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Does the COVID-19 Pandemic Cause People to Be Unhappy?

Evidence from a Six-Country Survey

Cuong Viet Nguyen*

Abstract

Does the COVID-19 pandemic cause people unhappy? In this study, we use a recent survey from China, Japan, South Korea, Italy, the United Kingdom and the United States to explore this question. We find a relatively large effect: a one per-mille point increase in the incidence of the COVID-19 cases increases the probability of unhappiness by 0.002. Possibly channels through which the COVID-19 pandemic causes unhappiness are negative effects on economic outcomes and social interactions of people. We also find that more disadvantaged people including poor, rural, female and older people are more likely to be affected by the pandemic.

Keywords: COVID-19; happiness; life satisfaction; income loss, job loss.

JEL classification: I30, J18, J24.

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1. Introduction

The COVID-19 pandemic is considered as the most serious health problem in this century. It affects not only health of people but also the global economy. According to forecast from OECD (2020), the global economy can fall between 6% and 7.6% in 2020. Five years of income growth could be lost due to the COVID-19 pandemic. Moreover, this is the first time many countries have witnessed social distancing, lockdowns, and other restrictions on public life. There is growing concern that well-being and mental health are also harmed by the COVID-19 pandemic.

In this study, we examine whether the COVID-19 pandemic causes people unhappy using a nationally representative survey from China, Japan, South Korea, Italy, the United Kingdom and the United States. We find an unhappiness-causing effect of the COVID-19 pandemic: if the COVID-19 rate increases by 1 per-mille point, the probability of being unhappy and the probability of being extremely unhappy increase by 0.002 and 0.0014, respectively. As COVID-19 cases and death continue to increase in many countries, there is growing concern about a decrease in wellbeing and happiness of people.

This study is expected to make several contributions to the current studies on COVID-19 pandemic and related literature of happiness. Firstly, this study provides findings on the effect of the COVID-19 pandemic on happiness. There are a number of studies on the effect of the COVID-19 pandemic on economic and health outcomes (e.g., see review from Nicola et al., 2020; Rajkumar, 2020). However, there is little evidence on to what extent the COVID-19 pandemic affects happiness. An exceptional study is Yang and Ma (2020), which finds a 74% drop in overall emotional wellbeing before and after the onset of the pandemic in China. Our study uses more updated data from six countries and examines the effect of exposure to the COVID-19 rate on happiness. We find a robust finding that people living in areas with a

higher rate of COVID-19 cases are more likely to report unhappiness and extreme unhappiness.

Secondly, we look at the effect of the COVID-19 pandemic on not only happiness but also a wide range of outcomes including employment, income, time for leisure and family, boredom and loneliness. We find that the COVID-19 pandemic results in job and income loss, and these economic factors can be one of channels through which the COVID-19 pandemic causes people unhappy. There is a debate whether income can increase happiness. Several studies find a positive correlation between income and self-reported happiness (e.g., see Frey and Stutzer, 2002; Diener and Biswas-Diener, 2002; Gardner and Oswald, 2007; Ridley et al., 2020; Lim et al., 2020), while other studies such as Layard (2005) and Kahneman and Deaton (2010) show that the effect of income on happiness is negligible after income achieves a given level. Our study supports the hypothesis of the positive correlation between income and happiness by showing that people who lost job and income due to the COVID-pandemic are more likely to report unhappiness. The COVID-19 pandemic also has psychological effects. It causes more boredom, loneliness and sleeping troubles, and therefore unhappiness of people. Social connection plays an important role in happiness (Coleman, 1998; Mogilner, 2010), and lockdown and social distancing reduce social connections and life satisfaction (Hamermesh, 2020).

Thirdly, we find a heterogeneous effect of the COVID-19 pandemic. Vulnerable people are more likely to be affected. Specifically, the COVID-19 pandemic tends to have more harmful effect on female, older, rural and poor people than other ones. This finding suggests that support policies should be targeted at the disadvantaged people and tailored to different population sub-groups.

This paper is structured into four sections. The second section presents the data and econometric method used in this paper. The third section discusses empirical results of the effect of the COVID-19 pandemic. The fourth section concludes.

2. Data and method

This study relies on a survey on the COVID-19 pandemic which was collected between April 15 and April 23 by Belot et al. (2020). Funding for this survey is from the Creative-Pioneering Researchers Program at Seoul National University and the European University Institute. The survey covered 6,089 respondents from China, South Korea, Japan, Italy, the United Kingdom and the four largest states in the United States (California, Florida, New York, and Texas). The sample size of each country is nationally representative. The sample size ranges from 963 for South Korea to 1,055 for the US. The survey contains information on basic demographic variables of respondents, their employment and living situations, self-reports on economic and non-economic consequences of the pandemic, and reported happiness level.

