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Take It Easy! How Flexible Work Arrangements Bust the Commuting Life Satisfaction Nexus

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RESEARCH ARTICLE OPEN ACCESS

Take It Easy! How Flexible Work Arrangements Bust the Commuting Life Satisfaction Nexus

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ABSTRACT

Commuting to work can negatively affect people's well-being. This paper analyzes the effect of commuting distance on subjective well-being for employees under different work time regimes. The analysis is based on data from the German Socio-Economic Panel (GSOEP) for 2003–2021. The causal effect of commuting distance is identified by quasi-experimental changes for employees who experience firm relocation. Accounting for idiosyncratic unobserved effects, the results suggest that the loss in life satisfaction is about two and a half times higher for employees in non-flexible work arrangements than for those in a flexible work regime.

JEL Classification: C23, I31, R23, R40

1 | Introduction

For most people, commuting to work is a daily routine that adds up to a tremendous amount of time over a lifetime. At the dawn of the COVID-19 pandemic, a good third of employees were working partially or completely from home in Germany. However, daily commuting to work still prevails (Schröder et al. 2020). In contrast to urban economics theories, Stutzer and Frey (2008) have shown that the burden of commuting is not compensated for in the labor or housing market. According to their results, people with long journeys to and from work are systematically worse off and report significantly lower subjective well-being in Germany.

Several studies investigated the influence of commuting on well-being with mixed results. Roberts et al. (2011) confirmed a negative effect of commuting on psychological health in the United Kingdom, which they found to be more pronounced in women and robust to the inclusion of compensating factors such as job satisfaction, housing quality, or income. Dickerson et al. (2014) assessed a range of alternative estimators for fixed-effects ordered models, which, they argue, are theoretically preferable and more appropriate. Still, they find that linear

and ordered fixed-effects models of life satisfaction give similar results. Like Roberts et al. (2011), they find that longer commutes are associated with lower levels of mental health for women but find no evidence that commuting is related to lower levels of overall satisfaction in the United Kingdom. Clark et al. (2020) confirmed that longer commute times are associated with lower job and leisure time satisfaction, increased strain, and poorer mental health but are not associated with lower overall life satisfaction.

Using data for Germany, Pfaff (2014) finds a negative association of commuting distance and life satisfaction, in accordance with Stutzer and Frey (2008). Lorenz (2018) provides a comprehensive analysis of the commuting—well-being relationship in Germany with respect to several cognitive and affective measures. She finds commuting particularly affecting satisfaction with family life and leisure time but has no negative influence on satisfaction, in general. Ingenfeld et al. (2019) suggest that negative effects of commuting are particularly likely when commuting exceeds a certain threshold of time or distance. They find individuals who commute more than 80 km daily per way report the greatest amount of negative stress.

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We hypothesize that the impact of commuting on life satisfaction can be better understood when accounting for different work time regimes. It is not only the amount of time or distance required by travel that shapes this relationship but the way people spend it. Work time flexibility gives the individual more control over events related to, for example, road congestion or family or social responsibilities. Our work relates to Lorenz (2018), who finds that the relationship between commuting and satisfaction with family life and leisure can largely be explained by time scarcity because commuting increases the length of the total workday while simultaneously reducing time for private use. Our analysis further relates to Novaco et al. (1990), who developed the concept of subjective impedance to explain how road congestion and timely schedules frustrate the goal to arrive.

While there is a positive association of flexible work schedules or flexitime with happiness or overall life satisfaction (Golden et al. 2014; Seitz and Rigotti 2018; Uglanova and Dettmers 2018), the present inquiry takes the analysis further by assessing how negative effects of commuting can be mitigated by flexitime. Kröll and Nüesch (2019) discovered that flexible work practices (in the form of flexitime, sabbaticals, and working from home) increase job satisfaction and reduce turnover intentions in Germany.

The purpose of this inquiry is to analyze how the negative effects of commuting on well-being can be mitigated via flexible work time arrangements with German Socio-Economic Panel (GSOEP) household panel data.

Our results confirm the findings of Stutzer and Frey (2008) that people with long commuting distances are not compensated and systematically worse off and report lower overall well-being. However, our primary results reveal a nuanced picture, suggesting that this reduction in life satisfaction is less pronounced among employees under flexible work regimes compared to those under non-flexible arrangements.

