we'll experience a drop in congestion and therefore shorter commutes. Lastly we might experience a drop in housing prices. These changes underline the importance of the adaptation of responsible design (Budd and Ison, 2020). Furthermore some studies have indicated that in some regions working from home leads to a reduction in overall energy usage, that can be as much as 9.33 kWh per commuter per day (Fu et al., 2012). However, WfH might have mental health effects, as boundaries with work are less defined and social cohesion is lower (Oakman et al., 2020).

The (permanent) shift in WfH behaviour is the subject of this thesis, as a better understanding of this topic might yield various benefits. What does however happen to underlying preferences of employees? How can employers anticipate on these preferences after the pandemic? These are some of the questions that are not yet assessed completely. Table 1.1, shown below, displays the relevance of this thesis to society and science.

Table 1.1: Relevance of the thesis study

Societal
Better understanding of the impact of the COVID-19 pandemic on working from home preferences of employees.
Helping understand the possible change in land use and travel behaviour due to changing WfH preferences.
Provide insight in design of office policies post COVID-19 to create an environment suited for shifted preferences.
Enabling more work from home possibilities, will reduce commuting patterns leading to a reduction in the carbon footprint of mobility.
Scientific
First study into the lasting changes to travel and WfH behaviour due to the COVID-19 pandemic.
Assessment of the attributes that are of importance in the WfH choice made by employees.
Contribution to the knowledge of predicting the preferred WfH choice of employees.

Especially on the latter points exists a knowledge gap on the understanding of the integral choice of WfH behaviour and what attributes are of influence on this choice. This will be the primary focus of the thesis study.

1.3. Objective and research question

The objective of this research is to understand the metrics that constitute the choice of employees to work from home or travel to the office. This will give us the ability to better understand the reasons why individuals choose certain schedules pertaining to working from home. This understanding helps us to create policies both for companies as for transport authorities that better reflect the needs from employees and commuters, as it will give insight into questions such as: "will employees prefer a form of hybrid work" and "how can policies be designed to promote this desire?" This brings us to the main research question of this thesis:

What work from home related office policies do workers commuting in public transport in the Netherlands prefer and how do they influence their work from home choices?

To understand which employer policies might influence work from home choices, we have to identify possible employer policies in literature and their function according to prior studies. The most promising employer policies can then be included in the study to understand their influence on the preferred office policies for workers. This leads to the first sub-question:

What employer policies on working from home can be identified to have an influence on the choice to work from home and can these used to design a working scheme to convince employees to work from home or from the office?

The choice to work from home might be influenced by personal characteristics of employees or the social-economic environment of the employee. Indicators of these attitudes and preferences have to be found, since these latent variables cannot be observed directly. This leads to the sub-question:

What personal characteristics of the employee or social-economic environment of the employee can be identified that have an influence on the choice to work from home in general?

The choice to work from home might be influenced by attitudes and preferences of employees. Indicators of these attitudes and preferences have to be found. This leads to the next sub-question:

What attitudes and perceptions can be identified that have an influence on the choice to work from home in the context of COVID-19 and what indicators can be used to understand these?

Scenario-related attributes may also influence the choice to work from home. These, however, cannot be chosen or directly influenced. Scenario-related attributes include, but are not limited to, the situation of the pandemic or crowding in public transport.

What influence do the attributes that describe an underlying scenario have on the choice to work from home?

The research can be used as a means to formulate the most optimal framework for employers to design and implement work policies for their employees. Another sub-question is proposed to identify the policies that have an influence on the work preferences of employees:

Given the results of the model, what influence do the different employer policies have on the number of days the respondent prefers to work from home?

1.4. Research approach

To answer the research questions stated in the previous section, a survey will be used. In this survey people will be asked to make choices in hypothetical situations that cannot be simulated in real-life; situations like different COVID-19 scenarios and different schedules and office policies.

To understand what attributes actually influence the choice to work from home or commute to the office and thus have to be included in the survey, relevant literature will be reviewed. After, a survey is devised which assesses the relevant attributes found in literature.

Using a pilot study, the survey can be verified and be made more efficient. Afterwards, the survey is constructed using the findings of the pilot study. The results of this survey can then be used to estimate a final model. The estimations serve to answer the different research questions post in the previous chapter.

1.5. Thesis outline

In chapter 2, the aforementioned literature review is discussed. The literature review focuses on two topics in particular; it first states the research what had already been done on the decision to WfH before the pandemic, in order to better understand the choices employees make. Second, it reviews literature dealing with the rapid change in this behaviour due to the COVID-19 pandemic. Both the travel behaviour of people under the context of COVID-19 in general, as well as the choice to work from home under this scenario specific.

In chapter 3 the method used to answer the research question will be discussed. The method used to interpret the behavioural choices is explained generally, after which the implementation of this model in this research is explained specifically. The design of the survey used to collect the data on people perceptions and choices is discussed in chapter 4.

chapter 5 discusses the results of the experiment. Firstly, the statistics of the group of respondents are discussed to understand the representation of the respondents for a broader population. Also the estimation of the model is shown and discussed in this chapter. In chapter 6 these estimations are translated to actual predictions what different policies and scenarios mean for the choice to work from home. Lastly, the research is discussed and recommendations for further research are made in the last chapter.

2

Literature study

This chapter will explain what work from home (WfH) is, how it was used in the past, is used in the present and what the factors are when employees make the decision to work from home. The first section will go into the research done before and during the pandemic on the factors that influence the decision to work from home. The last section will focus on the adaptation of working from home before and during the pandemic, how this has changed and if we can already see a lasting adaptation.

2.1. Factors of teleworking

Before COVID-19, multiple studies have been conducted on the understanding of teleworking behaviour. Baruch and Nicholson (1997) define what is understood by teleworking, as well as four elements that should be present for teleworking to be feasible. These four elements are: personality, home/work balance, the kind of job and the kind of organisation.



Figure 2.1: Elements that are present while working from home (Baruch and Nicholson, 1997)

These quadrants described by Baruch and Nicholson (1997) make out the framework for the rest of the literature research. The findings on the parts individual, organisation, job and, home and family will be presented in the following sections.

2.1.1. Individual

The first quadrant that is identified in Baruch and Nicholson (1997), is the individual that makes the choice. This individual is defined by socio-economic attributes, which influence the WfH behaviour. Yassenov (2020) concludes that different individuals with certain social-economic attributes work more often from home on average. These attributes, including gender, age, wage and education, mostly determine the chance that the individual has a job can be done from home. However, after standardization, women tend to choose more often to work from home, especially when they have children (Patnaik, 2018; Timsal and Awais, 2016).

Another study also finds that higher educated individuals value the choice to work remotely higher than average (Patnaik, 2018). There is also a relation with age and the choice to work from home, younger and older workers are more likely to work from home, around the age of 42 workers in Japan were least likely to work from home (Kawaguchi and Motegi, 2021).

Travel time also seems to have an effect on the choice to work from home. If employees have to commute fewer times a week, some studies predict people choosing to live further from the office (Delventhal et al., 2020; Moeckel, 2017), this is in line with older predictions that travel time can be considered a constant, if people travel faster or less, they can travel further, the so called BREVER law (Peters et al., 2001).

2.1.2. Organisation

One of the most important factors that have an effect on employees choosing to work from home has to do with the organisation. In literature it is found that employees that were permitted to work from home pre-COVID-19 delivered a higher work effort, indicating a positive reception of pro-WfH policies (Rupietta and Beckmann, 2018). This mostly is in line with other papers that have a similar conclusion; already in 2016 one concluded that it is in a companies best interest to implement arrangement for working from home to pertain and retain talent (Timsal and Awais, 2016). This indicates that if given the choice, employees prefer the option to work from home. Another found that employees that worked under a new WfH policy had improved work satisfaction (Bloom et al., 2015). This new policy mainly provided the employee with greater freedom in choosing working hours. This is in line with conclusions during the COVID-19 pandemic (Wilson, 2021).

Since 2022 employers in the Netherlands can pay their employees a compensation that will be tax exempt up to €2 a day. This is meant to pay for extra costs in utilities. This will create an extra incentive for employees to work from home (Rijksoverheid, 2022b).

2.1.3. Job

The third quadrant identified by Baruch and Nicholson (1997) is the ability to perform the job at home. In other words it is possible to do the occupancy at home. This means the profession does not involve physical contact with clients and/or locations (such as retail, hairdressers, manufacturing workers and contractors) (Baker, 2020). Most professions suited consist mostly of working on a computer, nowadays faster internet connections and cloud computing make it possible for most office workers to work from home (Stiles et al., 2019).

In similar research into working from home Rupietta and Beckmann (2018) excluded from the survey, next to the groups previously described, self-employed people, since they often already hold office at home and therefore don't commute or use transport in the same way that office workers do. Because of this different use and thus a different choice metric, they are excluded from similar studies.

2.1.4. Home and family

The last part of external influence is the home and family situation. It is obvious that the home is important in a decision to work from home. The parts that combined describe this situation are however plentiful.

Household member are of influence of the choice to work from home, especially children. Employees with children at home indicated had a greater decline in productivity than employees during the pandemic, with the effect even greater on women (Gibbs et al., 2021). This is most likely caused by a uneven distribution in childcare between partners, women bore more of the burden relative to their male partner when the child had to stay at home (Sevilla and Smith, 2020).

The other part in this quadrant is the home itself. Cuerdo-Vilches et al. (2021) gives clear examples of the circumstances of home offices that are not suitable for working from home long term. The study

point out aspects of the work space considered by participants, these are among other light, size, temperature, noise. In total about 27.5% of people in his study have no suited or little suited office space for working from home.

Working from home seems to have a negative influence on the work-life balance, employees take less care of maintaining a healthy balance as they develop a higher work engagement (Palumbo, 2020). He calls for more specific human relationship tools tailored to assist employees working from home.

2.2. Adaptation of working from home

Working from home was already gaining in popularity before the pandemic, this had to do on one hand with more availability of ICT infrastructure (Stiles et al., 2019). This part of the literature study discusses the adaptation of WfH before and during the pandemic, it shows what was holding back the adaptation before 2020, and if these challenges of WfH have been met by the forced implementation of WfH during the pandemic.

2.2.1. Adaptation of WfH before the pandemic

Already before the pandemic in 2018 working from home was implemented within offices in the Netherlands, this was however growing slow and was done by a smaller group than now is accustomed to WfH during the pandemic, as can be seen in Figure 2.2 (CBS, 2018).

Important for this growth was the adaption of online work environments within companies, which allowed employees to work from the comfort of their home. Additionally, ongoing improvements in computing infrastructure modes, mobile and cloud computing, make it possible to complete more complex tasks from home (Stiles et al., 2019).

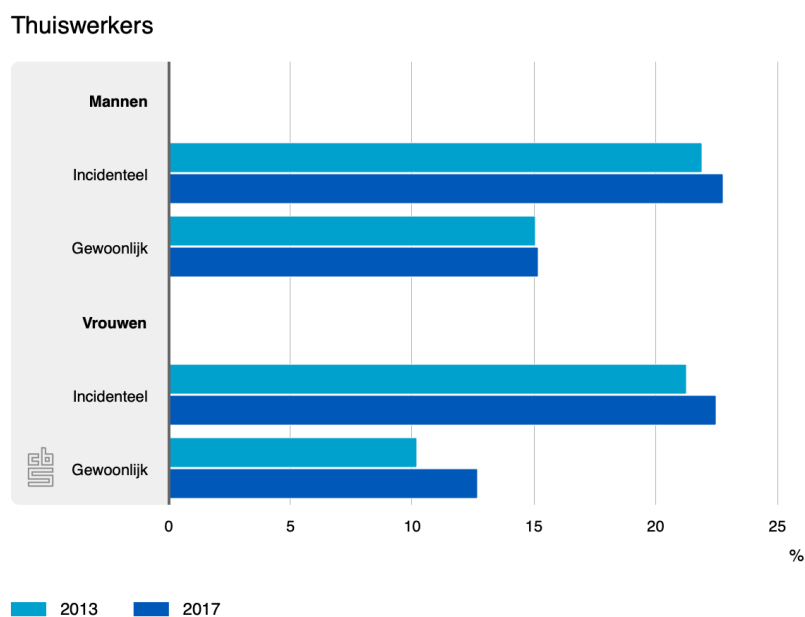


Figure 2.2: Number of people working from home pre-COVID in the Netherlands (CBS, 2018)

One of the advantages, that already had been realised before the pandemic is the better use of the available mobility. As the number of work trips declines, as people work from home, and people have the option to travel outside of rush hour (Stiles et al., 2019). The design capacity of our mobility can be smaller and thus improves environmental impact (I&O research, 2015; Fu et al., 2012).

To understand this adaptation better the different stages of pandemic are discussed. During the COVID-19 pandemic, as mentioned in the chapter 1, working from home was adopted on a large scale to combat the spread of the virus. This caused a shift in WfH behaviour (Wilson, 2021). On the question what will remain of this shift after the pandemic is over, multiple studies have been performed. All have a

similar outcome, namely that they expect working from home to stay around supplementary to working from the office, most report two or three days working from home (Davis et al., 2021; Nayak and Pandit, 2021; Rijksoverheid, 2021).

