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Abstract

The aim of the paper is to investigate the role of technological infrastructures in affecting the relation between technological behaviour and subjective well-being (SWB). We use the 6th wave of World Value Survey that allows us to have comparable data for 60 countries over the period 2010-2014 through which we provide our empirical contribution in light of the scarcity of studies about the linkages between innovation and SBW. By focusing on the use of internet as a means of collecting information, we show that the same technological behaviour may generate different impacts on SWB depending on the efficiency of the internet infrastructure which makes it possible. Moreover, since recent contributions highlighted a role of technological and scientific beliefs in affecting SWB, we investigate if it is related with the quality of technological infrastructure finding a positive, though not always statistically significant effect, and showing that this effect is stronger in areas with less efficient infrastructure. The focus on the relationship between technological infrastructure and SWB paves the way for policy interventions aimed at promoting a coherent development of technological access, use and beliefs.

Keywords: Subjective well-being; Internet infrastructure; Technological behaviour; Technological beliefs.

JEL: I31; O10; O33

1. Introduction

The use of technological goods of whatever sort (such as TV, mobile phone, Internet) has grown a lot in recent years. According to the Internet World Stats website (https://www.Internetworldstats.com/stats.htm, accessed: 11.10.20) the 63.2% of the world population uses Internet, with a growth rate in the last twenty years equal to 1,266% and a penetration rate (% of population) which ranges from the 47.1% in Africa – growth rate 13,898% - to the 90.3% in North America – growth rate 208% (data at the 20 October 2020). This general context has led many to "compare digital transformation with earlier industrial transformations propelled by general-purpose technologies like steam or electricity." (OECD, 2019, p.3). The impacts generated by new technologies have been at the core of several theoretical and empirical studies which investigate the microeconomic and macroeconomic effects of technology on economic variables such as employment (e.g. Harrison et al. 2014; Vivarelli 2014), productivity (e.g. Liang et al. 2010; Crowley and McCann 2018) and economic growth (e.g. Hasan and Tucci 2010). However, while the effect of technological innovations on the performance of firms or countries has been deeply investigated, much lower importance has been reserved to the examination of the effects that innovation may have on subjective well-being (SWB) of people.[1] In this respect, Martin (2013) has put into evidence that innovation studies are confronted with some crucial social challenges, identifying one of the most important as the investigation of the impacts of innovation on measures of wellbeing. This position is echoed by Binder (2013) who underlines that the uneven nature of innovativeness calls for further investigations on its role on the society's wellbeing. From a conceptual point of view, the model proposed by Engelbrecht (2014; 2018) helps to frame the likely consequences and manyfold relationships between technological innovations and employment, environment, social relations, cultural identity, recognizing that they can affect SWB in an ambiguous way. In particular, quoting Schubert (2012), he underlines that if innovation studies are not linked to their well-being implication, they lose their capability of being relevant also from a policy perspective.

In the empirical literature, the nexus between innovation and SWB has mainly focused the attention on one of the channels identified by Engelbrecht (2014), that is, the consumption perspective relative to the practical use of technological innovations, such as technological devices. Some analyses at the macroeconomic (e.g. Aldieri et al. 2020; Ganju 2016; Maiti and Awasthi 2020) and at the microeconomic level have introduced variables accounting for the use of technological goods in the specification of the life satisfaction equation. In particular, most of the analyses study the impact of the TV (Bruni and Stanca 2006; 2008), the smartphone (e.g. Rotondi et al. 2017), Internet and the use of social network (e.g. Graham and Nikolova 2013; Sabatini and Sarracino 2017; Arampatzi et al. 2018). This type of literature, despite the

[1] It is not the aim of this contribution to go into the depth of the effect on SWB of other socio-cultural and economic variables. For a survey on the determinants of SWB see for example Frey and Stutzer (2002); Easterlin (2003); MacKerron (2012).

good analysed, has generated two contradictory findings. On the one side, authors agree in claiming that a greater access to technological goods may exert a positive effect on SWB, because it extends the possibilities of contacts and relationship with other people, it favours a greater endowment of "power" over personal life and it allows to save time that can be devolved to other activities. On the other side, relying on technological devices to a greater extent can also adversely affect the quality of life and face-to-face relationships among people, increasing stress and anxiety because of their pervasiveness. By starting from this conceptual framework, we focus our analysis specifically on the effects of Internet on SWB. One of the main reasons is that Internet is one of the most pervasive means through which technology affects our life and as a consequence our well-being. It is "incorporated" in mostly all of the technological goods we use, such the mobile phone, computer and TV: nowadays, everything is connected through the use of the web. Moreover, as also Lohman (2015) points out, Internet is inherently different from other technological devices as the amount of information flows that pass through the web, amplifies the possibility and frequency of interactions among people.

While the role of Internet has already been investigated in some studies that nevertheless lead to mixed results, we think two important variables are missing from the framework, on which we give our contributions.

The first pertains to the role of ICT infrastructure. Our approach is analogous to that proposed by Lohmann (2015), as we take the broadband penetration rate as a proxy for the quality of the technological infrastructure. However, differently from Lohmann (2015), who shows that a higher quality of Internet infrastructure lowers the effect of income on SWB by increasing the level of material aspirations, we propose to see whether better technological infrastructure has any impact on the direct effect of Internet on SWB. Therefore, our first contribution is that of studying the role of technological infrastructures in affecting the relation between the use of technology and SWB. We think that a more efficient ICT infrastructure can make information (of whatever type) available in less time reducing information asymmetries, and can help achieving network externalities within the country thus making the use of Internet more valuable. We show that the use of Internet to collect information generate a different impact on SWB depending on the efficiency of the technological infrastructure.

The second variable not accounted for in most studies, is relative to the role played by technological and science attitude of people. In the papers considered so far, some very limited psychological literature has investigated through which type of mental mechanism, beliefs in science and technology can have an impact on SWB at the individual level. They make use of the compensatory control theories according to which people when do not feel to be in control over their lives try to restore it by filling the void usually through religious beliefs (e.g. Kay et al. 2008) or technological beliefs (Stavrova et al. 2016). Inside the innovation literature, this side of the issue has been mainly neglected. Only Dolan and Metcalfe (2012) in their study on a UK sample find that higher creativity is associated with higher level of life satisfaction. We therefore offer a contribution in this literature by first introducing a variable accounting for the role of personal attitude

towards science and technology. Furthermore, as with respect to the analysis of technological behaviour, we analyse whether the technological environment in terms of the quality of technological infrastructure available to subjects can influence the final effect on SWB. In particular, we make the hypothesis that where the ICT infrastructure is weaker the impact of positive technological and scientific attitude on SWB will be higher due to the fact that in context of technological development, people may feel more urgently the demand for a secondary source of control over one own life. We highlight a positive, though not always statistically significant, effect of beliefs on SWB and show that this effect is stronger in areas with less efficient technological structures.

In our opinion, the focus on the technological infrastructure contributes to improve our understanding of the relation between the use of technology, technological and scientific beliefs and SWB. Moreover, the role of the quality of technological infrastructure in affecting our results seems to rule out a crucial role of reverse causality in generating our empirical evidence. In fact, there are no reasons to expect that a possible effect of SWB on the use of Internet or technological beliefs is affected by the efficiency of technological infrastructure.

