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Introduction

Throughout the history, human have always attempted to obtain more and more materials assuming that prosperity might improve their living condition and, thus being more joyful with their life. Happiness is an abstruse definition, as it can vary among different people, depending on their lives' principles. Some would say that they can be happy with peaceful lives in which prosperity plays little role. For instance, Eleanor Roosevelt, former first lady of the United States who had reputation, power, and wealth, defined her own happiness as a component of three abilities, including being honest to yourself and your surrounding people, feeling that you have done the best you could on everything, and being able to love others (Popova, 2017). On the other hand, others would claim that capital will help them fulfill their needs and wishes, which implied that they would be happier. As paradoxical as it is, the field of measuring and analyzing humans' happiness first belonged to the psychology. However, since happiness is a good indicator of how well-being or sustainable people are, economists started to find ways to measure happiness using numbers and factors in the early 1970s. Since then, many metrics have been developed to monitor happiness, which resulted in a blossoming field with many research projects and empirical studies on investigating the relationship between being wealthy and being happy.

Easterlin's study in 1974 was one of the first attempts to look at actual evidence regarding the social happiness. Easterlin's measurement of happiness circled around the question: "In general, how happy would you say that you are: very happy, fairly happy, not very happy?" (Easterlin, 1974). His studies also took cross-country data into consideration, which were collected by Cantril and published in 1965, and compared the level of happiness among 14 different countries. In this study, within a country, there was a noticeable positive correlation between the level of happiness from low-income status group and high-income status group. However, Easterlin argued that life satisfaction rose with average incomes but only up to a specific point. Beyond that point, the marginal gain in happiness declines. In other word, as countries get richer, they don't get happier. For cross-country analysis, there was not a significant difference on happiness of rich countries and poor countries. Additionally, the data collection method was criticized as too subjective and biased to ask about people's happiness on a survey, in which many other demographic as well as personal questions were asked. For instance, one's response on happiness would be seriously biased if the question on happiness is placed after a question on income. Regardless of critiques, Easterlin's studies had broken the ice and paved the first path for investigating happiness using economics techniques and theories. The finding on the diminishing level of marginal happiness in this paper is called the "Easterlin Paradox", which has been revisited and studied by many contemporary economists and econometrists.

Due to the development of technology, innumerable number of macro and micro databases regarding national and international happiness level have been constructed throughout years and widely shared on the internet. The innovation of databases, along with the advancement in statistical and econometric techniques, have contributed to a significant increase in the number of modern studies on the field of happiness, starting from the 1990s. One of the largest surveys on

subjective happiness across 90 nations from 1990 to 2000 is from the world database of happiness. This survey focused on the question “All things considered, how satisfied or dissatisfied are you with your life a whole now?” with 0 being total dissatisfaction and 10 being total satisfaction. Borooah used this dataset to show that happiness depends on faith in a deity, income, employment, family and social life, and good health (Borooah, 2006). Kacapyr, using the same dataset on the life satisfaction level, had pointed out many factors affecting self happiness level (Kacapyr, 2008). The result suggested that nation with better health (measured by life expectancy), more spirituality (measured by percentage of population believing in god), and more gender equality (male to female ratio) tend to be happier. On the other hand, the average level of life satisfaction is lower among countries that experienced war, inflation, and unemployment. His model shows that all these factors explain 66% of the variation in life satisfaction across 63 countries. More interestingly, when Kacapyr introduced two dummy variables for Latin nations and former Soviet republics nations, the significant level of the model dramatically improved with 86% of the variation in life satisfaction is explained. This means Latin Americans are extremely happy whereas citizens of former Soviet countries are extremely sad.