In this study, we look at the effect of the exposure to the COVID-19 pandemic on happiness. We measure this exposure by the incidence of COVID-19 at the region level of the six countries. Respondents are sampled from 82 regions (in the six countries). The incidence of COVID-19 is measured by the number of cumulative COVID-19 cases over 1000 people in each region by April 14 (just before the survey started). The average COVID-19 incidence at the regional level is 1.04 per mille. This incidence ranges from 0.003 per mille in Qinghai, China to 23.4 per mille in New York, the US. Figure A.1 in Appendix presents kernel density of the incidence of COVID-19 cases on 82 regions in our data set.

To measure happiness, we use information from a question in the survey, which asked respondents “How happy do you feel these days?”. The responses are coded from 1 to 7: 1 = Extremely unhappy; 2 = Moderately unhappy; 3 = Slightly unhappy; 4 = Neither happy nor unhappy; 5 = Slightly happy; 6 = Moderately happy; 7 = Extremely happy. For the whole sample of the six countries, 6.6% of respondents reported ‘Extremely unhappy’, 11.5% reported ‘Moderately unhappy’, and 11% reported ‘Slightly unhappy’. One-third of respondents reported ‘Neither happy nor unhappy’. The proportion of respondents reporting ‘Slightly happy’, ‘Moderately happy’, and ‘Extremely happy’ was 13.5%, 13.2% and 3.1%, respectively. Figure A.2 in Appendix presents the distribution of people by happiness levels in the six countries. The proportion of people reporting unhappiness is highest in Japan and lowest in China.

To examine the effect of the COVID-19 pandemic, we estimate the following econometric model:

$$HAPPY_{i,j,k} = \alpha + COVID_{j,k}\beta + X_{i,j,k}\gamma + COUNTRY_k\delta + u_{i,j,k} \quad (1)$$

where $HAPPY_{i,j,k}$ is an indicator of happiness of individual i in region j in country k . $COVID_{j,k}$ is the rate of COVID-19 cases per 1000 people in region j of country k . The control variables, X , include age and gender of individuals. $COUNTRY_k$ is a vector of country dummies. $u_{i,j,k}$ denotes unobserved variables. We control for only age and gender, which are exogenous. We aim to estimate the total effect instead of the partial effect of the COVID-19 pandemic. Thus we do not control for endogenous variables, which can be affected by the COVID-19 pandemic (Angrist and Pischke, 2008).

We take the advantage of the exogeneity of the COVID-19 rate at the regional level to estimate the effect of the COVID-19 pandemic. For robustness analysis, we use

heteroscedasticity-based instrument approach, which is developed by Klein and Vella (2010) and Lewbel (2012), to estimate the effect of the COVID-19 rate.

3. Empirical results

Table 1 reports regressions of happiness on the COVID-19 rate and control variables. We tried to include the squared and higher order of the COVID-19 rate as well as its logarithm form. However, these variables are not statistically significant at the conventional levels. Thus we use the linear form in the final analysis. Column (1) presents the OLS regression of happiness level, which ranges from 1 (extremely unhappy) to 7 (extremely happy). The effect is negative and significant at the 10% level. It means that higher COVID-19 rates reduce the happiness level. Since the happiness level is more difficult to interpret, we create dummy variables indicating whether people feel unhappy (people selected responses ‘extremely unhappy’, ‘moderately unhappy’, or ‘slightly unhappy’) or extremely unhappy (people selected response ‘extremely unhappy’). In regression of these dependent variables, the COVID-19 rate is positive and statistically significant at the 1 percent level (columns 2 and 3 in Table 1). If the COVID-19 rate increases by 1 per-mille point, the probability of being unhappy and the probability of being extremely unhappy increase by 0.002 and 0.0014, respectively.

In addition, we also conduct multinomial logit regression of the happiness level, since this variable is a multiple-response variable. The results are presented in Table A.1 in Appendix. Consistent with OLS results, we find that people living in areas with higher rates of COVID-19 are more likely to report unhappy. The COVID-19 pandemic tends to move people from ‘neither happy nor unhappy’ to ‘unhappy’ and ‘extremely unhappy’.