2.2.2. Stages of the pandemic

Infection rate

The infection rate is chosen as a variable to communicate the state of the pandemic. The state of the pandemic has to be varied to understand its effect on the choice of working from home. It is expected that more participants opt to work from the office as infection rates are higher. It is interesting to see how big this impact will be. If working from home is here to stay, the influence of the infection rate might even be small.

The attribute levels are coupled to the different peaks and lulls of the infection rate over time and the participant will be presented with the number as well as the point in time the infection rate was near this rate. The levels represented are 20 (/100.000) (begin September 2021), 60 (/100.000) (mid July 2021) and 120 (/100.000) (late November 2021), these can also be observed in Figure 2.3.

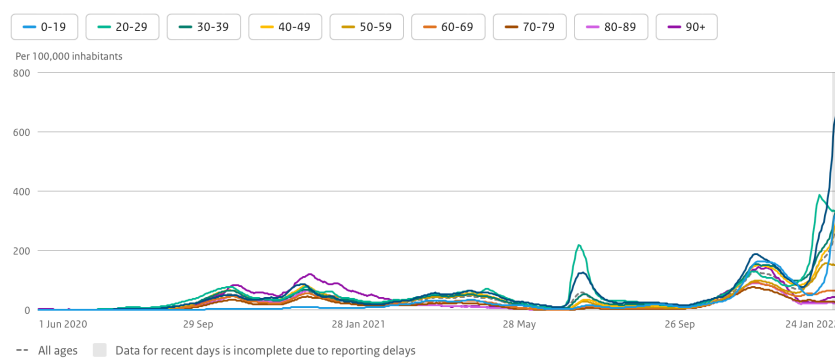


Figure 2.3: Number of positive tests (/100.000) (Rijksoverheid, 2022a)

Hospitalization rate

An important measurement to understand how serious the infections are, is the hospitalization rate. The occupation of hospital beds has been one of the issues arising from the pandemic. As COVID-19 over time has become more treatable, the biggest issue is to have enough places for people to be treated. This has been the main influence on COVID-19 policies.

The attribute levels chosen for the hospitalization rate are 30 and 120 (/1.000.000). These are chosen because they are representative of different COVID-19 situations the last year and fall within the risk levels of "Caution" and "Serious" used by the Dutch government (Rijksoverheid, 2022a). These levels can also be observed in mid July and begin September (30 cases per 1.000.000) and late November (120 cases per 1.000.000), as shown in Figure 2.4.

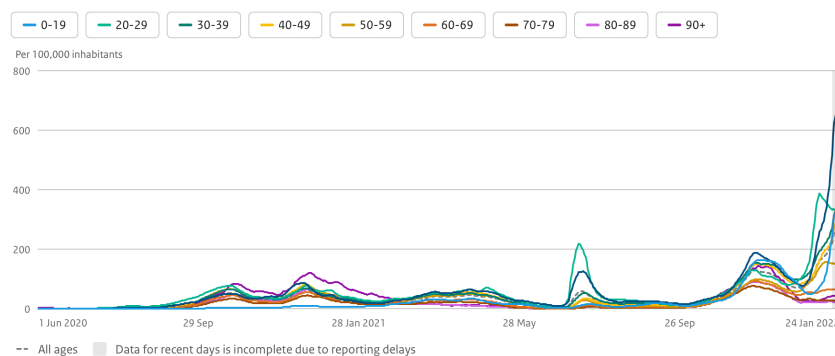


Figure 2.4: Number of hospitalizations (/1.000.000) (Rijksoverheid, 2022a)

2.3. Conclusion

Following the literature study, a conceptual framework is proposed which considers the choice between different designs of a working week. These will be called working schemes and are composed of office policies, numbers of days working from home and the ability to work flexible hours. These are identified as the parts that are more easily influenced by managers and governments alike. These are provided by the quadrant of organisation as proposed by Baruch and Nicholson (1997), which was used as a base for the literature study and can be seen in Figure 2.1.

The quadrant job is discussed, but will be implemented as a filter in this study as we want to study groups that can choose between working from home and working at the office. How these groups are filtered will be discussed in chapter 3.

Also, the individual and home&family aspects seem to have an influence on the choice to work from home. These measurable characteristics of the respondents such as age and number of children situations have to be included in the framework. The state of the home office is also an important factor for this category. Next, to the measurable attributes, personal perceptions play a role in the choice to work from home and will be included in the conceptual framework.

Lastly, next to the quadrants discussed there is a new dimension since 2020. The dimension of a pandemic. This dimension is included within the conceptual model. Considering all these findings we can order them as shown below in Figure 2.5. How we include these different influences in the survey is discussed in chapter 4.

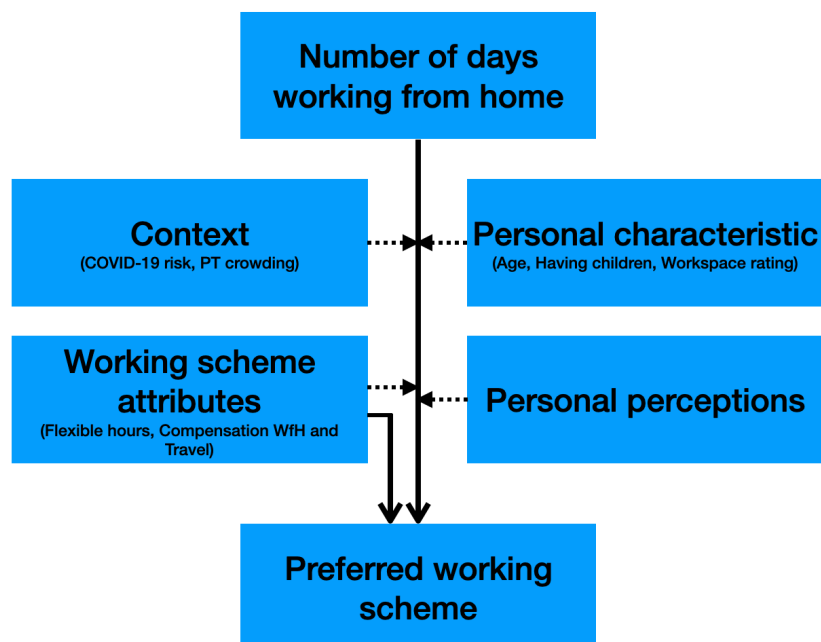


Figure 2.5: Conceptual model

3

Research method

To understand the preferences of employees in their decision to work from home, an analysis has to be performed on the data available for this research. The data was gathered by using a stated preference experiment, the choice of which is explained in section 3.1. This chapter also explains how the stated preference experiment was constructed. Next, the modelling of this data is discussed in section 3.2. To account for personal attitudes, attitudinal variables are used. This is expanded on in section 3.3.

3.1. Data collection

There are two different types of data collection generally used in studying the preferences of people. Revealed preference (RP) uses data collected from real choices of users in a real situation. The preference of the individual is observed in a real situation and these choices therefore have a high validity. On the other hand hypothetical conditions cannot be evaluated by RP experiments and since only the chosen alternative is revealed it is relative difficult to find the trade-off in the decision making process of the individual (Kroes and Sheldon, 1988; Ortúzar and Willumsen, 2011).

The other option is stated preference (SP) using a survey. SP experiments are useful in understanding situations that cannot be observed or tested. Participants have to state their preferred option between two or more hypothetical alternatives. This gives the researcher greater control over the presented alternatives, and thus better insight in the trade-off that are present in the choice of participants. Since the survey covers (partly) hypothetical alternatives, it is of importance that the options are easy to understand and appear plausible and realistic (Ortúzar and Willumsen, 2011; Hensher, 2010).

To answer the proposed research question a model has to be developed that meets certain requirements. The data needed for the experiment cannot be observed in the real world since the situation of COVID-19 is a given for the moment an observation is made. Therefore, a SP experiment is used. The data gathered will consist of choices people would make between hypothetical alternatives in these different situations in which the situation of COVID-19 will vary.

3.1.1. Scoping

To ensure that the collected data is focused on participants that help us answer the research question, the survey has to be sent to participants that fall into a defined group. First of all, the participants need to work at least four days a week. We want to compare only these workers as workers that work less will have a different trade-off for the same choices. For these workers the choice to work from home will mean that they are relatively even less at work compared to workers that work four or five days.

Also, it is important that the participants have the option to work from home within their job. The factors that have to be met to work from home are mentioned by Olson (1981), these include:

- A high degree of cerebral, rather than manual work;
- Work done as an individual, or with clearly defined areas of individual work;
- A moderate degree of initiative, pursuing employer-given objectives under conditions of minimal supervision;

- Measurable output or 'deliverables' (though this does not always determine the payment method);
- Measurable performance success criteria;
- No requirement to operate very bulky or costly items of equipment.

Besides this condition, participants have to commute primarily to the office using public transport. These will make the choice while weighing the state of COVID-19 in the sense of the office space as well as the context of public transport. This will ensure that the research question is met, as it is specifically meant to understand the influence on public transport.

3.1.2. Scenarios within the survey

Given that this study intends to study working from home behaviour under different COVID-19 situations a SP experiment is the best option. To gather data on the working from home behaviour of participants in different situation the data collection would take up too much time and it would be difficult to properly observe different policies under as many different schedules for work weeks.

To integrate the different contexts within the survey the contexts are combined into scenarios. The alternatives are then split up in the same number of groups and combination of these groups are rotated, such that every alternative is presented with every scenario included.

3.1.3. Pilot study

It is good practice to perform a pilot study. This is a pilot study that ensures that all alternative are clear for the users and gives a preliminary insight in the possible outcome of the actual study. The pilot study helps to improve the survey before release and helps to remove potential issues with interpretability of the questions and alternatives presented.

Moreover, the pilot study can help to find priors for the generation of the final survey, the process of which is discussed in subsection 3.1.4.

3.1.4. Construction of the survey

Within the boundaries of this research it is not possible to subject all participants to alternatives that include all combinations of different company policies. To ensure that the survey still provides as much information as possible while reducing the alternatives presented. This is done by presenting a trade-off options instead of presenting all choices between alternatives such as choices that have a clear preferred option or choices between alternatives that are, in the eyes of the participant, equal.

There are different methods to reduce the number of choices needed in the survey. One such way is an efficient survey design, which was used for this research. Efficient designs need priors, these are expected variables for the model, as found in literature or in a pilot study.

An efficient design can be constructed using, for example, the software package Ngene. These software packages use their computing power to find survey designs that work particularly well. One measurement that is used to asses if the design is efficient is the D-error. These designs are called D-efficient (Rose and Bliemer, 2009).

3.2. Discrete choice modelling

To understand the collected SP data, this needs to be modelled. The generation of these models that explain this choice, most of the time, are done using 'random utility theory' (Williams, 1977). This theory entails, that every individual acts rationally and selects the option that is most beneficial for them, given that the choice presented is clear and participants possess all information needed (Domencich and McFadden, 1975). Furthermore, this information on the individual and alternatives can be represented by measurable attributes.

The participant is presented with alternatives that are chosen from a set of available alternatives. These alternatives all consist of a rational part V and a random part ϵ , this is represented in part by the utility function presented in Equation 3.1. Combined with the error term ϵ they give a certain utility to the alternative. Here U_{iq} is the total utility of the alternative i for the individual q . The rational part is further represented by Equation 3.2; this part is constructed by a sum of the attributes s_{ikq} scaled by a weight factor θ_{ik} , where the different attributes are presented by k .

$$U_{iq} = V_{iq} + \epsilon_{iq} \quad \forall i \in A(q) \quad (3.1)$$

$$V_{iq} = \sum_k \theta_{ik} \cdot s_{ikq} \quad (3.2)$$

Next, the individual q selects the maximum-utility alternative, in case of Equation 3.3 the individual chooses alternative i over alternative j .

$$U_i > U_j \quad i \neq j \quad \forall i, j \in A(q) \quad (3.3)$$

Due to the error term that is unique for each user and alternative combination, it is provided that different individuals can choose different preferred alternatives from the same alternative set presented.

3.2.1. Multinomial Logit

The Multinomial Logit (MNL) model is the most used and simple kind of discrete choice model. It defines the probability (P_i) of choosing alternative i (i) as:

$$P_i = \frac{e^{V_i}}{\sum_j e^{V_j}} \quad (3.4)$$

It is assumed that the error term is independently and identically distributed (i.i.d.). This is because the unobserved factors are uncorrelated within the alternatives, as they have the same variance Ortúzar and Willumsen (2011). The error term has therefore no influence on the choice probability between the alternatives in the model.

3.3. Discrete Choice Model with attitudinal variables

Since attitudes and preferences are of importance to understand the behaviour of individuals, traditional models aren't ideal for understanding *transport psychology*. This is why attitudinal attributes will be included, these are preferences and social constructs used to explain behaviour (Everett, 2013). These cannot be measured directly, as there is no clear defined scale and different participants with the same attitude will answer differently, leading to measurement errors.