The empirical analysis is based on data from the World Value Survey (WVS) 6th Wave. The dataset includes 60 countries and cover the years 2010-2014. This allows us to verify whether the effect may hold for several countries thus providing evidence of cross-country empirical regularities as well as heterogeneities between and within group of countries. As other studies argue, there are some universal determinants of SWB such as income and health, but others are more specific to some group of countries (e.g. Bartolini et al. 2017; Lim et al. 2019). Indeed, countries have different SWB determinants as they keep because of different cultural values that may evolve over time possibly including the experience with technological goods and scientific knowledge. This may hold also for different expectations people may have for the future about what advantages and disadvantages technological knowledge may bring them.

The paper is organized as follows. In section 2 we review the literature, in section 3 we propose the main theoretical hypotheses of this study. Section 4 presents the dataset and empirical methods. Section 5 focuses on the results obtained. Section 6 concludes providing also some hints for avenues of further research.

2. Related literature

Technological innovations are present in our daily life in a very pervasive way, and we currently consume in large quantities material outcomes of innovation activities of the firms. The literature has started to investigate the impact of innovations on SWB from this perspective, that is through the use of technological devices. As Engelbrecht (2014, 2018) illustrates in his framework, this "consumption" perspective is one of the channels through which innovation can impact on SWB. The literature is mainly concentrated on a micro-level perspective as it is our approach, but a limited macro-level literature has analysed the topic as well but with a different approach, as it is not possible in this case to account for

the personal use of the technological devices as well as for the role of personal attitude towards science and technology. Two papers are worth mentioning. The first is by Ganju et al. (2016), who investigate the channels through which ICT can affect SWB. By using Gallup Word Poll data between 2006-2014, they find that ICT can exert positive effects on SWB through several mechanisms: fostering lower social inequality, improving health due to greater awareness of health issues, enhancing the level of education through the possibility of following on-line courses, and improving the level of commercial exchanges through e-commerce. However, these beneficial effects of ICT are not the same across countries. For example, an increase in the use of mobile phones in high income countries does not automatically lead to higher SWB. It is important to stress this point which highlights the role of heterogeneity of countries with respect to the effects of different types of technologies on life satisfaction.[2] The second is by Aldieri et al. (2020) who, following the conceptual elaborations put forward by Engelbrecht, (2014, 2018) and using a time series approach on a group of European countries, find negative effects of innovations on SWB mediated by a rising level of inequality.[3]

Most of the literature has instead tried to shed light from a micro-level perspective on the role of technological behaviour on SWB. Some early papers refer only to older and conventional technological devices such as the TV. For example, Bruni and Stanca (2006) find that television viewing has a negative effect on SWB, especially for those that are heavy TV users, as generates higher material aspirations and favours both adaptation and positional effects. In a further article (Bruni and Stanca 2008) find that the number of hours spent watching TV may act as a barrier to the consumption of relational goods, thus negatively affecting SWB. Later, the attention has been posed on more recent technological devices, such as the smartphone and Internet. In this respect, Kavestos and Koutroumpis (2011) find a positive effect on SWB for the Internet access by using Eurobarometer Survey Series over the period 2005-2008 for 29 countries.[4] The same positive impact is shown by Graham and Nikolova (2013), over the period 2009-2011, for quite a large sample of countries. An important discovery of their studies is that the positive effect is different considering different groups of people, that is for those who are already heavy-technology users the effect is lower. Dividing the sample into poorer and richer nations they find that access to ICT is less important for SWB for the latter one. In the same way, Penard et al. (2013) discover for the Luxembourg case that Internet use has a greater positive influence on SWB specifically for those of younger age and those that receive lower satisfaction from income. Rotondi et al. (2017) find that, while generating a direct positive effect on SWB, the use of the smartphone also reduces the quality of face-to-face relations and, as a consequence, their positive effect on well-being. Nie et al. (2017), who analyse the Chinese case by going in depth on the reasons for which

[2] In this paper, the use of ICT is proxied by three variables that consider the amount of fixed telephone lines, the number of Internet users, and the number of mobile phones.

[3] Maiti et al. (2020) instead, by referring to the theoretical framework developed by Castellacci and Tveito (2018) use cross-country data to investigate the impact of ICT exposure on objective measure of well-being, finding a lower effect for lower income countries.

[4] They also consider the role of TV finding positive effects as well.

people use Internet and disentangling on specific on-line activities, provide evidence of a negative effect of the intensity of the Internet use on SWB[5]. Some contributions highlight a mixed effect. Lohmann (2015) shows a positive effect of the use of Internet on SWB, while emphasizing that, through Internet, people may change the way they value their lives having more chances to compare themselves with other, in this way rising their material aspiration. This lowers the effect of income on SWB especially in contexts endowed with advanced Internet infrastructure. He analyses the role of broadband penetration but considering only the use of PC and limiting the analysis to a small sample of 29 European countries over the period 2004-2009.

A theoretical approach dealing with the effects that Internet may have on SWB is the one employed by Castellacci and Tveito (2018) who, besides surveying the literature, propose a new framework about the mechanisms through which Internet may affect our lives highlighting how they can be quite different from one another and equally conducing to possible positive as well as negative effects. They refer to the change in the way we use our time, the possibility of being part of other activities, the higher possibility of having access to more information and the availability of further communication tools.

As evidenced from the literature produced on this topic, two contradictory effects emerge from the analysis. On the one side, Internet can facilitate several dimensions of everyday life as well as personal relationships. It may happen because people can be better informed and educated, can activate multiply contacts with friends and family and therefore rise their social capital. On the other side, spending too much time to handle a "virtual" life can become dangerous because of the time taken away to face-to face interactions, in this way stressing the feeling of loneliness that can occur, besides having more opportunities to compare our life with that of our peers.

In this literature briefly review so far, what is lacking is the role of technological infrastructure in affecting the direct effect of the use of technological devices on SWB. Indeed, if we want to adopt a comparative perspective, we need to take into consideration that in different countries the possibility of accessing ICT resources may be hampered or favoured by the presence, respectively, of a weak or strong ICT infrastructure. This mediating effect has never been considered before.

For this reason, in our study, we focus not only on the direct effect possibly generated by the use of Internet to collect information on SWB, but also whether it can be mediated by the efficiency of the ICT infrastructure.

[5] A further strand of literature examining the effect of Internet is the one dealing more specifically with the use of Social Network (SNS). Only a few studies examine this aspect, among them Sabatini and Sarracino (2017) on Italy who find a negative effect of the use of SNS on life satisfaction, mediated by trust. A recent survey on this argument is provided by Verduyn et al. (2017), who distinguish between passive and active use of SNS. In the first case they detect a negative effect on life satisfaction because of the presence of a "comparison" effect, while a positive effect appears when an active use of SNS is done. Arampatzi et al. (2018) find no relationship between the time spent on social network sites and happiness.

