Involuntary Changes in Commuting Distances: Effects on Subjective Well-Being in the Era of Mobile Internet

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Abstract

Commuting is a fundamental aspect of employees' daily routines and continues to evolve with technological advancements. Yet the effects of commuting on subjective well-being remain insufficiently investigated in the context of expanding digital connectivity. This paper examines the causal effects of changes in commuting distance on subjective well-being in an era of widespread mobile internet availability. Exploiting exogenous shifts in commuting distance resulting from employer-driven workplace relocations, we employ a Difference-in-Differences framework using data from the German Socio-Economic Panel (SOEP) from 2010 to 2019. Our results show that an involuntary increase in commuting distance reduces life satisfaction by 3 percent, on average, and heightens feelings of worry by almost 8 percent, on average. Our heterogeneity analysis shows that increased mobile coverage during commutes partially mitigates the decline in life satisfaction but exacerbates the negative impact on satisfaction with leisure.

Keywords: Commuting, Subjective well-being, Mobile coverage, Life satisfaction, SOEP, Panel data

JEL Codes: I31, J28, R40

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1. Introduction

Commuting is a key aspect of modern life, shaping how individuals navigate work, leisure, and their well-being. In Germany, more than 60 percent of employees commute across municipality borders (BBSR, 2023). While commuting is often considered a necessary cost of employment, longer commutes tend to reduce life satisfaction (Stutzer and Frey, 2008; Botha et al., 2023). Over time, technological advancements, such as the introduction of mobile internet, have transformed commuting from a passive task into an opportunity for work, digital communication, and media consumption. This raises the question of how commuting affects subjective well-being with these technological advancements and what role digital connectivity plays in this relationship.

This paper examines the marginal effects of altered commuting distance on subjective well-being.[1] We leverage exogenous changes in commuting distance which might be induced by employer-driven workplace relocations or detours due to roadworks in Germany. We focus on employees whose commuting distance changes involuntarily and compare them with commuters with a constant commuting distance in a Difference-in-Differences framework. We estimate the causal effect of a commuting distance increase while holding constant other life circumstances, such as home and employer. Using longitudinal data from the German Socio-Economic Panel (SOEP) between 2010 and 2019, we find that an involuntary commuting distance increase of at least 5 km reduces individuals' life satisfaction.

The exogenous increase in the commuting distance reduces life satisfaction by 0.25 points on an 11-point scale or 3 percent evaluated at the control group's mean, reflecting the immediate disruption to individuals' routines when no compensatory factors, such as improved living or working conditions, are present. Analyzing event study estimates, we observe adaptation, with the negative impact diminishing one year after the treatment. Additionally, employees with an involuntary increase in their commuting distance experience feelings of worry almost 8 percent more often (0.14 points on a 5-point scale), underscoring the emotional strain caused by such changes.

To analyze the mechanism, we differentiate between the negative effects of increased commuting distance and those arising from potentially new circumstances, such as relocation to a different office at the same employer. Our findings indicate that the adverse impact on subjective well-being intensifies as the change in the commuting distance grows. Doubling the commuting distance decreases life satisfaction by 0.37 points and increases the frequency of feeling worried by 0.16 points. We furthermore find that about two-thirds of the reduction in

[1] Subjective well-being is increasingly used as an outcome measure, providing a more comprehensive assessment of individuals' lives and experiences instead of objective indicators such as income. Economists frequently use subjective well-being as a proxy for individual utility (Dolan et al., 2008; Kahneman and Krueger, 2006). In this paper, we use subjective well-being to evaluate the effects of exogenous commuting changes on individuals' utility.

life satisfaction can be attributed to the distance increase and only one-third to other circumstances.

Since mobile internet became more widely available after 2010, we examine whether it has the potential to reshape the commuting experience. We use data from the German Federal Network Agency (*Bundesnetzagentur*). Enhanced connectivity allows individuals to remain productive or entertained during their commute but may blur the boundaries between work and personal time, limiting opportunities for relaxation. While improved connectivity during commutes mitigates the decline in life satisfaction for those facing increased distances, it exacerbates the reduction in satisfaction with leisure.

We further examine how subjective well-being responds to other types of commuting distance changes, specifically decreases in commuting distance and voluntary increases, such as those arising from job changes or residential relocations. Our results reveal an asymmetry in responses to commuting distance changes: *increases* reduce life satisfaction, but *equivalent reductions* do not yield comparable gains. However, commuting distance reductions do enhance satisfaction with leisure, likely due to more time for personal activities. This pattern may reflect a negativity bias, where negative events, such as longer commutes, have a greater impact on subjective well-being than comparable positive changes, such as shorter commutes (Baumeister et al., 2001). Notably, the negative effects of longer commutes are mitigated when the change is *voluntary*. When individuals accept longer commutes due to job transitions (or change of residence), work (dwelling) satisfaction increases while overall life satisfaction remains stable, highlighting how having control over the decision to commute longer distances allows individuals to offset costs with perceived benefits.

This study contributes to the literature by revisiting the commuting paradox in the context of modern digital connectivity and by isolating the marginal effects of commuting.[2] The predominant approach in the literature is to analyze changes in commuting distance (Lorenz, 2018; Ingenfeld et al., 2019) or commuting time (Clark et al., 2020; Stutzer and Frey, 2008; Dickerson et al., 2014) regardless of their cause. We follow the identification strategy by Jacob et al. (2019) and Botha et al. (2023) and investigate commuting distance increases while the employer, job, and living location of an employee remain unchanged.[3] We extend the literature by constructing a dummy variable for a commuting distance increase and estimate event studies which enable us to study the duration of the effect and show that the parallel trends assumption might hold. Additionally, we decompose the treatment effects into a portion explained by changes in the commuting distance and changes in the circumstances.

Furthermore, we challenge the literature on the commuting paradox by demonstrating that voluntary increases in commuting distance, such as those resulting from job changes, do not

[2] The commuting paradox refers to findings in the literature showing that individuals are not adequately compensated for longer commutes (Stutzer and Frey, 2008).

[3] Roberts et al. (2011) and Künn-Nelen (2016) apply the same identification strategy as a robustness check.

negatively impact overall life satisfaction (Stutzer and Frey, 2008) and explain this with improvements in satisfaction with other life domains, like work. Finally, we provide novel evidence on the effect of increased mobile coverage during the commute on subjective well-being. Our findings offer new insights into how digitalization impacts commuting experiences.

The rest of the paper proceeds as follows. Section 2 provides an overview of the related literature. Section 3 details the data and variables used in our analysis. In Section 4, we describe our identification strategy. Results are presented in Section 5. Section 6 concludes with a discussion of the findings.

2. Related Literature

Microeconomic theory suggests that commuting should not affect utility or subjective well-being, as rational individuals would choose to commute only when the resulting benefits (such as higher salaries or better housing conditions) compensate for the costs (including time expenditure, stress, and health impairments). However, empirical evidence presents a mixed picture.

Stutzer and Frey (2008) exploit longitudinal data for Germany (SOEP) from 1985 to 2003 and find that employees with longer commutes consistently report lower levels of subjective well-being. Consequently, they conclude that commuters are not adequately compensated for their travel burden. Stutzer and Frey (2008) refer to their finding as the commuting paradox since it contradicts the spatial equilibrium prediction from microeconomic theory.

Subsequent research has revealed significant heterogeneity in the relationship between commuting and subjective well-being, particularly in terms of gender differences. Botha et al. (2023) find that commuting has a modest negative effect on the affective well-being of Australian men and is strongest for men with pre-existing mental health issues. They do not find a statistically significant effect on women. Conversely, Roberts et al. (2011) and Jacob et al. (2019) document negative effects on women's overall life satisfaction in the UK, with no significant impact on men. Bergemann et al. (2024) analyze data for West Germany and find a positive willingness to pay for reducing commuting distance, which almost doubles for mothers, indicating a negative relation between commuting and subjective well-being.

Contrary to these findings, several studies find no general negative relationship. Lorenz (2018) analyzes the same longitudinal data frame but a different time period as Stutzer and Frey (2008) and finds no overall negative effect of longer commutes on subjective well-being, a finding corroborated by Dickerson et al. (2014) using UK data. Nevertheless, these studies identified negative effects in specific life domains, such as family life and leisure time. Clark et al. (2020) find a similar result for employees in England. They find no effect of longer commutes on overall life satisfaction but a negative effect on job and leisure satisfaction and lower mental health. Künn-Nelen (2016) finds a negative effect of longer commutes on subjective health measures, which is accentuated for women.

The relationship between commuting and subjective well-being also depends on the commuting mode and distance. The literature distinguishes between active (walking or cycling) and passive commuting modes (public transport or driving). Wang et al. (2023) report that longer commutes decrease life satisfaction in China, noting that switching from passive to active commuting modes can enhance life satisfaction. Clark et al. (2020) find that walking to work increases satisfaction with leisure time. Additionally, the distance appears to play a crucial role: Ingenfeld et al. (2019) analyze German data from the SOEP, and their results indicate a non-linear relationship with negative effects predominantly concentrated among individuals commuting more than 80 km daily each way.