To include attitudes and preferences in a discrete choice model (DCM) indicators can be used, as attitudes and perceptions cannot be observed directly. To measure the influence of attitudes and preferences on the utility an factor analysis (FA) is performed. After presenting participants with a likert scale for different indicators, an factor analysis (FA) can find indicators that explain attitudes that explain the indicators (Suhr, 2006). This indicator can then be used as input for the DCM, as shown in Figure 3.1 (Walker, 2001).

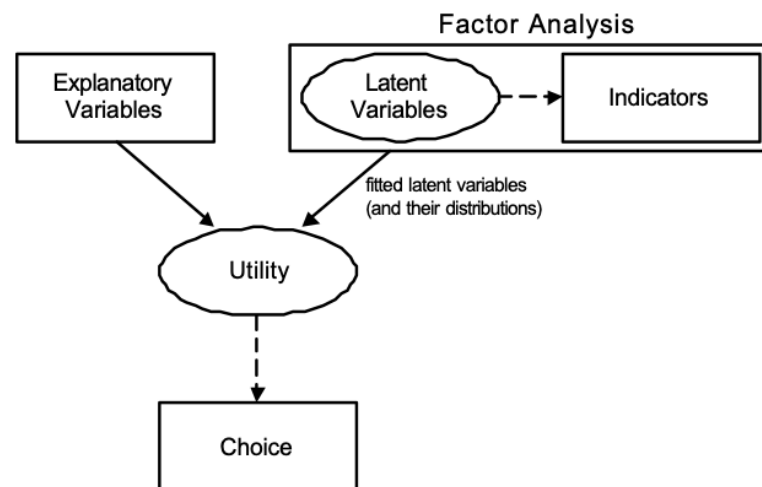


Figure 3.1: Overview of the DCM including indicators using FA (Walker, 2001)

The estimation of the indicators is done by exploratory factor analysis (EFA). EFA estimates the indicators without the use of hypotheses regarding the indicators. For this study the use of EFA is therefore needed, as there is no interest in the specific hypothesised indicators. The goal is to find as much common variance within the first factor (Suhr, 2006). Next, all subsequent factors need to provide as much variance as possible, until there is after several iterations no common variance left for the indicators. To extract factors from the input principal factor analysis (PFA) is used.

Factor rotation improves the interpretability of the FA as high factor loadings are maximized and low loadings are minimized (Henson and Roberts, 2006; Williams et al., 2010). There are two main types of factor rotation: orthogonal and oblique rotation (Suhr, 2006). Orthogonal rotation represent the axes in the factor space at an angle of 90 degrees. This method is simpler than an oblique rotation, yet it is accurate enough to explain an FA of this size. VARIMAX is the most common method of orthogonal rotation and ideal for the size of FA performed in this study. The method of factor rotation used is the VARIMAX method.

4

Survey design

This chapter describes what information is will be included in the survey and the process of how the survey has come about. The data needed for this kind of experiment is described in the first sections of this chapter. As discussed in chapter 2 working from home is determined by different variables. This information of the participants characteristics, preferences and stated choices is collected with the survey.

Firstly, the attributes to create the alternatives are discussed in section 4.1. The next part of the survey asks participants to answer questions about their personal situation. These parts of the survey are presented in the first three sections of this chapter.

In section 4.3 the choice of implementing the two contexts are discussed. What choices are made to include these contexts within the survey. Furthermore, the participants are asked to react to eight statements regarding COVID-19 and Working from Home (WfH). These are used to understand their positions on these two subjects. Some participants might act differently due to COVID-19 and WfH choices because of their perceptions of these factors, as discussed in chapter 2.

Next, the pilot survey is discussed, including what this means for the design of the survey, how this influenced the design and why. How the survey is composed will be explained in the last section as well as how this survey is presented to the public.

4.1. Alternatives

The choice participants have to make is between two alternatives that are described by the alternative variables shown in Table 4.1. The values of these choice attributes are altered for different choice alternatives and choices. This will result in a multitude of choices that the participants have to answer. The participants are asked, given a certain scenario (which is discussed in section 4.3), to choose between two schedules built from the attributes in the table below. For example, a participant could be asked to choose between a schedule of 4 days working from home and only receiving a high WfH contribution or working 2 days from home receiving both contributions and having the ability to work from home.

Table 4.1: Choice variables

Choice attributes	Attribute levels
Days working from home	[0,1,2,3,4,5]
Travel contribution	[€0.00/km, €0.19/km]
Work from Home contribution	[€0.-/day, €2.-/day, €4.-/day]
Ability to work flexible hours	[Yes, No]

4.1.1. Days working from home

The days spent working from home give an indication the amount of days that the participants will choose to work from home. The amount of days working from home is an indicator of how much time the participant will choose to spent at home or at the office. This is the main metric used to answer the

research question. The attribute levels are varied from zero to five days a week. The number of days are chosen as they give insight of the number of times an employee will travel and the amount of time spent at the office.

Bloom et al. (2015) found people's preference for the amount of days they want to be working from home to be two days. This is in line with the conclusion reported by NOS (2021). Because of these conclusions it is expected that the regression is not linear, therefore the coefficients in the model will be modelled as dummy variables. The attribute levels are the range of the days of a working week.

4.1.2. Travel and work from home contribution

Lastly, different contribution policies for working from home are introduced within the choice. This will indicate how useful contribution policies are for promoting different teleworking behaviour. Travel contribution might help getting employees to come to the office more regularly. Whilst work from home contributions (aimed at improving working conditions at home) might sway employees with less suited home offices to improve that place and work from home.

4.1.3. Ability to work flexible hours

The ability to work flexible hours might influence peoples motivation to work at least partly at the office. This is usually seen as attractive to parents with school going children, work at the office during school hours and at home if the children are at home (Baxter, 2011). The attribute flexible office hours is introduced as it indicates the time spent at the office.

4.2. Socio-demographic variables

Age, gender, income and education describe the individual. These are some social-economic influences on the choice to work from home (Baruch and Nicholson, 1997). Travel time, household members, daycare availability and study room availability at home are variables that describe the home and family. The travel time between home and work is a metric that we expect to influence working from home negatively. Household members, daycare and study room availability are variables indicate how suitable the household is to work from home.

4.2.1. Personal characteristics

The personal characteristics of individual participants that have to be collected are presented in the Table 4.2. These explanatory variables include personal information such as age, gender and income. These factors give a quantitative description of the participants. Also, information on the participants organisation and home are collected. These characteristics will be used to estimate the model.

Table 4.2: Personal characteristics

Personal characteristics	Value
Age	[Open question]
Gender	[Categorical]
Income	[Categorical]
Education	[Categorical]
Travel time	[Categorical]
Possibility to work from home	[Yes, No]

The age of the participant will be an open question. Gender, income, education and travel time will be presented categorical. The income will be presented in brackets of €10.000 up to €100.000 and one up to €150.000 and one higher. Education will include the options of all the schooling levels in the Netherlands. Lastly, travel time is ordered in brackets of 30 minutes, with the highest bracket 90 minutes or longer.

4.2.2. Household characteristics

The other set of explanatory variables have to do with the household of the participants. These characteristics have, as discussed in chapter 2, influence on the decision. More members in the household and lesser accommodations in the home office influence the decision to work from home negatively.

Table 4.3: Household characteristics

Household characteristics	Value
Household members	[Open question per category]
Separate work space at home	[Yes bedroom; Yes, office; No]
Rating home office	[1-10]
Rating work office	[1-10]

The participants are asked how many members the household has per age group and if they have a separate work space at home, either a home office or a workspace in the bedroom. Lastly, they are asked to rate both their home and work office.

4.2.3. Past work from home behaviour

To understand if there has been a shift in behaviour it is interesting to collect data of working from home behaviour in the last month before February. These won't be used in the model itself, but can be used to compare the current preferences to the pre-COVID-19 behaviour.

Table 4.4: Past information on working from home

Information working from home pre-COVID-19	Value
Number of days worked at home per week on average (February 2020)	[Categorical]
Received travel contribution in February 2020	[Yes, No]
Received work from home contribution in February 2020	[Yes, No]
Did employer allow working from home in February 2020	[Yes, No]

4.3. Context

The first part of choices in working conditions are complemented by different contexts that describes the COVID-19 situation and commuting conditions. The variable describing the state of the pandemic, presents different situations that consider the infection rate and the hospitalization rate. How this attribute was constructed is included in this section. The participants have to select their preferred alternative within a multitude of choices, these will be grouped into the different contexts that are made up from the different combinations of the variables.

4.3.1. COVID-19 risk

As the infection rate and the hospitalization rate are dependent of each other it makes sense to provide the participants with combined scenarios of these two attributes as context, corresponding with the different scenarios. These contexts for COVID-19 are presented in Table 4.5. This context of COVID-19 is of importance to understand the influence of the pandemic on the choice to work from home and is therefore included.

Table 4.5: Contexts chosen for the survey, based on corresponding points in time.

COVID-19 risk	Period	Infections (/100.000)	Hospitalizations (/1.000.000)
Low	Begin September 2021	20	30
Medium	Mid July 2021	60	30
High	Late November 2021	120	120

4.3.2. Crowding in public transport

The crowding at the time of travelling is indicated. It is interesting to see what effect the crowding will have with the preference to work from home. It might also have an interaction with the COVID-19 situation, the pandemic could exacerbate the influence of crowding as people try and avoid crowding more. This could result in people choosing working flexible hours as this helps them to avoid rush hour. Two levels will be provided either no crowding, where commuters are guaranteed to find a seat, and crowding, where no seating options are available.

4.3.3. Scenario design and corresponding context variables

With three levels of COVID-19 risk and two levels of crowding in public transport, there are six possible combinations of scenarios. The alternatives are presented in six groups that are rotated over six groups of participants, as indicated in Table 4.6.

Table 4.6: Blocks presented to each group

Group	1	2	3	4	5	6
Low COVID-19 risk, no crowding	1	2	3	4	5	6
Low COVID-19 risk, crowding	2	3	4	5	6	1
Medium COVID-19 risk, no crowding	3	4	5	6	1	2
Medium COVID-19 risk, crowding	4	5	6	1	2	3
High COVID-19 risk, no crowding	5	6	1	2	3	4
High COVID-19 risk, crowding	6	1	2	3	4	5

4.4. Attitudes and perceptions

The survey will also include questions that serve as indicators for the attitudes people have pertaining to COVID-19. The perception that is included is expected to have influence on the choice to work from home. The wariness of COVID-19 is important to understand how worried participants are about COVID-19 in the latter stages of the pandemic, how are certain participants still affected in their choice by the pandemic as infections drops .

The indicators included in the survey are shown in Table 4.7 translated from Dutch. These indicator questions will be posed as a statement and has to be answered using a likert scale of 1 to 7.

Table 4.7: Perceptions and indicators

Perceptions	Indicator
COVID-19	How much do you worry about getting infected with COVID-19?
	How much do you worry about getting seriously ill or deceasing due to a COVID-19 infection?
	How much do you worry about friends and family getting infected with COVID-19?
	How much do you worry about friends and family getting seriously ill or deceasing due to a COVID-19 infection?
	How much do you worry about the spread of COVID-19 in the Netherlands?
	How much do you worry about infecting friends and family when u are infected with COVID-19?
	How much does the threat of COVID-19 influence your decision to attend events?
	How much does the threat of COVID-19 influence your decision to travel using public transport?

4.5. Pilot study

After the attributes and their corresponding levels had been chosen, an experimental survey has been constructed, using the software package of Ngene similar as discussed in subsection 3.1.4, to test the survey. This was done to make sure that the choices made sense, to see if the questions are understood by the test respondents and if we can find priors for survey generation of the main design. The pilot study collected 31 results in total.

Test respondents mainly commented on the instructions given in the introduction of the survey. This feedback was used to rewrite the introduction to clearer explain the task that the respondents are given.

The most difficulty test respondents had, was with understanding the scale of crowding in public transport as used by the NS. To mitigate this difficulty the attribute was reduced from having three levels to two levels. This attribute indicates if there is the possibility of a seat in the public transport.

Other test respondents had questions about the vaccination rate, as this is, with the need for boosters, becoming a more complex variable; one is not simply protected as well by one shot as with three shots. The vaccination rate was scrapped from the final survey, and COVID-19 scenarios were simplified as discussed in subsection 4.3.3.

4.6. Survey construction

To generate the choice alternatives, the software package Ngene is used, as mentioned in subsection 3.1.4. The code used for this generation, is shown in Appendix A. The attributes found in the pilot study were used as priors in the survey generation. Six blocks were created, the same number as scenarios included in the study, to rotate the groups of choices with the scenarios, as described in subsection 4.3.3. This results in choices included in the survey, as shown in Appendix B. An example of a question posed in the survey is presented in Appendix C, in this example the participant is asked to choose between working either four days from home with flexible hours and a travel compensation and a high WfH compensation, and working one day from home without flexible hours, no travel compensation and a normal WfH compensation, given there is a high COVID-19 risk and a low chance of a seat in transit.

5

Data analysis and results

The data collected with the survey is discussed in this chapter. Firstly, the collected data will be presented and summarized in a descriptive analysis. This is followed by the exploratory factor analysis on the answers regarding the perceptions of the participants on COVID-19. Next, the estimation results are presented, this is the regression of the estimation of the discrete choice model.

