BACHELOR THESIS

From Isolation to Connection: Testing the Relationship Between Internet Use and Subjective Well-being in Europe's Elderly Population

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1 Introduction

Over the last decades, the use of online devices, mobile phones, and the internet, has increasingly grown. These digital technologies have taken a major role in our daily lives (Tsekeris, 2018). This so-called global phenomenon of digitalisation provides more efficient and smarter ways of communication. Everyday habitual activities such as reading online newspapers, booking holidays, scheduling public transportation trips, and foremostly, communicating online with your family and friends, have become commonplace over the last decade. At the same time, the world is facing a demographic change, meaning a significant increase in the number of older people (United Nations, 2017). These two megatrends, digitalisation, and the demographic change, are fundamentally changing and affecting society and individual lives (Hämmerle et al., 2022). Simultaneously, everyday public services are becoming online-based as well. E-government, which is established to improve public administration by making it accountable, transparent, participative, and open, launches a new era of digitalisation (Hooda et al., 2022). As the skills and utilization of these technologies, including the use of the internet, differ over different population groups, a new challenge emerged in the mid-1990s: the digital divide (Friemel, 2014). What are the consequences of these digital developments and the digital divide on our aging society and the fast-growing group of elderly in Europe? This paper investigates the implications of one of the foundations in this era of digitalization, namely the use of the internet, on the subjective well-being of elderly in Europe by performing statistical tests on a Eurobarometer survey.

The next section will elaborate on the rising of the internet and briefly introduce possible downsides for elderly of this phenomenon. Next, it will identify the current research gaps regarding this topic. Based on this research gap, the research approach and research question will be formulated.

1.1 Rising of the Internet and Aging Society

Europe is becoming more digitalised regarding the availability of ICT, and the dependence on online public services such as e-government. To use new technologies, mobile phones, or online services, one is dependent on the availability and accessibility of the internet. According to Eurostat, the statistical agency of the European Union, the share of individuals who have access to the internet is 92% in 2021. This population has grown by 20% over the last decade (72% in 2011) and almost doubled from 2007 when internet access was 53%. A second and more important indicator to measure one's digital activity is the degree of internet

use. Along with the data on internet accessibility in Europe, internet use in Europe has expanded over the last decades. In 2021, nine out of ten individuals in Europe use the internet at least once every 3 months. 87% of the population is classified as a regular user (at least weekly) and 80% uses the internet daily (Eurostat, 2021). Nevertheless, a second survey by Eurostat showed significant differences between age categories and the utilisation of the internet. Whereas the average use of the internet by citizens of the EU is 88%, there is a gap between the elderly and the younger generations. 98% percent of the population aged from 16 to 24 uses the internet in comparison with 61% of the elderly people, aged from 65 to 74 (Eurostat, 2021). Essentially, age is a stronger predictor for the utilisation of the internet and ICT compared with factors such as race, gender and other historical factors that contribute to digital inequalities (Cotton, et al., 2011; Ball et al., 2017).

Besides the disparity of internet use over different ages, Europe is facing a demographic phenomenon of aging. Due to increased longevity, progressions in our healthcare system, and improved fertility, the life expectancy prospects of the European population are elevated (Bloom & Luca, 2016, Balachandran et al., 2019). As the European population ages and the life span increases, the elderly comprises a growing component of society as well as the current and potential internet users (United Nations, 2017).

in the meantime, national and local governments are facing a digital transformation to keep up with the digital revolution. The digitalisation of government services is referred to as e-governance, the digital relationship between the government and its citizens, and e-government, the enabling of public services by ICT (Umbach & Tkalec, 2022). E-government could be interpreted as the services provided by the government to the citizens through the internet (Scholl & Janssen, 2015). The goal of these recent developments is to provide more cost-effective and time-effective solutions to the aging society (Vandemeulebroucke et al., 2018). Examples of e-governmental Information and Communication Technologies (ICT) applications are online banking, online insurance, digital taxation services, and electronic identification software (eIDs) (Pirhonen et al., 2020).

Despite the great potential of online public services, such a complex change could be marginalising for vulnerable groups, in this case elderly (Siren & Knudsen, 2016). Although there are many benefits related to the rising of the internet, new technologies may also lead to the exclusion of some groups. Older people are finding it difficult to use digital technologies and experience barriers to take part in information and activities that take place online instead of physically (Hunsaker & Hargittai, 2018). This concept of digital exclusion, also known as the digital divide, refers to limited access to and utilisation of the internet and online devices

(see Ch.2) (Rose et al., 2020). The digital divide is particularly significant in terms of age, with younger people generally having better access to and proficiency with ICT than older individuals. This has led to concerns about the potential exclusion of older people from many of the benefits of the digital age (Stern et al., 2009; van Deursen et al., 2015). The combination of a rapidly transforming digitalised society and the supplementary challenges of the digital divide and social exclusion is a challenge for the aging society. One could ask whether the digital 'improvements' of today's society are beneficial for the older people. The lack of elderly's abilities to use the internet can negatively affect the health and daily life of older people (Holthe et al., 2018; Ball et al., 2017). The question arises whether the rise and the use of the internet affects the elderlies' well-being. The theory section demonstrates that several studies indicate opposite relationships between one's internet use and one's subjective well-being. Due to these contrary findings, further research could contribute to understanding the effect of digitalisation and internet use on the well-being of elderly people. The next paragraph further explores the knowledge gap as well as the aim of this study to contribute to this knowledge gap.

1.2 Knowledge Gap and Research Approach

As discussed in the theory- and concepts part (Ch.2) of this research, studies demonstrate opposite relationships between the amount of internet use and the subjective well-being (SWB) of older people. On the one hand, several studies claim a reduction in depression and loneliness levels due to the use of the internet among the elderly. The internet could offer advantages such as improved community engagement and more online participation (Neves et al., 2017). On the other hand, these online platforms and services are a threat to maintaining strong ties and real-life relationships via face-to-face communication (Odacı & Çelik, 2013, Sami et al., 2018). As secondary research indicates different perspectives on the effect of internet use on SWB, including life satisfaction and quality of life, further research is necessary. In addition, a plurality of the studies concerning SWB is focussed on the effect of education, income, socioeconomic status, and government quality on one's SWB. There is less attention paid to studies that focus on the relationship between SWB and technology applications or the amount of internet use (Yang et al., 2021). Overall, there is no consensus or scientific agreement about the effect of internet use on the SWB of elderly (Zhong et al., 2022). Therefore, to improve the inconsistency of previous literature, this paper aims to find a relationship between the internet use and the SWB of elderly in Europe by performing a survey based quantitative analyses. In

addition, as human capital is increasingly important for innovation and economic development, exploring the effect of internet use on the SWB provides insights for future research and development (Heckman & Kautz, 2012; (Yushkova, 2013).

To test this relationship, the following research question is formulated: *What is the effect of internet use on the subjective well-being of elderly in Europe*? First, this study will identify possible hypotheses based on the available findings in the secondary literature. The hypotheses will be tested through quantitative analyses using survey data. The data is conducted from the Eurobarometer 95.3, which is a dataset covering data from 37214 citizens of 40 European states.

The next chapter further investigates the current finding about the effect of internet use on the SWB of elderly. It will analyse the concept of the digital divide and the current literature theories regarding the digital divide and SWB. Furthermore, it seeks to identify the state-of-the-art findings about the relationship between internet use and SWB.

2 Theory

This research aims to contribute to the knowledge gap on the effect of the rise of the internet on the well-being of elderly. Therefore, existing theories and present research about this relationship should be analysed to formulate clear hypotheses. This chapter will start with an introduction to the concept of the digital divide as well as the grey digital divide. Next, it will examine the relationships and theories regarding the digital divide and the SWB of elderly people. In addition, this chapter aims to clarify the meaning of SWB and its connection with the concepts of 'life satisfaction' and 'quality of life'. Also, the state-of-the-art relationships and theories between internet use and SWB are investigated in this chapter. To summarize the findings of the existing theories, the last section will formulate the hypotheses.

2.1 The Digital Divide

As indicated in the introduction, the rising of the internet comes with several downsides, especially in relation to the elderly population. The next paragraph will further elaborate on the possible causes and consequences of the lack in understanding and utilization of the internet among elderly, also referred to as the digital divide.

