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Data collection methods and response behavior in a multi-stage survey with linked stated preference designs

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Multimodality in the Swiss New Normal: Data collection methods and response behavior in a multi-stage survey with linked stated preference designs

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Abstract: The *Swiss New Normal* is defined by a substantial increase in telework adoption following the COVID-19 pandemic. Although telework has been extensively studied in the transport literature since the start of the ICT revolution, previous findings may not be applicable to the current context due to evolving economic conditions, personal preferences, and employer perspectives. The net benefits of telework for energy consumption and its climate impact remain ambiguous, as the potential higher-order effects that might offset energy savings from reduced commuting are still under debate. Our survey is designed to model the options, adoption, and frequency of telework. We conducted two stated preference experiments: The first examines preferences for various hybrid work arrangements and the influence of work policies on telework adoption, while the second explores the relationship between telework frequency and mobility tool ownership, a previously neglected higher-order effect. This paper focuses on data collection methods, analyzes response behavior, and provides a descriptive overview of the telework landscape in Switzerland. Our data suggests that the pandemic has increased the telework share in Switzerland by 15 percentage points. Of the population, 60% hold teleworkable jobs, and 91.33% of these individuals wish to utilize telework. However, a gap of 20 percentage points exists between those who can work from home and those who actually do. Additionally, about one-quarter of teleworkers desire to telework more frequently but are restricted from doing so. Telework patterns also vary throughout the week, with Fridays being the most popular day for working from home, suggesting significant variations in transport network loads. We found no evidence that telework negatively impacts emissions through a shift from public transport (PT) subscriptions to car ownership. Teleworkers tend to cancel PT subscriptions and purchase half-fare cards, but this behavior occurs only at high telework frequencies (4+ days per week). Nonetheless, this shift could have second-order effects at the trip level: households with cars and no PT subscriptions may prefer car travel over other modes of transport.

1 Introduction and motivation

The revolution in information and communication technologies (ICTs) enabled remote work, sparking interest in the relationship between telework, transport demand, energy, and climate impacts (Salomon, 1986; Hook *et al.*, 2020). Alongside economic and digital transformations, the service industry's growth has also contributed to the steady increase in telework. However, the COVID-19 pandemic dramatically accelerated this trend, quadrupling the home office share in a few quarters (Barrero *et al.*, 2023). It remains uncertain how pre-pandemic findings translate to the post-pandemic "new normal". For instance, Asmussen *et al.* (2023) suggests a reduction in the heterogeneity of telework adoption and frequency, with fewer sociodemographic and work-related variables influencing these factors. Additionally, the literature shows significant variation in home office potential and adoption across countries, cities, and economic sectors (see Dingel and Neiman, 2020; Groen *et al.*, 2018; Cetrulo *et al.*, 2020), complicating the generalization of findings.

Before the pandemic, working from home was rare and often stigmatized, seen as detrimental to career advancement, which discouraged workers from expressing their desire to telework (Brewer and Hensher, 2000). Indeed, Mokhtarian and Salomon (1996) found that telework was a *preferred impossible* option for many workers. The pandemic, however, helped break this stigma and relaxed some constraints, making telework a *preferred possible* scenario for many.

Hybrid work policies can benefit employees and employers by responding to employee demands, reducing labor costs, expanding the labor pool, lowering office space expenditures, and complying with environmental mandates (see Nilles, 1988; Olson, 1989; Bernardino, 1995). Therefore, it should be acknowledged that observed telework frequencies are the outcome of a negotiation process between employers and employees (i.e., the classical demand and supply side on labor markets).

Despite significant interest in telework research, data sources tailored to understanding its complexities are rare and often limited to national or regional census data, which provide sparse telework-related information. These existing data sources struggle to disentangle the reasons behind an individual's telework habits, such as personal preferences, job-related factors, and employer constraints. Our data collection aims to fill this gap for Switzerland, providing a rich dataset to support various telework-related research questions. Thus, the primary motivation for this paper is to detail the survey methods and collected data also to facilitate data sharing with interested researchers.[1]

The choice to telework depends not only on individual characteristics and attitudes but also on work arrangement characteristics. Despite the recognized need for this, little work has explored telework adoption and frequency choices under different work arrangements. Bernardino *et al.* (1993) investigated choices involving telecommuting frequency, schedule flexibility, salary, available equipment, and cost responsibilities, concluding that incurring costs is more acceptable than a salary decrease. Furthermore, an asymmetry exists between salary increases and decreases, where a decrease hinders adoption more than an increase encourages it, consistent with prospect theory Kahneman and Tversky, 2013. In contrast, Sullivan *et al.* (1993) focused exclusively on cost implications without examining other factors like schedule flexibility. Appel-Meulenbroek *et al.* (2022) studied workplace location preferences, finding that workplace attractiveness can influence telework decisions, with fac-

[1] The data is available at the ETH data archive. You can also contact the first author.

tors such as crowdedness and noise being significant. This paper expands on this research by implementing a work arrangement stated preference (SP) experiment, where participants select their preferred work arrangement and intended telework frequency, based on attributes and levels defined through a pre-study.

Literature on the energy and climate impacts of teleworking highlights the importance of indirect channels that might offset reduced commuting, including changes in non-work travel and home energy consumption (Hook *et al.*, 2020). Significant lifestyle changes might bring about higher-order effects (Horner *et al.*, 2016) such as relocation (De Vos *et al.*, 2018) or re-evaluation of mobility tool ownership. In Switzerland, public transport (PT) is a primary commuting mode, with subscriptions like the national season ticket (GA) being popular. Previous studies suggest that in countries where PT is common, teleworking has less impact on energy use compared to countries dominated by private car use (Mokhtarian, 2009; Van Lier *et al.*, 2014). However, reduced PT commutes might lead individuals to reconsider PT subscriptions and potentially shift to less sustainable modes such as cars. Mobility tool ownership significantly influences mode choice (Schmid *et al.*, 2023) and thus the transport equilibrium. Telework could make car ownership more attractive by enabling greater use of the household car by other members on home office days (Hook *et al.*, 2020). Wang *et al.* (2023) calls for further exploration of the relationship between telework and vehicle ownership. This paper addresses this by investigating the higher-order effect of telework on mobility tool ownership, using a second SP experiment to examine the relationship between work from home (WFH) frequency and mobility tool ownership (car, car sharing, bike, E-bike, and various PT subscriptions).

Experimental approaches to mobility tool ownership are rare due to the high complexity of attribute combinations, making it difficult to construct realistic choice sets. One approach to address this is the stated adaptation design (e.g., Schmid *et al.*, 2019; Erath and Axhausen, 2010). Alternatively, some studies reduce the choice task, focusing on trade-offs between car and annual season ticket ownership (e.g., Weis *et al.*, 2010; Scott and Axhausen, 2006) or considering a single mobility tool (e.g., Fang, 2008; Jong *et al.*, 2004; Hess *et al.*, 2012).

This study focuses on the German-speaking part of Switzerland, particularly the city and canton of Zurich. Switzerland is an ideal study area due to its high proportion of white-collar workers and diverse mobility tool ownership. Zurich, a financial hub, has experienced significant changes due to the pandemic. Prior to the pandemic, data security and privacy concerns limited home office possibilities, which have now become feasible.

A total of 10‘441 individuals from the Federal Statistical Office's (FSO) sampling frame were contacted, with 3‘234 completing the first survey. Among these, 1‘280 telework-eligible individuals were invited to participate in the two SP experiments, with 922 completing all stages, resulting in a high-quality representation of the population and a comprehensive set of SP choices.

The data collected in this work allows researchers to investigate key questions: Who can, may, and wants to telework? What are the preferences for hybrid work arrangement characteristics, and how do they affect telework adoption and frequency? How do teleworkers adjust their mobility tools in light of hybrid work arrangements? This study aims to develop a detailed understanding of WFH and its relation to mobility tool ownership. Further, Mokhtarian and Salomon (1994) emphasized the need to differentiate between possibility, preference, and choice, noting that possibility is constrained by factors such as job suitability and managerial approval. Our dataset includes item batteries to control for this home office feasibility.

The broader goal of this data collection was to enrich a synthetic population for MATSim (Horni *et al.*, 2016) and simulate transport demand implications. Initial results are reported in Heimgartner *et al.* (2024).

The remainder of the text is structured as follows: Section 2 details the survey methods and SP experiments. Section 3 analyzes response behavior and relates the response rate to the response burden score as proposed by Axhausen *et al.* (2015). Section 4 presents a descriptive analysis addressing who *can, may*, and *wants* to work from home. Section 5 demonstrates the usefulness of the data by investigating telework treatment effects on mobility tool ownership. Finally, Section 6 concludes the study.

2 Survey methods

The following sections provide an in-depth explanation of the survey instruments' structure and the details of the stated preference (SP) designs. Two different population samples from the German-speaking part of Switzerland were recruited for the two main survey waves: the pre-study and the main study. For the pre-study, 7'967 addresses were purchased from an address dealer, targeting age and gender marginals from the *Mobility and Transport Microcensus* (MTMC21, Federal Office for Spatial Development and Federal Statistical Office, 2021). For the main study, a stratified sample of 10'441 individuals was obtained from the Federal Statistical Office (FSO). Respondents from the canton of Zurich were over-sampled due to the city's and canton's partnership in this project. Additionally, the data collection aimed to estimate statistical models for MATSim, with scenario analysis planned for that particular area.

Both samples were invited by postal letter to participate in the introductory survey. One reminder was sent, and for the main study, an incentive of 20 Swiss francs was offered upon completion of all three stages of the study. After completion of the introductory survey, communication happened via E-mail. The importance of participating was emphasized, even if the respondent's current work situation did not permit telework. Key statistics of the four survey instruments are detailed in Table 1.

Table 1: Surveys key statistics.

