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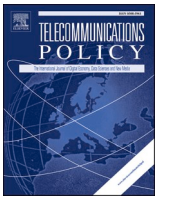

Social media and happiness nexus in the millennial generation

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ABSTRACT

The current paper empirically examines the relationship between social media and happiness. Unlike existing works, we study this nexus from a global perspective using a cross-sectional model consisting of 140 countries on data from 2012 to 2017. Assuming that this effect may differ according to the average level of perception of happiness in each country, we use the quantile regression framework to yield more accurate inferences. The findings show that social media measured by Facebook penetration has a positive and significant relationship with happiness, and this positive nexus differs in terms of amplitude and significance throughout the conditional distribution of the happiness index. However, analysis in different samples reveal that this positive nexus is not universal and differs with the level of economic development of the countries and from one region to another. We put forward mental illness approximated by anxiety as the main transmission channel.

1. Introduction

The dramatic growth of social media in the new millennium has not gone unnoticed, both within academia and in political discussions. With the advent of the internet age in the early 2000s and the launch of platforms like Myspace, LinkedIn and Facebook, social media have become all-pervasive interactive and participatory communication tools and technologies in the contemporary era. In 2020, it was estimated that more than 2.90 billion people were connected through different social networks (Fig. 1). In 2021, these statistics are expected to exceed 3 billion, which would represent more than a third of the world's population.

The literature relating to the effects and issues of these social media is vast. For example, the effects of social media have been established to be positively associated with institutions (Jha and Sarangui, 2017; Enikolopov et al., 2018; Asongu & Odhiambo, 2019a; Jha & Kodila-Tedika, 2020; Kodila-Tedika, 2021), the health sector (Mckee, 2013; Jane et al., 2018) and the education sector (Hong, 2012; Greenhow & Lewin, 2016). With regard in particular to the implications for the lives of users, the results are rather mixed. Several studies support the perspective that social media is one of the main methods of interaction between people in the world today (Wright & Hinson, 2010; Njamen & Nchofoung, 2020). They are sources of opportunities for a two-way dialogue and interaction between individuals and organizations (Bortree & Seltzer, 2009) and help to increase the visibility of commercial enterprises (Edosomwan et al., 2011). However, the perverse effects of these social media have also been raised. Studies such as that of Sigman (2009) have shown that the social media association has significantly reduced interpersonal relationships and social interactions. Salahodjaev (2021) finds that the effect of using social networking sites on life satisfaction is conditioned by the level of loneliness. Lonely people being more likely to increase their subjective well-being through social networking. Moreover, social media are proving to be a source of misinformation, cybercrime, less real-life interactions, victimization of people by online scams, less productivity and health hazards

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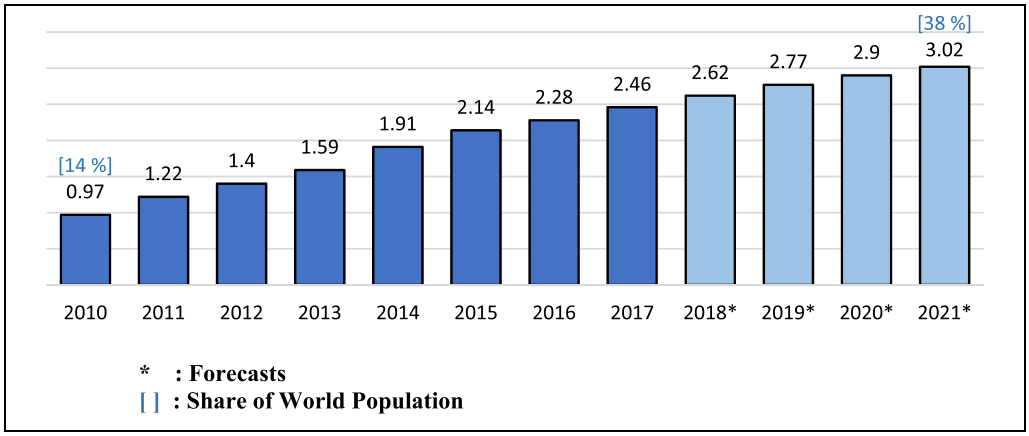

Fig. 1. Number of users of social networks in the world, from 2010 to 2021 (in billions).
Source: authors, inspired by eMarketer Statista.

(Nielsen, 2012) and are also associated with externalities such as crime (Asongu, Nwachukwu, et al., 2019), terrorism (Asongu, Orim, & Nting, 2019) and homicide (Asongu, Uduji, & Okolo-Obasi, 2019).

Regarding the specific effect of social media on happiness, the results are often mixed. For example, Swist et al. (2015) carry out a synthetic review of the literature on the relationship between social media and subjective well-being and identified eight key domains of social media's impact on children and young people: physical and mental health; identity and belonging; formal and informal learning; play and recreation; consumer practices; civic and political engagement; risk and safety; and, family and intergenerational relationships. In the same way, Verduyn et al. (2017) conclude on a negative effect when the use of social media is passive (i.e. monitoring others), and positive effects when the use of these social media is active (i.e. taking news), with the first relation which induces social comparisons and desires, being more robust than the second pertaining to active usage. Chae (2018) study's the effect of different social media on the subjective happiness using a sample of 7625 Korean women and finds on the basis of average estimates that media such as Instagram and LinkedIn accentuate social comparisons, and in the long term have negative effects on happiness. He concludes that social media can lead us to believe that other people's lives are better through social comparison. However, this comparison only influences a portion of overall happiness or life satisfaction.

The purpose of this paper is to extend this literature by reexamining the nexus between social media (measured mainly by the Facebook penetration) and happiness perceptions. This extension of previous work is on three points. First of all, this relationship is examined from a macroeconomic approach. Unlike these previous studies which were limited to microeconomic frameworks conducted in specific countries, a worldwide sample of 140 developed and developing countries is considered. In order to provide more targeted and country-specific recommendations, in line with recent studies by Asongu and Odhiambo (2019b, 2020), the sample is disaggregated in terms of income levels (i.e., average per capita income) and geographic proximity (i.e., different subregions).

Second, we are consistent with Veenhoven (1991) that happiness is relative, and for this purpose we specifically consider subjective happiness which, according to Diener et al. (2009) refers to an overall assessment of the quality of life. In doing so, we provide empirical evidence that social media could also be a relevant determinant. Indeed, although studies in the economics of happiness are relatively recent, several relevant factors have been identified. For example, Easterlin (2001), Frey and Stutzer (2002) show that an increase in gross domestic product (GDP) per capita improves the well-being of citizens. Chen (2012) finds that high levels of education are positively associated with life satisfaction. In contrast, Di Tella et al. (2001) argue that unemployment and inflation have perverse effects on individual life satisfaction. Moreover, socio-cultural factors such as marriage and having a child increase well-being according to Frey and Stutzer (2000).

Third, the originality of this study is above all methodological. Indeed, it is not limited to estimating the parameters for averages as apparent in the previous studies, but it uses a quantile regression framework introduced by Koenker and Bassett (1978) in order to examine the nexus throughout the entire distribution of happiness. Overall, results suggest that Facebook penetration is positively associated with subjective happiness but this positive nexus is not blanket, but contingent on the levels of economic development and regions.

The remainder of the paper is organized as follows. Section 2 outlines the data and methodology. Section 3 presents and analyses the results. Section 4 tests their robustness. Section 5 empirically tests the transmission channel, while section 6 concludes with implications and future research directions.

Table 1
Descriptive statistics and correlation matrix.

Variables	Obs	Mean	Std. Dev.	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Happiness	140	5.459	1.096	2.905	7.632	1						
(2) Facebook	140	21.523	18.980	0.038	97.637	0.777*	1					
(3) GDP per capita	140	8.756	1.495	5.531	11.578	0.799*	0.779*	1				
(4) Health	140	71.443	8.661	47.416	83.480	0.716*	0.753*	0.854*	1			
(5) Unemployment	140	7.850	5.904	0.384	28.010	−0.001*	0.175*	0.168*	0.096*	1		
(6) Inflation	135	5.348	6.021	−0.944	59.220	−0.249	−0.295	−0.265	−0.242	−0.120	1	
(7) Education	103	41.471	27.650	1.593	113.740	0.596*	0.638*	0.754*	0.740*	0.302*	−0.062	1

Source: authors' calculation. **Note:** Pearson's correlation matrix. *p < 0.05.

2. Data and methodology[1]

2.1. Data

Happiness is measured in this study in terms of subjective well-being[2] in accordance with Demir (2021) and approximated using the "life ladder" index which has been documented as widely used in extant studies on drivers of happiness. Some studies supporting such wide usage include: Ram (2017), Njangang (2019), Mignamissi and Malah (2020, 2021), McKee (2013), Salahodjaev and Mirziyoyeva (2021). The index is premised on survey averages on the perceptions of well-being of citizens. Respondents are required to reflect on their life in terms of a ladder and asked to scale their livelihoods from 0 (i.e. worst possible life) to 10 (best possible life). The primary source for this index is from the Gallup World Poll surveys and the data used are from the World Happiness Database for the year 2017. This database has the advantage of covering a large sample of countries (156 countries) in the world and is based on recently conducted surveys, compared to other databases.

