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**Home Alone:
Work from Home and Loneliness**

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Home Alone: Work from Home and Loneliness

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Does working from home lead to loneliness? If yes, how and for whom? Using a quasi-natural experiment and individual fixed-effects, this study shows that work from home leads to increased worker loneliness. Teleworking not only increases overall loneliness, but it also affects each of the three dimensions of loneliness (feeling isolated, feeling left out, lacking companionship). Working from home increases irregular work hours and decreases satisfaction with leisure time, dwelling, and family life. Consequently, teleworkers feel lonelier. However, the effect is highly heterogeneous. Work from home particularly exacerbates the loneliness levels of employees who are extroverted, not married, without children, living in smaller households, working in the private sector, or residing in East Germany. Importantly, this detrimental effect is mainly driven by fully working remotely. Implications are discussed. (JEL I31, M5, I10, J81)

The prevalence of work from home has increased significantly in the last decades (Aksoy et al. 2022; Barrero et al. 2023; Bartik et al. 2024). While work from home has been shown to increase productivity, flexibility, autonomy, job satisfaction, and work-life balance (Bloom et al. 2014, 2015; Gajendran and Harrison 2007; Kelliher

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and Anderson 2010), it may also entail unintended negative consequences for employees' overall well-being (Goux and Maurin 2025; Laß and Wooden 2022; Senik et al. 2024; Song and Gao 2020). Against this background, it is important to investigate the unintended costs of remote work for different aspects of employee well-being. This study uniquely investigates the social well-being consequences of teleworking by examining whether, how, and for whom working from home leads to loneliness.

Studying the association between work from home and loneliness stands as a crucial policy-relevant issue for several reasons. First, loneliness has been spreading globally and is acknowledged as a rising public health and well-being concern (e.g., Sirois and Owens 2023).¹ Second, loneliness is closely associated with chronic illnesses such as heart disease, lung disease, stroke, dementia, metabolic disease, and hypertension (Hakulinen et al. 2018; Hawkey et al. 2010; Knox and Uvnäs-Moberg 1998; Kuiper et al. 2015). Third, loneliness deteriorates mental well-being, increasing depression, anxiety, anger, and stress (Cacioppo et al. 2006, 2010; Horowitz et al. 1982). Indeed, Holt-Lunstad et al. (2015) show the health consequences of loneliness mimic those induced by smoking 15 cigarettes per day and more detrimental than the effect of obesity. Fourth, the negative consequences of loneliness go beyond individual health, and it even influences the productivity and profitability of firms and the success of families, society, democracy, and the entire economy (Langenkamp and Stepanova 2024; Mihalopoulos et al. 2020; Ozcelik and Barsade 2018; Valtorta et al. 2018).

Combating loneliness and promoting social participation is in line with the “leave no one behind” commitment of the United Nation’s 2030 Agenda for Sustainable Development. Thus, it is not surprising that governments around the globe are

¹ Indeed, the Google Trends data show a dramatic increase in the Google worldwide web searches for the following queries over the last decade: (1) “Where to meet people?” (2) “How to make friends?” and (3) “Where to make friends?” (see Google Trends, <http://www.google.com/trends>).

battling the loneliness epidemic. In 2023, the US Surgeon General declared a loneliness epidemic (OSG 2023). To address this epidemic in the US, Senator Murphy introduced legislation to the *National Strategy for Social Connection Act*. The UK government started to build a strategy to reduce loneliness in 2018 with an initial allocation of 20 million Pounds (DDCMS 2018). In 2023, the German Federal Government launched the *Strategy Against Loneliness* as part of the German Sustainability Strategy (FMFSWY 2023). The European Commission's Loneliness Project also aims to provide intervention policies for loneliness across EU-27 since 2023 (Casabianca et al. 2023).

From a theoretical perspective, the association between remote work and loneliness is *a priori ambiguous*. Work from home *increases* social capital investment at home, while it *decreases* social capital investment at work. On the one hand, work from home may decrease loneliness as it is associated with better work-life balance, saved commuting time, and increased time spent with family (Aksoy et al. 2023; Barrero et al. 2021; Pabilonia and Vernon 2020). On the other hand, remote work may increase loneliness as it is associated with increased stress, longer and irregular work hours, decreased quality and quantity of social interaction with colleagues, increased time spent at home alone, and diminished boundaries between work and personal life (Emanuel et al. 2026; Knight et al. 2022; Laß and Wooden 2022; Pabilonia and Vernon 2020; Sardeshmukh et al. 2012). Thus, we need to assess empirically whether the positive effects of remote work on loneliness outweigh the negative ones or vice versa.

Despite the rapid and global rise in both work from home and loneliness, the empirical evidence on the association between remote work and loneliness remains scarce.² Only a handful of studies pay attention to this association, and they produce

² While a growing body of empirical literature examines the well-being consequences of work from home, the association between work from home and loneliness has received surprisingly little attention. For studies examining the well-being consequences of work from home, see, among others, Kröll and Nüesch (2019), Oakman et al. (2020), Song and Gao (2020),

mixed results using limited samples, focusing on specific groups of employees, or not addressing endogeneity and measurement issues. Bloom et al.'s (2015) experiment in a Chinese call center provides descriptive statistics showing that one fourth of their work from home treatment group returned to the workplace because they got lonely. Using Australian data, Sundermeyer (2025) shows that work from home increases loneliness only in the long run. However, she does not address the issue of endogeneity. The few studies that exploit exogenous variations in remote work focus on subsamples of population and provide mixed evidence. Costi et al. (2024) concentrate on public sector employees in Italy and find no significant relationship between return-to-office mandates and loneliness. Similarly, Senik et al. (2024) find no significant association between teleworking and loneliness using a limited early-access version of their German data. Bertoni et al. (2025) focus on senior employees (age ≥ 50) and find a positive link between teleworking and feeling lonely. Recently, Cowan and Spearing (2026) show that in the UK, individuals who worked in teleworkable jobs in 2019 are slightly more likely to feel lonely during the pandemic. They suggest that this is a transitory effect and subsides by 2023. However, as their treatment variable is based on teleworkability of a job but not the actual work from home usage at the individual level, it may suffer from measurement error. The existing sparse literature on work from home and loneliness also does not provide sufficient evidence regarding heterogeneity and transmission mechanisms. Thus, these inconsistencies and past mixed findings call for a comprehensive investigation of work from home and loneliness.

This study comprehensively examines whether, how, and for whom working from home leads to loneliness and contributes to the literature in several ways. First, it draws on the economic approach of social capital to provide a theoretical

Bellmann and Hübler (2021), Platts et al. (2022), Gueguen and Senik (2023), Yang et al. (2023), Agnoletto (2024), Denzer and Grunau (2024), Hill et al. (2024), Laß et al. (2024), Senik et al. (2024), Wielgoszewska et al. (2024), Jirjahn and Rienzo (2025), and Kornadt et al. (2025). The findings of these studies are mixed, indicating positive, negative, and even null associations, and are mostly based on cross-sectional data.

framework for the link between remote work and loneliness. Second, distinct from other studies, this study uses a large-scale representative panel dataset containing individuals from different sectors, occupations, and ages with information on actual individual level work from home usage and UCLA 3-item loneliness scale. Third, it makes clear that self-selection into remote work matters and a simple comparison of those working from home versus those working on-site suffers from omitted variable bias due to unobserved time-varying and time-invariant characteristics. Failing to account for these characteristics leads to an underestimation of the true effect of teleworking on loneliness (and perhaps other well-being and health indicators).