Although older people are heavily dependent on public services, they are lacking behind on access to and use of the internet (Sourbati, 2009). Zhou et al suggest that there are shortcomings in the design of e-governmental services such as complicated interfaces and complex technical components which results in a lack of attention to the needs of the elderly. Their case study on the implications of digital public services on the elderly implied that older people are the forgotten group of this internet age (Zhou et al., 2022). There are concerns about elderlies' abilities to keep up with the rapidly developing digital applications and their required skills (Rose et al., 2020). Research found that the knowledge and skills to utilise digital technologies of the elderly lacks far behind compared with the younger. People with better internet skills reported a greater willingness to utilise new technologies (Berkowsky et al., 2017, Hargittai & Dobransky, 2017). This, in combination with the inferior cognitive processing abilities of the elderly leads to distrust in using online applications (D'cruz & Banerjee, 2020). Studies have shown that an overall better state of cognitive functions is related to more use of the internet (Freese et al., 2006, Hamer & Stamatakis, 2014). As impairments in cognitive function are most likely to appear in a later stage of life, this could affect the daily activities and functioning of the elderly. Daily online activities such as banking, shopping, and communicating may become a challenge for the elderly with cognitive decline (Hunsaker &

Hargittai, 2018). As a result of this, three out of four of the elderly population experience a lack of confidence in their ability to execute digital tasks provided by public services or commercial actors (Anderson & Perrin, 2020). The lack of skills and confidence in using internet-based technologies among elderly results in a 'digital gap' between different generations in society. This so-called digital divide is a commonly addressed problem in scientific literature. There is a consensus among social scientists that the digital divide in relation to elderly is getting more problematic with the passage of time (Mubarak & Suomi, 2022). Due to fast-developing technologies and the growing amount of new digital inventions, there is a spillover effect that even magnified the digital divide between the elderly and younger people (Hunsaker & Hargittai, 2018, Yu et al., 2015). The next section will elaborate on the concept of the digital divide. Furthermore, it will analyse the effects of the digital divide on elderly and their SWB.

The digital divide, also referred to as digital exclusion, illustrates the differences in the degree of utilising digital services due to the level of digital skills, literacy, and cultural habits of different groups (Tsetsi & Rains, 2017). The OECD defines the digital divide as the *differences between individuals, households, companies, or regions related to the access to and usage of ICT* (OECD, 2001). The inequalities related to the access to, and use of the internet are classified as the "first-level digital divide" (van Dijk, 2005). However, as access to digital technologies in European countries is well-developed, digital exclusion could be interpreted as a ladder of citizens' abilities to utilise and understand the digital services that are provided in society (Ebbers et al., 2017). Therefore, a second-level digital divide refers to inequality in internet skills rather than internet access. It marks further differences in the ability of individuals to effectively use technologies and the internet (Hargittai, 2002; van Dijk, 2005). Several studies indicate that access to the internet and sufficient skills to utilise the internet do not always lead to beneficial outcomes for individuals (Hämmerle et al., 2022; Stern et al., 2009; van Deursen et al., 2015). The digital divide discourse shifted to a discussion that led to the third-level digital divide also known as the 'digital health divide (Wei et al., 2011). It assumes that, despite the skills and access, the use of the internet is not always beneficial and could even lead to unfavourable outcomes (Lythreatis et al., 2022).

Several studies have shown that the digital divide exists between different levels of economic or educational backgrounds, occupations, and ages (Jun, 2020). However, as age is the main predictor for measuring the extent of utilising ICT-driven services, older people are the dominant group concerning the consequences of the digital divide (Ball et al., 2017). The elderly's 'digital use gap' obstructs the acceptance and appreciation of digital services whereas the 'digital knowledge gap' makes the elderly feel more socially isolated which deteriorates

their view on e-governmental services (Neves et al., 2018). Therefore, scientific literature often refers to the phenomenon 'grey digital divide' (Morris & Brading, 2007). A literature review from Mubarak & Suomi demonstrates an overall scientific consensus that claims that the grey digital divide is *becoming an increasingly significant area of research and policy concern in the information age.* Moreover, according to their findings, the grey digital divide shall never be completely solved (Mubarak & Suomi, 2022).

There are several studies on the grey digital divide that address the attitude of the elderly toward internet use and the rising of the digital age. Seniors often view ICT-driven services and communication as unappealing features compared with options such as phone, mail, or physical meetings (Rose et al., 2020). The elderly's negative attitudes toward ICT, and the possible social isolation of this major group in society generates a sense of fear among the elderly (Rose et al., 2020). Moreover, a case study in Ireland and Finland demonstrated that the elderly associate the use of the internet and digital services with stress, anxiety, and alienation from society. "*Rapid development of technology combined with one's own physical decline may exacerbate feelings of being old and unable to keep up with others. These rapid changes caused anxiety among some participants."* (Pirhonen et al., 2020).

Nevertheless, the potential advantages of stimulating the elderly to get engaged in digital society could reduce social isolation, endorse societal participation, and improve cognitive capabilities (Niehaves & Plattfaut, 2014). Thus, the question arises whether the potential cost-effective benefits and possible digital participation advantages of digitalisation counterbalance the consequences of the grey digital divide and its associated negative feelings among elderly. What are the mental effects of this phenomenon? How does the grey digital divide affect the SWB of elderly?

To answer this question, this study explores the relationship between the amount of internet use and the SWB of elderly. This paragraph demonstrated that the rise of the internet could create a grey digital divide that generates feelings as social isolation, fear, anxiety, and a lack of attention for the elderly. However, to what extent are these terms connected to the SWB of elderly? Furthermore, what are the current research findings on the relationship between internet use and the quality and satisfaction of life? To explore the state-of-the art findings concerning these relationships, a clear understanding of the concept of SWB is necessary. The next paragraph aims to explain the concept of SWB. What is the meaning of SWB and how is SWB related to the life satisfaction and quality of life of elderly?

2.2 Subjective Well-Being and Internet Use

The SWB describes experiences, behaviours, appraisals, and emotional reactions to certain circumstances (Skevington & Böhnke, 2018). It reflects an individual's subjective perception of their well-being (Campbell, 1976). Two concepts that are often associated with SWB in literature are life satisfaction and Quality of life (QoL). SWB is closely correlated with the QoL of the elderly "*as it reflects people's subjective evaluation of the individual's comprehensive quality of life" (*Yang et al., 2021). A survey study from Skevington & Böhnke illustrated that both concepts fulfil to measure personal indicators from the WHOQOL (World Health Organisation Quality of Life Assessment) which are amongst others: sleep, positive feelings, self-esteem, and happiness (2018). As QoL is closely related to one's SWB, it would be an interesting variable to analyse regarding answering the research question. Another concept that is closely related to the SWB is life satisfaction. Life satisfaction illustrates the well-being of an individual as it is associated with mental and physical health (Renshaw & Cohen, 2013, Ní Mhaoláin et al., 2011). It describes how positively a human being evaluates their daily life based on their own criteria (Han et al., 2020). It is one of the three aspects of SWB according to Diener, E. "*The higher the overall satisfaction with life, the more positive emotions experienced, and the less negative emotions experienced, the greater the person's well-being"* (Diener, 2009). As life satisfaction is reflective of the broad and continuing circumstances of an individual's life, it would be a solid way to measure a person's SWB (Helliwell & Barrington-Leigh, 2010). A lower level of life satisfaction could lead to an increase in depressive symptoms, mental health illness, or even suicidal ideation (Koivumaa-Honkanen et al., 2001, Bray & Gunnell, 2006). As Dumitrache et al characterised life satisfaction as a critical indicator for successful aging, it would be an interesting variable to examine in relation to the effect of internet use on the elderly (2017).

The previous paragraph demonstrated the concept of the grey digital divide and the corresponding unintentional consequences for elderly such as social exclusion. Besides the previously mentioned possible consequences of the digital divide on feelings such as stress, fear, and even anxiety among the elderly, more studies demonstrate a negative relationship between internet use and SWB, life satisfaction and QoL. First of all, numerous studies have demonstrated a relationship between problematic internet use and a decrease in life satisfaction and QoL (Chern & Huang, 2018, Pearson et al., 2021, Tran et al., 2017, Buctot et al., 2020). Addiction to the internet will diminish communication in real life which may reduce life satisfaction and happiness among the elderly (Yang et al., 2021). However, for this study, problematic use of the internet and addictive behaviour are not relevant. On the other side, we

could argue that these findings show a positive correlation between the amount of internet use and mental health issues (Masaeli & Billieux, 2022).