Social media is approximated by the Facebook penetration rate in 2012. With over 2.7 billion monthly active users in 2020, Facebook is the biggest social media worldwide.[3] The data for this measure comes from *Quintly,* one of the most widely used databases in the social media literature (see Jha & Sarangi, 2017; Asongu & Odhiambo, 2019a; Kodila-Tedika, 2021).

Regarding the control variables used for the analysis, we consider the main determinants of happiness as suggested by the literature, notably, per capita income, unemployment rate, inflation rate, education in terms of secondary school enrollment and life expectancy at birth as proxy of health. In accordance with the attendant literature (Easterlin, 2001; Frey & Stutzer, 2002, 2018), human well-being is positively linked to per capita income. Moreover, as shown by Di Tella et al. (2001) and Frey and Stutzer (2002), a part from income, when low inflation and unemployment rates are apparent in a country, people are happier compared to when respective rates are high. Following Helliwell and Aknin (2018), nations experiencing comparatively higher life expectancies are also associated with relatively higher levels of happiness. In the same vein, Chen (2012) and Cuñado and deGracia (2012) have shown that education engenders a better quality of life, owing to relatively stable jobs status and higher income.

Depending on data availability on both the happiness and the Facebook penetration measures, the sample of the study covers 140 countries.[4] Appendix 1 (i.e. Table A1) provides the list of countries while Appendix 2 (i.e. Table A2) discloses the definitions of variables and corresponding sources. The summary statistics and correlation matrix are provided in Table 1.

In the light of the summary statistics, the happiness measure seems to be less dispersed with regard to the proportionality between its mean and its standard deviation. This implies that overall the level of citizens' happiness in the sample is relatively grouped around its average of 5.45. This is more or less the case for all other control variables. Concerning the correlation matrix, it indicates that happiness is positively linked to Facebook penetration, as well as GDP per capita, life expectancy and education. These positive relationships, although purely descriptive, suggest that these variables are factors of fulfillment in a society.

2.2. Methodology

The methodological framework is based on Quantile Regressions (QR) as developed by Koenker and Bassett (1978). It is important to note that previous studies have been based on average values of the variables as apparent in the Ordinary Least Squares (OLS) technique that is mostly employed (Appel et al., 2015; Chae, 2018). This technique has the shortcoming of providing findings with general or blanket policy implications. However, the influence of the drivers of happiness can be contingent on initial levels of happiness such that countries with low initial levels of happiness respond differently to the independent variable of interest compared to countries with higher initial levels of happiness. It follows that there is an apparent shortcoming in the OLS technique because

[1] https://fr.statista.com/infographie/15383/utilisateurs-reseaux-sociaux-dans-le-monde/.
[2] See Senik (2011) for a synthetic review of subjective measures of happiness.
[3] See: https://www.statista.com/statistics/264810/number-of-monthly-active-facebook-users-worldwide/.
[4] The number of observations may vary in the regressions due to the lack of data on some of the controls variables included in the model.

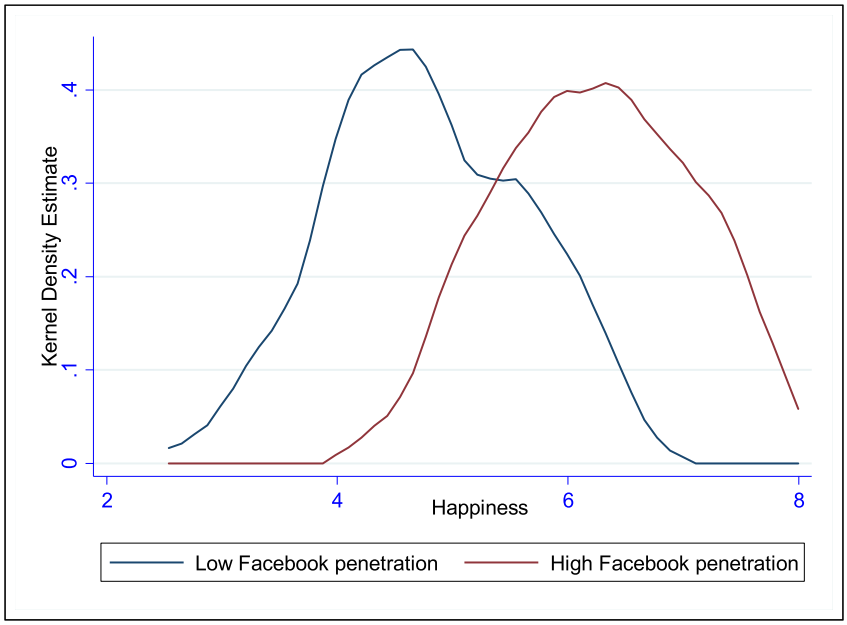

Fig. 2. The distribution of happiness conditional on Facebook penetration.
Source: Authors' construction. **Note:** Epanechnikov Kernel density estimates are presented. Low and High Facebook penetration levels denote values that are lower or higher than the median (21.52).

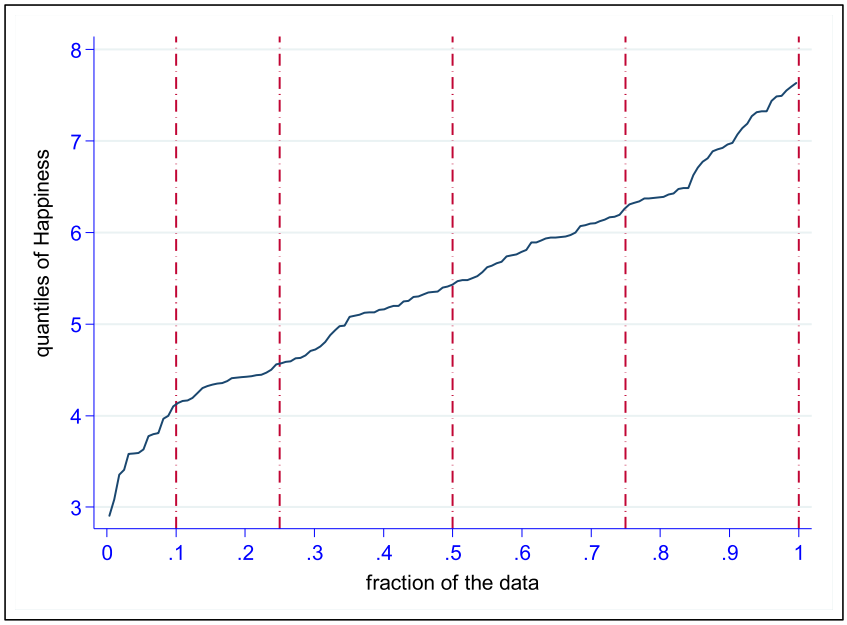

Fig. 3. Distribution of happiness index at different quantiles.
Source: authors' construction. The 10th, 25th, 50th, 75th and 95th quantiles correspond approximately to 4.14, 4.57, 5.45, 6.26 and 7.32 on the scale of happiness.

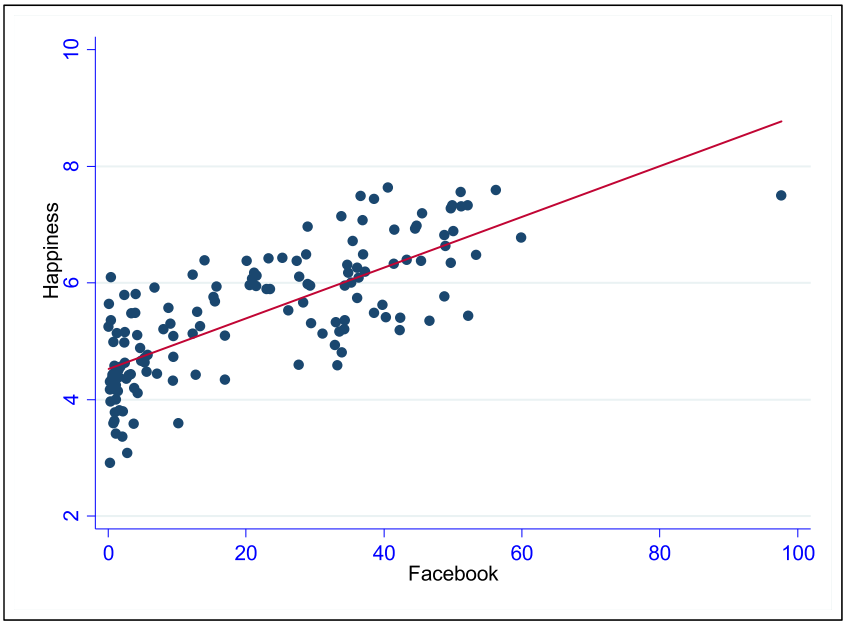

Fig. 4. Correlation between Facebook penetration and happiness.
Source: authors' construction.