	Survey			
	Pre-study	Intro	WFH-SP	MTO-SP
Start	2022-05-11	2023-06-02	2023-06-23	2023-07-07
End	2022-06-13	2023-08-28	2023-09-11	2023-09-10
Questions [N]	77	69	17	21
Invited [N]	7967	10441	1280	1067
Completed [N]	1345	3234	1067	922
Completed [%]	16.9	31.0	83.4	86.4
Median response time [min]	24.2	13.0	6.5	6.1
Response burden score*	373	254	88	163

Note: *Response burden scores are based on Axhausen *et al.* (2015)

2.1 Pre-study

As only little academic work has investigated the importance of work arrangement attributes on telework adoption, the main purpose of the pre-study was to identify attributes of relevance in the decision-making process required to design meaningful trade-offs in the SP. Participants were asked to rank order a menu of proposed generic work arrangement attributes (see Table 8 in Appendix A) and subsequently distribute 100 points among their top four choices. We find that employees place high value on efforts to maintain collegiality, corporate identity, and flexibility. Flexibility in choosing when to telework, where to work from, and time management when teleworking. Meanwhile, financial incentives are of less relevance. The reader can later confirm in Section 2.3 that we accounted for this revealed attribute importance in the SP design.

2.2 Stage I: Introductory survey

At the first stage, respondents were invited to participate in an online survey that collected socio-economic information, household structure, current home office status, work and residential situation, as well as mobility behavior and mobility tool ownership. The survey structure is detailed in Appendix A. Only individuals currently in the workforce qualified for participation, and telework-related questions were asked exclusively to those with jobs suitable for remote work.

A series of Likert-scale questions was included to assess an individual's theoretical telework feasibility (*teleworkability*). These questions encompassed job characteristics, the residential environment, and personality traits. This distinction allows modelers to differentiate between possibility and preference, an important concept emphasized by Mokhtarian and Salomon (1994). A factor analysis was conducted on these items, with results discussed more in-depth in Appendix B. Two factors emerged as important: One representing job-related dimensions (work context and work activities), and the other relating to personal characteristics and the home office environment. These latent factors could be incorporated into modeling approaches, either directly or indirectly, such as through a probabilistic choice set formation approach as in Manski's model (e.g., Manski, 1977; Bierlaire *et al.*, 2010).

2.3 Stage II: Work from home SP

Individuals identified as eligible for telework were invited to participate in the second stage - the work from home (WFH) SP. Eligibility required participants to be in the workforce and to have a work profile permitting at least one home office day per week, regardless of whether their current employer offers this option. Self-employed individuals were excluded since they do not face exogenous work arrangements.

The selection of attributes was largely inspired by Bernardino (1995) and insights from the pre-study detailed in Section 2.1. Salary adjustments were included in the design despite being deemed irrelevant by participants in the pre-study. This inclusion was justified for three reasons: First, salary adjustments as (dis)incentives for home office have been a topic of recent public debate; second, this attribute serves as a natural cost component, allowing modelers to interpret other attributes in a monetary (willingness to pay) framework; third, the attribute was found to be relevant in Bernardino (1995).

Table 2: Attributes and levels of the WFH-SP experiment.

Attribute	Level	Remark
Coordinated presence	Monday/Friday Tuesday/Wednesday/Thursday	Office attendance of team members is coordinated on these days.
Core hours	None Regular working hours	Employee can freely allocate working time or is expected to work during regular working hours.
Help-desk and training	Yes No	Help desk for technical assistance and training for effective home office collaboration and management.
Salary adjustment	-10% No salary adjustment +10%	On an hourly wage basis for home office hours.
Additional cost	No contribution 50% 100%	Compensation for increased energy consumption among others.
Hardware budget	No contribution 50% of the necessary expenses 100% of the necessary expenses	Yearly budget for setting up a productive home office work station.
Work from anywhere	Allowed Not allowed	Only within Switzerland.
Desk sharing	Yes No	Restructuring of the office space.

Attributes and their levels are presented in Table 2. Notably, three attributes (*hardware budget, additional cost*, and *salary adjustments*) imply a cost component and a marginal utility of one Swiss franc. It is to be tested whether the monetary utility equivalent remains constant across these three attributes. The *coordination* attribute could have both positive and negative utility implications: While it reduces personal flexibility, it also coordinates office attendance, enhancing collaboration and collegiality. The *desk sharing* attribute captures the concept of flexible office space utilization and expands on Appel-Meulenbroek *et al.* (2022) where work location attributes such as *noise, openness* and *crowdedness* were tested and found to be important. The *help and training* attribute implies support for technical difficulties and training, promoting effective digital collaboration and a successful home office culture. The full factorial design was reduced according to D-efficiency principles. Each participant completed four choice tasks.

Bernardino (1995) included telecommuting frequency as an attribute of the work arrangement, potentially resulting in unrealistic levels that do not account for teleworkability. In contrast, we propose a sequential choice setting where respondents first choose their desired work arrangement and subsequently reveal their preferred frequency, given the characteristics of the selected arrangement. However, this approach may result in unbalanced attribute-level combinations in the frequency choice, as less attractive work arrangement features are filtered out in the initial choice (see the discussion in Fig. 6). Further, it might necessitate a simultaneous modeling approach since work arrangement attributes are no longer exogenous in the frequency choice. An example of a combined choice task is provided in Fig. 1. The introductory text explaining the WFH choice task is included in Appendix A.

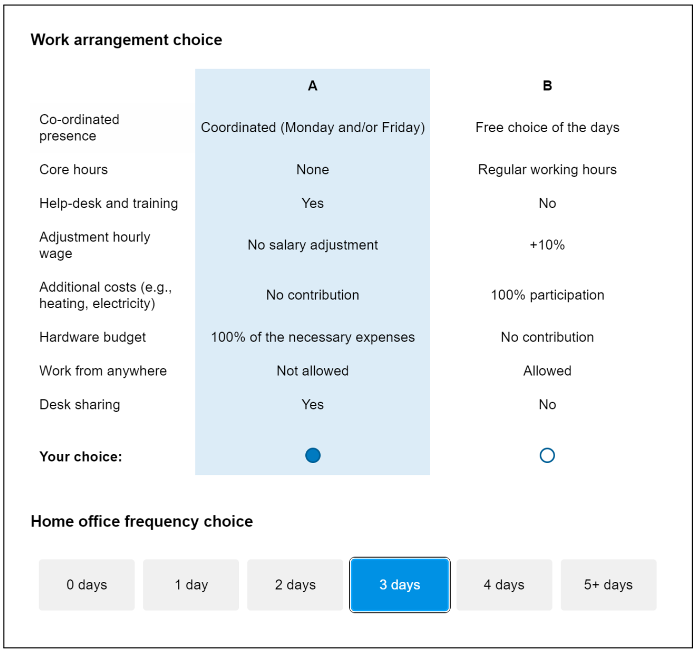

Figure 1: Example of a choice task for the work from home stated preference experiment.

2.4 Stage III: Mobility tool ownership SP

Conducting an SP experiment on mobility tool ownership presents challenges due to the necessity to precisely define the characteristics of each proposed mobility tool. Moreover, households may own and share multiple tools of the same type, and interdependencies between tools could exist (e.g., negative correlation between car ownership and public transport subscriptions). Therefore, decision-making involves complex trade-offs that may consider collective household preferences, bargaining dynamics, and the composition of bundles rather than evaluating each mobility tool in isolation. Accordingly, the SP design should incorporate bundled choices to assess the specific attributes of one tool against the entire set of available tools.

The bundle structure involves two primary dimensions: The availability of each considered mobility tool and their respective characteristics. Our study includes five distinct tools: cars, public transport (PT) subscriptions (national or regional season tickets), half-fare card (HT, allowing travelers to purchase PT tickets for half the price), car-sharing subscriptions, and (E-)bikes, following Becker *et al.* (2017) with additions of (E-)bikes and HT. Participants can combine these tools into 32 unique bundles (2^5 combinations), differing only in tool availability without imposing trade-offs within the same tool category (e.g., choosing between different types of cars).

Given the impracticality of directly comparing 32 alternatives (known as the "curse of dimensionality"), we initially explored an unlabeled approach in a pre-test where respondents chose between two predefined bundles. However, participants found this method too abstract and detached from their actual preferences, leading us to adopt a simpler design. In this revised approach, participants are presented with individual options for each mobility tool and are asked to compose a bundle from these options. An example choice task is

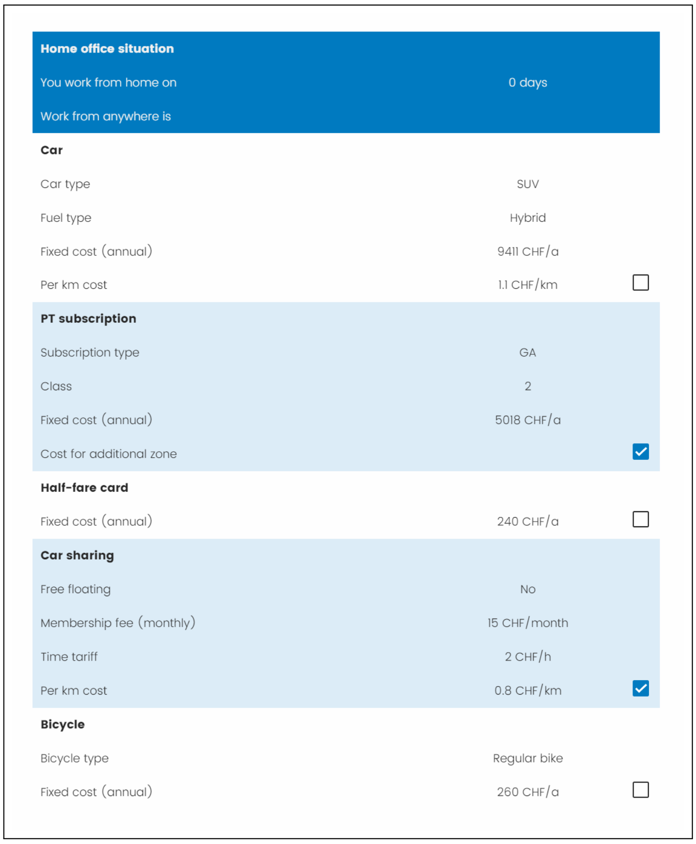

Figure 2: Example of an individualized choice task for the mobility tool ownership stated preference experiment.

illustrated in Fig. 2. The introductory text explaining the mobility tool ownership (MTO) choice task is enclosed in Appendix A.

