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DISCUSSION PAPER SERIES

IZA DP No. 17932

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ABSTRACT

Well-Being, Isolation, and Lockdowns in the UK*

Social connection is a key determinant of emotional well-being, yet the role of solitude in shaping both momentary affect and overall life satisfaction remains understudied. This paper investigates how being alone while engaging in daily activities relates to subjective well-being, using rich time-use diary data from the UK covering four distinct periods: pre-pandemic (2015–2016), the Covid-19 lockdowns (2020–2021), the relaxation phase (2021), and the post-pandemic period (2023). We find that being alone is negatively associated with momentary enjoyment, particularly in the post- pandemic period, but not during lockdowns or the initial relaxation phase, suggesting that the emotional cost of solitude depends on its perceived voluntariness and social norms. The enjoyment penalty is strongest for leisure and unpaid work episodes, and most pronounced among remote workers. We also document a negative association between full-day solitude and overall life satisfaction, but only during the relaxation phase, suggesting that solitude can impose both short-term and longer-term costs of well-being, depending on the social context and type of activity. Our results contribute to the literature on experienced utility, labor supply, and remote work, highlighting the need to account for the emotional toll of isolation in welfare analysis and policy design.

JEL Classification: J16, J22

Keywords: well-being, instant enjoyment, life satisfaction, COVID-19, lockdown, time use data

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1 Introduction

Economists, behavioral scientists, employers, and policymakers have long been interested in the relationship between happiness and productivity, given that productivity lies at the heart of economic growth. Empirical evidence suggests that happier individuals tend to be more productive (Oswald et al., 2015). A substantial body of research has identified several determinants of individual well-being, including age, gender, unemployment (Clark and Oswald, 1994; Di Tella et al., 2001), and marital status (Coombs, 1991; Stack and Eshleman, 1998; Diener et al., 2000). In contrast, the role of social isolation and the quality of social interaction has received comparatively less attention. The Covid-19 pandemic, however, brought this dimension into sharp focus by radically altering patterns of social engagement, particularly through extended periods of involuntary isolation due to lockdowns. This paper examines how being alone while engaging in daily activities is associated with individual well-being, measured both in terms of moment-to-moment affective experience (Kahneman and Krueger, 2006) and overall life satisfaction (Hamermesh, 2020; Ye and Shu, 2022). By leveraging the pandemic as an exogenous shock to social interaction, this study aims to shed light on the emotional cost of solitude, an increasingly relevant issue in an era of remote work and rising social disconnection. Understanding these effects is critical for accurately assessing the welfare implications of time use and for informing labor and social policy in the post-pandemic world.

The study of happiness and well-being has gained prominence within economics over the past two decades, bridging insights from psychology, behavioral science, and public policy(Kahneman et al., 1999; Frey and Stutzer, 2002; Layard, 2005; Clark et al., 2008). At its core, happiness research seeks to understand the determinants of individual well-being and the implications for economic behavior and welfare measurement. Traditionally, Economics relied on revealed preferences and choices to infer utility (Samuelson, 1938), but newer approaches incorporate stated preferences and self-reported well-being to capture subjective experiences more directly. Kahneman and colleagues have been instrumental in distinguishing between evaluative and experienced well-being, the former referring to overall life satisfaction, and the latter to moment-to-moment emotional states. The concept of instant utility, introduced by Kahneman and Krueger (2006), refers to the hedonic quality of experience during specific activities, as measured through methods like the "day reconstruction method". This framework allows researchers to assess how time use and contextual factors (such as social interactions) influence affective states throughout the day. Alongside these constructs, happiness research has identified consistent correlates of well-being, including income, employment status, health, social relationships, and personality traits (Diener et al.,

1999; Dolan et al., 2008). Integrating these dimensions provides a deeper understanding of welfare beyond traditional economic indicators.

A growing body of research highlights the critical role of social connections in shaping individual well-being. While happiness and life satisfaction have traditionally been associated with material and economic factors, there is increasing recognition of the psychological and emotional importance of social interaction. Numerous studies have found that both perceived and actual social disconnection are negatively associated with various dimensions of happiness and mental health (Cacioppo and Cacioppo, 2014; Holt-Lunstad et al., 2015; Layard, 2020). From a theoretical standpoint, social relationships fulfill basic human psychological needs, such as belonging, esteem, and emotional support, which are essential for sustained well-being (Baumeister and Leary, 1995; Deci and Ryan, 2000). Furthermore, Kahneman and Krueger's (2006) concept of instant utility reinforces the notion that the affective quality of daily experience is shaped not only by the activity itself but also by the social context in which it occurs. Empirical work using time-use data has shown that activities performed in the company of others are often associated with higher levels of enjoyment than those performed alone (Kahneman et al., 2004; Krueger et al., 2009; Bryson and MacKerron, 2017).

If being alone systematically reduces enjoyment or life satisfaction, loneliness and isolation constitute non-monetary costs that ought to be incorporated into models of time allocation, labor supply, and overall well-being (e.g., Cosaert et al., 2023). These emotional costs challenge the assumption that individuals always optimize utility purely through market-based choices, highlighting the importance of contextual and social factors in shaping well-being. This issue becomes increasingly salient in the context of structural changes in the labor market, particularly the widespread adoption of flexible work arrangements and remote work in the wake of the Covid-19 pandemic (e.g., Brynjolfsson et al., 2020; Barrero et al., 2021; Amuedo-Dorantes et al., 2025). While such arrangements may offer benefits in terms of autonomy, reduced commuting, and even productivity (Bloom et al., 2015), they can also lead to greater social isolation and a reduction in informal workplace interactions, elements that are rarely accounted for in traditional economic models. The net welfare effect of these changes depends not only on their financial implications but also on their emotional and psychological consequences. By analyzing the affective costs of solitude during daily activities, this paper contributes to a more comprehensive understanding of experienced utility (Kahneman et al., 2004) and offers empirical evidence to inform labor and social policies aimed at balancing flexibility with the need for social connection. This broader approach helps bridge the gap between subjective well-being metrics and standard economic indicators, offering a more holistic view of welfare in modern labor markets.

We draw on rich time-use diary data from the United Kingdom spanning four distinct periods: the pre-pandemic years (2015–2016), the Covid-19 lockdowns (2020–2021), the relaxation phase in 2021, and the post-pandemic context in 2023. These data offer detailed episode-level information on daily activities, social context during each activity, and self-reported measures of instantaneous enjoyment, alongside comprehensive socio-demographic and household-level variables, including life satisfaction, marital status, presence of children, and sleep patterns. Our empirical strategy estimates the association between being alone and momentary well-being by regressing instantaneous enjoyment on solitude and its interaction with each time period, employing a series of increasingly saturated models that incorporate individual fixed effects and episode-level controls. To complement this analysis, we estimate regressions at the individual level, linking social isolation to life satisfaction, in order to assess whether the relationship between solitude and well-being extends beyond momentary affect. This approach enables us to identify the population subgroups that are most vulnerable to the emotional costs of being alone.

Our results show that being alone is negatively associated with instantaneous enjoyment, but this pattern is not consistent across all time periods. Before the pandemic, episodes done alone were associated with a modest decrease in enjoyment (-0.13 points on a 1-7 scale), but this association became substantially stronger in the post-pandemic period, reaching -0.29 points. However, no such penalty is observed during the lockdowns or the subsequent relaxation period, suggesting that isolation was emotionally neutral when it was widely mandated or anticipated. This enjoyment penalty related to isolation is particularly pronounced for leisure and unpaid work episodes, where social interaction is likely more meaningful (the estimated effects exceed -0.25 points on a 1-7 scale), but not for paid work episodes, highlighting that certain activities moderate or drive the correlation between being alone and enjoyment.[1] Importantly, this magnitude compares with other key determinants of enjoyment at the diary level, such as the location of the activity, the start time, and the duration of the episode, whose estimated effects do not account for variations in enjoyment of similar magnitude in absolute value. These findings indicate that social context during daily activities is a central determinant of experienced utility, and its influence exceeds that of standard demographic characteristics.