Table 1. OLS regression of happiness

Explanatory variables	OLS			Heteroskedasticity-based instruments		
	Happiness level	Unhappy (yes=1, no=0)	Extremely unhappy (yes=1, no=0)	Happiness level	Unhappy (yes=1, no=0)	Extremely unhappy (yes=1, no=0)
	(1)	(2)	(3)	(4)	(5)	(6)
Rate of COVID cases (per mille)	-0.0052* (0.0029)	0.0020*** (0.0006)	0.0014*** (0.0005)	-0.0052* (0.0028)	0.0019*** (0.0006)	0.0015*** (0.0004)
Female (yes=1, no=0)	-0.0107 (0.0552)	0.0148 (0.0169)	0.0053 (0.0146)	-0.0107 (0.0548)	0.0148 (0.0168)	0.0052 (0.0145)
Aged 18 to 25	Reference					
Aged 26 to 35	0.1592** (0.0748)	-0.0404 (0.0243)	-0.0495*** (0.0186)	0.1591** (0.0743)	-0.0404* (0.0241)	-0.0495*** (0.0185)
Aged 36 to 45	0.0752 (0.0762)	-0.0103 (0.0245)	-0.0083 (0.0182)	0.0752 (0.0757)	-0.0102 (0.0243)	-0.0083 (0.0180)
Aged 46 to 55	0.0533 (0.0787)	-0.0270 (0.0246)	-0.0279 (0.0184)	0.0533 (0.0782)	-0.0270 (0.0244)	-0.0279 (0.0183)
Aged 56 to 65	0.1486** (0.0707)	-0.0464** (0.0232)	-0.0627*** (0.0147)	0.1486** (0.0702)	-0.0464** (0.0230)	-0.0627*** (0.0146)
Aged 66 to 75	0.3850*** (0.0828)	-0.1008*** (0.0270)	-0.1264*** (0.0199)	0.3850*** (0.0822)	-0.1008*** (0.0268)	-0.1264*** (0.0198)
Aged above 75	0.5943*** (0.1079)	-0.1504*** (0.0287)	-0.1187*** (0.0222)	0.5943*** (0.1071)	-0.1504*** (0.0285)	-0.1187*** (0.0220)
Urban areas	-0.0011 (0.0427)	0.0049 (0.0141)	0.0063 (0.0132)	-0.0011 (0.0424)	0.0050 (0.0140)	0.0063 (0.0131)
United States	Reference					
China	0.2116** (0.0878)	-0.0550* (0.0280)	-0.1038*** (0.0159)	0.2118** (0.0870)	-0.0557** (0.0277)	-0.1034*** (0.0159)
Japan	-0.3605*** (0.0774)	0.0065 (0.0210)	-0.0407*** (0.0115)	-0.3603*** (0.0764)	0.0059 (0.0206)	-0.0402*** (0.0114)
Korea	-0.5035*** (0.0744)	0.0435** (0.0215)	-0.0214 (0.0144)	-0.5034*** (0.0731)	0.0428** (0.0212)	-0.0209 (0.0144)
Italy	-0.6559*** (0.0765)	0.1065*** (0.0192)	0.0709*** (0.0125)	-0.6557*** (0.0755)	0.1060*** (0.0189)	0.0713*** (0.0124)
United Kingdom	-0.0889 (0.0721)	0.0181 (0.0166)	-0.0100 (0.0146)	-0.0887 (0.0710)	0.0176 (0.0162)	-0.0096 (0.0145)
Constant	3.9668*** (0.0987)	0.3801*** (0.0262)	0.2361*** (0.0148)	3.9666*** (0.0973)	0.3807*** (0.0258)	0.2356*** (0.0147)
Observations	6,089	6,089	6,089	6,089	6,089	6,089
R-squared	0.051	0.017	0.029	0.051	0.017	0.029

Robust standard errors in parentheses. Standard errors are clustered at the regional level.

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

Another issue is the potential problem of endogeneity of the COVID-19 rate.

Following the approach of Lewbel (2012), we construct heteroscedasticity-based instruments

for the COVID-19 rate. We estimate the first-stage regression of the COVID-19 rate using all the control variables. The test statistic of the Breusch-Pagan test of heteroscedasticity is equal to 12,780. It means that the null of homoscedastic errors is extremely strongly rejected. The control variables and the errors from the first-stage are used to construct instruments for the COVID-19 rate. The results from the second stage regressions, which are reported in columns from 4 to 6 in Table 1, are very similar to those from OLS regressions.

To examine mechanisms through which the COVID-19 pandemic causes people unhappy, we run OLS regressions of economic and non-economic outcomes on the COVID-19 rate. In the survey, respondents were asked about job loss and income reduction due to the COVID-19 pandemic. They were also asked about the potential non-economic consequences of the COVID-19 pandemic including positive and negative consequences. Table 2 shows a strong effect of the COVID-19 pandemic on economic and non-economic outcomes of people. People living in areas with higher rates of COVID are more likely to report job loss and income fall, and they also tend to expect higher income loss in the future. Lockdown and social distancing due to COVID-19 bring more free time but less time with family for people. A higher COVID-19 incidence results in psychological problems including boredom, loneliness, and sleeping troubles.