While conceptually simpler, this design emphasizes the availability trade-off and explicitly abstracts from trade-offs between mobility tools of the same type (not choosing the depicted car implies not owning a car at all). Thus, a particular mobility tool is chosen if the net benefit/utility is positive. For instance, even if a participant strongly dislikes a specific car attribute (e.g., car type being luxury or sports car), they might still choose it if the disutility of not owning any car outweighs their aversion to that attribute. This approach questions whether the utility or disutility of not owning a car remains constant across choice occasions, influenced by the characteristics of other mobility tools available which should be accounted for when modeling the choices collectively.

The attributes and assumed reference values are detailed in Table 3. The cost implications of owning and using a car were meticulously considered to provide a comparable basis for trade-offs with other mobility tools. Fixed costs, depreciation, taxes, insurance, and other expenses were factored into the analysis, with data sourced from the Swiss Touring Club (2024) website for various vehicle classes and fuel types. See also the **tcsscraper** python package available at `https://github.com/dheimgartner/tcsscraper` providing an API to retrieve many variables for the current Swiss car fleet.

Table 3: Attributes and levels of the MTO-SP experiment.

Attribute	Level	Reference	Remark
Car			
Type	Small car		
	Medium to large car		
	Minivan or van		
	SUV		
	Luxury or sports car		
Fuel	Gasoline		
	Diesel		
	Electric		
	Hybrid		
	Plug-in hybrid		
Fixed cost	0.7 (-30%)	Inferred from archetype*	Fixed costs include amortization, garaging costs, insurance, and taxes. The price of the car is reflected in the fixed cost (amortization).
	1		
	1.3 (+30%)		
Variable cost	0.7 (-30%)	Inferred from archetype*	Per kilometer cost, including depreciation of the car's value, fuel or energy costs, tire costs and maintenance.
	1		
	1.3 (+30%)		
Public transport			
Type	National season ticket (GA)		
	Regional season ticket		
	Half-fare		
Class	First		Cost multiplier of 1.7 for first class
	Second		
Fixed cost	0.7 (-30%)	3860 CHF/year (GA)	
	1	782 CHF/year (Regional)	
	1.3 (+30%)	185 CHF/year (Half-fare)	
Additional zone	0.7 (-30%)	40 CHF for additional zone	Only for regional season ticket
	1		
	1.3 (+30%)		
Bicycle			
Type	Regular bike		
	E-bike (up to 25 km/h)		
	E-bike (up to 45 km/h)		
Fixed cost	0.7 (-30%)	200 CHF/year (regular)	Fixed costs include amortization, maintenance, and insurance. The price of the bicycle is reflected in the fixed cost (amortization).
	1	600 CHF/year (25 km/h)	
	1.3 (+30%)	100 CHF/year (45 km/h)	
Car sharing			
Free-floating	Yes		Whether or not the car sharing is station-based or free-floating.
	No		
Membership fee	10 CHF/month		
	15 CHF/month		
	20 CHF/month		
Time tariff	2 CHF/h		
	3 CHF/h		
	4 CHF/h		
Km tariff	0.8 CHF/km		
	1 CHF/km		
	1.2 CHF/km		
Scenario variables			
Work from home	0-5+ days	Individual-specific	Either the current WFH frequency, the maximum feasible frequency (as asked in the introductory survey), the free-choice, or the observed choices in the SP.
Work from anywhere	Allowed		
	Not allowed		

Note: *An archetype has the average car specifics for a certain car and fuel type combination.

The generation of the random design is conceptualized in Algorithm 1.

Algorithm 1: Generation of random design for the MTO-SP

Input: Vector of levels for each attribute
Output: Random design with applied constraints and substituted effect codes

Step 1: Generate full factorial design;
Resulting in over 11 million possible attribute level combinations;

Step 2: Apply preference constraints;
if *PT type != regional subscription* **then**
| Set attribute level PT zones to blank;
end

Step 3: Replace effect codes;
Substitute reference values and apply the imposed cost structure;
if *attribute car fixed cost == high* **then**
| Increase the substituted archetype's fixed cost by 30%;
end
if *PT class == first* **then**
| Multiply PT subscription's fixed cost by 1.7;
end
... *similar for the other attribute levels* ...

Step 4: Random draw;
foreach *participant* **do**
| **if** *participant does not have driving license* **then**
| | Eliminate car and car sharing alternative;
| **end**
| Take a random draw from the revised factorial design (end of step 3);
| Take a random draw from the individual-specific WFH choice set;
end

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3 Response behavior

This section examines the demographic composition of survey participants, discusses the relationship between response burden (Axhausen *et al.*, 2015) and response rates, and explores the variability in choices observed in the two SP experiments.

As previously mentioned, the survey instrument in *Stage I* targeted the entire working population, while SP experiments focused exclusively on those eligible for telework. The distribution across cantons, completion rates, and response rates for *Stage I* are depicted in Fig. 3. To emphasize variability among cantons, Zurich, which was oversampled, is excluded from the linear color scale of the first two panels. The remaining German-speaking cantons are included, with invited participants proportionally reflecting their respective populations. Response rates vary across cantons, ranging from 14.29% (Glarus) to 34.10% (Lucerne).

Table 4 presents marginal distributions of shared variables for the MTMC21 sample, the prestudy, and the main study populations. The main study sample closely mirrors the MTMC21 sample with some exceptions, likely attributable to Zurich's oversampling. Overrepresentation is noted among high-income households and PT season-ticket holders. Regarding ownership of mobility tools, comparability of marginals is limited due to differing survey questions: MTMC21 assessed access to tools while ours inquired about ownership and regular usage. Marginal distributions across reported NOGA sectors diverge notably, reflecting Zurich's status as a financial and ICT hub. Disparities in *Telework* distributions are ex-

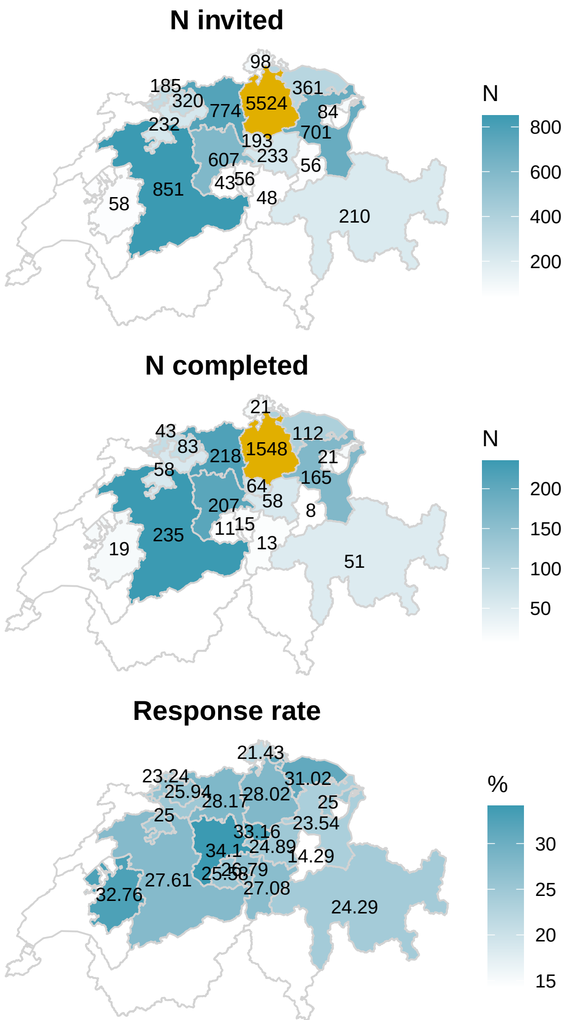

Figure 3: Distribution of invited participants, survey completion, and response rates across cantons. Zurich is excluded from the color scale in the first two panels to highlight variation among other cantons.

Table 4: Descriptive statistics: MTMC21 versus pre-study and main samples.

		%		
Variable	Value	MTMC21	Pre-study	Main study
Age	18-35	29.4	17.1	27.9
	36-50	36.1	25.7	40.9
	51-65	30.9	56.6	30.5
	65+	3.5	0.7	0.8
Sex	Male	52.7	59.1	52.3
	Female	47.3	40.9	47.7
Married	Yes	50.5	-	50.6
	No	49.5	-	49.4
Nationality	Swiss	75.0	96.2	80.2
	Other	25.0	3.8	19.8
Education	Low	7.2	1.0	4.6
	Medium	45.2	49.7	45.6
	High	47.6	49.3	49.8
Household Size	1	18.8	12.6	16.9
	2	33.7	31.8	35.1
	3	18.6	17.9	17.6
	4+	28.9	37.6	30.4
Household Income	Not reported	15.4	5.4	6.2
	<4'000 CHF	5.5	2.9	4.4
	4'001-8'000 CHF	27.7	21.9	23.0
	8'001-12'000 CHF	26.6	37.2	28.7
	>12'000 CHF	24.7	32.6	37.7
Employment	Full time	60.6	59.8	60.6
	Part time	39.4	40.2	39.4
Telework	0	56.6	51.5	52.3
	1	14.3	17.9	15.0
	2	5.9	12.9	13.2
	3	6.5	7.6	9.9
	4	4.3	4.5	5.7
	5+	12.5	5.5	3.9
Noga Sector	Human Health and Social Work Activities	15.5	-	2.9
	Manufacturing	14.6	-	15.2
	Wholesale and Retail Trade	11.2	-	9.9
	Education	8.0	-	4.5
	Professional, Scientific and Technical Activities	9.0	-	9.8
	Other	41.7	-	57.7
Mobility Tools	Car	85.1	88.4	68.2
	Car sharing	6.0	10.8	2.8
	Bike	82.2	82.6	54.6
Season Tickets	National season ticket	9.5	12.5	11.3
	Half-fare card	40.4	63.2	61.3
	Regional season ticket	11.6	8.0	17.3
	None of above	42.8	21.9	21.6

Table 5: Logistic regression results: Regressing response burden score on (logit-transformed) response rates.