Moreover, what is still lacking from this framework is the consideration of the fact that positive or negative attitude to technology can change the degree of life satisfaction. Indeed, one of the early papers dealing with this issue is the one by Dolan and Metcalfe (2012), who are among the first to empirically analyse the causal relationship between innovation, in a broad sense, and SWB in a UK sample (British Household Panel Survey), finding that experiencing a higher level of SWB is correlated with a more creative personality and imagination capacity. However, only a very limited psychological literature has studied the topic. As the few results suggest at the individual level, the role of technological and science attitudes can positively affect SWB through a sort of compensatory control function. People may feel to dominate the real world and are allowed to adopt an optimistic attitude towards the future. Stavrova et al. (2016), through both experimental and survey evidence, recognize that having strong scientific beliefs lead to feel more sense of control over own life, therefore increasing SWB. They also find that the role played by the technological environment in which people live may have an impact as well. It means that living in a country characterised by a more deeply rooted "technological culture" may favour the impact of personal technological belief on SWB. Farias et al. (2013) considered through experimental evidence that people who do not believe in God can achieve a sense of meaning and purpose in life through scientific beliefs. Similarly, Aghababaei et al. (2016) find that scientific beliefs can be useful mediators in the achievement of a higher SWB because they can alleviate the sense of anxiety with respect to the fear of death as well as giving a purpose in life. Therefore, this type of literature highlights that scientific and technological beliefs may actually impact on SWB and they can represent a specific mean through which people can attach a meaning to life. As Kerchner and Ehlers (2016) argue, not enough effort has been carried out in the examination of the technological and science beliefs of people in the economics literature. This has become part of the investigation of the European Union through Eurobarometer polls that started after the 2000 (e.g. Eurobarometer 2013) and went on through years spurred by the so-called 2020 EU strategy in which the role of innovation is crucial. Among the reasons for the beginning of this investigation, there was the need of introducing Science and Technology (S&T) policies that are beneficial for the competitiveness of a country and the consequential need of a certain degree of public support (Besley 2013; Munoz et al. 2012). However, much of the effort has been taken out to understand what are the characteristics of people that are going to appreciate technology and science.[6]

[6] One of the strand of literature inside the social science domain dealing with technological and science attitudes is the one called "Public Understanding of Science" (PUS): one of the main points discussed is relative to the deficit model, that focuses on the supposed relationship between a higher level of scientific and technological knowledge and a more positive attitude towards science; on this respect see the meta-analysis by Allum et al. (2008) and the approach from an historical evolution perspective by Bauer (2009). Further elaborations, such as, for example, Guenther and Weingart (2018), have pointed out that the role of different groups of people characterized by specific features (such as social class, gender, geographical location) could generate different results with respect to science and technology attitudes. Some limited empirical evidence linking economics with PUS debate is evidenced in a paper by Sanz-Menéndez and Van Ryzin (2015). The authors find that the occurrence of the economic crisis in Spain has led to an increase in the scientific and technological positive attitude in accordance with the Post Industrial model of PUS debate. It is first evidenced that more

We therefore complement the empirical literature relative to the impact of technological devices on SWB by introducing the role of attitudes toward science and technology.

3. Theoretical hypotheses

With respect to the role of the quality of technological infrastructure in affecting the relationship between Internet use to retrieve information and SWB, our hypothesis is that the more efficient the Internet connection, the greater the direct effect on SWB of the use of Internet. A fast connection allows subjects to retrieve more information in less time. It implies the possibility to satisfy needs, in terms of collection of information, with a lower waste of energy and time than in the case of a slower connection. Whether information is needed to organize some activities, or to satisfy a curiosity, a faster connection produces a benefit at a lower cost.

Note that we do not maintain that a more efficient technological infrastructure always implies a *positive* greater effect of technological behaviours on SWB. We argue that a poor technological infrastructure may prevent the (positive or negative) effect of technology to arise. We neither exclude that, with respect to some behaviours, the efficiency of technological infrastructure might be pivotal in determining the sign of the effect on SWB. For example, if the slowness of the Internet connection used as a source of information did not allow to retrieve the desired information, or implied a significant waste of time, the use of technology could be frustrating and negatively affect SWB. However, this would induce rational subjects to look for other sources of information.

Since, technological infrastructures differ in quality both across countries and within the same country or region, we argue that their role in affecting the relations between technological behaviours and SWB should be carefully considered.

H1. The higher the quality of the Internet infrastructure, the higher the direct effect of the use of Internet as a source of information on SWB.

With respect to this issue concerning the effect of technological and scientific beliefs on SWB, we expect a greater effect in contexts characterized by a lower quality of Internet infrastructure.

As evidenced, science and technology may represent a mechanism through which people increase their control over their environment, their lives, the future and existential threats, in this way positively affecting SWB (Stavrova et al. 2016). Technological and scientific beliefs may have a role as secondary or compensatory sources of personal control in the absence of immediate personal control (Stavrova et al. 2016). We argue that the positive effect of technological and scientific beliefs on SWB due to their role as secondary or compensatory sources of control is higher in areas where a

positive evaluation of science and technology can be found in those regions characterized by a lower level of development. Moreover, the interest in science as well as the propensity to support S&T policies are higher in regions where unemployment is higher, that is where the economic crisis was more difficult to deal with.

lower technology development allows a poorer control over environment and existential threats. In fact, the lower the technological development, the higher and more urgent the need for a secondary source of control over one own life. By assuming the quality of the Internet infrastructure as a proxy of the technological development, we expect that subjects leaving in areas with a lower quality level of such infrastructure may benefit more by their technological and scientific beliefs than subjects who can exploit more the actual potentiality of technology.[7]

H2. Technological and scientific beliefs are expected to positively affect SWB to a greater extent in areas characterized by Internet infrastructure of lower quality.

4. Dataset, methods and variable description

4.1 Dataset

To analyse our research questions, we opted for a cross-country database to provide more generalizable results and put into evidence possible regional heterogeneities. The 6th Wave of the World Value Survey (2010-2014) include a total of 86,272 observations for about 60 different countries (both developed and developing). This dataset collects a large amount of information on several dimensions of human life encompassing those relative to SWB, personal beliefs, as well as some socio-demographic factors. More specifically, we use the 6th Wave because it provides information on the use and frequency of some technological devices and in particular the Internet, which are not included in the previous Waves. Not all variables are available for all countries.[8]

We use the World Bank classification to break down the sample into groups of countries (regions). In Table A1 in the Appendix we provide a list of all countries in each region. The average number of respondents is characterized by a different distribution across regions (see Table 1).

Table 1 Distribution of the sample across group of countries

Region	Freq.	Perc
East Asia	16,634	19.28
East Europe	8,571	9.93
Central Asia	10,839	12.56
South America	11,439	13.26
Middle East	10,768	12.48
Europe-Anglo Saxon	10,893	12.63
Africa	17,128	19.85
Total	86,272	100

[7] Recent experimental results have shown that the decrease of an individual's sense of personal control generates an increase in the belief in scientific–technological progress (Rutjens, van Harreveld and van der Pligt, 2010; Stavrova et al. 2016).

[8] In some questions people replied "Don't know" or the question is considered "Not applicable" or "No answer" was given: in all these cases, the observation is considered missing.

4.2 Methods

The equation we estimate, is the following:

$$SWB_{ijt} = \alpha + \beta_1 INTERNET_{ijt} + \beta_2 TECHNOBELIEF_{ijt} + \beta_3 SOCIO\text{-}DEMO_{ijt} + \gamma_c + \delta_t + \varepsilon_{ijt} \quad \textbf{(1)}$$