In contrast to studies that yield a negative effect between internet use and QoL, there are several studies that suggest the opposite. Internet use by the elderly reduces depression rates and the chance of having depression symptoms (Pénard et al., 2013, Cotten et al., 2014, Seifert et al., 2017, Heo et al., 2015). Internet could enhance the participation of the elderly and therefore improve their community engagement, expand their social network and enhance their life satisfaction (Bo Xie, 2007, Neves et al., 2017, Quan-Haase et al., 2017). Also, elderly people are able to keep close contact with their children, family, and friends through online communication platforms. According to some literature, internet use could help to reduce the feeling of loneliness and strengthen the feeling of happiness which contributes to higher life satisfaction (O'Hara, 2004, Chopik, 2016, Cotten et al., 2014). Lelkes et al indicate a decline in social isolation when elderly use the internet more often. They found a positive relationship between internet use and life satisfaction (Lelkes, 2013).

On the other hand, studies reject this by stating that the internet replaces face-to-face contact and negatively affects the social engagement of the elderly (Hage et al., 2016). The "internet-time substitution hypothesis" from Yang et al suggests that using the internet reduces the time spent on strong ties such as real-life relationships, communication with family, and friends and, face-to-face conversations (Yang et al., 2021). Maintaining rather weak ties online than strong ties in real-life could result in increased feelings of isolation and loneliness which reduces overall life satisfaction and QoL (Frey et al., 2007, Stepanikova et al., 2010, Odacı & Çelik, 2013, Sami et al., 2018). Another element related to the utilisation of online services and the internet is the increased access to information of others which expands the range of comparison. The social comparison theory claims that one's SWB, which includes life satisfaction, is partly determined by social comparison (C. Anderson et al., 2012). *"According to the theory of reference groups, people's cognition and judgment of their living conditions mostly do not depend on their current social environment status but by comparing with other reference objects" (*Yang et al., 2021). Social comparison due to the internet could lead to psychological loss, a decrease in happiness, and thus a decrease in life satisfaction and QoL (Lee, 2014, Bruni & Stanca, 2006, Chou & Edge, 2012). As a result of these contradictory findings, several studies identified a further research opportunity to test the relationship between internet use and life satisfaction among the elderly (Zhang & Li, 2022).

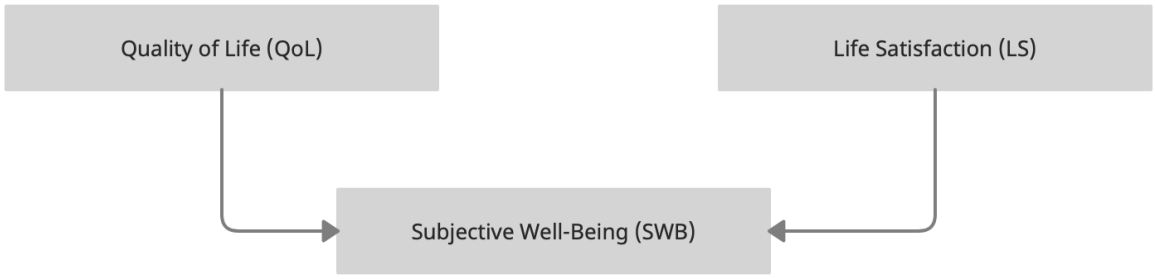

Figure 1: Conceptual Model of Subjective Well-Being

2.3 Hypotheses of this Research

To sum up the previous paragraphs, there are both positive and negative associations found in the literature regarding the effect of the digital divide on the SWB of elderly people. The grey digital divide makes older people feel more isolated which generates feelings of stress, fear, and anxiety. Apart from the consequences of the digital divide, there are several studies that indicate negative effects between the use of the internet and SWB. Yang's internet-time substitution theory replaces face-to-face contact and is associated with lower levels of happiness. This negative relationship strengthens as age increases. On the other hand, digital participation could enhance the overall social participation and life satisfaction of elderly. However, as the concept of the grey digital divide is a rather negative concept, this study assumes a negative relationship between internet use and SWB.

Based on the theoretical insights, this study argues the following hypothesis:

H1: There is a negative relationship between one's amount of internet use and one's subjective well-being.

Secondly, this study found that the negative attitude towards the use of the internet increases when people are older. In other words, the negative relationship between one's amount of internet use and one's SWB is influenced by the variable age. Literature showed that older people are more likely to experience a lower level of SWB than younger people in this digital age. The ability to use internet-driven services of elderly lacks far behind compared with younger people (Rose et al., 2020). For that reason, an interaction effect is added to the second hypothesis.

H2: Older people have a stronger negative relationship between one's amount of internet use and one's subjective well-being than younger people.

The next chapter further elaborates on the methodology and study design of this research. It describes the dataset and its variables that are relevant for testing the hypotheses. It explains what instruments and tests are applied to examine the relationships in the hypothesis.

3 Methodology

The research question "What is the effect of internet use on the subjective well-being of elderly people in Europe" is investigated via quantitative analyses. As there are just a few studies that have comprehensively investigated the relationship between internet use and SWB under an analytical framework, there is a research possibility to analyse this relationship via statistical analyses (Zhong et al., 2022). This empirical study design aims to contribute to this gap by understanding the multivariate and bivariate relationships between the following variables internet use, age, and SWB. Internet use and age are de independent variables that seek to explain the variance of the dependent variable, SWB. This chapter will further elaborate on the hypotheses. How are they measured? What instruments and statistical tests are applied to examine the possible relationships? Next, this chapter will provide more information on the dataset that is used for performing the analyses.

To answer the research question, this study formulated two following hypotheses that are based on insights from scientific literature:

H1: There is a negative relationship between one's amount of internet use and one's subjective well-being.

H2: Older people have a stronger negative relationship between one's amount of internet use and one's subjective well-being than younger people.

The next section addresses the following components that contribute to answering the research question: (1) the method of data collection, including more information about the Eurobarometer dataset; (2) the method of data analysis which covers the measurements and analytical models to examine the hypotheses; (3) the operationalisation of the variables and the control variables.

3.1 Method of Data Collection

This empirical methodology relies on secondary data that is available from an open-source database. After analysing multiple datasets from the European Social Survey and the Eurobarometer, this study selected the Eurobarometer 95.3 for collecting the data. The data from the Eurobarometer 95.3 was publicised in 2022 and conducted between the 14th of June

2021 and the 15th of July 2021. It is the latest and the most up-to-date Eurobarometer wave. The Eurobarometer survey is established in order of the European Commission and held annually since 1970. The Eurobarometer consists of variables that are based on questions and answers from the Eurobarometer survey. This questionnaire is completed by 37214 citizens of European Union member states as well as citizens from European states which are not a member of the European Union which are the United Kingdom, Switzerland, Norway, Turkey, North Macedonia, Montenegro, Serbia, Albania, Bosnia and Herzegovina, Iceland, and Kosovo. (European Commission, 2022). In total, the data collection is conducted in 40 European states. The purpose of the regular Eurobarometer survey is to monitor public opinion as well as attitudes on general and specific topics. *"It generates quality and relevant data for experts in public opinion, researchers, media and the public"* (European Commission, 2022).

The data is collected via face-to-face interviews, often held online due to the covid-crises. To ensure that the data collected are reliable and representative of the population, Eurobarometer uses a multi-stage sampling design to select its participants. In a multi-stage selection, the sampling procedure is divided into several stages, each time drawing a representative sample of participants from the population. After selecting representative samples from the regions in each country, 1000 interviewees per state are selected via randomised stratified sampling. The sample frames are stratified according to the degree of urbanisation in each region, meaning they are divided into different groups based on the degree of urbanisation. By dividing the sampling frames into these different groups, the Eurobarometer ensures that the sample accurately reflects the diversity of the population in each country (Mayo et al., 2022; European Commission, 2022).

In addition to the relevant variables for this research, the Eurobarometer 95.3 covers questions regarding respondents' attitudes towards e.g., the EU green deal, EU migration policies, and EU values like equality, democracy, and human rights. As the survey is carried out on the individual level, this dataset is an appropriate source to collect subjective views on the effect of internet use on life satisfaction and quality of life.

3.2 Method of Data Analysis

This paragraph covers the following subjects: (1) a conceptual model that explains the relationships between internet use, SWB and age; (2) the statistical models and tests that are applied to analyse the hypotheses; (3) the measurement tools that test the strength and significance of the hypotheses.