	Pooled	Yes, yes	Yes, no	No, no	No, yes	Pooled†	Yes, yes†	Yes, no†	No, no†
Response burden	-1.01^{***}	-0.31^{**}	-2.98^{***}	-1.63^{**}	-1.05	-0.58^{***}	-0.32^{**}	-1.55	-1.25^{***}
	(0.19)	(0.11)	(0.71)	(0.47)	(0.40)	(0.17)	(0.11)	(1.16)	(0.31)
Yes, yes	1.89^{***}					1.53^{***}			
	(0.25)					(0.20)			
Yes, no	0.63					0.84^{***}			
	(0.33)					(0.15)			
No, no	-0.64					-1.11^{***}			
	(0.34)					(0.20)			
No, yes	-0.73								
	(0.57)								
Intercept		1.23^{***}	1.49^{***}	-0.38	-0.64		1.28^{***}	1.13^{**}	-0.81^{***}
		(0.16)	(0.25)	(0.41)	(0.74)		(0.18)	(0.32)	(0.20)
R^2	0.81	0.13	0.72	0.16	0.92	0.79	0.13	0.13	0.22
Adj. R^2	0.80	0.08	0.70	0.13	0.90	0.78	0.07	0.07	0.19
Num. obs.	80	20	21	34	5	66	18	18	30
LL	-106.09	-20.97	-17.01	-47.70	-2.48	-69.99	-20.08	-13.94	-31.10
AIC	224.19	47.94	40.02	101.39	10.97	149.98	46.16	33.89	68.20
BIC	238.48	50.92	43.16	105.97	9.80	160.93	48.83	36.56	72.40

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. †Based on the sample of the last publication.

pected, influenced by the ongoing COVID-19 pandemic during the MTMC21 and pre-study survey periods, detailed further in Section 4.

Despite successful sampling, a re-weighting scheme was implemented to enhance sample representativeness. Using iterative proportional fitting, weights were adjusted based on specified variables, excluding *Telework* and *Mobility Tools* due to aforementioned limited comparability. These weights were applied to aggregate statistics whenever findings were generalized to the entire population, employing the **anesrake** package (Pasek, 2018) for weight determination.

Building on Axhausen and Schmid (2015), we estimated a linear regression model relating response burden scores to log-transformed response rates:

$$\log\left(\frac{y_i}{100 - y_i}\right) = \beta_0 + \beta_1 \frac{x_i}{1000} + \varepsilon_i \tag{1}$$

where y_i denotes the response rate (in percent), x_i represents the ex-ante response burden score, and ε_i is a normally distributed clustered error term. Observations were weighted by the square root of the sample size. The model was estimated for the entire sample and separately for recruitment by incentive status (*Pre-study:* No recruitment, no incentive; *Stage I (all):* No recruitment, no incentive; *Stage II and III:* Recruitment and incentive).

In comparison to the previous publication (Schmid and Axhausen, 2019), 14 additional surveys contributed by members of the *Institute of Transport Planning and Systems* (IVT) at ETH Zurich were included. Updated model estimates with clustered standard errors beside the estimates based on the last publication sample are reported in Table 5. A new group (no recruitment but with incentive payments) is now part of the sample, however the effect of the response burden is not significant because of limited sample size. Due to

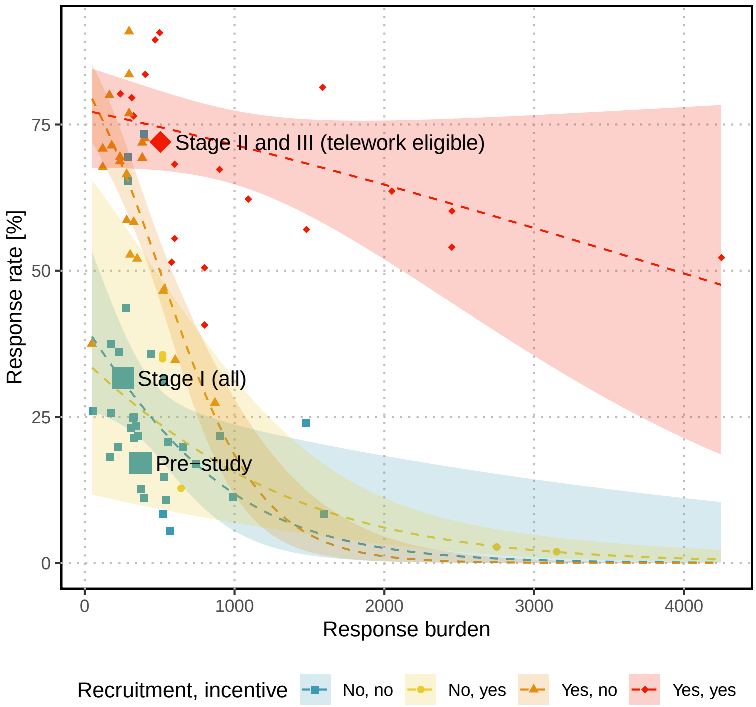

Figure 4: Updated relationship between response burden score and response rates.

the logistic transformation, parameters reflect changes in log-odds with marginal increases in response burden scores. The exponential $\exp(\beta_1)$ represents a marginal change in odds ratio (i.e., participation vs. non-participation). The back-transformed relationship between response burden and response rates is visualized in Fig. 4, alongside 95% confidence intervals. Commenting on the estimates, the effect of response burden is generally more negative than previously expected. The strongest effect can be found for the recruited subsample without incentive payment (*Yes, no*), where the odds of participating decrease by $(\exp(\beta_1/1000) - 1) * 100 = -0.298$, if the response burden score increases by 100 points (i.e., roughly 1/3). Whereas previously, the pooled effect of an increase in the response burden of 100 points was reported to be 6% it now is 10% decrease in the odds.

Response rates closely approximate ex-ante predictions, with the exception of the *pre-study*, falling below the 95% confidence bound. A potential explanation could be fatigue among respondents sourced via an address dealer, possibly due to frequent solicitations. Addresses for the main study were sourced from the Federal Statistical Office's official sampling frame, with careful measures to avoid repeated sampling. Additionally, initial participation was likely influenced by potential incentives offered upon completion of all three survey stages.

Recruitment shifts the curve, while incentives flatten it. Notably, the domain above a response burden score of 2'000 is sparsely populated, and the few observations strongly influence the curve's shape. However, surveys beyond 2'000 points appear overly burdensome for respondents, sustaining high response rates only through recruitment efforts combined with incentive payments, intensive care of the respondents and general interest in the topic of these intense studies.

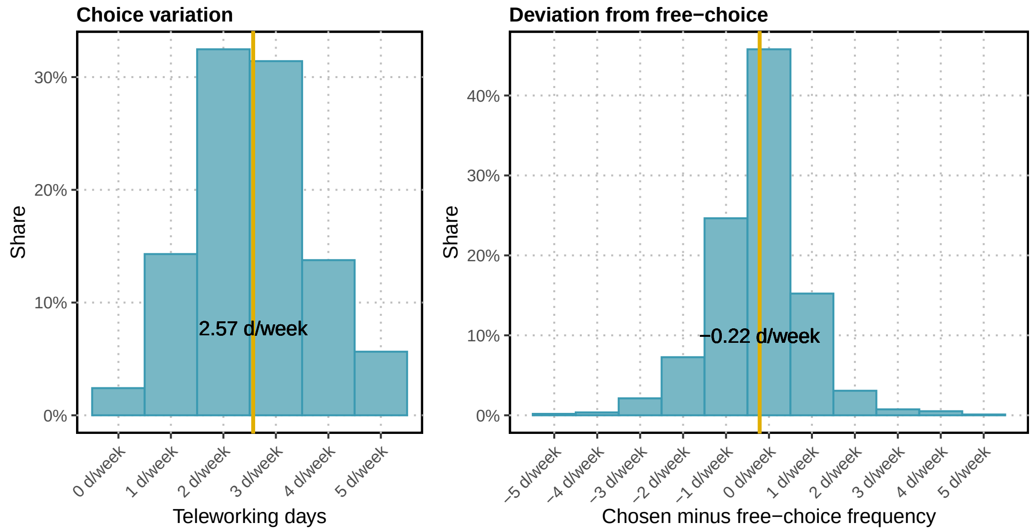

Figure 5: Variation in telework choices and deviation from the free-choice scenario.

The variability in telework choices within the SP experiment is illustrated in Fig. 5. Frequencies of telework choices reflect typical experimental work arrangement conditions but may not generalize universally. Choices of two to three teleworking days per week dominate, each accounting for over 30% of choices. Moreover, aggregate SP telework supply closely matches free-choice telework supply ($\Delta - 0.22$ days/week), with stated frequencies differing only marginally from free-choice frequencies in most instances. This suggests that the average pre-selected telework arrangement offers limited incentives for deviation beyond the marginal day.