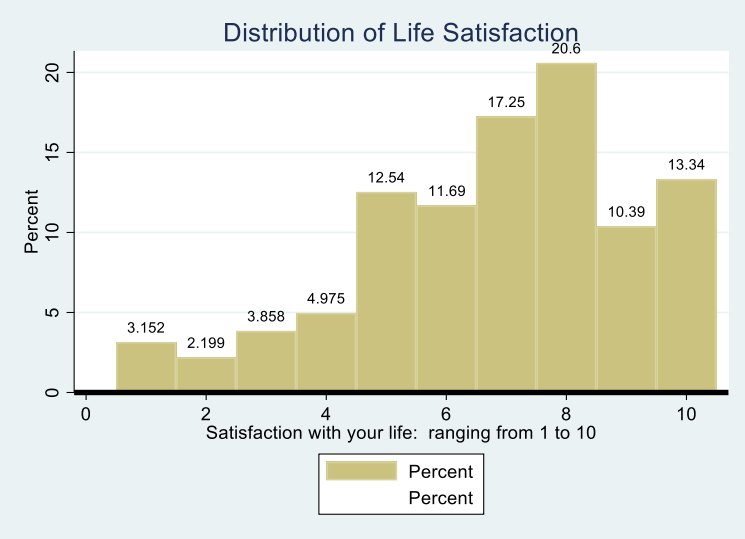
As clarified below, the dependent variable has an ordinal nature and estimating the model through an ordinal probit technique would be more appropriate. Nevertheless, as it is customary in this type of literature we run the models using a standard OLS. As Ferrer-i-Carbonnell and Frijters (2004) points out, the differences are negligible and results can be of easier interpretation. In order to investigate the role of the quality of technological infrastructure in affecting the impact on SWB of technological behaviour and technological and scientific beliefs we consider the role played by the amount of Fixed broadband subscriptions per 100 people (variable named *Broadband*). Data concerning this variable are taken from the World Development Indicators. Fixed broadband subscriptions "refers to fixed subscriptions to high-speed access to the public Internet (a TCP/IP connection), at downstream speeds equal to, or greater than, 256 kbit/s."[9] This variable takes the same value within each country. With respect to each region, we divided the sample according to the average value of *Broadband* in that region and run our regression model (1) with reference to subjects leaving in countries characterized by a higher or a lower percentage of broadband penetration, respectively.

4.3 Dependent variable

We measure SWB using answers to the following question: *"All things considered, how satisfied are you with your life as a whole these days?"* The answers can be given on a scale ranging from 1 (dissatisfied) to 10 (satisfied). In Fig. 1 we show the distribution of the answers for the whole sample. The values are concentrated between 7 and 8; being the highest frequency 20.6 of the ladder 8. This stands for the fact that people feel quite satisfied overall. However, the mean of the variable is 6.84, meaning that the heterogeneity of the countries involved in this sample is quite high. To dig deeper in this overall framework, we present the distribution of the variable dividing countries into regions. In Fig. 2 we show that the variability among regions is not negligible, with European -Anglo Saxon countries showing ladder 8 with the highest frequency (around 30%).

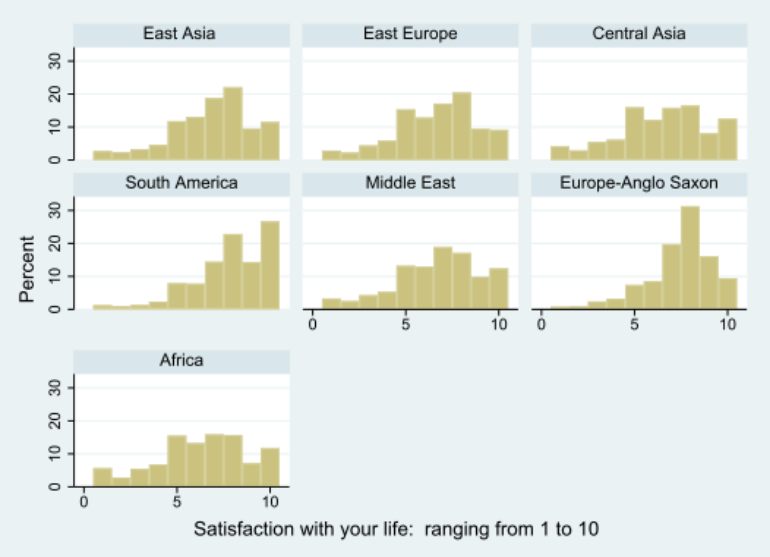
[9] "This includes cable modem, DSL, fiber-to-the-home/building, other fixed (wired)-broadband subscriptions, satellite broadband and terrestrial fixed wireless broadband. This total is measured irrespective of the method of payment. It excludes subscriptions that have access to data communications (including the Internet) via mobile-cellular networks. It should include fixed WiMAX and any other fixed wireless technologies. It includes both residential subscriptions and subscriptions for organizations."

Fig. 1 Life Satisfaction Distribution – full sample



Source: Authors' elaboration

Fig. 2 Life Satisfaction Distribution – sample divided by region



Source: Authors' elaboration

4.4 Independent Variables of main interest

The focal independent variables capture technological behaviour in terms of the use of Internet as a source of information ($INTERNET_{ijt}$), and beliefs ($TECHNOBELIEF_{ijt}$) that are divided into technological and scientific beliefs (*Tech_beliefs* and *Science&tech_belief*). The first variable is built considering the answers to the question "*People learn what is going on in this country and the world from various sources. For each of the following sources, please indicate whether you use it to obtain information daily, weekly, monthly, less than monthly or never*" with respect to the "Information source: Internet". The scale of the variable ranges from 1 (daily) to 5 (never). We transformed the variable into a dummy that is equal to 1 when the original value is equal 1, that is when a person is a heavy user.

With respect to technological and scientific beliefs, as Kerschner and Ehlers (2016) recommend, we use two separate variables based to two different questions to try to capture the possible different aspects of technology and science. The first variable (*Tech_beliefs)* is focalized on technology and refers to the answer relative to the approval rating of the following sentence: *"I'm going to read out a list of various changes in our way of life that might take place in the near future. Please tell me for each one, if it were to happen, whether you think it would be a good thing, a bad thing, or don't you mind?*" concerning "*More emphasis on the development of technology".* The scale of the variable ranges from 1 (bad thing) to 3 (good thing). For ease of interpretation the variable is used in the regressions as dummy: it is equal 1 when the value of the original variable is equal 3 depicting the highest degree of positive beliefs towards technology (*Tech_beliefs)*. The second variable we use (*Science&tech_belief*), includes also a specific reference to science; it is built considering the answers to the question "*Because of science and technology, there will be more opportunities for the next generation*". The scale of the variable ranges from 1 - Completely disagree - to 10 - Completely agree - (will help). The variable is a dummy equal 1 when the value is higher than 5, that is when people show more favourable attitude towards science and technology.[10]

Table 2 provides information about the use of internet and declared beliefs across and within regions. When considering data within each region - last line of each sub-table - we observe that the region characterized by the highest use of internet is the Europe-Anglo Saxon one, while the region with less intensive use is Africa. The greater use of Internet seems to be associated with a lower percentage of answers in terms of positive beliefs. Africa, Central Asia and South America which have the lowest percentages of 1 in the *Internet* variables report percentages of subjects having positive technological beliefs (variable *Tech_beliefs* equal to 1) higher than 70%. Conversely, in the Europe-Anglo Saxon area only the 55% of people show positive technological beliefs. The percentage of subjects who believe that, because of science and technology, there will be more opportunities for the next generation (*Science&tech_beliefs*) is quite high in Africa and in other regions characterized by a low diffusion of the use of Internet, with particular reference to Central Asia. However, it does not assume the lowest value in the Europe-Anglo Saxon region.

[10] As a robustness check we also run a regression in which we use the variable according to its original scale, that is a categorical variable ranging from 1 to 10. Results are virtually unchanged with respect to those obtained using the dummy variable. They are available upon request.

