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Going “beyond the GDP” in the digital economy: exploring the relationship between internet use and well-being in Spain

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In recent years, as Internet use has become more widespread, the use of “beyond-GDP” measures have become increasingly important, bringing well-being analysis into a more prominent position within scientific research topics. At the same time, our society is going through a deep process of digital transformation, which is characterized by important digital inequalities, mainly rooted in traditional socio-economic divides between and within population groups. The aim of this paper is to explore the relationship between internet use and individuals’ perceived levels of well-being. Five dimensions of well-being are studied: happiness, life satisfaction, social meetings, personal connections and social life participation. The modelling strategy consists of a set of three-simultaneous equations, in which the first one explains individuals’ internet use; the second one, the intensity of usage (measured by the time spent on the internet) and the third one, focuses on the impact of such intensity on well-being. To estimate such models microdata from two rounds (2016 and 2018) of the European Social Survey (ESS) are collected for Spain. Results show that the effect of internet usage depends on the dimension of well-being considered, being negative for happiness, life satisfaction and meetings but positive as regards connections and participation. Furthermore, the relationship between individuals’ well-being and internet use depends, to a large extent, on the socio-economic and socio-demographic characteristics of the individuals.

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Introduction

From the beginning of the diffusion of information and communication technologies (ICT) - more commonly known now as digital technologies- in the second half of the 1990s, it soon became clear that the uptake of these technologies was taking place very unevenly, both between countries and within them, across the different population groups.

As ICT became more widespread, attention moved beyond access towards the analysis of how these technologies were being used, whether (or not) people had enough skills to deal with the online environment and to what extent new divides emerged in the uses, skills... (van Deursen and van Dijk 2014).

Nowadays, in the midst of the so-called digital transformation, with these technologies having acquired an essential role in many daily activities (communication, leisure, work, education, citizen-government contacts, etc.), the focus of attention is on the outcomes that may result from their integration in individuals' lives. As stated by the European Commission 2030 Policy Programme "Path to the Digital Decade" (European Commission 2021), the main target of the digital transition goes "beyond the GDP" (Stiglitz et al. 2009) and focuses on the improvement of societal well-being.

The relevance of well-being and digital technologies have stimulated multiple academic contributions from various fields of knowledge such as economics and management, sociology or psychology, among others. On the one hand, the literature on well-being has focused on identifying the factors that shape well-being and happiness at individual level. Perceived levels of well-being reflect personal characteristics, subjective and objective circumstances as well as contextual ones (Akay et al. 2017; de Pedraza et al. 2020; Kahneman and Sugden 2005; Tella et al. 2001). Major events in life (divorce, the loss of some family member) and economic shocks (job loss, changes in household income) affect individuals' well-being (Cummins 2000; Diego-Rosell et al. 2018; Lucas and Donnellan 2007; Moro-Egido et al. 2022). On the other hand, the diffusion of ICT has gone along with increasing academic efforts to understand the patterns of use. Overall, research has shown that ICT adoption is clearly shaped by individuals' socioeconomic features (income, age, gender, education, occupation, habitat) (Helsper 2021; Loos and Ivan 2022; van Dijk 2020; Watts 2020).

Additionally, more and more attention is being paid to the concept of digital inequalities, those referring to the systematic differences in people's socioeconomic background that condition the integration of digital technologies in their lives and, might consequently, restrict their life chances (Büchi and Hargittai 2022; Helsper 2021). Chances, which, at the same time, are also shaped to a great extent by that socioeconomic background (Büchi 2021).