Table 2. Impacts of COVID-19 on economic and non-economic outcomes

Explanatory variables	Economic outcomes							Non-economic outcomes				
	Job loss (yes=1, no=0)	Household income loss (yes=1, no=0)	Log of lost income of household	Log of expected owned income reduction	Log of expected household income reduction	Reduction in weekly expenses (yes=1, no=0)	Enjoying more free time (yes=1, no=0)	Enjoying time with family (yes=1, no=0)	Boredom (yes=1, no=0)	Loneliness (yes=1, no=0)	Trouble with sleeping (yes=1, no=0)	Increased conflicts with other people (yes=1, no=0)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Rate of COVID-19 cases (per mille)	0.0024*** (0.0004)	0.0033*** (0.0008)	0.0277*** (0.0057)	0.0222*** (0.0071)	0.0290*** (0.0079)	0.0031** (0.0013)	0.0024*** (0.0008)	-0.0020*** (0.0006)	0.0030** (0.0012)	0.0037*** (0.0010)	0.0029*** (0.0004)	-0.0000 (0.0008)
Female (yes=1, no=0)	0.0134 (0.0111)	-0.0104 (0.0157)	-0.0417 (0.1376)	0.4307*** (0.1509)	-0.0187 (0.1571)	0.0182 (0.0173)	0.0103 (0.0122)	-0.0326* (0.0168)	0.0048 (0.0141)	-0.0333*** (0.0114)	-0.0615*** (0.0110)	-0.0326*** (0.0064)
Aged 18 to 25	Reference											
Aged 26 to 35	-0.0164 (0.0262)	-0.0126 (0.0265)	-0.1158 (0.2479)	0.0939 (0.2731)	-0.1568 (0.2848)	0.0106 (0.0272)	-0.0652*** (0.0241)	0.0392* (0.0229)	-0.0882*** (0.0204)	-0.0689*** (0.0232)	-0.0329 (0.0230)	-0.0506*** (0.0177)
Aged 36 to 45	-0.0040 (0.0263)	-0.0173 (0.0254)	-0.0648 (0.2048)	0.1978 (0.2429)	-0.1213 (0.2416)	-0.0149 (0.0250)	-0.1188*** (0.0210)	0.0651** (0.0253)	-0.1807*** (0.0263)	-0.1087*** (0.0194)	-0.0398* (0.0222)	-0.0542*** (0.0188)
Aged 46 to 55	-0.0333 (0.0276)	-0.0405* (0.0242)	-0.2199 (0.2478)	0.0656 (0.2619)	-0.1689 (0.2417)	-0.0381 (0.0242)	-0.1588*** (0.0237)	0.0039 (0.0227)	-0.2474*** (0.0289)	-0.1379*** (0.0261)	-0.0761*** (0.0232)	-0.0901*** (0.0148)
Aged 56 to 65	-0.1127*** (0.0278)	-0.1355*** (0.0240)	-1.0376*** (0.2460)	-0.6709** (0.2599)	-0.9783*** (0.2785)	-0.0674** (0.0262)	-0.2316*** (0.0212)	-0.1232*** (0.0245)	-0.2892*** (0.0216)	-0.1551*** (0.0217)	-0.0720*** (0.0207)	-0.0999*** (0.0149)
Aged 66 to 75	-0.2309*** (0.0314)	-0.2896*** (0.0269)	-2.2780*** (0.2208)	-2.4531*** (0.3175)	-2.7831*** (0.3032)	-0.1414*** (0.0268)	-0.2615*** (0.0232)	-0.1256*** (0.0256)	-0.2742*** (0.0278)	-0.1541*** (0.0264)	-0.1669*** (0.0252)	-0.1206*** (0.0138)
Aged above 75	-0.2257*** (0.0417)	-0.2979*** (0.0329)	-2.4717*** (0.3264)	-2.8481*** (0.3107)	-2.9261*** (0.3377)	-0.1159*** (0.0370)	-0.2985*** (0.0335)	-0.1893*** (0.0371)	-0.3573*** (0.0362)	-0.2154*** (0.0302)	-0.1806*** (0.0331)	-0.1324*** (0.0160)
Urban areas	0.0133 (0.0180)	0.0262* (0.0156)	0.3506** (0.1405)	0.3819*** (0.1420)	0.3377** (0.1477)	0.0341** (0.0129)	0.0001 (0.0141)	0.0321** (0.0154)	0.0030 (0.0136)	0.0057 (0.0123)	-0.0125 (0.0130)	0.0049 (0.0074)
United States	Reference											
China	0.0938*** (0.0181)	0.0995*** (0.0284)	1.3788*** (0.2716)	-0.1021 (0.2328)	-0.1692 (0.2439)	0.1277*** (0.0332)	0.2695*** (0.0229)	0.3400*** (0.0191)	0.0308 (0.0324)	-0.0239 (0.0270)	-0.0035 (0.0240)	-0.0010 (0.0185)
Japan	-0.1645*** (0.0139)	-0.0784*** (0.0160)	0.3852** (0.1636)	1.7305*** (0.1607)	2.2671*** (0.2061)	-0.0985*** (0.0307)	-0.0957*** (0.0350)	-0.0678*** (0.0216)	-0.0606* (0.0339)	-0.1646*** (0.0247)	-0.2089*** (0.0113)	0.0010 (0.0182)
Korea	-0.0788*** (0.0161)	-0.0153 (0.0209)	1.9853*** (0.2076)	2.3396*** (0.2708)	2.6386*** (0.2605)	0.0639* (0.0356)	-0.1303*** (0.0199)	0.0563** (0.0243)	0.0140 (0.0297)	-0.1290*** (0.0269)	-0.1673*** (0.0135)	0.0009 (0.0182)
Italy	0.0435*** (0.0150)	0.0911*** (0.0207)	-0.0339 (0.1627)	0.4392** (0.2045)	0.6139*** (0.2295)	0.1393*** (0.0319)	-0.0588** (0.0257)	0.1140*** (0.0184)	-0.0532* (0.0273)	0.0014 (0.0265)	0.0008 (0.0161)	0.0199 (0.0181)
United Kingdom	-0.0339** (0.0162)	-0.0514** (0.0248)	-0.7805*** (0.1973)	-0.5105** (0.2435)	-0.4800* (0.2535)	-0.0214 (0.0366)	-0.0246 (0.0201)	-0.0458** (0.0228)	-0.0079 (0.0283)	-0.0036 (0.0273)	0.0330** (0.0127)	0.0051 (0.0163)
Constant	0.3730*** (0.0196)	0.5552*** (0.0250)	4.2739*** (0.2061)	3.3823*** (0.2209)	4.2508*** (0.2297)	0.4342*** (0.0328)	0.5656*** (0.0193)	0.4809*** (0.0240)	0.6767*** (0.0346)	0.4308*** (0.0267)	0.4014*** (0.0191)	0.1708*** (0.0188)
Observations	6,089	6,089	6,089	6,089	6,089	6,089	6,089	6,089	6,089	6,089	6,089	6,089
R-squared	0.072	0.069	0.071	0.080	0.085	0.047	0.106	0.118	0.049	0.047	0.073	0.022