Table 2
Baseline results.

	Dep. Var.: happiness					
	OLS	Q (.1)	Q (.25)	Q (.5)	Q (.75)	Q (.95)
Facebook	**0.024*** **	**0.031** **	**0.018*** **	**0.018*** **	**0.018*** **	**0.043*** **
	(0.006)	**(0.012)**	**(0.006)**	**(0.005)**	**(0.007)**	**(0.004)**
GDP per capita	0.384***	0.464**	0.571***	0.410***	0.332***	0.219*
	(0.096)	(0.185)	(0.112)	(0.078)	(0.101)	(0.117)
Health	0.006	0.040**	0.031*	0.001	0.010	−0.018
	(0.015)	(0.019)	(0.017)	(0.014)	(0.014)	(0.016)
Unemployment	−0.031***	−0.036*	−0.041***	−0.036***	−0.035***	−0.018
	(0.011)	(0.018)	(0.013)	(0.010)	(0.012)	(0.018)
Inflation	−0.003	−0.047	−0.006	−0.000	−0.007	−0.003
	(0.010)	(0.048)	(0.032)	(0.018)	(0.042)	(0.039)
Education	0.001	−0.004	0.003	0.0034	0.006*	−0.001
	(0.004)	(0.010)	(0.006)	(0.00)	(0.004)	(0.002)
Observations	99	99	99	99	99	99
R^2/Pseudo R^2	0.724	0.402	0.478	0.531	0.566	0.500

Source: Authors' estimates. **Notes:** OLS and QR estimates. Robust standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.010.

different determinants yield divergent incidences when different levels of life satisfaction are considered.[5] The QR estimation technique enables the study to take into account the perspective that varying factors have different impacts on citizens with different happiness levels.

Furthermore, when estimating the kernel density for the happiness index separately by the Facebook penetration below and above the median in our sample (Fig. 2), we observe that both the high and low Facebook penetration levels are reflected as an asymmetric density function skewed to the right and neither conditional distribution seems Gaussian. In this context, OLS regression could yield unreliable estimates, whereas QR does not require a normally distributed error term.

Thus, using the QR technique enables the study to carefully examine the effect of Facebook penetration at multiple points in the conditional distribution of the happiness index, with particular focus on the countries with the most and least happy citizens.

The quantile estimator is obtained by solving the following optimization problem for the θ^{th} quantile $(0 < \theta < 1)$:

[5] For example, Senik (2005, 2009) shows that income distribution and comparisons exert a significant impact on subjective well-being. According to Ball and Chernova (2008), Frey and Stutzer (2000), income has a positive effect on life satisfaction but its effect varies from "not significant" for people with the highest level of life satisfaction to "very significant" for people who are least satisfied with life.

$$min_{\beta \epsilon R^K}\left[\sum_{i\epsilon\left\{i:y_i \geq x_i^{'}\beta\right\}} \theta\left|y_i - x_i^{'}\beta\right| + \sum_{i\epsilon\left\{i:y_i < x_i^{'}\beta\right\}} (1-\theta)\left|y_i - x_i^{'}\beta\right|\right] \quad (1)$$

y_i represents the happiness index of country *i*. β reflects the vector of parameters that are to be estimated and x_i is a $K-1$ vector of the independent variables. Within the framework of this study, QR distributes citizens' happiness into the 10th, 25th, 50th, 75th and 95th quantiles. This choice was inspired by the recent study by Asongu and Odhiambo (2020). The 10th quantile representing the 10% of the respondents who are least satisfied with life, and the 95th quantile reflecting the 95% of respondents that are the most satisfied respondents (Fig. 3).

3. Results and discussion

3.1. Preliminary evidence

We first provide a visual relationship between Facebook penetration and happiness index (Fig. 4). As evidenced by the correlation matrix above (Table 1), overall we observe from this figure a positive relationship between Facebook penetration and the level of happiness. This means that countries with a high rate of Facebook media users also seem to be countries where the perception of happiness according to the citizens is relatively high.

This descriptive result is highlighted empirically by the findings in Table 2. For comparison purposes, the OLS regression estimates are also presented in the first column. While the results obtained with the OLS regression suggest on average a positive and significant nexus between Facebook penetration and happiness, those of the QR certainly confirm this result but provide proof that this relationship varies according to the level of perception of happiness, following a U-shaped curve from the 10th to the 95th quantile.

The interpretation that follows from this econometric result is that for individuals with a relatively low level of well-being (in the first quantile) the effect of using Facebook is high because at the beginning it involves new encounters, belonging and acceptance. However, at a certain threshold, routine sets in, the happiness of using social media is still present, but its marginal utility tends to be constant (from the 25th to the 75th quantile). The happiness of individuals in this interval depends on other factors much more important than the use of social media. However, from the 95th quantile onwards, the effect of Facebook use becomes much more important again. Individuals in this range have a higher level of happiness, probably because of a good economic, professional and health situation. In this context, they use social media to entertain, distract, de-stress, or increase their business, which could explain the renewed high effect of Facebook use on the happiness of individuals in this bracket.

Overall, the positive effect on average and across the happiness distribution are consistent with other studies showing that using Facebook can positively influence people's social lives (Ellison et al., 2007; Kim & Lee, 2011).

As an attempt to explain this statistical result, we put forward three main transmission channels through which the use of Facebook can improve the happiness. The first is that social networks can be viewed as promotional tools for business enterprises and service providers by means of websites through which businesses are promoted. Indeed, they allow entrepreneurs to keep in touch with their employees and promote their activities. As demonstrated by Zhao et al. (2020), by increasing households' income and wealth (i.e. *via* income effects and wealth effects), entrepreneurship brings happiness to attendant households. Second, social networks in general make it possible to keep in touch with loved ones. Indeed, studies such as that of Botha and Booysen (2014), show that staying in contact with family members improves the level of satisfaction and happiness. In addition, Facebook just like several dating sites (*inter alia*, *Meetic* or *eDarling)* enable users to meet new people and build friendly and romantic relationships. Third, social media is also a cure for mental illness. Indeed they fill the relational void and can bring some company to single people. For example, authors such as Ryan and Xenos (2011) explored the relationship between depression, loneliness and Facebook and found that respondents not using Facebook reported being more socially lonely compared to Facebook users. Likewise, through social networks, an individual can also acquire public notoriety. By sharing photos or videos creating "buzz", with a certain number of "views" and "likes", the underlying user can become famous thanks to his/her publications, with the possibility of being paid for the outreach of attendant publications. Thirdly.,

Regarding the control variables, overall they highlighted the expected signs. The positive nexus with GDP per capita throughout the distribution of happiness confirms those obtained by Easterlin (2001) and Frey and Stutzer (2018). However, this result somewhat contradicts the famous Easterlin paradox, according to which, beyond a certain threshold, further increases in income or GDP per capita do not necessarily translate into higher levels of individual happiness. In this study, the results indicate that as per capita GDP increases, the effect of Facebook use on happiness increases. Likewise, results suggest that the health condition as measured by life expectancy has a positive relationship with happiness, particularly in the first quantiles. As Helliwell and Aknin (2018) pointed out, being in good health guarantees good physical condition, which allows individuals to deploy vigorously in their social activities. Health is thus understood as an essential dimension of human capital which enables people to achieve their aspirations and goals. In addition, we found that unemployment is negatively associated with happiness. According to Di Tella et al. (2001) and Frey and Stutzer (2002), unemployment is economically associated with a lack of economic activity, which in the long term prevents human development. In this context which inflates the overall unemployment rate, possibilities for remuneration and capital accumulation are

reduced, which could negatively impact happiness. Although not significant, inflation could decrease happiness by eroding the purchasing power of households, which has a significant impact on the consumption basket. From a time perspective, it could decrease the net profitability of financial investments. Results also suggest a mixed relationship in terms of sign and significance of education on happiness between quantiles. Added to the conclusion of Nikolaev (2018) who argues that the effect of education on happiness depends on the age group, our results also provide empirical evidence that the effect of education on happiness depends on the level of perception of happiness by citizens. However, the positive and significant effect at the 75th quantile can be explained by the fact that people with higher levels of education are more likely to have higher levels of income and a higher probability of being employed, and thus report higher levels of happiness. Similarly, education induces a "self-confidence" or "self-esteem" effect resulting from the acquisition of knowledge (Cuñado and Gracia, 2012) which improves life satisfaction.