To date, there is only one study dealing with the relationship between internet usage, commuting, and subjective well-being. Lachmann et al. (2017) use data from an online survey but do not investigate causal relationships. Participants are asked about their commuting status and their individual assessment of their life satisfaction. Their internet usage is measured by their responses to a shortened version of the Internet Addiction Test. The authors find evidence that some commuters attempt to alleviate their perceived stress by increasing their internet usage.

In recent years, the amount of studies on the impact of internet use on subjective well-being has increased.[4] The results are ambiguous. Studies that find a positive effect on subjective well-being are mostly studies that connect broadband internet to an improvement in economic outcomes, which in turn has a positive impact on subjective well-being.[5] Papers studying the relation of internet availability and particularly social media find mostly negative effects on mental health, especially for young people (Allcott et al., 2020; Braghieri et al., 2022; Donati et al., 2022). Allcott et al. (2020) find in a randomized experiment setting that deactivating Facebook leads to higher subjective well-being levels. Braghieri et al. (2022) examine the introduction of social media in colleges and find that the adoption of Facebook has a negative impact on students' mental health and attribute this to the fact that Facebook reinforces unfavorable social comparisons. Studies that use data from the SOEP and use internet as an explanatory variable tend to focus on health aspects (e.g., sleep and the effect on social capital).[6]

3. Data

3.1. German Socio-Economic Panel

We use data from the German Socio-Economic Panel (SOEP) for the years 2000 until 2019. The SOEP provides representative longitudinal survey data of currently about 30,000 house-

[4] Castellacci and Tveito (2018) develop a theoretical framework on how the internet influences subjective well-being. They identify communication, easier information access, change in time use, and the creation of new activities as mechanisms through which the internet affects well-being.

[5] For an overview, see Johnson and Persico (2024).

[6] Billari et al. (2018) find a negative effect of internet use on sleep. Presumably, poorer health will lead to lower subjective well-being. Bauernschuster et al. (2014) find a positive effect on social capital, which would have a positive effect on subjective well-being.

holds in Germany. The same households and individuals participate annually in the survey. The SOEP offers extensive data on work and employment, wealth, income, standard of living, health, and subjective well-being measures, as well as family and social networks and socio-economic factors.

In our study, we focus on the period from 2010 to 2019.[7] Hence, we examine the influence of internet availability during commuting on subjective well-being. The period from 2010 onward is of particular interest because smartphones and mobile internet only became widespread from then onward.[8]

We derive the treatment indicator from the self-reported commuting distance, given by the answer to the question: "How far do you travel to work on a normal workday? [A] x km, [B] Can't say since I work in different locations, [C] Workplace and dwelling are in the same building or on the same property".[9] If the distance increased by at least 5 km from one year to the next and the individual did not move nor change employer or job, our treatment dummy is one, otherwise zero.[10]

To answer our research question, we restrict the data in several dimensions. First, we restrict our sample to working adults aged 16–67 and exclude self-employed individuals (following Roberts et al., 2011) as we are interested in commutes to the workplace. Second, we restrict our sample to years in which individuals did not move or change employer or job to separate voluntary commuting distance changes from employer-induces ones. Furthermore, we exclude individuals who have changing workplaces (e.g., craftsmen with changing construction sites) and individuals who work in the same building they live in since non-commuters could be inherently different from commuters. Additionally, we exclude individuals who commute longer than 300 km since these individuals most likely do not commute each day, which makes them less comparable with daily commuters. Finally, we only keep individuals who have three or more consecutive years of observation to be able to follow individuals appropriately over time.

[7] We report the results for the period from 2000 to 2009 only in the Appendix to compare our approach with studies analyzing this earlier period, such as Lorenz (2018).

[8] The first iPhone was sold in Germany at the end of 2007. The first LTE (4G) station in Germany was activated in mid-2010.

[9] We use commuting distance as the independent variable because individuals were asked about their commuting distance more regularly than about their commuting time. Commuting time and distance are correlated in our sample, as shown in Figure A.1. The figure only shows observations for the years 2015, 2017, and 2019, as only in these years individuals have been asked about their commuting time.

[10] In the years 2014, 2016, and 2018, individuals were not surveyed about their commuting distance. We impute the commuting distance using data from the subsequent year. This approach, however, implies that we cannot precisely determine in which of the two years the change in commuting distance actually occurred. As a result, it could happen that someone moves or changes their employer or job in 2015, and therefore, the change in distance occurs. We would then have a false treatment in 2014 (distance increase without relocation, job, or employer change). To address this issue, we examine whether a relocation, job change, or employer change took place either in the imputed year or the following year. If such a change is identified, we exclude the respective year from our analysis. Nevertheless, we might still assign the treatment one year too early when, in fact, the change occurs later. This would lead to an underestimation of the effect.

Subjective well-being is a multidimensional concept that includes cognitive and affective components. The cognitive component refers to satisfaction with life and satisfaction with certain subdomains of life, such as leisure, health, or work. It describes how individuals evaluate their lives in general and in specific areas. Affective well-being refers to the experience of certain emotions and moods. Higher subjective well-being is indicated by having a higher satisfaction with life (cognitive) and experiencing positive emotions/ moods more frequently and experiencing negative emotions and moods less frequently (affective) (Diener et al., 2002). Therefore, the outcome variable referring to the cognitive component of subjective well-being is derived from self-reported satisfaction with life. Individuals answer the question "How satisfied are you currently with your life in general?" by choosing a value between [0] completely dissatisfied to [10] completely satisfied. Respondents answer similar questions about satisfaction with leisure, health, work, family life, and personal income. The dependent variable referring to the affective component is derived from the question: "For each of the following feelings, please state how often you experienced this feeling in the last four weeks. How often have you felt sad/ worried/ angry/ happy?"[11]

We include the following control variables: status of partnership, number of children, household size, and current health.[12] These variables may change over time but are not seen as direct outcomes of an involuntary commuting distance change.

We report descriptive statistics on outcome measures, control variables, and the commuting distance in Table 1. Columns (1) through (3) show descriptive statistics for the control group (employees with no commuting distance change), and Columns (4) through (6) for the treatment group (employees with an employer-induced commuting distance increase of at least 5 km). Columns (1) and (4) present the number of observations, Columns (2) and (5) show sample means, and Columns (3) and (6) display standard deviations. The control group is more than 20 times larger than the treatment group. This is due to our restrictive sample design, which is necessary for a clean identification strategy. The main disadvantage of this is limited statistical power, but the advantage is that the bias caused by staggered treatment timing is negligible. The summary statistics show that the control and treatment groups are very similar in terms of the characteristics of the outcomes and the control variables. The control group has a commuting distance of 16.5 km, on average, while this is about twice as large for the treatment group.

3.2. Mobile Coverage

The mobile coverage measure draws on annual data on the number of mobile internet antennas per municipality provided by the German Federal Network Agency (*Bundesnetzagentur*). In Figure 1, the antennas are depicted as red stars. For each individual in the SOEP, we only

[11] These questions were only answered from 2007 onward. Therefore, we will only analyze the time period from 2010 until 2019 for affective measures.

[12] In regressions with satisfaction with health as the dependent variable, we exclude current health as a control variable.

Table 1: Descriptive Statistics

	Control			Treatment		
	Obs.	Mean	SD	Obs.	Mean	SD
Commuting Distance	16,409	16.50	16.87	778	30.66	31.80
Cognitive Well-being						
Life	16,380	7.41	1.50	774	7.27	1.63
Health	16,391	6.84	1.91	778	6.71	2.01
Work	16,344	7.07	1.83	778	7.12	1.84
Leisure	15,857	6.89	1.92	746	6.70	2.08
Family Life	16,279	7.90	1.71	775	7.71	1.88
Income	16,384	6.99	1.91	776	6.95	1.92
Affective Well-being						
Angry	16,215	2.83	0.93	764	2.87	0.95
Worried	16,200	1.83	0.88	762	1.93	0.93
Happy	16,210	3.60	0.77	762	3.57	0.73
Sad	16,211	2.21	0.95	763	2.27	0.98
Control Variables						
Current Health	16,397	2.51	0.83	778	2.55	0.81
Children	16,409	0.80	1.05	778	0.91	1.13
Household Size	16,409	2.98	1.30	778	3.03	1.33
Partnership: Partner	16,409	0.80	0.40	778	0.78	0.42