Robust standard errors in parentheses. The standard errors are clustered at the region level.

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

We conduct two additional analyses to examine whether the COVID-19 pandemic cause people unhappy through the economic and non-economic channels. Firstly, we regress the happiness variables on the COVID-19 rate with controlling for the economic and non-economic outcomes. As shown in Table 1, without controlling for these variables, the COVID-19 rate is statistically significant. However, once the economic and non-economic outcomes are controlled for, the COVID-19 rate has a substantially smaller magnitude and it is not statistically significant in the regressions of happiness (Table 3). The economic and non-economic variables have expected sign in the regression of happiness. Loss in income and employment reduces happiness and increases unhappiness of respondents. This is consistent with a hypothesis on a positive correlation between income and happiness (e.g., see Frey and Stutzer, 2002; Diener and Biswas-Diener, 2002). Social connection plays an important role in happiness (Coleman, 1998; Mogilner, 2010). Enjoying free time and time with family is positively correlated with happiness. On the other hand, boredom, loneliness and sleeping troubles are negatively correlated with happiness.

Secondly, we test whether the economic and non-economic outcomes mediate the effect of the COVID-19 pandemic on unhappiness using mediation analysis. We follow the approach of Imai et al. (2010a; 201b) to estimate the indirect effect of the COVID-19 pandemic on unhappiness through each of the economic and non-economic outcomes. Figure 1 shows the proportion (in percent) of the indirect effect on the total effect of the COVID-19 pandemic on unhappiness. Figure 1 again shows indirect effects of the COVID-19 pandemic on unhappiness through employment and income loss, more boredom, loneliness and sleeping troubles.