Fourth, this study uses a quasi-natural experiment and individual fixed-effects to investigate the association between work from home and loneliness. Exploiting the exogenous shock in working from home regulations during the COVID-19 pandemic in Germany allows isolating the causal effect of work from home on employees' loneliness using a difference-in-differences approach. This approach rules out the problem of self-selection into remote work due to unobserved factors. Additionally, the richness of the German Socio-Economic Panel (SOEP) allows controlling for unobserved time-invariant individual heterogeneity and isolating the impact of remote work from the broader impact of the pandemic. Fifth, this study investigates empirically the channels through which telework may increase loneliness. This exercise reveals irregular work hours and lower satisfaction with leisure time, dwelling, and family life as important channels.

Finally, and most importantly, it shows that the relationship between remote work and loneliness is highly heterogeneous. Addressing the heterogeneity issue may well explain why previous studies have provided mixed findings. The association between work from home and loneliness depends strongly on individual personality, availability of social support at home (spouse, children, household size), employment sector, and culture. Teleworking is particularly detrimental to

the loneliness levels of employees who are extroverted, not married, without any children, living in smaller households, working in the private sector, or residing in East Germany. The heterogeneity analysis also shows that fully working from home is the main driver of this detrimental effect.

In what follows, the next section sets the stage by focusing on social capital theory to develop the hypotheses to be tested. Section II introduces the SOEP and the key variables of the study. Section III starts with providing the initial estimates of loneliness that include work from home as a determinant and continues with presenting the difference-in-differences estimates. It also shows the channels through which teleworking may increase loneliness, heterogeneity analysis, and a series of robustness checks. Section IV provides discussion and conclusions.

I. Theoretical Framework

A. Work from Home and Loneliness

This study draws on an economic approach to social capital to examine the association between remote work and loneliness. According to the social capital theory (Glaeser et al. 2002), loneliness can be perceived as the cost of insufficient investment in social capital. Social capital theory also suggests that “physical distances” and “spatial proximity” can be seen as the drivers of social connections and social capital (Festinger et al. 1950; Glaeser and Sacerdote 2000; Glaeser et al. 2002; Putnam 2000).

According to the social capital theory, the impact of work from home on loneliness is a priori ambiguous. Work from home can *increase* or *decrease* social capital, and hence, loneliness. Work from home decreases social capital investment at the workplace, whereas it increases social capital investment at home and outside the workplace. Remote workers have increased physical distance and decreased spatial proximity to their colleagues. At the same time, their spatial proximity to

family and friends increases by working from home. Thus, the overall effect of remote work on loneliness depends on whether the positive influences of work from home on loneliness outweigh the negative ones or vice versa.

On the one hand, work from home increases the proximity and available time for family, and hence, is associated with increased social capital at home. Employees who work from home save commuting time and have better time flexibility (Bloom et al. 2014; Aksoy et al. 2023). Reduced commuting can allow the formation of social capital (Putnam 2000). Increased flexibility and diminished commuting both facilitate spending more time with family and friends outside the workplace, increasing their investment in non-work-related social capital. Against this background, remote work may decrease loneliness.

On the other hand, work from home decreases the proximity and available time for colleagues, and hence, is associated with decreased social capital at work. Decreased proximity with coworkers leads to changes in interaction and communication behavior (Battiston et al. 2021). Thus, working from home negatively affects face-to-face communication of the employees as well as their real-time workplace visibility (Felstead et al. 2003). Remote workers even switch their communication behavior during their presence at the workplace (Bloom et al. 2024). These could lead to decreased networking, feedback exchange, and cooperation among colleagues (Emanuel and Harrington 2024; Emanuel et al. 2026; Gibbs et al. 2023; Lee et al. 2011; Yang et al. 2022), which in turn, influences the quality and quantity of social connections at the workplace (Knight et al. 2022). Further, spatial proximity and physical distance are also associated with the formation of workplace friendships (Marmaros and Sacerdote 2006) and the feelings of altruism toward colleagues (Rotemberg 1994). Thus, reduced socialization and workplace friendships, in turn, decrease the probability of receiving social support from colleagues and a sense of belonging at work. Against this background, telework may increase employee loneliness.

Although work from home increases the available time for family (Pabilonia and Vernon 2020), it is also associated with blurred boundaries between work and private life (Laß and Wooden 2023). Remote workers are more likely to work longer and “unsocial hours,” i.e., working in the evenings and weekends (Eurofound 2021; Laß and Wooden 2023). They also report increased stress (Song and Gao 2020) and time spent at home alone (Makridis 2025; Pabilonia and Vernon 2020). Pabilonia and Vernon (2020) show that on typical workdays, teleworkers spend less time with friends and more time on TV and computers for leisure. This implies that the quality of their social relationships outside the workplace could be negatively affected. Despite having a closer spatial proximity to their family and friends, teleworkers may not psychologically detach from work during their leisure time. Against this background, the unintended consequences of work from home on loneliness may outweigh its intended ones. Thus, the basic hypothesis to be empirically tested is as follows.

HYPOTHESIS 1: *Work from home leads to increased employee loneliness.*

B. Heterogeneous Effects of Work from Home on Loneliness

Individuals differ in their needs and preferences for social interactions and social support. Accordingly, the effect of work from home on loneliness may not be the same for all employees.

Social Support at Home.—First, social capital theory suggests that work from home increases proximity and time spent with family at home. The sense of belonging and the social support received at home may compensate for the reduced face-to-face interactions and friendships with colleagues (Adamczyk 2016; Shin

and Park 2022; Penning et al. 2024). However, this is valid only for individuals who have such social support at home. This implies that employees who are married, have children, and live in larger households should suffer less or not at all from the loneliness consequences of teleworking. On the contrary, employees without such social support at home (i.e., not married, without children, and living in smaller households) suffer to a larger degree from the loneliness consequences of remote work as their reduced social connections at work cannot be compensated for by increasing social capital at home.

HYPOTHESIS 2: The effect of work from home on loneliness is larger for employees who are not married, without children, or living in smaller households.

Individual Personality.—Second, individuals may differ in their degrees of social interaction preferences (Burger 1995). Extroverted individuals (i.e., communicative, sociable, not reserved) enjoy the company of others and may fulfill their sense of belonging by interacting with colleagues at their workplaces. Theoretical and empirical evidence suggest a strong association between extraversion and sorting into gregarious jobs, i.e., jobs with more social interaction (Kreuger and Schkade 2008; Pfeiffer and Schulz 2012). Thus, work from home may have a stronger influence on the loneliness levels of gregarious employees. On the contrary, introverted individuals enjoy spending time alone, and hence, teleworking may not be detrimental to their feelings of loneliness.

HYPOTHESIS 3: The effect of work from home on loneliness is larger for extroverted employees.

Employment Sector.—Third, the association between work from home and loneliness may depend on the employment sector. There exists evidence showing

that the levels of competition and commitment differ among public and private sector employees (e.g., Bryson and Freeman 2014; Bryson et al. 2017; Buchanan 1975; Lyons et al. 2006; Zeffane 1994). The higher competition and commitment in the private sector imply a higher degree of diminished boundaries between work and private life while one works from home. At the same time, the cost of decreased social capital at the organization may be higher in the private sector than in the public sector. The informal interactions between employees in private sector could be beneficial not only for social integration but also for career advancement through information sharing and competitive gains (Granovetter 1973; Horak et al. 2020).

HYPOTHESIS 4: The effect of work from home on loneliness is larger for private sector employees.