The results are robust to worker heterogeneity, as our main estimates include a range

[1]Several authors have analyzed how Covid-19 and the subsequent confinements and lockdowns impacted worker time allocation (e.g., Del Boca et al., 2020; Sevilla and Smith, 2020; Boll et al., 2021; Farré et al., 2020; Pabilonia and Vernon, 2023; Restrepo and Zeballos, 2022). Besides, other authors have analyzed well-being, reporting both increases (e.g., Recchi et al., 2020; Foa et al., 2020; Long, 2021; Restrepo and Zeballos, 2023) and decreases (e.g., Möhring et al., 2021; Ruiz et al., 2021; Brindal et al., 2022; Foliano et al., 2022). Gimenez-Nadal et al. (2025) review the literature. However, to the best of our knowledge, this is the first analysis that specifically focuses on social isolation.

of observable factors at the individual level, as well as individual fixed effects, day effects, and detailed episode-level controls, such as location, duration, and type of activity. We also explore heterogeneity across gender, parenthood, income level, and remote working status. The main pattern –stronger post-pandemic penalties for being alone– holds across these groups, though it is most pronounced among remote workers. However, additional analyses at the individual level show that those who spent their entire day alone reported lower life satisfaction during the relaxation period only. These results support the view that isolation impacts both short-term enjoyment and broader dimensions of well-being, and that both need to be carefully considered as the impacts may differ.

This paper contributes to the literature on workers' well-being, with a focus on how being alone during daily activities relates to experienced utility and instantaneous enjoyment, and broader well-being outcomes. To the best of our knowledge, this is the first study to compare the relationship between isolation and both instant enjoyment and life satisfaction across pandemic phases. We exploit the Covid-19 outbreak, and subsequent lockdowns, as an exogenous shock to social interaction, affecting the entire population simultaneously and potentially altering preferences toward solitude and remote work. We show that isolation reduces enjoyment, particularly in the post-pandemic period and for non-work activities. We also show heterogeneity in the emotional cost of solitude by gender, income, parenthood, and WFH, and also in terms of the measures of worker well-being.

Second, we contribute to the growing literature on remote work by documenting that work from home relates to stronger emotional penalties from being alone in market work activities, especially after the pandemic. This indicates that remote work at home, a potential source of isolation during and after lockdowns, relates to decreased emotional well-being and reduced instantaneous enjoyment while working. Such isolation also leads to decreased instantaneous enjoyment during non-work activities, our results suggest that the benefits of working from home in terms of increased productivity (e.g., Bloom et al., 2015) may be moderated by unintended side-effects on social connection and well-being during both market and non-market work activities.

The rest of the paper is structured as follows. Section 2 describes the data and variables. Sections 3 and 4 show the empirical strategy and the results, respectively. Section 5 discusses the results, and Section 6 concludes.

2 Data and variables

We use time use data from the UK, taken from three different sources, namely the UK Time Use Survey (UKTUS) of the year 2015; the Click and Drag Diary Instrument (CaDDI) of

the years 2016, 2020, and 2021; and the Extended Light Digital Diary Instrument (ELiDDI) of the year 2023. The UKTUS is the official time use survey of the UK and is sponsored by the Centre for Time Use Research (CTUR).[2] The CaDDI comprises time use diaries collected in the UK during three distinct periods: prior to the pandemic in 2016, during the pandemic (May-June 2020, November 2020, January 2021), and post-pandemic when confinement measures eased (summer 2021), and is also sponsored by the CTUR (Sullivan et al., 2021).[3] The ELiDDI is an extension of the CaDDI data, designed to be compatible with other time use surveys and expanding the different activities covered by its predecessor survey, and is UK-nationally representative.[4]

In addition to providing information on the socio-demographic characteristics of respondents, these surveys include time use diaries, with information on respondents' activities during the 24h of the day, from 4 am to 4 am of the following day, along with information about where and with whom activities are done, and how much these activities had been enjoyed. Furthermore, these surveys include two time use diaries per interviewee, typically one during the week and another at the weekend. Time use diaries have become a standard tool in analyzing individual time allocation, as they offer more accurate data compared to surveys reliant on general questions (Harms et al., 2019), providing more precise estimations (Bonke, 2005; Yee-Kan, 2008). Therefore, they are the "gold standard" to study individual and worker behaviors (Aguiar and Hurst, 2007; Guryan et al., 2008; Ramey and Ramey, 2010; Sevilla et al., 2012).

By utilizing the UKTUS, the CaDDI, and the ELiDDI, we combine time use diaries from before Covid-19 and the lockdowns, but also during lockdowns, during the period where restrictions were relaxed, and afterwards. Specifically, the UK initiated lockdown measures on March 23rd, 2020, and legally enforced them from March 26th, to address evolving pandemic situations. This lockdown was extended on April 16th, until May 10th, when workers unable to work from home gradually returned to workplaces (avoiding public transport), while schools and non-essential shops gradually reopened during the end of June. However, a second national lockdown commenced from November 5th to December 2nd. These two periods of lockdown coincide with the CaDDI's data collection phase. Afterwards, during the spring and summer of 2021, most restrictions were gradually eased or relaxed, and this phase corresponds to the relaxation period during which the CaDDI also collected time use diaries. Finally, the ELiDDI includes time use diaries during 2023, far from lockdowns and the relaxation of restrictions.

[2]The UKTUS is free access from the UK Data Service and can also be freely downloaded from the Integrated Public Use Microdata Series (IPUMS) online system (https://timeuse.ipums.org/).

[3]See https://www.timeuse.org/time-use-diaries-and-the-covid-19-crisis.

[4]See https://timeuse.org/new-hetus-compatible-caddi.

The original UKTUS sample includes 11,421 individuals, while the CaDDI and the ELiDDI comprise 3,423 individuals and 2,179 individuals, respectively. We exclude individuals due to incomplete data on key variables, and individuals who reported diary entries on atypical days. We also keep individuals between 18 and 69 years old, to focus on the working age population and delete students and retired individuals. This yields sample sizes of 1,453 individuals for the UKTUS, 1,579 individuals for the CaDDI, and 820 individuals for the ELiDDI.[5] Next, because employed individuals have quite different time allocation than unemployed counterparts, and their feelings also differ even when doing similar activities (e.g., Knabe et al., 2010; Krueger and Mueller, 2012), we keep employee and self-employed workers who filled in diaries during workdays, defined as days in which individuals spend at least 1 hour in market work activities, to capture work-related diary entries (Gimenez-Nadal et al., 2020).

This finalizes our sample selection process, leaving a sample of 2,577 individuals, and 3,405 observations, as some individuals filled in two diaries during two different workdays. In addition, exploiting the time use diaries, the sample is comprised of 300,797 episodes with valid information. Table 1 summarizes the sample composition. Specifically, 744 individuals (32,284 episodes) correspond to the UKTUS, 1,171 individuals (251,712 episodes) correspond to the CaDDI, and 662 individuals (16,801 episodes) correspond to the ELiDDI.

Table 1: Sample composition

Time period	N. episodes	N. observations	N. individuals
Pre Covid-19 (UKTUS 2015)	32,284	916	744
Pre Covid-19 (CaDDI 2016)	41,184	286	228
Lockdowns (CaDDI 2020-2021)	163,440	1,135	747
Relaxation (CaDDI 2021)	47,088	327	196
Post Covid-19 (ELiDDI 2023)	16,801	741	662

Notes: The samples (UKTUS2015, CaDDI, ELiDDI) are restricted to working age employed individuals with complete data on key variables who worked the diary day.

To hold constant the demographic composition of the sample, and to ensure that the samples for each of the surveys are comparable, we follow Aguiar and Hurst (2007) and Gimenez-Nadal and Sevilla (2012) and apply demographic weighting. Specifically, we divide the sample into demographic cells defined by five age cohorts (16–25 years, 26–35 years, 36–45 years, 46–55 years, and 56–65 years, all inclusive), two gender categories (male and female), and 12 regions (North East, North West, Yorkshire and The Humber, East Midlands, West Midlands, East of London, London, South East, South West, Wales, Scotland, and Northern

[5]We eliminated a small number of individuals who recorded diary entries in the CaDDI during a brief period between lockdowns in the summer of 2020.

Ireland). We do not create separate cells distinguishing education categories or household composition (e.g., the presence of children), due to the small size of the resulting subsamples.

