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Is Too Much Time on the Internet Making us Less Satisfied with Life?

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Abstract

The Internet's profound impact on society, communication, and the global economy is undeniable. Despite the studies on Internet adoption and frequency of use, little attention has been given to the intensity of usage as measured by the time spent online. In highly developed countries like the European ones, bridging the access gap is nowadays less relevant, as almost everyone has Internet access. Instead, the focus should be on analysing usage intensity to uncover new digital disparities among different groups and understand potential impacts on individuals' subjective well-being (SWB).

This study aims to deeply examine Internet usage time, its socioeconomic determinants, and its effects on SWB using data from the European Social Survey (ESS) spanning from 2016 to 2020–22 in 21 European countries. We seek to answer two research questions: (1) How do individuals' characteristics influence Internet usage intensity? (2) What is the impact of Internet usage intensity on individuals' SWB?

Our findings show inequalities in Internet usage time driven by individuals' socioeconomic and sociodemographic characteristics. Traditionally disadvantaged groups, both offline and online, exhibit lower Internet usage time, consistent with the existing literature on the digital divide. As for the effect of intensity of Internet use on SWB, after accounting for individuals' characteristics and addressing Internet's endogeneity, we found a negative and significant relationship between Internet usage intensity and life satisfaction, especially for the most intensive internet users.

Keywords Well-being · Life satisfaction · Internet · Digital divide · Europe

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Introduction

Among the countless information and communication technologies (ICTs), the Internet emerges as a central and game-changing innovation that has left an incomparable mark on society, communication, and the worldwide economy. Since the initial diffusion of digital technologies, the Internet has had a central role and has become an essential part of everyone life. Indeed, the United Nations (2016) declared the importance of providing and expanding access to the Internet, since it is considered a catalyst for the enjoyment of human rights, most notably, the right to freedom of expression. Moreover, additionally to its inherent relevance, it has also served as the foundational infrastructure that enables the functioning and proliferation of various digital technologies, online applications and services.

Nevertheless, the expansion of the digital technologies in general, and of the Internet in particular, has not been uniform across the society but has experienced an uneven development. In this sense, the term digital divide was coined as early as the 1990s, to describe inequalities in the access and uptake of digital technologies (OECD, 2001). Differences in access were referred to as the first-level of the digital divide, which later on, gave rise to other types of divides, not in access or adoption, but in obtaining the necessary skills to effectively use digital technologies (the second-level of the digital divide) and the differences that emerge from the differential uses and outcomes according to users' proficiency (the third-level of the digital divide).

Since recent years and until now, the focus has been rather on the expected outcomes derived from the so-called digital transformation. Digital technologies play a crucial role in numerous aspects of daily life, such as education, communication, leisure, or work. As a result, there is a growing focus on exploring the potential consequences that may emerge as these technologies become more deeply integrated into people's life. Related to this, the analysis of the effects that digital technologies might have on people's well-being stands out, given that the ultimate effect of this integration of technologies in all aspects of daily life would be on well-being. As the (European Commission, 2023, p.24) states: "Putting people at the centre of the digital transformation of our societies and economies is at the core of the EU vision for the Digital Decade. The EU and its Member States have agreed to ensure digital technologies enhance the well-being and quality of life of all Europeans, respect their rights and freedoms, and promote democracy and equality".

In this context, the objective of this paper is to analyse in depth the time Europeans spent using the Internet, its socio-economic determinants and its effects on their subjective well-being (SWB). To achieve this, data from the European Social Survey (ESS) will be used, specifically from the three most recent available rounds (Rounds 8–10 covering the period 2016–2022) and encompassing 21 European countries. Two main research questions (RQ) are addressed: RQ1, how individuals' characteristics shape Internet usage intensity? And RQ2, which is the effect of the intensity/time of Internet use on individuals' SWB?

While there are studies that investigate the decision to use (or not) the Internet as well as the frequency of its use, little attention has been paid to the intensity of

its use, i.e. the time using it -some exceptions are Goldfarb & Prince, (2008); Nie & Erbring, (2001); Rosenberg et al., (2022). Nevertheless, nowadays, in countries with a high degree of development such as those in Europe, addressing the first digital divide (access and adoption) loses meaning, since practically the entire population has access to the Internet and uses it on almost a daily basis. On the contrary, an analysis of Internet usage intensity could shed some light, firstly, on the identification of new digital divides between different population groups and secondly, on the effects that different intensities (times) of Internet use might have on individuals SWB.

Likewise, and in relation to our second research question that tries to unravel the effect of Internet use on well-being, the evidence on this issue is doubly partial, firstly, because most of the studies are for specific groups of the population (i.e. elderly, adolescents, disabled) without taking into account the general population, and secondly, because many of them focus on a specific use of the Internet (such as social networks) and not on the general use of the Internet, and even less in the intensity of its use.

Moreover, most of studies do not take into consideration the endogeneity of Internet usage while it has been proved to be endogenous and strongly dependent on individuals' socio-demographic characteristics (Helsper, 2021). There are some exceptions such as Ali et al., (2020), Lu and Kandilov, (2021), Suárez Álvarez and Vicente, (2023) and Zheng et al., (2023), who do address endogeneity in their analysis, but show evidence for a single country. The present analysis will provide cross-country evidence for the European area and will address the effects of Internet usage on individuals' subjective levels of well-being by properly tackling the former variable as endogenous through the implemented modelling.