Given respondents first selected preferred telework arrangements before specifying intended frequencies, the extent to which attribute-level balance is sustained in the frequency choices is questioned. Figure 6 features separate panels for each attribute level, detailing mean telework frequencies on the left y-axis and frequency of attribute levels retained on the right y-axis. Attributes display generally balanced distributions, even in secondary frequency choices. Initial work arrangement choices filtered out some attributes such as salary decreases and restricted telework locations (*work from anywhere*). The direction of the effects (blue lines) align with intuition: Attributes favorable to telework (e.g., salary increases) correlate with increased mean telework frequencies. The reported maximum difference (*Max diff*) in each panel serves as an indicator for effect strength, highlighting salary adjustments and flexible telework locations as influential levers in telework behavior.

Fig. 7 illustrates discrepancies between real-world and SP-implied shares of mobility tool ownership. Notably, car ownership is underrepresented, while PT subscriptions are overrepresented, reflecting the abstract nature of choice tasks. For example, one of the car attributes might be so unfavorable that respondents switch to PT, whereas in reality, they would simply buy another car. However, as these trade-offs are random they are in particular not correlated with telework frequencies and therefore should not bias telework treatment effects (see Section 5).

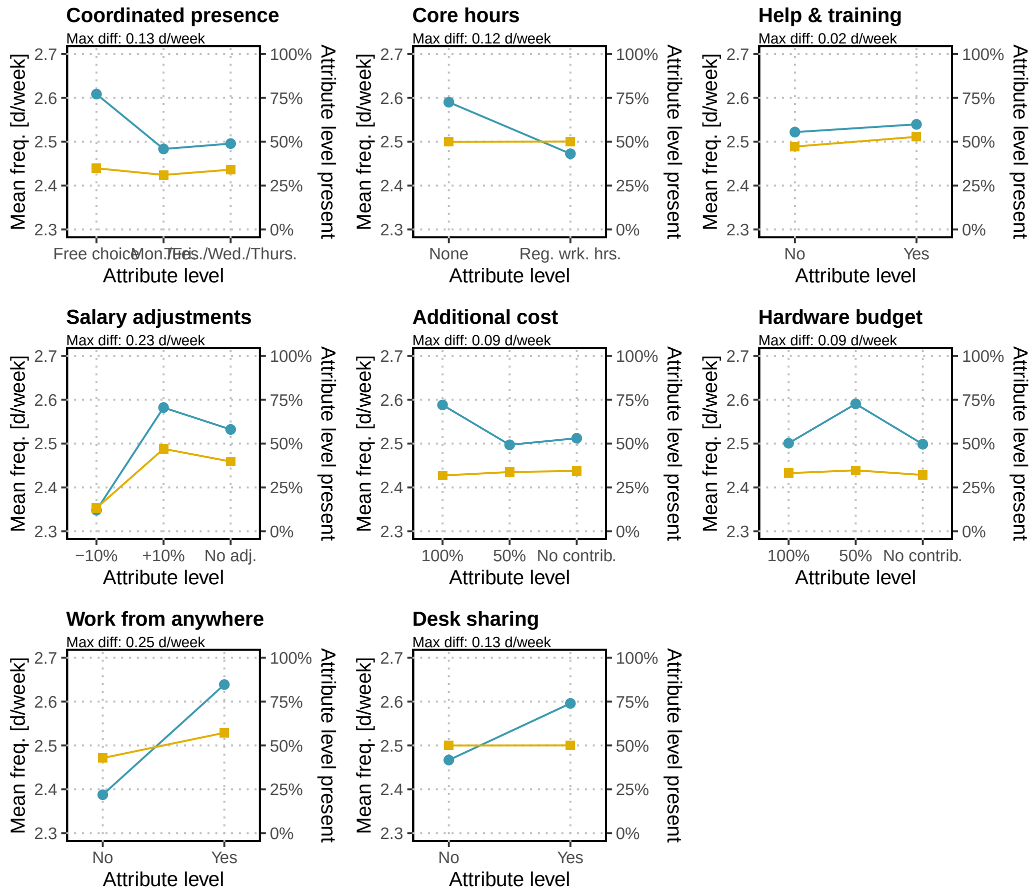

Figure 6: Relation between attribute levels and aggregate telework supply (blue lines, left y-axis) and attribute level balance (orange lines, right y-axis).

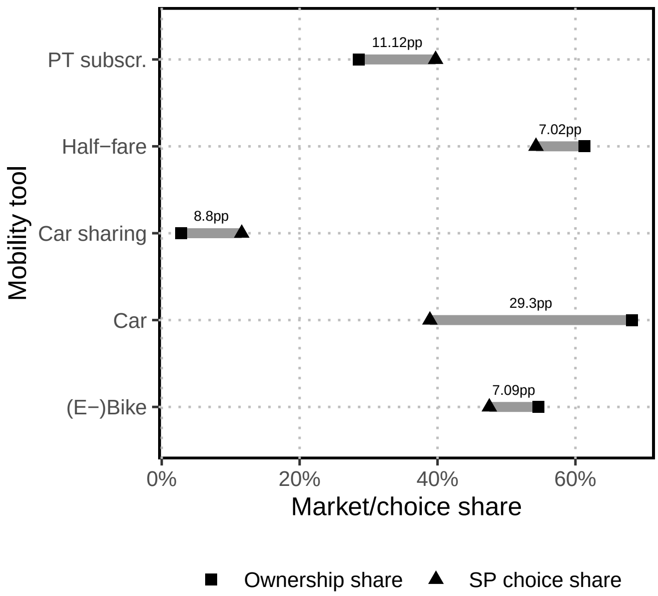

Figure 7: Comparison of real-world mobility tool ownership shares and SP choice shares.

4 Descriptive findings

Our dataset offers a unique opportunity to analyze shifts in telework patterns prompted by the COVID-19 pandemic. We distinguish between individuals who have the capability (*can*), permission (*may*), and inclination (*want*) to telework, and assess the extent of untapped telework potential. Table 6 provides comprehensive insights into these dimensions of telework and their distribution, presenting all possible two-way contingency tables for frequency and binary indicators.

Table *(12)* (first row, second column of Table 6) reveals a profound telework potential among the Swiss workforce, with over 60% holding teleworkable positions. Of these, 91.33% express a desire to telework, indicating widespread preference for remote work. As of the survey period (June-August 2023), approximately 40% actually teleworked, which implies a 20 percentage point gap between those who can and those who do.

We now turn to telework frequency shares before, during, and after the pandemic (table indexed *(11)*). The lockdown period witnessed exceptional telework uptake, with over half of the workforce shifting to remote work, and about one third fully remote. Comparison with the *Feasible* scenario suggests an oversupply during the lockdown (*Lockdown, 5+* > *Feasible, 5+*). The pandemic accelerated telework adoption by approximately 15 percentage points. Notably, the share of employees teleworking two to three days increased disproportionately, while full-time remote work even decreased. Panel a of Fig. 9 presents these results visually.

While a majority (83.72%) of those with teleworkable jobs work from home, employer constraints are still prevalent (table *(11)*, row *Budget*). To assess the extent of these constraints, refer to table *(51)*, which cross-tabulates *Budget* and *Free-choice*. The upper triangular matrix indicates the share of employees who desire more frequent telework but are constrained.

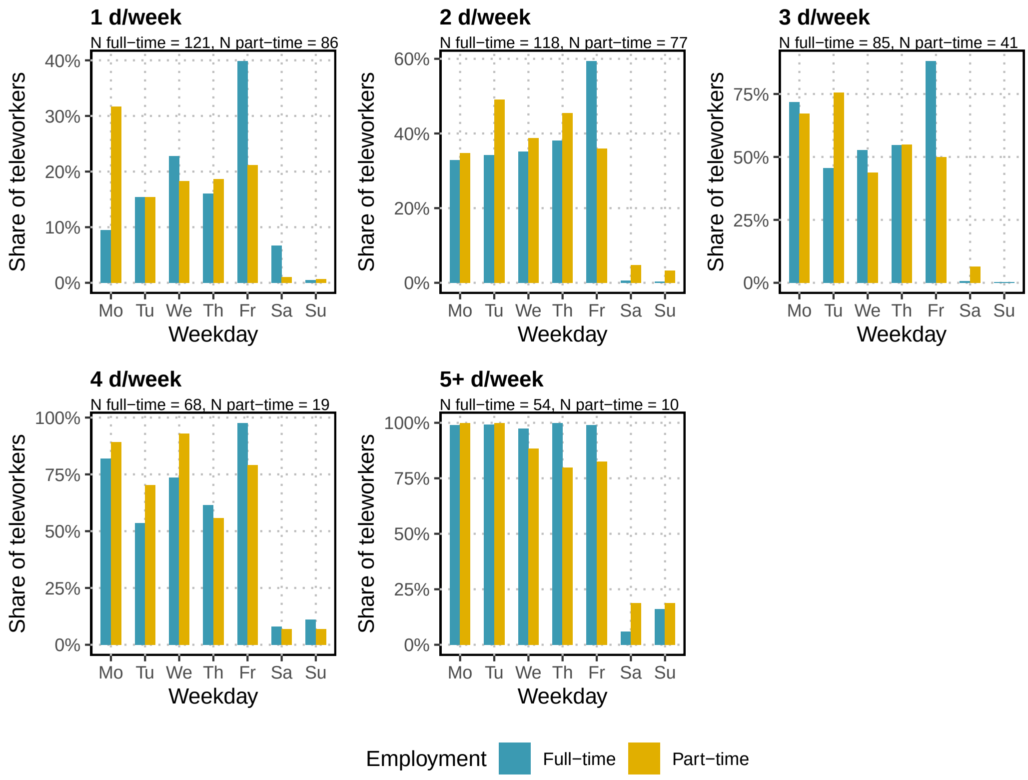

Figure 8: Distribution of telework shares across weekdays by number of teleworking days, for teleworking population only. Differentiating between full-time and part-time employed.

For instance, the first row, second column shows 6.23% who wish to telework one day but are not allowed to. Totaling 26.47% across the upper triangular matrix, highlights significant binding constraints. Understanding employer perspectives is crucial for interpreting telework frequencies.