To calculate the constant weights, we pool together all the samples of the UKTUS 2015, the CaDDI and the ELiDDI, and compute the percentage of the population that resides in each demographic cell for each region. Following Katz and Murphy (1992), we use these fixed weights to recalculate sample weights, and scale them to sum exactly one (Gimenez-Nadal and Sevilla, 2012). When pooling the different samples to compute the percentage of the population in each of our cells, we used the sample weights provided by each survey, to ensure the data is representative of the total population. We adjusted these weights so that each population cell is equally represented in the overall sample.

2.1 Key variables

We use the diary structure of the UKTUS, the CaDDI, and the ELiDDI to determine the time allocated by workers to a range of main activities. Since the level of detail in the activity codes differs across surveys, harmonizing fine-grained time-use categories is not feasible. To ensure comparability and avoid the risk of some activity types being inconsistently defined or poorly constructable, we group activities into broad categories: market work, unpaid work, leisure, childcare, sleep, and a residual "other activities" category.[6] In doing so, we carefully check the various activities included in the surveys, and ensure that similar activities are considered in the same type of activity. We follow existing research to define leisure (e.g., Aguiar and Hurst, 2007; Gimenez-Nadal and Sevilla, 2012), encompassing activities such as dog walking, hobbies, reading, engaging in sports, etc. Unpaid work comprises activities related to household chores, excluding childcare duties. Paid work includes all types of activity related to main or secondary jobs (at home or not at home, including transport as paid work, and work breaks).

We exploit the episode-based structure of the time-use diaries to identify whether individuals were alone or with others during each activity, allowing us to construct a dummy variable for solitude that serves as the key explanatory variable in our analysis. This dummy variable capturing being alone tells us whether any other person was physically present during the activity, but not whether the respondent interacted with others remotely (e.g., via phone or video call). We cannot identify non-physical interactions in time-use data, which we acknowledge as a limitation of the data.

We also define solitude at the individual level, via a dummy variable that takes value 1 for those individuals who report all their episodes during the day alone, 0 otherwise. Then,

[6] See Appendix A for details.

this variable shows whether a respondent was physically alone during the entire diary day, i.e., it represents a strong form of daily solitude, regardless of the activities engaged in. As such, it captures a complete absence of in-person social contact across all time-use episodes in a day, and allows for the identification of people who may be at the highest risk of social isolation or who deliberately choose to spend their day entirely alone.

Furthermore, the UKTUS, as well as the CaDDI and the ELiDDI, collect information on enjoyment ratings for all episodes recorded in the diary, aiming to assess the instantaneous well-being experienced by individuals during their daily activities. Following the day-reconstruction method proposed by Kahneman et al. (2004) and Kahneman and Krueger (2006), respondents are asked the day after the diary day to rate each activity in response to the question: "How much did you enjoy this time?" with responses ranging from 1 ("not at all") to 7 ("very much").[7]

This measure represents instantaneous enjoyment, also referred to as instantaneous well-being or experienced utility (Kahneman et al., 2004), and captures the immediate subjective enjoyment experienced by individuals while engaging in specific activities, reflecting "the moment-to-moment flow of pleasure or pain" (Kahneman and Krueger, 2006). It is essential to differentiate instantaneous well-being from other measures of subjective well-being, such as cognitive measures (e.g., overall life satisfaction). For recent reviews, see Fritjers (2022) and Gimenez-Nadal et al. (2023).

The data also includes information on a life-satisfaction ladder, measuring how respondents personally feel about where they stand at present in regard to the best/worst possible life for them. This variable takes values from 1 ("completely dissatisfied") to 7 ("completely satisfied"), and represents the subjective cognitive evaluation of one's life (often referred to as Satisfaction With Life Scales, SWLS).[8]

Table 2 shows the summary statistics of the main variables defined at the episode level, namely the average enjoyment experienced by respondents in their daily episodes, and the rate of episodes done alone. Before Covid-19, 38.4% of the daily episodes of respondents were done alone, and the average enjoyment was 5.2 out of 7. During lockdowns, 47.4% of episodes were done alone, and the average enjoyment was 5.2 out of 7, while during the relaxation period 41.4% of episodes were done alone and the average enjoyment was 5.3 out of 7. In the post Covid-19 era, 34.0% of the episodes were done alone, and the average enjoyment is 5.2 out of 7. In summary, enjoyment rates have remained relatively stable during the

[7]Since enjoyment is an ordinal variable and reflects a subjective measure of well-being, making comparisons across individuals can be problematic (Bond and Lang, 2019), and it is important to control for individual fixed effects, or for individual overall well-being, to capture and net out individual heterogeneity.

[8]Alternative approaches to measuring well-being include affective well-being (the subjective evaluation of emotions experienced during one's daily life), such as the Positive Affect Negative Affect Scale (PANAS).

Table 2: Descriptive statistics of main episode variables

	Pre Covid-19		Lockdowns		Relaxation		Post Covid-19	
VARIABLES	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.
A. Full sample								
Being alone	0.384	0.486	0.474	0.499	0.414	0.493	0.340	0.474
Enjoyment	5.175	1.506	5.218	1.434	5.345	1.629	5.204	1.434
N. episodes	73,468		163,440		47,088		16,801	
B. Paid work episodes								
Being alone	0.317	0.465	0.556	0.497	0.457	0.498	0.331	0.471
Enjoyment	4.526	1.503	4.764	1.487	4.896	1.725	4.518	1.348
N. episodes	20,213		51,557		15,507		3,407	
C. Leisure episodes								
Being alone	0.382	0.486	0.412	0.492	0.300	0.458	0.341	0.474
Enjoyment	5.671	1.252	5.527	1.304	5.749	1.351	5.703	1.240
N. episodes	13,581		30,366		8,161		3,369	
D. Unpaid work episodes								
Being alone	0.387	0.487	0.394	0.489	0.403	0.491	0.352	0.478
Enjoyment	5.042	1.461	5.104	1.416	5.202	1.640	5.104	1.444
N. episodes	5,030		5,334		1,611		1,621	

Notes: The samples (UKTUS2015, CaDDI, ELiDDI) are restricted to episodes of working age employed individuals with complete data on key variables who worked the diary day.

analyzed time periods, whereas the rate of alone episodes increased during lockdowns but also during the relaxation period, and then again decreased in the post Covid-19 period. Table 2 also shows similar summary statistics for the episodes of paid work, for the episodes of leisure, and for the episodes of unpaid work.[9] For paid work, the picture is quite similar to the general case described above, although the increase in alone paid work episodes during lockdowns was more pronounced, likely due to the increase of work-from-home practices. The pictures for leisure and for unpaid are also similar to the average episodes.

Table 3 shows the summary statistics of the key variables defined at the individual level, namely the life-satisfaction ladder, and the rate of individuals who spent their day alone. On average, life satisfaction has increased in the analyzed period, ranging from 4.0 out of 7 before Covid-19, to 4.7 during lockdowns, and to 5.0 during both the relaxation period and after Covid-19. About 4.2% of individuals were completely alone before Covid-19, a

[9]We focus on these activities following existing research (e.g., Gimenez-Nadal et al., 2023), and because these are the most common activities. For instance, 30.15% of the episodes in the sample are paid work episodes, 18.4% are leisure episodes, and 4.5% are unpaid work episodes. Among the remaining time use categories, sleeping represents 30.65% of observations, childcare only 1.19%, and the remaining 15.05% are categorized as other activities.

Table 3: Descriptive statistics of main individual variables

	Pre Covid-19		Lockdowns		Relaxation		Post Covid-19	
VARIABLES	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.
Life satisfaction	4.025	1.517	4.650	1.303	5.016	1.414	5.024	1.273
All day alone	0.042	0.200	0.267	0.442	0.201	0.402	0.036	0.185
N. observations	1,202		1,135		327		741	
N. individuals	972		747		196		662	

Notes: The samples (UKTUS2015, CaDDI, ELiDDI) are restricted to working age employed individuals with complete data on key variables who worked the diary day.

magnitude that increased to 26.7% during lockdowns, and then decreased to 20.1% during the relaxation period, and returned to very low values (3.6%) in the post Covid-19 period.