3.2. *Sensitivity analysis: is the positive effect of facebook penetration on happiness universal?*

The previous results have revealed an overall positive effect of Facebook penetration on happiness. However, the magnitude of this effect varies across quantiles. This motivates an assumption that the heterogeneity of our sample (made up of both developed and developing countries) could explain the fact that the positive effect of Facebook penetration on happiness seems higher for one part of the distribution and not in others. To dissipate this doubt, we perform some sensitivity tests using different sub-samples.

First, we use the World Bank classification of countries by levels of development and distinguish two groups of countries, namely: developing countries (low and lower middle income) and developed (high income and upper middle income).[6] Second, we examine how the effect of Facebook penetration on happiness varies across sub-regions. We distinguish for this purpose South Asia, Europe and Central Asia, East Asia and Pacific, Africa, and Latin America and Caribbean sub-regions. Fig. 5 shows the graphical correlation between Facebook penetration and happiness by highlighting (in red) the different samples distinguished for this sensitivity test.

Regarding the distinction according to the level of development (a), we observe that overall, low and middle-income countries such as Burundi, Central African Republic and Yemen which have a very low level of Facebook penetration are also those with a relatively low average level of perception of happiness by citizens. At the regional level, this observation is globally visible for the African (b) and South Asian (f) regions, where the low Facebook penetration is positively correlated with the low level of citizens' happiness. Whereas, in regions like Europe and Central Asia (c) and Latin America and Caribbean (e), most of the countries with the high penetration rate to Facebook (e.g. Iceland and Chile) show a high average level of people's happiness.

We now analyze these descriptive results with respect to the estimates. However, given that the sampled data is in cross-section, performing the analysis in each of these sub-samples would be unrealistic due to the low number of observations. For this reason, we interact the dummies representing these different sub-samples with the Facebook penetration variable. Results obtained are summarized in Table 3. Three main observations can be made.

The first is that even taking into account the level of economic development of the countries and regional specifies, the coefficients of the Facebook penetration variable remain significant and positive in all specifications, suggesting that overall Facebook penetration has a positive effect on happiness. The second observation is that of the coefficients associated with the dummies representing the different subsamples. The results suggest that the low level of income that characterizes developing countries has a negative effect on the perception of happiness. This result is not really surprising given the findings obtained previously, which already showed a positive and significant effect of the increase in per capita income on happiness. At the regional level, we also find that belonging to the African region seems to hurt the happiness of citizens, unlike the Latin America and Caribbean region where the effect is rather enhancing although not significant in the happiness distribution. The third observation, and not the least, is that of the interaction effect between the sub-regional dummies and the Facebook penetration variable. We find that the low level of income attenuates the positive effect of social media on the happiness of populations with a magnitude which increases as one goes towards the top of the distribution. Furthermore, the results reveal that for relatively high levels of happiness (i.e. at the top of the distribution of the measure of happiness) living in Africa reduced the positive effect of social media on happiness. This result is different in Latin America and the Caribbean, East Asia and Pacific, and Europe and Central Asia where the specificities of these regions seem to increase the positive nexus between social media and happiness.

Without claiming to be exhaustive, two main arguments can be put forward to support these results. The first is the level of digital divide in these different sub-samples. In fact, the digital divide whether at the level of "access" or "use", describes inequalities in access to information and communication technologies, and the use of social media between countries. Since the start of the new millennium, internet use in general, has increased tenfold in developing countries, from 2% of the population in 2000 to 21.1% in 2010; however, a significant digital divide remains between these countries. Almost 87% of people in developed countries used the Internet in 2018, compared to 47% in developing countries (ITU, 2018a). In most cases, information technology equipment in developing countries is obsolete. In addition, if the equipment of equivalent quality is marketed in southern countries, then we are faced with a population with limited purchasing power. At the regional level, the uneven rate of internet use could also justify our results. According to the World Economic Forum (WEF, 2016), Northern Europe remains the most connected region with 95% of users. North America has almost the same penetration rate. Conversely, Africa occupies by far the last place for internet use with a penetration rate of 11.4% which represents only 5.7% of the number of users connected to the internet.

The second argument is the low level of regulation in the use of social media which characterizes most developing countries such as

[6] See Appendix 1 for the distinction of countries according to the level of economic development.

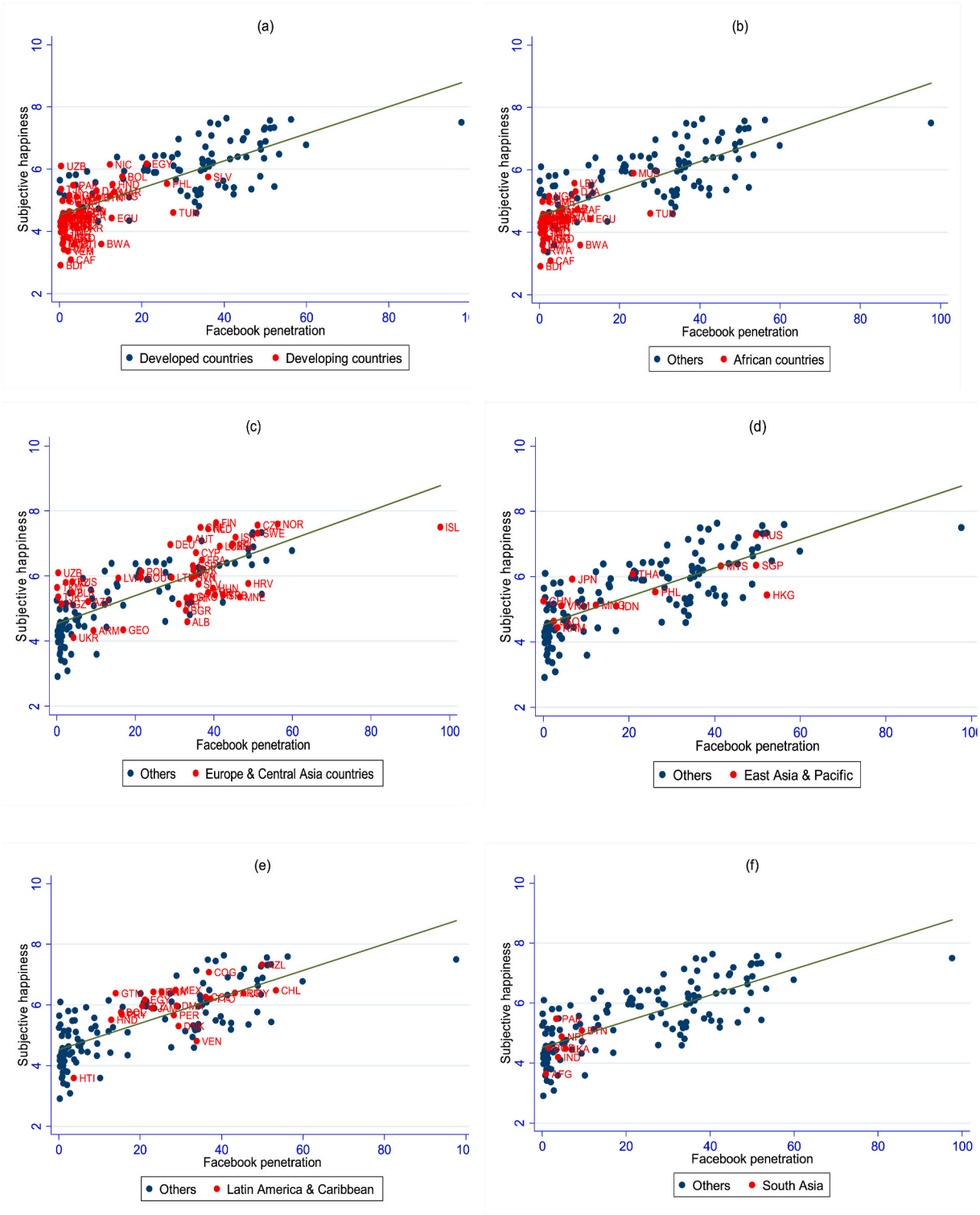

Fig. 5. Correlations between Facebook penetration and happiness according to different samples.
Source: Authors' construction.

Table 3
Differentiated effects according to the level of development and the sub-region.