Culture.—Finally, cultural context may also play a moderating role in the relationship between teleworking and loneliness. In the former East Germany, social life and identity were largely organized around work and local community networks, whereas West Germans maintained more diversified social connections (Vester 1995). More than three decades after the reunification of Germany, there remain cultural and behavioral differences between the former East and West Germans (Ockenfels and Weimann 1999; Alesina and Fuchs-Schuendeln 2007; Rainer and Siedler 2009). Against this background, employees in East Germany may suffer more from the loneliness consequences of teleworking as they rely more on workplace social connections.

HYPOTHESIS 5: The effect of work from home on loneliness is larger in former East Germany.

II. Data and Variables

Dataset.—I use the SOEP to empirically examine the influence of work from home on loneliness. The SOEP is a large-scale representative longitudinal survey of private households in Germany (Goebel et al. 2019). It asks routine demographic and socio-economic questions annually and ‘special’ topic questions in specific waves. As the questions regarding work from home and loneliness are asked in specific waves, I focus on those waves (see below for details).

Loneliness.—Loneliness is the key outcome variable of this study and appears in the 2013, 2017, and 2021 waves. It is measured using the following three items: (1) “How often do you miss the company of other people?” (2) “How often do you feel socially isolated?” (3) “How often do you feel left out?” For each item, interviewees respond on a five-point Likert scale with categories “never,” “seldom,” “sometimes,” “often,” and “very often.” Thus, I build the short-scale loneliness index by summing the three items, with larger scores indicating higher loneliness (Hughes et al. 2004; Lepinteur et al. 2022; Baktash 2026). The intercorrelation of the three items is suitably high with a Cronbach’s alpha of 0.73. Distinct from other studies that treat loneliness as a dummy variable, the measure of loneliness in this study ranges from 0 to 12. Table 1 shows the descriptive statistics of the key variables. The mean loneliness score in the sample is 3.35 with a 2.30 standard deviation.

Work from Home.—The first key explanatory variable is the work from home dummy. Employees are asked whether they work from home or not in the respective survey year. This information could be matched with the 2013 and 2021 information on loneliness. On average, 34.2 percent of respondents in the

estimation sample have worked from home. 23.1 percent in 2013 and 38.8 percent in 2021.

Exogenous Treatment.—The second key explanatory variable is the exogenous treatment that happened during the COVID-19 pandemic. The SOEP asked their participants during the pandemic whether they have started working from home *because* of the COVID-19 crisis or not. Thus, the treatment group is employees who partially or fully started working from home *because* of the pandemic. About 29 percent of employees are treated. The control group consists of employees who did not switch to remote work. For the difference-in-differences analysis, I can use all the three available waves that contain information on loneliness (i.e., 2 waves before the pandemic and 1 wave during the pandemic). This would allow testing for the parallel trends assumption and increase the credibility of the findings.

Control Variables.—I control for a series of time-variant socio-economic characteristics, such as age, marital status, education, household size, number of children, gross income, tenure, region of residence, dwelling characteristics, industries, and occupations. In the OLS and random-effects models, I additionally control for time-invariant characteristics such as gender and migration background.³

³ See Appendix Table A.1 for the definitions and descriptive statistics of the control variables.

III. Results

A. Initial Estimates

First, the study examines the role of work from home on loneliness using OLS, random-effects and fixed-effects strategies. The main estimation equation takes the following form:

$$(1) \quad Loneliness_{it} = \beta_1 WFH_{it} + \gamma X_{it} + \alpha_i + u_{it},$$

where $Loneliness_{it}$ is the score of loneliness for employee i in year t . The key explanatory variable WFH_{it} is the indicator of work from home for employee i in year t . X is a vector of control variables. α_i is the unobserved time-invariant heterogeneity, and u_{it} is the error term. The parameter of interest is β_1 capturing the effect of work from home on loneliness.

Table 2 presents the results.⁴ The first three columns show the bivariate estimates, and the latter three columns show the multivariate estimates. OLS and random-effects models both show a negative association between work from home and loneliness in a bivariate setting. Whereas the fixed-effects model shows a significant positive association between work from home and worker loneliness. This already suggests that remote work is not randomly assigned and failing to account for unobserved time-invariant heterogeneity leads to an underestimated effect of teleworking on loneliness.

The latter three columns, where control variables are added, show that the negative association between work from home and loneliness disappears in OLS and random-effects models. This implies that failing to account for observable characteristics also leads to an underestimated effect of remote work on loneliness,

⁴ See Appendix Table A.2 for the full results.

and hence, raises the importance of accounting for both time-varying and time-invariant unobserved characteristics. Thus, both random-effects and fixed-effects estimations show a significant positive association between work from home and loneliness, with the magnitude of the impact being twice larger in the fixed-effects regression. Switching to work from home increases employee loneliness by 0.23 of a point in loneliness scale.

B. Quasi Natural Experimental Estimates

The results so far indicated that failing to account for observable and unobserved time-invariant characteristics leads to an underestimated effect of remote work on loneliness. In the next step, I use the pandemic as a natural experiment to estimate the causal effect of work from home on loneliness. The main difference-in-differences estimation equation takes the following form:

$$(2) \quad \begin{aligned} Loneliness_{it} = & \beta_1 Treat_{i20/21} + \beta_2 Post_t + \beta_3 Treat_{i20/21} * Post_t \\ & + \gamma X_{it} + \alpha_i + u_{it} , \end{aligned}$$

where $Treat_{i20/21}$ is a dummy equal to 1 if the employee started working from home *because* of the pandemic and equals 0 if the employee did not switch to remote work. $Post_t$ is a dummy equal to 1 if the survey year is during the COVID-19 pandemic and is equal to 0 if the survey year is before the pandemic. $Treat_{i20/21} * Post_t$ is the interaction of the treatment dummy with the post dummy. The rest of the equation is identical to equation (1). In this equation, the parameter of interest is β_3 , which captures the impact of switching to work from home due to the pandemic.

Table 3 presents the difference-in-differences regression results.⁵ Again, the first three columns are without, and the latter three columns are with control variables. When no controls are included, the coefficient for $Treat_{it} * Post_{it}$, which captures the causal effect of working from home on loneliness, takes statistically significant positive coefficients ranging from 0.23 – 0.28. Thus, the findings are similar across models regardless of accounting for the unobserved time-invariant worker heterogeneity. Importantly, these coefficients are very similar to the ones reported in column (6) of Table 2, where the effect of switching to work from home was estimated using an individual fixed-effects model.

The latter three columns, where control variables are included, report an even larger effect of work from home on loneliness. When no individual fixed-effects are employed, the impact of work from home on loneliness ranges from 0.44 – 0.47. However, when the unobserved time-invariant heterogeneity is accounted for, the effect of work from home on loneliness slightly diminishes but remains large at 0.40. All these coefficients are significant at the 1% level. Altogether, the findings of both Tables 2 and 3 suggest a crucial association between working from home and loneliness.

Next, at issue is whether the parallel trends assumption holds. The difference-in-differences estimation strategy assumes that the loneliness levels of treatment and control groups would have been following a parallel trend in the absence of the exogenous shock in mandatory work from home regulations. Fortunately, the dataset allows for testing the parallel trends assumption as it consists of two waves of information before the crisis (i.e., 2013 and 2017) and one wave during the pandemic (i.e., 2021). Figure 1 depicts the evolution of loneliness in the treatment and control groups. Before the crisis, the loneliness levels of both treatment and control groups follow a parallel trend with downward slopes. The treatment group's

⁵ See Appendix Table A.3 for the full results.

loneliness level has fallen slightly more than the control group. During the COVID-19 crisis, there appears a strong increase in the loneliness levels of both groups. However, the increase is much sharper for the treatment group than for the control group. These findings suggest that the parallel trends assumption holds and the sharp increase in the loneliness levels of the treatment group is caused by working from home.