Intrigued and motivated by previous findings on the relationship between happiness and wealth among different countries, I decided to revisit this type of cross-country regressions. The data used for analysis is from the World Happiness Report, which is annual publication of the United Nations Sustainable Development Solutions Network. This report is based on international surveys in which thousands of respondents were asked to imagine a ladder with steps numbered 0 to 10 and say where they felt they stood. Survey question on happiness is randomly mixed in a pool of questions to reduce bias, which coming from the critique mentioned above. Together with happiness level, six factors are also included in this dataset: GDP per capita, social support, life expectancy,

freedom to make life choice, generosity, and corruption level. Combining multiple annual reports, starting from 2014 when data is available to present, this study aims to not only analyze the cross-country level of happiness but also within-country changing in the level of happiness over time. The testable hypothesis is that happiness is positively correlated to level of GDP per capita but not the real income, which takes purchasing power and inflation into consideration (Easterlin Paradox). Some other factors like life expectancy, social support, freedom, generosity would exhibit a positive correlation to happiness level whereas corruption will show a negative correlation to happiness level. Moreover, countries in this dataset are divided into 8 region groups, which could possibly lead to interesting findings on level of happiness across regions and continents. Using more recent data, this study will help answer the question does happiness still show a correlation with wealth and some other factors.

Data

Data used in this project is retrieved from the World Happiness Report, which is a landmark survey of United Nation on global happiness. This report, starting from 2012, has continued to gain global recognition as governments and civil organizations increasingly use happiness indicators to reflect on their policies decision- making. The actual dataset used in this project is a combination of several World Happiness Report, from 2014 to the most recent one, 2018. Thus, each observation in the dataset is country by year, followed by happiness level and other related variables on economic, health, social, environment. The categorical variable “Region” was added to this dataset to examine the happiness difference among regions. Happiness score’s measurement has used the data from Gallup World Poll, which is based on the question to national

representatives of “thinking about your current life as a ladder with the best possible life being 10, how do you think your life stand on that scale?”. By exploring this data on happiness and its correlation with wealth or health, we can have a better insight on how people around the world define their own happiness.

First, a world map, shown in figure 1, illustrated with a color gradient is used to provide insights into the “happiness data.” In particular, each country received a calculated score, named as the happiness index. As the score gets higher on a scale from 3 to roughly 7, the color purple becomes darker. Thus, with an assigned happiness index, each country is colored with the corresponding shade of purple. In other words, countries colored with a darker purple shade are considered “happier” compared to the ones with a lighter shade. This kind of data report provides a better visualization of “happiness” according to regions. From this world map, it is observed that developed areas, such as North America, some countries in Western, Central and Northern Europe, and Australia are considered “happier” than other regions. In general, areas in Asia and Africa tend to have lower indexes indicated by the color coding, with the exceptions of Saudi Arabia, United Arab Emirates, and Oman in the Middle East. In South America, the happiest country that can be detected from this map is Brazil. Thus, it is not surprising that wealthier countries will stay in the above range when scoring on happiness, since money is expected to play a certain factor in determining whether one person is happy or not. However, as this map reveals, happiness is not the only variable to calculate happiness. For instance, Japan is one of the most developed countries in Asia, with comparable economic potentials to the well-industrialized Western countries. Nonetheless, Japan does not show any significant difference in this category from other nations in Asia, and consequently, Japan scores below a number of countries from other regions. On the other hand, in Europe where most nations are considered wealthy, their happiness scores varies from one

to another. Countries such as the Netherlands, Switzerland, and the Scandinavia are assigned noticeably higher scores compared to Germany, France, Spain, and Portugal, despite their little difference in economic wealth. Last but not least, according to this map, in North America, Canada receives a higher score, while the United States and Mexico score relatively close to one another. Thus, it can be concluded from this map that money contributes to the definition of happiness. Nonetheless, there are a lot of other potential variables, such as health, environment conditions, and social issues,... that also dictate the trends in happiness.