	Dep. Var.: happiness					
	OLS	Q (0.1)	Q (.25)	Q (.5)	Q (.75)	Q (.95)
Facebook	0.023***	0.030***	0.019**	0.019***	0.019*	0.043***
	(0.006)	(0.008)	(0.008)	(0.005)	(0.010)	(0.008)
Developing countries	−0.459*	−0.499**	−0.379	−0.208	−0.327	0.335
	(0.256)	(0.249)	(0.337)	(0.236)	(0.377)	(0.578)
Facebook *Developing	**−0.014**	−0.021	−0.020	**−0.007**	**−0.050***	**−0.170***
	(0.012)	(0.016)	(0.017)	**(0.006)**	**(0.029)**	**(0.101)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	OLS	**Q (0.1)**	**Q (.25)**	**Q (.5)**	**Q (.75)**	**Q (.95)**
Facebook	0.023***	0.035***	0.024***	0.021***	0.027***	0.027***
	(0.005)	(0.012)	(0.005)	(0.006)	(0.009)	(0.007)
Africa	−0.876***	−0.674**	−0.690***	−0.808***	−0.801**	−1.241***
	(0.233)	(0.299)	(0.232)	(0.284)	(0.333)	(0.304)
Facebook *Africa	**−0.019**	**−0.033**	**−0.023**	**−0.010**	**−0.021**	**−0.066***
	(0.015)	**(0.029)**	**(0.016)**	**(0.024)**	**(0.031)**	**(0.039)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	OLS	**Q (0.1)**	**Q (.25)**	**Q (.5)**	**Q (.75)**	**Q (.95)**
Facebook	0.023***	0.031**	0.018***	0.018***	0.016***	0.024*
	(0.006)	(0.012)	(0.006)	(0.005)	(0.004)	(0.013)
Latin America & Caribbean	0.965**	1.641	1.310	1.170***	1.383	1.102
	(0.403)	(4.946)	(4.592)	(0.377)	(2.894)	(0.769)
Facebook *LAC	**0.023***	**0.024**	**0.034****	**0.004**	**0.007**	**0.013**
	(0.013)	**(0.099)**	**(0.014)**	**(0.020)**	**(0.011)**	**(0.015)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	OLS	**Q (0.1)**	**Q (.25)**	**Q (.5)**	**Q (.75)**	**Q (.95)**
Facebook	0.026***	0.031**	0.023***	0.015***	0.021**	0.046***
	(0.007)	(0.014)	(0.007)	(0.005)	(0.009)	(0.010)
East Asia & Pacific	0.373	0.493	0.545	−0.114	−0.022	−0.198
	(0.224)	(1.260)	(0.370)	(0.188)	(0.336)	(0.446)
Facebook *EAP	**0.015**	**0.042**	**0.019**	**0.021****	**0.033**	**0.063*****
	(0.012)	**(0.177)**	**(0.150)**	**(0.010)**	**(0.110)**	**(0.019)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	OLS	**Q (0.1)**	**Q (.25)**	**Q (.5)**	**Q (.75)**	**Q (.95)**
Facebook	0.030***	0.011	0.036**	0.018**	0.029**	0.061***
	(0.009)	(0.018)	(0.015)	(0.007)	(0.014)	(0.014)
Europe & Central Asia	0.574**	0.020	0.557	0.293	0.543	0.596
	(0.280)	(0.462)	(0.473)	(0.382)	(0.401)	(0.493)
Facebook *ECA	**0.009**	**0.017**	**0.016**	**0.004**	**0.012**	**0.023***
	(0.008)	**(0.018)**	**(0.015)**	**(0.009)**	**(0.014)**	**(0.013)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
	OLS	**Q (0.1)**	**Q (.25)**	**Q (.5)**	**Q (.75)**	**Q (.95)**
Facebook	0.024***	0.032***	0.018***	0.017***	0.019*	0.044***
	(0.006)	(0.011)	(0.007)	(0.005)	(0.010)	(0.006)
South Asia	−0.264	−0.517	−0.135	−0.113	−1.084	−0.691
	(0.402)	(0.414)	(3.874)	(0.564)	(3.104)	(1.265)
Facebook *SA	**−0.037**	**0.012**	**−0.026**	**−0.008**	**−0.128**	**−0.121**
	(0.048)	**(0.090)**	**(0.514)**	**(0.104)**	**(0.788)**	**(0.713)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	99	99	99	99	99	99

Source: Authors' estimates. **Note:** OLS and QR estimates. LAC = Latin America and the Caribbean; EAP = East Asia and Pacific; ECA = Europe and Central Asia; SA= South Asia. See Appendix 1 for the list of countries according to the level of development and the sub-regions. Robust standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.010.

those of Africa and South Asia. Studies have shown that social networks have perverse effects on the well-being of users, particularly in countries where legislation on cybercrime is weak (Clough, 2015; Weber, 2003). According to ITU (2018b), while more than two-thirds of European countries consider their legislation on the use of social media sufficient, the relationship is reversed in Africa where more than two-thirds of countries judge it not at all sufficient. In Africa particularly, Nigeria, Senegal and the Ivory Coast are the most vulnerable countries, and this is mainly due to the poor security of its infrastructure. Social networks are not used responsibly and users are increasingly exposed to the possible risks of their use such as the dissemination of hate messages, violence and cybercrime.

4. Robustness check

We run two main robustness tests to appreciate the solidity of the positive relationship between social media and happiness. The first test controls for endogeneity and the second controls the possible limited nature of happiness measures.

Table 4
Alternative measure of happiness.

	Dep. Var: Happy Planet Index					
	OLS	Q (0.1)	Q (.25)	Q (.5)	Q (.75)	Q (.95)
Facebook	0.058	0.058	0.007	0.140**	0.190*	0.253***
	(0.056)	(0.110)	(0.065)	(0.071)	(0.107)	(0.067)
Developing countries	−4.266***	−3.829	−2.871	−1.471**	−2.281*	−3.650*
	(1.163)	(4.069)	(2.839)	(0.749)	(1.382)	(2.198)
Facebook*Developing	−0.309*	−0.051	−0.097	−0.359	−0.554*	−0.340**
	(0.183)	(0.120)	(0.115)	(0.257)	(0.326)	(0.172)
Controls variables	Yes	Yes	Yes	Yes	Yes	Yes
Facebook	**OLS**	**Q (0.1**	**Q (.25)**	**Q (.5)**	**Q (.75)**	**Q (.95)**
	0.122**	0.105	0.031	0.064	0.129**	0.190***
	(0.061)	(0.113)	(0.110)	(0.066)	(0.065)	(0.033)
Africa	−8.898**	−0.896	−8.885**	−7.538***	−8.698***	−1.100
	(3.625)	(8.583)	(3.493)	(2.686)	(3.833)	(3.973)
Facebook*Africa	−0.292*	−0.042	−0.174	−0.373***	−0.258	−0.539**
	(0.172)	(0.406)	(0.198)	(0.141)	(0.194)	(0.274)
Controls variables	Yes	Yes	Yes	Yes	Yes	Yes
Facebook	**OLS**	**Q (0.1)**	**Q (.25)**	**Q (.5)**	**Q (.75)**	**Q (.95)**
	0.023*	0.120	0.057	0.033	0.144	0.182**
	(0.012)	(0.085)	(0.053)	(0.071)	(0.072)	(0.092)
Latin America & Caribbean	3.793	−0.420	2.117	2.429	4.114**	2.313*
	(8.744)	(2.623)	(3.556)	(2.090)	(2.082)	(1.380)
Facebook *LAC	0.177	0.262	0.068	0.242	0.573	0.775**
	(0.310)	(26.791)	(0.861)	(0.371)	(0.899)	(0.389)
Controls variables	Yes	Yes	Yes	Yes	Yes	Yes
	OLS	**Q (0.1)**	**Q (.25)**	**Q (.5)**	**Q (.75)**	**Q (.95)**
Facebook	0.092	0.092	0.016	0.028	0.060	0.253***
	(0.069)	(0.070)	(0.060)	(0.075)	(0.115)	(0.074)
East Asia & Pacific	6.255	0.470	0.534	6.152	9.545	12.157
	(5.008)	(6.866)	(12.483)	(11.347)	(16.511)	(9.725)
Facebook*EAP	0.227	0.119	0.206	0.088	0.273	0.596
	(0.186)	(0.304)	(0.467)	(0.362)	(1.033)	(0.701)
Controls variables	Yes	Yes	Yes	Yes	Yes	Yes
Facebook	**OLS**	**Q (0.1)**	**Q (.25)**	**Q (.5)**	**Q (.75)**	**Q (.95)**
	0.091	0.119	0.035	0.035	0.259*	0.351**
	(0.118)	(0.176)	(0.106)	(0.128)	(0.148)	(0.143)
Europe & Central Asia	0.772**	7.804*	0.499	1.263	0.886	1.409*
	(0.393)	(4.544)	(3.986)	(3.423)	(3.397)	(0.848)
Facebook*ECA	0.038	0.194	0.032	0.006	0.150*	0.098*
	(0.099)	(0.143)	(0.122)	(0.125)	(0.090)	(0.059)
Controls variables	Yes	Yes	Yes	Yes	Yes	Yes
Facebook	**OLS**	**Q (0.1)**	**Q (.25)**	**Q (.5)**	**Q (.75)**	**Q (.95)**
	0.077	0.089	0.049	0.018	0.089	0.238***
	(0.066)	(0.074)	(0.060)	(0.070)	(0.113)	(0.029)
South Asia	−0.866***	−0.491***	−0.419***	−0.141**	−0.757	−0.022
	(0.176)	(0.940)	(0.232)	(3.767)	(0.690)	(0.422)
Facebook*SA	−0.670**	−0.941	−0.667	−0.621	−0.762**	−1.049
	(0.284)	(0.665)	(0.489)	(0.560)	(0.370)	(0.800)
Controls variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	90	90	90	90	90	90

Source: Authors' estimates. **Notes:** OLS and QR estimates. LAC = Latin America and the Caribbean; EAP = East Asia and Pacific; ECA = Europe and Central Asia; SA= South Asia. Robust standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.010.