Our contribution to the literature is twofold. First, we consider the heterogeneous effects of commuting distance on well-being with respect to work time flexibility. Second, to the best of our knowledge, we are the first to utilize novel postcode data on employers in GSOEP. We exploit this postcode data to derive commuting distance via the Google Maps DirectionFinder for two waves. Furthermore, postcode distances offer an objective benchmark in favor of our identification strategy.

The paper proceeds as follows. Section 2 describes the data. Section 3 introduces the empirical model and describes the variables. Section 4 reports the main results. Section 5 performs various robustness checks. Section 6 offers concluding remarks.

2 | Data

The analysis is based on 14 waves from the GSOEP between the years 2003 and 2021 (SOEP long v38.1 dataset). The GSOEP is an annually conducted, large-scale panel study that is representative of the German population. The panel was started in 1984 and includes information on the participants' income, education, occupation, health, and other demographic characteristics (Giesselmann et al. 2019).

Commuting behavior data within the SOEP are meticulously curated, facilitating multifaceted analyses of mobility trends. Among the various metrics, commuting distance stands out as a cornerstone, offering a comprehensive understanding of commuting patterns over time. Commuting distance data have been consistently gathered in the SOEP, enriching our understanding of commuting dynamics (with exceptions in recent years—2014, 2016, 2018, and 2020). Commuting distance is a good proxy for commuting time (with a moderate correlation of 0.52).

Information regarding commuting mode was available for the years 2003, 2018, and 2020. During these years, respondents predominantly reported commuting by car, surpassing all other modes of transportation combined (including public transportation, biking, or walking).

Commuting frequency data were collected intermittently throughout SOEP. Among the years 1991, 1993–2005, 1997, 1999–2002, and 2004–2013, respondents were directly queried about their commuting frequency—whether they commuted daily, weekly, or less frequently. Remarkably, across these years, 90.5% of respondents reported commuting on a daily basis.

In 2016 and 2018, participants were not asked for commuting distance or commuting time. Instead, they were asked: “What is your employer’s postcode (at the specific location where you work)?” This question was answered with a five-digit postcode by 9181 people in 2016 and by 10,303 people in 2018. Commuting distances for these two waves are calculated between the household location and employer’s postcode via the Google Maps API (DirectionFinder).

For the purpose of this study, the sample is restricted to individuals aged 18 and above who are employed full-time in the private sector and maintain a stable work schedule. The estimation sample consists of 41,229 observations stemming from 15,204 units with an average panel length of $T = 2.7$.

3 | Empirical Model

The analyses are based on an unbalanced panel to exploit the maximum information on the association between commuting and satisfaction. Fixed-effects models are estimated to detect effects caused by within changes in commuting distance while controlling for unobserved heterogeneity. The fixed effect controls for all—observed and unobserved—person-specific, time-constant influences on the outcome. Because various stable factors could affect life satisfaction and its related domains, the fixed-effects model is a parsimonious and robust way to avoid confounding due to unobserved heterogeneity.¹ Flexible work time arrangements are captured via an interaction with an indicator variable. Equation (1) summarizes the empirical model:

$$Y_{it} = \alpha_i + \beta_1 CD_{it} + \beta_2 CD_{it}^2 + \beta_3 CD_{it} \cdot FT_{it} + \beta_4 CD_{it}^2 \cdot FT_{it} + \beta_5 FT_{it} + \gamma X_{it} + \epsilon_{it}. \quad (1)$$

Hence, the life satisfaction Y_{it} of person i at time point t is modeled as a function of commuting distance in km CD_{it} , commuting distance squared CD_{it}^2 , and their interaction with flexitime FT_{it}

TABLE 1 | Summary statistics.

Statistic	Mean	St. Dev.	Min	Median	Max
Overall life satisfaction	7.5	1.5	0	8	10
Distance (in km)	22.1	35.0	0	13	330
Flexitime	0.6	0.5	0	1	1
Age	43.5	10.4	18	44	85
Education	2.4	0.5	1	2	3
Partner	0.6	0.5	0	1	1
Number of children	0.8	1.1	0	0	9
HH income (log)	10.1	0.5	7.4	10.1	13.0
Annual work hours	2314.4	396.3	1820	2182	6024
Year	2013	5.4	2003	2015	2021
State	7.8	3.8	1	8	16

Note: Descriptive statistics for the main sample ($N = 41,229$).