In this context, the aim of this paper is to disentangle the existing relationship between internet use and individuals' well-being. Empirical evidence will be provided for Spain, using microdata from two rounds (2016 and 2018) of the European Social Survey (ESS). Our paper makes the following contributions to the literature. First, our modelling strategy explicitly considers that internet use is molded by the systematic socioeconomic differences between individuals, while previous analyses have neglected the fact that whether (or not) some individual uses some technology and how he/she uses it is shaped by his/her socioeconomic background. Our modelling strategy consists of a set of three-simultaneous equations, in which the first one explains the use of internet; the second one, the intensity of this usage (measured by the time spent on the internet) and the third one, focuses on the impact of such intensity on well-being. Second, and given the multidimensionality of the concept of well-being, we consider a wide range of measures of it, specifically, happiness, life satisfaction, social meetings, personal connections

and social life participation. Previous literature has mostly focused on a single dimension. Finally, we paid attention to three particular groups of population which are of special attention for European authorities in the path of the digital transition, those being, the eldest, women and people with some disability. Usually, each of these groups are analyzed separately. With our approach we attempt to provide a more complete vision of internet use within the population and its potential extension to differences in well-being.

The remaining of the paper is structured as follows: section 2 presents the literature review; section 3 describes the data and the empirical approach; then, section 4 summarises the results and finally section 5 shows some concluding remarks.

Literature review

The diffusion of digital technologies has gone along with scholarly efforts to unveil and understand its patterns. In the very beginning, special attention was paid to identify whether it was taking place evenly or unevenly across countries and the different groups of population. Research consistently showed that some particular groups of population were systematically lagging behind (OECD 2001). More specifically, people with lower levels of income and education, the eldest, women, people unemployed, those living in rural areas or suffering from some disability were much less likely to use these technologies than those with higher levels of income and education, youngsters, men, people working or living in urban areas and without any disability. Although such gaps were expected to disappear over the time, the existence of important differences in the access and use of digital technologies became clear during the pandemic and point out that digital inequalities were an issue far from being solved (Goldfarb and Prince 2008; Loos and Ivan 2022; Lucendo-Monedero et al. 2019; OECD 2021; van Deursen et al. 2017; van Dijk 2020; Watts 2020). Furthermore, these inequalities might constraint people's life chances as digital technologies are increasingly major elements for the different facets of individuals' daily lives (education, work, shopping, personal relationships, and so on and so forth).

The early work by (Kraut et al. 1998) was one of the first papers to explore how the use of these technologies could shape individuals' well-being. Two competing hypotheses were stated. On the one hand, the enhancement hypothesis specified some positive effects of the internet through reinforcing people's offline relationships and social capital. On the other hand, the displacement hypothesis suggested some negative impacts of the internet as people substituted offline activities, that usually required some socialization, for the internet that allowed them to carry them out alone and independently at home, possibly fostering individuals' isolation. At that early time, their results showed that the internet had a negative effect on individuals' well-being. However, some years later, these same authors observed that most of this negative effect had disappeared (Kraut et al. 2002).

From these early works, subsequent studies have found no conclusive association between digital technologies and well-being, reporting either positive, negative or non-significant links (Aggarwal et al. 2020; Ali et al. 2020; Beneito-Montagut et al. 2018; Castellacci and Tveito, 2018; Gaia et al. 2021; Hasan and Linger, 2016; Johannes et al. 2022; Kavetsos and Koutroumpis, 2011; Lelkes, 2013; Lifshitz et al. 2018; Lohmann, 2015; Lu and Kandilov, 2021; McDool et al. 2021; Nie et al. 2017; Orben et al. 2022; Pénard et al. 2013; Schmiedeberg and Schröder, 2017; Sen et al. 2022; Silva et al. 2022; Stockwell et al. 2021; Szabo et al. 2019; Vas and Gombor, 2009). Among the most recent studies, two of them find no statistically significant effect of digital

technologies on individuals' well-being (Johannes et al. 2022; Orben et al. 2022), while other two report a positive impact in reducing elder's social isolation (Sen et al. 2022; Silva et al. 2022).