2.2 Other explanatory variables

We define other variables that can potentially influence the experienced instantaneous enjoyment of episodes (Gimenez-Nadal et al., 2023), designated as control variables, including the location of episodes (at home, workplace, or other/unspecified location), engagement in secondary activities while performing the main activity,[10] the hour of the day when activities are undertaken (intended to capture potential fatigue accumulated throughout the day that might impact well-being), and the episode duration. The data also allows us to define several demographic characteristics of interviewees, including respondents' gender, age (measured in years), highest level of formal education attained (primary, secondary, or University), marital status (cohabiting or single), UK citizenship status, family size, number of children, and self-employment status. Additionally, we categorize the day of the week and the month when diaries were completed, and residential region (Northeast, North West, Yorkshire and The Humber, East Midlands, West Midlands, East of London, London, South East, South West, Wales, Scotland, and Northern Ireland). We consider worker occupation, earnings, family income, and self-reported health. Summary statistics for the variables defined at the episode level are shown in Table B.1 in Appendix B, while summary statistics of the demographic composition of the samples (defined at the individual level) are shown in Table B.2 in Appendix B.

[10] We identify six categories: no other activity done in the episode, personal care, paid work, unpaid work and care, leisure, and travel.

3 Empirical strategy

To analyze the relationship between isolation and instant enjoyment, we estimate three models. Our first, baseline approach regresses enjoyment in terms of a dummy that identifies episodes alone, and interactions between this dummy and variables that identify individuals interviewed during lockdowns, during the relaxation period, and during the post Covid-19 period, with the pre Covid-19 period as the reference. Second, we exploit the fact that we have information on several episodes per interviewed individual, and include individual fixed effects, to capture heterogeneity across individuals. Third, we include day fixed effects, to determine wheher they influence estimates "on an average day" (Frazis and Stewart, 2012). Our richest model includes episode-level controls (start time of the episode, duration of the episode, location of the episode, and main and secondary activity done during the episode), to net out from our estimates the potential impact of tiredness during the day, location, and activity type.

For a given person i and episode p, we estimate the following equation using Ordinary Least Squares (OLS):

$$e_{ip} = \alpha_i + \beta_1 a_{ip} + \beta_2 l_i a_{ip} + \beta_3 r_i a_{ip} + \beta_4 p_i a_{ip} + \boldsymbol{\beta}_{\boldsymbol{X}}^{'} \mathbf{X_{ip}} + \gamma + \varepsilon_{ip}, \tag{1}$$

where e_{ip} represents the enjoyment experienced by i during episode p; α_i represents individual fixed effects, a_{ip} is the dummy that takes value 1 if the episode is done alone (0 otherwise); l_i, r_i, and p_i are the dummies that identify individuals interviewed during lockdowns, the relaxation period, and the post Covid-19 period, respectively. Because a_{ip} is defined at the episode level, the interaction terms $l_i a_{ip}$, $r_i a_{ip}$, and $p_i a_{ip}$ are not constant within individuals, which ensures identification.[11] $\mathbf{X_{ip}}$ is the vector of episode details; and γ represents day fixed effects. Finally, the term ε_{ip} represents the error term.

Because the dependent variable e_{ip} is ordinal, and takes values between 1 and 7, alternative approaches could be based on ordinal output variable models (e.g., ordered logit, or ordered probit models), or on censored models such as the Tobit model. Nevertheless, prior research has shown that OLS produces similar estimates when studying instantaneous enjoyment and time use data, particularly when the ordinal scale has multiple categories, and we have thus decided to rely on OLS estimates, as is common in the literature (Foliano et al., 2022; Mylona and Gershuny, 2023; Gimenez-Nadal et al., 2025).[12] We use robust-cluster

[11] It is important to note that, as we include individual fixed effects, we cannot control for the dummies l_i, r_i, and p_i as standalone variables, since these are constant within individuals, and are captured by the fixed effect α_i.

[12] Because we include individual fixed effects, ordered logit and ordered probit models require much longer computation times and may fail to converge.

standard errors (at the individual level) to account for potential correlation within clusters and heteroskedasticity (Cameron and Miller, 2015).

Our second analysis focuses on how isolation relates to life satisfaction defined at the individual level. To do so, we estimate, for a given individual i and using OLS, the following equation:

$$s_i = \beta_0 + \beta_1 a_i + \beta_2 l_i a_i + \beta_3 r_i a_i + \beta_4 p_i a_i + \boldsymbol{\beta_Z'} \mathbf{Z_i} + \gamma + \delta + \varepsilon_i, \tag{2}$$

where s_i represents the satisfaction with life of individual i, a_i is the dummy that takes value 1 if person i has spent his/her day alone (0 otherwise); l_i, r_i, and p_i are defined as in (1); $\mathbf{Z_i}$ is a vector of individual level demographics; γ and δ represent day and month fixed effects; and the term ε_i represents the error term.

The dependent variable s_i is also ordinal, but we use OLS instead of ordinal logit or probit models for similar reasons as in the previous analysis. Again, we use robust standard errors to account for potential heteroskedasticity (Cameron and Miller, 2015).

4 Results

Table 4 summarizes the partial derivatives of instant enjoyment with respect to being alone, for the analyzed periods: before Covid-19, during lockdowns, during the relaxation period, and after Covid-19.[13] We focus on partial derivatives, instead of on point estimates, as when models include interactions between a treatment (i.e., being alone) and multiple time periods, the individual coefficients are not directly informative on their own. What matters for interpretation is the combined effect of the treatment coefficient, and the interaction coefficient at specific points in time. Partial derivatives, computed as linear combinations of the relevant coefficients, capture these net effects directly, and the statistical significance allows us to properly assess whether the treatment had a meaningful effect at specific time points, and whether the effect changed significantly over time. Column (1) shows the first, baseline model, which excludes control variables and individual fixed effects, column (2) includes individual fixed effects, column (3) includes day effects and, column (4) includes the whole set of episode-level controls and represents the full model summarized by (1).

Estimates in Table 4 indicate that controlling individual effects (i.e., by worker observed and unobserved heterogeneity that remains constant in time) is crucial, as results diverge from Column (1) to Columns (2), (3), and (4). On the other hand, the results also suggest that controlling day effects is not relevant. However, the results do indicate that controlling episode details, which are not captured by individual fixed effects, is important, as again

[13] Standard errors and p-values are computed using the Deltha method. Detailed point estimates of (1), including robust standard errors clustered at the individual level, are shown in Table B.3 in Appendix B.

Table 4: Baseline results – main partial correlations

VARIABLES	Baseline	Individual FE	Day effects	Full
Alone | Pre Covid-19	−0.272***	−0.082	−0.081	−0.133*
	(0.008)	(0.303)	(0.305)	(0.059)
Alone | Lockdowns	−0.323***	−0.201***	−0.199***	−0.014
	(< 0.001)	(< 0.001)	(0.001)	(0.804)
Alone | Relaxation	−0.232	0.024	0.019	0.099
	(0.345)	(0.847)	(0.876)	(0.414)
Alone | Post Covid-19	−0.327***	−0.344***	−0.342***	−0.291***
	(< 0.001)	(< 0.001)	(< 0.001)	(< 0.001)
Individual fixed effects	No	Yes	Yes	Yes
Day effects	No	No	Yes	Yes
Episode controls	No	No	No	Yes
Observations	300,797	300,797	300,797	300,797

Notes: The samples (UKTUS2015, CaDDi, ELiDDI) are restricted to episodes of working age employed individuals with complete data on key variables who worked the diary day. *P*-values computed using the Delta method in parentheses. *** significant at the 1%; ** significant at the 5%; * significant at the 10%.

the results diverge whether these controls are included or not in the model. Therefore, we focus on the most complete model estimated in Column (4) of Table B.3, whose main partial derivatives are shown in Column (4) of Table 4.

Estimates indicate that being alone is related to decreased instantaneous enjoyment before Covid-19, with such correlation being -0.13 and statistically significant at the 10% level only. This indicates that, before Covid-19, individuals disliked being alone and enjoyed more episodes of any type done with someone else, in line with existing results on togetherness by Hamermesh (2020), Cosaert et al. (2023), and Gimenez-Nadal et al. (2023). Despite that, this correlation seemed to be not statistically significant during lockdowns and during the relaxation period, indicating that enjoyment did not relate to togetherness or isolation during the times of Covid-19, likely due to the confinement measures aimed at reducing social contact. This aligns with the fact that, after Covid-19, we find a negative and highly significant correlation between being alone and instantaneous enjoyment. Specifically, the estimated coefficient is -0.29, more than double what it was before Covid-19, indicating that after the long period of isolation due to lockdowns, individuals particularly enjoyed not being alone.