5.1. Descriptive analysis

The survey responses were gathered over the month of March 2022. It was distributed by means of different social media platforms. In total 138 respondents responded to the survey and 68 of those met the criteria that were posed in subsection 3.1.1. The 68 respondents all completed the entire survey. Of those turned away it was because they responded negative to one or more of the following questions:

- Is it possible to work from home in your line of work? (14 times)
- Do you work at least 4 days a week? (21 times)
- Do you travel to work mainly using public transport? (78 times)

5.1.1. Socio-demographic characteristics of the respondents

The descriptive analysis of respondents is discussed in this section. Table 5.1 shows the social-demographic analysis of the respondents. It is clear that the pool of participants is not equally distributed over all characteristics. The other characteristics are better distributed. Income is distributed as expected for the social-demographic group of most common respondents (20-39 years, higher educated).

Lastly, the household members don't seem to be distributed equally. People generally live with roommates/partners that are about the same age, as expected having less household members that are 40 or older has to do with the distribution of the respondents themselves. Three groups can be distinguished:

- People that live alone (11)
- People that share a house hold (57)
 - *of which have children (9)*

Table 5.1: Socio-demographic analysis of the respondents

Socio-demographic characteristics	Categories	% of respondents (#of respondents)	/population [statline CBS]
Gender	Women	49% (33)	50%
	Men	49% (33)	50%
	Other	2% (1)	
	Don't want to say	2% (1)	
Age	20 years or younger	0% (0)	8 %
	20 to 29 years	50% (34)	17 %
	30 to 39 years	32% (22)	16 %
	40 to 49 years	6% (4)	17 %
	50 to 59 years	3% (2)	19 %
	60 years or older	9% (6)	23 %
Income	Less than €20.000	16% (11)	24 %
	€20.000 to €29.999	7% (5)	31 %
	€30.000 to €39.999	21% (14)	24 %
	€40.000 to €49.999	24% (16)	12 %
	€50.000 to €59.999	10% (7)	5 %
	€60.000 to €69.999	12% (8)	2 %
	€70.000 to €79.999	7% (5)	1 %
	€80.000 to €89.999	2% (1)	1 %
	€90.000 and higher	2% (1)	0 %
Education	Primary school	0% (0)	8 %
	Secondary school - lower grade	0% (0)	18 %
	Secondary school - higher grade	6% (4)	38 %
	HBO/BSc	10% (7)	22 %
	MSc or higher	84% (57)	13 %
Travel time to the office	less than 15 min	4% (3)	
	15-29 min	15% (10)	
	30-44 min	22% (15)	
	45-59 min	22% (15)	
	60-74 min	16% (11)	
	75-89 min	28% (19)	
	90 min or longer	9% (6)	
Household members	4 years or younger	7% (5)	
	5-11 years	4% (3)	
	12-17 years	2% (1)	
	18-29 years	47% (32)	
	30-39 years	29% (20)	
	40-49 years	4% (3)	
	50-59 years	7% (5)	
	60 years or older	3 % (2)	
Home situation	Lives alone	16% (11)	
	Has roommates	84% (57)	
	<i>of which have children</i>	13% (9)	

5.1.2. Descriptive analysis of work behaviour

The survey also included questions about the work environment and work behaviour of the participants: these results are presented in Table 5.2.

The data in Table 5.2 shows us the shift in Work from Home (WfH) behaviour that has occurred due to COVID-19, this is shown in Figure 5.1. A clear shift in the number of days working from home can be seen in the number of days that respondents WfH. Where it was around one day a week on average before the pandemic, now the average is almost three days a week. Clearly there has been a shift in remote work in the past two years.

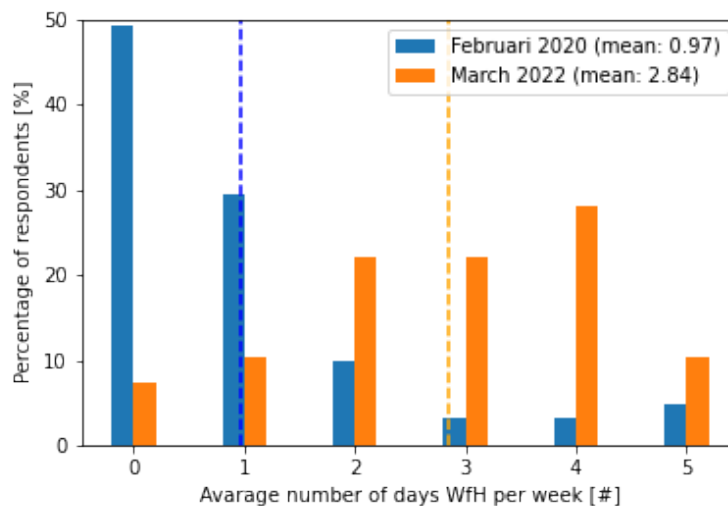


Figure 5.1: Number of days worked from home for 2020 and 2022

Another factor in work behaviour is the availability of different contributions, these are a contribution to the travel costs and a contribution for working from home. It is possible that employers use the space offered by the government in tax exemptions (Rijksoverheid, 2022b). Figure 5.2 compares the percentile change of contributions offered by employers. What is clear is that the pandemic has had a profound impact on the contribution for WfH provided by employers.

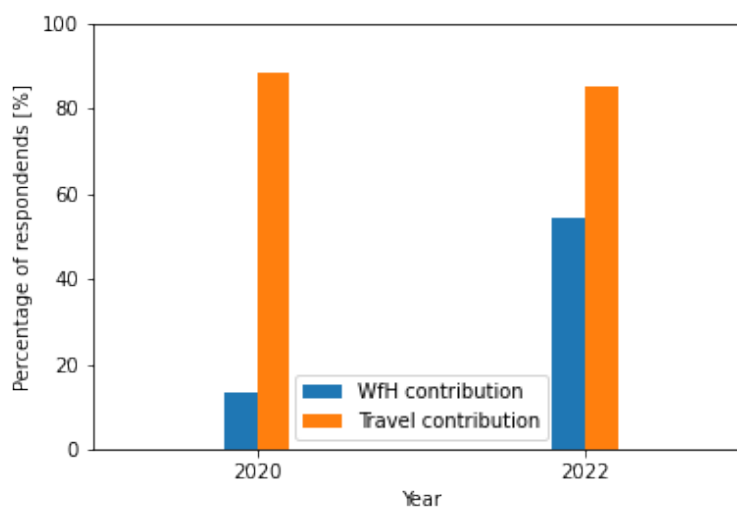


Figure 5.2: Change in contributions offered by employers between 2020 and 2022

Interesting is to see that the influence is of this change in contributions on the actual behaviour of the participants, this is shown in Figure 5.3. It seems that participants receiving WfH contributions are more likely to work more days from home; on average they work a whole day more from home than participants not receiving WfH contribution. If this is directly influenced by the contribution or if it has to do with the fact that offices offering WfH contribution are more facilitating to working from home cannot be said based on this information. This is further supported by the fact that the correlation between the

two distributions is low (0.24).

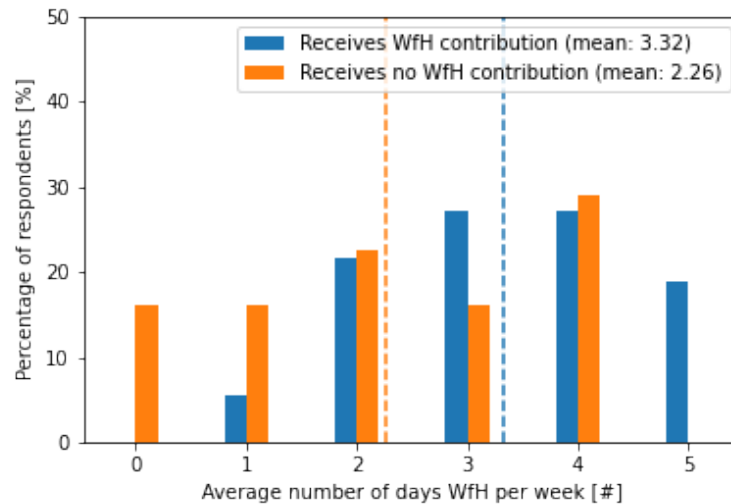


Figure 5.3: Influence of WfH contribution in March 2022 on the number of days worked from home

Interesting is to see that there is little difference in the number of days working from home between the group receiving and not receiving a travel contribution, this can be seen in Figure 5.3 and also the correlation between the two distributions is quite high and has a reasonable CI (0.77 [0.07]). The average number of days WfH is ever so slightly higher when participants receive a travel contribution.

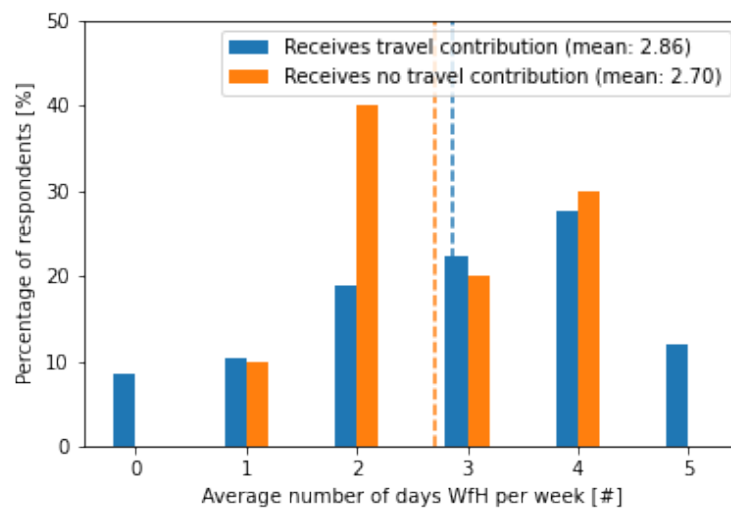


Figure 5.4: Influence of travel contribution in March 2022 on the number of days worked from home

The last characteristics are focused on the quality of the home office, a majority of the participants (53%) don't have a secluded room to work at home. Of those that have a secluded space, 31% have a home office whereas 16% use a secluded room they work from for another purpose as well, for

example a desk in the bedroom. Figure 5.5 shows that it is unlikely that the availability of a home office or secluded room influences the preference to work from home.

The participant's own rating of their work spaces appears to be a better metric in predicting their choice to work from home. When participants are asked how they rate their home and work office, the participants that rate their home office higher work on average more days from home, this is further supported by the weak correlation (-0.09). The question remains however if these people have invested more in their home office because they work more from home or if they want to work more from home because of their home office.

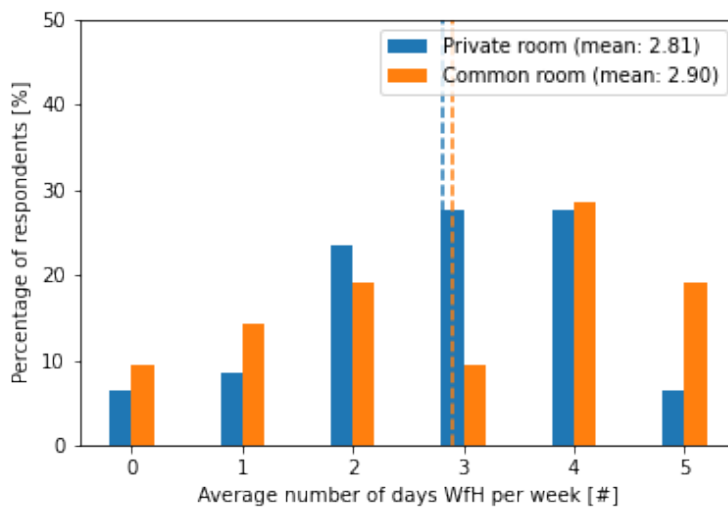


Figure 5.5: Relation of the type of home office on the number of days worked from home

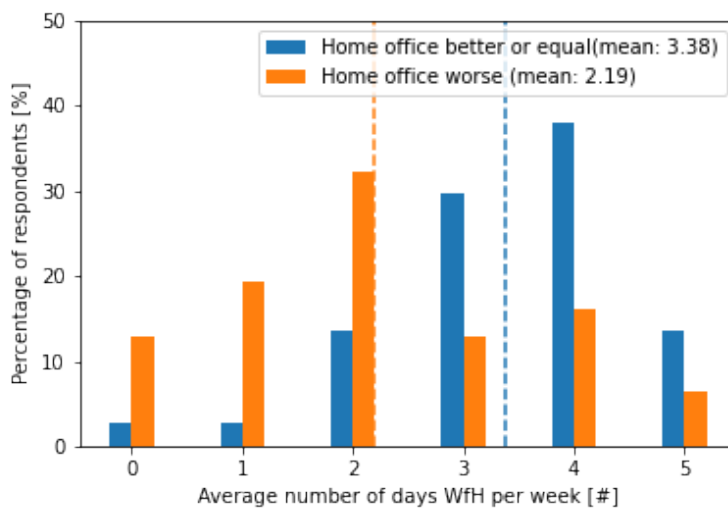


Figure 5.6: Relation of the rating of the home office on the number of days worked from home