Fig. 8 illustrates current telework distribution across weekdays for full-time and part-time employees. Mondays and Fridays are preferred telework days: Full-time employed favor Fridays, while part-time employed favor Mondays (potentially not working at all on Fridays). A preference for Mondays and Fridays can be observed among full-time employed teleworking at least three days a week.

Simulations based on telework access and frequency distributions project potential telework shares under alternative scenarios (panel b, Fig. 9). Implied home office shares under free-choice frequencies substantially increase, notably peaking on Fridays with nearly half of the workforce teleworking from home. Tuesdays and Thursdays show lower shares, suggesting varied impacts on transport infrastructure load across weekdays. These insights underline the need for separate analysis of Fridays and Tuesdays to Thursdays when examining telework's impact on transport demand.

Given these pandemic-driven shifts and the remaining potential, reconsidering the effect

Table 6: Telework distributions and contingency tables.

Frequency

(11)

	0	**1**	**2**	**3**	**4**	**5+**	***Sum***
Budget*	16.28	9.15	21.25	8.94	2.68	41.7	*100*
Current	60.01	12.23	11.81	7.44	4.9	3.59	*100*
Feasible	33.83	16.03	13.57	11.57	9.67	15.34	*100*
Free-choice*	8.67	25.18	24.93	20.48	11.3	9.44	*100*
Lockdown	43.02	6.17	7.44	5.57	7.49	30.31	*100*
Pre-COVID	74.16	9.55	4.98	1.62	2.99	6.7	*100*

Binary

(12)

	No	**Yes**	***Sum***
Can	38.41	61.59	*100*
May*	16.28	83.72	*100*
Want*	8.67	91.33	*100*
Do	60.01	39.99	*100*

Contingency

*(21)** **Current** (rows) × **Budget** (columns)

	0	**1**	**2**	**3**	**4**	**5+**	***Sum***
0	16.28	3.83	2.75	1.09	0.07	11.28	*35.3*
1	0	4.77	4.51	0.62	0.36	9.57	*19.83*
2	0	0.28	9.94	1.82	0.44	6.64	*19.12*
3	0	0	2.77	3.65	0.6	5.06	*12.08*
4	0	0.16	1.14	1.42	0.91	4.21	*7.84*
5+	0	0.1	0.14	0.35	0.31	4.94	*5.84*
Sum	*16.28*	*9.15*	*21.25*	*8.94*	*2.68*	*41.7*	*100*

*(22)** **Can** (rows) × **May** (columns)

	No	**Yes**	***Sum***
No	0	0	*0*
Yes	16.28	83.72	*100*
Sum	*16.28*	*83.72*	*100*

*(31)** **Current** (rows) × **Free-choice** (columns)

	0	**1**	**2**	**3**	**4**	**5+**	***Sum***
0	8.03	15.25	8.55	2.32	0.5	0.65	*35.3*
1	0.37	8.52	7.11	3	0.35	0.48	*19.83*
2	0.24	1.26	7.29	7.54	2.37	0.41	*19.12*
3	0	0	1.1	5.35	3.46	2.17	*12.08*
4	0	0	0.89	1.57	3.99	1.38	*7.84*
5+	0.02	0.14	0	0.69	0.62	4.36	*5.84*
Sum	*8.67*	*25.18*	*24.93*	*20.48*	*11.3*	*9.44*	*100*

*(32)** **Can** (rows) × **Want** (columns)

	No	**Yes**	***Sum***
No	0	0	*0*
Yes	8.67	91.33	*100*
Sum	*8.67*	*91.33*	*100*

(41) **Current** (rows) × **Feasible** (columns)

	0	**1**	**2**	**3**	**4**	**5+**	***Sum***
0	33.83	12.23	5.35	3.68	2.29	2.64	*60.01*
1	0	3.44	3.57	2.45	1.11	1.66	*12.23*
2	0	0.35	3.35	2.7	2.81	2.6	*11.81*
3	0	0	0.83	1.96	1.58	3.07	*7.44*
4	0	0	0.38	0.74	1.76	2.02	*4.9*
5+	0	0	0.08	0.04	0.12	3.36	*3.59*
Sum	*33.83*	*16.03*	*13.57*	*11.57*	*9.67*	*15.34*	*100*

*(42)** **Can** (rows) × **Do** (columns)

	No	**Yes**	***Sum***
No	38.27	0.14	*38.41*
Yes	21.74	39.85	*61.59*
Sum	*60.01*	*39.99*	*100*

*(51)** **Budget** (rows) × **Free-choice** (columns)

	0	**1**	**2**	**3**	**4**	**5+**	***Sum***
0	2.8	6.23	4.78	1.57	0.36	0.54	*16.28*
1	1.02	3.05	2.8	1.71	0.32	0.24	*9.15*
2	1.19	3.19	5.37	7.2	2.78	1.52	*21.25*
3	0.61	0.69	0.99	3.82	1.88	0.96	*8.94*
4	0.07	0.49	0.31	0.3	0.93	0.59	*2.68*
5+	2.98	11.53	10.68	5.88	5.04	5.59	*41.7*
Sum	*8.67*	*25.18*	*24.93*	*20.48*	*11.3*	*9.44*	*100*

*(52)** **May** (rows) × **Want** (columns)

	No	**Yes**	***Sum***
No	2.8	13.48	*16.28*
Yes	5.87	77.85	*83.72*
Sum	*8.67*	*91.33*	*100*

*(61)** **Budget** (rows) × **Feasible** (columns)

	0	**1**	**2**	**3**	**4**	**5+**	***Sum***
0	0	8.96	2.38	1.91	1.42	1.6	*16.28*
1	0	2.44	2.1	2.1	0.65	1.85	*9.15*
2	0	0.83	7.16	4.41	4.38	4.47	*21.25*
3	0	0.09	1.05	3.28	1.94	2.57	*8.94*
4	0	0	0.04	0.53	0.65	1.45	*2.68*
5+	0	10.6	7.43	6.25	5.66	11.77	*41.7*
Sum	*0*	*22.92*	*20.17*	*18.49*	*14.71*	*23.72*	*100*

*(62)** **May** (rows) × **Do** (columns)

	No	**Yes**	***Sum***
No	16.28	0	*16.28*
Yes	19.02	64.7	*83.72*
Sum	*35.3*	*64.7*	*100*

*(71)** **Free-choice** (rows) × **Feasible** (columns)

	0	**1**	**2**	**3**	**4**	**5+**	***Sum***
0	0	3.69	2.03	0.71	1.1	1.13	*8.67*
1	0	13.35	5.84	3.22	1.54	1.24	*25.18*
2	0	5.02	8.09	5.19	3.09	3.54	*24.93*
3	0	0.64	3.02	7.32	3.14	6.37	*20.48*
4	0	0.04	0.89	1.08	4.96	4.33	*11.3*
5+	0	0.19	0.29	0.97	0.87	7.12	*9.44*
Sum	*0*	*22.92*	*20.17*	*18.49*	*14.71*	*23.72*	*100*

*(72)** **Want** (rows) × **Do** (columns)

	No	**Yes**	***Sum***
No	8.03	0.63	*8.67*
Yes	27.27	64.06	*91.33*
Sum	*35.3*	*64.7*	*100*

Note: *Population where telework is feasible (Can == Yes), **Budget:** Max. number of days allowed to telework, **Current:** Telework frequency as of survey date (June - August 2023), **Feasible:** Max. number of teleworking days feasible given job situation, **Free-choice:** Free-choice telework frequency (given job situation), **Lockdown:** Telework frequency during COVID-related lockdowns, **Pre-COVID:** Telework frequency before the COVID-pandemic, **Can:** Job is teleworkable, **May:** Employer allows teleworking, **Want:** Respondent wants to telework, **Do:** Respondent teleworks.

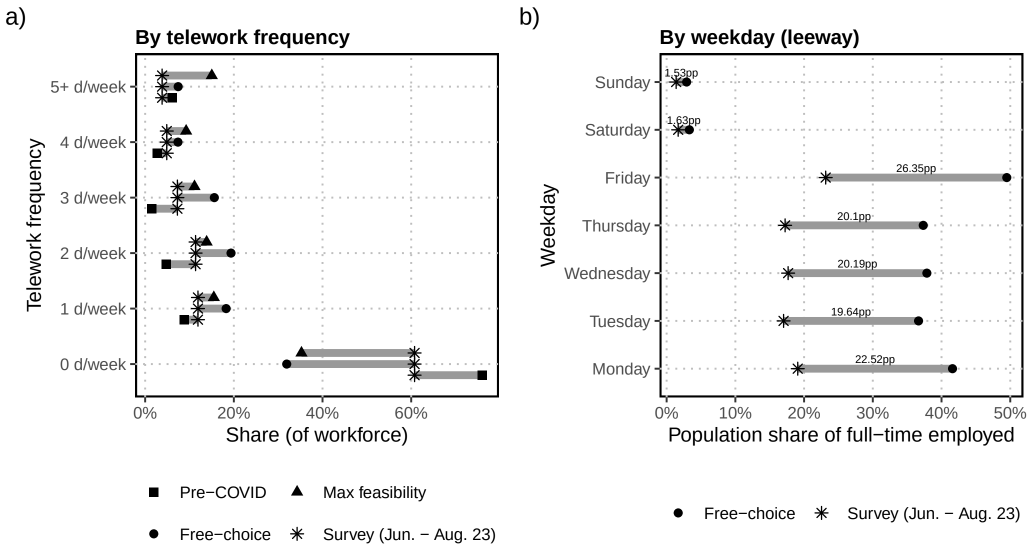

Figure 9: Evolution of telework frequency shares, before, during and after the pandemic (panel a), and potential leeway for teleworking shares on weekdays (panel b). Workforce population only.

on mobility tool ownership is pertinent. As discussed in Section 1, this higher-order effect has been overlooked in previous studies. While group differences in ownership (panel a and b, Fig. 10) suggest teleworkers more commonly own a half-fare card and slightly more often bicycles or E-bikes, car ownership and PT subscriptions are marginally lower among teleworkers. Panel b highlights distinct mobility tool compositions among those teleworking five or more days weekly, notably lower car and PT subscription ownership, the predominant commuting modes in Switzerland. However, simple group comparison might not portray the full picture as teleworkers likely constitute a special group with different mobility tool preferences even in the absence of the telework treatment (selection bias).