In this framework, our paper makes two important contributions to the literature. Firstly, we put on the spotlight the usage intensity or time of Internet usage as a key variable for understanding digital inequalities and their effects on well-being. Secondly, we carried out an analysis for the general population, obviously controlling for personal characteristics, which allows us to draw general conclusions.

Our findings demonstrate that, once online, individuals' socioeconomic background still matters to explain the intensity of Internet usage. Such results underscore the existence of disparities in Internet usage time, primarily influenced by the socio-economic and socio-demographic attributes of individuals. Additionally, we found a significant and negative relationship between Internet usage intensity and life satisfaction.

The remaining of the paper is structured as follows: Section "Literature Review" summarizes the literature, Section "Data & Methodology" describes the data and methodology, Section "Results" presents and discuss the results and finally, Section "Concluding Remarks" concludes.

Literature Review

Since the last decade of the twentieth century, as digital technologies, and especially the use of the Internet in society, began to spread, research on inequalities and the derived effects from the use of these technologies started to become centre of attention.

Initially, in the 1990s, this research focused on what is now known as the first-level of the digital divide, i.e., at that time Internet was only accessible for those who can afford it, and this generated a divide in access (Dewan & Riggins, 2005; Mehra et al., 2004; Newhagen & Bucy, 2004; Van Dijk, 2002).

Later on, at the beginning of the twenty-first century, studies on digital inequalities shifted from addressing the binary research question of whether individuals had Internet access or not, to focus of more complex inequalities that had emerged as the digital transition progressed, such as differences about how people use these technologies, digital skills and literacy, online engagement or access to information, i.e., the second-level of the digital divide (Büchi et al., 2016; Dimaggio et al., 2004; Goldfarb & Prince, 2008; Hargittai, 2002; Selwyn, 2004; Van Deursen & van Dijk, 2014).

Research on digital divides continues to evolve as digital technologies advance. In fact, there is yet another strand, the so-called third-level of the digital divide (van Deursen & Helsper, 2015, 2018; Wei et al., 2011) which put the focus on the outcomes and consequences of digital inequalities.

There are, indeed, a great number of works which try to identify the causes and outcomes of digital inequalities, suggesting that these gaps are mainly rooted in individuals' socio-economic backgrounds, which shape how digital technologies are integrated in their lives and in turn, would affect individuals' chances (Büchi, 2016, 2021; Büchi & Hargittai, 2022; Büchi et al., 2019; Helsper, 2021; Loos & Ivan, 2022; Lucendo-Monedero et al., 2019; OECD, 2021; Van Deursen et al., 2017; van Dijk, 2020; Watts, 2020).

Closely related to the studies on the third-level of the digital divide, a large branch of research focuses on analysing the effects of digital technologies on well-being. This line of research initiates with the early works of Kraut et al., (1998, 2002), and numerous studies were subsequently carried out. However, the literature on this topic has so far failed to find a general pattern of the effect of digital technologies, in general, and of Internet use, in particular, on well-being, with studies having found both positive, negative and non-significant effects (Aggarwal et al., 2020; Ali et al., 2020; Castellacci & Tveito, 2018; Hasan & Linger, 2016; Johannes et al., 2022; Lelkes, 2013; Lifshitz et al., 2018; Lohmann, 2015; Lu & Kandilov, 2021; Marciano et al., 2022; Nie & Erbring, 2001; Pénard et al., 2013; Sanders et al., 2000; Schemer et al., 2021; Sen et al., 2022; Suárez Álvarez & Vicente, 2023; Szabo et al., 2019; Valkenburg & Peter, 2009; Vas & Gombor, 2009; Zheng et al., 2023).

The lack of conclusive results is due to several factors. Firstly, different dimensions of well-being are considered and, in some cases, measured differently, which limits comparability. Secondly, the effect on well-being of various technologies is analysed: there are studies focusing on Internet use and others that focus on specific uses of the Internet. Thirdly, many studies refer to specific subpopulations (adolescents, the elderly, people with disabilities) and, in many cases, use samples drawn from small surveys that are not nationally representative. Finally, the methodology implemented in these studies does not consider the endogenous nature of Internet about which the literature on the digital divide provides plenty of evidence (Helsper, 2021). Some of the recent and few exceptions which address endogeneity are: Ali

et al., (2020); Lu and Kandilov, (2021); Suárez Álvarez and Vicente, (2023); and Zheng et al., (2023).

In this line, the present analysis aims to bring together research on the digital divide and that on the effects of the Internet on well-being by properly addressing the endogeneity of the former and using representative country-level data for a set of 21 European countries.

Data & Methodology

The Data

The present analysis relies on data from the European Social Survey (ESS). The ESS is a very comprehensive database that contains microdata for a great number of European countries, provides weights to make the data country-level representative, and has a wide range of variables, including socio-demographic and socio-economic features and measures of individuals' levels of subjective well-being and internet usage. The survey is conducted every two years. This analysis will focus on the last three rounds available, rounds 8, 9 and 10 which correspond to years 2016, 2018 and 2020,[1] respectively, since they include data on Internet usage intensity, which will be a key variable in the analysis. 21 European countries are analysed: Austria, Belgium, Czech Republic, Germany, Greece, Spain, Finland, France, United Kingdom, Hungary, Ireland, Iceland, Switzerland, Italy, Lithuania, the Netherlands, Norway, Poland, Portugal, Sweden and Slovenia.[2]

Table 1 shows the variables included in the analysis as well as their definition and main statistics (average and standard deviation) by round. The main variables of interest in our analysis are: *Life satisfaction*, which is our reference variable on subjective well-being, and *Internet time* which considered individuals' Internet use time, in minutes.