(where 1 indicates a flexible and 0 an inflexible regime), as well as a vector of time-varying covariates X_{it} , a person-specific potentially correlated error term α_i , and an idiosyncratic error term ϵ_{it} .

The respondents are asked to give a response on an 11-point scale for the question: “How satisfied are you with your life, all things considered?” where the lowest value (0) is labeled “completely dissatisfied” and the highest value (10) is labeled “completely satisfied.” The key explanatory variable is commuting distance, which is derived from the question: “How far (in kilometers) is it from where you live to where you work?” This is a one-way commuting distance in kilometers, measured at the interview date.

The flexitime dummy is 0 for employees with fixed daily working hours and 1 if the pattern is either self-determined working time (described as “No formally fixed working hours, decide my own working hours”) or a working time account (“Flexitime within a working hours account and a certain degree of self-determination of daily working hours within this account”).

Individual control variables include age (and age squared), educational attainment, partner status, number of children, annual working hours, equivalence household income,² as well as state of residence. The level of education is measured as less than high school, high school level, and more than high school, where less than high school is the base level. Partner status is captured by a dummy for married individuals and is zero for individuals who are single, widowed, divorced, or living separately.

Table 1 shows the summary statistics for the estimation sample. We applied top coding to commuting distance, limiting it to the 99.5th percentile (330 km), in order to mitigate the impact of extreme outliers. This approach ensures that excessively large values do not disproportionately influence the analysis, thereby enhancing the robustness and reliability of our results. On average, respondents commuted 22.1 km each way on a normal workday (standard deviation of ± 35.0).

4 | Results

Table 2 presents the results from fixed-effects models with overall life satisfaction as the outcome and a threefold interaction of commuting distance (commuting distance squared) and flexible work regimes.³

The analysis was conducted on six samples to assess the robustness of the findings. The first column displays the main results from the linear fixed-effects model using the main sample of adult full-time workers in the private sector. The second column ignores small changes in commuting distances (up to 5 km). The third column excludes data from the years 2016 and 2018, for which commuting distance data was imputed. Column 4 presents results from a conservative subset analysis, focusing on individuals who reported no change in their home location or job position. The fifth column further limits the sample to individuals under the age of 66 to account for potential retirement effects. Lastly, the sixth column removes extreme commuters by excluding individuals with commuting distances above 330 km. These alternative specifications ensure that our findings are not driven by data imputation, outliers, or structural changes in commuting behavior.

Our main finding is that people who commute longer distances report significantly lower life satisfaction. More importantly, the general negative trend is more dominant in the non-flexible working group, as shown in Figure 1.

To illustrate, consider an employee who transitions from a 20-km commute to a location 50 km away. Under a flexible work regime, we expect a loss in overall life satisfaction of about -0.04 whereas a non-flexible employee would experience a loss two and a half times greater (-0.11). In order to offset the negative effect of increased commuting distance, it would require an approximate 155% increase in equivalent household income under a non-flexible regime in comparison to only about a 40% increase in income under a flexible work time arrangement.

Table 3 presents the AMEs of commuting distance on life satisfaction across the six samples. AMEs provide a direct interpretation of how a 1-km increase in commuting distance affects life satisfaction while controlling for other variables. In contrast, coefficients from the three-way interaction model lack such a straightforward interpretation.

Across the six samples, the AME of a 1-km increase in commuting distance ranges between -0.0021 and -0.0035 (Table 3). Separate estimates are provided for individuals with and without flexible work arrangements, allowing us to assess how work flexibility mitigates the negative effect of commuting. To formally test whether these differences are statistically significant, we conducted a linear hypothesis test (Wald test), which confirmed that the differences in AMEs between flexible and non-flexible workers are statistically significant.

5 | Robustness

A common concern with self-reported commuting distances is measurement error (Van Ommeren and Gutiérrez-i Puigarnau

TABLE 2 | Fixed-effects regressions.