Table 3. Regression of unhappiness on economic and non-economic outcomes

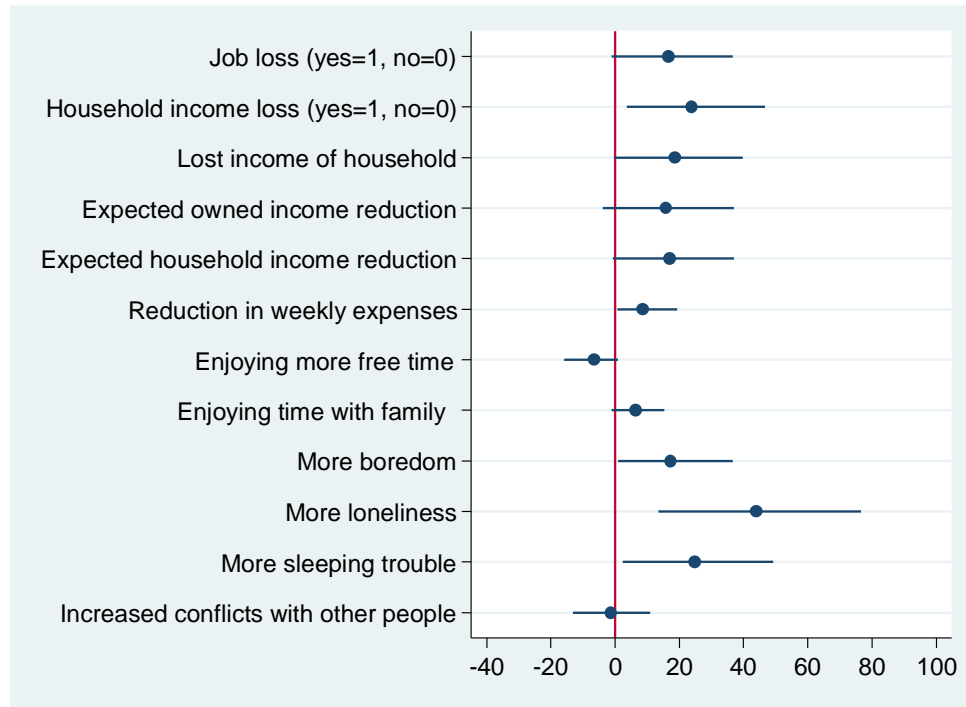
Explanatory variables	Happiness level	Unhappy (yes=1, no=0)	Extremely unhappy (yes=1, no=0)
	(1)	(2)	(3)
Rate of COVID cases (per mille)	0.0002 (0.0021)	0.0003 (0.0005)	0.0003 (0.0006)
Job loss (yes=1, no=0)	-0.2028*** (0.0366)	0.0548*** (0.0132)	0.0489*** (0.0111)
Log of lost income	-0.0193*** (0.0039)	0.0056*** (0.0014)	0.0033*** (0.0011)
Log of expected income reduction	-0.0178*** (0.0038)	0.0064*** (0.0017)	0.0049*** (0.0012)
Reduction in weekly expenses	-0.0048 (0.0384)	0.0170 (0.0144)	0.0125 (0.0080)
Enjoying more free time	0.3725*** (0.0634)	-0.0860*** (0.0172)	-0.0535*** (0.0140)
Enjoying time with family	0.3175*** (0.0381)	-0.0714*** (0.0115)	-0.0872*** (0.0115)
Boredom	-0.3258*** (0.0514)	0.0759*** (0.0156)	0.0325*** (0.0123)
Loneliness	-0.5337*** (0.0488)	0.1843*** (0.0153)	0.1224*** (0.0152)
Trouble with sleeping	-0.4347*** (0.0460)	0.1326*** (0.0174)	0.0722*** (0.0129)
Increased conflicts with other people	-0.2573*** (0.0575)	0.0746*** (0.0192)	0.0758*** (0.0183)
Control variables	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes
Constant	4.4929*** (0.1113)	0.1930*** (0.0288)	0.1373*** (0.0171)
Observations	6,089	6,089	6,089
R-squared	0.171	0.117	0.104

Control variables include age, gender and urban variables.

Robust standard errors in parentheses. The standard errors are clustered at the region level.

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

Figure 1. The proportion of indirect effects in the total effect of the COVID-19 pandemic on unhappiness (in percent)



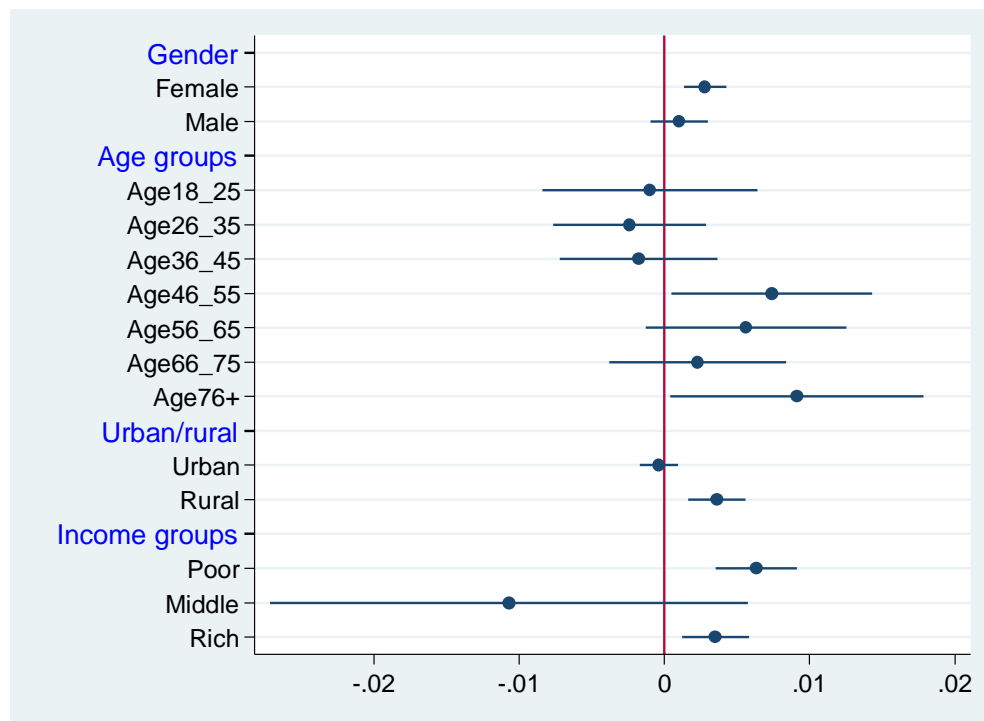
Note: This figure reports point estimates and the 95% confidence interval of the proportion of indirect effects in the total effect of the COVID-19 pandemic on unhappiness (in percent).