To obtain a more thorough analysis, scores are further collected and used to construct a box plot (figure 2). In this plot, countries are divided into regions. Other than the group data shown by the box plot, each country is also represented by a data point. According to this plot, Australia and New Zealand has the highest median score, closely followed by North America and both areas have medians higher than 7. These areas have a narrow distribution of happiness indexes since they include few countries. With a median score at a little below 7, Western Europe comes in third, meanwhile Latin America and Caribbean can only score a little above 6. The lowest median belongs to Sub-Saharan Africa, followed by Southern Asia. The last four regions have close median scores, ranging from higher to lower: Eastern Asia, Central and Eastern Europe, Middle East and North Africa, and Southeastern Asia. Based on this observation, it can be seen that in general, more developed regions will have higher medians compared less developed ones, which agrees with the idea that wealth affects happiness. It is also noticed from this graph that areas also vary in distribution patterns. Middle East and North America has a very wide range of values. Additionally, Sub-Saharan Africa and Southeastern Asia also have moderately broad ranges. Thus, it is witnessed that despite being near to each other in terms of geographical distance, each nation's happiness can drastically differ from one another. This phenomenon can be explained since locating in the same

region does not mean that the contributing variables, whether they are health, wealth or social and cultural issues, among countries are comparable or similar.

In addition, a graph plotting GDP per Capita against Happiness Score is also provided to predict whether there is a correlation between these two variables (figure 3). Based on this graph, there is a positive correlation between GDP per Capita and Happiness Score. It is observed that in general, as GDP per Capita increases, happiness score increases. However, this relationship is not perfectly linear since the data set spreads quite widely. For instance, at 5 Happiness Score, there are a number of countries with a variety of GDP per Capita values. Some have moderately high GDP per Capita, while other have low GDP per Capita. Nonetheless, they managed to get the same happiness index. Another example is a country from the Middle East and Northern Africa succeeded in being the country with highest GDP per Capita. However, it can only score around 6.5 staying below many nations that are not as rich. This further strengthens the previous conclusion from both the box plot and the world map, that wealth play a part in scoring on happiness, but not the only determining factor. To develop a more consolidated statement on the relationship between Happiness Score and GDP per Capita, a more quantitative analysis should be conducted to produce numbers and coefficients with statistical meanings. The data set should also be reviewed as there is a potential outlier with 0 GDP per Capita and approximately a 5.5 Happiness Score.

Last but not least, this paper will also present two following tables: one listing top 10 happiest countries, and the other listing top 10 countries with highest GDP per Capita (table 1 and table 2). It is recorded in these tables, that apart from Norway and Switzerland, no other countries appear on both lists. This means that despite considering the richest citizens compared to those with other nationalities, a lot of people do not live in a happy countries. On the other hand, Norway managed to rank second on the Happiest list, although standing at 6th on the Highest GDP per

Capita list. Similarly, Switzerland jumped from 8th to 5th rank moving from Highest GDP per Capita list to Happiest list. This table is another piece of evidence, indicating that wealth by itself cannot alter one's happiness. As previously mentioned, there are many potential candidates that can be labeled as an indicator of happiness. For instance, based on the Happiest list, it might be concluded that social welfare plays a significant role in measuring happiness. Some countries such as Finland, Denmark, and Norway are known to have a favorable social welfare system, in which their citizens are well taken care of. Another variable that might worth examining is pollution. The top 10 Happiest countries also have relatively clean and less polluted environment, which secure their dwellers a healthy and sustainable life.

With the difference in the lists of the happiest countries and the wealthiest countries, it's likely that there would be other factors that could be correlated to happiness. Therefore, the relationship between happiness score and life expectancy is also represented in a different scatter plot (figure 4). In this graph, it's not difficult to recognize a clear positive linear relationship between happiness score and health life expectancy. Similar to figure 3, figure 4 also shows a clear distinction between different regions. While regions with developed countries like North America or Europe show a high health life expectancy, corresponding with higher level of happiness, other regions with lower health life expectancy like Africa or Asia show a lower happiness level. It's also interesting to notice that there is a outlier data point coming from Middle East and Northern Africa region, which has an extremely low happiness value of 3 but a decent health life expectancy value of 0.6.

This data exploration has shown that happiness score, which is the dependent variable, and GDP per capita, which is the key independent variable, are positively correlated to each other. Therefore, the testable hypothesis will remain, which states that happiness is positively correlated to

the level of GDP per capita. Data exploration also shows that other factors such as life expectancy or social justice could possibly contribute to the happiness score. Therefore, these relationships would also be carefully studied by adding these variables into the empirical model. The predicted sign of each independent variable with a clear explanation of how each of them measured is shown in the table below. The descriptive analysis also shows some potential data problems that should be taken into consideration in the result part. Since the dataset contains of all countries in the world with different levels of development, heteroskedasticity is the first problem to be examined. Secondly, by using graphs, some extreme remotes data points are observed, indicating that these might be potential outliers. And lastly, the data is four-year period from 2015 to 2018, of which serial correlation is an issue to be carefully studied as well.