C. Exploring the Channels

The theoretical considerations of this study proposed that irregular work hours, quality and quantity of interactions with colleagues, time spent at home alone, stress, and blurred boundaries between work and personal life are channels through which work from home increases the risk of loneliness.

The richness of the SOEP allows testing the roles of irregular work hours and satisfaction with family life, leisure time, and dwelling. Irregular work hours are captured by a dummy variable equal to 1 if the employee works in the evenings and equal to zero if otherwise. About half of the sample has reported working in the evenings. Moreover, the satisfaction scores for family life, leisure time, and dwelling are based on the following questions: “How satisfied are you today with the following areas of your life? – How satisfied are you with ... – your family life? – your leisure time? – your dwelling?” Thus, employees may respond on an 11-point Likert scale, ranging from 0 (completely dissatisfied) to 10 (completely satisfied). The mean satisfaction scores for family life, leisure time, and dwelling are 7.81, 6.76, and 7.92, respectively.

Table 4 presents the results for the influence of work from home on irregular work hours, and satisfaction with family life, leisure time, and dwelling. Column (1) shows that remote work increases the probability of working in the evenings. This is in line with the notion of blurred boundaries between work and private life.

Moreover, columns (2) – (4) show that work from home decreases satisfaction with family life, leisure time, and dwelling by 0.11, 0.12, and 0.09 points, respectively. This implies that although teleworking may facilitate physical proximity to family members, the increased stress and blurred boundaries lead to decreased satisfaction with family life. Additionally, despite their spatial proximity to their family and friends, teleworkers may not psychologically detach from work during their leisure time. All these could therefore be detrimental to their leisure time satisfaction. Finally, constantly having work-related objects around the dwelling and reduced space for other activities in the dwelling lead to diminished satisfaction with dwelling. All these channels support the notion that work from home blurs the boundaries between work and private life, and hence, leads to increased loneliness.

D. Heterogeneity Analysis

The study has established a strong link between work from home and loneliness thus far. However, the background discussion demonstrated that individuals vary in their preferences and needs for social interactions, sense of belonging and social support. Thus, factors such as marital status, living situation, parenthood, personality trait, employment sector, and region of residence may moderate the association between remote work and loneliness. In what follows, I examine whether the link between teleworking and loneliness is moderated by these factors. Table 5 presents the results.

Heterogeneous Treatment Effects by Marital Status, Children, and Household Size.—According to Hypothesis 2, the effect of work from home on loneliness should be larger for employees who are not married, without children, or living in smaller households. Panels A, B, and C of Table 5 test this hypothesis. The empirical findings support the hypothesis. There exists no significant association

between work from home and loneliness for employees who are married, with children, or living in larger households. However, work from home significantly increases the loneliness levels of employees who are not married, without children, or living in smaller households by 0.54, 0.49, and 0.52 points on the loneliness scale, respectively. Therefore, the decreased interactions and social support from colleagues at workplace can be compensated by the increased sense of belonging and social support from spouses, children, and other household members while working from home. However, this is conditional on having such social support or sense of belonging available at home.

Heterogeneous Treatment Effects by Personality Trait.—According to Hypothesis 3, the effect of work from home on loneliness should be larger for extroverted employees. The richness of the SOEP also allows testing this hypothesis empirically.⁶ Panel D of Table 5 presents the results and the findings are in line with the hypothesis. Work from home is significantly associated with an increase in the loneliness levels of extroverted employees by 0.45 points. While the teleworking coefficient for introverted employees is -0.21 and not significantly different than zero. This implies that if anything, work from home may even reduce the loneliness levels of the introverted individuals by allowing them to control their quantity of interactions with others. Therefore, these findings uncover an important heterogeneity in the link between remote work and loneliness showing that teleworking only hurts the social well-being of extroverted employees.

⁶ The score of extraversion is constructed using three survey items measured on a seven-point Likert scale ranging from 1 “does not apply to me at all” to 7 “applies to me perfectly.” The sum of items is divided by 3. The items are: I see myself as someone who... “is communicative,” “is sociable,” “is reserved.” The last item is recoded in inverse order before adding up. Individuals scoring above 4 are considered as extroverted and individuals scoring 4 or below are considered as introverted.

Heterogeneous Treatment Effects by Employment Sector.—Hypothesis 4 suggests that the effect of work from home on loneliness is larger for private sector employees than for public sector ones. Panel E of Table 6 shows the results by splitting the sample into public and private sector employees. The estimates show a significant effect of work from home on loneliness for private sector employees. Telework increases the loneliness levels of employees in the private sector by 0.56 points. However, consistent with Costi et al. (2024), there exists no significant association between teleworking and loneliness for public sector employees. Therefore, the importance of informal networks, collaboration, and competitiveness in private sector makes workplace social connections more sensitive to remote work, leading to increased feelings of loneliness among teleworkers.

Heterogeneous Treatment Effects by Region.—According to Hypothesis 5, the effect of work from home on loneliness is larger in former East Germany than in West Germany. Panel F of Table 5 demonstrates the results. The estimates show a positive association between work from home and loneliness for both residents of the East and West Germany, with the influence being almost twice larger for the East Germans (0.60). Therefore, because of greater reliance on workplace social connections in East Germany, the effect of remote work on loneliness is larger among East Germany residents.⁷

⁷ The study also explores the moderating roles of age, tenure, and gender, but finds no significant differences. The estimates show that both employees with longer and shorter tenures as well as younger and older employees are affected similarly by the loneliness costs of working from home. Also, both men and women are exposed to a similar degree of loneliness while working from home. See Appendix Table A.4 for the results.

E. Work from Home Intensity

The study thus far showed that work from home increases loneliness significantly and the effect is particularly strong for employees who are extroverted, not married, without children, living in smaller households, working in private sector, or residing in East Germany. The next question is whether the intensity of work from home matters. Employees who fully telework may suffer more from the loneliness consequences of teleworking, as they are constantly away from their colleagues and superiors.

The SOEP allows distinguishing between *partial* work from home and *complete* work from home. Thus, I generate two additional treatment groups. The first treatment captures employees who *fully* started working from home because of the COVID-19 crisis. The second treatment captures those who *partially* started working from home because of the crisis. Table 6 presents the difference-in-differences estimates focusing on the full sample. The results show that both fully and partially working from home increase loneliness. However, only the effect of fully teleworking is statistically significant. This implies that partially working from home is not generally detrimental to employee loneliness.⁸

Heterogeneous Treatment Effects.—As the heterogeneity analysis indicated, the effect of teleworking on loneliness is heterogeneous. Thus, in the next step, I rerun separate regressions for the subgroups that are influenced the most from the loneliness consequences of remote work, i.e., extroverted, non-married, without children, living in smaller households, private sector, and East Germany. Table 7 presents the results. Fully working from home significantly and persistently

⁸ This is in line with Choudhury et al.'s (2024) field experiment from Bangladesh that shows among hybrid workers, those who work on-site about 2 days per week have significantly lower isolation from colleagues and better work-life balance and job satisfaction.

increases the loneliness levels of employees who are not married, living in smaller households, extroverted, working in private sector, or residing in East Germany (the effect size ranges from 0.4 to 1.1). However, while mostly insignificant, partially working from home has a significant positive effect only on the loneliness levels of employees without any children and employees working in the private sector. These findings suggest that working fully from home has a stronger and larger effect on employee loneliness in comparison to partially teleworking. However, in private sector, both partial and full teleworkers suffer from the loneliness consequences of remote work to a similar degree.