In addition to these two key variables, we include other variables that will be used as explanatory variables in our analysis of both Internet use and well-being. As can be seen in Table 1, these are the variables commonly used as explanatory variables in both the literature on well-being (*Age, Female, Employed, Retired Partner, Bad health, Hampered, Meetings, Discuss, Domicile, Rural, HH Income, Education, Occupation, Politics, Religious, Institutional trust*) and the literature on digital divide (*Age, Employed, retired, Occupation, HH income, Meetings, Discuss*).

All the variables presented in Table 1 have been collected from the ESS, with the exception of the variable *Speed*, which is the average Internet download speed in megabits per second (Mbps) at regional level and which data has been retrieved

[1] It is worth mentioning that due to the COVID-19 pandemic, the date of Round 10 survey ranges between 2020 and 2022 depending on the country. Additionally, some countries instead of conducting a face-to-face questionnaire, switched to self-completion mode. Such was the case of Austria, Germany, Spain, Poland, Lithuania and Sweden.

[2] The ESS covers more countries than those analyzed, but in order to have a more homogeneous sample we have restricted the analysis to those countries for which data are available in all three rounds.

Table 1 Description of the variables and main statistics

	Description	Round 8		Round 9		Round 10	
		Mean	SD	Mean	SD	Mean	SD
Life satisfaction	Respondents' self-reported level of life satisfaction in a scale from 0 extremely dissatisfied to 10 extremely satisfied	7.45	1.85	7.51	1.83	7.38	2.01
Internet time	Use in minutes on a typical day (in minutes)	192.13	169.43	199.77	171.17	248.52	198.97
$TimeQ3_i^+$	= 1, if respondent's time spent on the Internet is over the third quartile of the distribution (0 otherwise)						
Speed	Average download speed in megabit per second (Mbps) from EDJNet	93.65	31.58	93.45	32.28	88.08	28.17
Female	= 1, if respondent is female (0 otherwise)	0.51	0.50	0.52	0.50	0.52	0.50
Employed	= 1, if respondent is employed at the time of interview (0 otherwise)	0.71	0.46	0.70	0.46	0.69	0.46
Retired	= 1, if respondent is retired (0 otherwise)	0.15	0.35	0.17	0.37	0.19	0.39
Age	Respondents' age	45.04	15.51	46.56	15.90	47.98	16.37
Partner	= 1, if respondent lives with a partner (0 otherwise)	0.64	0.48	0.64	0.48	0.65	0.48
Meetings	Respondents' self-reported frequency of social meetings with friends, relatives or colleagues, from 1 never to 7 every day	5.03	1.42	4.99	1.43	4.79	1.46
Discuss	Respondents' self-reported number of people with whom they can discuss intimate and personal matters, from 0 none to 6, 10 or more	3.07	1.36	3.08	1.39	3.05	1.36
Bad health	= 1, if respondent reports having a bad or very bad health status (0 otherwise)	0.24	0.43	0.25	0.43	0.28	0.45
Hampered	= 1, if respondent reports being hampered in daily activities by an illness, disability, infirmity, or mental health problem (0 otherwise)	0.20	0.40	0.21	0.41	0.26	0.44
Domicile	Respondents' self-reported place of residence in five categories:						
1	A big city	0.20	0.40	0.20	0.40	0.20	0.40
2	Suburbs or outskirts of a big city	0.12	0.33	0.13	0.34	0.13	0.34
3	Town or small city	0.32	0.47	0.32	0.47	0.32	0.47
4	Country village	0.29	0.45	0.29	0.45	0.29	0.45
5	Farm or home in countryside	0.07	0.25	0.06	0.24	0.06	0.23
Rural	= 1, if respondent reports living in a country village or countryside, i.e., Domicile is > 3 (0 otherwise)	0.36	0.48	0.35	0.48	0.35	0.48

Table 1 (continued)

	Description	Round 8		Round 9		Round 10	
		Mean	SD	Mean	SD	Mean	SD
HH Income	Respondents' self-reported feelings about household income in four categories						
1	Living comfortably with present income	0.41	0.49	0.41	0.49	0.44	0.50
2	Coping on present income	0.46	0.50	0.45	0.50	0.44	0.50
3	Difficult on present income	0.11	0.31	0.12	0.32	0.10	0.30
4	Very difficult on present income	0.03	0.16	0.03	0.16	0.02	0.15
Education	Respondents' level of education according to ISCED categories in a scale from 1, less than lower secondary to 7, higher tertiary education	4.48	1.73	4.52	1.74	4.67	1.73
Tertiary	= 1, if respondent's level of education is tertiary or higher (0 otherwise)	0.32	0.47	0.33	0.47	0.36	0.48
Occupation	Respondents' level of qualification in occupation by ISCO codes in three categories						
Low	ISCO groups 0 and 9	0.07	0.25	0.07	0.26	0.06	0.24
Medium	ISCO groups 4–8	0.44	0.50	0.43	0.50	0.40	0.49
High	ISCO groups 1–3	0.49	0.50	0.50	0.50	0.54	0.50
Politics	Respondents' self-reported position in politics from 0 left to 10 right	5.10	2.13	5.03	2.12	4.93	2.30
Religious	Respondents' self-reported religiosity from 0 not at all religious to 10 very religious	4.09	3.07	4.00	3.08	3.82	3.06
Institutional trust	Index of respondents' self-reported institutional trust in 3 dimensions: the legal system, the police & politicians. From 0 to 30	16.28	5.92	16.78	5.87	16.53	6.15

from the European Data Journalist Netowrk (EDJNet, 2023), and were provided by the Ookla Global Fixed and Mobile Network Performance Maps Speedtest.