Model & Results

The testable hypothesis is that happiness could be explained by wealthiness. The base model is: $\text{LifeLadder} = f(\text{LogGDP per capita}, \text{Life_Expectancy}, \text{Freedom}, \text{Generosity}, \text{Corruption}, \text{and Social_Support})$

To test this hypothesis, three models have been constructed, in which the life ladder index is the independent variable and log GDP per capita is the key independent variable for all three models (shown in table 4). Model 1, or the base model, shown in table 1, is the normal pooled OLS model that regresses the life ladder index over 6 independent variables: LogGDP_perCap, Life_Expectancy, Freedom, Generosity, Corruption, and Social_Support. In the first model, our key independent variable, LogGDP_perCap, showed a statistically significant correlation to the life ladder index at the 1% significance level. The coefficient for this variable is 0.2907, implying that if

a country's GDP per capita increases by 1 percent, the happiness level would increase by 0.00291, when holding other variables for constant. To illustrate this result more specifically, we can try an example of United States, of which the GDP per capita level is \$59,531.66 in 2017 and the log GDP per capita calculated is 4.778. So to increase the level of happiness by 0.00291 point, the US's log GDP per capita needs to hike up by 0.048, resulted in a log GDP per capita of 4.826. This is equal to a GDP per capita of \$67,000, which is more than \$8000 from the current US level. This is not impossible for the US as their GDP per capita has been increased from \$57,588.54 in 2016 to \$59,531.66 in 2017, which is a \$1943.12 enhancement. But considering the increase in the life ladder index, we can observe that the change in life ladder is not that significant when compared to the great increase in GDP per capita level. United States is ranked 18 in the ladder with the life ladder index being 6.9917. To get into top 10 of the happiest countries in the world, US's life ladder index needs to increase by 0.295. This gap is so large that it could not be achieved just solely by increasing the GDP per capita level. With this example, we know that although log GDP per capita has a strong explanatory power with a statistical significance at the 1% level, it doesn't show a strong economic significance with a small magnitude of the coefficients. However, our testable hypothesis is confirmed, that is life ladder, representing the happiness level of a country, is positively correlated to the log GDP per capita, representing the prosperity of that country.

Other than the key independent variable, 4 other variables, including the Life_Expectancy, Generosity, Corruption, and Social_Support, show statistic significance at the 1% level. Firstly, one year increase in a country's life expectancy will lead to a 0.033 increase in the life ladder value. Life expectancy has long been used to gauge the overall health of a community and the health status over all age group. The significance level of life expectancy is reasonable in a sense that other than money, being healthy is also a critical explanation for people's assessment of their own happiness.

For corruption, one percentage increase in the national average response to the corruption perception of a country will lead to a 0.0057 decrease in the life ladder index. This is the only negative coefficient in the model with a strikingly large magnitude when compared to that of other variables. That being said, a well- organized and well- functioned politic system without corruption plays a significant role in determining the happiness level of citizens. Last but not least, for generosity, one percentage increase in the national average response to the question of “Did you donate money to a charity in the past month?” will lead to a 0.146 enhancement in the life ladder index. It is a common sense that people will donate to charity if their money is more than sufficient for their livings. Putting it differently, if people have money, it will be more likely for them to donate to charity and thus, resulting in a larger happiness index. Moreover, with the money donated to charity, poor people will receive more helps with their life, and thus, being less unhappy. Although generosity is not our key independent variable, this has again confirmed our testable hypothesis on the correlation between wealthiness and happiness. In general, all of the independent variables’ coefficient sign value are expected as mentioned in the data section. With the significance level of 4 independent variables other than log GDP per capita, we have gained the insights that in addition to the wealthiness, people need a healthy life with a well- functioned political system and a good social support in order to feel happy. In other words, using our based on model, wealthiness is a “necessary but not sufficient” condition for happiness.