We run two additional analyses. First, existing research has documented that the lockdowns during the Covid-19 pandemic impacted worker daily lives and time allocation (Restrepo and Zeballos, 2022; Pabilonia and Vernon, 2023; Gimenez-Nadal et al., 2025), and well-being, while doing specific activities (Song and Gao, 2020). Then, to study whether the

results shown in Table 4 are driven by specific activities, we re-estimate (1) on the episodes of paid work, on the episodes of leisure, and on the episodes of unpaid work. Second, we explore some potential forms of heterogeneity in the correlation between being alone and instantaneous enjoyment. In doing so, we analyze separately men and women, as prior research suggests that the pandemic had a differential impact on male and female well-being (Gimenez-Nadal et al., 2023; Pabilonia and Vernon, 2023). We also study whether the presence of kids moderates the relationship between isolation and enjoyment, since individuals with children may have difficulties being alone and their daily feelings may differ from those of individuals without kids. We next analyze whether being able to work from home (WFH), relative to working away from home (WAFH), affects the correlation between isolation and enjoyment, as prior empirical analyses using time use data have shown that working from home relates to different feelings (Gimenez-Nadal et al., 2020; Song and Gao, 2020; Restrepo and Zeballos, 2020, 2023). We analyze whether the correlations of interest are similar across the income distribution by separate analysis of those workers with low income, those with middle income, and those with high income (Pabilonia and Vernon, 2022).

In summary, the analysis shows that being alone during paid work episodes was generally not significantly associated with instantaneous enjoyment, except for a positive correlation during the Covid-19 relaxation period, possibly reflecting temporary concerns about social contact. In contrast, being alone during leisure and unpaid work activities was consistently linked to lower enjoyment, especially for leisure, with negative and significant correlations re-emerging after the pandemic. Gender and parental status differences suggest that solitude affected women and parents more before the pandemic, but post-Covid-19 correlations became similarly negative for all groups, pointing to a convergence. While WFH did not alter the direction of correlations, its magnitude became notably more negative post-pandemic. Results also show that solitude was harmful to low-income workers pre-pandemic, but after Covid-19 the negative correlation between solitude and enjoyment became significant across all income groups.

For paid work episodes, we find that the correlation between being alone and instantaneous enjoyment was negative but not significant before Covid-19, and remained not significant during lockdowns (the main partial effects are shown in Table 5, while estimated coefficients are shown in Table B.4 in Appendix B.) However, that correlation was positive and marginally significant at 10% during the relaxation period, although it returned to a very small and non-significant magnitude after the relaxation period, during the post Covid-19 period. This suggests that doing paid work alone or with coworkers did not necessarily relate to increased or decreased enjoyment in general terms, although during the relaxation period workers preferred to work alone than in the presence of others, perhaps reflecting a

Table 5: Results by activity – main partial correlations

	Paid work	Leisure	Unpaid work
Alone | Pre Covid-19	−0.181	−0.314***	−0.198**
	(0.338)	(< 0.001)	(0.011)
Alone | Lockdowns	0.003	−0.129	0.035
	(0.983)	(0.136)	(0.835)
Alone | Relaxation	0.444*	−0.166*	−0.327*
	(0.072)	(0.098)	(0.066)
Alone | Post Covid-19	−0.026	−0.249***	−0.259**
	(0.802)	(< 0.001)	(0.016)
Individual fixed effects	Yes	Yes	Yes
Day effects	Yes	Yes	Yes
Episode controls	Yes	Yes	Yes
Observations	90,684	55,477	13,596

Notes: The samples (UKTUS2015, CaDDi, ELiDDI) are restricted to episodes of working age employed individuals with complete data on key variables who worked the diary day. *P*-values computed using the Delta method in parentheses. *** significant at the 1%; ** significant at the 5%; * significant at the 10%.

temporary fear of the recent Covid-19 waves, which disappears over time. Consequently, we conclude that the general results shown in Table 4 are not driven by paid work episodes.

On the other hand, for leisure and unpaid work activities, the estimates are partially in line with the general results shown in Table 4. Results indicate that individuals enjoyed their leisure less, as well as their unpaid work episodes done alone, compared to episodes done with others, with said difference being especially relevant for leisure activities. This result aligns with existing research on togetherness concluding that individuals prefer to spend leisure activities with others (e.g., Cosaert et al., 2023). However, these correlations are not significant during lockdowns. Correlations during the relaxation period are negative and marginally significant at the 10% level, and the similar magnitudes during the post Covid-19 period are negative and statistically significant at standard levels. This is suggestive evidence that individuals did not enjoy leisure and chores time while alone during the Covid-19 lockdowns any differently than how they enjoyed joint leisure, reflecting some form of fear of social contact. However, this fear gradually disappeared during the relaxation period and afterwards, returning during the post Covid-19 times to similar magnitudes as before the pandemic.

The partial correlations of interest for the different sample groups are shown in Table 6 and point estimates are shown in Table B.5 in Appendix B. As for gender differences, before Covid-19 being alone only related negatively to the instantaneous enjoyment of women, while

the correlation was not statistically significant among men. The correlations are estimated not to be significant at standard levels during lockdowns and during the relaxation period, although in the post Covid-19 period the partial correlations are negative and highly significant for both men and women, suggesting that Covid-19 has operated as a gender-equalizer mechanism in the correlation between loneliness and instantaneous enjoyment.

Results regarding the presence of kids are similar. Before the pandemic, being alone was only related to the instantaneous enjoyment of those with kids, perhaps displaying that these individuals enjoyed more episodes with their kids. However, during the lockdowns and relaxation periods the correlations were not significant for either group, and after the Covid-19 period, the correlations are estimated to be negative and highly significant for workers with and without kids.

On the other hand, WFH seems not to moderate the correlation between being alone and enjoyment, as the partial correlations are qualitatively similar for those who WFH and for those who WAFH.[14] Despite that, we find quantitative differences, since in the post Covid-19 period, the partial correlation between being alone and instantaneous enjoyment is more than double among WFH than among WAFH. This indicates that being alone is especially harmful in terms of enjoyment for those who WFH, who face additional isolation while doing paid work, compared to those who WAFH and typically work in the presence of coworkers, which often entails increased social interaction and reduced isolation.

Regarding income heterogeneity, our estimates suggest that the correlation between being alone, and instantaneous enjoyment was negative and significant before Covid-19 only among workers with low-income.[15] Conversely, it was not statistically significant among middle-income and high-income workers in the pre Covid-19 period. During lockdowns and during the relaxation period, the correlation was non-significant for everyone, regardless of income levels, despite that we find some differences regarding the signs of the correlations.[16] During

[14]We identify WFH as in Gimenez-Nadal et al. (2025), based on whether workers spent all their paid work time at home (WFH) or not (WAFH).

[15]We cannot observe wages, or income as a continuous variable in the datasets, which only include income in brackets. We then classify workers in three categories based on family income. Those whose annual family income is lower than 30,000 pounds are identified as low-income individuals; those between 30,000 and 49,999 pounds are classified as middle-income individuals; those whose families earn 50,000 pounds or more are identified as high-income individuals.

[16]The correlations between being alone and instantaneous enjoyment are relatively small and not significant during lockdowns for low-, middle-, and high-income workers. However, during the relaxation period, the correlation for low income workers is negative but not significant at standard levels, the correlation among middle-income workers is small and not significant, and the correlation among high-income workers is positive and not significant. Despite the lack of statistical significance, likely due to limited sample sizes during the relaxation period, this indicates a divergence in the correlation between loneliness and enjoyment: low-income workers seemed to prefer not to be alone, and high-income workers preferred to be alone, perhaps indicating a different perception of social distance measures and their relaxation in terms of income. Further research using larger samples should investigate this differential correlation.