As can be seen in Table 1, in average terms, *Life Satisfaction* experiences a slight reduction from Round 8 to Round 10, while there is an increase in *Internet time* from Round 8 (2016) to Round 10 (2020–22). The increase in the time spent using the Internet could be explained by both the growing importance of digital technologies and the COVID-19 pandemic that moved many of daily activities to the online environment. Likewise, the pandemic might be the main factor behind the lower levels of well-being observed for Round 10 data.

Methodology

To answer the two research questions stated in this paper two complementary methodological approaches are used. Specifically, the first research question, *how individuals' characteristics shape Internet usage intensity?*, is addressed by means of a descriptive approach to see whether Internet usage time patterns change depending on individuals' characteristics and how. Then, cumulative distribution functions (CDFs) of time usage are plotted by the categories of the socio-economic and socio-demographic features considered. In addition, the sample has been split by the quartiles of the distribution of Internet time and the means values of individuals' characteristics have been computed for those who below the first quartile of the distribution (25%) and those above the third quartile (75%). The comparison of these means will allow to see what characterises individuals who use the Internet a little versus those who use it a lot.

To answer the second research question, and thus analyse the effect of Internet usage intensity on Life Satisfaction, some econometric modelling is proposed. Particularly, a system of two equations is considered, with one equation to explain what shapes the amount of time people spend online and the other equation to assess the effect of such time on individuals' levels of life satisfaction. Two sets of systems are specified as follows:

Model A

$$\begin{cases} Internet\ time_i = \alpha_{11} + \beta Controls_i + \delta Speed_i + \gamma CountryD_i + \mu RoundD_i + \varepsilon_{1i} (1) \\ Satlife_i = \alpha_{21} + \alpha_{22} Internet\ time_i + \eta Controls_i + \lambda CountryD_i + \phi RoundD_i + \varepsilon_{2i} (2) \end{cases}$$

Model B

$$\begin{cases} TimeQ3_i^+ > Q3_i = \alpha_{31} + \beta Controls_i + \delta Speed_i + \gamma CountryD_i + \mu RoundD_i + \varepsilon_{3i} (3) \\ Satlife_i = \alpha_{41} + \alpha_{42} TimeQ3_i^+ + \eta Controls_i + \lambda CountryD_i + \phi RoundD_i + \varepsilon_{4i} (4) \end{cases}$$

The difference between Models a and b relies on the variable that measures the time spent on the Internet. In Model a, *Internet time* is a quantitative variable, then, the coefficient α_{22} will assess the effect on life satisfaction of using Internet an extra

minute; whilst in Model b, the variable $TimeQ3_i^+$ is dichotomous and takes value one for those individuals whose Internet use is on the top 25% of the distribution, implying that they use the Internet on average more than 300 min or 5 h per day. Hence, the coefficient α_{42} will capture the effect of using Internet very intensively compared to moderate levels of usage on life satisfaction.

Equations (1) and (3) deal with the endogeneity of the time spent on the Internet -in Models A and B, respectively- by including control variables that are determinants of this usage time as well as some dummies to capture time (rounds) and cross-country potential variation. Additionally, the variable *Speed* is included; this variable is highly correlated with Internet use in general, and especially with the amount of time people spend on it, since the faster the connection, the more people are likely to use it and the more time they will spend.

To estimate these two-equation models, the CMP process introduced by Roodman (2011) is used, in particular, the models would be estimated recursively using a limited-information maxium likelihood (LIML) estimator.[3] CMP proves being useful for estimating multi-equation systems that involve recursive process and address endogeneity concerns. Some recent research (Zheng & Ma, 2022) uses it to address endogeneity using an instrumental variable model involving two SUR equations. Moreover, CMP has been applied in recent research papers on well-being (Bimonte et al., 2020; Castellacci & Schwabe, 2020; Huang et al., 2022; Schwabe & Castellacci, 2020; Zheng & Ma, 2022).

Results

How Individuals' Characteristics Shape Internet Usage Intensity?

Figures 1, 2, 3 and 4 show the differences in the cumulative distribution of *Internet time* (in minutes) in relation to the different variables that characterise individuals.

Figure 1 suggests the existence of large differences in Internet usage time by place of residence (with individuals living in less populated places using Internet less time than those in urban areas) and even more differences by age, with the older the person is, the less time they use the internet. In terms of gender and whether individuals are disabled or not, there are hardly any differences in the CDFs.

Figure 2 shows that for health status there is barely any difference in usage, but retired individuals, the unemployed and those living with a partner tend to use the Internet less time.