This study aims to find a correlation between one's internet use and one's SWB by performing a quantitative analysis on two hypotheses. The first hypothesis (H1) assumes a negative relationship between one's internet use and one's SWB. The second hypothesis (H2) suggests that older people are more likely to experience a negative relationship between internet use and SWB than younger people. To test these hypotheses, both bivariate linear regression analyses, as well as multiple linear regression analyses are applied.

The data analyses will be executed with SPSS, the Statistical Package for the Social Sciences. To analyse whether, and to which degree, internet use will affect one's SWB, an OLS model will be used. *"The ordinary least square model minimizes the sum of squares of the differences between the real dependent variables and the predicted dependent variables to obtain the best linear unbiased estimator"* (Zhong et al., 2022). A plurality of studies in social sciences analysing possible effects on SWB is using the OLS model as the results are relatively easy to interpret (Brockmann et al., 2008). Therefore, OLS is one of the most common forms of regression analyses models (Angrist & Pischke, 2008). For the first hypothesis (H1), the following equation is formulated:

$$\hat{Y}_{Subjective\ Well-Being} = b_0 - b_1 Internet\ Use \quad .$$

$\hat{Y}_{Subjective\ Well-Being}$ equals the estimated equation in the dataset in which b_0 equals the intercept and b_1 equals the slope of the regression.

To test the second hypothesis (H2), it is important to consider the potential interaction effect of age on the relationship between internet use and SWB. An interaction effect occurs when the relationship between two variables is different at different levels of a third variable, in this case age. In other words, the effect of internet use on SWB may be different depending on the age of the individual. To test for this interaction effect, it is necessary to include age as a moderator variable in the statistical analysis. See figure 2 for the conceptual model of the assumed relationships and interaction effect of hypothesis 2 (H2).

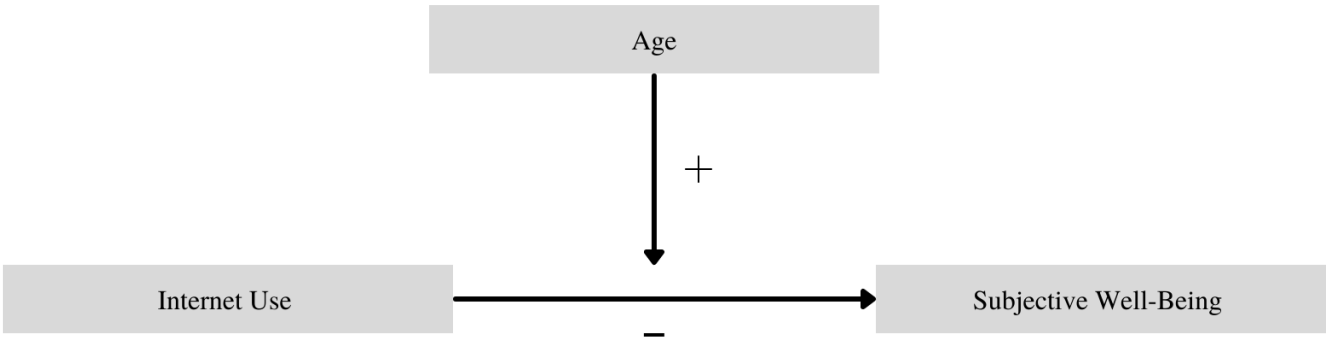

Figure 2: Conceptual model of the relationships between age, internet use, and subjective well-being.

To analyse whether there is a significant interaction effect, the following formula is formulated:

$$\hat{Y}_{Subjective\ Well-Being} = b_0 + b_1 Internet\ Use + b_2 Age + b_3 Internet\ Use * Age$$

The strength of these correlations is tested by the unstandardized B coefficient.

3.3 Operationalisation of the Variables

The Eurobarometer includes 471 variables related to different topics of research. As this quantitative research is dependent on the available variables in the dataset, the SWB is measured with the four questions in the dataset that are related to measuring one's life satisfaction or one's quality of life. Eventually, these four variables combined are suitable to measure one's SWB.

To increase the reliability of the analysis and the ability of detect relationships between the independent and dependent variables, the four variables are combined and transformed into one variable. The Eurobarometer 95.3 contains multiple variables that are measuring the same construct, namely SWB. Combining the variables into one variable increases the power of analysis and improves the interpretability of the results. Whether the four variables fit together can be tested by running a Cronbach's alpha test. By calculating the mean or sum of the four variables, the reliability can be calculated with Cronbach's Alpha (Internal Consistency Reliability). A value of > 0.70 indicates that the items are suitable for making one index variable.

To perform the actual data analyses, the data needs to be operationalised. All variables are recoded or flipped to ensure that the newly obtained variables present a higher outcome with a higher degree of SWB. The independent variable is the level of internet use. There are several variables related to internet use in the Eurobarometer dataset. For this study, the variables 'Internet use Index' (netuse), 'Internet use at Home' (d62_1) and 'Internet use on Mobile Phone' (d62_3) are used for the regression analyses as these variables are most applicable for elderly. The age variable is labelled as 'Age scale' or 'Age Recoded 6 Categories' and coded as d11 or d11r2. The operationalisation table of the dependent and independent variables can be found in the Appendix A (table 1 & 2).

3.4 Control Variables

To check the effect of third variables (or exogenous variables), this study added control variables. The control variables are not of interest to this study; however, they are implemented to ensure that the outcome of the analyses is not influenced by mediating or confounding effects. A third variable could lead to misleading outcomes as they might influence the dependent or independent variable. To avoid biased outcomes and strengthen the validity of this research, this study will execute hierarchical regression analyses. By adding control variables to the original equations, this study aims to determine whether the effect of internet use on the dependent variables is still significant. This study uses the following control variables: gender, and social class. The gender variable d10 "Gender" is recoded so that 0 equals man and 1 equals woman. The social class variable (d63) is labelled as 1= the working class of society, 2= the lower middle class of society, 3= the middle of society, 4= the upper middle class of society, 5= the higher class of society. All other responses were coded as missing.

To sum up, this study uses two hypotheses to guide the analysis and, eventually, try to answer the research question: H1 states that there is a negative relationship between internet use and SWB, and H2 posits that older people have a stronger negative relationship between internet use and SWB than younger people. To test the hypotheses, the study uses data from the Eurobarometer 95.3 survey, which was conducted in 40 European countries in 2021. The data is collected via a multi-stage sampling design to ensure that the sample is representative of the population. By analysing subjective views from European seniors, this study aims to contribute to the knowledge gap on the effect of internet use on SWB. To examine the relationship between

internet use, age, and SWB, this study performs bivariate and multivariate OLS regression analysis. An interaction variable is added to the regression analysis as this study assumes that age affects the relationship between internet use and SWB.

4 Findings

To answer the research question and to test the hypotheses that are based on the theoretical background, a quantitative approach is used. There are scientific inconsistencies about the effect of the fast rising of technologies, including the rise of the internet, on the life satisfaction and quality of life of a vulnerable group in society, the elderly. The theory demonstrated both positive and negative associations between one's internet use, one's SWB and age. To contribute to this knowledge gap, the empirical study design of this research seeks to find relationships in data from the subjective opinions of 37000 European citizens.

This chapter contains the following topics that contribute to the analyses of answering the research question: 1) an overview of the variables for the data analyses and how they are recoded and combined into new variables; 2) descriptive statistics that provide a summary of the basic statistics of the Eurobarometer data: 3) bivariate relationships and multivariate analysis between the effects of age, internet use and one's SWB; 4) interpretations of the findings of the analyses.

To understand the outcomes of the data analysis, it is important to understand the different variables that are used for the analysis. Both age and the amount of internet use are measurable variables. The age is continuous and distributed on a scale from 15 to 99 (Appendix A. descriptive statistics table 3). The amount of internet use is an ordinal variable ranging from 1, never to 6, every day. The third critical variable for measuring the effects of the grey digital divide on elderly is one's SWB, the dependent variable. To measure an abstract variable such as SWB, a conceptual framework is needed. This study found that both 'life satisfaction' and 'quality of life' are closely related to one's SWB (Yang et al., 2021; Diener, 2009). To ensure an accurate and reliable outcome of one's SWB, the variables that are related to life satisfaction and quality of life are recoded into one variable named 'subjective well-being'. The Eurobarometer includes 471 variables, foremostly consisting of questions about general attitudes towards topics like climate change, migration and covid policy. Four variables are measuring individuals' overall life satisfaction and quality of life. These are 'Life satisfaction overall', 'Life satisfaction in daily life', 'Statement: Quality of Life was Better Before', and 'Statement: Having Confidence in the Future' (Appendix A. Table 1).