F. Robustness Checks

The key identification assumption of this study is that the treatment and control groups would have a parallel trend in their loneliness levels before the change in remote work regulations in 2020. Although Figure 1 supports the parallel trends assumption and shows that the treatment and control groups had a parallel trend in their loneliness levels prior to the 2020 pandemic, I perform an additional robustness check to test the validity of this assumption.

Thus, the first robustness check employs a placebo difference-in-differences estimation by shifting the treatment year backward to 2017. Column (1) of Table 8 presents the results. The placebo test shows no statistically significant effect of work from home on loneliness, and hence, increases the credibility of the identification strategy.

The second robustness check considers the teleworkability of occupations. Not all jobs can be performed remotely (Dingel and Neiman 2020). Thus, column (2) of Table 8 focuses only on white-collar employees, as their jobs have a higher propensity of teleworkability. The estimates suggest a significant positive association between remote work and loneliness for white-collar workers. Further,

column (3) of Table 8 focuses only on the first three categories of the International Standard Classification of Occupations (ISCO), namely, managers, professionals, technicians and associate professionals. These occupations also have a higher propensity of teleworkability in comparison to other ISCO categories, such as plant and machine operators, agricultural, forestry and fishery workers (Golden 2008; Dingel and Neiman 2020). Focusing only on these occupations generates a similar picture again. Working from home significantly increases the loneliness levels of these workers.

The third robustness check assesses the exogeneity of the treatment variable. If workers quit or change a job that sends them to work from home because of the pandemic, then the treatment variable might be endogenous and subject to self-selection. However, I provide reasoning and evidence against this. First, during the COVID-19, labor demand decreased and economic uncertainties spiked (Altig et al. 2020; Forsythe et al. 2020), leading to a decreased incentive to quit a job. Second, contrary to fluid labor markets such as in the US and the UK, the labor market in Germany is less flexible (Hall and Soskice 2001; Schneider 2021). Thus, workers tend to stay longer with their employers in Germany (Eurofound, 2015). Against this background, I rerun the initial estimates focusing only on employees with longer tenures (tenure > 2; tenure > 3; tenure > 4; tenure > 5). Table 9 presents the results. Working from home continues to emerge as an important determinant of worker loneliness.

The fourth issue is whether work from home only increases overall loneliness, or it also affects each dimension of loneliness. The dataset differentiates three dimensions: feeling isolated, feeling left out, and lacking companionship. Table 10 presents the estimates for each dimension as the outcome variable. The findings suggest that remote work is significantly associated with all three dimensions of

loneliness.⁹ Employees who work from home are more likely to feel isolated, feel left out, and lack companionship.

Finally, the next question is whether work from home increases the probability of feeling *very lonely* or not. The mean loneliness score in this study is 3.35. Thus, I generate five additional dummy outcome variables to investigate the likelihood of feeling very lonely. Table 11 presents the estimates for each dummy outcome variables (loneliness ≥ 4 ; loneliness ≥ 5 ; loneliness ≥ 6 ; loneliness ≥ 7). The estimates show that remote work consistently increases the probability of feeling very lonely. Teleworking increases the likelihood of scoring 4 or more on the loneliness scale by 11.7 percentage points, while it also increases the likelihood of scoring 7 or more by 2.8 percentage points.

IV. Discussion and Conclusions

This study investigated the causal effect of work from home on worker loneliness. First, it showed that a simple comparison of remote workers versus on-site workers suffers from omitted variable bias due to observable and unobservable characteristics. Controlling for socio-demographic and job related characteristics reduces this bias significantly and reveals a positive association between work from home and loneliness. Controlling for unobserved time-invariant heterogeneity reduces this bias further and provides a larger effect of remote work on loneliness.

Second, the finding that work from home increases loneliness is also backed-up by the difference-in-differences estimates exploiting the exogenous shock in work from home regulations in Germany. Regardless of controlling for observable and

⁹ The existing patterns of heterogeneity were also repeated for the three dimensions of loneliness. Work from home significantly affects each of the three dimensions of loneliness for employees who are not married, without children, living in smaller households, extroverted, working in private sector, or residing in West Germany. While teleworking also significantly affects two out of the three dimensions of loneliness in East Germany (i.e., feeling isolated and lacking companionship), in line with the heterogeneity analysis, the effect sizes are much larger among East Germans. The results are available upon request.

unobservable characteristics, these estimates show a persistent and strong causal effect of work from home on loneliness. The findings are also robust to a series of robustness checks. Third, exploring the channels through which remote work may increase loneliness revealed that work from home is significantly associated with increased likelihood of working in the evenings. It also reduces satisfaction with home-related domains of life, which are important determinants of feeling lonely.

Fourth, the effect of work from home on loneliness is highly heterogeneous. Work from home does not have a detrimental effect on the loneliness level of all employees. However, employees who are extroverted, not married, without children, living in smaller households, working in private sector, or residing in East Germany are particularly suffering from the loneliness consequences of remote work. Identifying these subgroups is extremely crucial for employers and policymakers. Organizations and policymakers should consider the negative consequences of work from home and provide support for employees at risk. As the loneliness consequences of teleworking are mainly driven by fully remote work, firms and policymakers should also focus on the intensity of teleworking.

Furthermore, the negative consequences of loneliness can go beyond individual health, well-being, and success. From an economic perspective, the individual worker's decision to telework can also cause negative externalities through loss of shared social capital. Work from home not only increases individual workers' loneliness level, but it can also negatively affect colleagues through reduced knowledge-spillover (Jaffe et al. 1993), emotional support (Acoba 2024), collaboration (Yang et al. 2022), and informal networks (Granovetter 1973). At the same time, it can also cause macro-level externalities through weakened community engagement, civic trust, and social participation (Putnam 2000).

The findings of this study that teleworking causes employee loneliness have several implications. Firstly, employers and policymakers could organize intervention programs to reduce the loneliness levels of employees at risk. This

would not only improve individual workers' well-being and health, but also diminish any negative externalities loneliness may cause to colleagues, families, firms, society, and the economy. Secondly, as fully teleworking is more detrimental to employee loneliness than partially teleworking, public intervention to monitor the intensity of teleworking may be warranted.

Finally, I propose avenues for future research. First, while this study could distinguish broadly between fully and partially working from home, future studies may dig deeper into the intensity of working from home. Teleworking one or two days per week, for instance, may even enhance employees' social connections outside the workplace without deteriorating workplace relations and could be the best of both worlds. Second, as the degree of loneliness varies by country, future research may focus on other countries with different degrees of loneliness. Third, as remote work is here to stay and has transitioned to a stable work arrangement, future studies may also investigate the link between remote work and loneliness in the post COVID-19 era.

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TABLES

TABLE 1—DESCRIPTIVE STATISTICS AND DEFINITIONS OF THE KEY VARIABLES

<i>Variable</i>	<i>Definition</i>	<i>Mean</i>	<i>Std. dev.</i>
Loneliness	Short-scale loneliness score based on the sum of the following three items: (1) “How often do you miss the company of other people?” (2) “How often do you feel socially isolated?” (3) “How often do you feel left out?” For each item, interviewees respond on a 5-point scale with categories never, seldom, sometimes, often, and very often. The score ranges from 0 “never” to 12 “very often”.	3.35	2.30
Work from home	Dummy equal to 1 if the employee works from home. The variable is based on the following question: “Does it happen that you do your job at home?”	0.34	---
Treatment	Dummy equal to 1 if the employee partially or fully started working from home because of the COVID-19 crisis.	0.29	---

Source: Author calculations.