The inconsistencies observed could be attributable to several factors. First, different dimensions of well-being are considered, from life satisfaction to social participation through happiness, mental health and quality of life. Second, several technologies are analyzed, from the use of internet, in general, to specific online services and applications (such as social media), through the ownership of devices. Third, there are also differences in the reference populations considered: some studies draw random samples representative of the full population and study the relationship between digital technologies and well-being; meanwhile, other works have specifically focused on certain groups of population (e.g. teenagers, the elderly, widows...) either by drawing random samples representative of these particular groups or carrying out qualitative studies on convenience samples. Experimental or quasi-experimental studies are comparatively few, with (Allcott et al. 2020) reporting 13 (including theirs) randomized impact evaluations of the particular case of Facebook. These authors, who have carried out the largest impact evaluation till now, find that the deactivation from Facebook for some time leads to increases in offline socializing activities and individuals' subjective well-being as measured by the levels of happiness and life satisfaction.

In addition to the inconsistencies noted above, the major drawback of this stream of empirical studies is that, with the exception of Ali et al. (2020), the use of digital technologies is considered to be exogenous. Such a fact contradicts all the literature on digital inequalities and ICT diffusion which provides plenty of evidence on the fact that individuals' use is deeply rooted in their socioeconomic characteristics (Helsper, 2021), which at the same time, shape people's well-being.¹

The present paper tries to overcome such a drawback by explicitly considering the socioeconomic origin of the use of the internet; and once, controlled for this, we study their influence of well-being.

Empirical approach

Description of data. To perform the analyses, we use microdata for Spain, retrieved from the European Social Survey (ESS). More precisely, we use data from Rounds 8 and 9 of this survey, which corresponds to years 2016 and 2018, respectively, with a sample of 3614 observations. The choice of the ESS survey to perform our analysis is due to the wide variety of variables available, within which we can distinguish three key types as shown in Table 1.

Firstly, the survey includes five questions that allows us to assess individuals' subjective levels of well-being (SWB) in several dimensions. From this set of questions we can build: (i) two variables of individuals' happiness and life satisfaction (*Happy* and *Satlife*) that measure individuals' happiness and life satisfaction, both in a scale 0–10 from extremely unhappy/dissatisfied to extremely happy/satisfied; and (ii) three variables which evaluate individuals' social life: *Meetings* that measures how often the respondent meet with friends, relative or colleagues from 1, never to 7, every day; *Discuss* measures with how many people the respondent can discuss intimate and personal matters, from 0, none to 6, 10 or more persons; finally *Sactiv* takes into account individuals' participation in social activities in comparison with others of the same age, from 1, much less to 5, much more.

Secondly, the ESS survey includes information about individuals' internet usage. More specifically, we construct two variables regarding the use of internet: *Daily Internet*, which is a dummy that considers whether or not the respondent uses

internet daily or mostly daily and *Internet time*, which provides information about the intensity of use as it measures the time spent on the internet on a typical day (in minutes) for those individuals using internet on a daily basis, i.e., *Internet time* is observed only when *Daily Internet* takes value 1.

Thirdly, the ESS survey incorporates a broad range of socioeconomic variables. Using the available information, we include several dummy variables to control for these characteristics: *Gender* (=1, female), *Employed* (=1, employed individuals at the time of the interview), *Partner* (=1, living with a partner), *Bad Health* (=1, individuals who report having bad or very bad health status), *Hampered* (=1, if the person is hampered in daily activities by several reasons -illness, disability, infirmity, mental health problem-), *Age > 60* (=1, if the respondent is over 60 years old), *Rural* (=1, when respondent lives in a country village or countryside). Additionally, we include individuals' *Age* as a continuous variable and their *Domicile* distinguishing five types of area (=1, a big city; =2, suburbs or outskirts of big city; =3 town or small city; =4, country village; and =5, farm or home in countryside). Likewise, we measure income using two variables: *Hincfel*, a subjective variable that considers individuals' feelings about their household income in four categories (=1, living comfortably on present income; =2, coping on present income; =3, difficult on present income; =4, very difficult on present income) and *Income* which classifies respondents' income within three categories (=1 individuals' income below the 5th decile; =2 income above the 5th decile; and =3, don't know/ don't answer).² Finally, we include the variable *Education* which measures respondents' educational level using ISCED categories, this variable includes seven categories and will be treated as a quantitative variable, so that the higher the value of this variable, the higher the educational level of the individual.