	Main sample	Smoothed distance	Imputation excluded	Fixed residence and job	Age under 66	Distance under 330 km
Distance (in km)	−0.0048*** (0.0001)	−0.0049*** (0.0001)	−0.0058*** (0.0001)	−0.0043** (0.0078)	−0.0049*** (0.0012)	−0.0035** (0.0014)
Distance ²	0.0000** (0.0019)	0.0000** (0.0014)	0.0000** (0.0073)	0.0000 (0.1095)	0.0000** (0.0000)	0.0000 (0.0000)
Flexitime	−0.0631 (0.0538)	−0.0662* (0.0437)	−0.0450 (0.2428)	−0.0809* (0.0344)	−0.0658* (0.0328)	−0.0519 (0.0336)
Flexitime × Distance	0.0031* (0.0209)	0.0032* (0.0149)	0.0033* (0.0383)	0.0033* (0.0378)	0.0032** (0.0013)	0.0019 (0.0015)
Flexitime × Distance ²	0.0000* (0.0270)	0.0000* (0.0203)	0.0000 (0.0607)	0.0000 (0.1732)	0.0000* (0.0000)	0.0000 (0.0000)
Age	−0.0600*** (0.0000)	−0.0600*** (0.0000)	−0.0519*** (0.0000)	−0.0871*** (0.0000)	−0.0596*** (0.0107)	−0.0618*** (0.0106)
Age ²	0.0006*** (0.0000)	0.0006*** (0.0000)	0.0005*** (0.0000)	0.0008*** (0.0000)	0.0006*** (0.0001)	0.0006*** (0.0001)
HH income (log)	0.1172*** (0.0008)	0.1173*** (0.0008)	0.1043** (0.0091)	0.1007* (0.0137)	0.1179*** (0.0351)	0.1174*** (0.0351)
Annual work hours	−0.0001** (0.0042)	−0.0001** (0.0043)	−0.0001* (0.0284)	−0.0001* (0.0315)	−0.0001** (0.0000)	−0.0001** (0.0000)
Year dummies	Included	Included	Included	Included	Included	Included
State dummies	Included	Included	Included	Included	Included	Included
No. of observations	41,229	41,229	33,647	41,229	41,125	41,014
No. of individuals	15,204	15,204	14,234	19,382	15,171	15,141

Note: Linear fixed-effects models. Standard errors in parentheses. The main sample consists of full-time workers in the private sector aged 18 and above, characterized by a stable work time pattern. The second sample analyzes smoothed commuting distance changes, disregarding variations of up to 5 km between two consecutive measurements. The third sample excludes the imputation of commuting distance in the years 2016 and 2018. The fourth sample represents individuals who reported no changes in residence location or job. The fifth column restricts age to 65. The last column excludes extreme commuters with distances above 330 km.

Source: SOEP long v38.1 dataset.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

TABLE 3 | Average marginal effects

	Main sample	Robustness checks				
		Smoothed distance	Imputation excluded	Fixed residence and job	Age under 66	Distance under 330 km
Distance (in km)	−0.0026***	−0.0026***	−0.0035***	−0.0021**	−0.0026***	−0.0023**
At flexitime No	−0.0032***	−0.0033***	−0.0042***	−0.0032**	−0.0033***	−0.0032***
At flexitime Yes	−0.0013**	−0.0013**	−0.0021*	−0.0008**	−0.0013**	−0.0013**
Difference	−0.0019**	−0.0020**	−0.0021*	−0.0024**	−0.0020**	−0.0019**
z-statistic	−2.098	−2.220	−1.922	−2.237	−2.187	−2.080
p-value	0.036	0.026	0.055	0.025	0.029	0.038

Note: Average marginal effects (AMEs) of commuting distance (in km) on overall life satisfaction are estimated based on the fixed-effects model (Equation 1). Differences in AME-s between flexible and non-flexible work regimes were tested using a linear hypothesis test (Wald test). The null hypothesis of no difference was rejected at conventional significance levels.