Table 5.2: Analysis of work related characteristics

Work related characteristics	Categories	% of respondents (# of respondents)	/population
Days WfH in 2020	0	49% (30)	
	1	30% (18)	
	2	10% (6)	
	3	3% (2)	
	4	3% (2)	
	5	5% (3)	
Days WfH in 2022	0	7% (5)	
	1	10% (7)	
	2	22% (15)	
	3	22% (15)	
	4	28% (19)	
	5	10% (7)	
Change in days WfH	Fewer days from home	18% (11)	
	No change	5% (3)	
	More days from home	77% (47)	
Travel contribution in 2020	Yes	89% (54)	
	No	12% (7)	
Travel contribution in 2022	Yes	85% (58)	
	No	15% (10)	
WfH contribution in 2020	Yes	13% (8)	
	No	87% (53)	
WfH contribution in 2022	Yes	54% (37)	
	No	46% (31)	
Allowed to WfH in 2020	Yes	77% (47)	
	No	23% (14)	
Workspace at home	Works from dedicated study	31% (21)	
	Works from secluded room	16% (11)	
	Works from common area	53% (36)	
Difference in workspace rating	Office workspace better	38% (26)	
	Home workspace better	46% (31)	
	Equal rating	16% (11)	

5.2. Exploratory factor analysis

To understand if the COVID-19 situation influences the decision to work from home it is good to understand what influences the risk perception of COVID-19. Part of the survey was used to collect peoples perception of COVID-19. To understand the perceptions of participants indicator questions are introduced. These help to model the perception of the participants of the risks involved with COVID-19. The questions (translated from Dutch) used in the survey are:

- Protect1: How much do you worry about friends and family getting seriously ill or deceasing due to a COVID-19 infection?
- Protect2: How much do you worry about infecting friends and family when u are infected with COVID-19?
- Control1: How much does the threat of COVID-19 influence your decision to attend events?
- Control2: How much does the threat of COVID-19 influence your decision to travel using public transport?
- Infect1: How much do you worry about friends and family getting infected with COVID-19?
- Infect2: How much do you worry about getting infected with COVID-19?
- Infect3: How much do you worry about getting seriously ill or deceasing due to a COVID-19 infection?
- Infect4: How much do you worry about the spread of COVID-19 in the Netherlands?

To provide information about this perception, part of the survey was designed to understand people's perceptions. First part of this section is focused on the question if these questions provided suitable information to understand this perception. The suitability for factor analysis is included in Appendix D. Now the number of factors that will be used is known, a factor analysis can be performed. Table 5.3 shows the results of the factor analysis, factor loading lower than 0.3 are being repressed in the table as they do not influence the factors significantly.

The two factors that are found can be represented with two attitudes. The first factor will be called *Protect*, as the variables that influence this factor have to do with the influence of COVID-19 on this group. The second factor, is loaded most by factors related to risk taking of the participant or how much control they retain, such as attending events and public transport. This factor will be called *Control*. All indicators are sufficiently loaded, therefore none are excluded.

Table 5.3: Exploratory factor analysis

	Protect	Control
Protect		
Protect1	0.82	
Protect2	0.67	
Control		
Control1		0.90
Control2		0.74
Infect		
Infect1	0.79	0.36
Infect2	0.52	0.56
Infect3	0.42	0.39
Infect4	0.39	0.36

5.3. Estimation results

To find the best model to estimate the model, multiple models are tested and compared. These models are based on the conceptual model (Figure 5.7). The context and personal perceptions are respectively added in model 2 and model 3. The first part of this section shows what the different models yield and discusses the difference between them. After settling on the model most suited for this research, the results of that model are presented in the latter part of this section.

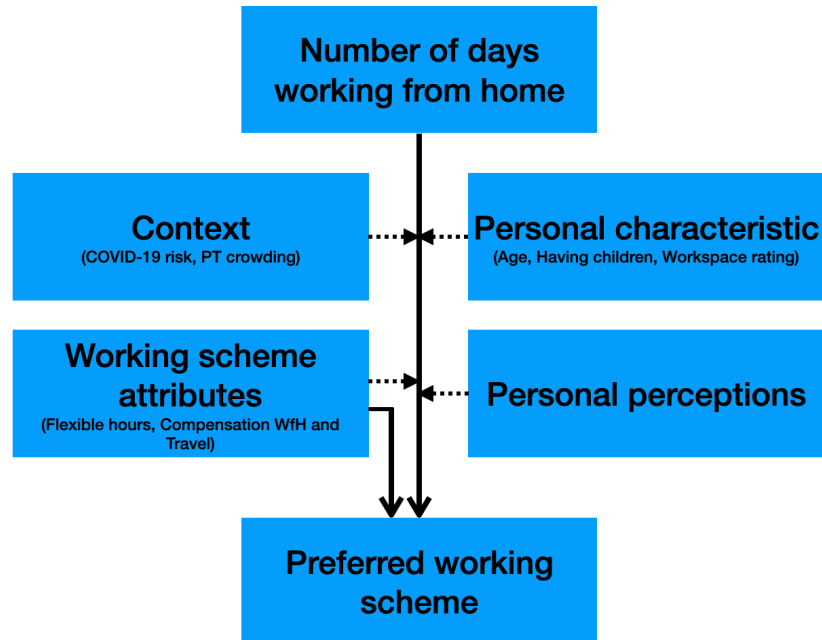


Figure 5.7: Conceptual model

5.3.1. Model comparison

Three different models are considered as part of this thesis. The first is a base multinomial logit (MNL) model, that only includes the attributes presented to the participants in the survey as well as the interactions with days of these attributes. All office policies influence the decision of the participant in two manners. First, just the existence of a compensation offers a positive addition to the utility function. On top they influence the number of days that the participant wants to work from home. If they receive a compensation to work from home, they are more likely to work from home and if they are paid to travel to the office, they are less likely to work from home. This is included as an interaction between the office policies and the number of days. The utility function for this model is shown in Equation 5.1.

$$\begin{aligned}
 U_i = & (\beta_{days} + \beta_{age,days} * age + \beta_{children,days} * children + \beta_{workspace,days} * workspace \\
 & + \beta_{trvlc,days} * trvlc + \beta_{wfhc,days} * wfhc) * days_i \\
 & + \beta_{trvlc} * trvlc + \beta_{wfhc} * wfhc + \beta_{flex} * flex
 \end{aligned} \tag{5.1}$$

Next, the base MNL model is extended with the different contexts: the state of the COVID-19 pandemic and crowding in public transport. These contexts are introduced as an interaction with the number of days. As the state of the pandemic is the same for both alternatives their direct influence on the utility function is canceled out. However, as the pandemic has influence on the number of days people work from home, the state of the pandemic can be introduced as an interaction. The same method is used to include the crowding in public transport into the model. The utility function of this model can be seen in Equation 5.2.

$$\begin{aligned}
U_i = & (\beta_{days} + \beta_{age;days} * age + \beta_{children;days} * children + \beta_{workspace;days} * workspace \\
& + \beta_{covid;days} * covid + \beta_{crowding;days} * crowding \\
& + \beta_{trvlc;days} * trvlc + \beta_{wfhc;days} * wfhc) * days_i \\
& + \beta_{trvlc} * trvlc + \beta_{wfhc} * wfhc + \beta_{flex} * flex
\end{aligned} \tag{5.2}$$

The third model is also an MNL model. This one is extended with the perceptions that were found in the EFA that was discussed in section 5.2. These scale the influence the state of the pandemic has on the number of days participants choose to work from home. Equation 5.3 shows the utility function for this model.

$$\begin{aligned}
U_i = & (\beta_{days} + \beta_{age;days} * age + \beta_{children;days} * children + \beta_{workspace;days} * workspace \\
& + (\beta_{covid;days} + \beta_{protect;covid;days} * protect + \beta_{control;covid;days} * control) * covid \\
& + \beta_{crowding;days} * crowding + \beta_{trvlc;days} * trvlc + \beta_{wfhc;days} * wfhc) * days_i \\
& + \beta_{trvlc} * trvlc + \beta_{wfhc} * wfhc + \beta_{flex} * flex
\end{aligned} \tag{5.3}$$

In Table 5.4 it can be seen that the indicators of the model overall improve for every model that is more complicated. For the first step where the scenario is introduced this is quite a leap if you consider the LL. The improvement to the second model seems much smaller however. When performing a Log Likelihood ratio test the extra attributes do result in a better explanation of the data.

Table 5.4: Estimation results

Attributes	Base MNL		MNL and Scenario		MNL and Scenario + LV	
	Value	p-value	Value	p-value	Value	p-value
β_{days}	0.555	0.00	0.223	0.01	0.232	0.05
β_{trvl}	0.696	0.00	0.702	0.00	0.668	0.00
β_{wfhc}	1.036	0.00	1.070	0.00	1.070	0.00
β_{flex}	0.214	0.00	0.224	0.00	0.229	0.00
Characteristics						
$\beta_{age;days}$	0.071	0.01	0.081	0.00	0.064	0.00
$\beta_{children;days}$	0.346	0.00	0.386	0.00	0.386	0.00
$\beta_{rating;days}$	0.132	0.00	0.138	0.00	0.136	0.00
Interaction						
$\beta_{trvl;days}$	-0.358	0.00	-0.368	0.00	-0.368	0.00
$\beta_{wfhc;days}$	-0.189	0.00	-0.195	0.00	-0.196	0.00
Contexts						
$\beta_{covid;days}$			0.253	0.00	0.186	0.08
$\beta_{crowding;days}$			0.185	0.00	0.189	0.00
Perception						
$\beta_{protect;covid;days}$					-0.034	0.02
$\beta_{control;covid;days}$					0.052	0.00
$LL(\beta)$	-703.21		-676.09		-669.88	
$LLR - test$			0.079	[>95%]	0.018	[>99%]

5.3.2. Estimated parameters

This part discusses the estimation results of the MNL model, these parameters describe how these variables influence the decision making process. The values discussed can be seen in Table 5.4. This results in the following model:

$$\begin{aligned}
 U_i = & (0.232 + 0.064 * age + 0.386 * children + 0.136 * workspace \\
 & + (0.186 - 0.034 * protect + 0.052 * control) * covid \\
 & + 0.189 * crowding - 0.368 * trvlc_i - 0.196 * wfhc_i) * days_i \\
 & + 0.668 * trvlc_i + 1.070 * wfhc_i + 0.229 * flex_i
 \end{aligned}
 \tag{5.4}$$

Choice attributes

The first attributes that are discussed are the choice attributes. These are the attributes that are different between the alternatives presented in the survey to the participants.

Days

The number of days are the most important variable in the research as most variables have a direct relation with the amount of days worked from home. The estimation describes, that there is a tendency to work more days from home in the Base MNL model, but a negative influence in the other models. This can be explained by the lack of description of the COVID-19 situation, with low COVID-19 the participants actually seem to prefer working at the office over working from home. Interesting is the interaction of other variables with the amount of days working from home. These interactions are further discussed at the sections about the different variables.

Travel contribution

The existence of a travel contribution has a high influence on the utility, this means that participant value the existence of a travel contribution, independent of the number of days they choose to work from home. A travel contribution has a positive effect on the utility. Besides that, it is clear the interaction of travel contribution with number of days working from home has a negative utility, which results in a schedule with more days spent working at home with a travel contribution having a lower utility.

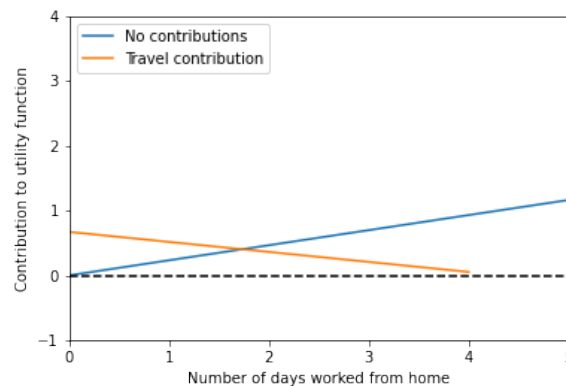


Figure 5.8: Influence on the utility due to travel contribution

Work from home contribution

As goes for the travel contribution, the contribution to work from home promotes the choice for the specific alternative and raises the utility, despite the number of days that actually is worked from home. What is more interesting, is that there is a small negative utility for the interaction of the work from home contribution with the number of days worked from home. This could be caused by this factor being linear and participants not wanting to work 5 days from home. This could be prevented by not having a linear contribution of days in the interaction, however the number of respondents for this research were too little to implement this in the model.