We also collect data on internet *Speed* from Fundación Telefónica (2019), which accounts for the average maximum internet speed in Spanish regions (NUTS II).

Table 2 shows the average values for the key variables used in our analysis, we provide these values for the whole sample and for internet users, so that, it can be observed whether the composition of the sample changes when restricted to internet users. It can be seen that 70% of the individuals surveyed use the internet on a daily basis and the average time of usage is 224 min (a bit less than four hours). Regarding to the differences in the average values between the total sample and internet users, we note that the mean values of the SWB variables are slightly higher when only internet users are considered.

As for the socioeconomic variables, if compared to the full sample, the average age of internet users is lower, as is the share of individuals with a bad health status, hampered individuals and those living in low-income households and in rural areas. On the contrary, a higher percentage of employed individuals is observed among internet users and also the average educational level is higher among them. With regard to the remaining variables, there are hardly any differences between the full sample and internet users.

Table 3 shows the pairwise correlations between the intensity of internet use (*Internet time*) and the SWB variables. It can be observed that there are significant and positive correlations between the five SWB variables, though they are not very strong (the highest correlation is the one between *Happy* and *Satlife* of around 0.60, while the correlations between the rest of the variables generally do not exceed 0.20). The latter can be interpreted in the sense that this set of variables measures different aspects of individuals' SWB. On the one side, variables of happiness and life satisfaction (*Happy* and *Satlife*) show a negative correlation with *Internet time*. On the other side, the remaining three SWB variables, those related to individuals' social

Table 1 Description of the variables.

Variable & category	Description
<i>Internet use</i>	
Daily internet	=1, if the respondent reports using internet daily or mostly daily
Internet time	Time spent on the internet on a typical day (in minutes) for those reporting daily usage, i.e., <i>Daily internet</i> = 1
Speed	Average maximum internet speed in Spanish regions (NUTS II) in Mbps (year 2016)
<i>Subjective Wellbeing</i>	
Happy	Respondents' self-reported level of happiness in a scale from 0, extremely unhappy to 10, extremely happy
Satlife	Respondents' self-reported level of life satisfaction in a scale from 0, extremely dissatisfied to 10, extremely satisfied
Meetings	Respondents' self-reported frequency of meets with friends, relatives or colleagues in a scale from 1, never to 7, every day
Discuss	Respondents' self-reported number of people with whom he/she can discuss intimate and personal matters in a scale from 0, none to 6, 10 or more persons
Sactiv	Respondents' self-reported participation in social activities in comparison with others of the same age, in a scale from 1, much less to 5 much more
<i>Socioeconomic</i>	
Female	=1, if respondent is female
Employed	=1, if the respondent is employed at the time of the interview
Age	Respondents' age
Age>60	=1, if the respondent is over 60 years old
Partner	=1, if the respondent lives with a partner
Bad Health	=1, if the respondent reports having bad or very bad health status
Hampered	=1, if the respondent reports being hampered in daily activities either by illness, disability, infirmity, or mental health problem
Domicile	Respondents' self-reported place of residence in five categories (=1, a big city; =2, suburbs or outskirts of big city; =3 town or small city; =4, country village; and =5, farm or home in countryside)
Rural	=1, if the respondent lives in a country village or countryside, i.e. if the variable <i>Domicile</i> is >3
Hincfel	Respondents' self-reported feelings about household income in four categories (=1, living comfortably on present income; =2, coping on present income; =3, difficult on present income; =4, very difficult on present income)
Income	Respondents' self-reported household income decile in three categories (=1 individuals' income below the 5 th decile; =2 income above the 5 th decile; and =3, don't know/ don't answer)
Education	Respondents' level of education according to ISCED categories in a scale from 1, less than lower secondary to 7, higher tertiary education
<i>Survey collection</i>	
Round 9	=1, if survey information was collected during Round 9 (2018)

life, show a positive correlation with *Internet time*. This might suggest that the intensity of internet use is negatively related to individuals' happiness and life satisfaction, but positively related to their social life. However, none of these correlations are statistically significant, apart from the one between *Internet time* and *Meetings* (how often individuals meet with friends).