Figure 3 indicates the existence of differences in the time spent using the Internet by educational level (the lower the educational level the less time spent using the Internet), by occupation qualification level (individuals working in high-skilled occupations spent more time using the Internet than the rest) and by household income; in this latter case, though differences seem to be quite small, it appears that households that report having difficulties to meets ends use the Internet less time.

[3] In our estimations standard errors will be clustered at country level.

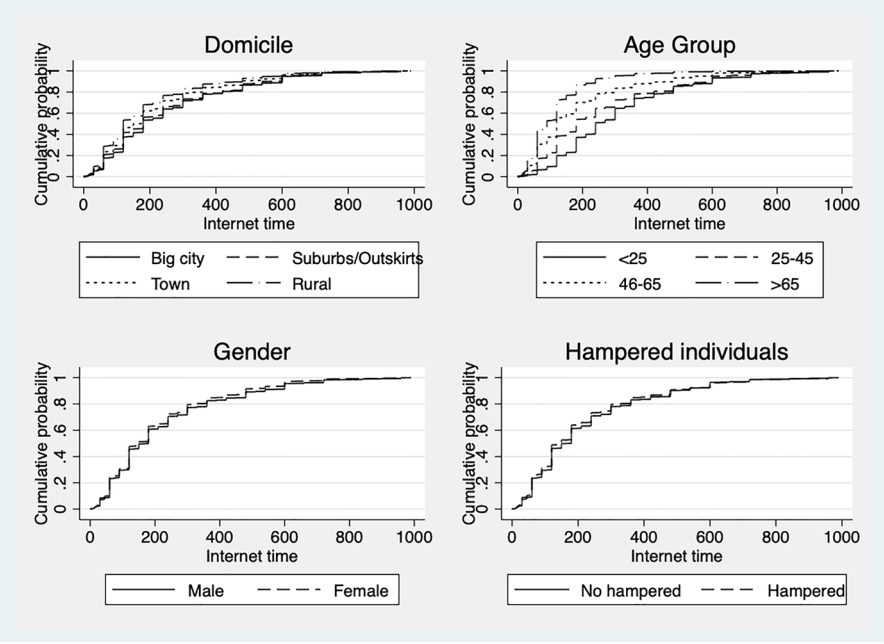

Fig. 1 CDFs for Internet time (minutes) by individuals' domicile, age group, gender, and hampered status

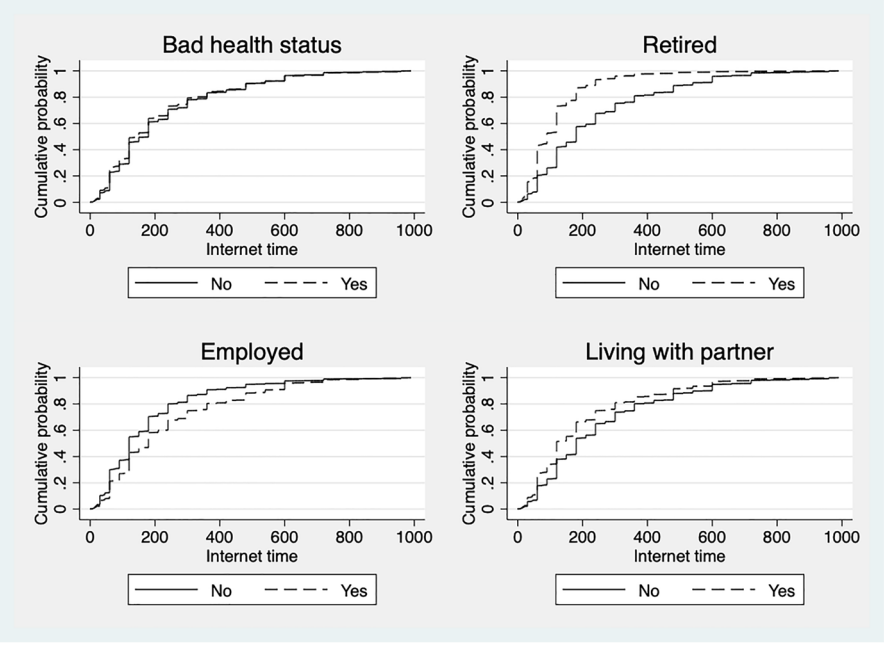

Fig. 2 CDFs for Internet time (minutes) by individuals' health, retired and employment status as whether individuals live with a partner