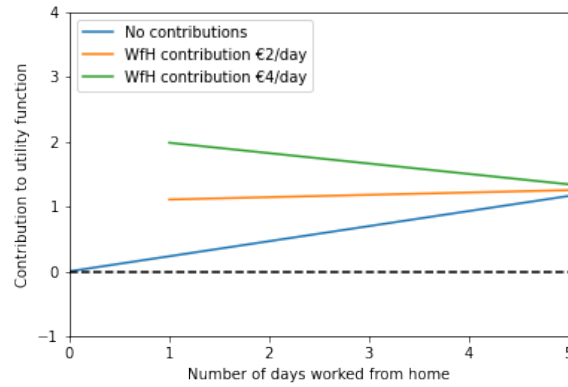


Figure 5.9: Influence on the utility due to WfH contribution

Ability to work flexible hours

The last observable variable is the ability to work flexible hours. A small contribution to the choice independent of the number of days was found. An interactions with the number of days or another attribute was not found, with other words no matter if the participant works from home or the office, they prefer to have flexible office hours.

$$0.229 * flex_i \tag{5.5}$$

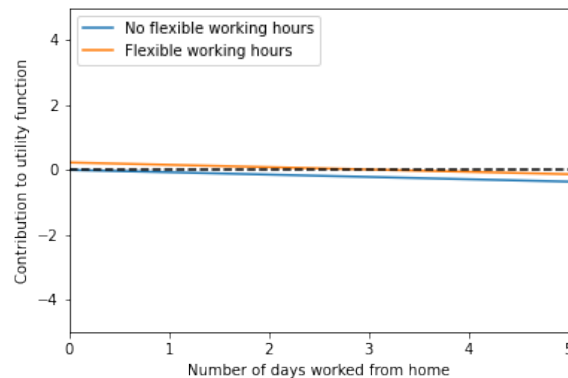


Figure 5.10: Influence on the utility when allowed to work flexible hours

Personal characteristics

The behaviour can partly be explained by measurable characteristics of the participants. There are three characteristics that were gathered in the survey that can be used in the model. These are discussed below. These personal characteristics are fixed to the individual and cannot be changed between alternatives and as an result of this cannot be included utility function on their own. It is found that they interact with the number of days that participants choose to work from home. How they are included is discussed per attribute below.

Age

The first personal characteristic discussed is age. Age has an interaction with the number of days working from home, this is included in the model as follows:

$$(0.232 + 0.064 * age) * days_i \tag{5.6}$$

The attribute orders the participants in age groups, as shown in Table 4.2. These groups are included as a number between 0 and 5, for each group the influence of the number of days working from home

is scaled. There is a higher utility for the interaction of older people with number of days working from home.

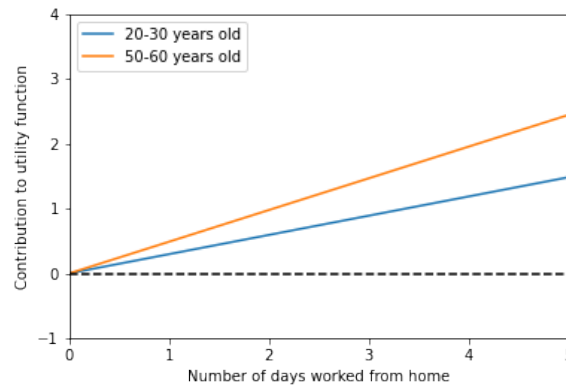


Figure 5.11: Influence of the interaction between age and days working from home on the utility

Children

Like with the characteristic of age, the attribute of having children has an interaction with the number of days working from home which results in a positive utility. This is included in the utility function as follows:

$$(0.232 + 0.386 * children) * days_i \quad (5.7)$$

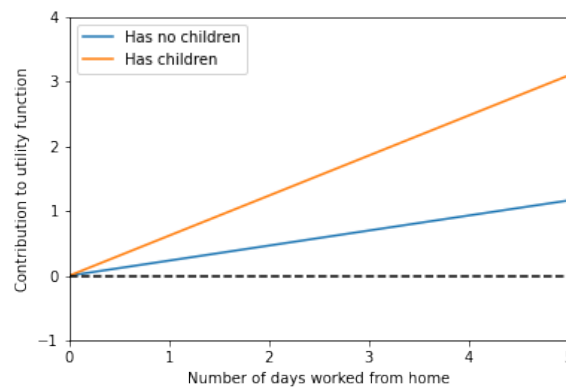


Figure 5.12: Influence of the interaction between having children and days working from home on the utility

Relative rating of the home office

In the survey the participant was asked to rate both the work and home office. These could be included on their own. However, it seems that the difference between these scores are more telling. The hypothetical range of this attribute is between -9 and 9. The lowest resulting from a work office rated 9 points better than the home office, and the highest meaning that the home office being better rated with 9 points. In practice the scores vary between -6 and 5.

This attribute was included quite similar to the other personal attributes. Following from the inclusion as follows:

$$(0.232 + 0.136 * rating) * days_i \quad (5.8)$$

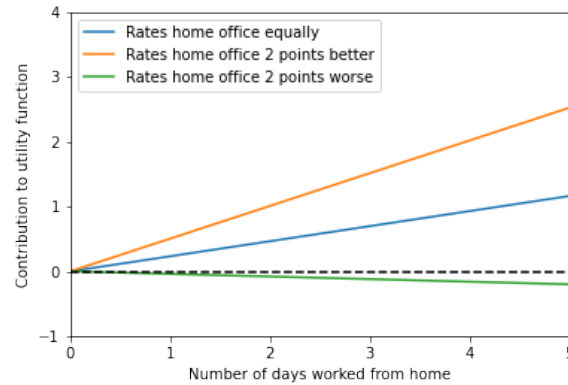


Figure 5.13: Influence of the interaction between the rating of the office spaces and days working from home on the utility

Contextual attributes

Two context variables were included in the survey: crowding in public transport and the state of the COVID-19 pandemic. The results of including these context in the model are discussed in this section. They both interact with the number of days that people want to work from home.

State of the COVID-19 pandemic

There is a interaction between the days that participants work from home and the COVID-19 risk. When the state of the pandemic is no risk, participants have a preference to work from the office more days, but as the state of the pandemic worsens, preference to work from home increases, and, as can be seen in Figure 5.14, with medium COVID-19 risk the favourability of working from home is higher than working at the office.

$$(0.232 + 0.186 * covid) * days_i \tag{5.9}$$

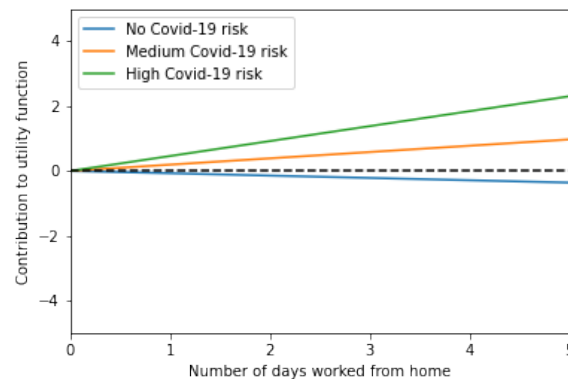


Figure 5.14: Influence on the utility for different states of the COVID-19 pandemic

Crowding in public transport

The influence of crowding in public transport on the utility is as expected. The believe that crowding in public transport would deter participants from choosing to work most days at the office seems to be true. As can be seen in Figure 5.15, the preference of participants to work from the office is canceled out by the interaction of crowding in public transport with the number of days that participants work from home.

$$(0.232 + 0.189 * crowding) * days_i \tag{5.10}$$

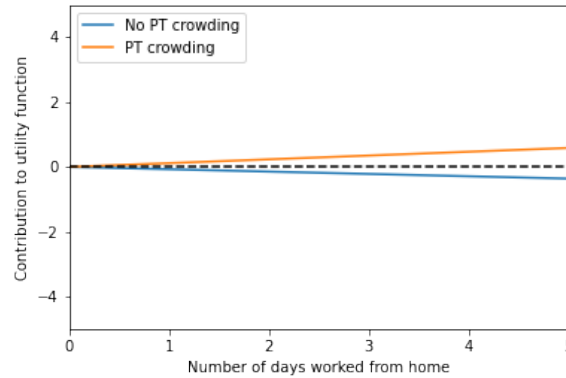


Figure 5.15: Influence on the utility of crowding in public transport

Attitudinal variables

The factor analysis in section 5.2 identified two perceptions from the survey: protect and control. They both interact with the state of the pandemic and the number of days. This is described by the following part of the model:

$$(0.232 + (0.186 - 0.034 * protect + 0.052 * control) * covid) * days_i \quad (5.11)$$

Protect

The first one, named *Protect*, shows that people that answered they worry about family and friends in the pandemic more, seem to weigh working fewer days from home more than other participants. This is found by the utility of the interaction of the number of days working from home, the state of the pandemic and the indicators for this perception.

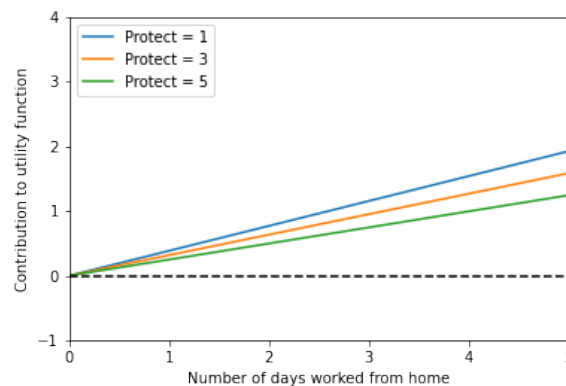


Figure 5.16: Influence of perception of the COVID-19 pandemic on working from home

Control

The interaction of the perception of the participants' own control on the situation by joining events with the number of days and the COVID-19 situation seems to work as expected. This perception called *Control* shows that people that think less about the pandemic when participating in events, seem to weigh the number of days working at the office more as there is a higher state of pandemic, as goes for the opposite, as can be seen in Figure 5.17.

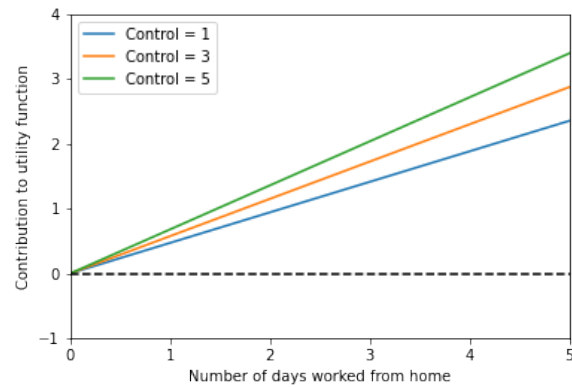


Figure 5.17: Influence of perception of the COVID-19 pandemic on working from home

Interestingly however, when people score the indicators both high or low, the influence of these perceptions seem to provide a total that is expected, as can be seen in Figure 5.18.

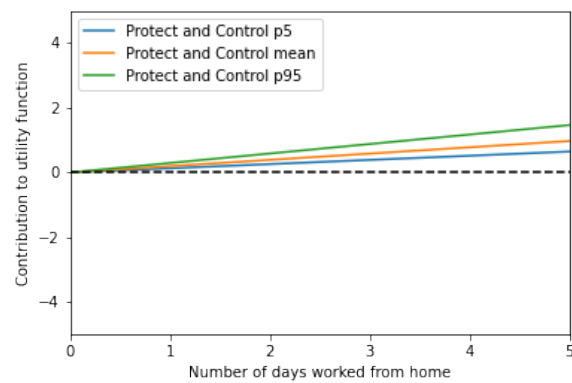


Figure 5.18: Influence of attitude on the COVID-19 pandemic

5.3.3. Conclusion

These estimates give an insight in the contribution of the different factors within the choice the employees will make. However, these are mostly in line with what would be expected of these factors with some notable exceptions which will be discussed in chapter 7. However, to gain a more useful insight of the model a simulation is needed. This is done in the next chapter.

6

Simulation

To understand the implications of the different parts of the utility functions, as found in subsection 5.3.2, a simulation is performed to give an indication of the influence of different policies on the decisions of different hypothetical alternatives. This is done by estimating the probabilities of participants choosing a particular workweek including policies over the 'standard week'. This standard week with standard policies is the most prevalent situation from the revealed preference. The standard week considered is a week where the participant works two days from home, receives a travel contribution of €0.19 per kilometer a day, a WfH contribution of €2.- a day and does not have the option to work flexible hours. This week is shown in gray within the figures of this chapter.

6.1. Office policy preference

First of all, the influence of office policies. These are contributions to travelling and working from home, and the ability to work flexible hours. These are the three attributes in the study that can be changed by the employer. The other attributes are fixed with the employee or are contextual and therefore can't be influenced. As was found in chapter 2, employees are influenced by company policies. All attributes considered influence the choice to work from home.

6.1.1. Work from home contribution

Figure 6.1 shows different policies for compensations for working from home. For each amount of compensation all possible number of days to work from home are shown on the x-axis. The y-axis shows the probability of choosing this alternative over the "standard workweek" as mentioned before in chapter 6

Figure 6.1 shows that people generally prefer any alternative where a €4.00 a day compensation is offered even when they don't work any days from home. When they receive €2.00 a day the working more from home than the base scenario is preferred. However, it should be noted that some individuals will still choose to work five days from home as the probabilities are fairly close.