Therefore, clearer trends emerge from stated preference data where telework treatment was exogenous (see discussion in Section 2.4). Fully remote employees exhibit unique characteristics, evidenced by trends in (E-)bike and car ownership reversals, alongside linear trends in half-fare card and bike ownership increases, and declines in car ownership and PT subscriptions, particularly evident beyond four telework days weekly.

5 Telework treatment effects

To assess the telework treatment effects, we conducted simple probit regressions, regressing telework frequency on mobility tool ownership. Due to observed non-linearities, separate coefficients were estimated for each telework frequency. Further distinctions were made between E-bikes and regular bikes, as well as between national and regional PT season tickets (ST). Results including estimates and standard errors are presented in Table 7. Bootstrapped ownership shares derived from these probit models, along with their corresponding

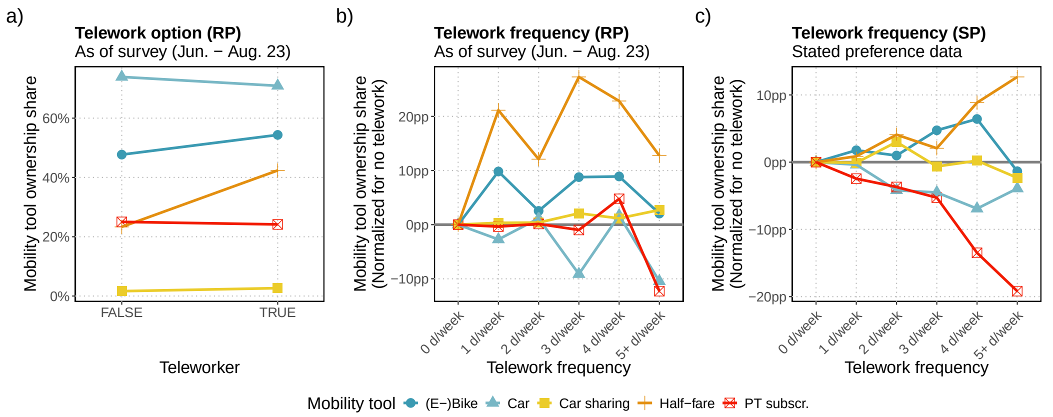

Figure 10: Comparison of mobility tool ownership shares by telework status and frequency. Panel a and b reflect ownership as of the survey period (June-August 2023), panel c is based on stated preference choices.

95% confidence intervals (accounting for uncertainty in parameter estimates), are illustrated in Fig. 11.

Consistent with earlier observations, the overall trends remain unchanged (as expected). Notably, significant telework treatment effects were observed only for frequencies of four days per week or more, particularly impacting PT subscriptions (half-fare card, national, and regional season tickets). These effects are evident as individuals at higher telework frequencies opt to cancel their season tickets in favor of the half-fare card. Conversely, no significant substitution effect was observed for car ownership, though it may play a role for (E-)bikes at lower telework frequencies. Contrary, there is some indication that car as the other main commuting mode looses some ownership share while not as pronounced as for PT subscriptions and with the before mentioned reversal for fully remote workers.

6 Conclusion

There has been enduring interest in the complex interplay between telework and mobility behavior, particularly regarding their implications for energy consumption and broader climate considerations. The COVID-19 pandemic acted as a catalyst for the widespread adoption of telework, reigniting academic discussions on its impact. In Switzerland, our data indicates a 15 percentage point increase in the teleworking population during the pandemic, with a notable rise in those opting for two to three teleworking days. The comprehensive dataset gathered for this study uniquely positions us to analyze the telework-related shifts brought about by the pandemic in Switzerland, including distinctions among those capable, permitted, and desiring to telework, as well as the potential for further expansion of telework practices.

The primary objective of this paper was to detail the survey methodology and present the collected data. Initially, 10‘441 addresses were obtained from the Federal Statistical Office, with 3‘234 respondents completing the introductory survey. Eligible telework participants

Table 7: Simple probit models regressing telework frequency (as an indicator) on mobility tool ownership.

	Bike	Car	Car sharing	E-bike	National ST	Half-fare	Regioanl ST
(Intercept)	−0.06	−0.22***	−1.22***	−0.14**	−0.30***	0.03	0.01
	(0.07)	(0.04)	(0.06)	(0.05)	(0.06)	(0.04)	(0.06)
wfh1	−0.02	−0.01	−0.00	0.07	−0.09	0.02	−0.05
	(0.11)	(0.06)	(0.08)	(0.07)	(0.09)	(0.06)	(0.09)
wfh2	0.02	−0.11	0.15	0.03	−0.09	0.10	−0.10
	(0.11)	(0.06)	(0.08)	(0.08)	(0.09)	(0.06)	(0.09)
wfh3	0.14	−0.12	−0.03	0.10	−0.16	0.05	−0.13
	(0.11)	(0.07)	(0.09)	(0.08)	(0.10)	(0.07)	(0.10)
wfh4	0.20	−0.18*	0.01	0.15	−0.39**	0.22**	−0.36**
	(0.14)	(0.08)	(0.10)	(0.10)	(0.12)	(0.08)	(0.11)
wfh5	−0.06	−0.10	−0.13	−0.03	−0.51***	0.33**	−0.54***
	(0.17)	(0.10)	(0.14)	(0.12)	(0.15)	(0.10)	(0.15)
AIC	1664.14	4841.47	2603.35	3358.74	2349.83	4986.28	2439.51
BIC	1694.65	4878.64	2640.51	3393.50	2382.95	5023.44	2472.39
Log Likelihood	−826.07	−2414.73	−1295.67	−1673.37	−1168.91	−2487.14	−1213.75
Deviance	1652.14	4829.47	2591.35	3346.74	2337.83	4974.28	2427.51
Num. obs.	1195	3620	3620	2425	1846	3620	1774

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. ST = Season ticket. wfh = Work from home (d/week).

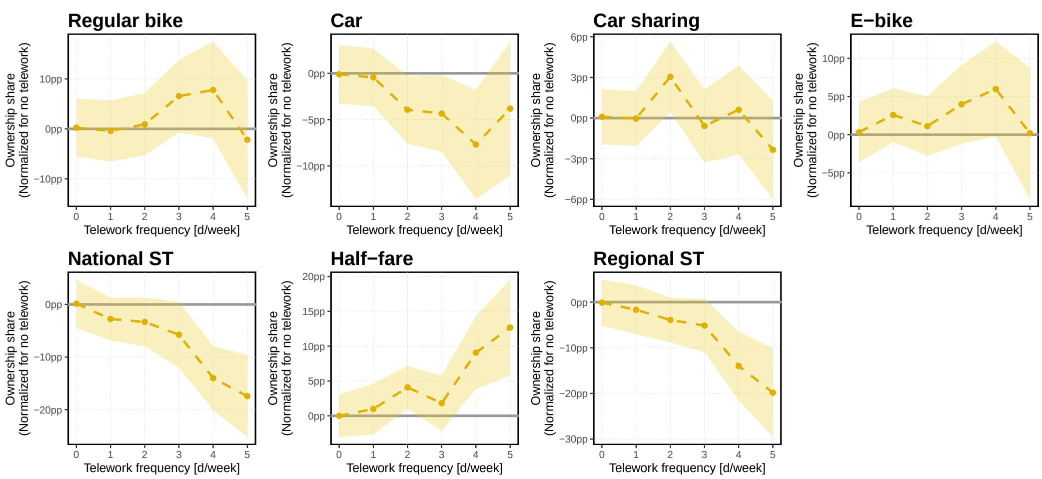

Figure 11: Bootstrapped ownership shares based on probit models linking telework frequency to ownership choices (Table 7). 95% confidence intervals reflect parameter estimation uncertainties. ST denotes season ticket.

were subsequently invited to participate in two stated preference experiments: One exploring preferences for hybrid work arrangements and another examining the relationship between telework and mobility tool ownership (MTO). A total of 922 respondents completed all three stages of the survey. The dataset supports a wide array of telework-related research questions, available for future academic exploration.

Our findings underscore Switzerland's unique telework potential, with over 60% of the workforce having jobs amenable to telework. Of these, 91.33% express a desire to telework, underscoring widespread interest in hybrid work arrangements. Despite this potential, there remains a 20 percentage point gap between telework-capable individuals and those currently teleworking. Although a majority (83.72%) of telework-capable individuals can work from home, employer-imposed constraint restrict telework for approximately one-fourth (26.47%) of these individuals who wish to telework more frequently.

Mondays and Fridays are generally preferred as teleworking days. Through simulation exercises that account for telework access, frequency distributions, and weekday preferences, we demonstrated strong variability, potentially translating to similar variability in transport network loads across weekdays. Notably, Fridays warrant separate analysis when assessing telework's impact on transport demand.

Various higher-order effects have been proposed that may influence the overall climate impact of telework, supplementing the reduction in commute-related emissions. This study contributes by examining a previously overlooked higher-order effect: The relationship between telework and mobility tool ownership. We argue against simplistic group comparisons, highlighting the endogeneity of telework supply which introduces potential bias into analyses if not accounted for. Our analysis of stated preference data reveals no direct adverse impact of telework on climate through a shift from public transport (PT) subscriptions to car ownership. Instead, teleworkers tend to substitute PT subscriptions with half-fare cards, particularly at higher frequencies of telework (4+ days per week). However, this shift may influence household-level mode choice, potentially favoring car use where households retain cars but forego PT subscriptions. Presently, only about 8% of the workforce teleworks four or five days a week, suggesting that PT subscriptions are still attractive contrary initial concerns of PT service providers. Furthermore, our findings indicate that these second-round adverse effects, while theoretically significant, are practically negligible.