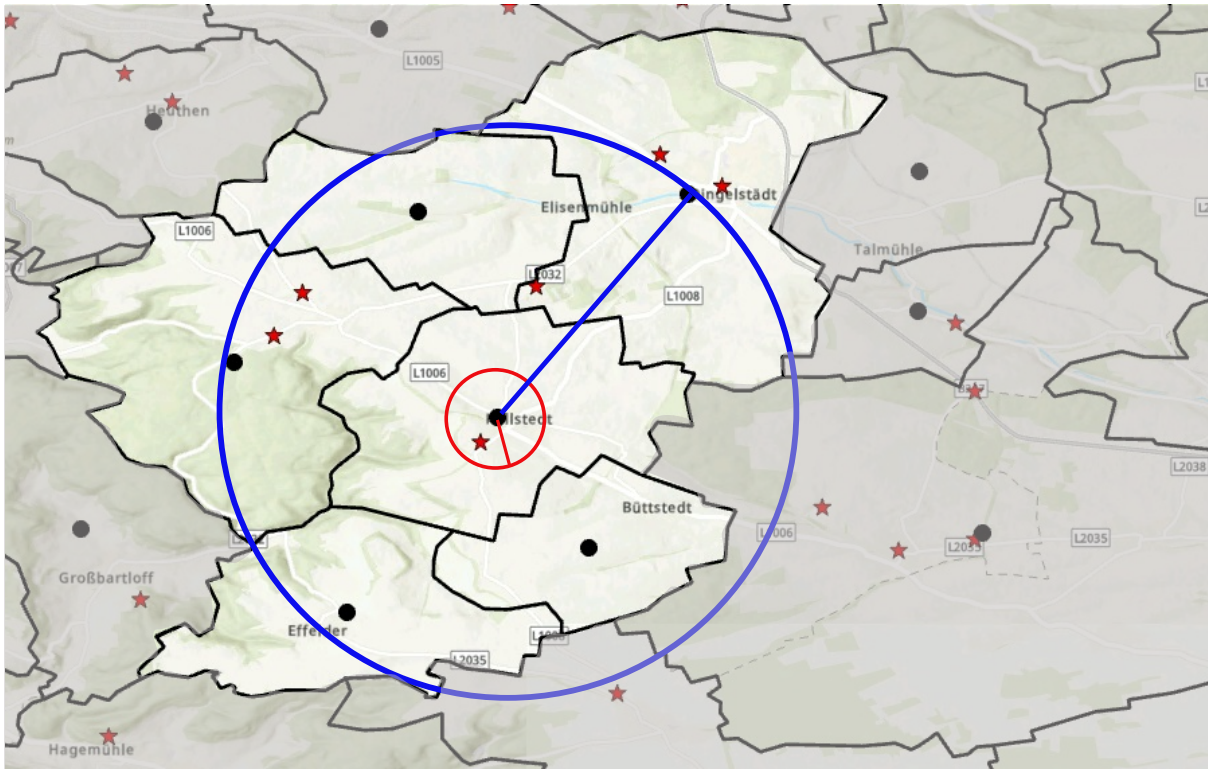
Notes: Number of observations, mean, and standard deviation of important variables shown separately by treatment and control group.

know the residential municipality (black lines depict municipality borders) instead of the exact residential address. Hence, we use the municipality's centroid (black dots). Moreover, we only know the commuting distance instead of the workplace location. Thus, we use the individual-specific commuting distance as a radius and draw a buffer around the centroid. This is symbolized by the red line and buffer. Next, we calculate for each year the number of antennas per municipality inside the municipalities that the buffer crosses. We only count the antennas if the buffer includes the municipality's centroid.[13] For the red buffer, this is one antenna. If an individual has an exogenous increase in the commuting distance, we draw a new buffer using the increased commuting distance (blue line and buffer). Again, we sum up all antennas inside municipalities that the buffer crosses. According to Figure 1, there are six antennas after the treatment.[14] As a last step, we divide this total number of antennas by the area of the municipalities inside the buffer to construct an area-weighted mobile coverage measure. Thus, the mobile coverage measure does not increase by construction with an increase in the commuting distance, but only if the density of antennas increases.

[13] Note that the antennas do not necessarily lie in the buffer. But since antennas cover large areas, their signal can still be used (Goldbeck et al., 2021).

[14] This is a fictitious example due to data protection of the SOEP respondents.

Figure 1: Construction of Mobile Coverage Variable



Notes: The figure should help to explain how we construct the variable for mobile coverage. The area in the black lines depicts different municipalities. First, we calculate the centroid of the municipality in which an individual lives (black dots). Second, we draw a buffer with the radius of the commuting distance around the centroid (red: before commuting distance increase, blue: after commuting distance increase). Third, we count the antennas of each municipality centroid that is within the buffer. Before treatment: one antenna, after treatment: six antennas.

4. Method

4.1. Identification Strategy

We investigate the effect of a commuting distance increase on subjective well-being. Therefore, we use involuntary changes in the commuting distance, defined by individuals having an increase in their commuting distance while staying in the same job, in the same living location, and working for the same employer.[15] These exogenous changes can happen due to establishment relocations within the same firm or due to detours because of roadworks or other infrastructure matters. This identification strategy is accepted and widely used in the literature to identify the causal effect of commuting on subjective well-being (Botha et al., 2023; Jacob et al., 2019).

[15] We will later also investigate distance decreases and *voluntary* distance changes.

We estimate the effect of a commuting distance change on subjective well-being using a fixed effects regression. Equation 1 shows the empirical model:

$$Y_{it} = \beta D_{it} + \gamma X_{it} + \delta_i + \lambda_{bt} + \epsilon_{it}, \tag{1}$$

where Y_{it} is the subjective well-being of an individual i in year t,[16] β is the coefficient of interest, D_{it} is the treatment dummy, which is one if an individual's commuting distance increased by at least 5 km, while an individual did not relocate nor change employer or job. X_{it} are the control variables (status of partnership, number of children, current health, and household size), δ_i are individual fixed effects, which absorb any time-invariant factors that influence the outcome, and λ_{bt} are year×state fixed effects, which account for common shocks in each state.[17]

According to the recent development in the Difference-in-Differences literature, the standard two-way fixed effects model should only be used if the setting is based on two time periods and treatment effects are homogeneous across individuals and time periods (Goodman-Bacon, 2021; De Chaisemartin and d'Haultfoeuille, 2020; Sun and Abraham, 2021; Callaway and Sant'Anna, 2021). Since we have staggered treatment adoption, these conditions do not hold in our data. However, the effect of the bias decreases with the size of the control group, which consists of never-treated individuals. Our never-treated group, individuals with no changes in their commuting distance, is about 20 times larger than the treatment group. Additionally, we present event study results using the estimator proposed by Sun and Abraham (2021). This estimator produces more reliable results for staggered treatment timing and heterogeneous treatment effects.

4.2. Potential Endogeneity Issues

We assume that the treatment is an exogenous change from the employee's perspective. The subjective well-being of the individual is affected by the increased commuting distance. However, we cannot exclude that the utility is also affected by other changes that come along with the new commute because it could be an employer-induced decision to send an employee to a different office site.[18] This could be accompanied by a promotion or a salary increase. If this is the case, however, we would expect the salary to increase after the relocation or job satisfaction to change. We show regression results for wages and satisfaction with work and find that wages and satisfaction with work are not affected (Table B.1).

A major concern in the causal analysis of the effect of commuting on subjective well-being is sample selection. If the control group includes individuals who do not commute but work

[16] To estimate the effect on subjective well-being, we are showing results on satisfaction with life in general, on sub-categories of satisfaction with life, and on affective measures.

[17] There are 16 states in Germany.

[18] In Germany, it is possible for employers to transfer employees to another location (depending on the employment contract) according to § 106 GewO and BAG, 17.08.2011 - 10 AZR 202/10.

from home, they will most likely differ fundamentally from the individuals who commute due to unobserved character traits. To make the control group comparable, only individuals who commute at least 1 km and who do not change their commuting distance, their employer, or their place of residence are considered in this group. Furthermore, by definition of our identification strategy, the treatment group contains only individuals who are relocated to another branch after a professional transfer and do not quit their jobs as a consequence. We cannot rule out that sample selection happens in a way that employees who find commuting the least pleasurable quit their jobs. Thus, our estimates can be seen as a lower bound.[19]

Another endogeneity concern regarding our data is the self-reported commuting distance. To counteract measurement error in the commuting distance,[20] we regard only an increase of at least 5 km for the treatment.[21]

5. Results

5.1. Subjective Well-being

We start by showing the results based on our main specification (Equation 1). We identify the influence of an exogenous increase in the commuting distance on the subjective well-being of individuals. First, we analyze the impact on satisfaction with life in general. Then, we turn to five sub-categories, namely satisfaction with leisure, health, work, family life, and personal income.

The results in Table 2 show that a shock that leads to an increase in the commuting distance impacts satisfaction with life statistically significantly negatively (Column 1). On average, an increase in the commuting distance of at least 5 km reduces individuals' life satisfaction by 0.25 points on an 11-point scale if the individual does not move or change employer or job.[22] This is equivalent to a 3 percent decrease, compared to the baseline level of satisfaction with life in the control group (Table 1, Column 2). Our results indicate that sub-categories of life satisfaction in Columns (2) through (6) are not affected. The coefficients of satisfaction with leisure, health, work, family life, and personal income are close to zero and lack statistical significance.[23] However, the point estimates are mostly negative.[24]

[19] Lorenz (2018) shows that the effect of an involuntary employment termination due to a plant closure on life satisfaction is significantly negative.

[20] This can be seen in individuals reporting their commuting distance in 5 km increments (Figure A.2).

[21] We also estimate specifications with a 2-km dummy and a continuous commuting distance measure.

[22] To contextualize the estimated effect size, the decline in life satisfaction associated with unemployment is 0.9 points for males and 0.6 points for females (Gielen and van Ours, 2014).