Table 6: Heterogeneity analysis – main partial correlations

	Men	Women	No kids	Kids	WFH	WAFH	Low inc.	Mid inc.	High inc.
Alone | Pre Covid-19	-0.070	-0.215^{**}	-0.136	-0.175^{**}	-0.121	-0.106	-0.197^{**}	-0.024	-0.058
	(0.448)	(0.045)	(0.163)	(0.026)	(0.386)	(0.151)	(0.032)	(0.881)	(0.768)
Alone | Lockdowns	-0.030	-0.003	-0.023	-0.049	-0.084	0.131	0.086	-0.013	-0.049
	(0.685)	(0.976)	(0.758)	(0.536)	(0.274)	(0.100)	(0.407)	(0.851)	(0.641)
Alone | Relaxation	0.178	-0.269	0.031	0.100	0.055	0.139	-0.192	-0.044	0.227
	(0.202)	(0.140)	(0.889)	(0.451)	(0.797)	(0.379)	(0.441)	(0.739)	(0.222)
Alone | Post Covid-19	-0.356^{***}	-0.252^{***}	-0.296^{***}	-0.306^{***}	-0.456^{***}	-0.170^{***}	-0.283^{***}	-0.279^{***}	-0.328^{***}
	(< 0.001)	(< 0.001)	(< 0.001)	(< 0.001)	(< 0.001)	(0.005)	(0.007)	(0.002)	(< 0.001)
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Episode controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	172,266	128,531	178,344	122,453	136,316	164,481	103,895	92,267	104,635

Notes: The samples (UKTUS2015, CaDDi, ELiDDI) are restricted to episodes of working age employed individuals with complete data on key variables who worked the diary day. P-values computed using the Delta method in parentheses. *** significant at the 1%; ** significant at the 5%; * significant at the 10%.

the post Covid-19 period, the correlation between being alone and instantaneous well-being is estimated to be negative and highly significant for workers of every income group.

Regarding the analysis of life satisfaction, Table 7 shows the main partial correlations between being alone on one hand, and life satisfaction. Point estimates are shown in Table B.6 in Appendix B.[17] We observe that being alone during the day was not statistically significant at standard levels before the Covid-19, during lockdowns, or during the post Covid-19 period. However, individuals who were alone during the relaxation period reported lower levels of overall life satisfaction, with the partial correlation being highly significant, and decreasing by almost one point in the scale of life satisfaction (which takes values from 1 to 7).

Table 7: Results at the individual level – main partial correlations

	Life satisfaction
All day alone	−0.238
	(0.304)
Alone × Lockdowns	−0.024
	(0.817)
Alone × Relaxation	−0.930***
	(< 0.001)
Alone × Post Covid-19	−0.002
	(0.994)
Demographics	Yes
Time allocation effects	Yes
Earning effects	Yes
Family income effects	Yes
Occupation effects	Yes
Health effects	Yes
Day effects	Yes
Month effects	Yes
Observations	3,405

Notes: The samples (UKTUS2015, CaDDi, ELiDDI) are restricted to working age employed individuals with complete data on key variables who worked the diary day. *P*-values computed using the Delta method in parentheses. *** significant at the 1%; ** significant at the 5%; * significant at the 10%.

Regarding respondents' demographic characteristics, the analysis shows that most vari-

[17] We run an additional robustness check to study the sensitivity of the results to the definition of being alone at the individual level. In doing so, we define a dummy variable for those individuals who are alone at least 12h during their diary day (excluding sleeping). Estimates in Table B.6 in Appendix B show that the results are robust to the definition of being alone at the individual level.

ables are not significantly associated with life satisfaction at standard levels. For instance, coefficients related to being male, age, education level, family size, and number of children have small and non-statistically significant correlations with respondents' life satisfaction. However, UK citizenship is associated with higher life satisfaction, suggesting potential benefits from social integration or stability. Being self-employed is negatively associated with life satisfaction. Finally, the time allocation across paid work, leisure, and chores does not show significant correlations with life satisfaction, indicating that how individuals distribute their time across these domains may matter less than the quality of time or the context in which it is experienced.

5 Discussion

The pattern of enjoyment associated with being alone suggests that social context plays a central role in shaping daily well-being, but that its influence is not fixed. The lack of a penalty for isolation during lockdowns likely reflects an exceptional context in which being alone was both prescribed and expected. Furthermore, we find that this lack of relationship is only present when we exploit all the information in the diary data, suggesting that the negative correlation found otherwise is driven by episode heterogeneity, i.e., by differences in episodes during lockdowns compared to episodes before or after lockdowns. Despite that, the stronger penalty observed in the post-Covid period indicates a rebound effect. After prolonged distancing, individuals may have become more sensitive to the absence of social interaction. This may reflect both a renewed appreciation for social presence and a lower tolerance for solitude during worker daily activities.

However, when we focus on paid work, we report almost null correlations between loneliness and instantaneous enjoyment. This absence of correlation suggests that social context is less relevant for enjoyment at work, perhaps due to the nature of paid work activities, which are typically related to lower and less variable enjoyment, and to negative feelings such as stress (Kahneman and Krueger, 2006). Then, working alone or not, as well as lockdown periods, may have limited emotional salience. However, the positive (and marginally significant) coefficient during the relaxation period could reflect health concerns, where being alone reduced perceived risk, as well as a lower tolerance for solitude in the general context.

In contrast, for leisure and unpaid work episodes, social presence clearly matters, as well as the time period. Enjoyment is consistently lower when these activities are done alone, except during lockdowns. This points to the social function of leisure and chores, as these are daily tasks for resting or doing housework, but at the same time are occasions for interaction. The absence of correlation during lockdowns could reflect health concerns,

whereas the gradual reappearance of the enjoyment gap between alone and not-alone episodes as restrictions ease suggests a restoration of prior norms. People may return to seeking shared leisure and joint domestic tasks, not only for efficiency but for emotional benefit.

The heterogeneous patterns across gender, parenthood, work from home status, and income groups provide clues about which groups are more vulnerable to isolation. First, the post-pandemic convergence of men and women in their response to solitude suggests that gender differences in social needs or constraints may have narrowed. The same is true for parents and non-parents, indicating that the experience of lockdown may have recalibrated expectations or habits for both groups. Similarly, the disappearance of income-based differences, post-pandemic, suggests that the costs of isolation have become more universal. Before Covid-19, only low-income individuals showed a clear enjoyment penalty when alone, while mid- and high-income individuals did not care so much about being alone (perhaps indicating a trade-off between earnings and social distance). During the pandemic, none of these groups showed a significant correlation between being alone and instantaneous enjoyment, perhaps reflecting health concerns, as in the baseline analysis. However, after the pandemic, high- and middle-income workers show similar patterns to low-income workers, hinting at a widespread shift in how solitude is experienced, possibly linked to changes in work-life balance, social habits, and emotional expectations.

The results for WFH and WAFH workers seem somehow different. In principle, WFH workers face a stronger penalty for being alone, as they do not physically interact with coworkers, which could negatively affect their well-being by reducing social interaction, although at the same time WFH workers avoid commuting and its negative consequences (e.g., Roberts et al., 2011; Dickerson et al., 2014). Our analysis suggests that before the pandemic, when WFH was not so common, the associations between instantaneous enjoyment and isolation were not significant for both WFH and WAFH. In other words, the relationships were similar for these workers, perhaps due to trade-offs between isolation and a blurred barrier between work and non-work on one hand, and the avoidance of stressful commutes on the other, both related to WFH. However, the correlation becomes significant after lockdowns, and specially pronounced among WFH workers. This points to a mechanism of cumulative isolation. WFH eliminates formal workplace routines and social encounters (e.g., brief conversations, shared breaks), and being alone in other episodes amplifies this sense of disconnection, creating a stronger correlation between loneliness and well-being. Moreover, WFH arrangements often blur the boundaries between work and non-work domains, and WFH workers spend most of the day in the same physical environment with limited variation in social or spatial context, magnifying the psychological weight of being alone during other activities. It is also possible that the penalty for being alone among WFH workers

reflects a mismatch between expectations and reality, as workers who choose WFH may do so for flexibility or autonomy, but still expect to preserve social contact and, when said contact does not materialize, instantaneous enjoyment may be particularly affected. Future analyses using longer periods after lockdowns should analyze the persistence of this pattern, to study whether this emotional cost of WFH is not merely transitional.