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A Survey methods

Table 8: Generic attributes tested in the pre-study.

Attribute	Explanation
Collegiality	The employer takes specific measures to promote the flow of information as well as the feeling of togetherness.
Flexible working hours	Possibility to freely arrange working hours. You are also allowed to stay away from work for longer periods during the home office, provided you complete your tasks and compensate for the working time.
Free choice of home office days	Possibility to freely choose available home office days. You are free to decide on which days of the week you work from home.
Free choice of work location	You are free to choose the location at which you operate your home office, as long as you are in Switzerland.
Desk sharing	At your company's office, you do not have your own office space but have to work in desk-sharing.
Working during commute	If you decide to work in the office, you may work on the commute and count this time to your working hours.
Financial compensation	All additional costs caused by home office (office supplies, heating costs, internet, etc.) are borne by the employer.
Wage deductions	If you work in home office, your salary will be marginally adjusted (assume here a salary adjustment of 2% per home office day). The wage deductions can also be realized indirectly via reduced fringe benefits.

Table 9: Structure of introductory survey.

Topic	Question	Remark
Intro	User consent	Welcome participant; Reminder to participate even if teleworking is not possible/allowed
Screening employment	Work status	Only proceed if respondent is in workforce
Screening WFH	Feasibility to perform work partially remotely; Employer's stance on home office; Is the option to telework provided; Current home office frequency and free-choice	Understand the current WFH status; Identify display logic for WFH-related questions

Continued on next page

Table 9 (*Continued*)

Topic	Question	Remark
Sociodemographics	Marital status; Education	Further sociodemographics can be inferred from address register
Household	Household size; Household and personal income	
Residence	Type of residence; Size of residence; Monthly additional costs (e.g., heating and hot water); Access to second residence	Residential characteristics determine the quality of the home office environment; Home office as an option to spend more time at second residence
Work	Full-time or (multi-) part-time employed; Workload (as % of full-time equivalent); NOGA sector; Work location (geo-referenced); Firm size; Occupation's ISCO classification; Type of work contract (e.g. permanent vs. fixed-term); Shiftwork; Work schedule (e.g. fixed number of working hours per week); Managing people	The job role is expected to highly influence the home office access and frequency
Mobility	Driving license; Mobility tool ownership pre-COVID; Current mobility tool and PT season ticket ownership; Specifics of current car; Parking available (at home and work location); Main commute mode	Investigate COVID-induced change in MTO; Inertia/habits in MTO
WFH I	Work status before and during COVID; Home office frequency before COVID and during lockdown	Frequency during lockdown can be used as a proxy for maximum home office feasibility

Continued on next page

Table 9 (*Continued*)

Topic	Question	Remark
WFH II	Budget required to set up home office workstation; Does employer contribute to these expenses; Desk sharing in office	Reference values for SP and pooled RP-SP estimation
WFH III	Preferred home office weekdays; Maximum number of home office days set by employer; Degree of coordination (office attendance); Reference values for SP (see SP attributes); Characteristics of home office workstation	Reference values for SP and pooled RP-SP estimation
Teleworkability	Job's degree of digitization; Job requires physical interaction; Work context (specialized work environment); Tech savyness; Personal suitability; Residential suitability; Home office workstation suitability	Indicators for measurement equations (for latent teleworkability variable)
Psychometrics	Minimal item battery to identify character traits	Possibility to include character traits as latent variables; Home office as an option to avoid personal interaction, to shirk, etc.
Outro	E-mail address	Further communication is done via E-mail

The participants were introduced to the WFH choice task with the following text:

On the following pages, you are asked to choose between different **work arrangements** and tell us about **how many days** you would work from home under the selected scenario. Here is what a choice situation looks like:

- Two work arrangements are presented (A and B), which differ along eight dimensions (will be explained at a later stage).
- You are asked to choose your preferred arrangement.
- As a last step, you are asked to reveal how many days you would work from home (home office frequency) given your selected arrangement.

There are for choice situations in total.
(see Fig. 1 with selected work arrangement A and selected telework frequency of 3 days)

I prefer work arrangement A over B and would like to work from home on 3 days a week given the conditions in arrangement A.

The participants were introduced to the MTO choice task with the following text:

In this survey, we want to determine how far **home office** impacts your **mobility tool ownership** choices.

On the following pages, you are asked to choose between different mobility tools under various home office scenarios. Imagine that all your current mobility tools have expired and need to be **renewed** anyways. This is what a choice task looks like:

(see Fig. 2 with selected PT subscription and bicycle).

In the example above and given the home office situation presented, I would choose to own the PT subscription and the bicycle.

- In the black box, a hypothetical home office situation is presented. The scenario consists of **how many days a week you work from home** and whether or not **working from anywhere (within Switzerland)** is allowed. The home office frequency is based on your answers from previous surveys: Either it matches your stated preference or it is based on your answer regarding how many days you could shift to home office given your work tasks.
- Please take a moment to reflect on what your life and mobility behaviour would look like, **given the home office situation** presented.
- Each choice card contains a **car** offer, a **public transport (PT) subscription** offer (either GA or regional season ticket), the price of the **half-fare card**, a **car sharing** service as well as a **bicycle** (either regular or E-Bike) offer. The exact attributes and what they imply are subsequently introduced.
- Last, you can choose for each of the five mobility tools whether or not you would like to own these tools at the conditions outlined. There are no other options available. F.ex. if you do not want to own the presented car, you don't have any other car available. So think about what composition of mobility tools would best match your needs given the home office scenario.
- Apart from the costs presented, you can assume that **all other prices are as of today** (e.g., fuel prices, single-fare train tickets, electricity prices, etc.).

B Teleworkability factor analysis

To assess an individual's teleworkability, an item battery of six Likert-style questions was proposed. In this section, the result of an exploratory and confirmatory factor analysis (EFA and CFA) is presented to gauge the suitability of the indicators to capture this latent dimension.

The EFA hinted that two latent variables explain the choices on the Likert-scale, cumulatively explaining 53% of the variation. One factor describes job-related dimensions whereas the other is concerned with the personal characteristics as well as the (home office) environment of that person. The two factors could thus be labeled *in-job* and *out-job*.

Table 10: Confirmatory factor analysis.

	One factor model	Two factor model
F1: I am tech savy	1.00	1.00
	(0.00)	(0.00)
F1: you as a person	1.54^{***}	1.94^{***}
	(0.08)	(0.10)
F1: workstation	1.41^{***}	1.77^{***}
	(0.08)	(0.09)
F1: job can be done from computer	2.69^{***}	
	(0.13)	
F1: job requires physical interaction	-1.54^{***}	
	(0.09)	
F1: job requires specific work environment	-1.99^{***}	
	(0.10)	
F2: job can be done from computer		1.00
		(0.00)
F2: job requires physical interaction		-0.59^{***}
		(0.03)
F2: job requires specific work environment		-0.76^{***}
		(0.03)
Nu. obs.	1914	1914
Nu. params.	12.00	13.00
CFI	0.82	0.94
TLI	0.70	0.89
RMSE	0.18	0.11
LL	−22424	−22229
AIC	44872	44484
BIC	44939	44556

Note: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

The CFA confirms that the two-factor model performs better than the one-factor model across all fit indicators. The comparative fit index (CFI) and Tucker-Lewis index (TLI) imply good fit whereas the root mean squared error of approximation (RMSE) implies mediocre fit. Still, the one-factor model can be used to gauge the relative importance of all the indicators (as the two-factor model has two normalized loadings). Unsurprisingly, the possibility to perform a job on a computer loads most strongly on the overall teleworkability.

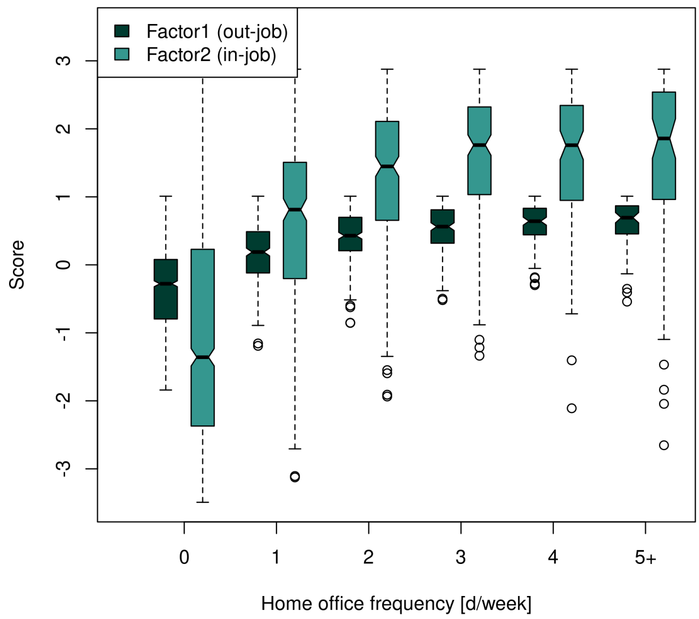

Figure 12: Correlation between teleworkability factors and telework frequency.

Meanwhile job-related and person-specific indicators load with similar magnitudes.

The signs of the factor loadings are intuitive and the loadings itself highly significant. The two factors are correlated hinting that people with a higher in-job teleworkability have higher out-job teleworkability, e.g. they are equipped with a more suitable home office workstation.

Both factors seem to discriminate people who do not work remotely and people who do (Fig. 12). On the other hand, teleworkability seems not to be different for employees working three, four or five-plus days from home a week. Going fully remote is therefore most likely not purely a question of teleworkability but other factors (such as the preference dimension) could play a dominant role.

We propose accounting for this latent teleworkability in modeling approaches, acknowledging that not every employee has the full choice set.