Finally, we examine the heterogeneous effect of the COVID-19 pandemic on unhappiness across different groups. We estimate OLS regression of the unhappiness variable on the COVID-19 rate and other control variables using the same model specification as in Table 1 for each population sub-group. Figure 2 presents the point and 95% confidence interval of the effect of the COVID-19 rate on unhappiness for different population sub-groups. It shows that the point estimate of the effect is higher for females than males, though the difference in the point estimates between females and males is not statistically significant. Several studies suggest that women are more affected by the pandemic than men. For example, Dang and Nguyen (2020) find a more harmful effect of the COVID-19 pandemic on employment of women than men. Women might be more

burdened with child care and house work due to the lockdown (Alon et al., 2020) and they are more worried about the pandemic than men (Galasso et al., 2020).

Older people, especially those from 76, are more affected than younger people. Possibly, older people are more sensitive to COVID and they are more concerned about it. The COVID-19 pandemic has a higher effect on unhappiness of rural people than urban ones. Interestingly, we find an inverted U-shaped relation between the effect of the COVID-19 pandemic on unhappiness and income levels. The poor people (the 20% of the population with the lowest income) are most affected by the COVID-19 pandemic. The rich people (the 20% of the population with the highest income) are also affected by the COVID-19 pandemic, albeit at a smaller magnitude. There are no statistically significant effects of the COVID-19 pandemic on unhappiness of the middle-income people.

Figure 2. Heterogeneous effect of COVID-19 on unhappiness



Note: Point estimates and the 95% confidence interval.

4. Conclusions

In this paper, we examine whether exposure to the COVID-19 pandemic reduces happiness of people using a survey in six countries. We find that people in areas with higher rates of COVID-19 are more likely to report unhappiness and extreme unhappiness. Female, older and rural people are more likely to be affected by the COVID-19 pandemic than male, younger and rural ones. The COVID-19 pandemic tends to make the poor and the rich unhappy, while it does not have a significant effect on middle-income people. The finding suggests that policies and measures to cope with the COVID-19 pandemic should be tailored to different population sub-groups, especially vulnerable and disadvantaged groups.

The COVID-19 pandemic causes people unhappy through both economic and non-economic channels. People in areas with higher COVID-19 rates are more likely to suffer from job loss and income reduction, which are in turn negatively correlated with happiness. The COVID-19 pandemic also causes more boredom, loneliness, and sleeping troubles for people. These factors are also negatively correlated with happiness. To improve wellbeing and happiness, governments should implement policies that increase not only economic activities but also social interactions of people.

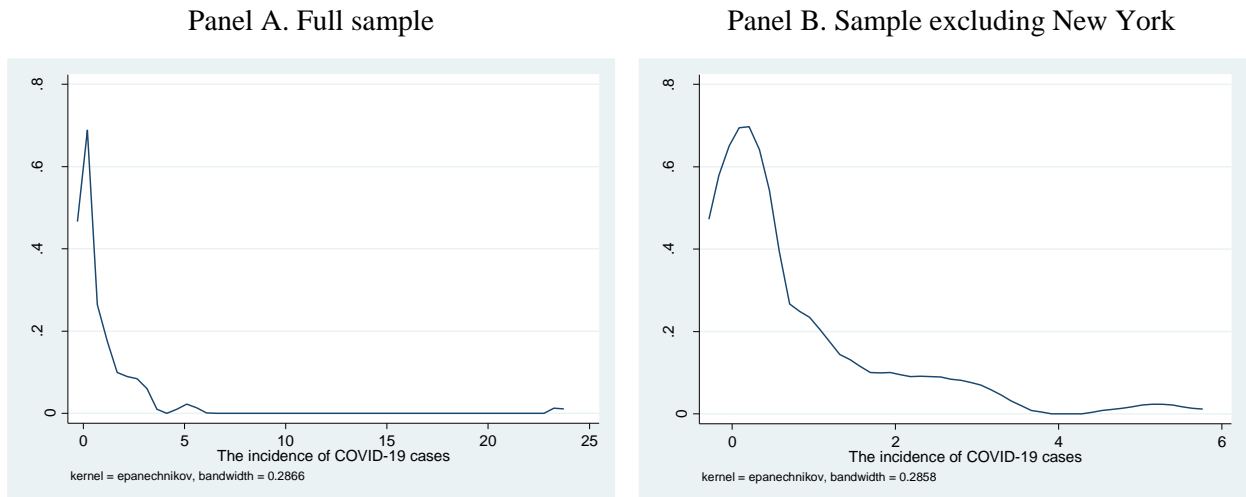
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Appendix

Figure A.1. Kernel density of the incidence of COVID-19 cases



Note: This figure presents kernel density of the incidence of COVID-19 cases until April 14, 2020 on 82 regions which are covered in the survey.