Prior to merging the variables, all variables are reversed recoded to ensure that an individual's higher score corresponds with a higher rate of SWB. To compute the four variables into one index variable named 'subjective well-being', the internal consistency between the

different items is measured. The reliability of the consistency among the variables is tested with the Cronbach's alpha. The outcome of the reliability test ranges with a Cronbach's alpha from 0, not reliable, to 1, very reliable. A Cronbach's alpha that is higher than 0.70 is scientifically associated with a sufficient reliability outcome to combine the variables into one index variable (Taber, 2017). As shown in the Appendix A (table 3), the reliability statistics calculated a Cronbach's alpha of 0.718 (> 0.70). This is evidence that it would be valid to compute the variables into one index variable.

The new index variable illustrates the SWB of an individual by combining the four variables that are related to life satisfaction and quality of life. The variable computes the total score of the outcomes of the original four ordinal variables. To enhance the reliability of the variable, the variable excludes individuals when one or more than one of the four outcomes of the original variables is missing. Since the new variable is the sum of the total score of the four variables, the lowest possible score is 4 and the highest possible score is 16. Therefore, the variable 'subjective well-being' is recoded by decreasing the old values by 3. In this way, the outcome ranges from 1 to 13.

4.1 An Overview of the Data

The Eurobarometer survey consists of data from 37000 individuals living across European states. Before testing the effect of internet use on their SWB, descriptive statistics are needed for this research as they provide a snapshot of the sample and give an overview of the distribution of the European individuals in different categories, including internet use, age, gender, and social class. Descriptive statistics and bivariate relationships help to understand the data. Before starting with the multivariate regression analyses of the relationships between age, internet use, and SWB, the report provides an overview of the relevant data. Tables 4-9 in Appendix B show the descriptive statistics of gender, social class, SWB, age and the amount of internet use.

The descriptive statistics show a slightly higher number of men (47.8 %) than women (52.0 %) in this dataset (Appendix A, table 4). Table 4 (Appendix A) demonstrates that most people in this dataset are classified as middle class of society (51.8%) followed by the working class of society (21.0%). Tables 8 and 9, which are displayed in Appendix B, show the percentage of internet use for different age categories. It demonstrates that the respondents are quite equally distributed among the six age categories with a mean percentage of 17-18% of respondents per age category. Most people are using the internet every day or almost every day

(82.5% at home and 77.4% on the phone). However, there are some people that use the internet less frequently or have never used it. As expected, the major group of these lower internet users are aged 65 or older. The youngest age category (15-24) has the lowest percentage of individuals who never use the internet and the highest percentage of individuals who use the internet everyday. In the oldest age category (65+) these results are reversed. Overall, both tables indicate that younger people are more likely to use the internet more frequently, while older people are less likely to do so. Therefore, internet usage at home and on phone decreases with age. Last, the histogram (Appendix B, Table 6) illustrates that the outcomes of the SWB index variable are normally distributed. The mean of all scores, ranging from 1 to 13, is 8.2 (sd = 2.27). The mode of this variable is 8.

Next, the bivariate relationships (Appendix C) between the variables help us understand the correlations between the dependent variable and the independent variables. The dependent variable is the SWB score, which is measured as a scale variable ranging from 1 to 13. The independent variables are age and internet use. To test the strength of the correlation, the Pearson's correlation (r) is applied. Pearson's correlation is a statistical measure that examines how closely two variables are related. This strength is measured on a scale from -1 to 1 as there could be a negative or a positive correlation. A negative correlation means that if one variable increases, the other variable goes down. On the other hand, a positive correlation indicates that if one variable goes up, the outcome of the other variable increases as well, and vice versa (Emerson, 2015). If $r = 0$, there is no correlation between the variables.

Table 10 (Appendix C) shows that there is a negative correlation between age and the use of internet at home ($r = -3.48$; $p < .05$). In this context, a negative correlation means that as age increases, internet use decreases. The "Sig. (2-tailed)" column shows the p-value, which indicates the probability that the correlation observed is due to chance. Values less than .05 (or .01 in this case) indicate that the correlation is statistically significant. As expected, there is also a negative correlation between age and the use of internet on phone ($r = - 3.76$; $p < .05$). In general, a correlation between .3 and .5 or -.3 and -.5 is classified as a medium or moderate correlation (Cohen, 1988). These correlations demonstrate a negative correlation between one's age and one's amount of internet usage. In other words, these correlations are consistent with the statistics from Eurostat (2021) that show a lower utilization of the internet when people are getting older.

The second correlation table (Table 11, Appendix C) displays the strength of the correlations between 1) internet use at home and SWB, and 2) internet use on phone and SWB. These are $r = .207$ ($p < .05$) and $r = .195$ ($p < .05$) respectively. The magnitude of the correlations

is generally assessed as weak when r < .3 or r < -.3 (Cohen, 1988). However, despite the rather weak correlation, there is a positive correlation between the use of internet and SWB in this dataset. This indicates that an increase in the use of internet slightly increases one's SWB.

The last correlation table (Table 12, Appendix C) demonstrates that there is no correlation between the variables age and SWB (r = -.064; p < .05). People are not experiencing a lower SWB when they are getting older. To test whether the use of internet influences this relationship, an interaction variable is created. The next paragraph analyses if older people have a stronger negative relationship between internet use and SWB than younger people.

4.2 Multiple Analysis

The last part of the findings covers the multivariate regression analyses. The theory and hypotheses assume that the effect of internet use on SWB is affected by the modification variable age. More specifically, older people are expected to have a stronger negative effect negative relationship between internet use and SWB than younger people. To test this effect, an interaction effect is added to the regression analyses. The output is displayed below.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.211[a]	.045	.045	2.93499

a. Predictors: (Constant), Interaction Age & Internet Use, Internet use, Age

Regression analysis

Model		Unstandardized Coefficients		Standardized Coefficients	
		B	Std. Error	Beta	Sig.
1	(Constant)	4.029	.295		<.001
	Age	.036	.004	.278	<.001
	Internet Use	.681	.050	.412	<.001
	Interaction Age & Internet Use	-.005	.001	-.248	<.001

a. Dependent Variable: Subjective Wellbeing Recoded

The model summary shows that the R square of this regression analyses is 4.5%. This indicates that 4.5% of the variance of SWB is caused by the effects of age, internet use, and the interaction effect of age and internet use. If the model would add control variables like social class, gender or religion, the explained variation of SWB will increase. However, this study is not interested in the possible factors that contribute to explaining one's SWB. This research is only interested in the effect of internet use on SWB and whether this effect changes for different age categories. Adding control variables does not enhance the examined effect of this study. However, the regression analysis is checked for control variables to analyse whether the effects of the variables significantly differ when other variables are added. After controlling for sociodemographic variables, there was no significant difference between the effects of the variables on SWB.

To understand the effect of age and internet use on SWB, the following equation is formulated:

$$\hat{Y}_{Subjective\ Well-Being} = b_0 + b_1 Internet\ Use + b_2 Age + b_3 Internet\ Use * Age$$

After performing the regression analysis, the predicted outcome of SWB is:

$$\hat{Y}_{Subjective\ Well-Being} = 4.029 + 0.681 * Internet\ Use + 0.036 * Age - 0.005 * Internet\ Use * Age$$

In this equation, the predicted outcome, $\hat{Y}$, of SWB ranges on a scale from 1 to 13, internet use ranges from 1, never, to 6, everyday; and age ranges from 15 to 98.

What do these numbers indicate? Table 5 helps to illustrate the effect of internet use and age on SWB by providing three examples of possible respondents with different ages and different amounts of internet usage. The table calculates the SWB scores of three respondents of different ages, 30 years, 60 years, and 90 years. Secondly, the respondent's SWB outcomes were measured with different amounts of internet usage: never, sometimes (about once a week), and every day.

Table 5: subjective well-being outcome of three respondents

	Internet Use	Subjective Well-being	Differences
R1 (30 years)	Never	5.64	-
	Sometimes	7.23	*1.59*
	Every day	8.45	*1.22*
R2 (60 years)	Never	6.57	-
	Sometimes	7.71	*1.14*
	Every day	8.50	*0.79*
R3 (90 years)	Never	7.50	-
	Sometimes	8.19	*0.69*
	Every day	8.61	*0.42*

N = 34360

There are a couple of observations one can make based on the outcomes of the regression analysis. First, there is a positive relationship between internet use and one's SWB. As the frequency of internet use increases, the SWB scores for all ages increase as well. Across all ages, the highest level of SWB is measured when the rate of internet use is highest (R1=8.45, R2=8.50, R3=8.61). Therefore, it can be concluded that internet use positively affects SWB, regardless of a person's age. This is in line with the positive correlation between internet use and SWB that was measured in the previous section, the bivariate relationships.