4.1. Endogeneity issue

This robustness test consists of controlling for likely sources of endogeneity. More precisely, we control for endogeneity that may arise from measurement error and unobserved heterogeneity.

4.2. Measurement error check

To the extent that the happiness variable used earlier is not accurately calculated, this could lead to a bias in the estimation of the coefficient of interest and thus to spurious conclusions. Such a possibility cannot be ruled out in studies conducted in developing

Table 5
Additional control variables.

	Dep. Var.: happiness					
	OLS	Q (0.1)	Q (.25)	Q (.5)	Q (.75)	Q (.95)
Facebook	0.112*	0.108**	0.096*	0.123*	0.125*	0.142*
	(0.067)	(0.055)	(0.057)	(0.075)	(0.076)	(0.085)
Developing countries	−0.152**	−0.207**	−0.206***	−0.470	−0.401	−0.386
	(0.064)	(0.063)	(0.070)	(0.348)	(0.338)	(0.351)
Facebook *Developing	−0.361	−0.445	−0.296	−0.324***	−0.338***	−0.386***
	(0.310)	(0.314)	(0.312)	(0.115)	(0.120)	(0.146)
Previous control variables	Yes	Yes	Yes	Yes	Yes	Yes
Government Expenditures	0.127***	0.181***	0.125***	0.087**	0.002	0.117***
Control corruption	(0.048)	(0.052)	(0.042)	(0.044)	(0.068)	(0.041)
	0.410	0.330	0.117***	0.133***	0.152***	0.117***
Religion	(0.334)	(0.345)	(0.041)	(0.041)	(0.039)	(0.039)
	0.090	0.187	0.069	−0.185	−0.080	−0.169
Legal origin	(0.132)	(0.155)	(0.131)	(0.141)	(0.132)	(0.145)
	−0.013	−0.080	0.061	−0.079	−0.069	0.165
	(0.301)	(0.300)	(0.303)	(0.300)	(0.301)	(0.300)
Facebook	**OLS**	**Q (0.1)**	**Q (.25)**	**Q (.5)**	**Q (.75)**	**Q (.95)**
	0.012***	0.041***	0.034***	0.018***	0.025***	0.031***
	(0.004)	(0.012)	(0.005)	(0.006)	(0.009)	(0.011)
Africa	−0.123***	−0.174**	−0.125***	−0.208**	−0.213*	−0.230*
	(0.033)	(0.099)	(0.032)	(0.104)	(0.129)	(0.139)
Facebook *Africa	−0.021*	−0.040	−0.031	−0.012	−0.021*	−0.066**
	(0.012)	(0.059)	(0.036)	(0.024)	(0.012)	(0.033)
Previous control variables	Yes	Yes	Yes	Yes	Yes	Yes
Government Expenditures	0.186***	0.275***	0.146***	0.227***	0.490***	0.508***
	(0.015)	(0.009)	(0.016)	(0.014)	(0.045)	(0.040)
Control corruption	0.024***	0.032***	0.018***	0.017***	0.019*	0.044***
	(0.006)	(0.011)	(0.007)	(0.005)	(0.010)	(0.006)
Religion	0.713	0.970***	0.961	0.359***	0.872***	0.471
	(0.550)	(0.272)	(0.788)	(0.045)	(0.042)	(0.397)
Legal origin	−0.011*	−0.005	−0.003	−0.010	−0.013	−0.010
	(0.006)	(0.005)	(0.010)	(0.009)	(0.010)	(0.009)
Facebook	**OLS**	**Q (0.1)**	**Q (.25)**	**Q (.5)**	**Q (.75)**	**Q (.95)**
	0.467**	0.445*	0.425*	0.446*	0.421*	0.464**
	(0.210)	(0.229)	(0.221)	(0.232)	(0.240)	(0.233)
Latin America & Caribbean	0.460*	0.372	0.451*	0.470*	0.417	0.468*
	(0.254)	(0.275)	(0.245)	(0.270)	(0.252)	(0.267)
Facebook *LAC	0.025***	0.028*	0.021*	0.016*	0.051**	0.013
	(0.008)	(0.014)	(0.013)	(0.010)	(0.025)	(0.025)
Previous control variables	Yes	Yes	Yes	Yes	Yes	Yes
Government Expenditures	0.486***	0.440***	0.545***	0.484***	0.482***	0.218***
	(0.069)	(0.129)	(0.083)	(0.096)	(0.148)	(0.096)
Control corruption	0.095**	0.202***	0.040	0.154***	0.100	0.144
	(0.041)	(0.071)	(0.058)	(0.044)	(0.089)	(0.197)
Religion	−0.178	−0.233	−0.201	−0.177	0.213	−0.118
	(0.211)	(0.401)	(0.199)	(0.146)	(0.210)	(0.207)
Legal origin	−0.020	−0.022	0.004	−0.035	−0.007	0.022
	(0.015)	(0.025)	(0.021)	(0.029)	(0.031)	(0.056)
Facebook	**OLS**	**Q (0.1)**	**Q (.25)**	**Q (.5)**	**Q (.75)**	**Q (.95)**
	0.059	0.078	0.040**	0.030*	0.041**	0.051
	(0.103)	(0.104)	(0.010)	(0.018)	(0.020)	(0.049)
East Asia & Pacific	0.044	0.093	0.020	0.021**	0.031	0.061
	(0.124)	(0.078)	(0.070)	(0.010)	(0.120)	(0.059)
Facebook *EAP	0.032	0.022	0.030	0.054	0.060**	0.070
	(0.041)	(0.089)	(0.100)	(0.065)	(0.030)	(0.066)
Previous control variables	Yes	Yes	Yes	Yes	Yes	Yes
Government Expenditures	0.029***	0.041**	0.021*	0.027	0.019*	0.064**
	(0.006)	(0.021)	(0.012)	(0.038)	(0.011)	(0.032)
Control corruption	0.055***	0.056***	0.051***	0.042***	0.045***	0.032**
	(0.011)	(0.019)	(0.013)	(0.015)	(0.013)	(0.016)
Religion	0.231	−0.319	−0.195	−0.238	0.464	−0.221
	(0.157)	(0.430)	(0.175)	(0.177)	(0.307)	(0.198)
Legal origin	−0.030**	−0.024	0.108	−0.031	0.022	0.019*
	(0.015)	(0.056)	(0.099)	(0.051)	(0.029)	(0.010)
Facebook	**OLS**	**Q (0.1)**	**Q (.25)**	**Q (.5)**	**Q (.75)**	**Q (.95)**
	0.108***	0.103**	0.076**	0.077	0.065*	0.120**
	(0.036)	(0.043)	(0.034)	(0.050)	(0.038)	(0.045)
Europe & Central Asia						

(*continued on next page*)

Table 5 (*continued*)

	Dep. Var.: happiness					
	OLS	Q (0.1)	Q (.25)	Q (.5)	Q (.75)	Q (.95)
	0.020	0.031	0.017	0.033**	0.041	0.031
	(0.019)	(0.049)	(0.020)	(0.016)	(0.068)	(0.029)
Facebook *ECA	0.036***	0.026*	0.044***	0.041***	0.055***	0.027*
	(0.013)	(0.014)	(0.013)	(0.014)	(0.014)	(0.015)
Previous control variables	Yes	Yes	Yes	Yes	Yes	Yes
Government Expenditures	0.025***	0.017	0.022***	0.029***	0.028***	0.012
	(0.008)	(0.033)	(0.007)	(0.006)	(0.010)	(0.021)
Control corruption	0.058***	0.060***	0.056***	0.068***	0.052***	0.071***
	(0.011)	(0.010)	(0.012)	(0.012)	(0.012)	(0.013)
Religion	−0.074	0.039	−0.022	0.027**	0.085*	−0.190
	(0.148)	(0.178)	(0.150)	(0.013)	(0.0.051)	(0.161)
Legal origin	−0.003	0.017	−0.016	−0.012	−0.036	−0.044
	(0.017)	(0.085)	(0.034)	(0.016)	(0.031)	(0.047)
Facebook	**OLS**	**Q (0.1)**	**Q (.25)**	**Q (.5)**	**Q (.75)**	**Q (.95)**
	0.176***	0.172***	−0.067	0.296***	0.144***	0.241***
	(0.045)	(0.046)	(0.056)	(0.077)	(0.049)	(0.064)
South Asia	−0.098	−0.100	−0.101	−0.089	−0.110	−0.105
	(0.090)	(0.097)	(0.134)	(0.198)	(0.109)	(0.118)
Facebook *SA	−0.110	−0.109	−0.121	−0.123	−0.134	−0.140
	(0.209)	(0.210)	(0.238)	(0.144)	(0.130)	(0.149)
Previous control variables	Yes	Yes	Yes	Yes	Yes	Yes
Government Expenditures	0.172***	−0.067	0.296***	0.144***	0.241***	0.133*
	(0.046)	(0.056)	(0.077)	(0.049)	(0.064)	(0.076)
Control corruption	0.090***	0.187***	0.069**	0.185***	0.080**	0.169***
	(0.032)	(0.055)	(0.031)	(0.041)	(0.032)	(0.045)
Religion	−0.201	−0.221	−0.206	−0.198	−0.228	−0.121*
	(0.216)	(0.188)	(0.187)	(0.104)	(0.222)	(0.073)
Legal origin	−0.222	−0.190	0.180	0.208	−0.210	0.211
	(0.321)	(0.165)	(0.137)	(0.188)	(0.231)	(0.221)