Figure A.2. Distribution of respondents by reported happiness levels

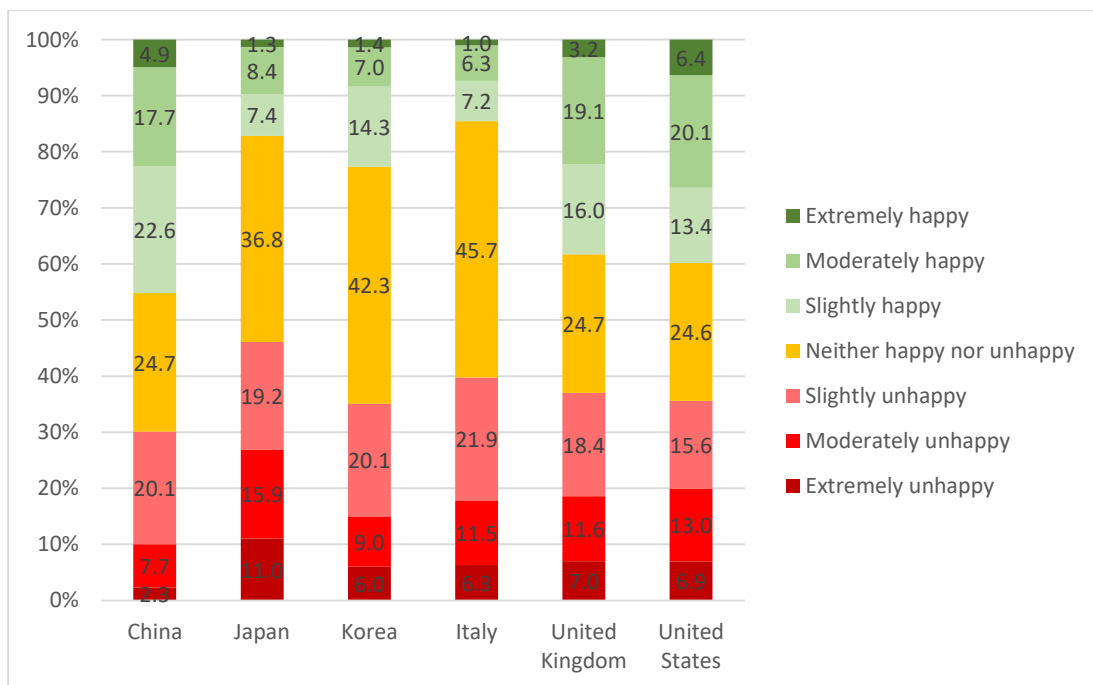


Table A.1. Multinomial logit model

Explanatory variables	Extremely unhappy	Unhappy	Happy	Very happy
	(1)	(2)	(3)	(4)
Rate of COVID-19 cases (per mille)	0.0129*** (0.0027)	0.0096** (0.0041)	0.0045 (0.0062)	0.0041 (0.0066)
Female (yes=1, no=0)	0.0682 (0.1157)	0.0919 (0.0753)	0.0174 (0.0979)	0.0547 (0.1066)
Aged 18 to 25	Reference			
Aged 26 to 35	-0.2909** (0.1466)	0.0127 (0.1369)	-0.0613 (0.1526)	0.1956 (0.1683)
Aged 36 to 45	-0.0399 (0.1341)	-0.0087 (0.1461)	-0.1381 (0.1596)	0.2113 (0.1747)
Aged 46 to 55	-0.2582** (0.1264)	-0.1176 (0.1345)	-0.2723* (0.1397)	-0.0671 (0.1714)
Aged 56 to 65	-0.4734*** (0.1252)	-0.0592 (0.1423)	-0.2787* (0.1528)	-0.0026 (0.1765)
Aged 66 to 75	-0.9881*** (0.1870)	-0.0694 (0.1547)	-0.4234** (0.1801)	0.2131 (0.1744)
Aged above 75	-0.8384*** (0.2307)	-0.2691 (0.1904)	-0.1292 (0.1796)	0.6271*** (0.2229)
Urban areas	0.0849 (0.0916)	0.0367 (0.0864)	-0.0019 (0.1189)	0.1401* (0.0824)
United States	Reference			
China	-0.7159*** (0.1694)	0.2833* (0.1561)	0.5268*** (0.1634)	-0.1458 (0.1649)
Japan	-0.7314*** (0.0900)	-0.2223* (0.1276)	-0.4386*** (0.1596)	-1.6288*** (0.1772)
Korea	-0.7121*** (0.1126)	-0.2411** (0.1159)	-1.2184*** (0.1908)	-1.8537*** (0.1769)
Italy	-0.0717 (0.0700)	-0.1724 (0.1145)	-0.9671*** (0.1911)	-1.3719*** (0.1836)
United Kingdom	-0.0204 (0.1153)	0.2011* (0.1180)	0.2098 (0.1866)	-0.1040 (0.1712)
Constant	-0.0233 (0.0970)	-0.5170*** (0.1524)	-0.4564** (0.2156)	-0.1942 (0.2205)
Observations	6,089	6,089	6,089	6,089

This table reports the multinomial logit regression. The dependent variable is happiness level reported by respondents. This variable is categorized into 5 categories: extremely unhappy, unhappy, neither happy nor unhappy, happy and very happy. The base category in this regression is 'neither happy nor unhappy'.

Robust standard errors in parentheses. The standard errors are clustered at the region level.

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