However, what is the effect of the interaction between age and internet use on SWB? More specifically, does the positive effect between the use of internet and a person's SWB changes when someone gets older? The regression model as well as table 5 indicate that the older the people are, the less positive impact internet use has on their SWB. To illustrate this, the differences between SWB scores caused by different amounts of internet use are calculated for each respondent. In the 30-year-old group, those who use the internet every day had an SWB score of 8.45, which is significantly higher than those who never use the internet, who had a score of 5.64. In the 90-year-old group, however, the difference between those who use the internet every day and those who never use the internet was much smaller, with scores of 8.61 and 7.50, respectively. It appears that the difference in SWB between those who use the internet daily and those who sometimes or never use it decreases as the age group gets older. Another way to illustrate this is the SWB scores of the respondents when they use the internet every day

(R1=8.45, R2=8.50, R3=8.61) compared with the scores when they use the internet about once a week (R1=7.23, R2=7.71, R3=8.19). When the internet usage increases, the differences in SWB scores over different ages decrease. Added to this is the fact that there is no correlation between age and SWB as demonstrated in chapter 4.2. This means that the observed differences in SWB when the respondents are getting older are caused by the interaction effect of internet use and age. Based on the outcomes of this quantitative research, it seems that internet use has a more significant impact on SWB for younger age groups compared to older age groups.

The next chapter will explain the main findings of the research and how they relate to the research question and its hypotheses. Furthermore, it describes how it correlates with the existing literature and the theory of this study.

5 Discussion

Hämmerle and her colleagues concluded in their research on digital skills training for elderly people that there are two megatrends that change our society fundamentally, digitalisation and demographic change (Hämmerle et al., 2022). Siren & Knudsen, who studied the implications of e-governmental services for elderly people; reported that, despite the great potential, digitalisation could be problematic for those with limited skills in ICT and internet. This group predominantly consists of elderly (Siren & Knudsen, 2016). The two megatrends that Hämmerle et al. addressed in their study are a major cause for a concept that emerged in the mid 1990s, the digital divide. Studies implicate different effects of this grey digital divide on the well-being of elderly, ranging from feelings of loneliness and stress (Frey et al., 2007) to symptoms of anxiety and fear (Pirhonen et al., 2020). On the other side, the use of internet offers advantages associated with more online participation, improved community engagement, and a reduction in levels of loneliness and depression. The theories in the literature about the effect of the digitalisation on elderly people are divided. Therefore, this study seeks to find the answer to *What is the effect of internet use on the subjective well-being of elderly in Europe*? To answer this question, two hypotheses are formulated: *H1: There is a negative relationship between one's amount of internet use and one's subjective well-being* and *H2: Older people have a stronger negative relationship between one's amount of internet use and one's subjective well-being than younger people.* The next paragraphs highlight the main findings of this study and how they relate to the research question and the hypotheses. Next, it aims to connect the results with findings from existing literature. Subsequently, it seeks to identify possible limitations and implications of this research.

Based on the findings from the Eurobarometer survey, this study argues three conclusions: 1) there is a negative relationship between the amount of internet use and age, 2) there is a positive relationship between the amount of internet use and SWB, 3) the positive relationship between internet use and SWB decreases with age. How do these findings correlate with the literature?

The first conclusion corresponds with the findings in the literature, including the statistics from Eurostat. According to Eurostat, there is a significant difference between age groups in the utilisation of internet whereas younger people are using the internet more frequently than older people (Eurostat, 2021). One of the most consistent findings on internet use is the association between the digital divide and age (Ball et al., 2017). The data from the Eurobarometer that was conducted in 2021 shows that the internet use decreases when people

are aging. However, the numbers that indicate a lower use of internet among elderly have changed over the last years. Studies reported increased rates of internet use among older adults over the last decade meaning that the internet utilization gap between elderly and younger people is narrowing (Ball et al., 2017; Tavares, 2020). One major cause for the rise of internet use among elderly is the COVID-19 pandemic. Several studies indicate a significantly higher rate of internet use among elderly following the pandemic onset (Nimrod, 2020). The COVID-19 influence on the results of this study is interesting to address as the Eurobarometer survey was conducted during the second wave of the corona outbreak. The first hypothesis predicted a negative relationship between internet use and SWB. This is the opposite of the second conclusion which states that there is a positive relationship between these variables. Could the pandemic have something to do with this?

5.1 The Covid Context

The COVID-19 pandemic has had a significant impact on the use of the internet among the elderly population and their well-being. Due to lockdowns and social distancing measures, many older adults have been forced to rely on technology and the internet to stay connected with loved ones, access healthcare, and complete essential tasks such as grocery shopping and banking. This has led to an increase in the number of older adults using the internet and digital devices (Nimrod, 2020). Nimrod's study revealed that elderly people are using the internet for coping with stressful situations during the pandemic. Being online on the internet reduces the feeling of loneliness. Older people are seeking for online relationships to prevent social isolation, especially during the COVID-19 period.

As demonstrated in the theoretical framework, Cotton's theory indicated significant evidence between internet use, reduced feelings of loneliness and higher rates of life satisfaction (Cotten et al., 2014). Yang et al countered this with the internet-time substitution theory, claiming that the internet replaces face-to-face contact and deteriorates strong relational ties (Yang et al., 2021). This theory is widely discussed and supported by fellow scientists (Hage et al., 2016, Frey et al., 2007, Stepanikova et al., 2010, Odacı & Çelik, 2013, Sami et al., 2018). However, due to the lockdown, face-to-face contact was not possible. Elderly used the internet to communicate with other people during the pandemic. Recent literature shows that the highest increase in internet use during the pandemic among the elderly was communication platforms like Zoom or WhatsApp (Nimrod, 2020). In line with Cotton's theory, internet use for communication purposes is associated with higher levels of SWB (Szabo et al., 2018).

Therefore, our positive correlation between internet use and SWB could be clarified by the fact that older people used the internet during the pandemic to communicate with others. There has been a shift over the last years in which elderly experienced that online communication could enhance their social participation and overall levels of SWB. Utilizing technology to maintain connections with loved ones has become a crucial way to combat the negative effects of loneliness and isolation during prolonged periods of isolation, such as during lockdowns (Martins Van Jaarsveld, 2020).

Our research findings correspond to the *activity theory* which beliefs that social context and interaction play a significant role in mental well-being. The activity theory emphasizes the importance of maintaining social activity and participation to enhance mental well-being, particularly in older adults who may lose social roles as they age (Forsman & Nordmyr, 2015). Our findings demonstrate positive relationships between the use of internet and SWB. This could suggest that ICT technology can provide opportunities for active aging in today's society. Therefore, partly due to the COVID-19 crisis, the European Commission and national government have been actively promoting e-inclusion among elderly in Europe. Projects such as 'e-Digital Agenda for Europe' and 'eHealth Action Plan' were implemented to tackle the grey digital divide (European Parliament, 2022., European Commission, 2020). However, recent studies reported that there are still concerns about elderly people who are not able to keep up with the rise of the internet due to a lack of skills (Tavares, 2020). This refers to the last conclusion of the analysis which indicates that the relationship between internet use and SWB is significantly stronger for younger people compared with older people.

5.2 Effects of the Digital Divide

The theoretical background of this study demonstrated the different levels of the digital divide in which the second level refers to the gap in internet skills (Van Dijk, 2005). Although the increase in internet use among elderly during the pandemic, recent literature shows that inequalities exist between younger and older people in terms of internet use skills. Due to poor digital literacy and inferior cognitive processing abilities, a part of the older people is still experiencing a lack of confidence in their abilities to use the internet (Anderson & Perrin, 2020). Seniors' attitudes about the impact of internet use are still divided within the group. On the one hand, the internet offers great potential as a communication platform. On the other hand, many new, and often complex, digital services emerging at a rapid pace. Hunsaker and Hargittai call

this the spillover effect, which can induce feelings of anxiety or stress among the elderly. (Hunsaker & Hargittai, 2018). In addition, research indicated that older people prefer outdated technologies and simple user interfaces (Tsai et al., 2015).