Modelling strategy. To assess the effects of internet use on individuals' well-being, our modelling consists of a three-equation model in which firstly we try to explain whether (or not) an individual decides to use the internet; secondly, for those individuals who have decided to use it, we study the intensity of this usage, measured by the time they spend on it³; and finally, we assess the effect of internet usage time on individuals' levels of SBW. Since SWB is measured using five different variables, it will result in five sets of three-equation models. It is important to note that the reference population for the estimation of the first equation differs from those of the second and third equations: in the former we consider the full population, whilst only internet users are analyzed for the latter.

The specification of our models relates the well-being of individuals to the intensity of internet use, based on existing subjective well-being models, and will account for personal, family, economic and job-related characteristics (Akay et al. 2017; de Pedraza et al. 2020; Tella et al. 2001). Following literature on ICT diffusion and digital inequalities, internet use, will be modeled as a function of individuals' socioeconomic characteristics. In addition, we will also include the variable *Internet speed* on the first two equations to control for the extent to which the quality of telecommunications infrastructure influences usage. In addition, some interaction terms between internet time and the

three particular groups of interest (the eldest, women and people with disabilities) are considered.

The estimation of these models is quite complex due to the inclusion of three different equations, therefore, there may be convergence problems when there are many categorical variables. To avoid the lack of convergence in our models, we have recoded some variables and used other some categorical variables as continuous, as explained in the previous section.

Results

Tables 4 and 5 show the results of the regressions, specifically, Table 3 shows the models for happiness and life satisfaction and Table 4 for the three social life variables. As it can be seen, each model is composed of three equations. In each of these tables, the first column refers to the corresponding well-being variable; and, then, the second and third to internet time and internet daily use, respectively.

Paying attention to second and third columns of each regression, we can see that both the use of the internet and intensity of that usage are shaped by individuals' socioeconomic characteristics. Specifically, findings show that the likelihood of using the internet on a daily basis increases with the level of education and income, while it decreases with age. Moreover, people in urban areas are much more likely to use it than those in rural areas. In the same vein, people living in areas with higher internet speed tend to be daily users. In addition, the positive sign of the dummy variable Round 9 suggests that there has been an increase in internet use between the two periods of analysis. With regard to the time devoted to the internet, the patterns are similar to those identified by usage: time increases with individuals' levels of education and income and with the speed of the region where he/she lives⁴; meanwhile, it decreases with age and tends to be larger

for people working and living in urban areas. All these results are coherent with previous evidence from the literature on ICT diffusion and the digital divides.

If we focus now on well-being and its relationship with the intensity of internet use, the first thing to notice is that the sign of this relationship depends on how well-being is measured. On the one hand, in Table 3 it can be seen the intensity of internet use is negatively and significantly related with individuals' happiness and life satisfaction. Such results suggest that the more time people spend on the internet, the lower levels of happiness and satisfaction they tend to report. Likewise, results in Table 4 show that the intensity of internet use is negatively related to the variable *Meetings* (how often individuals meet with friends). Accordingly, as time on the internet increases, people report less

frequent meetings with friends, family or colleagues. These observed negative effects are in line with those recently reported by Allcott et al. (2020) from a randomized impact. They found that, when people stopped using Facebook, their levels of happiness, life satisfaction and offline socialization improved. However, our results indicate that internet intensity would be positively related to the variables *Discuss* (how many people individuals have with whom they can discuss intimate matters) and *Sactiv* (individuals' participation in social activities). Hence, as time on the internet increases, people seem to have more contacts with whom they can discuss intimate and personal matters. Moreover, they self-report more participation in social activities compared to people of the same age.