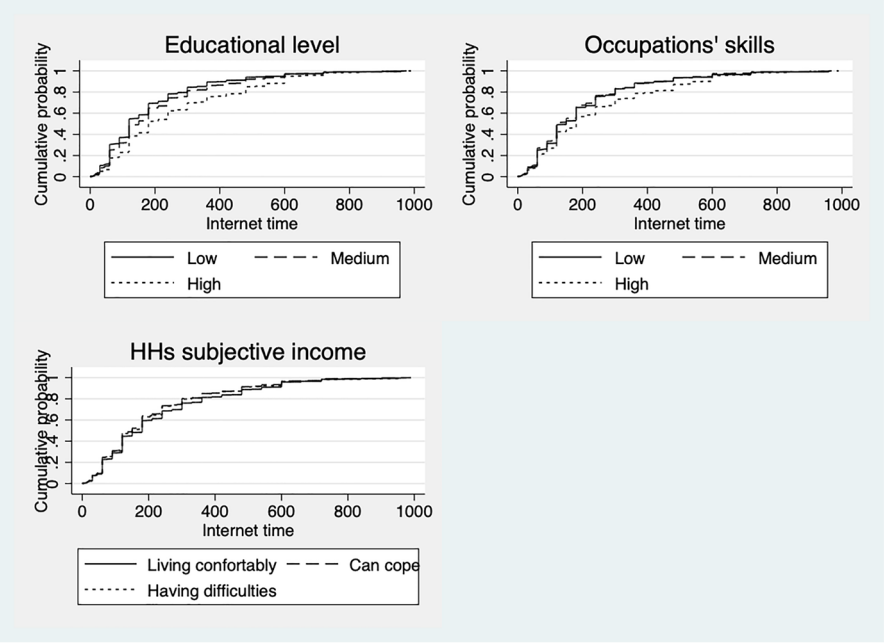

Fig. 3 CDFs for Internet time (minutes) by individuals' educational level, occupations' skills and HH subjective income. *Notes: Educational level is divided into three categories according to ISCCED categories (Categories from 1–2 are included into the low category, from 3–5 into the medium category and 6–7 in the high category*

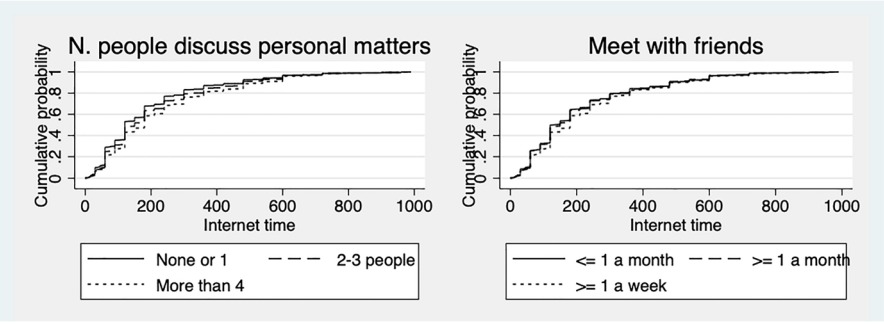

Fig. 4 CDFs for Internet time (minutes) by individuals' social life variables (*Discuss* and *Meetings*)

Finally, Fig. 4 also shows some differences in the time spent on the Internet as regards people's social interactions: in particular, it seems that those who have less social interactions also use the Internet less time.

Table 2 Mean values by quartiles of *Internet time*

Variables	Below Q1 (< 90 min.)	Above Q3 (> 300 min.)
Life satisfaction	7.51	7.41
Internet time (minutes)	56.18	517.25
Female	0.52	0.50
Age	53.29	39.71
Partner	0.71	0.59
Meetings	4.82	5.05
Discuss	2.95	3.26
Bad Health	0.29	0.23
Hampered	0.25	0.21
Rural	0.43	0.27
Living comfortably with HH income	0.40	0.48
Tertiary	0.26	0.47
Employed	0.61	0.82
Retired	0.29	0.03
High skill occupation	0.45	0.64

Differences between mean values are always statistically significant at 1% level.

To complement this descriptive analysis, Table 2 shows the mean values of individuals' characteristics when the time they spent on the Internet is below(over) the first(third) quartile of the total distribution of Internet usage time, implying that they use the Internet less than 90 min per day or more than 300 min per day, respectively. The descriptive statistics provided in Table 2 are consistent with the CDFs figures, showing significant differences in the mean values of the variables between those using the Internet a little versus those who spent a lot of time online. More specifically, the mean age and the percentages of individuals living with a partner, of retired people, and of individuals living in rural areas are higher among those who use the Internet less, while the educational level, the average levels of social life, and the percentage of workers are higher among those who use the Internet more.

In short, these results seem to suggest that inequalities in Internet usage time are closely related to the socio-economic and socio-demographic characteristics of individuals. In fact, those groups of population, that have been traditionally disadvantaged both offline and online, show comparatively less Internet usage time compared to the advantaged, which is in line with the literature on the digital divides (Büchi, 2021; Büchi & Hargittai, 2022; Büchi et al., 2016; Helsper, 2012, 2021). Therefore, even once online, the divides are shaped by people's socio-economic background.

Which is the effect of Internet usage intensity on individuals' SWB (life satisfaction)?

Some first ideas on the relationship between the intensity of Internet usage and individuals' self-reported levels of life satisfaction can be gathered from Fig. 5, which

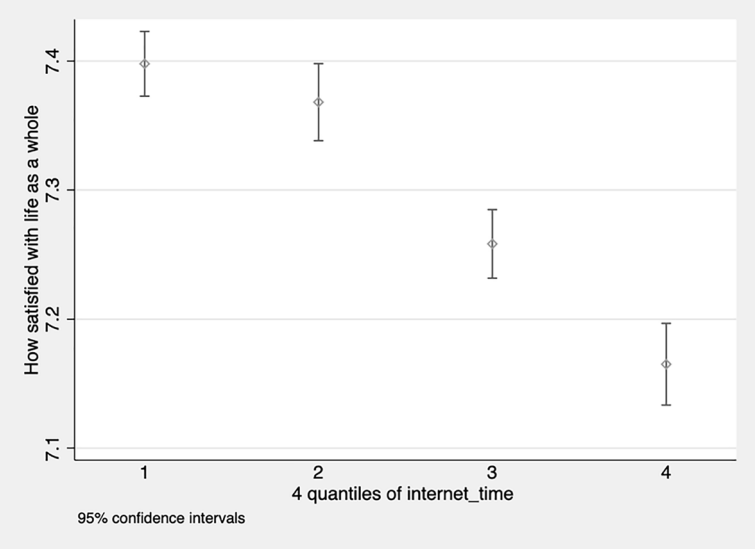

Fig. 5 Average life satisfaction levels by quartile of Internet time

suggests the existence of some inverse link as, on average, the levels of life satisfaction are higher for those individuals who use the Internet less intensively, i.e., during less time.