Source: Authors' estimates. **Note**: OLS and QR estimates. LAC = Latin America and the Caribbean; EAP = East Asia and Pacific; ECA = Europe and Central Asia; SA= South Asia. See Appendix 1 for the list of countries according to the level of development and the sub-regions. Robust standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.010.

countries where the statistical capacity of countries is weak and unreliable. In order to control for the influence of this error, we use as alternative measure of happiness, the Happy Planet Index (HPI) (Abdallah et al., 2012). The HPI employs global data pertaining to experienced ecological footprint, well-being and experienced life expectancy to generate an index that reveals which countries are comparatively most efficient in terms of delivering happy and long lives for their citizens, without jeopardizing conditions for future generations to do the same. Like the life ladder index previously used as a proxy for happiness, the HPI ranges from 1 (low average level of citizen happiness) to 10 (high average happiness) and is available for a total of 144 countries around the world.[7] We use the 2012 index values to remain consistent with our proxy for Facebook penetration that is available for this year.

The results obtained with this new measure are summarized in Table 4. Overall, even using an alternative measure, the finding on a positive nexus between social media and happiness withstands empirical scrutiny. This robustness extends to the control for the level of development of the countries and regional specificities. However, unlike the previous results, even if the coefficients are positive throughout the HPI distribution, in general it is only from the median quantile that they become significant, meaning that, *ceteris paribus*, the positive nexus of social media is particularly visible for countries where citizens have reached a certain level of perception of happiness. Moreover, as clarified before, the negative coefficients associated with these dummy variables on happiness in Africa and South Asia are traceable to the comparatively poor weather conditions in these regions. This is unlike the Latin America and Caribbean and Europe and Central Asian regions where these corresponding coefficients are positive. Regarding the interaction between these regional dummies and Facebook penetration, we find that belonging to the group of developing countries in general, and to the Africa and South Asia regions in particular, inhibits the positive nexus between social media and happiness.

4.3. Unobserved heterogeneity check

It is possible that the relationship between social media and happiness is simply related to the effect of a third factor. In this case, the endogeneity may come from the fact that one of the explanatory variables correlated with both the happiness variable and the error term is not included in the equation. To account for this, we control for other economic, institutional, cultural, and historical factors drawing on the empirical literature on the determinant of happiness. Perovic and Golem (2010) investigate the macroeconomic determinants of happiness in transition countries, and find that public spending is an important factor. Studies such as those by Moller

[7] Data source: http://happyplanetindex.org/about.

Table 6
Robustness check: controlling for the bounded nature of happiness measure.

	Life ladder index		Happy planet index	
	TOBIT	Censored Poisson	TOBIT	Censored Poisson
Facebook	0.010**	0.009*	0.007	0.016***
	(0.005)	(0.005)	(0.005)	(0.005)
Developing countries	−0.011**	−0.008	−0.012**	−0.002
	(0.004)	(0.005)	(0.005)	(0.008)
Facebook*Developing	−0.019**	−0.008	−0.010	−0.023**
	(0.008)	(0.007)	(0.009)	(0.009)
Controls variables	Yes	Yes	Yes	Yes
Facebook	**TOBIT**	**Censored Poisson**	**TOBIT**	**Censored Poisson**
	0.122**	0.105	0.031	0.064
	(0.061)	(0.113)	(0.110)	(0.066)
Africa	−0.116***	−0.100***	−0.090***	−0.158***
	(0.032)	(0.027)	(0.029)	(0.028)
Facebook*Africa	−0.021**	−0.021**	−0.001	−0.004
	(0.008)	(0.008)	(0.002)	(0.002)
Controls variables	Yes	Yes	Yes	Yes
Facebook	**TOBIT**	**Censored Poisson**	**TOBIT**	**Censored Poisson**
	0.023*	0.120	0.023***	0.028***
	(0.012)	(0.085)	(0.008)	(0.009)
Latin America & Caribbean	−0.056	−0.032	−0.060	0.056**
	(0.052)	(0.050)	(0.055)	(0.027)
Facebook *LAC	0.066**	0.018	0.023**	0.038
	(0.032)	(0.027)	(0.009)	(0.053)
Controls variables	Yes	Yes	Yes	Yes
Facebook	**TOBIT**	**Censored Poisson**	**TOBIT**	**Censored Poisson**
	0.011**	0.008*	0.015***	0.019***
	(0.005)	(0.004)	(0.003)	(0.003)
East Asia & Pacific	0.047	0.149	0.161	0.184
	(0.434)	(0.441)	(1.269)	(1.347)
Facebook*EAP	0.296	0.317	0.444*	0.487*
	(0.430)	(0.420)	(0.237)	(0.249)
Controls variables	Yes	Yes	Yes	Yes
Facebook	**TOBIT**	**Censored Poisson**	**TOBIT**	**Censored Poisson**
	0.009**	0.006	0.070***	0.070***
	(0.005)	(0.004)	(0.025)	(0.026)
Europe & Central Asia	0.016**	0.010	0.031	0.062**
	(0.007)	(0.009)	(0.019)	(0.025)
Facebook*ECA	0.013**	0.035	0.011*	0.106
	(0.005)	(0.245)	(0.005)	(0.249)
Controls variables	Yes	Yes	Yes	Yes
Facebook	**TOBIT**	**Censored Poisson**	**TOBIT**	**Censored Poisson**
	0.005**	0.006**	0.040	0.109**
	(0.002)	(0.002)	(0.087)	(0.044)
South Asia	−0.063	0.063	−0.192*	−0.226*
	(0.108)	(0.108)	(0.116)	(0.117)
Facebook*SA	−0.043	−0.124	−0.031	−0.075**
	(0.106)	(0.086)	(0.092)	(0.035)
Controls variables	Yes	Yes	Yes	Yes
Observations	90	90	90	90

Source: Authors' estimates. **Note**: The Tobit estimates is a model in which the censored values of the dependent variable are fixed. Censorship can be observed on the left, on the right or both.The Censored Poisson estimator is recommended for a dependent variable that has some of its observations censored left, right, or both. Robust standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.010.

et al. (2017) and Njangang (2019) have shown that the institutional framework and particularly governance improves the well-being of individuals in developing countries. Hout and Greeley (2012) and Popova and Otrachshenko (2020) show globally that religious persons are demonstrably happier than those who do not belong to a religious community. Mignamissi and Malah (2020) study the robust determinants of happiness in Africa based on 25 potential factors. Among other things, they identify the colonial past of these countries as an explanatory factor of contemporary happiness.

Drawing on this non-exhaustive literature, we introduce into the baseline model the government's public expenditures from the World Development Indicator, the control of corruption from the World Governance Indicator, the religion approximated by the religious fragmentation from Alesina et al. (2003) and the French legal origin from La Porta et al. (1999). The results obtained are presented in Table 5. Even controlling for unobserved heterogeneity, our results corroborate those found previously. Social media significantly affect happiness with the magnitude varying at different levels of happiness perception. Moreover, belonging to developing countries, particularly in Africa, tends to reduce the magnitude of the effect. Regarding the results obtained for the additional control variables introduced in the model, we find that government spending and control of corruption positively affect happiness.

Table 7
The mental illness channel.