As regard to the three of groups of population of interest, hampered individuals, women and the eldest, estimates show the following results. First, we observe that the negative relationship between internet time and the frequency of social meetings intensifies for hampered individuals; hence, the more time hampered individuals spend online, the lower the frequency of meeting other people compared to not hampered internet users. We do not find any other statistically significant result for the rest of well-being variables. Second, the amount of time spent on the internet does not differ by gender as regards its links with well-being variables. Lastly, for the eldest, that is, people aged 60 years old and over, the negative association between time spent on the internet and the level of reported happiness seem to attenuate (note the negative sign of the variable internet time and the positive sign of its interaction with Age>60 over Happy). Then, for older internet users, the time spent on the internet seem to pay off less negatively in terms of happiness than for younger users. Interestingly, the positive relationship between social participation and internet time accentuates for people aged 60 years old and over. As these users report more time spent on the internet, they also tend to report more social participation than people same age surfing less time the web, and compared to younger individuals.

In addition, our results support previous findings about the role of individuals' socioeconomic characteristics on their levels of well-being. Main findings are summarized as follows. We find a negative association between individuals reporting to have bad health and all the well-being variables, which corroborates the importance of health in people's well-being and social life (Angner et al. 2009, 2013). Similarly, being hampered in daily activities is negatively related with individuals' happiness, which is in line with Angner et al. (2013) who show that disruptions in daily functioning are inverse related with happiness.

Regarding the effect of living with a partner on happiness and life satisfaction, we find a positive association, which also supports previous findings (Zimmermann and Easterlin 2006). Additionally, we find that living with a partner is negatively associated with *Meetings* and *Discuss*. Then, people who live with their partner meet less with their friends and have fewer people with whom can talk about personal matters. This may suggest

Table 2 Average values of the key variables.

Variable & category	All	Internet users
<i>Internet use</i>		
Daily internet	0.7	
Internet time		224
Speed		31.3
<i>Subjective Wellbeing</i>		
Happy	7.72	7.83
Satlife	7.37	7.45
Meetings	5.25	5.33
Discuss	3.07	3.22
Sactiv	2.7	2.8
<i>Socioeconomic</i>		
Female	0.51	0.5
Employed	0.52	0.63
Age	48.58	41.6
Age>60	0.27	0.11
Partner	0.61	0.59
Bad Health	0.37	0.28
Hampered	0.15	0.09
Domicile: Big city	0.2	0.22
Domicile: Suburbs/outskirt big city	0.06	0.07
Domicile: Town/small city	0.29	0.29
Domicile: country village	0.43	0.39
Domicile: Farm or countryside	0.02	0.02
Rural	0.45	0.41
Hincfel: Living comfortably	0.32	0.38
Hincfel: Coping on present income	0.45	0.42
Hincfel: Difficult on present income	0.19	0.16
Hincfel: Very difficult on present income	0.05	0.04
Income: <5th decile	0.45	0.39
Income: >5th decile	0.3	0.36
Income: DK/DA	0.25	0.25
Education	3.43	4.1
<i>Survey collection</i>		
Round 9	0.5	0.51
Observations	3618	2486

Table 3 Pairwise correlations with statistically significant levels.

	Internet time	Happy	Satlife	Meetings	Discuss	Sactiv
Internet time	1					
Happy	-0.022	1				
Satlife	-0.003	0.6298***	1			
Meetings	0.0588***	0.1805***	0.1469***	1		
Discuss	0.021	0.161***	0.1354***	0.1753***	1	
Sactiv	0.023	0.181***	0.1683***	0.2419***	0.1936***	1

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

Table 4 Coefficient estimates for happiness and life satisfaction.