When no compensation is offered, all options are less preferred than the current standard with a €2.00 compensation. It seems that compensation actually can make a big difference in the preference of employees. There are quite pronounced differences in probability in certain scenarios.

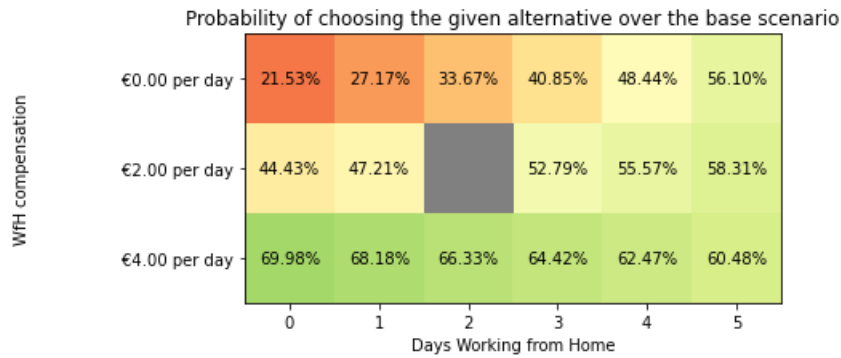


Figure 6.1: Simulated influence of WfH contribution on WfH choice

6.1.2. Travel contribution

It is clear that the travel contribution impacts the preference for working from home as well. When people aren't paid to travel to work, they are more likely to work from home more days than choosing the former regular workweek, as is shown in Figure 6.2.

When both receiving a contribution to work from home and travel, people prefer the one day over the base scenario. Whereas, when no travel contribution is received, individuals show on average to slightly prefer to work from home three days or more from home. It should be noted that probability means that there is a chance employees will opt for the less probable option.

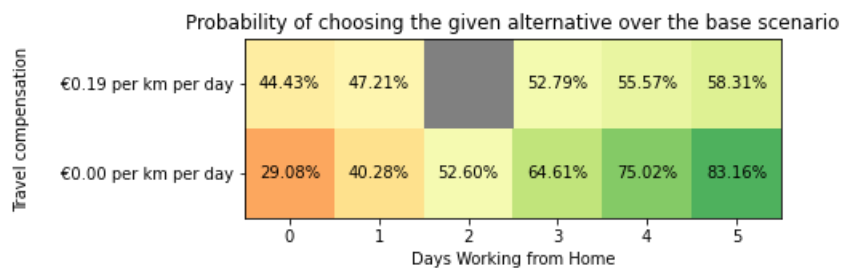


Figure 6.2: Simulated influence of travel contribution on WfH choice

6.1.3. Flexible hours

The possibility to work other hours than the usual nine-to-five working day has a small influence, but is independent of the number of days working from the office. Flexible office hours are however slightly preferred; this results in working from home three days with flexible hours and working from home two days without flexible hours a toss-up.

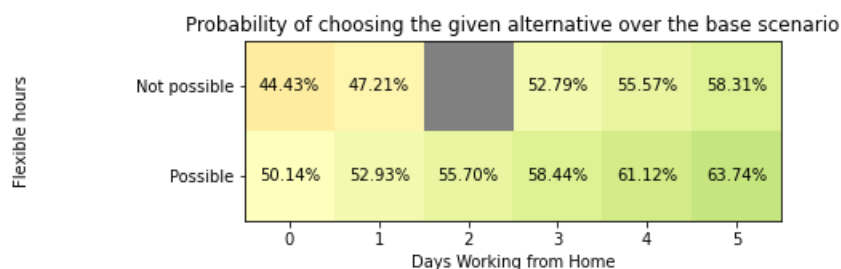


Figure 6.3: Simulated influence of flexible working hours on WfH choice

6.2. Personal characteristics influence

Next, the personal characteristics of the employee are considered. These are either fixed to the employee or can't be easily changed. However, they influence the preference for different schedules.

As these can't be changed, the different characteristic groups compare the different number of days working from to working 2 days from home.

6.2.1. Age

The first one considered is age. The participants are ordered in six groups as presented in subsection 5.1.1. Interestingly a higher age seems to result in less preference for an average number of days working from home. This results in an apparent preference of younger participants to work at the office.

It should be noted, that due to the design of the study, it could be interpreted as an dampening of the influence of office policies. Generally all office policies have an influence that decreases the probability of an employee choosing more days working from home, the influence seen in Figure 6.4 could be seen as the characteristic of age reducing the influence of these policies.

Kawaguchi and Motegi (2021) found that older people prefer to work from home more on average, than people around their forties, this is in line with what is found in this study. The study however finds only a small effect. The study in Japan was performed during a different state of COVID-19. This could have had resulted in a bigger effect.

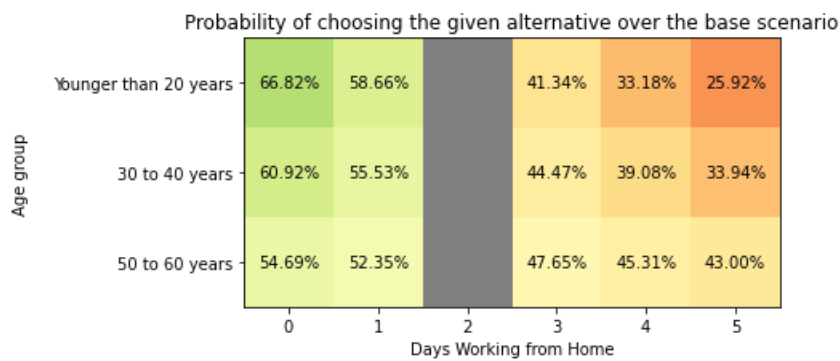


Figure 6.4: Simulated influence of age on WfH choice

6.2.2. Children

Another characteristic that is quite influential is having children. When participants have children they clearly have a higher preference for working more days from home, especially when compared to participants that don't have children. This is in line what was found in subsection 2.1.4.

Interpreting Figure 6.5, we see that working more than three days from home is preferred over the two days, given the 'standard' office policies. Whereas working more at the office than the 'standard workweek' is less probable to be chosen. This is partly in line with the findings in chapter 2. Patnaik (2018) and Timsal and Awais (2016) found there to be a similar effect for woman with children. The interaction with gender could not be recreated with the survey results.

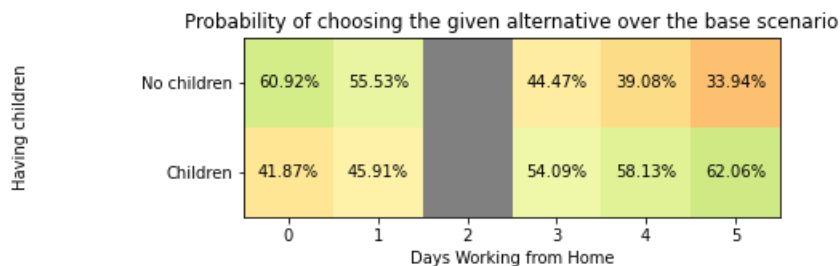


Figure 6.5: Simulated influence of having children on WfH choice

6.2.3. Work space rating

Work space has a strong influence of changing the probable choice for the different number of days working from home, as can be seen in Figure 6.6. A relatively better rated home office increases the probability of choosing a work week with more days working from home. This is in line with prior studies,

as discussed in subsection 2.1.4. The opposite is also true; better work offices increase the probability of employees choosing to commute to the office. Especially when the differences between the rating increases, the probability shifts in favour of the preferred work space. This is similar as what was found in chapter 2.

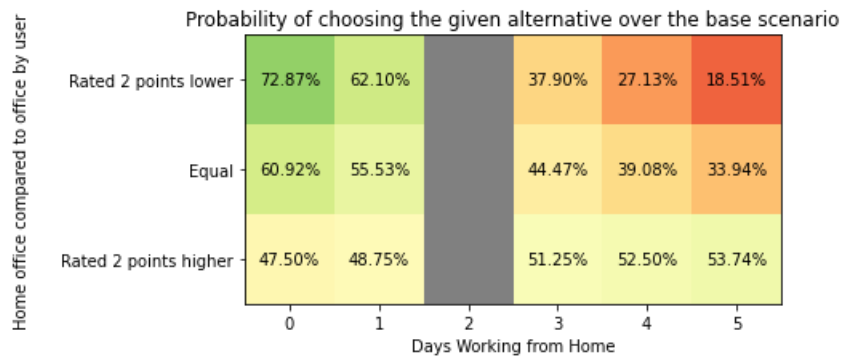


Figure 6.6: Simulated influence of rating of work space on WfH choice

6.3. Contextual influence

Just like with the personal characteristics, the contextual scenarios cannot be altered by the employer or the employee. These contexts are fixed for the choice made by the participant. For every scenario therefor the 'standard workweek' conforms to these contexts.

6.3.1. State of the pandemic

One of the clearest effects on WfH behaviour is the pandemic itself. When there is an credible threat of getting infected with COVID-19, people are more probable to choose working from home more days in the week than the standard to. The probability increase greatly in case of a severe COVID-19 outbreak.

People tend to prefer to work more from home if there is a medium outbreak, but it is clear that the willingness to work more from home depends on the state of the pandemic. This can be observed in Figure 6.7.

When there is no COVID-19 risk, we can see that there is a higher chance of participants choosing fewer days working from home over more days from home. This is however under the influence of the 'standard' office policies. When stimulants are provided, as discussed in section 6.1, or the employee has other characteristics than the mean participant, as discussed in section 6.2, these probabilities are subject to change.

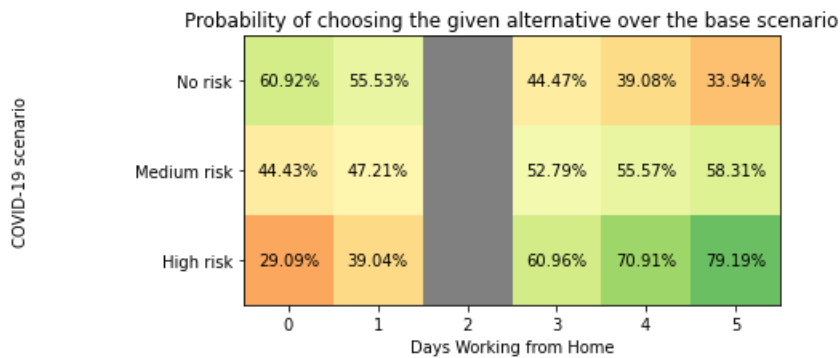


Figure 6.7: Simulated influence of COVID-19 on WfH choice

6.3.2. Crowding in public transport

In Figure 6.8 something unexpected can be observed. It seems that participants prefer to travel more days to the office when there is crowding in public transport. It is rather contradictory of common believe if this were to be true.

One possible explanation of this behaviour is that participants used this as a measure of public safety; when there is crowding in public transport, it must be safe to travel. Instead of treating crowding as a nuisance during the commute. Whatever the reason of this result it, further research is needed to make sense of this outcome.

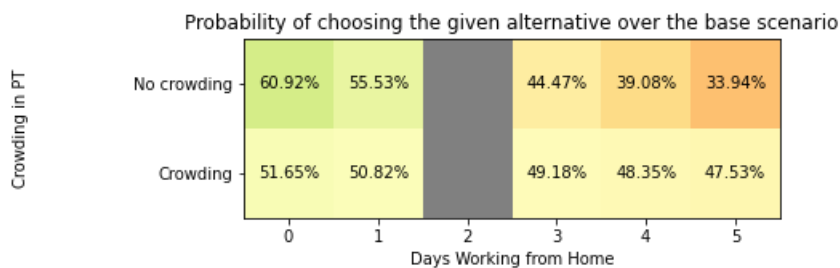


Figure 6.8: Simulated influence of crowding in public transport on WfH choice

6.4. Perceptions

Next, the influence of the latent variables that are participant specific are considered. It seems two latent variables can be distinguished: one focusing on the safety of friends and family and the other on

the safety of the individual. They are respectively shown in Figure 6.9 and Figure 6.10

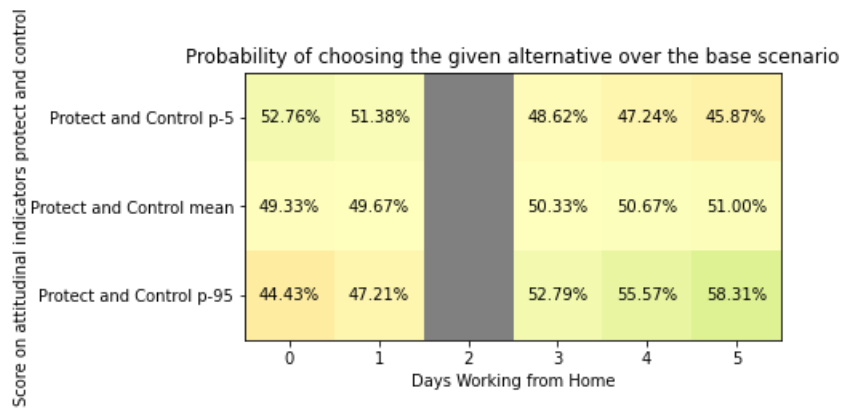


Figure 6.9: Simulated influence of attitude on the safety of friends and family on WfH choice

The attitude on safety of friends and family influences the impact of a compensation to work from home, individuals that worry less about their friends and families well-being due to COVID-19, are more probable to work from home. This seems to be a counter-intuitive result.