TABLE 2—INITIAL ESTIMATES: WORK FROM HOME AND LONELINESS

	(1) <i>OLS</i>	(2) <i>RE</i>	(3) <i>FE</i>	(4) <i>OLS</i>	(5) <i>RE</i>	(6) <i>FE</i>
Work from home	-0.198 (0.036)***	-0.160 (0.036)***	0.364 (0.108)***	0.133 (0.048)***	0.154 (0.048)***	0.223 (0.131)*
Control variables	No	No	No	Yes	Yes	Yes
R ²	0.002	0.002	0.006	0.043	0.043	0.044
Number of observations	17258	17258	17258	12390	12390	12390
Number of employees	15502	15502	15502	11125	11125	11125

Notes: Dependent variable: Loneliness index. The table shows the estimated coefficients. Standard errors in parentheses are clustered at the individual level. Control variables include age, age-squared, gender, marital status, migration background, education, size of household, children in household, gross income, region dummy, residential area, m2 per head, one-digit industry dummies, and one-digit occupation dummies. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Source: Author calculations.

TABLE 3—DIFFERENCE-IN-DIFFERENCES: WORK FROM HOME AND LONELINESS

	(1) <i>OLS</i>	(2) <i>RE</i>	(3) <i>FE</i>	(4) <i>OLS</i>	(5) <i>RE</i>	(6) <i>FE</i>
Treatment	-0.508 (0.066)***	-0.486 (0.065)***	---	-0.175 (0.084)**	-0.182 (0.082)**	---
Post	0.555 (0.052)***	0.524 (0.050)***	0.481 (0.053)***	0.602 (0.071)***	0.579 (0.069)***	0.721 (0.102)***
Treatment x Post	0.232 (0.091)**	0.249 (0.089)***	0.281 (0.091)***	0.470 (0.113)***	0.440 (0.109)***	0.401 (0.117)***
Control variables	No	No	No	Yes	Yes	Yes
R ²	0.022	0.022	0.035	0.054	0.054	0.049
Number of observations	10241	10241	10241	6667	6667	6667
Number of employees	4517	4517	4517	3357	3357	3357

Notes: Dependent variable: Loneliness index. The table shows the estimated coefficients. Standard errors in parentheses are clustered at the individual level. Control variables include age, age-squared, gender, marital status, migration background, education, size of household, children in household, gross income, region dummy, residential area, m2 per head, one-digit industry dummies, and one-digit occupation dummies. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Source: Author calculations.

TABLE 4—WORK FROM HOME AND LONELINESS: CHANNELS

	(1) <i>Evening work</i>	(2) <i>Family life satisfaction</i>	(3) <i>Leisure time satisfaction</i>	(4) <i>Dwelling satisfaction</i>
Post	-0.004 (0.014)	-0.038 (0.034)	-0.086 (0.039)**	0.133 (0.033)***
Treatment x Post	0.052 (0.022)**	-0.109 (0.051)**	-0.124 (0.057)**	-0.087 (0.046)*
Control variables	Yes	Yes	Yes	Yes
R ²	0.016	0.011	0.015	0.022
Number of observations	15065	29713	32478	34879
Number of employees	3875	3900	4004	4024

Notes: The table shows the estimated coefficients. Standard errors in parentheses are clustered at the individual level. Control variables include age, age-squared, marital status, education, size of household, children in household, gross income, region dummy, residential area, m2 per head, one-digit industry dummies, and one-digit occupation dummies. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Source: Author calculations.

TABLE 5—WORK FROM HOME AND LONELINESS: HETEROGENEITY

	<i>A: Marital status</i>		<i>B: Children in HH</i>	
	(1)	(2)	(3)	(4)
	<i>Non-married</i>	<i>Married</i>	<i>Without children</i>	<i>With children</i>
Post	0.615 (0.169)***	0.940 (0.132)***	0.751 (0.142)***	0.879 (0.169)***
Treatment x Post	0.538 (0.204)***	0.168 (0.149)	0.492 (0.183)***	-0.124 (0.171)
Control variables	Yes	Yes	Yes	Yes
R ²	0.040	0.098	0.077	0.057
Number of observations	2828	3839	3590	3077
Number of employees	1569	2064	2133	1716
	<i>C: Size of HH</i>		<i>D: Personality</i>	
	(5)	(6)	(7)	(8)
	<i>Small HH</i>	<i>Large HH</i>	<i>Extroverted</i>	<i>Introverted</i>
Post	0.716 (0.154)***	0.945 (0.148)***	0.899 (0.122)***	0.502 (0.307)
Treatment x Post	0.519 (0.198)***	0.045 (0.165)	0.449 (0.140)***	-0.207 (0.328)
Control variables	Yes	Yes	Yes	Yes
R ²	0.063	0.084	0.070	0.062
Number of observations	3170	3497	5301	1366
Number of employees	1859	1923	2972	976
	<i>E: Sector</i>		<i>F: Region</i>	
	(9)	(10)	(11)	(12)
	<i>Private</i>	<i>Public</i>	<i>West</i>	<i>East</i>
Post	0.684 (0.128)***	0.991 (0.230)***	0.715 (0.118)***	0.763 (0.200)***
Treatment x Post	0.557 (0.162)***	-0.056 (0.217)	0.335 (0.134)**	0.604 (0.242)**
Control variables	Yes	Yes	Yes	Yes
R ²	0.058	0.095	0.057	0.080
Number of observations	4338	1951	5209	1458
Number of employees	2380	1115	2633	742

Notes: Dependent variable: Loneliness index. The table shows the estimated coefficients. Standard errors in parentheses are clustered at the individual level. Control variables include age, age-squared, marital status, education, size of household, children in household, gross income, region dummy, residential area, m2 per head, one-digit industry dummies, and one-digit occupation dummies. * p < 0.10, ** p < 0.05, *** p < 0.01.

Source: Author calculations.

TABLE 6—WORK FROM HOME INTENSITY AND LONELINESS

	(1)	(2)
Post	0.777 (0.096)***	0.793 (0.097)***
Treatment (Full WFH) x Post	0.394 (0.148)***	---
Treatment (Partial WFH) x Post	---	0.221 (0.163)
R ²	0.049	0.047
Number of observations	6802	6419
Number of employees	3447	3260

Notes: Dependent variable: Loneliness index. The table shows the estimated coefficients. Standard errors in parentheses are clustered at the individual level. Control variables include age, age-squared, marital status, education, size of household, children in household, gross income, region dummy, residential area, m2 per head, one-digit industry dummies, and one-digit occupation dummies. * p < 0.10, ** p < 0.05, *** p < 0.01.

Source: Author calculations.

TABLE 7—WORK FROM HOME INTENSITY AND LONELINESS: HETEROGENEITY

	<i>A: Non-married</i>		<i>B: Without children</i>		<i>C: Small HH</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
Post	0.597 (0.160)***	0.621 (0.160)***	0.783 (0.137)***	0.782 (0.135)***	0.706 (0.147)***	0.759 (0.144)***
Treatment (Full WFH) x Post	0.532 (0.265)**	---	0.336 (0.224)	---	0.483 (0.227)**	---
Treatment (Partial WFH) x Post	---	0.104 (0.293)	---	0.467 (0.282)*	---	0.178 (0.294)
R ²	0.034	0.032	0.077	0.073	0.056	0.063
Number of observations	2915	2779	3665	3534	3236	3133
Number of employees	1620	1540	2190	2117	1902	1840
	<i>D: Extroverted</i>		<i>E: Private</i>		<i>F: East</i>	
	(7)	(8)	(9)	(10)	(11)	(12)
Post	0.933 (0.114)***	0.967 (0.116)***	0.765 (0.123)***	0.777 (0.121)***	0.742 (0.190)***	0.871 (0.196)***
Treatment (Full WFH) x Post	0.455 (0.188)**	---	0.405 (0.198)**	---	1.119 (0.344)***	---
Treatment (Partial WFH) x Post	---	0.113 (0.189)	---	0.513 (0.290)*	---	0.079 (0.331)
R ²	0.066	0.065	0.051	0.051	0.075	0.066
Number of observations	5423	5121	4399	4232	1527	1432
Number of employees	3058	2888	2436	2336	780	735

Notes: Dependent variable: Loneliness index. The table shows the estimated coefficients. Standard errors in parentheses are clustered at the individual level. Control variables include age, age-squared, marital status, education, size of household, children in household, gross income, region dummy, residential area, m2 per head, one-digit industry dummies, and one-digit occupation dummies. * p < 0.10, ** p < 0.05, *** p < 0.01.