Tables 3 and 4 present the results of the estimation of the econometric models when the time spent on the Internet is specified as a continuous variable (Model A) and when it is defined by a binary variable that indicates whether the user is on the 25% top of the time distribution (Model B), respectively. The main differences between the results of the two models lie mainly in the interpretation of the effect on life satisfaction of the time spent on the Internet.

Estimates from Model A (Table 3) indicate that individuals' self-reported levels of life satisfaction tend to decrease as the time on the Internet increases. At first glance, it may appear that the effect of Internet usage time is very small, however, the coefficient would indicate that, in average terms, an increase in Internet usage time of 100 extra minutes would be associated with more than half a point less on the SWB variable, life satisfaction.

Model B looks at the differential in life satisfaction between those individuals who use the Internet very intensively and, hence, could be considered excessive, i.e., those on the top 25% of the distribution, and the rest of the people. In this case, the sign of the coefficient of the time variable and its significance level coincide with estimates in Model A; however, the value of the coefficient is much higher in absolute terms. This implies that compared to individuals who use the Internet less, those individuals whose use is on the top 25% (i.e., above the third quartile of the distribution of Internet time), experience significantly lower levels of life satisfaction. Specifically, intensive Internet users exhibit a level of life satisfaction around 1.7 points lower than the rest of Internet users.

Table 3 Results of the modelling of the relationship between the intensity of Internet use (time, in minutes) and life satisfaction

	Satlife	Internet time
Internet time	-0.0066*	
Bad health	-0.5716***	
Hampered	-0.2524***	
Partner	0.4858***	
Rural	-0.0752	-27.3222***
Female	0.0518	
Age	-0.0586***	-3.5575***
Age^2	0.0004***	
Employed	0.2767***	14.3442***
Retired	0.2345***	-11.3323
High skill occupation	0.3070*	42.0501***
Hincfel: Living comfortably	*Reference category*	
Hincfel: Coping on present income	-0.5881***	-4.1337
Hincfel: Difficult on present income	-1.2837***	13.1477**
Hincfel: Very difficult on present income	-2.3613***	6.7090
Education	0.0302	7.9130***
Instrust	0.0622***	
Religion	0.0170***	
Politics	0.0502***	
Meetings	0.1442***	0.9551
Discuss	0.0826***	-0.9473
Speed		0.2202*
Round 8	-0.3312	-72.5155***
Round 9	-0.2465	-59.3333***
Round 10	*Reference category*	
Country dummies	*Yes*	*Yes*
Constant	8.4327***	325.0315***
Observations	70,963	70,963

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

As for the rest of the variables included in the analysis, they appear to have the expected signs. On the one side, with regard to the coefficients of the regressors in Eqs. (1) and (3), their signs are consistent with the analysis previously conducted to answer our first research question. Looking at the coefficients, it can be seen that those variables that have the greatest impact on reducing the time spent using the Internet are being retired and living in a rural area, and those that, on the contrary, have the most positive impact on Internet usage intensity are working in a highly skilled occupation and having a high level of education. Estimates also show that Internet usage time has been increasing significantly from 2016.

Table 4 Results of the modelling of the relationship between an intensive use of Internet (time above Q3) and life satisfaction

	Satlife	Internet time > Q3
Internet time > Q3	-1.7068***	
Badhealth	-0.5665***	
Hampered	-0.2588***	
Partner	0.4937***	
Rural	0.0323	-0.1613***
Female	0.0558	
Age	-0.0485***	-0.0206***
Age^2	0.0004***	
Employed	0.2561***	0.1438***
Retired	0.2511***	-0.4002***
High skill occupation	0.1734***	0.3073***
Hincfel: Living comfortably	*Reference category*	
Hincfel: Coping on present income	-0.5732***	-0.0402**
Hincfel: Difficult on present income	-1.3251***	0.0720
Hincfel: Very difficult on present income	-2.3753***	0.0188
Education	0.0033	0.0586***
Instrust	0.0617***	
Religion	0.0167***	
Politics	0.0486***	
Meetings	0.1397***	0.0067
Discuss	0.0842***	-0.0146
Speed		0.0021**
Round 8	-0.0782	-0.4574***
Round 9	-0.0407	-0.3764***
Round 10	*Reference category*	
Country dummies	*Yes*	*Yes*
Constant	6.9439***	-0.3716**
Observations	70,963	70,963

*** p < 0.01, ** p < 0.05, * p < 0.1

On the other side, with respect to the sign of the coefficients of the regressors included in the life satisfaction equations, Eqs. (2) and (4), results are in line with those of the literature on SWB. The relationship between age and life satisfaction follows a U-shape pattern, (Blanchflower, 2021; Blanchflower & Oswald, 2008; Gwozdz & Sousa-Poza, 2010; López-Ulloa et al., 2013); those living with a partner tend to report higher levels of life satisfaction (Zimmermann & Easterlin, 2006), while economic and financial difficulties lower such levels (Cummins, 2000; Diego-Rosell et al., 2018; Moro-Egido et al., 2022); retired individuals appear to show higher levels of life satisfaction (Atalay & Barrett, 2022) as well as those employed (Paul & Moser, 2009). Additionally, individuals with higher levels of

institutional trust (Bittmann, 2022), religiosity beliefs (Jackson & Bergeman, 2011) and on a right-wing ideology (Napier & Jost, 2008) tend to report higher levels of life satisfaction.