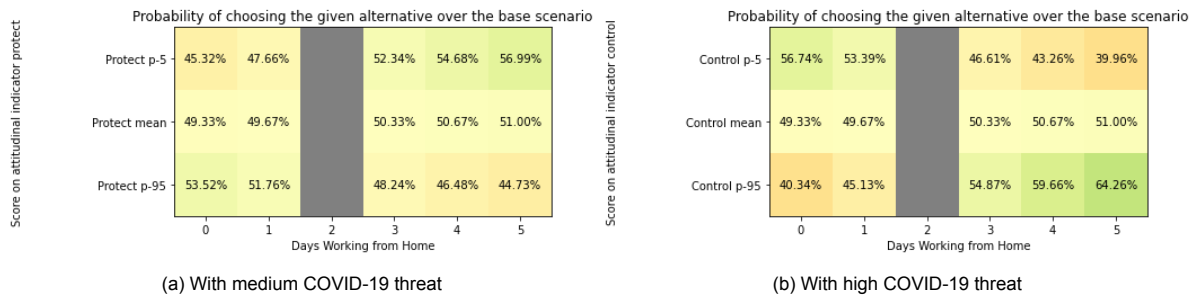


Figure 6.10: Simulated influence of attitude on the safety of the individual on WfH choice

Lastly, the similar behaviour is observed when considering the influence of the attitude of ourselves safety. Figure 6.10 shows that individuals that worry less about their own safety, prefer working from home. Again, this finding is quite surprising. This will be further discussed in chapter 7.



Conclusions and recommendations

The focus of this research was to understand the decision to work from home by employees, as well as the policies that influence teleworking that could be implemented by employers and the perception of teleworking to understand how these influence the decision of employees. This could then offer employers and the state the tools to create the most optimal combination of office policies. In conclusion, the sub-research questions will be answered first. After which, a conclusion for the main research question is formulated.

What employer policies on working from home are identified by prior studies to have an influence on the choice to work from home?

The office policies found to influence the work from home choice in the literature review and considered in this study are compensations for working from home and commuting to the office, and the ability to have flexible working hours. These are the tools that employers can use to create a work environment that persuades employees to work the desired number of days from the office. The contributions, as found in this study, influence the attractiveness of working a different number of days. Whereas the ability to be able to work flexible hours is generally preferred by employees but has no persuasion for more or fewer days working from home.

However, it should be noted that the focus of this particular research considered broadly most office policies that are available at most companies in the Netherlands. The research offers a global insight into the general influences of these policies combined. Nonetheless, there might be more forming these preferences than visible in this study. Further research is needed to focus on the three policies outlined within this thesis to understand these policies further and to be able to implement them properly.

This could be achieved by having separate studies for the different policies. The insight into the interaction of the different policies in this study is useful in understanding the general trends. Some observed trend seem contradictory to what one would have expected. These results should be further researched.

The flexible working hours are not directly found to have an influence on the number of days employees work from home. Despite this, crowding in public transport was linked to this choice. Choosing to work on different working hours could result in many cases in less crowding due to avoiding rush hour. This interaction was not included in the survey but might be interesting for further research.

What personal characteristics of the employee or socioeconomic environment of the employee can be identified that have an influence on the choice to work from home?

This study was centered on examining various personal traits that may impact the decision to work from home. The research findings underscore the significance of individual factors in influencing the inclination to work remotely, such as characteristics like age, gender and having children have a substantial impact on the choice to work from home.

One potential explanation for the limited influence of these factors could be the homogeneity of the study participants. The survey distribution method and the applied filters resulted in responses predominantly from a group that shared numerous characteristics. Consequently, the model may struggle to discern distinctions within this generally similar participant group.

To address this limitation, it is recommended to replicate the study with a more diverse and targeted participant pool, enabling a deeper exploration of the impact of distinct social and economic conditions on users' choices. Additionally, it is suggested to include employees who opt for commuting to the office using their personal means of transportation. The current study excluded participants who (partly) commuted using their own transportation, resulting in a significant reduction in the number of respondents. This was a mistake as it is clear that the influence of public transport is difficult to explain without the insight of the choices people make that do not use public transport.

What are the attitudes and perceptions of employees towards teleworking and how do these influence the choice to work from home?

The study explored how personal attitudes and perceptions influence the choice to work from home, revealing two attitudes, "protect" and "control," through factor analysis. Unexpectedly, one latent variable showed an inverse impact. A larger sample size is needed to confirm these findings.

The research provides initial insights into teleworking preferences, but further research is essential. Recommendations include studying specific office policies, involving a more diverse group of participants, and exploring the influence of personal attitudes and perceptions in more depth. An answer to the main research question can be formulated nonetheless.

What work from home related office policies do workers commuting in public transport in the Netherlands prefer and how do they influence their work from home choices?

The study's findings offer general insights into teleworking behavior under different circumstances and identify a couple of office policies that can be used to influence the choice to work from home. With a larger group, general trends can be observed with more certainty than was done in this study. The research should be viewed within this perspective; the general observations appear to be true with low certainty and could be used as a jumping-off point for further research focused on the different trends observed within this thesis.

In conclusion, The thesis confirms what is found in literature and what is observed in the earlier studies after relaxations of COVID-19 measures. It recognises certain influences found by the literature study.

Additionally the relative rating of the workspace at home and at the office is a new addition that was not found in earlier literature. Given that it is integrated in a broader study, this could be a reason to further research the influence of the relative rating of the work space.

Another new aspect that was not found during the literature study is the influence of the perception of COVID-19 on choices made regarding COVID-19 in a discrete choice model. The findings however are not clearly interpretable and further studies at the moment are not recommended due to the time past since widespread caution due to the virus.

Despite that all, compensations for travel and working from home as well as the ability of working flexible hours show to influence the behaviour of the respondents significantly. Aiming to persuade employees to work more or fewer days from home with these policies needs greater consideration and more in depth studies into the separate policies to better understand its implications.

Some recommendation can be made using this study to government and workers alike. For governments and transport companies it could be advantageous to reduce the peak hours in public transport by spreading the demand over a greater time. Since employees seem to prefer flexible hours promoting companies to offer flexible hours might be a smart policy to reduce the biggest strain on the transport systems during rush hour.

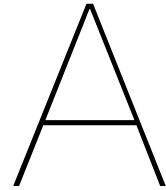
For employers that prefer to have their employees at the office it seems most effective to give a proper compensation for travel costs. This turns out to have the biggest impact on employee behaviour in interaction with the number of days they work at the office. Even better compensations could be explored, such as complete compensation or a monthly public transport card for example. This could be a subject for further research.

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Ngene code

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design
;alts = alt1,alt2
;rows = 60
;block = 6
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;cond:
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if(alt1.days <> 0 , alt1.hours <> 0),
if(alt1.days = 0 , alt1.wfhc = 0),
if(alt1.days = 5 and alt1.hours = 8, alt1.trvlc = 0),
if(alt2.days = 0 , alt2.hours = 0),
if(alt2.days <> 0 , alt2.hours <> 0),
if(alt2.days = 0 , alt2.wfhc = 0),
if(alt2.days = 5 and alt2.hours = 8, alt2.trvlc = 0),
if(alt1.hours = 4 , alt1.crowd <> 3),
if(alt2.hours = 4 , alt2.crowd <> 3),
if(alt1.inft = 20 , alt1.hosp = 30),
if(alt1.inft = 60 , alt1.hosp = 30),
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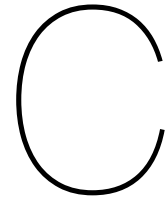
;con
;model:
U(alt1) = Bday.dummy[0.4|0.4|0.3|0.5|0.5] * days [0,1,2,3,4,5]
+ Bhour [ 0.1] * hours [0,4,8]
+ Bcrowd [ 0.0] * crowd [1,2,3] *days + Btrvlc [-0.1] * trvlc [0,1] *days
+ Bwfhc [ 0.1] * wfhc [0,1] *hours*days + Bpeers [ 0.0] * peers [20,50,80] *hours*days
+ Bvaccin[ 0.0] * vacc [70,85] *hours*days
+ Binfect[ 0.0] * inft [20,60,120]*hours*days
+ Bhosp [ 0.0] * hosp [30,120] *hours*days /

U(alt2) = Bday * days
+ Bhour * hours
+ Bcrowd * crowd *days + Bwfhc * wfhc *days
+ Btrvlc * trvlc *hours*days + Bpeers * peers *hours*days
+ Bvaccin * vacc [vacc] *hours*days
+ Binfect * inft [inft] *hours*days
+ Bhosp * hosp [hosp] *hours*days
$
```


B

Survey design

Block	Alternative 1				Alternative 2			
	Days WfH	Flex	Travel comp.	WfH comp.	Days WfH	Flex	Travel comp.	WfH comp.
1	4	1	1	2	1	0	0	1
1	4	0	0	0	2	1	1	2
1	5	1	0	0	4	0	0	2
2	1	1	0	2	3	0	1	1
2	0	0	0	0	3	1	0	0
2	3	1	1	2	2	0	0	0
3	3	1	0	2	4	0	1	0
3	0	0	1	0	1	1	1	1
3	2	0	0	2	5	1	0	0
4	3	0	0	1	4	1	1	2
4	2	0	1	0	0	1	1	0
4	1	0	1	2	2	1	0	1
5	1	0	1	1	0	1	0	0
5	4	1	0	1	1	0	1	2
5	2	1	0	1	5	0	0	2
6	2	0	1	0	0	1	1	0
6	5	1	0	1	3	0	1	2
6	5	0	0	2	1	1	0	0



Example survey question

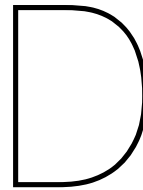
The COVID-19 risk is **high**. There are many new infections and hospitalisations and lockdown measures are in force.

The public transport is crowded; there is a **low** change of sitting down.

De alternatives working schemes are:

	Option 1	Option 2
Number of days working from home	4	1
Possibility of flexible working hours	Yes	No
Travel compensation	€0.19/km	€0.00/km
Work from Home compensation	€4.00	€2.00

Given the COVID-19 risk and crowding in public transport, which working scheme would you choose?



Factor Analysis

Indicators	mean	std. dev
Cov01	2.34	0.92
Cov02	1.66	0.93
Cov03	2.92	0.94
Cov04	2.86	1.04
Cov05	2.74	0.87
Cov06	3.37	1.11
Cov07	2.71	1.04
Cov08	2.26	1.18

Table D.1: Mean and standard deviations for the different indicators

Table D.1 shows the means and standard deviations of the responses on the latent variables, one being the least amount of worry and five being the most. It is interesting to see that respondents seem to worry significantly less about themselves getting seriously ill or dying, than worrying about friends and family getting infected.

D.0.1. Suitability for factor analysis

Table D.2 describes the suitability for factor analysis. First of all, the Kaiser-Meyer-Olkin (KMO) Measure is designed to understand the for all variables their sampling adequacy for the entire model. Generally, a KMO above 0.8 is considered adequate (Shrestha, 2021). Next, Table D.2 also shows the Bartlett's Test of Sphericity. This is a measurement that describes the correlation between variables and should provide a p-value smaller than 0.05, which it does.

Table D.2: Analytical tests

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.802
Bartlett's Test of Sphericity	Approx. Chi-Square (χ^2) 4876.464
	Significance (p-value) 0.000

Afterwards, the number of factors used should be considered. This is done by calculating the eigenvalues for a different number of factors, this can be represented visually as shown in Figure D.1. Generally, an eigenvalue just greater than 1 is considered good (Shrestha, 2021). In this case this means that two factors will be used.

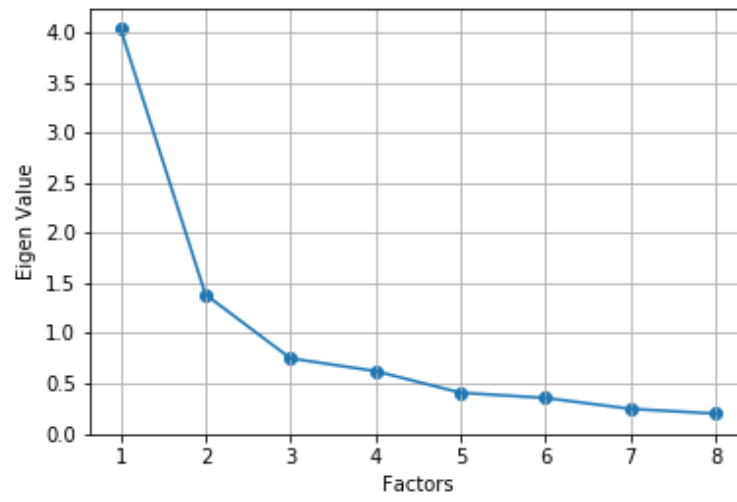


Figure D.1: Scree plot of the data on the latent variables