Source: Author calculations.

TABLE 8—WORK FROM HOME AND LONELINESS: ROBUSTNESS CHECKS

	(1) <i>Placebo test</i>	(2) <i>Only white-collars</i>	(3) <i>Only managers, professionals, technicians and associate professionals</i>
Placebo post	-0.900 (0.103)***	---	---
Treatment x Placebo post	0.146 (0.104)	---	---
Post	---	0.937 (0.129)***	0.786 (0.156)***
Treatment x Post	---	0.328 (0.141)**	0.335 (0.151)**
Control variables	Yes	Yes	Yes
R ²	0.046	0.071	0.075
Number of observations	6667	4578	3893
Number of employees	3357	2479	2115

Notes: Dependent variable: Loneliness index. The table shows the estimated coefficients. Standard errors in parentheses are clustered at the individual level. Control variables include age, age-squared, marital status, education, size of household, children in household, gross income, region dummy, residential area, m2 per head, one-digit industry dummies, and one-digit occupation dummies. * p < 0.10, ** p < 0.05, *** p < 0.01.

Source: Author calculations.

TABLE 9—WORK FROM HOME AND LONELINESS: LONGER TENURE

	(1) <i>Tenure > 2</i>	(2) <i>Tenure > 3</i>	(3) <i>Tenure > 4</i>	(4) <i>Tenure > 5</i>
Post	0.714 (0.111)***	0.669 (0.117)***	0.734 (0.122)***	0.759 (0.125)***
Treatment x Post	0.453 (0.133)***	0.522 (0.139)***	0.449 (0.145)***	0.421 (0.149)***
Control variables	Yes	Yes	Yes	Yes
R ²	0.059	0.068	0.078	0.083
Number of observations	5345	4889	4492	4143
Number of employees	2925	2743	2567	2374

Notes: The table shows the estimated coefficients. Standard errors in parentheses are clustered at the individual level. Control variables include age, age-squared, marital status, education, size of household, children in household, gross income, region dummy, residential area, m2 per head, one-digit industry dummies, and one-digit occupation dummies. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Source: Author calculations.

TABLE 10—WORK FROM HOME AND DIMENSIONS OF LONELINESS

	(1) <i>Feel isolated</i>	(2) <i>Feel left out</i>	(3) <i>Lack companionship</i>
Post	0.109 (0.042)***	0.021 (0.044)	0.590 (0.048)***
Treatment x Post	0.152 (0.048)***	0.108 (0.048)**	0.143 (0.057)**
Control variables	Yes	Yes	Yes
R ²	0.023	0.006	0.115
Number of observations	6678	6670	6681
Number of employees	3361	3357	3361

Notes: The table shows the estimated coefficients. Standard errors in parentheses are clustered at the individual level. Control variables include age, age-squared, marital status, education, size of household, children in household, gross income, region dummy, residential area, m2 per head, one-digit industry dummies, and one-digit occupation dummies. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Source: Author calculations.

TABLE 11—WORK FROM HOME AND FEELING VERY LONELY

	(1) <i>Loneliness</i> ≥ 4	(2) <i>Loneliness</i> ≥ 5	(3) <i>Loneliness</i> ≥ 6	(4) <i>Loneliness</i> ≥ 7
Post	0.090 (0.025)***	0.089 (0.021)***	0.057 (0.017)***	0.042 (0.014)***
Treatment x Post	0.117 (0.029)***	0.054 (0.024)**	0.054 (0.019)***	0.028 (0.016)*
Control variables	Yes	Yes	Yes	Yes
R ²	0.030	0.022	0.017	0.019
Number of observations	6667	6667	6667	6667
Number of employees	3357	3357	3357	3357

Notes: The table shows the estimated coefficients. Standard errors in parentheses are clustered at the individual level. Control variables include age, age-squared, marital status, education, size of household, children in household, gross income, region dummy, residential area, m2 per head, one-digit industry dummies, and one-digit occupation dummies. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Source: Author calculations.

FIGURES

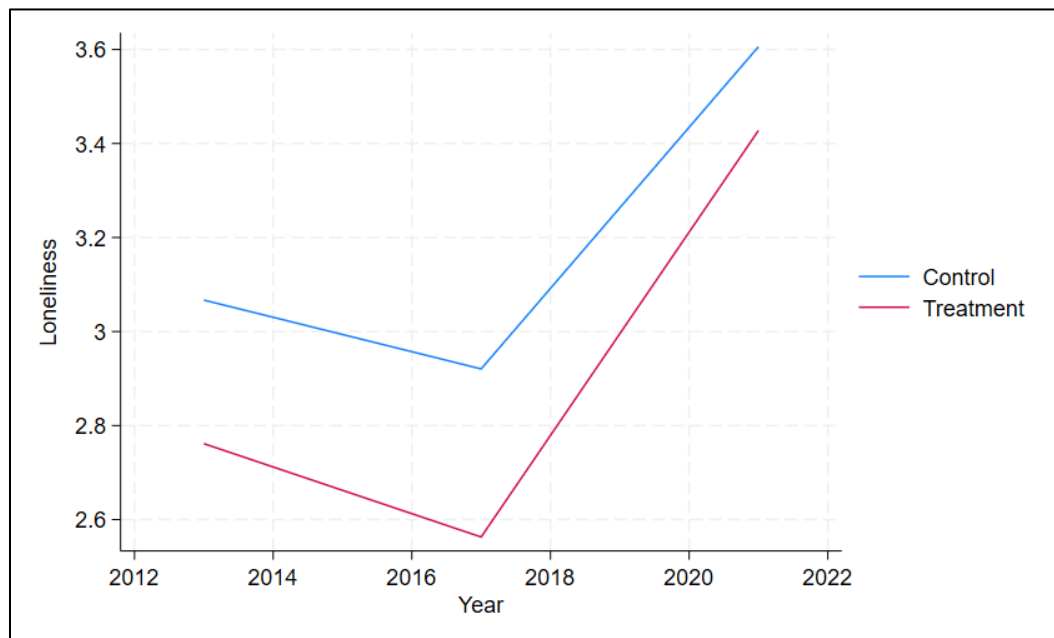


FIGURE 1. PARALLEL TRENDS ASSUMPTION:
EVOLUTION OF LONELINESS IN THE TREATMENT AND CONTROL GROUPS

Notes: N = 10241. Year = 2013, 2017, 2021.