	Dep. Var. : happiness				
	(1)	(2)	(3)	(4)	(5)
Facebook	**0.024*** **	**0.018**	**0.012***	**0.017***	**0.013***
	(0.006)	**(0.050)**	**(0.007)**	**(0.010)**	**(0.007)**
GDP per capita	0.384***	0.373***	0.374***	0.314***	0.313***
	(0.096)	(0.102)	(0.100)	(0.117)	(0.118)
Health	-0.006	-0.005	-0.005	-0.009	-0.007
	(0.015)	(0.015)	(0.015)	(0.016)	(0.016)
Unemployment	-0.031***	-0.033***	-0.033***	-0.039***	-0.037***
	(0.011)	(0.010)	(0.011)	(0.011)	(0.011)
Inflation	-0.003	-0.002	-0.002	-0.003	-0.003
	(0.010)	(0.009)	(0.009)	(0.008)	(0.008)
Education	0.001	0.001	0.001	0.000	0.000
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Anxiety		**-0.015*** **	**-0.010***	**-0.031**	**-0.051**
		(0.005)	**(0.006)**	**(0.056)**	**(0.079)**
Facebook*Anxiety			**0.030*** **		
			(0.011)		
Developing countries				**-0.427**	
				(0.277)	
Facebook*Anxiety*Developing_count.				**0.033** **	
				(0.013)	
Developed countries					**0.330***
					(0.201)
Facebook*Anxiety*Developing_count					**0.010**
					(0.012)
Constant	2.279***	2.232***	2.274**	3.209***	2.570***
	(0.820)	(0.834)	(0.871)	(1.177)	(0.931)
Observations	99	96	96	96	96
R^2	0.724	0.745	0.746	0.754	0.752

Source: Authors' estimates. **Notes:** OLS estimates. Robust standard errors in parentheses. *p<0.10, **p<0.05, ***p<0.010.

4.4. Controlling for the bounded nature of the dependent variable

Since our measures of happiness are bounded between 1 and 10, Tobit and Censored Poisson estimators are employed to further assess if the established nexus withstands empirical scrutiny.[8] This alternative empirical strategy is worthwhile when the values of the variable to be explained are apparent for a restricted range while the corresponding values of the explanatory variable are always observed (Cameron & Trivedi, 1998; Winkelmann, 2008). The results obtained in Table 6 (with the two measures of happiness considered) overall, remain consistent with the previous results: *(i)* social media promotes the happiness of citizens; *(ii)* belonging to developing countries, particularly in the Africa and South Asia regions, reduces the perception of happiness and (*iii*) even more, attenuates the positive effect of social media on happiness.

5. Testing a channel

The previous results show the existence of a correlation between social media and happiness. These results raise the question of the transmission mechanisms through which Facebook use affects individuals' happiness. In Section 3.1, we theoretically discussed three main transmission channels: business development, contact with loved ones, and mental illness. In this section, we empirically test the mental illness channel, which we approximate by anxiety (Headey et al., 1993). The underlying hypothesis is that networking is a solution to anxiety and, in fact, contributes to a better self-esteem and a sense of happiness. To do this we use the prevalence of anxiety that measures panic, generalized anxiety disorder, agoraphobia, specific phobia, social anxiety disorder (social phobia), post-traumatic stress disorder, obsessive-compulsive disorder and separation anxiety disorder. The data is taken from the World Health Organization.[9]

The results obtained are presented in Table 7. We restrict ourselves to the mean effect using the OLS estimator. Column 1 presents the results of the baseline specification for comparison purposes, while columns 2–5 present the results after adding the anxiety variable and the interaction variables with Facebook use and membership in the developing and developed country group. We find that anxiety is a negative determinant of happiness. Furthermore, when this variable is introduced into the model, it tends to cancel out the significance (column 2) and lessen the effect (column 3–5) of the Facebook variable on happiness. The results of the effect of the

[8] Noted that this robustness analysis is to test whether the positive relationship established between social media and happiness is robust to the boundedness of our happiness index. This analysis focuses on the average effect previously established and not on the effect on the whole happiness distribution.

[9] https://ourworldindata.org/mental-health.

interaction variables reveal, first, that anxiety coupled with Facebook use improves happiness. Second, anxiety coupled with Facebook use and membership in the developing country group significantly improves happiness, while the effect is not significant for the interaction variable with the developed country dummy.

6. Concluding implications and future research directions

Social media, whatever they are, have become an undeniable means of communication, exchange, sharing and establishing an expertise in a particular field. Its increasing use in the new millennium has prompted many studies to examine its relevance to the lives and happiness of citizens. This study has contributed to the extant literature by assessing the relationship between social media and happiness from a global perspective. The empirical framework has focused on quantile regressions which have allowed us to better appreciate the effect at different levels of the perception of happiness. The findings indicate that in addition to the factors commonly used in the literature as determinants of happiness such as income level, education and health, social media is also a positive determinant. However, its relevance varies according to the level of perception of happiness and is not universal. Specifically, in countries with upper-middle and high per capita income, the magnitude of this effect is greater than in those of low and lower-income. Likewise, the same observation is made in sub-regions such as Europe and Central Asia, unlike those of Africa and South Asia. We empirically identify mental illness as the primary transmission channel. Our results thus highlight the fact that the perception of happiness is not universal and that the level of economic development of a country is also an important factor.

Without claiming to be exhaustive, these findings invite us to make a few recommendations to the governments of sampled countries. In particular, the promotion of social media access for all, and quality ICT infrastructure, particularly in developing countries. Likewise, policies should be implemented that favor the elimination of the digital divides that hinder the achievement of inclusive-oriented sustainable development goals set by the United Nations for 2030. Finally, and not at least, the development of policies, laws and regulations mobilizing all actors, from citizens to the State, in order to curb the perverse effects of the use of social media such as cybercrime.

This research has certain limitations. First the objective of the study was to empirically analyze the nexus between social media and happiness in a global perspective; however, the analysis is limited to 140 countries due to data limitations. Second, because of the nature of the dependent variable (cross-section data), this study did not explore dynamic relationships among selected variables using panel analysis. Third, the likely endogeneity bias that could occur due to the existence of a bidirectional correlation between social media and happiness or omission of relevant variables in the model, was not taken into account. Fourth, this study was limited to a theoretical discussion of the transmission channels through which this relationship could pass. The lack of data on certain social and microeconomic variables did not allow for empirical testing. Fifth, this study was limited to one type of social media and hence, future research can provide new evidence by exploring this nexus using other media or indicators of internet use. As a perspective, future work could assess whether the established relationships withstand further empirical scrutiny, including the use of (i) various other social media and (ii) instrumental variable methods to account for the likely simultaneity bias between social media and happiness.

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Appendix

Table A1
list of countries by sub-regions and level of development

Sub regions	Countries
Africa	Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Comoros*, Congo. Dem. R., Egypt, Ethiopia*, Gabon*, Ghana, Guinea, Kenya, Lesotho, Libya *, Madagascar, Malawi, Mali, Mauritania, Mauritius*, Mozambique, Namibia*, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, South Africa*, Togo, Tunisia, Uganda, Zambia.
South Asia	Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka.
Europe and Central Asia	Albania*, Armenia*, Austria*, Azerbaijan*, Belarus*, Belgium*, Bosnia and Herzegovina*, Bulgaria*, Croatia*, Cyprus*, Czech, Republic*, Denmark*, Estonia, Finland*, France*, Georgia*, Germany*, Greece*, Hungary*, Iceland*, Ireland*, Israel*, Italy*, Kazakhstan*, Kyrgyzstan*, Latvia*, Lithuania*, Luxembourg*, Montenegro*, Netherlands*, Norway*, Poland*, Portugal*, Romania*, Russian Federation*, Serbia*, Slovakia*, Slovenia*, Spain*, Sweden*, Switzerland*, Tajikistan, Turkey*, Turkmenistan*, Ukraine, Uzbekistan.
East Asia and Pacific	Australia*, Cambodia*, China*, Hong Kong*, Indonesia*, Japan*, Laos, Malaysia*, Mongolia, Philippines, Singapore*, Thailand*, Vietnam.
Latin America and Caribbean	Argentina*, Belize*, Bolivia, Brazil*, Chile*, Colombia*, Costa Rica*, Dominica*, Ecuador*, El Salvador, Guatemala*, Haiti, Honduras, Jamaica*, Mexico*, New Zealand*, Panama*, Paraguay*, Peru*, Trinidad and Tobago*, Uruguay*, Venezuela*.

Source: authors' construction. **Note:** *upper middle income or high income countries

Table A2
Data sources and description

Variables	Definitions	Sources
Happiness	Subjective well-being obtained by inviting respondents to think of their lives as a ladder, with the worst possible life for them as 0, and the best possible life as 10, Year 2017.	WHD
Facebook	Facebook penetration, defined as the percentage of total population that uses Facebook, Year 2012.	Quintly
GDP per capita	Gross domestic product divided by midyear population.	WDI
Health	Life expectancy at birth.	WDI
Unemployment	Share of the labor force that is without work but available for and seeking employment.	ILOSTAT
Education	School enrollment, primary (% gross).	WDI
Inflation	Consumer price index reflecting the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals such as yearly.	WDI

Source: authors' construction. **Note:** Given the cross-sectional nature of the Facebook and happiness variables, all control variables were cross-sectioned by averaging over the period 2012–2017. WHD, WDI and ILOSTAT respectively designates World Happiness Database, world Development Indicators and Institute of Labor Statistics.

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