Source: SOEP long v38.1 dataset.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

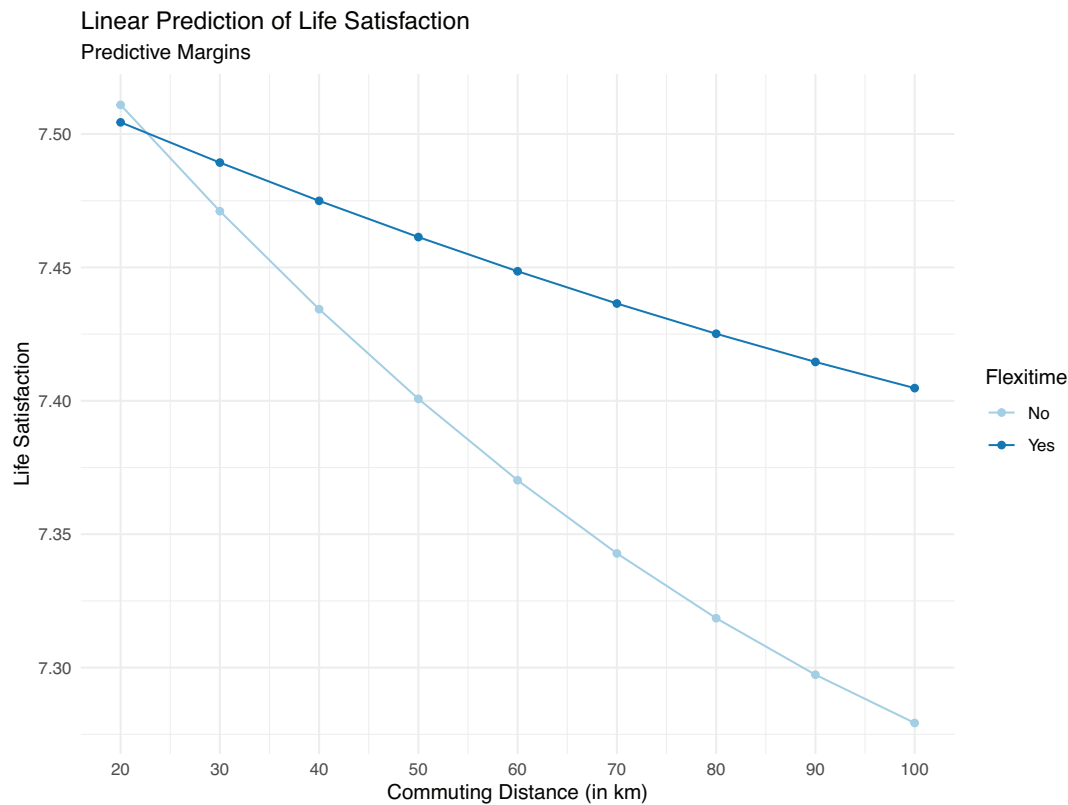


FIGURE 1 | Linear prediction of life satisfaction. *Note:* Linear prediction of life satisfaction as a function of commuting distance, estimated using a fixed-effects regression model (Equation 1). The predictions are based on the main sample (see Tables I and Table II, column 1), with predictive margins computed for commuting distances between 20 and 100 km (in 10 km increments). Margins are displayed separately for individuals with and without flexible work arrangements. [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

2011; Carta and De Philippis 2018). People might report 10 km in 1 year and 15 km in another year out of ignorance, despite no fundamental changes to their commute. Thus, we reestimate the fixed-effects model, ignoring changes below 5 km that are likely to be due to measurement error. Because the estimates in this smoothed distance model remain similar, we conclude that our results are not driven by ultra-short distance variation that is likely to be the result of measurement error.

We further explored postcode distances for the years 2016 and 2018, where commuting distance was not available. Utilizing the Google Maps Direction Finder, we calculated the distance between two postcodes, considering the centers of both the home and work locations. While alternatives like the Haversine formula exist, we opted for Google navigation due to its ability to better reflect the real-life journey people undertake, particularly by car, providing more accurate estimations of travel distance. Based on comparable means and standard deviation of the postcode and self-reported commuting distance in different years, we included those years in the base model. It is important to note potential limitations, particularly in regions with either very small or very large postcode areas. To address this concern, we conducted additional analyses without imputation (Table 2, column 3) and found that our results remained consistent.

There is a concern that endogeneity bias can result from self-selection into commuting. Strictly speaking, people might choose

a long commuting distance for an unknown reason that is correlated with the error term and not captured by our model. To estimate the causal effect of commuting, we leverage firm relocation as a source of exogenous commuting distance variation. Employer-induced changes in commuting distance have been explored by Gutiérrez-i Puigarnau and van Ommeren (2010) and Van Ommeren and Gutiérrez-i Puigarnau (2011) and ever since exploited by the commuting researcher community (Mulalic et al. 2014; Gutiérrez-i Puigarnau and van Ommeren 2015; Künn-Nelen 2016; Carta and De Philippis 2018; Jacob et al. 2019).