APPENDIX TABLES

TABLE A.1—DESCRIPTIVE STATISTICS AND DEFINITIONS OF CONTROL VARIABLES

<i>Variable</i>	<i>Definition</i>	<i>Mean</i>	<i>Std. dev.</i>
Age	The worker's age by years ranging from 18 to 67.	43.63	10.96
Female	Dummy equals 1 if the worker is a woman.	0.52	0.50
Married	Dummy equals 1 if the worker is married.	0.62	0.49
Migration background	Dummy equals 1 if the worker is a first- or second-generation immigrant.	0.23	0.42
Education	The worker's years of education ranging from 7 to 18.	12.99	2.84
Size of household	The number of persons in the household.	3.27	1.46
Children in household	The number of children in the household under age of 18.	1.19	1.20
Gross income	The gross wage received last month.	3212.70	3768.56
East Germany	Dummy equals 1 if the worker resides in one of the federal states located in East Germany.	0.22	0.41
Residential area	Dummy equals 1 if the worker resides in a residential area.	0.78	0.42
M ² per head	The living space in m ² divided to number of persons in the household.	41.45	24.70
Tenure	The number of years the worker is with their current firm.	9.97	9.95
One-digit industry dummies	Seven broad one-digit industry dummies for manufacturing, construction, trade, transport, bank/insurance, services, and other industries.	---	---
One-digit occupation dummies	Eight broad one-digit occupation dummies for managers, professionals, technicians and associate professionals, clerical support workers, service and sales workers, skilled agricultural, forestry and fishery workers, craft and related trade workers, and plant and machine operators.	---	---

Source: Author calculations.

TABLE A.2— INITIAL ESTIMATES: WORK FROM HOME AND LONELINESS (FULL RESULTS)

	(1) <i>OLS</i>	(2) <i>RE</i>	(3) <i>FE</i>	(4) <i>OLS</i>	(5) <i>RE</i>	(6) <i>FE</i>
Work from home	-0.198 (0.036)***	-0.160 (0.036)***	0.364 (0.108)***	0.133 (0.048)***	0.154 (0.048)***	0.223 (0.131)*
Age	---	---	---	-0.013 (0.014)	-0.014 (0.014)	-0.026 (0.069)
Age ²	---	---	---	0.000 (0.000)	0.000 (0.000)	0.001 (0.001)
Female	---	---	---	0.149 (0.045)***	0.149 (0.045)***	---
Married	---	---	---	-0.080 (0.051)	-0.097 (0.051)*	-0.660 (0.239)***
Migration background	---	---	---	0.322 (0.054)***	0.342 (0.054)***	---
Size of household	---	---	---	-0.110 (0.028)***	-0.102 (0.028)***	0.018 (0.109)
Number of children	---	---	---	-0.050 (0.033)	-0.060 (0.032)*	-0.017 (0.085)
East Germany	---	---	---	-0.059 (0.049)	-0.063 (0.049)	-0.524 (0.596)
Residential area	---	---	---	-0.075 (0.048)	-0.081 (0.048)*	-0.103 (0.161)
M ² per head	---	---	---	-0.003 (0.001)***	-0.003 (0.001)***	-0.001 (0.004)
Education	---	---	---	-0.044 (0.010)***	-0.046 (0.010)***	-0.092 (0.137)
Gross income	---	---	---	-0.000 (0.000)***	-0.000 (0.000)***	0.000 (0.000)
Tenure	---	---	---	-0.013 (0.002)***	-0.013 (0.002)***	0.008 (0.011)
Industry dummies	No	No	No	Yes	Yes	Yes
Occupation dummies	No	No	No	Yes	Yes	Yes
R ²	0.002	0.002	0.006	0.043	0.043	0.044
Number of observations	17258	17258	17258	12390	12390	12390
Number of employees	15502	15502	15502	11125	11125	11125

Notes: Dependent variable: Loneliness index. The table shows the estimated coefficients. Standard errors in parentheses are clustered at the individual level. * p < 0.10, ** p < 0.05, *** p < 0.01.

Source: Author calculations.

TABLE A.3— DIFFERENCE-IN-DIFFERENCES: WORK FROM HOME AND LONELINESS (FULL RESULTS)

	(1) <i>OLS</i>	(2) <i>RE</i>	(3) <i>FE</i>	(4) <i>OLS</i>	(5) <i>RE</i>	(6) <i>FE</i>
Treatment	-0.508 (0.066)***	-0.486 (0.065)***	---	-0.175 (0.084)**	-0.182 (0.082)**	---
Post	0.555 (0.052)***	0.524 (0.050)***	0.481 (0.053)***	0.602 (0.071)***	0.579 (0.069)***	0.721 (0.102)***
Treatment x Post	0.232 (0.091)**	0.249 (0.089)***	0.281 (0.091)***	0.470 (0.113)***	0.440 (0.109)***	0.401 (0.117)***
Age	---	---	---	0.032 (0.022)	0.024 (0.022)	-0.084 (0.048)*
Age ²	---	---	---	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)
Female	---	---	---	0.180 (0.070)**	0.191 (0.069)***	---
Married	---	---	---	-0.314 (0.074)***	-0.274 (0.071)***	-0.071 (0.149)
Migration background	---	---	---	0.019 (0.084)	0.017 (0.085)	---
Size of household	---	---	---	-0.129 (0.042)***	-0.121 (0.040)***	-0.086 (0.071)
Number of children	---	---	---	0.148 (0.047)***	0.105 (0.044)**	-0.020 (0.065)
East Germany	---	---	---	0.001 (0.077)	0.035 (0.076)	0.169 (0.526)
Residential area	---	---	---	-0.085 (0.068)	-0.081 (0.064)	-0.074 (0.096)
M ² per head	---	---	---	-0.003 (0.002)**	-0.004 (0.001)***	-0.004 (0.003)*
Education	---	---	---	-0.014 (0.016)	-0.022 (0.015)	-0.059 (0.119)
Gross income	---	---	---	-0.000 (0.000)***	-0.000 (0.000)***	0.000 (0.000)
Tenure	---	---	---	-0.010 (0.003)***	-0.010 (0.003)***	0.002 (0.009)
Industry dummies	No	No	No	Yes	Yes	Yes
Occupation dummies	No	No	No	Yes	Yes	Yes
R ²	0.022	0.022	0.035	0.054	0.054	0.049
Number of observations	10241	10241	10241	6667	6667	6667
Number of employees	4517	4517	4517	3357	3357	3357

Notes: Dependent variable: Loneliness index. The table shows the estimated coefficients. Standard errors in parentheses are clustered at the individual level. * p < 0.10, ** p < 0.05, *** p < 0.01.

Source: Author calculations.

TABLE A.4—WORK FROM HOME AND LONELINESS: HETEROGENEITY BY AGE, GENDER, AND TENURE

	<i>A: Age</i>		<i>B: Gender</i>		<i>C: Tenure</i>	
	(1) <i>Younger</i> (≤ 45)	(2) <i>Older</i> (> 45)	(3) <i>Male</i>	(4) <i>Female</i>	(5) <i>Shorter</i> (< 10)	(6) <i>Longer</i> (≥ 10)
Post	0.927 (0.193)***	0.699 (0.132)***	0.676 (0.157)***	0.782 (0.134)***	0.708 (0.161)***	0.786 (0.151)***
Treatment x Post	0.436 (0.214)**	0.353 (0.158)**	0.441 (0.172)**	0.420 (0.164)**	0.434 (0.186)**	0.452 (0.176)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.061	0.058	0.058	0.056	0.047	0.085
Number of observations	2821	3846	2616	4051	3693	2974
Number of employees	1697	2157	1287	2070	2154	1686

Notes: Dependent variable: Loneliness index. The table shows the estimated coefficients. Standard errors in parentheses are clustered at the individual level. Control variables include age, age-squared, marital status, education, size of household, children in household, gross income, region dummy, residential area, m2 per head, one-digit industry dummies, and one-digit occupation dummies. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Source: Author calculations.