[23] The coefficients of the sub-categories do not add up to the one of life satisfaction. The question about life satisfaction, in general, is asked independently and is not calculated from the individual answers of other satisfaction categories.

[24] Only satisfaction with work has a positive coefficient. This might indicate that individuals who are transferred to a new working location and decide not to quit (or move) are, on average, slightly more content with their job. Nonetheless, there is a strong negative impact of the increase in the commuting distance on life satisfaction.

Table 2: Marginal Effect of Commuting on Cognitive Well-being

	Life	Leisure	Health	Work	Family Life	Income
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment Dummy	-0.2456***	-0.0192	-0.0985	0.0903	-0.0355	-0.0504
	(0.0941)	(0.1258)	(0.1161)	(0.1007)	(0.0995)	(0.1116)
Observations	17,144	16,591	17,169	17,110	17,042	17,148
R^2	0.70382	0.68265	0.67577	0.66200	0.69236	0.74836
Individual FE	✓	✓	✓	✓	✓	✓
Year × State FE	✓	✓	✓	✓	✓	✓

Notes: The dependent variables display how satisfied individuals are with their lives in general and in specific areas. Individuals answered on an eleven-point scale: [0] low to [10] high. The treatment dummy is one if the commuting distance increases by at least 5 km, while an individual did not relocate nor change employer or job. Regressions include the following control variables: status of partnership, number of children, current health, and household size. Current health is excluded in Column (3) (satisfaction with health). Standard errors are clustered at the household level. * p<0.10, ** p<0.05, *** p<0.01.

These results, satisfaction with life being negatively affected but sub-categories not being affected, also hold without control variables (Table B.2) and with year instead of year×state fixed effects (Table B.3). Moreover, statistical significance remains with randomization inference (Table B.4) using the method proposed by Heß (2017) with 1,000 repetitions. This non-parametric method assesses significance without relying on specific distributional assumptions by comparing observed test statistics to those generated under the null hypothesis. Applying randomization inference confirms our findings: the p-value for satisfaction with life is below 0.001, while other subdomains remain insignificant.

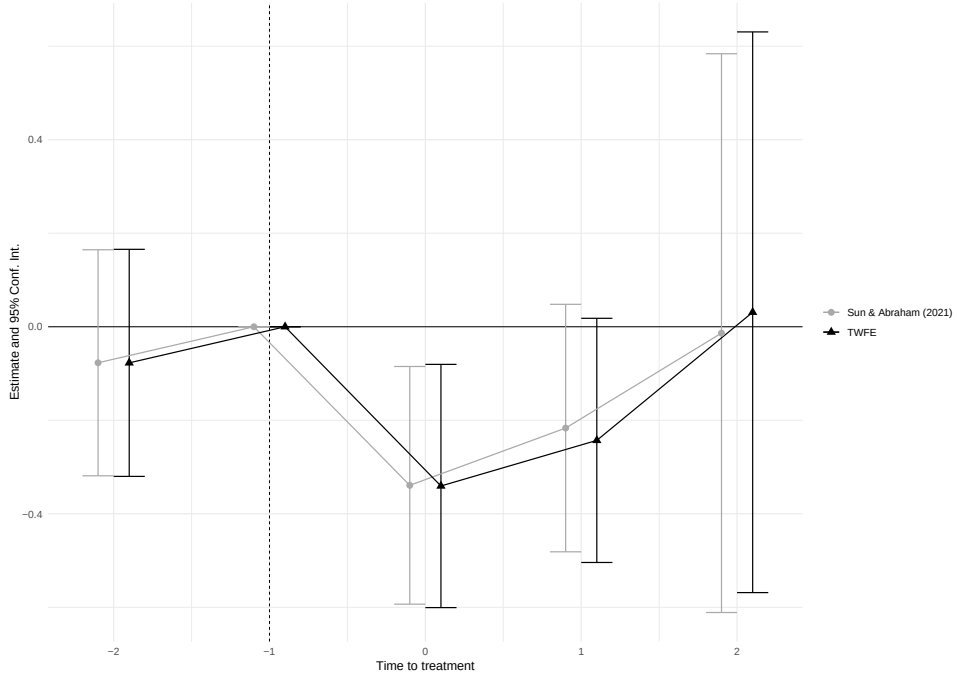
We also investigate the previous decade, when it was almost impossible to use the Internet while commuting. For the time period 2000 until 2009, the results indicate no statistically significant impact on satisfaction with life and sub-categories (Table B.5). In contrast to the following decade, the coefficient for life satisfaction is close to zero. This indicates that the commuting experience might have changed during the last two decades and that the availability of mobile internet during the commute might negatively impact satisfaction with life.[25]

Next, we conduct an event study to determine how persistent the negative effect on life satisfaction is. We limit our sample to two years before treatment and two years after treatment since there are not enough observations for the other years to produce valid event study estimators. In Figure 2, we show the estimates for a two-way fixed effects event study (TWFE) and event study estimates based on Sun and Abraham (2021). As expected, we do not find a significant difference between the estimators as the treatment group is much larger than the never-treated control group. Furthermore, we observe from the event study that the pre-treatment coefficient is close to zero and lacks statistical significance, indicating that the par-

[25] Lorenz (2018) finds no statistically significant effect on life satisfaction for the years 2007 until 2013. She uses fixed-effects regressions with individual fixed effects to determine the effect of the commuting distance and the squared commuting distance on subjective well-being.

allel pre-trends assumption might be fulfilled. The size of the coefficient in the treatment year is slightly larger than in Table 2. Furthermore, the effect is short-term and converges to the baseline level in the second year after the treatment. Individuals adapt fast to the increased commuting distance.

Figure 2: Event Study: Marginal Effect of Commuting on Satisfaction with Life



Notes: The figure shows event study estimates using TWFE estimates and the Sun and Abraham (2021) estimator.

Another component of subjective well-being is an individual's perception of the frequency and intensity of experiencing positive and negative feelings. Therefore, we investigate the effects of affective well-being in Table 3. The results indicate that individuals who have an involuntary increase in their commuting distance experience the feeling of worry more often (0.14 points on a 5-point scale). Compared to the baseline level of the control group (Table 1, Column 2), this refers to treated individuals experiencing a feeling of worry, on average, almost 8 percent more often. Figure A.3 shows event study estimates for the frequency of feeling worried. As for life satisfaction, we limit our sample to two years before treatment and two years after treatment and show estimates for a basic two-way fixed effects event study and event study estimates based on Sun and Abraham (2021). We observe no pre-treatment deviations and the effect does not seem to fade out as fast as for life satisfaction. The coefficients for other feelings, such as sadness, anger, and happiness, are close to zero and not statistically significant. The

outcomes for regressions without control variables (Table B.6), with only year fixed effects (Table B.7), and randomized inference (Table B.8) support the previous results.[26]

Table 3: Marginal Effect of an Increase in Commuting Distance on Affective Well-being

	Sad	Worried	Angry	Happy
	(1)	(2)	(3)	(4)
Treatment Dummy	0.0326	0.1413***	-0.0212	0.0324
	(0.0545)	(0.0524)	(0.0545)	(0.0464)
Observations	16,962	16,950	16,967	16,960
R^2	0.57689	0.63153	0.58296	0.63714
Individual FE	✓	✓	✓	✓
Year × State FE	✓	✓	✓	✓

Notes: The dependent variable gives the frequency of feeling a certain emotion in the last four weeks. Individuals answered on a five-point scale: [1] very rare to [5] often. The treatment dummy is one if the commuting distance increases by at least 5 km, while an individual did not relocate nor change employer or job. Regressions include the following control variables: status of partnership, number of children, current health, and household size. Standard errors are clustered at the household level. * p<0.10, ** p<0.05, *** p<0.01.

5.2. Decrease in Commuting Distance

Next, we increase the sample by adding individuals with an involuntary commuting distance decrease. While the literature about the effects of longer commutes is large and mostly finds a negative impact on subjective well-being, the impact of an exogenous decrease remains less explored. Investigating this matter allows us to examine whether the negative effects of longer commutes are symmetric—–that is if reducing commuting time enhances well-being to the same extent that increasing it diminishes it.

Therefore, we show results for the influence of commuting distance increase and commuting distance decrease on subjective well-being. It is an extension of Equation 1, where we add a treatment dummy for a decrease in commuting distance. Individuals are only allowed to have one distance change (either increase or decrease).

In Table 4, we show results for the cognitive measures of subjective well-being. We find that for a distance increase, the effect on satisfaction with life is negative and statistically significant at the 5 percent level and thus confirms the result from Table 2. Also, the results for the sub-categories are very similar.

One might expect the results for a reduction in distance to be the symmetric opposite of those for an increase in distance. Satisfaction with life should, therefore, improve. In Table 4, we see, however, that the results for a decrease in the commuting distance do not match these expectations. A reduction in commuting distance does not appear to affect life satisfaction in general. The coefficient is very close to zero and not statistically significant.

[26] Due to data limitations, we cannot show results for the period 2000 to 2009, as the survey question has only been asked since 2007.