Firm relocation can be thought of as a quasi-experiment that mimics experimental manipulation of the commuting distance.⁴ We follow Zax (1991), who notes that, if moves and quits are costly, workers will not relocate in response to exogenous shocks unless alternative workplace or residence locations offer a substantial utility increase. Van Ommeren and Gutiérrez-i Puigarnau (2011) point out that German job quit and residential moving rates were among the lowest in the world.

We construct our sample based on changes in residential and job positions. Each individual residing at a particular dwelling and holding a specific job is considered a distinct unit. We employ fixed-effects models on these units, also known as group fixed effects. In essence, if an individual residing in the same housing experiences any change in job status (e.g., obtaining a new job, switching to a new employer, or receiving a promotion within

the same company and position) across two consecutive waves, they are treated as a separate unit of analysis. Consequently, the number of observations remains constant, while the number of units increases from 15,204 to 19,382.

Commuting behavior may shift with age, particularly near retirement. To check for potential biases, we restricted the sample to individuals under 66. Given that only 104 individuals were older than 65, the impact on our results is minimal.

Additionally, we considered extreme commuting distances. In our main sample, commuting distance is top-coded at 330 km (99.5% percentile). To assess the robustness of our results, we ran an alternative model excluding individuals reporting distances greater than 330 km (215 observations), and found consistent results.

We see a very close correspondence between the estimates. There are no reversals in sign for our significant variables. We also tested for alternative specifications of our empirical model to address the concern of misspecification, for example, including health status. To sum up, our main findings are robust to different sample specifications and unambiguously suggest that increasing commuting distance lowers well-being, which can be compensated for by a flexible work regime.

6 | Conclusion

In this paper, we analyze the relationship between commuting distance and subjective well-being for employed workers in Germany and find a negative causal effect of commuting. Particularly, our results suggest that this negative effect can be almost completely mitigated by a flexible work time regime. This finding turns out to be consistent across several robustness checks. Longer commutes increase the length of the total workday and decrease the time for all other activities. However, we suggest that both the amount of time spent traveling and the level of control over the commute in the form of flexible work time arrangements determine overall satisfaction.

People move from the cities to suburban or rural areas to optimize their work-life balance and acquire better housing quality. We point to the potential negative effects of increased mobility due to separated living and working environments in terms of loss of time, increased stress, and, ultimately, a decrease in overall life satisfaction.

In sum, we identify the potential to increase happiness and well-being if flexitime is fostered (e.g., by labor law). Our results suggest that exploiting opportunities for flexible work time arrangements can substantially mitigate negative commuting effects, thereby raising overall welfare. Flexitime has the potential to increase job satisfaction and motivation of employees; it reduces stress and makes commuting easier when rush hours can be avoided, and family or social responsibilities can be balanced with work requirements. A flexible work regime can help employers improve the acquisition of skilled labor. Various forms of work time arrangements and remote work deserve attention from future research.

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Data Availability Statement

The data are from GSOEP v38.1 (1984 to 2021). Regional variables are only accessible in the SOEP Research Data Center at DIW Berlin. Postcode distances come from Google Maps.

Endnotes

¹ For more details about why one should use fixed-effects models in well-being research, see Ferrer-i Carbonell and Frijters (2004).

² The log of equivalence household income is calculated as a weighted average of the post-government total household income divided by the number of people in the household (1 for the first adult; 0.5 for every other person).

³ Giesselmann and Schmidt-Catran (2020) point to the necessity of double demeaning interaction terms in the fixed-effects context. A potential problem occurs if another unobserved moderator of the commuting-satisfaction relationship also affects the moderation variable. We run a double demeaned fixed-effects model to test for this. Because the Hausman test statistic is negative, no informed decision on applying double demeaning can be made. This may stem from a too-small sample. In similar specifications, the Hausman test was statistically insignificant and thus in favor of the single demeaned models, thus, we pursue with single demeaned models.

⁴ A similar form of a natural experiment that targets commuting time is the analysis of high-speed railway network expansion used by Heuermann and Schmieder (2019) or the exploitation of strike data by Adler and van Ommeren (2016).

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