Tab 2 The use of internet and declared beliefs across and within regions

	East Asia	East Europe	Central Asia	South America	Middle East	Europe-Anglo Saxon	Africa	Total
					Internet			
n. of 0	10,473	5,166	8,395	8,224	7,038	4,092	12,696	56,084
% in the total sample	18.67	9.21	14.97	14.66	12.55	7.3	22.64	100
n. of 1	4,799	3,273	2,412	3,120	3,488	5,428	3,111	25,631
% in the total sample	18.72	12.77	9.41	12.17	13.61	21.18	12.14	100
Total	15,272	8,439	10,807	11,344	10,526	9,520	15,807	81,715
	18.69	10.33	13.23	13.88	12.88	11.65	19.34	100
% of 1 within each region	31.42	38.78	22.32	27.50	33.14	57.02	19.68	
					Tech_beliefs			
n. of 0	6,058	2,448	3,066	3,127	2,815	4,671	4,544	26,729
% in the total sample	22.66	9.16	11.47	11.7	10.53	17.48	17	100
n. of 1	10,250	5,753	7,647	7,844	7,648	5,710	11,784	56,636
% in the total sample	18.1	10.16	13.5	13.85	13.5	10.08	20.81	100
Total	16,308	8,201	10,713	10,971	10,463	10,381	16,328	83,365
	19.56	9.84	12.85	13.16	12.55	12.45	19.59	100
% of 1 within each region	62.85	70.15	71.38	71.50	73.10	55.00	72.17	
					Science&tech belief			
n. of 0	2,982	1,173	1,231	2,335	1,913	1,983	2,332	13,949
% in the total sample	21.38	8.41	8.83	16.74	13.71	14.22	16.72	100
n. of 1	12,626	7,064	9,510	8,720	8,545	8,677	14,120	69,262
% in the total sample	18.23	10.2	13.73	12.59	12.34	12.53	20.39	100
Total	15,608	8,237	10,741	11,055	10,458	10,660	16,452	83,211
	18.76	9.9	12.91	13.29	12.57	12.81	19.77	100
% of 1 whitin each region	80.89	85.76	88.54	78.88	81.71	81.40	85.83	

Source: Authors' elaboration

4.5 Control variables

In accordance with the relevant literature, we account for most of the individual level determinants of life satisfaction by considering the common socio-demographic variables (SOCIO-DEMO$_{ijt}$) that are present in all micro-level studies (e.g Dolan, 2008). They are represented by age (*Age*) and age squared (*Age sq*) to account for the likely U shape relationship with SWB; the marital status, as being single, is negatively associated with life-satisfaction with respect to sharing life with a person. We measure this aspect by including a dummy (*Single*) which is equal to 1 if the person is single/never married and 0 for all the other categories. The health status (*Health*) is measured through a categorical variable ranging from 1 (very poor) to 4 (very good), represents the answer to the following question "*All in all, how would you describe your state of health these days?"* We expect a positive sign for this variable as most of the literature has found (e.g.Graham 2008; Borghesi and Vercelli 2012). A further dummy variable equal to 1 is included for being female (*Gender*) as women are expected to get a higher degree of satisfaction from life than men. Education, which may have an uncertain effect on

SWB, is captured by a variable indicating the highest level of education (*High_edu*) that respondents have achieved (e.g. Chen 2012). This variable ranges from 1 (lowest level, that is "*Inadequately completed elementary education*") to 8 (highest level, that is "*University-level education completed with a degree*"). One of the key variables in these types of studies is the income of the household (*Income*). Following the literature (e.g. Bjørnskov et al. 2008) it is built as a categorical variable ranging from 1 to 10, in which each respondent should subjectively position its household's income on the scale.[11] We also control for the employment status of the respondent (*D_employment*), through a dummy variable indicating whether the respondent is full-time employed, with respect to all the other categories, among the most important, being self-employed or unemployed.

Finally, in all regressions we include country fixed effects (γc) in order to account for possible country unobserved heterogeneity. We report robust standard errors in all regressions.

In Table A2 in the Appendix we show some descriptive statistics of variables for the overall sample.

4.6 The quality of technological infrastructures

Table 3 summarizes the average, the minimum and maximum value of broadband penetration (*Broadband*) with respect to each region and the number of observations included in each subsample. The average value of the variable at regional level reveals that Africa, Central Asia and Middle East are characterized by the lowest broadband penetration rate. The highest penetration rate is in the Europe-Anglo Saxon region. The diffusion of positive beliefs on technology and science (Table 2) seems to be higher in the regions characterized by lower rates of broadband penetration, with Africa and Middle East showing the highest percentages of 1 with respect to the *Tech-beliefs* variable and Africa and Central Asia showing the highest percentages of 1 with respect to the *Science&tech_beliefs* variable. Moreover, the Europe-Anglo Saxon region presents the highest broadband penetration rate and the lowest percentage of 1 with respect to the *Tech-beliefs* variable. With respect to the use of Internet (Table 2) we observe that regions with high broadband penetration rates seem to reveal high percentages of subjects who use internet as a source of information, even though there is not a strict correspondence between the two variables, with Middle East representing the most significant exception, having quite a high percentage of people using internet to collect information and a low broadband penetration rate.

[11] The question wording is: "*On this card is an income scale on which 1 indicates the lowest income group and 10 the highest income group in your country. We would like to know in what group your household is. Please, specify the appropriate number, counting all wages, salaries, pensions and other incomes that come in*."

Tab 3 Broadband penetration rate at macro-regional level

	Obs	Mean	Stdv	Min	Max
East Asia	15,396	16.073	11.855	0.810	34.704
East Europe	8,571	19.258	5.481	12.272	26.282
Central Asia	10,839	8.490	7.107	0.510	22.284
South America	11,439	10.548	3.002	4.890	14.814
Middle East	7,568	8.841	6.308	1.300	21.524
Europe-Anglo Saxon	10,893	30.937	5.482	23.719	39.626
Africa	15,369	1.989	1.451	0.052	4.747

Source: Authors' elaboration

5. Results

Table 4 and 5 report the results of our OLS regressions. Table 4 includes *Tech_beliefs* and table 5 *Science&tech_beliefs*. The Broad 0 (Broad 1) regressions refers to the sub-samples of subjects who live in areas characterized by a broadband penetration rate lower (higher) than the average of the region. The tables show the coefficients of the independent variables of main interest. Full estimates results are reported in Table A3 and A4 in the Appendix. We find that the main stylized facts relative to SWB determinants are mainly confirmed. Indeed, age and age squared have the expected non-linear trend. In addition, being female and married is positively related to SWB as expected. The variable measuring income is positively and highly significant confirming that higher level of income has a positive impact on life satisfaction. Moreover, being healthy has a positive impact as well. Instead, being full-time employment is mainly not significant or weakly positive. When focusing on our proxy of technological behaviour (the use of Internet) we see that in both table 4 and 5 the coefficient of the *Internet* variable is positive and statistically significant in 9 out of 14 regressions and it is always the case when the broadband penetration rate is higher than the average of the single region. Moreover, in all regions but South America, the size of the coefficient is greater when the broadband penetration rate is higher. This effect of the broadband penetration rate seems to rule out the possibility that our empirical result on the impact of Internet on SWB is driven by reverse causality. In fact, we cannot explain any effect of SWB on the use of Internet which is affected by the quality of technological infrastructure. The main difference between table 4 and 5 seems to be the lower level of the variable's significance in table 5 when South America, MENA and Africa are considered.

We also find that the positive effect of the quality of technological infrastructure can be more relevant in countries characterized by a lower level of development. In those countries the degree of life satisfaction that may be generated by efficient technological infrastructure can amplify the positive effect of the use of a technological goods that we expect being higher in line with what found by the empirical literature so far. As a whole, the analysis seems to reveal that the

effect on SWB of the use of Internet as a way to be more informed, is mediated by the penetration of broadband thus providing support for our H1. This evidence can be considered as generalizable across countries.