The communication technologies during the pandemic created an overall positive relationship between internet use and SWB. Nevertheless, the findings demonstrate a weaker positive effect between the use of internet and SWB when age increases. This could be explained by the implications of the digital divide.

6 Conclusion

This thesis has investigated the effect of internet use on the SWB of elderly people in Europe. The research aimed to answer the following research question: *What is the effect of internet use on the subjective well-being of elderly in Europe*? By analysing data from the Eurobarometer survey, the study found that there is a negative relationship between internet use and age, a positive relationship between internet use and SWB, and that the positive relationship between internet use and SWB decreases with age. Although the results of the quantitative analysis were not corresponding with the formulated hypotheses, the findings align with existing literature on the digital divide and internet use among older adults. This suggests that while internet use among the elderly population has been increasing in recent years, there are still differences between older and younger people in terms of internet utilization and its relationship with SWB. This is partly due to a lack of skills and confidence in the use of internet. However, this research did not demonstrate the negative results related to the attitude of elderly people on internet as expected. Although the effect between internet use and SWB is stronger for younger people, there is a significant positive relationship between internet use and SWB over all ages. Therefore, this study agrees with the theories that examine positive relationships between internet use and SWS and, in addition, support internet use among elderly. Increased levels of SWB are associated with lower levels of depression and loneliness (Bray & Gunnell, 2006). Therefore, the findings of this study, which demonstrates higher SWB levels in relation to higher internet use rates, are in line with the theory from Cotton (Cotten et al., 2014). Cotton's theory, which is supported by many scientists, claims a reduction in loneliness among elderly who use the internet more often. In addition, Neves' study claims that internet use among older people could enhance their social network and improve their participation and community engagement (Neves et al., 2017). These theories, as well as the findings of this study, correspond with the activity theory that claims that social action in the latter stage of life plays a crucial role to increase happiness and higher levels of SWB (Forsman & Nordmyr, 2015). The results of this study do not comply with the theories that claim a negative relationship between internet use and SWB among elderly. In fact, this study support scientist and policymakers that support technologies among older people to get them socially engaged and familiar with the benefits that digital devices could offer. There are plenty of studies that address the negative implications of the digital divide such as the internet-time substitution theory from Yang et al which claims that the internet replaces face-to-face contact. This study does not agree with this theory as the internet could offer beneficial opportunities for elderly to stay in contact

with loved ones. However, the positive effect of the internet on SWB was weaker for older people. Therefore, this study encourages policymakers to watch out for excluding individuals who are lacking behind with digital skills. On the other side, this study does not agree with Zhou's statement which states that the elderly is the forgotten group of society due to the digital divide (Zhou et al., 2022). Contrarily, the results of this study show that the internet could bring us together rather than split society.

Additionally, the study found that the COVID-19 pandemic may have had an impact on the results, as the Eurobarometer survey was conducted during the second wave of the outbreak. This highlights the need for further research to fully understand the impact of the pandemic on internet use and SWB among the elderly population. Although there are some first insights about the effect of the pandemic, it would be interesting to examine the relationship between internet use, age, and SWB before the pandemic and after the pandemic to test the effect of communication technologies that arose during the corona outbreak. Moreover, it would be interesting to examine the digital skill level of the elderly after the pandemic to indicate whether the skills improved due to the outbreak. A longitudinal study could measure the differences in the use of and view on the internet before and after the pandemic to provide insights into the effect of the corona crisis on the use of internet among elderly.

The most important limitation is the scale of the 'internet use' variable. As this study is restricted to the data of the Eurobarometer, which only included variables about the amount of internet use, measured on a scale from "never" to "everyday.", it would be interesting to see the effects of internet use when the internet use is also measured in, for example, hours. Recent literature after the pandemic shows a high increase in internet use among elderly. This means that most of the elderly are using the internet at least everyday which indicates that the analyses of this study are restricted and have a great potential to become a lot more reliable by measuring the internet use in hours instead of days per week. This would provide a more detailed understanding of the relationship between internet use and SWB among elderly people, and it would also allow for a more nuanced analysis of the different types of internet use. Further research is recommended, although this research is dependent on the available databases. Therefore, this study recommends the Eurobarometer and the European Social Survey to change the measurement levels of internet use in the next survey. Instead of asking respondents whether they use the internet once per week or twice a month, this study would recommend asking how many hours they spent on the internet per day. To strengthen the survey, a variable could be implemented that specifies the type of use of the internet. This introduces the next limitation.

The last limitation of this study is that it has not considered the type and purpose of internet use. Recent studies have shown that the effect of internet use on SWB depends on whether the internet is being used for communication, task performance, information, or leisure (Lifshitz et al., 2016). Therefore, it is possible that the relationship between internet use and SWB among elderly people may vary depending on the type and purpose of internet use. One example is Anderson's social comparison theory, which indicated that the use of certain types of internet, primarily the use of social media, can lead to a decrease in happiness. Additionally, by measuring the type of internet and the internet use in hours, it would also be possible to see whether there is a threshold effect, in which a certain amount of internet use is beneficial for well-being, but beyond that, it starts to have negative effects.

Besides these recommendations for further research on the effect of internet use on SWB of older people, there are noteworthy practical implications of this study. First and foremost, governments should encourage the use of digital services among elderly and provide them with information about the current resources that are available. In today's digital age, the internet has become a necessity for daily life. With the internet being used for everything from banking and shopping to staying in touch with loved ones, older adults should be encouraged and trained to use these facilities. The findings of this research as well as findings from the literature indicate a positive relationship between internet use and SWB. Internet use among elderly is often associated with lower levels of loneliness and depression. Research has shown that digital literacy programs for older adults can be highly effective, with long-term benefits for their digital skills (Martins Van Jaarsveld, 2020). Such programs, specifically designed for the elderly, have also been found to boost confidence and interest in using technology. Most of these programs involve training in digital skills, which in turn leads to increased self-efficacy and motivation to continue using technology. This could include social events and exercise programs that older adults can participate in, physically. Additionally, studies have shown that the elderly are more likely to own outdated technology and can benefit from the design of simple user interfaces, hence the design of technology and software for the elderly are important.

Overall, this study provides valuable insights into the relationship between internet use and SWB among elderly people. Although the discord among scientists about the consequences of internet on the ‘vulnerable’ group of society, this study proves a positive relationship between internet use and SWB among elder people. Due to the COVID-19 crisis, elderly were forced to use the internet to stay in contact with their loved ones. The findings of this study were against the expectations that correspond with the negative feelings associated with the digital divide.

We live in a digitalized world in which the use of internet is unavoidable, irrespective of people's age. Therefore, we should encourage older people to use online services and train them to boost their confidence and skills. In addition, this study advises policymakers to take care of the elderly that are alone and more vulnerable to the digital spillover. Digital literacy programs for older adults could be implemented to prevent feelings of fear and anxiety among elderly that are struggling with digital services. To conclude, this study agrees with the statement from Mubarak and Suomi who claim that the digital divide shall never be completely solved. Nevertheless, we should use the internet to bring people together rather than split society apart.

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8 Appendix

8.1 Appendix A. Operationalisation

Table 1: operationalisation of the dependent variables.

Code in dataset	Dependent variable	Question statement	Original Code	New code
d70	Life Satisfaction (overall)	On the whole, are you very satisfied, fairly satisfied, not very satisfied or not at all satisfied with the life you lead?	1= Very satisfied 2= Fairly satisfied 3= Not very satisfied 4= Not at all satisfied 5= Don't know	1= Not at all satisfied 2= Not very satisfied 3= Fairly satisfied 4= Very satisfied 5= 99 (missing)
d70a	Life Satisfaction in daily life	On the whole, are you very satisfied, fairly satisfied, not very satisfied or not at all satisfied with your daily life?	1= Very satisfied 2= Fairly satisfied 3= Not very satisfied 4= Not at all satisfied 5= Don't know	1= Not at all satisfied 2= Not very satisfied 3= Fairly satisfied 4= Very satisfied 5= 99 (missing)
qc9_1	Statement: Quality of Life was Better Before	Please tell whether you totally agree, tend to agree, tend to	1= Totally agree 2= Tend to Agree 3= Tend to disagree	1= Totally agree 2= Tend to Agree

		disagree or totally disagree with the statement.	4= Totally disagree 5= Don't know	3= Tend to disagree 4= Totally disagree 5= 99 (missing)
qc9_3	Statement: Having Confidence in the Future	Please tell whether you totally agree, tend to agree, tend to disagree or totally	1= Totally agree 2= Tend to Agree 3= Tend to disagree 4= Totally disagree 5= Don't know	1= Totally disagree 2= Tend to disagree 3= Tend to agree 4= Totally agree 5= 99 (missing)