Table 4: Marginal Effect of an Increase or a Decrease in Commuting Distance on Cognitive Well-being

	Life	Leisure	Health	Work	Family Life	Income
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy Increase	-0.2234**	0.0717	-0.1062	0.0712	-0.0379	-0.0166
	(0.0972)	(0.1345)	(0.1206)	(0.1063)	(0.1083)	(0.1174)
Dummy Decrease	-0.0081	0.3017**	0.0142	-0.0152	0.0102	0.0236
	(0.0965)	(0.1464)	(0.1349)	(0.1213)	(0.1546)	(0.1045)
Observations	16,784	16,226	16,809	16,749	16,690	16,787
R^2	0.70346	0.68048	0.67138	0.65947	0.68666	0.74802
Individual FE	✓	✓	✓	✓	✓	✓
Year × State FE	✓	✓	✓	✓	✓	✓

Notes: The dependent variables display how satisfied individuals are with their lives in general and in specific areas. Individuals answered on an eleven-point scale: [0] low to [10] high. The dummy increase (decrease) is one if the commuting distance increases (decreases) by at least 5 km, while an individual did not relocate nor change employer or job. Regressions include the following control variables: status of partnership, number of children, current health, and household size. Current health is excluded in Column (3) (satisfaction with health). Standard errors are clustered at the household level. * p<0.10, ** p<0.05, *** p<0.01.

This could be explained by the concept of negativity bias. Psychological research shows that bad events have more impact on people than comparable good events (Baumeister et al., 2001). This would explain why the "bad" event having an increase in commuting distance impacts life satisfaction, but the "good" event decrease in commuting distance does not. Moreover, the impact might be the result of two components. A negative (positive) impact of the distance increase (decrease) and a negative impact of the change in commute (and working situation) independent of whether it results in an increase or decrease of the commuting distance.

Additionally, our results suggest that satisfaction with leisure time increases when the commuting distance decreases (Table 4, Column 2). This could be attributed to the fact that individuals have more time for leisure activities due to a shorter commute. A decrease in the commuting distance of at least 5 km increases satisfaction with leisure on average by 0.3 points. The coefficient corresponds to more than 4 percent, evaluated at the control group's mean (Table 1, Column 2). Furthermore, our results indicate that a decrease in the commuting distance does not affect the remaining sub-categories of life satisfaction (Table 4, Columns 3 through 6).

In Table 5, we analyze the effect of a decrease in commuting distance on affective measures. For an increase in commuting distance, this sample shows that individuals experience a feeling of worry more often, which is in line with the results from Table 3. The results, moreover, show that a reduction in commuting distance has no influence on the frequency of experiencing feelings of sadness, worry, anger, or happiness. All coefficients are approximately zero and not statistically significant. They can again be explained by the negativity bias, indicating that positive events have less impact than negative ones.

Table 5: Marginal Effect of an Increase or a Decrease in Commuting Distance on Affective Well-being

	Sad (1)	Worried (2)	Angry (3)	Happy (4)
Dummy Increase	0.0236	0.1476***	-0.0213	0.0273
	(0.0579)	(0.0569)	(0.0585)	(0.0493)
Dummy Decrease	-0.0270	0.0149	-0.0280	-0.0045
	(0.0767)	(0.0604)	(0.0712)	(0.0567)
Observations	16,596	16,585	16,601	16,594
R^2	0.57270	0.62893	0.57882	0.63823
Individual FE	✓	✓	✓	✓
Year × State FE	✓	✓	✓	✓

Notes: The dependent variable gives the frequency of feeling a certain emotion in the last four weeks. Individuals answered on a five-point scale: [1] very rare to [5] often. The dummy increase (decrease) is one if the commuting distance increases (decreases) by at least 5 km, while an individual did not relocate nor change employer or job. Regressions include the following control variables: status of partnership, number of children, current health, and household size. Standard errors are clustered at the household level. * p<0.10, ** p<0.05, *** p<0.01.

5.3. Mechanism

The results thus far have demonstrated that an exogenous increase in commuting distance leads to a reduction in life satisfaction and an increase in the frequency of feeling worried. Next, we want to investigate whether this effect stems from the extended commuting distance itself or a change in circumstances. First, we show in Table 6 results for the effect of an increase in commuting distance by at least 2 km and 5 km (our baseline) on satisfaction with life and the frequency of feeling worried.[27] Furthermore, Column (3) displays the continuous impact of the logarithmic commuting distance. Finally, we run a regression with the treatment dummy for an exogenous distance increase of at least 5 km and the logarithmic commuting distance to decompose the effect into a fraction for distance and one for other circumstances (Column 4). Again, the analysis assumes no changes in residence, employer, or job during the observation period.

The results indicate that the larger the change in commuting distance, the stronger the negative impact on life satisfaction (Panel A). The reduction in life satisfaction is only about half for those who have a distance increase of at least 2 km (Column 1) in comparison to the baseline specification (Column 2). The result is similar regarding the frequency of worrying (Panel B). The coefficient doubles when the commuting distance threshold increases from 2 km (Column 1) to 5 km (Column 2). The results in Column (3) state that doubling the commuting distance decreases life satisfaction by 0.37 points (Panel A) and increases the frequency of feeling worried by 0.16 points (Panel B). The results show that the larger the commuting distance increase is, the larger the decrease in life satisfaction and the more often individuals feel

[27] In Column (1), we show the effect of a distance increase of at least 2 km. Therefore, we include individuals that have no distance change in the control group and in the treatment group individuals that have at least a 2 km increase, while observations with a distance increase of 1 km are excluded.

worried. This suggests that the main effect comes from the change in the commuting distance itself and not from changing circumstances.

To investigate this result further, in Column (4), we run a regression using both variables, the treatment dummy and the logarithmic commuting distance. When controlling for the distance, the life satisfaction coefficient of the treatment dummy shrinks to about a third of its original size (Panel A). Hence, about two-thirds of the reduction in life satisfaction can be attributed to the distance increase and only one-third to other circumstances. For feeling worried, this decomposition reveals that about 40 percent of the increase can be attributed to the distance increase and 60 percent to other circumstances (Panel B).

Table 6: Mechanism

	(1)	(2)	(3)	(4)
Panel A: Life Satisfaction				
Distance Increase ≥ 2 km	-0.1290**			
	(0.0560)			
Distance Increase ≥ 5 km		-0.2468***		-0.0878
		(0.0940)		(0.1242)
log(Commuting Distance)			-0.3115***	-0.2521**
			(0.0951)	(0.1263)
Observations	15,986	17,144	17,144	17,144
R^2	0.70056	0.70388	0.70401	0.70403
Panel B: Feeling Worried				
Distance Increase ≥ 2 km	0.0716**			
	(0.0365)			
Distance Increase ≥ 5 km		0.1401***		0.0843
		(0.0525)		(0.0695)
log(Commuting Distance)			0.1456**	0.0890
			(0.0586)	(0.0757)
Observations	15,786	16,950	16,950	16,950
R^2	0.62234	0.63159	0.63159	0.63164
Individual FE	✓	✓	✓	✓
Year × State FE	✓	✓	✓	✓

Notes: The dependent variable in Panel A, life satisfaction, displays how satisfied individuals are with their lives in general and in specific areas. Individuals answered on an eleven-point scale: [0] low to [10] high. The dependent variable in Panel B, worried, gives the frequency of feeling worried in the last four weeks. Individuals answered on a five-point scale: [1] very rare to [5] often. The dummy is one if the commuting distance increases by at least 2 km (Column 1) or by at least 5 km (Column 2), while an individual did not relocate nor change employer or job. Regressions include the following control variables: status of partnership, number of children, current health, and household size. Standard errors are clustered at the household level. * p<0.10, ** p<0.05, *** p<0.01.

5.4. Voluntary Increase of Commuting Distance

In the previous analyses, we have always focused on exogenous changes in commuting distance. According to rational choice theory, individuals should only voluntarily change their job, employer, or living location if the change enhances utility. Previous results show that

an involuntary higher commuting distance reduces satisfaction with life and does not affect sub-categories of life satisfaction. To test whether voluntary decisions match these outcomes, we analyze cases where individuals voluntarily change jobs, employers, or their living location resulting in increased commuting distances. A dummy variable indicates treatment (one for voluntary changes with increased commuting distance), while the control group comprises individuals with no changes in job, employer, living location, or commuting distance. This approach evaluates whether voluntary decisions mitigate the negative effects of increased commuting distance observed in involuntary scenarios.

The results in Table 7 show that this change in employment leads to a statistically significant increase in satisfaction with work. One would expect this result, as individuals will most likely only change their job (and also accept a longer commute) if they prefer the new job to the old one. Consequently, job satisfaction will increase. In contrast to our main analysis, the coefficient for satisfaction with life is statistically insignificant. Also, other sub-categories remain unaffected.