The divergent results for instantaneous enjoyment at the diary level, and life satisfaction measured at the individual level, underscore the need to treat these two measures as conceptually distinct (Fritjers, 2022). Instantaneous enjoyment reflects short-term affective states linked to specific episodes, and is highly sensitive to momentary social context. On the other hand, life satisfaction aggregates cognitive evaluations that are likely shaped by broader dimensions. The significant drop in life satisfaction for those alone immediately after lockdowns, during the relaxation period, may reflect shifts in social norms and needs after a relatively long lockdown with limited social contact. Besides, isolation was no longer mandated, but still prevalent and suggested for some individuals (e.g., those with health issues or those who had recently been infected). Being alone when others had resumed social interaction could have intensified subjective dissatisfaction. However, in the post-Covid period, said correlation disappears, perhaps indicating that in terms of overall life satisfaction being alone was no longer related to how individuals aggregate their cognitive expectations about their lives.

6 Conclusions

This paper addresses the broader question of how physical solitude during daily activities influences instantaneous enjoyment and life satisfaction, which ultimately affects well-being and productivity, an issue that has gained prominence in the context of widespread remote work and social fragmentation. The study aims to disentangle the emotional impact of being alone by examining its relationship with both momentary enjoyment and overall life satisfaction. We treat the Covid-19 pandemic as an exogenous shock to social interaction that affected the entire population, and use time-use diary data from the UK spanning pre-pandemic, lockdown, relaxation, and post-pandemic phases.

Our results show that being alone is negatively associated with instantaneous enjoyment or experienced utility, but this relationship varies significantly across time periods. Before the pandemic, solitude modestly reduced enjoyment, while during lockdowns and the subsequent relaxation phase, this effect disappeared, likely reflecting the social normalcy of isolation in those contexts. In contrast, the post-pandemic period shows a substantial and statistically significant enjoyment penalty for being alone, especially during leisure and unpaid work

activities. These patterns suggest that solitude became emotionally costly once it was no longer mandated. We also find that full-day solitude correlates with lower life satisfaction, but only during the relaxation phase, indicating that longer-term well-being may be more sensitive to solitude in transitional social contexts. The effects are especially pronounced among remote workers and are consistent across gender, parenthood status, and income groups in the post-pandemic period.

Several conclusions can be drawn from this analysis. Our study demonstrates that solitude imposes non-monetary costs that vary by social context and type of activity, as solitude can be emotionally neutral in some contexts, but harmful in others. The distinction between voluntary or involuntary solitude seems essential for understanding well-being, and this emotional cost of solitude should be integrated in theoretical and empirical models of time allocation. Future research should further explore the mechanisms behind the heterogeneity in the emotional cost of solitude, especially among remote workers, and should also study physical and virtual forms of solitude.

Our analysis has certain implications for society in general and for policy makers. From a practical perspective, workers who spend large portions of their day alone, particularly those working from home, may experience reduced well-being even if their productivity remains unaffected. This suggests that employers should not overlook the emotional impact of isolation and solitude in the design of flexible work arrangements. Structured opportunities for social interaction, such as collaborative projects, hybrid schedules, or virtual coffee breaks, could help mitigate the emotional costs of solitude. More broadly, organizations and society should promote awareness about the psychological risks of prolonged solitude and encourage strategies to maintain meaningful social contact. On the policy side, labor and social policies should explicitly account for the emotional costs of isolation when evaluating remote and hybrid work frameworks. In particular, policies that focus exclusively on economic outcomes may miss significant non-monetary welfare losses, which may negatively impact productivity in the longer run. Policymakers should ensure that well-being indicators include both life satisfaction and instantaneous enjoyment, as they capture different dimensions of utility. Public initiatives aimed at fostering social inclusion could play a key role in safeguarding emotional well-being. Finally, labor regulations may need to balance the benefits of flexibility with explicit incentives for maintaining in-person social interaction in both work and non-work contexts.

This study has some limitations that should be acknowledged. First, the measure of isolation reflects physical solitude only, based on the presence of others in the same location. Thus, episodes spent alone may still involve virtual social interaction (e.g., video meetings, phone calls), which we cannot identify. As such, our estimates may overstate the extent of

social disconnection in activities such as remote work. Second, the analysis relies on repeated cross-sectional data, which prevents us from estimating causal effects, despite controlling for unobserved heterogeneity. Relatedly, while the Covid-19 pandemic provides an exogenous shock to patterns of social interaction, it affected the entire population, and we lack a counterfactual which would allow us to estimate causal effects. Finally, although the time-use diaries are detailed and nationally representative, the data do not include all relevant psychological or contextual variables, such as individual preferences for solitude, which may moderate the observed relationships. Finally, the cross-sectional nature of most data points prevents us from tracking long-term individual-level changes in response to shifts in social norms or working arrangements.

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Appendix

A Consolidation of time use categories

Table A.1: Time use categories

	UKTUS 2015	CaDDi	ELiDDI
Paid work	paid work, main job (not at home); paid work at home; second or other job not at home; travel as a part of work; work breaks; other time at workplace	paid work including at home; work break	paid work; work breaks; travel for paid work; other employment activities
Leisure	worship and religion; general out of home leisure; attend sport event; cinema, theatre, opera, concert; other public events; restaurant, cafe, bar, pub; party, social event, gambling; general sport or exercise; walking; cycling; other outside recreation; gardening; walk dog; receive or visit friends; conversation; games, in-home social; general indoor leisure; art or music; correspondence; hobbies; relax, "do nothing"; read; listen to music or audio content; listen to the radio; watch TV, video, dvd, streamed film; computer games; email, surf internet, computing	church, temple, synagogue, prayer; shopping; watching tv, video, DVD, music; reading including e-books; playing sports, exercise; walking, dog walking; playing computer games; time with friends/family; telephone, text, email, letters; cinema, theatre, sport etc; hobbies; walking, jogging	religious activities; walking, jogging; shopping and e-shopping; outdoors leisure; indoors leisure, hobbies
Unpaid work	food preparation/cooking; set table, wash or put away dishes; cleaning; laundry, ironing, clothing repair; home/vehicle maint. or improvement; other domestic work; adult care; voluntary, organisational activity	preparing food, cooking etc; cleaning tidying housework; clothes washing, mending; maintenance DIY, etc; voluntary work for organization; help, caring for cores adult; help, caring for no coresidents	home care, repairs, etc; voluntary, organisational work; organisational work; adult care and help; household management

Notes: Authors' elaboration.

B Additional results

Table B.1: Additional descriptive statistics of episode variables

	Pre Covid-19		Lockdowns		Relaxation		Post Covid-19	
VARIABLES	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.
Where: at home	0.593	0.491	0.829	0.377	0.720	0.449	0.688	0.463
Where: at workplace	0.276	0.447	0.135	0.342	0.223	0.416	0.160	0.366
Where: other	0.131	0.337	0.036	0.186	0.057	0.232	0.153	0.360
Paid work episode	0.290	0.454	0.317	0.465	0.325	0.468	0.206	0.404
Leisure episode	0.184	0.387	0.186	0.389	0.182	0.386	0.201	0.401
Unpaid work episode	0.057	0.233	0.031	0.174	0.033	0.177	0.098	0.298
Childcare episode	0.013	0.111	0.007	0.085	0.009	0.094	0.038	0.190
Sleeping episode	0.257	0.437	0.352	0.478	0.321	0.467	0.112	0.315
Other episode	0.200	0.400	0.106	0.308	0.131	0.337	0.345	0.476
N. episodes	73,468		163,440		47,088		16,801	

Notes: The samples (UKTUS2015, CaDDi, ELiDDI) are restricted to working age employed individuals with complete data on key variables who worked the diary day.