Variables	(1)			(2)		
	Satlife	Internet time	Daily Internet	Happy	Internet time	Daily Internet
Internet time	-0.0010***			-0.0012***		
Health	-0.2676***			-0.3279***		
Hampered	-0.1733			-0.2536*		
Hampered*Internet time	0.0002			0.0001		
Partner	0.2504***			0.3297***		
Female	0.1282**			0.0844		
Female*Internet time	-0.0001			0.0001		
Age	-0.0144***	-7.8980***	-0.0401***	-0.0168***	-7.9122***	-0.0401***
Age >60	0.1861			0.0626		
Age >60*Internet time	0.0005			0.0009*		
Employed	0.1024**		0.0037**	0.0194		-0.0005
Education		35.0354***	0.1771***		35.0854***	0.1746***
Hincfel: Living comfortably (reference category)						
Hincfel: Coping on present income	-0.3286***			-0.2402***		
Hincfel: Difficult on present income	-0.5972***			-0.2990***		
Hincfel: Very difficult on present income	-1.2581***			-0.6579***		
Income: <5th decile (reference category)						
Income >5th decile		20.7831**	0.1084**		22.5110**	0.1322
Income: dk/da		-30.9302***	-0.1426***		-30.2063***	-0.1348*
Domicile: Big city (reference category)						
Domicile: Suburbs or outskirts of big city	0.0057			-0.0361		
Domicile: Town or small city	0.1395**			0.0217		
Domicile: Country village	0.0486			-0.1160**		
Domicile: Farm or home in countryside	-0.0926			-0.2658*		
Rural		-34.7891***	-0.1722***		-35.1026***	-0.1609**
Internet Speed			0.0035***			0.0028
Round 9	0.0443	25.8558***	0.1497***	0.0020	26.0806***	0.1355**
Constant		359.7695***	1.6789***		359.2052***	1.7023***
Observations	3612	3612	3612	3613	3613	3613

***p < 0.01; **p < 0.05; *p < 0.1.

that individuals who live with their partner neglect to some extent or pay less attention to their social life than those who do not live with their partner.

For the gender variable, we only find a significant and positive association of *Female* with life satisfaction, implying that females are significantly more satisfied with life than men.

As for the age variables included in our models, the continuous variable *Age* is significant and shows a negative coefficient, while the dichotomous variable *Age > 60* is significant and shows a positive sign. This corroborates that the relationship between well-being and age is U-shaped (Blanchflower 2021; Blanchflower and Oswald 2008; López-Ulloa et al. 2013).

The dummy variable *Employed* provides evidence of a positive and significant relationship between life satisfaction and being employed (Tella et al. 2001). Nonetheless, our results show that there is a significant and negative relationship between being employed and the frequency of meeting friends or colleagues.

Regarding the domicile variables included, on the one side, the analysis shows that living in a town or small city is significantly and positively related to both life satisfaction and the three social life variables included (Meetings, Discuss and Sactiv). On the other side, we find a negative relationship between living in a country village/countryside and individuals' happiness; moreover, living a country village is negatively related with individuals' social life variables.

Finally, it can be noted that subjective income is positively related to all the dependent variables. The implication is that the more economic hardship the less happy and satisfied with life individuals are and the less social life they have (Cummins 2000; Diego-Rosell et al. 2018; Moro-Egido et al. 2022).

Conclusions

This paper explores the relationship between internet use, the intensity of this usage and some measures of individuals' (subjective) levels of well-being through a three-equation model, providing empirical evidence for Spain.

The first point to note is that effect of the internet on the well-being of individuals depends both on their socioeconomic characteristics and on the type of variables on which well-being is measured. Individuals who make a more intensive use of the internet report having lower levels of life satisfaction and happiness than those who report using it to a lesser extent; additionally, as internet usage increases individuals report less frequent meetings with friends, family or colleagues. On the contrary, those using internet intensively report having more people with whom they can discuss intimate and personal matters and participating more in social activities compared to people of the same age.

These two facts (i.e., higher intensity of internet use associated with (i) less face-to-face meetings and, simultaneously, with (ii) more social participation and more people to talk about intimate matters) seem to suggest that there is some substitution of face-to-face social interactions by virtual interactions. Such a finding provides empirical support to the replacement hypothesis stated by Kraut et al. (1998) at the beginning of the diffusion of digital technologies.

Additionally, we find that internet use among the eldest and people with disabilities have different pay-offs in terms of well-being for these groups of population. In this sense, we find that the more time hampered individuals spend online, the lower the frequency of face-to-face meetings compared to not hampered internet users. This seems to suggest that the substitution effect of

face-to-face for virtual interactions is greater for this group of individuals.