Table 7: Endogenous Change in Commuting Distance and Employment

	Life	Leisure	Health	Work	Family Life	Income
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment Dummy	0.0566	-0.0370	0.1603	0.7240***	-0.1835	0.2173
	(0.0991)	(0.1636)	(0.1341)	(0.1867)	(0.1468)	(0.1388)
Observations	19,508	18,889	19,534	19,400	19,393	19,509
R^2	0.69801	0.68208	0.66891	0.64087	0.68765	0.73724
Individual FE	✓	✓	✓	✓	✓	✓
Year × State FE	✓	✓	✓	✓	✓	✓

Notes: The dependent variables display how satisfied individuals are with their lives in general and in specific areas. Individuals answered on an eleven-point scale: [0] low to [10] high. The treatment dummy is one if the commuting distance increases by at least 5 km, while an individual changed employer or job. Regressions include the following control variables: status of partnership, number of children, current health, and household size. Current health is excluded in Column (3) (satisfaction with health). Standard errors are clustered at the household level. * p<0.10, ** p<0.05, *** p<0.01.

We find similar results using the relocation of an individual as a treatment instead of an employer/ job change. For a move and a consequently increased commuting distance, satisfaction with dwelling increases (but not statistically significant). Satisfaction in other areas of life and with life in general does not change statistically significantly, but the coefficient for satisfaction with life is positive (Table B.9).

The comparison of these results leads to the conclusion that individuals who decide to increase their commuting distance due to a move or a job change are compensated for a higher commuting distance by the increase in satisfaction in the corresponding areas of life and, consequently, satisfaction with life is not changed. For those individuals for whom only the commuting distance increases and who are not compensated by an improved job or housing situation, life satisfaction in general decreases.

5.5. Heterogeneity: Mobile Coverage

So far we have only indirectly shown the effects in the time of mobile internet availability. Comparing our results from an exogenous increase in the commuting distance from 2010 to 2019 and the results for 2000 until 2009, we find that a higher commuting distance decreased satisfaction with life for the period 2010 onward and no statistically significant effect for the previous decade. A major transformation between the two decades was the widespread use of smartphones and improved mobile internet availability. Therefore, as a next step, we analyze whether internet availability during the commute has an impact on subjective well-being. We use our previous research strategy and interact the density of mobile internet antennas (referred to as mobile coverage) with the treatment dummy.

We use the following regression model:

$$SWB_{it} = \mu_1 D_{it} + \mu_2 \ln(A_{it}) + \mu_3 (D_{it} \times \log(A_{it})) + \tau X_{it} + \rho_i + \kappa_{bt} + \varepsilon_{it} \tag{2}$$

where D_{it} is the treatment dummy as explained above and $\log(A_{it})$ is mobile coverage during the commute. The coefficient of the interaction term then gives us the influence of better internet availability for someone whose commuting distance increased on subjective well-being.[28]

In Table 8, we show results of the effect of mobile coverage during the commute on the cognitive measures of subjective well-being. Column (1) gives us the results for satisfaction with life. The negative coefficient for mobile coverage suggests that, on average, satisfaction with life decreases with better mobile coverage. For treated individuals, it indicates that the negative effect of a commuting distance increase on satisfaction with life is attenuated. However, this effect is not statistically significant. In Table 8, Column (2), the results for satisfaction with leisure are shown. The interaction term of mobile coverage and the treatment dummy is significant and negative. This means that for treated individuals, satisfaction with leisure decreases with an increasing number of antennas. An explanation for this effect could be that individuals who have an increased commuting distance decide to work during their commute if also mobile coverage is improved. The interaction terms for other sub-categories of satisfaction are not statistically significant but show in parts large point estimates (Columns 3 through 6). The effect on affective measures supports our findings. In Column (4) of Table B.10, the interaction term of mobile coverage and the treatment dummy is significant and negative for feeling happy, indicating that improved mobile coverage makes individuals with an increased commuting distance even less happy. For all other domains, the interaction term lacks statistical significance. However, point estimates indicate that with improved mobile coverage, an increase in the commuting distance leads to a higher frequency of feeling worried and angry (Columns 2 and 3). For these two outcomes, also on average the frequency increases with improved mobile coverage.

[28] In the SOEP, there are no direct questions on mobile internet usage during the commute. Therefore, we rely on the availability measure.

Table 8: Analyzing the Effect of Mobile Coverage: Marginal Effect of an Increase in Commuting Distance on Cognitive Well-being

	Life	Leisure	Health	Work	Family Life	Income
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment Dummy	-0.2494*	0.1132	0.1040	0.0589	0.1647	0.0979
	(0.1348)	(0.1675)	(0.1555)	(0.1431)	(0.1389)	(0.1625)
Mobile Coverage	-0.2686**	0.0837	-0.1693	-0.1816	0.2001	0.0643
	(0.1216)	(0.1516)	(0.1999)	(0.1736)	(0.1724)	(0.1440)
Dummy × Mobile Coverage	0.1102	-0.2982**	-0.3726	-0.0494	-0.2938	-0.1808
	(0.1268)	(0.1517)	(0.2521)	(0.1541)	(0.1894)	(0.1857)
Observations	15,894	15,599	15,921	15,874	15,800	15,901
R^2	0.70654	0.68712	0.67547	0.65906	0.69357	0.74924
Individual FE	✓	✓	✓	✓	✓	✓
Year × State FE	✓	✓	✓	✓	✓	✓

Notes: The dependent variables display how satisfied individuals are with their lives in general and in specific areas. Individuals answered on an eleven-point scale: [0] low to [10] high. The treatment dummy is one if the commuting distance increases by at least 5 km, while an individual did not relocate nor change employer or job. Regressions include the following control variables: status of partnership, number of children, current health, and household size. Current health is excluded in Column (3) (satisfaction with health). Standard errors are clustered at the household level. * p<0.10, ** p<0.05, *** p<0.01.

6. Conclusion

Our study provides a detailed examination of the impact of an increase in commuting distance on subjective well-being in the era of increased digital connectivity. The findings indicate that an increase in commuting distance leads to a statistically significant decrease in overall life satisfaction and increases the frequency of feeling worried, highlighting the negative effects of commuting on subjective well-being when the change is exogenously imposed by factors such as employer-driven workplace relocations. About two-thirds of the reduction in life satisfaction can be attributed to the distance increase and only one-third to other circumstances. Comparing increases and decreases in commuting distances, our results show an interesting asymmetry: While increased commuting distances reduce life satisfaction, decreases in commuting distance do not yield a corresponding improvement. However, we do observe that shorter commutes enhance satisfaction with leisure, likely due to additional time for leisure.

Additionally, we explore the role of internet availability during commuting and find that while increased internet availability has negative effects on subjective well-being, it mitigates some of the negative effects of increased commuting distance. Moreover, for those experiencing an increase in commuting distance, higher internet availability during the commute further reduces satisfaction with leisure time, possibly due to increased pressure to remain productive while commuting, and makes them less happy and more worried and angry.

We want to acknowledge the limitations of our study. Although we aim to investigate the impact of employers on commuting distance, we cannot provide conclusive evidence as it could also be an employee's decision to switch to another plant. Moreover, we do not observe indi-

viduals who left the firm due to the employer-demanded workplace relocation. Additionally, due to data limitations, we cannot determine the extent to which the change in commuting mode contributes to the effect.

Our findings have important implications for urban planning, labor market policies, and the design of remote work strategies. Employers should carefully weigh the productivity gains from workplace relocation against the subjective well-being costs imposed on employees through longer commutes. Furthermore, while investments in mobile infrastructure may help mitigate some negative effects, policies should address the potential blur of work-life boundaries. This could include establishing clear rules about working during commuting time.

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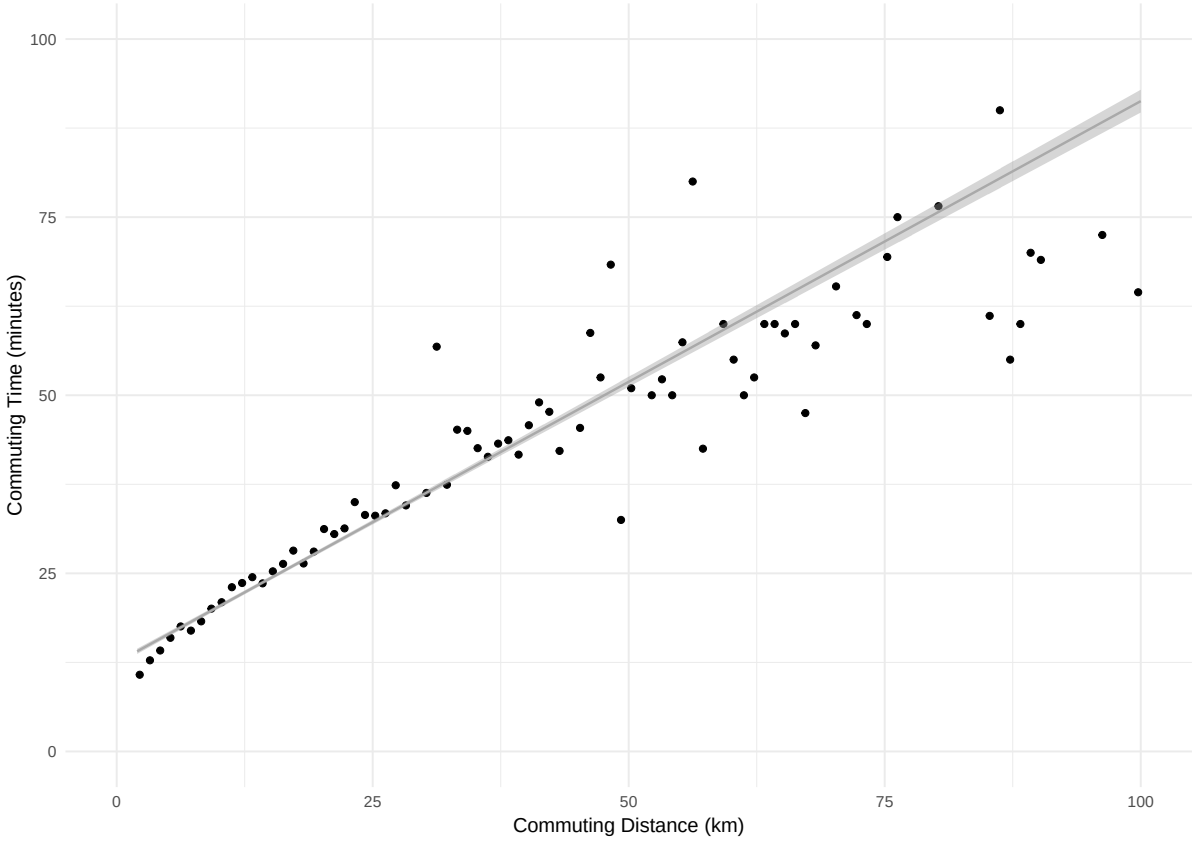
Online Appendix