Passing to conder our second hypothesis relative to the role of subjects' beliefs about technology and science, we observe a positive effect on SWB which is statistically significant in 7 out 14 regressions when the *Tech_beliefs* dummy is considered (table 4) and in 12 out of 14 regressions when the *Science&tech_beliefs* dummy is alternatively included in the regression (table 5). The positive beliefs on the advantages of technology and science tend to have a greater effect than just technological beliefs on SWB, probably because a multiplying effect of both science and technology can occur. Moreover, what is crucial for our analysis is that, in both the tables, the size of the variable capturing beliefs tends to be higher in areas characterized by a lower rate of broadband penetration. This happens with respect to all the regions but Africa in table 5 and in 5 out of 7 regions in table 4. This confirms the fact that in regions endowed with lower technological capabilities, material expectations about positive effects of what technology and science may generate not only for individuals but also for the overall development of the country, drive the final positive effect on SWB.

As a whole, the empirical analysis seems to reveal quite a generalized positive effect of technological and science beliefs on SWB. These results are in line with our H2. Finally, in our opinion, also the effect of beliefs on SWB seems not to be determined by reverse causality as there are no reasons that may explain an effect of SWB on technological and science beliefs depending on the quality of technological infrastructures.

Tab 4 The relation between the use of Internet, technological beliefs and SWB

	East Asia	East Asia	East Europe	East Europe	Central Asia	Central Asia	South America	South America	MENA	MENA	Europe - Us	Europe - Us	Africa	Africa
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Var	Broad 0	Broad 1	Broad 0	Broad 1	Broad 0	Broad 1	Broad 0	Broad 1	Broad 0	Broad 1	Broad 0	Broad 1	Broad 0	Broad 1
Tech_ beliefs	0.0903	0.0382	0.232***	0.141**	0.393***	0.0688	0.0980	0.258***	0.327***	0.117	0.0114	0.116**	0.116*	0.00639
	(0.0567)	(0.0517)	(0.0707)	(0.0664)	(0.0584)	(0.0727)	(0.0728)	(0.0601)	(0.0816)	(0.0753)	(0.0564)	(0.0468)	(0.0661)	(0.0616)
Internet	-0.00926	0.167***	0.0920	0.308***	0.120*	0.138*	0.149**	0.126**	0.0243	0.227***	-0.0749	0.0934*	-0.0140	0.205***
	(0.0694)	(0.0561)	(0.0717)	(0.0791)	(0.0680)	(0.0821)	(0.0743)	(0.0638)	(0.0687)	(0.0857)	(0.0580)	(0.0513)	(0.0743)	(0.0724)
Cons.	5.759***	4.458***	4.658***	4.047***	4.106***	3.483***	6.363***	5.419***	4.580***	4.942***	4.502***	4.491***	3.382***	3.625***
	(0.329)	(0.315)	(0.350)	(0.364)	(0.276)	(0.361)	(0.302)	(0.252)	(0.385)	(0.410)	(0.309)	(0.248)	(0.315)	(0.320)
Obs.	7,126	4,733	4,415	3,329	6,872	3,614	3,660	5,791	4,193	2,328	3,717	4,398	6,063	5,952
R^2	0.179	0.151	0.211	0.254	0.290	0.287	0.124	0.109	0.167	0.099	0.221	0.232	0.151	0.230

Robust standard errors in parentheses. Country dummies included. *** p<0.01, ** p<0.05, * p<0.1

Tab 5 The relation between the use of Internet, technological and scientific beliefs and SWB

	East Asia	East Asia	East Europe	East Europe	Central Asia	Central Asia	South America	South America	MENA	MENA	Europe - Us	Europe - Us	Africa	Africa
	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
Var	Broad 0	Broad 1	Broad 0	Broad 1	Broad 0	Broad 1	Broad 0	Broad 1	Broad 0	Broad 1	Broad 0	Broad 1	Broad 0	Broad 1
Science &tech_ beliefs	0.657***	0.221***	0.450***	0.0597	0.316***	0.230**	0.217***	0.0778	0.454***	0.316***	0.356***	0.304***	0.362***	0.577***
	(0.0731)	(0.0699)	(0.0889)	(0.102)	(0.0821)	(0.0993)	(0.0726)	(0.0642)	(0.0846)	(0.106)	(0.0747)	(0.0779)	(0.0973)	(0.0728)
Internet	-0.00164	0.176***	0.0862	0.319***	0.126*	0.150*	0.151**	0.121*	0.0387	0.213**	-0.0664	0.0925*	-0.0295	0.136*
	(0.0696)	(0.0572)	(0.0711)	(0.0787)	(0.0678)	(0.0815)	(0.0734)	(0.0638)	(0.0673)	(0.0856)	(0.0575)	(0.0497)	(0.0741)	(0.0729)
Cons.	5.262***	4.398***	4.672***	4.070***	4.241***	3.756***	5.643***	5.562***	3.802***	4.680***	4.504***	4.480***	3.122***	3.400***
	(0.317)	(0.312)	(0.346)	(0.363)	(0.278)	(0.378)	(0.292)	(0.262)	(0.352)	(0.428)	(0.318)	(0.249)	(0.326)	(0.318)
Obs.	7,024	4,538	4,397	3,381	6,898	3,620	3,666	5,847	4,229	2,323	3,707	4,574	6,088	6,083
R^2	0.191	0.152	0.209	0.262	0.286	0.286	0.128	0.104	0.170	0.103	0.225	0.229	0.151	0.228

Robust standard errors in parentheses; Country dummies included *** p<0.01, ** p<0.05, * p<0.1

6. Conclusions

In this study, we contribute to the literature on the relationship between technological innovation and SWB. By starting from the conceptual framework originally elaborated by Engelbrecht (2014; 2018), we adopt a complementary microeconomic point of view. In particular, we make a step forward in clarifying the role of the technological infrastructure in affecting the impact of the technological behaviour and technological beliefs on SWB. This paper can be positioned at the intersection of different strands of literature, that have followed quite independent paths so far. Namely, they are represented by the SWB literature and the economics of innovation literature.

In the previous micro -level literature the mediating role of ICT infrastructure has not been properly taken into consideration. In doing so, we employ the sixth wave of the WVS over the years 2010-2014 covering a large sample of both developed and developing countries. We therefore offer generalizable results even though we do not always find common pattern of behaviour across macro-regions.

With respect to the technological behaviour, we focus on the use of Internet as a source of information and analyse if its impact on SWB is mediated by the quality of internet infrastructure, captured by the broadband penetration rate. As expected, a positive direct effect of the use of internet on SWB seems to emerge in the majority of regions considered in the analysis. Moreover, we show that the higher the broadband penetration rate, the higher tend to be the significance and the magnitude of the effect. The previous result highlights a specific consequence of policy interventions aimed at improving the quality of Internet infrastructure which deserves to be taken into account. The improvement in the quality of infrastructure expands the direct positive effect of the use of Internet as a source of information on SWB. This should be considered, along with all the other effects, when costs and benefits of such interventions are evaluated.

With respect to the technological and scientific beliefs, we consider two proxies, one focusing exclusively on technology the second one considering both technology and science. Also, with respect to beliefs, we observe a positive effect on SWB which tends to be greater when the level of broadband penetration is lower. Again, this is an expected result, in accordance with our initial hypothesis.

The role of the broadband penetration rate in affecting the relation between SWB and technological behaviour and beliefs makes us confident that our results are not determined by reverse causality even though we furnish results that can be interpreted in terms of correlations rather than causation.