Moreover, older internet users seem to pay off less negatively for the time spent on the internet in terms of happiness in comparison with younger users. The more time they spend, the more social participation they report having compared to people of the same age who spend less time on the internet as well as to younger individuals.

However, gender differences do not emerge as regards the links between internet and well-being.

Based on our results, two main policy implications can be drawn. First, it is worth highlighting the complexity of the achievement of the policy goal of improving societal well-being. As we have found, the intensity of internet use may have opposite effects on the different dimensions of well-being. So, it would be necessary to take into account that the net effect of these technologies on individuals' well-being might be zero, as positive and negative effects compensate each other. In this sense, it would be useful to better define whether there is a specific dimension of well-being that policy efforts should focus on. Additionally, we note that having access to internet does not translate a priori into well-being gains for some especially vulnerable groups such as people with disabilities.

Finally, when interpreting these results, it is important to note that the measures of well-being used are subjective. Though the levels of self-perceived well-being for each person may be comparable (de Pedraza and Vicente 2021) and are of standard use in the literature, there could be some bias when individuals are asked to report their well-being in comparison to others, such as in the question related to social participation (*Sactiv* variable) when people indicate how they perceive themselves compared to others the same age.

Moreover, while the ESS is rich in data about individuals' well-being and their socioeconomic background, it provides information on two quite basic measures of the spread of digital technologies, i.e., whether someone uses the internet and the time spent on it. While the latter data (time) is quite a unique feature provided by the ESS, it would be key to be able to distinguish the types of online services people spend time on. It might be not the same in terms of well-being spending one hour of daily time on surfing the web to gather health information than to spend it on playing games or reading other people social networks' posts, among other activities. Only by having this kind of detailed information would be we able to properly assess the effects of the digital transformation on people's well-being. In this sense, it is important to note the information asymmetries between the social scientists who rely on standard data sources (surveys) and those who can access data from big technological companies. As previously stated by Einav and Levin (2013) academic research could benefit greatly if data from private companies were made available for research.

Data availability

The datasets analyzed during the current study are available in the Dataverse repository, <https://doi.org/10.7910/DVN/3BGM5V> and in the supplementary materials of this publication. These datasets were derived from the public domain resource: <https://www.europeansocialsurvey.org>

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Notes

1 For instance, there is a well-known U-shaped relationship between age and individuals' level of well-being (Blanchflower 2021; Blanchflower and Oswald 2008;

López-Ulloa et al. 2013). In fact, the relevance of age is said to "be comparable with major events such as becoming unemployed or disabled" (López-Ulloa et al. 2013). Similarly, disabilities tend to lower individuals' well-being (Uppal 2006; van Campen & van Santvoort 2013), although the size of these differences can be moderated by some socio-economic features (Emerson et al. 2020). Gender differences in well-being seem to be small, however, some authors highlight that significant gaps might be concealed by the interaction between age and gender (Inglehart 2002; Kennedy et al. 2020).

- 2 The ESS provides information on household income by deciles. After running several checks on this variable and given the number of missing observations, we decided to recode it into the aforementioned three categories.
- 3 Internet time is included in the models in its linear form; however, we had previously considered including the square term of time in case the relationship between internet usage time and subjective well-being could be quadratic. Nonetheless, estimates indicated that the quadratic term was not statistically significant. Accordingly, we decided to exclude it from the models presented in this paper.
- 4 We have also checked whether internet speed could be related to some other infrastructure, services, or living arrangements that could influence individuals' well-being measures. When it was included in the well-being equations, speed was never statistically significant (see Annex).

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Author contributions

The contributing authors of this manuscript are ASÁ and MRV, both authors have worked on the design and conceptualization of this work, as well as the analysis and interpretation of the data. In addition, both authors have drafted the work and revised it critically.

Competing interests

The authors declare no competing interests.

Ethical approval

This article does not contain any studies with human participants performed by any of the authors’.

Informed consent

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Additional information

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