Involuntary Changes in Commuting Distances: Effects on Subjective Well-Being in the Era of Mobile Internet

by *Katharina Bettig* and *Valentin Lindlacher*

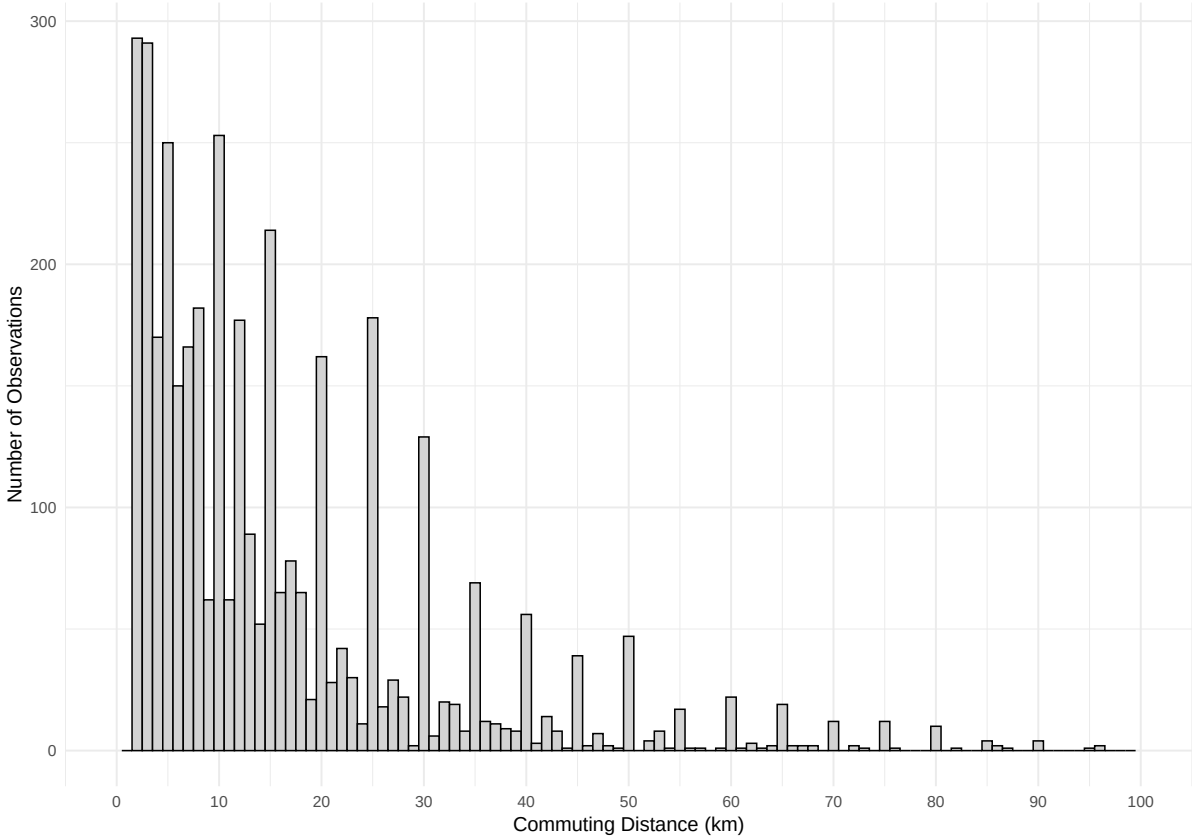
Appendix A. Figures

Figure A.1: Relation of Commuting Time and Commuting Distance



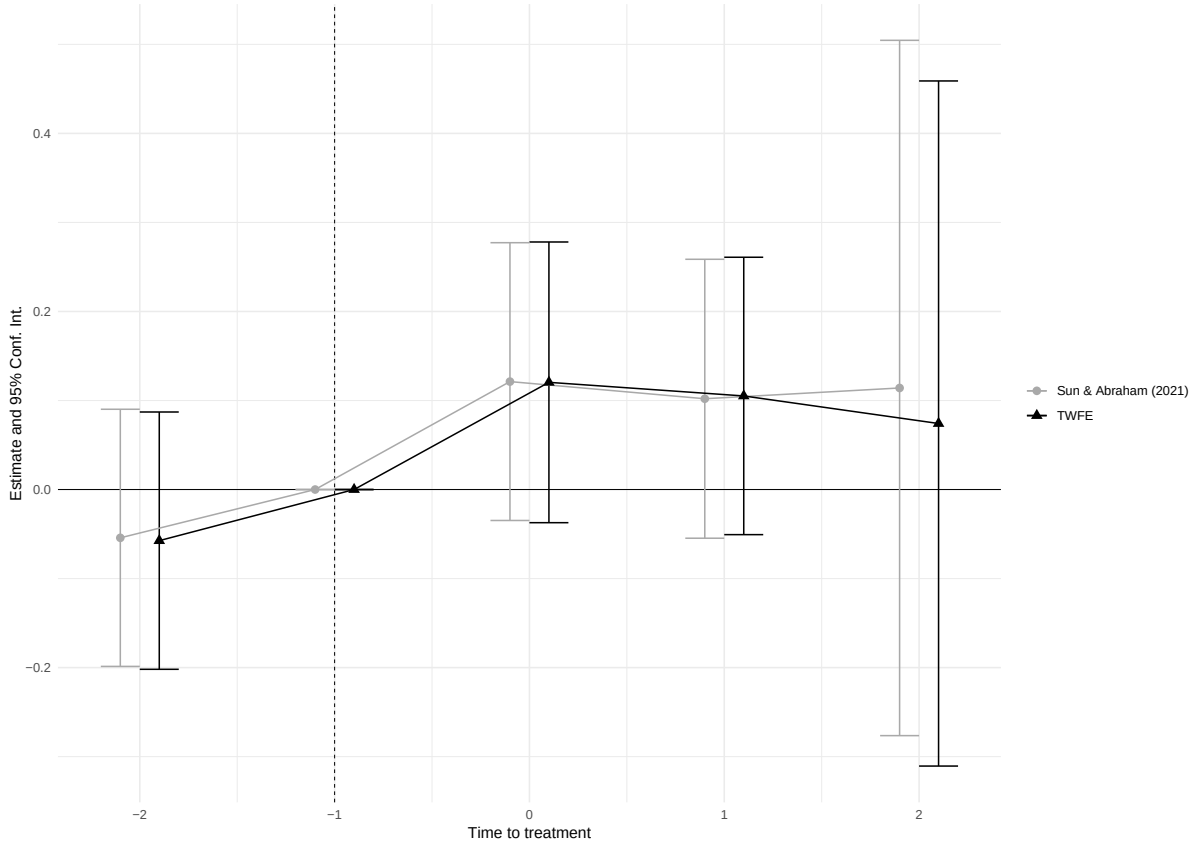
Notes: The binned scatter plot illustrates the relationship between commuting time and distance. We include only observations for the years 2015, 2017, and 2019 due to data limitations with respect to the question on commuting time.

Figure A.2: Commuting Distance



Notes: The figure shows the commuting distance of each individual. For treated individuals, the commuting distance in the year before the treatment is shown.

Figure A.3: Event Study: Marginal Effect of Commuting on Frequency of Feeling Worried



Notes: The figure shows event study estimates using TWFE and the Sun and Abraham (2021) estimator.