Table 2: operationalisation of the independent variables

Code in dataset	Independent variable	Original code	New code
d62_1	Internet use at Home	1= Everyday/Almost everyday 2= Two or three times a week 3= About once a week 4= Two or three times a month 5= Less often 6= Never/No access 7= No Internet access at all	1= Never 2= Less often 3= Two or three times a month 4= About once a week 5= Two or three times a week 6= Everyday/ almost every day 7= 99 (missing)
d62_3	Internet use on Mobile Phone	1= Everyday/Almost everyday	1= Never 2= Less often

		2= Two or three times a week 3= About once a week 4= Two or three times a month 5= Less often 6= Never/No access 7= No Internet access at all	3= Two or three times a month 4= About once a week 5= Two or three times a week 6= Everyday/ almost every day 7= 99 (missing)
netuse	Internet use index	1= Everyday/Almost everyday 2= Two or three times a week 3= About once a week 4= Two or three times a month 5= Less often 6= Never/No access 7= No Internet access at all	1= Never 2= Less often 3= Two or three times a month 4= About once a week 5= Two or three times a week 6= Everyday/ almost every day 7= 99 (missing)
d11r2	Age on a Scale from 15 to 98	Age on a Scale from 15 to 98	Age on a Scale from 15 to 98
d11r2	Age Recoded in 6 Categories	1= 15-24 2= 25-34 3= 35-44 4= 45-54 5= 55-64 6= 65+ 7= refusal	1= 15-24 2= 25-34 3= 35-44 4= 45-54 5= 55-64 6= 65+ 7= 99 (missing)

Table 3: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.718	.730	4

8.2 Appendix B. Descriptive Statistics

Table 4: Descriptive statistics Gender

		N	%
Man		17794	47.8%
Woman		19360	52.0%
Missing	System	60	0.2%

Table 5: Descriptive statistics Social class

		N	%
The working class of society		7813	21.0%
The lower middle class of society		5901	15.9%
The middle class of society		19260	51.8%
The upper middle class of society		3463	9.3%
The higher class of society		333	0.9%
Missing	System	444	1.2%

Table 6: Descriptive statistics Subjective well-being

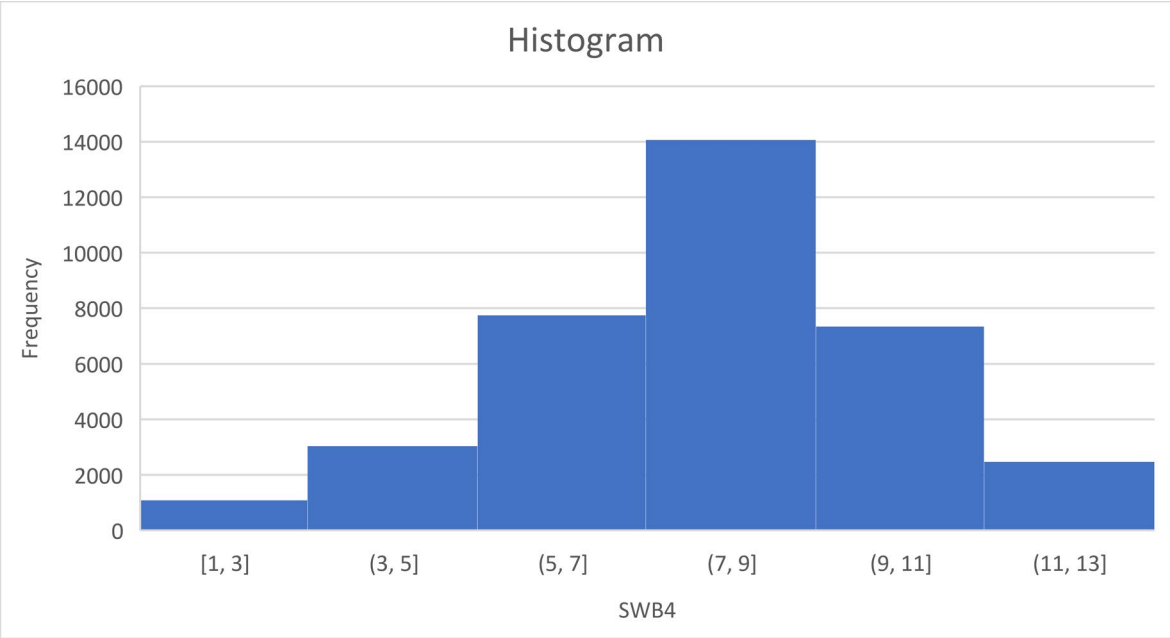

Table 7: Descriptive statistics Age

N	Valid	37214
	Missing	0
Mean		48.87
Range		84
Minimum		15
Maximum		99

Table 8: Descriptive statistics Internet use at home per age category

		Age - 6 Categories						
		15-24	25-34	35-44	45-54	55-64	65+	Total
Internet use at Home	Never	0.1%	0.2%	0.3%	0.7%	1.9%	5.8%	9.0%
	Less often	0.0%	0.0%	0.1%	0.2%	0.3%	0.4%	1.0%
	Two or three times a month	0.0%	0.0%	0.1%	0.1%	0.1%	0.2%	0.5%
	About once a week	0.1%	0.1%	0.2%	0.3%	0.4%	0.5%	1.5%
	Two or three times a week	0.3%	0.7%	0.7%	1.0%	1.3%	1.6%	5.6%
	Everyday/ almost everyday	9.6%	13.6%	15.8%	16.0%	14.3%	13.2%	82.5%
Total		10.3%	14.7%	17.1%	18.2%	18.2%	21.6%	100.0 %

Table 9: Descriptive statistics: Internet use on phone per age category

		Age - 6 Categories						
		15-24	25-34	35-44	45-54	55-64	65+	Total
Internet use on Phone	Never	0.2%	0.3%	0.4%	1.0%	2.6%	7.3%	11.8%
	Less often	0.1%	0.1%	0.2%	0.2%	0.4%	0.5%	1.5%
	Two or three times a month	0.0%	0.1%	0.1%	0.2%	0.1%	0.2%	0.7%
	About once a week	0.3%	0.3%	0.3%	0.4%	0.5%	0.5%	2.4%
	Two or three times a week	0.5%	0.8%	0.9%	1.1%	1.4%	1.6%	6.3%
	Everyday/ almost everyday	9.2%	13.2%	15.2%	15.3%	13.1%	11.4%	77.4%
Total		10.3%	14.7%	17.1%	18.2%	18.2%	21.6%	100.0 %

8.3 Appendix C. Bivariate relationships

Table 10: Correlation Age and internet use

		Internet at home	Internet on phone	Age
Internet at home	Pearson Correlation	1	.705**	**-.348****
	Sig. (2-tailed)		.000	.000
	N	36592	36440	36592
Internet on phone	Pearson Correlation	.705**	1	**-.376****
	Sig. (2-tailed)	.000		.000
	N	36440	36527	36527
Age	Pearson Correlation	**-.348****	**-.376****	1
	Sig. (2-tailed)	.000	.000	
	N	36592	36527	37214

**. Correlation is significant at the 0.01 level (2-tailed).

Table 11: Correlation: Internet use and subjective wellbeing

		Subjective Wellbeing	Internet at home	Internet on phone
Subjective Wellbeing	Pearson Correlation	1	**.207****	**.195****
	Sig. (2-tailed)		.000	<.001
	N	34360	33842	33789
Internet at home	Pearson Correlation	**.207****	1	.705**
	Sig. (2-tailed)	.000		.000
	N	33842	36592	36440
Internet on phone	Pearson Correlation	**.195****	.705**	1
	Sig. (2-tailed)	<.001	.000	
	N	33789	36440	36527

**. Correlation is significant at the 0.01 level (2-tailed).

Table 12: Correlation: Age and subjective wellbeing

		Subjective Wellbeing	Age
Subjective Wellbeing	Pearson Correlation	1	**-.064****
	Sig. (2-tailed)		<.001
	N	34360	34360
Age	Pearson Correlation	**-.064****	1
	Sig. (2-tailed)	<.001	
	N	34360	37214

**. Correlation is significant at the 0.01 level (2-tailed).