Some avenues for further research could be found in several directions. First, a more dynamic analysis would be useful to understand not only how the use of internet and technological and scientific beliefs change over time but also how they possible changes reflect in higher or lower life satisfaction. Second, we focus on the use of Internet as a source of information. Further analysis may investigate if the quality of technological infrastructure has a role in mediating the effect of other technological behaviours on SWB.

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APPENDIX

Tab A1. Full list of countries divided by macro-region

East Asia	
China	2,300
Taiwan	1,238
Hong Kong	1,000
India	1,581
Japan	2,443
South Korea	1,200
Malaysia	1,300
Pakistan	1,200
Philippines	1,200
Singapore	1,972
Thailand	1,200
Total	16,634

East Europe	
Cyprus	1,000
Estonia	1,533
Poland	966
Romania	1,503
Russian Federation	2,500
Slovenia	1,069
Total	8,571

Central Asia	
Azerbaijan	1,002
Armenia	1,100
Belarus	1,535
Georgia	1,202
Kazakhstan	1,500
Kyrgyzstan	1,500
Ukraine	1,500
Uzbekistan	1,500
Total	10,839

Argentina	1,030
Brazil	1,486
Chile	1,000
Colombia	1,512
Ecuador	1,202
Mexico	2,000
Peru	1,210
Trinidad and Tobago	999
Uruguay	1,000
Total	11,439

MENA	
Bahrain	1,200
Palestine	1,000
Iraq	1,200
Jordan	1,200
Kuwait	1,303
Lebanon	1,200
Qatar	1,060
Turkey	1,605
Yemen	1,000
Total	10,768

Europe-Anglo saxon	
Australia	1,477
Germany	2,046
Netherlands	1,902
New Zealand	841
Spain	1,189
Sweden	1,206
United States	2,232
Total	10,893

Africa	
Algeria	1,200
Ghana	1,552
Libya	2,131
Morocco	1,200
Nigeria	1,759
Rwanda	1,527
South Africa	3,531
Zimbabwe	1,500
Tunisia	1,205
Egypt	1,523
Total	17,128

Tab A2 Descriptive statistics - full sample

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Life_satisfaction	85,717	6.8438	2.272891	1	10
Age	86,119	42.09281	16.56611	16	99
Age_sq	86,119	2046.238	1553.028	256	9801
High_edu	80,875	4.994077	2.174026	1	8
Gender	86,184	0.5231017	0.4994689	0	1
Single	86,037	0.2526122	0.4345129	0	1
D_employment	84,717	0.326369	0.4688868	0	1
Health	85,955	2.908836	0.852432	1	4
Income	83,194	4.890954	2.105881	1	10
Tech_beliefs	83,365	0.6793738	0.4667201	0	1
Science &Tech_beliefs	83,211	0.8323659	0.3735433	0	1
internet_freq	81,715	0.3136633	0.4639841	0	1

Tab A3 The relation between the use of Internet, technological beliefs and SWB – full estimate results

	East Asia	East Asia	East Europe	East Europe	Central Asia	Central Asia	South America	South America	MENA	MENA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	Broad 0	Broad 1	Broad 0	Broad 1	Broad 0	Broad 1	Broad 0	Broad 1	Broad 0	Broad 1
Age	-0.0127	-0.0614***	-0.0596***	-0.0518***	-0.0268***	-0.0776***	-0.0290***	-0.0204**	-0.0295**	-0.0105
	(0.0126)	(0.0108)	(0.0117)	(0.0119)	(0.00932)	(0.0128)	(0.0110)	(0.00895)	(0.0148)	(0.0177)
Age_sq	0.000142	0.000765***	0.000632***	0.000598***	0.000275***	0.000762***	0.000345***	0.000315***	0.000386**	0.000175
	(0.000138)	(0.000110)	(0.000120)	(0.000119)	(9.64e-05)	(0.000132)	(0.000120)	(9.67e-05)	(0.000171)	(0.000206)
High_edu	0.0217	0.0321**	0.00186	-0.00214	0.0208	0.00970	-0.00933	-0.0270*	0.0394**	-0.0496***
	(0.0144)	(0.0150)	(0.0178)	(0.0179)	(0.0149)	(0.0211)	(0.0159)	(0.0139)	(0.0161)	(0.0182)
Gender	-0.0110	0.288***	0.0690	0.181***	0.144***	0.264***	0.0639	0.119**	0.111*	0.182**
	(0.0524)	(0.0517)	(0.0607)	(0.0643)	(0.0509)	(0.0663)	(0.0638)	(0.0536)	(0.0665)	(0.0785)
Single	-0.138	-0.317***	-0.381***	-0.401***	-0.0117	-0.376***	-0.0854	-0.241***	-0.394***	-0.0981
	(0.0867)	(0.0774)	(0.0956)	(0.0929)	(0.0826)	(0.100)	(0.0777)	(0.0659)	(0.0874)	(0.106)
D_employment	-0.108*	0.0633	0.147**	-0.0205	-0.0485	0.0880	0.134*	-0.0374	-0.0409	0.106
	(0.0593)	(0.0569)	(0.0668)	(0.0739)	(0.0567)	(0.0759)	(0.0693)	(0.0581)	(0.0709)	(0.0899)
Health	0.439***	0.672***	0.802***	0.737***	0.662***	0.859***	0.499***	0.602***	0.575***	0.544***
	(0.0344)	(0.0371)	(0.0468)	(0.0447)	(0.0364)	(0.0489)	(0.0471)	(0.0372)	(0.0472)	(0.0560)
Income	0.149***	0.165***	0.264***	0.292***	0.314***	0.383***	0.0963***	0.0610***	0.224***	0.150***
	(0.0135)	(0.0126)	(0.0187)	(0.0212)	(0.0149)	(0.0213)	(0.0173)	(0.0132)	(0.0195)	(0.0208)
Tech_beliefs	0.0903	0.0382	0.232***	0.141**	0.393***	0.0688	0.0980	0.258***	0.327***	0.117
	(0.0567)	(0.0517)	(0.0707)	(0.0664)	(0.0584)	(0.0727)	(0.0728)	(0.0601)	(0.0816)	(0.0753)
Internet	-0.00926	0.167***	0.0920	0.308***	0.120*	0.138*	0.149**	0.126**	0.0243	0.227***
	(0.0694)	(0.0561)	(0.0717)	(0.0791)	(0.0680)	(0.0821)	(0.0743)	(0.0638)	(0.0687)	(0.0857)
Constant	5.759***	4.458***	4.658***	4.047***	4.106***	3.483***	6.363***	5.419***	4.580***	4.942***
	(0.329)	(0.315)	(0.350)	(0.364)	(0.276)	(0.361)	(0.302)	(0.252)	(0.385)	(0.410)
Observations	7,126	4,733	4,415	3,329	6,872	3,614	3,660	5,791	4,193	2,328
R-squared	0.179	0.151	0.211	0.254	0.290	0.287	0.124	0.109	0.167	0.099

Robust standard errors in parentheses. Country dummies included. *** p<0.01, ** p<0.05, * p<0.1

Tab A3 The relation between the use of Internet, technological beliefs and SWB – full estimate results - continues