Appendix B. Tables

Table B.1: Marginal Effect of an Increase in Commuting Distance on Work Outcomes

	Wage (ln) (1)	Work (2)	Work Hours (3)
Treatment Dummy	0.0185	0.0903	0.4303
	(0.0128)	(0.1007)	(0.3557)
Observations	16,474	17,110	16,999
R^2	0.93536	0.66200	0.90974
Individual FE	✓	✓	✓
Year × State FE	✓	✓	✓

Notes: Outcome Variables: wage (ln): logarithmic net income last month; satisfaction with work: individuals respond on an eleven-point scale: [0] low to [10] high. Actual working hours: overtime work included. The treatment dummy is one if the commuting distance increases by at least 5 km, while an individual did not relocate nor change employer or job. Regressions include control variables. Standard errors are clustered at the household level. * p<0.10, ** p<0.05, *** p<0.01.

Table B.2: Marginal Effect of Commuting on Cognitive Well-being without Control Variables

	Life (1)	Leisure (2)	Health (3)	Work (4)	Family Life (5)	Income (6)
Treatment Dummy	-0.2653***	-0.0321	-0.0991	0.0785	-0.0417	-0.0567
	(0.0953)	(0.1271)	(0.1159)	(0.1028)	(0.0997)	(0.1117)
Observations	17,154	16,603	17,169	17,122	17,054	17,160
R^2	0.68622	0.68006	0.67558	0.65608	0.68702	0.74699
Individual FE	✓	✓	✓	✓	✓	✓
Year × State FE	✓	✓	✓	✓	✓	✓

Notes: The dependent variables display how satisfied individuals are with their lives in general and in specific areas. Individuals answered on an eleven-point scale: [0] low to [10] high. The treatment dummy is one if the commuting distance increases by at least 5 km, while an individual did not relocate nor change employer or job. Standard errors are clustered at the household level. * p<0.10, ** p<0.05, *** p<0.01.

Table B.3: Marginal Effect of Commuting on Cognitive Well-being without State-Year Fixed Effects

	Life	Leisure	Health	Work	Family Life	Income
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment Dummy	-0.2470***	-0.0244	-0.0864	0.0787	-0.0464	-0.0516
	(0.0931)	(0.1250)	(0.1169)	(0.1011)	(0.0998)	(0.1119)
Observations	17,144	16,591	17,169	17,110	17,042	17,148
R^2	0.70070	0.68009	0.67216	0.65852	0.68893	0.74618
Individual FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓

Notes: The dependent variables display how satisfied individuals are with their lives in general and in specific areas. Individuals answered on an eleven-point scale: [0] low to [10] high. The treatment dummy is one if the commuting distance increases by at least 5 km, while an individual did not relocate nor change employer or job. Regressions include the following control variables: status of partnership, number of children, current health, and household size. Current health is excluded in Column (3) (satisfaction with health). Standard errors are clustered at the household level. * p<0.10, ** p<0.05, *** p<0.01.

Table B.4: Randomized Inference on Main Results (Cognitive Well-being)

	Life	Leisure	Health	Work	Family Life	Income
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment Dummy	-0.246***	-0.019	-0.098	0.090	-0.035	-0.050
	[<0.001]	[0.825]	[0.216]	[0.230]	[0.612]	[0.464]
Num.Reps	1000	1000	1000	1000	1000	1000

Notes: The dependent variables display how satisfied individuals are with their lives in general and in specific areas. P-values shown in parentheses, with control variables, H0: Treatment Dummy=0. Current health is excluded in Column (3) (satisfaction with health). The treatment dummy is one if the commuting distance increases by at least 5 km, while an individual did not relocate nor change employer or job.

Table B.5: Marginal Effect of Commuting on Cognitive Well-being (2000 - 2009)

	Life	Leisure	Health	Work	Family Life	Income
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment Dummy	-0.0234	-0.0267	-0.0524	-0.1874	0.0882	0.0621
	(0.0979)	(0.1247)	(0.1205)	(0.1201)	(0.1552)	(0.1351)
Observations	12,620	12,610	12,623	12,548	5,505	8,937
R^2	0.69461	0.69715	0.66615	0.65550	0.73325	0.77374
Individual FE	✓	✓	✓	✓	✓	✓
Year × State FE	✓	✓	✓	✓	✓	✓

Notes: The dependent variables display how satisfied individuals are with their lives in general and in specific areas. Individuals answered on an eleven-point scale: [0] low to [10] high. The treatment dummy is one if the commuting distance increases by at least 5 km, while an individual did not relocate nor change employer or job. Regressions include the following control variables: status of partnership, number of children, current health, and household size. Current health is excluded in Column (3) (satisfaction with health). Standard errors are clustered at the household level. * p<0.10, ** p<0.05, *** p<0.01.

Table B.6: Marginal Effect of an Increase in Commuting Distance on Affective Well-being without Control Variables

	Sad	Worried	Angry	Happy
	(1)	(2)	(3)	(4)
Treatment Dummy	0.0432	0.1508***	-0.0146	0.0257
	(0.0563)	(0.0538)	(0.0555)	(0.0468)
Observations	16,974	16,962	16,979	16,972
R^2	0.56859	0.62371	0.57892	0.63140
Individual FE	✓	✓	✓	✓
Year × State FE	✓	✓	✓	✓

Notes: The dependent variable gives the frequency of feeling a certain emotion in the last four weeks. Individuals answered on a five-point scale: [1] very rare to [5] often. The treatment dummy is one if the commuting distance increases by at least 5 km, while an individual did not relocate nor change employer or job. Standard errors are clustered at the household level. * p<0.10, ** p<0.05, *** p<0.01.

Table B.7: Marginal Effect of an Increase in Commuting Distance on Affective Well-being without State Fixed Effects

	Sad	Worried	Angry	Happy
	(1)	(2)	(3)	(4)
Treatment Dummy	0.0326	0.1453***	-0.0139	0.0270
	(0.0542)	(0.0533)	(0.0535)	(0.0456)
Observations	16,962	16,950	16,967	16,960
R^2	0.57348	0.62823	0.57789	0.63396
Individual FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓

Notes: The dependent variable gives the frequency of feeling a certain emotion in the last four weeks. Individuals answered on a five-point scale: [1] very rare to [5] often. The treatment dummy is one if the commuting distance increases by at least 5 km, while an individual did not relocate nor change employer or job. Regressions include the following control variables: status of partnership, number of children, current health, and household size. Standard errors are clustered at the household level. * p<0.10, ** p<0.05, *** p<0.01.

Table B.8: Randomized Inference on Main Results (Affective Well-being)

	Sad	Worried	Angry	Happy
	(1)	(2)	(3)	(4)
Treatment Dummy	0.033	0.141***	-0.021	0.032
	[0.464]	[0.001]	[0.614]	[0.327]
Num.Reps	1000	1000	1000	1000

Notes: The dependent variable gives the frequency of feeling a certain emotion in the last four weeks. P-values shown in parentheses, with control variables, H0: Treatment Dummy=0. The treatment dummy is one if the commuting distance increases by at least 5 km, while an individual did not relocate nor change employer or job.

Table B.9: Endogenous Change in Commuting Distance and Housing Situation

	Life	Leisure	Health	Work	Family Life	Income	Dwelling
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treatment Dummy	0.1552	-0.1487	0.1983	-0.0519	0.2880	0.0156	0.3654
	(0.1373)	(0.1738)	(0.1855)	(0.1450)	(0.2168)	(0.1817)	(0.2648)
Observations	18,888	18,281	18,915	18,842	18,781	18,898	18,902
R^2	0.70529	0.68456	0.67074	0.66359	0.68674	0.74595	0.70807
Individual FE	✓	✓	✓	✓	✓	✓	✓
Year × State FE	✓	✓	✓	✓	✓	✓	✓

Notes: The dependent variables display how satisfied individuals are with their lives in general and in specific areas. Individuals answered on an eleven-point scale: [0] low to [10] high. The treatment dummy is one if the commuting distance increases by at least 5 km, while an individual relocated but did not change employer nor job. Regressions include the following control variables: status of partnership, number of children, current health, and household size. Current health is excluded in Column (3) (satisfaction with health). Standard errors are clustered at the household level. * p<0.10, ** p<0.05, *** p<0.01.

Table B.10: Marginal Effect of an Increase in Commuting Distance on Affective Well-being - Analyzing the Effect of Mobile Coverage

	Sad	Worried	Angry	Happy
	(1)	(2)	(3)	(4)
Treatment Dummy	0.0047	0.0989	-0.0102	0.0582
	(0.0737)	(0.0749)	(0.0798)	(0.0689)
Mobile Coverage	-0.0928	0.0225	0.1633	-0.1114
	(0.0994)	(0.0852)	(0.1031)	(0.0715)
Dummy × Mobile Coverage	0.0004	0.0641	0.0796	-0.1215*
	(0.0823)	(0.1145)	(0.0731)	(0.0670)
Observations	15,903	15,892	15,920	15,913
R^2	0.57922	0.63429	0.57745	0.63320
Individual FE	✓	✓	✓	✓
Year × State FE	✓	✓	✓	✓

Notes: The dependent variable gives the frequency of feeling a certain emotion in the last four weeks. Individuals answered on a five-point scale: [1] very rare to [5] often. The treatment dummy is one if the commuting distance increases by at least 5 km, while an individual did not relocate nor change employer or job. Regressions include the following control variables: status of partnership, number of children, current health, and household size. Standard errors are clustered at the household level. * p<0.10, ** p<0.05, *** p<0.01.