Overall, results highlight that, while Internet access is usually claim to be positive for individuals' well-being and for some specific groups of population such as the elderly (Aggarwal et al., 2020; Hasan & Linger, 2016; Lu & Kandilov, 2021; Sen et al., 2022; Szabo et al., 2019), the intensity of its use and, specifically, using it for too long, ends up having negative effects in terms of SWB.

Concluding Remarks

The analyses performed in this paper have allowed us to obtain robust and consistent results for the European population on the distribution of Internet usage time and its association with European citizens' subjective well-being, as measured by their reported levels of life satisfaction, by using a large representative sample of more than 70,000 observations and controlling for the endogeneity of Internet usage.

Our findings reveal that the same socio-economic variables that shape the first and second digital divides are the primary factors influencing Internet usage intensity. In summary, these results highlight the presence of disparities in Internet usage time, stemming from the socio-economic and socio-demographic attributes of individuals. Specifically, socio-demographic groups traditionally disadvantaged in both offline and online contexts exhibit reduced Internet usage time, aligning with existing literature on the digital divides.

As for the potential effect of the intensity of Internet use on people' SWB, two models with two-equations have been proposed, which address the endogeneity of Internet use and control for individuals' characteristics. Additionally, to better understand such effects, we distinguish between the effect of using the Internet for an additional minute and that associated with an excessive Internet use, defined as being on the top 25% of those who spend more time on it.

In this sense, our results show some interesting findings. Firstly, results show that Internet usage time is statistically significant and hold a negative relationship with individuals' levels of life satisfaction. Hence, increasing Internet usage would imply on average a significant reduction on individuals' levels of SWB. Secondly, when people with an excessive use of the Internet (more than 300 min per day, in other words) are compared to the rest of Internet users, the size of the estimate is much larger, which indicates that top 25% Internet users exhibit, on average significantly lower levels of SWB.

As for the remaining variables included in the models, their coefficients exhibit the expected signs and therefore the analysis provides further evidence and corroborates findings from the literature on SWB.

Some academic and policy implications can be drawn from the results. From an academic perspective, it is crucial to connect the research on the digital divide with the well-being literature to gain a more comprehensive understanding of the Internet's significance in terms of its distribution and its impact on overall well-being. Regarding policy implications, considering that our findings indicate that

excessive Internet usage can detrimentally affect individuals' subjective well-being, it becomes imperative to implement measures that promote responsible utilization of this crucial tool. Ensuring that the Internet is integrated into our lives in a manner that enhances well-being should be a priority.

As regards the potential limitations in our research, it is worth noting that we have not differentiated between the various purposes for which the Internet is used. While it would be indeed insightful to discern these different uses and identify distinct patterns of individual behavior, the data at our disposal do not permit such differentiation.

Nevertheless, we do not believe that this diminishes the validity of our findings, which primarily centre on the intensity of Internet use regardless of its purpose. Moreover, by controlling for individuals' personal characteristics, we indirectly address the diversity of Internet usage to a significant extent, as variations in usage patterns often correlate with the social group individuals belong to, which are ultimately closely linked to their socio-economic and socio-demographic characteristics.

Finally, another limitation of our analysis is that we only consider the effect of the time spent using the Internet on life satisfaction and we do not take into account the existence of a possible reverse causality, that is, the effect that life satisfaction may have on time spent using the Internet. Indeed, there is some research that shows that individuals' levels of well-being or personal traits might influence individuals' Internet and digital technologies usages (Papacharissi & Rubin, 2000; Perugini & Solano, 2021). Consequently, we believe that it is of great importance to develop future lines of research that explore this inverse relationship between well-being and Internet use as well as to explore a bidirectional relationship between both factors.

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Data Availability The datasets used in the present study were derived from the public domain resource: https://www.europeansocialsurvey.org. The do files that allow to replicate the analysis done are available at the website of the project E-WELLBEING (https://sites.google.com/view/ewellbeing). And at Harvard Dataverse (https://doi.org/10.7910/DVN/H4JKDI).

Declarations

Ethics Approval This research uses microdata from the European Social Survey (ESS) as a secondary data source. The ESS Research Infrastructure Consortium subscribes to the Declaration on Professional Ethics of the International Statistical Institute. https://www.europeansocialsurvey.org/about/ethics.html

Informed Consent Participants in the ESS provided consent. The ESS Research Infrastructure Consortium guarantees that all the information is treated with strict confidentiality and in accordance with EU's General Data Protection Regulation (GDPR) and national data protection laws. https://www.europeansocialsurvey.org/about/privacy.html

Conflict of Interest The authors have no relevant financial or non-financial interests to disclose.

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