	Europe - Us	Europe - Us	Africa	Africa
	(11)	(11)	(12)	(12)
VARIABLES	Broad 0	Broad 1	Broad 0	Broad 1
Age	-0.0384***	-0.0303***	-0.0217	-0.0625***
	(0.0101)	(0.00861)	(0.0137)	(0.0126)
Age_sq	0.000484***	0.000415***	0.000313*	0.000811***
	(0.000102)	(8.59e-05)	(0.000161)	(0.000144)
High_edu	-0.0332*	-0.000436	0.00247	0.0195
	(0.0196)	(0.0115)	(0.0147)	(0.0169)
Gender	0.180***	0.0822*	0.266***	0.0354
	(0.0570)	(0.0464)	(0.0551)	(0.0590)
Single	-0.498***	-0.411***	-0.0748	-0.152**
	(0.0835)	(0.0653)	(0.0744)	(0.0758)
D_employment	-0.106*	0.0650	-0.0183	0.146**
	(0.0622)	(0.0541)	(0.0669)	(0.0690)
Health	0.960***	0.842***	0.564***	0.747***
	(0.0413)	(0.0343)	(0.0392)	(0.0395)
Income	0.148***	0.148***	0.281***	0.320***
	(0.0151)	(0.0128)	(0.0161)	(0.0155)
Tech_beliefs	0.0114	0.116**	0.116*	0.00639
	(0.0564)	(0.0468)	(0.0661)	(0.0616)
Internet	-0.0749	0.0934*	-0.0140	0.205***
	(0.0580)	(0.0513)	(0.0743)	(0.0724)
Constant	4.502***	4.491***	3.382***	3.625***
	(0.309)	(0.248)	(0.315)	(0.320)
Observations	3,717	4,398	6,063	5,952
R-squared	0.221	0.232	0.151	0.230

Robust standard errors in parentheses. Country dummies included. *** p<0.01, ** p<0.05, * p<0.1

Tab A4 The relation between the use of Internet, technological and scientific beliefs and SWB – full estimate results

	East Asia	East Asia	East Europe	East Europe	Central Asia	Central Asia	South America	South America	MENA	MENA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	Broad 0	Broad 1	Broad 0	Broad 1	Broad 0	Broad 1	Broad 0	Broad 1	Broad 0	Broad 1
Age	-0.0179	-0.0582***	-0.0605***	-0.0504***	-0.0280***	-0.0783***	-0.0274**	-0.0233***	-0.0327**	-0.0102
	(0.0127)	(0.0110)	(0.0117)	(0.0116)	(0.00935)	(0.0127)	(0.0108)	(0.00883)	(0.0146)	(0.0181)
Age_sq	0.000211	0.000736***	0.000630***	0.000576***	0.000291***	0.000775***	0.000328***	0.000346***	0.000414**	0.000161
	(0.000140)	(0.000112)	(0.000121)	(0.000116)	(9.69e-05)	(0.000132)	(0.000118)	(9.51e-05)	(0.000169)	(0.000212)
High_edu	0.0219	0.0282*	-0.00870	0.00130	0.0197	0.00750	-0.00683	-0.0247*	0.0399**	-0.0519***
	(0.0144)	(0.0152)	(0.0178)	(0.0175)	(0.0149)	(0.0210)	(0.0157)	(0.0139)	(0.0158)	(0.0181)
Gender	-0.0221	0.314***	0.0652	0.183***	0.129**	0.258***	0.0817	0.130**	0.0869	0.176**
	(0.0525)	(0.0522)	(0.0602)	(0.0634)	(0.0509)	(0.0660)	(0.0631)	(0.0535)	(0.0659)	(0.0786)
Single	-0.131	-0.279***	-0.393***	-0.462***	-0.0118	-0.384***	-0.0907	-0.233***	-0.429***	-0.105
	(0.0869)	(0.0780)	(0.0937)	(0.0901)	(0.0823)	(0.0995)	(0.0774)	(0.0656)	(0.0862)	(0.105)
D_employment	-0.151**	0.0625	0.147**	-0.0371	-0.0401	0.0767	0.158**	-0.0428	-0.0485	0.107
	(0.0597)	(0.0575)	(0.0664)	(0.0731)	(0.0566)	(0.0755)	(0.0683)	(0.0582)	(0.0703)	(0.0893)
Health	0.435***	0.661***	0.771***	0.737***	0.658***	0.859***	0.493***	0.607***	0.571***	0.564***
	(0.0349)	(0.0377)	(0.0469)	(0.0437)	(0.0363)	(0.0487)	(0.0467)	(0.0369)	(0.0470)	(0.0560)
Income	0.141***	0.163***	0.261***	0.295***	0.312***	0.381***	0.0944***	0.0602***	0.215***	0.153***
	(0.0135)	(0.0130)	(0.0188)	(0.0210)	(0.0150)	(0.0213)	(0.0171)	(0.0133)	(0.0194)	(0.0209)
Science&tech_beliefs	0.657***	0.221***	0.450***	0.0597	0.316***	0.230**	0.217***	0.0778	0.454***	0.316***
	(0.0731)	(0.0699)	(0.0889)	(0.102)	(0.0821)	(0.0993)	(0.0726)	(0.0642)	(0.0846)	(0.106)
Internet	-0.00164	0.176***	0.0862	0.319***	0.126*	0.150*	0.151**	0.121*	0.0387	0.213**
	(0.0696)	(0.0572)	(0.0711)	(0.0787)	(0.0678)	(0.0815)	(0.0734)	(0.0638)	(0.0673)	(0.0856)
Constant	5.262***	4.398***	4.672***	4.070***	4.241***	3.756***	5.643***	5.562***	3.802***	4.680***
	(0.317)	(0.312)	(0.346)	(0.363)	(0.278)	(0.378)	(0.292)	(0.262)	(0.352)	(0.428)
Observations	7,024	4,538	4,397	3,381	6,898	3,620	3,666	5,847	4,229	2,323
R-squared	0.191	0.152	0.209	0.262	0.286	0.286	0.128	0.104	0.170	0.103

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Tab A4 The relation between the use of Internet, technological and scientific beliefs and SWB – full estimate results - continues

	Europe - Us	Europe - Us	Africa	Africa
	(11)	(11)	(12)	(12)
VARIABLES	Broad 0	Broad 1	Broad 0	Broad 1
Age	-0.0380***	-0.0313***	-0.0211	-0.0681***
	(0.0101)	(0.00844)	(0.0136)	(0.0124)
Age_sq	0.000473***	0.000420***	0.000307*	0.000867***
	(0.000101)	(8.41e-05)	(0.000160)	(0.000141)
High_edu	-0.0457**	-0.0110	0.00367	0.0195
	(0.0193)	(0.0112)	(0.0147)	(0.0169)
Gender	0.189***	0.0680	0.268***	0.0633
	(0.0562)	(0.0449)	(0.0551)	(0.0585)
Single	-0.510***	-0.395***	-0.0679	-0.140*
	(0.0837)	(0.0632)	(0.0743)	(0.0753)
D_employment	-0.101	0.0528	-0.0153	0.175**
	(0.0621)	(0.0526)	(0.0666)	(0.0690)
Health	0.939***	0.828***	0.559***	0.707***
	(0.0413)	(0.0338)	(0.0389)	(0.0395)
Income	0.143***	0.144***	0.278***	0.305***
	(0.0151)	(0.0125)	(0.0160)	(0.0155)
Science&tech_beliefs	0.356***	0.304***	0.362***	0.577***
	(0.0747)	(0.0779)	(0.0973)	(0.0728)
Internet	-0.0664	0.0925*	-0.0295	0.136*
	(0.0575)	(0.0497)	(0.0741)	(0.0729)
Constant	4.504***	4.480***	3.122***	3.400***
	(0.318)	(0.249)	(0.326)	(0.318)
Observations	3,707	4,574	6,088	6,083
R-squared	0.225	0.229	0.151	0.228

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1