Table B.2: Additional descriptive statistics of main individual variables

	Pre Covid-19		Lockdowns		Relaxation		Post Covid-19	
VARIABLES	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.
Being male	0.532	0.499	0.620	0.486	0.808	0.395	0.506	0.500
Age	2.806	1.197	2.725	1.140	3.055	1.176	2.796	1.213
Married/cohabiting	0.594	0.491	0.661	0.474	0.685	0.465	0.760	0.427
UK citizen	0.609	0.488	0.934	0.249	0.975	0.157	0.891	0.312
Primary education	0.053	0.225	0.039	0.193	0.028	0.167	0.062	0.242
Secondary education	0.433	0.496	0.268	0.443	0.232	0.423	0.350	0.477
University education	0.513	0.500	0.694	0.461	0.739	0.440	0.588	0.493
Family size	2.772	1.261	2.738	1.272	2.930	1.277	2.794	1.154
# children	0.640	0.944	0.705	0.933	0.827	0.987	0.634	0.919
Self-employed	0.122	0.327	0.111	0.315	0.136	0.344	0.097	0.296
Paid work minutes/day	450.647	158.599	455.798	138.179	468.172	145.979	472.451	131.553
Leisure minutes/day	224.305	133.237	268.512	147.210	262.412	181.327	193.081	112.981
Unpaid work minutes/day	61.567	71.009	45.161	63.885	46.820	65.189	58.086	67.145
Child care minutes/day	15.459	43.854	10.447	41.695	12.797	49.285	29.326	70.271
N. observations	1,202		1,135		327		741	
N. individuals	972		747		196		662	

Notes: The samples (UKTUS2015, CaDDi, ELiDDI) are restricted to working age employed individuals with complete data on key variables who worked the diary day.

Table B.3: Baseline results in detail

VARIABLES	Baseline	Individual FE	Day effects	Full
With: alone	-0.272^{***}	-0.082	-0.081	-0.133^{*}
	(0.102)	(0.079)	(0.079)	(0.070)
Alone X Lockdowns	-0.051	-0.119	-0.117	0.119
	(0.110)	(0.100)	(0.099)	(0.089)
Alone X Relaxation	0.040	0.105	0.100	0.232^{*}
	(0.256)	(0.147)	(0.146)	(0.140)
Alone X Post Covid-19	-0.055	-0.262^{***}	-0.261^{***}	-0.158^{*}
	(0.103)	(0.096)	(0.096)	(0.084)
Episode controls:				
Start time				0.000^{***}
				(0.000)
Episode duration				0.001^{***}
				(0.000)
Location: At workplace				-0.179^{**}
				(0.076)
Location: Other				-0.155^{***}
				(0.051)
Main activity:				
Leisure				0.606^{***}
				(0.048)
Unpaid work				0.264^{***}
				(0.059)
Childcare				0.511^{***}
				(0.076)
Other				0.355^{***}
				(0.041)
Constant	5.371^{***}	5.311^{***}	5.346^{***}	4.774^{***}
	(0.053)	(0.027)	(0.076)	(0.091)
Individual f.e.	No	Yes	Yes	Yes
Day effects	No	No	Yes	Yes
Secondary activity f.e.	No	No	No	Yes
Observations	300,797	300,797	300,797	300,797
R-squared	0.012	0.581	0.582	0.631

Notes: The samples (UKTUS2015, CaDDi, ELiDDI) are restricted to working age employed individuals with complete data on key variables who worked the diary day. Robust standard errors, clustered at the individual level, in parentheses. *** significant at the 1%; ** significant at the 5%; * significant at the 10%.

Table B.4: Results by activity

VARIABLES	Paid work	Leisure	Unpaid work
With: alone	−0.181	−0.314***	−0.198**
	(0.188)	(0.082)	(0.078)
Alone X Lockdowns	0.183	0.185	0.233
	(0.217)	(0.116)	(0.180)
Alone X Relaxation	0.625**	0.149	−0.129
	(0.307)	(0.126)	(0.196)
Alone X Post Covid-19	0.155	0.065	−0.062
	(0.211)	(0.107)	(0.128)
Constant	4.801***	5.213***	4.896***
	(0.142)	(0.146)	(0.245)
Individual fixed effects	Yes	Yes	Yes
Day effects	Yes	Yes	Yes
Episode controls	Yes	Yes	Yes
Observations	90,684	55,477	13,596
R-squared	0.857	0.726	0.727

Notes: The samples (UKTUS2015, CaDDi, ELiDDI) are restricted to working age employed individuals with complete data on key variables who worked the diary day. Robust standard errors, clustered at the individual level, in parentheses. *** significant at the 1%; ** significant at the 5%; * significant at the 10%.

Table B.5: Heterogeneity analysis

VARIABLES	Men	Women	No kids	Kids	WFH	WAFH	Low inc.	Mid inc.	High inc.
With: alone	−0.070	−0.215**	−0.136	−0.175**	−0.121	−0.106	−0.197**	−0.024	−0.058
	(0.092)	(0.107)	(0.098)	(0.079)	(0.139)	(0.074)	(0.092)	(0.156)	(0.195)
Alone X Lockdowns	0.040	0.212	0.113	0.127	0.037	0.237**	0.284**	0.010	0.008
	(0.117)	(0.136)	(0.123)	(0.108)	(0.156)	(0.106)	(0.141)	(0.171)	(0.219)
Alone X Relaxation	0.248	−0.055	0.167	0.275*	0.175	0.246	0.005	−0.020	0.284
	(0.166)	(0.209)	(0.237)	(0.153)	(0.254)	(0.174)	(0.263)	(0.203)	(0.268)
Alone X Post Covid-19	−0.286**	−0.038	−0.159	−0.130	−0.335**	−0.064	−0.086	−0.256	−0.271
	(0.117)	(0.122)	(0.112)	(0.110)	(0.158)	(0.093)	(0.135)	(0.179)	(0.206)
Constant	4.949***	4.482***	4.578***	5.058***	4.700***	5.003***	4.616***	4.955***	4.736***
	(0.121)	(0.128)	(0.125)	(0.131)	(0.111)	(0.163)	(0.197)	(0.142)	(0.139)
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Episode controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	172,266	128,531	178,344	122,453	136,316	164,481	103,895	92,267	104,635
R-squared	0.646	0.611	0.642	0.620	0.659	0.617	0.639	0.644	0.624

Notes: The samples (UKTUS2015, CaDDi, ELiDDI) are restricted to working age employed individuals with complete data on key variables who worked the diary day. Robust standard errors, clustered at the individual level, in parentheses. *** significant at the 1%; ** significant at the 5%; * significant at the 10%.

Table B.6: Results at the individual level in detail

VARIABLES	Life satisfaction (all day alone)	Life satisfaction (12 hours alone)
Alone	−0.238	−0.018
	(0.232)	(0.120)
Alone X Lockdowns	0.214	−0.054
	(0.243)	(0.134)
Alone X Relaxation	−0.692**	−0.407*
	(0.342)	(0.208)
Alone X Post Covid-19	0.236	0.171
	(0.355)	(0.187)
Demographics		
Being male	0.014	0.015
	(0.078)	(0.078)
Age	−0.012	−0.014
	(0.040)	(0.040)
Secondary education	0.045	0.038
	(0.162)	(0.162)
University education	−0.033	−0.041
	(0.155)	(0.154)
Married/cohabiting	0.157	0.145
	(0.105)	(0.103)
UK citizen	0.246*	0.248*
	(0.128)	(0.128)
Family size	−0.004	−0.003
	(0.049)	(0.048)
# children	0.075	0.078
	(0.063)	(0.063)
Self-employed	−0.245*	−0.248*
	(0.140)	(0.140)
Time allocation effects		
Paid work time	0.000	0.001
	(0.000)	(0.000)
Leisure time	0.000	0.000
	(0.000)	(0.000)
Chores time	0.001	0.001
	(0.001)	(0.001)
Child care time	0.000	0.000
	(0.001)	(0.001)
Constant	1.729***	1.744***
	(0.429)	(0.420)
Earning effects	Yes	Yes
Family income effects	Yes	Yes
Occupation effects	Yes	Yes
Health effects	Yes	Yes
Day effects	Yes	Yes
Month effects	Yes	Yes
Observations	3,405	3,405
R-squared	0.221	0.220

Notes: The samples (UKTUS2015, CaDDi, ELiDDI) are restricted to working age employed individuals with complete data on key variables who worked the diary day. Robust standard errors, clustered at the individual level, in parentheses. *** significant at the 1%; ** significant at the 5%; * significant at the 10%.