Using the base OLS model, the multicollinearity was tested by using both the correlation matrix and the VIF test (Figure 5 and figure 6). As the result comes out, key independent variable log GDP per capita does show multicollinearity to the Life_Expectancy variable, with the absolute correlation value greater than 0.8 and a VIF value greater than 5. However, since pooled OLS is not the final best model as fixed effects and random effects will be used to deal with panel data, no

solutions for the multicollinearity has been applied here. Another issue is outliers, which is tested by several boxplots (Figure 6, 7, 9, 10). As the visuals might suggest, there seems to be no outliers in the dataset so no further investigation and treatment will be applied.

Although the first model is good for initial testing, it doesn't take the issues of heteroskedasticity, which can possibly be caused by the variation of countries and endogeneity, caused by the nature of longitudinal data, into consideration. To deal with the endogeneity issues, a fixed effect model has been applied to the current dataset with the same set of variables. Regarding the heteroskedasticity issue, a modified Wald test for group-wise heteroskedasticity has been performed. With the result from the test, the null hypothesis on constant variance of the model is rejected (figure 11). Therefore, Model 2 and model 3 are one way fixed effects model with robust standard errors and two way random effects model with robust standard errors, respectively. A random effect model was also constructed and both the fixed effect model and the random effect model were assessed by the Hausman test to decide that between the two models, which one is the better. Shown in figure 12 is the result of the Hausman test. With the significance level of the chi-squared value, it's statistically proved that fixed effect models is better and we should base our conclusion of the data on the fixed models and thus, the random effect models were removed from result table. Since the one way fixed effect only controls for the difference between entities, another two way fixed effect model is introduced to control for difference between entities over time. Although the group of 2016, 2017, and 2018 don't exhibit any significant difference when compared to the group of 2015 as shown in the result table (table 4), the F-test for joint statistical significance between year groups does show that there is joint significance between years at the 10% level (Figure 13). I think that even though there is evidence on the slight difference between years, the difference is so subtle and 4 years interval is also not a long time period. Therefore, I

picked the model one way fixed effect model with robust standard errors to be my final model and the discussion will be based on this model

In the one way fixed effect model, the Rho value, which is the intraclass correlation, of this model tells us that 95,8% of the variance is due to differences across panels. Comparing model 2 to model 1, we can easily observe some major changes. Our key independent variable, which is log GDP per capita, is now statistically significant at the 10% level. According to this fixed effect model, one percent increase in the GDP per capita will bring a 0.14832 increase in the life ladder level of a country. The magnitude of our key independent variable is much greater than that of the pooled model, which implies that GDP per capita is now contributing more to the happiness level. This result is reasonable because with the earned money, people have the rights to purchase things that make their and their families' lives better, and thus, being more satisfied. However, the small magnitude of the coefficient has shown that the effect of wealthiness on happiness is subtle because increasing 1 percent GDP per capita is so large whereas the gain in life ladder is so small. This might be resulted from the fact that to earn more money, people have to work harder and sacrifice something in their life like time spent with family, freedom, stress, or health, which would consequently negatively affect the happiness level. More interestingly, in the pooled OLS model, every variables show statistically significant correlation to our dependent variables except for the Freedom variable. However, in our fixed effect model, every other variables became not statistically significant in predicting the life ladder level, except for the Freedom variable, which surprisingly turns out to be statistically significant at the 1% level. A 0.1 unit increase in the national average response to the question of "Are you satisfied or dissatisfied with your freedom to choose what you do with your life?" will lead to a 0.1648 enhancement in the life ladder index. I specifically used 0.1 here because Freedom is the national average response to a Yes/No question, thus ranged from 0 to

1. There, interpreting this variable's coefficient by a 0.1 unit interval will be more reasonable than interpreting it by a 1 unit interval. With the large magnitude of the coefficient, we now also know that freedom is a good indicator for life ladder. This indicates that people would be happier if they have the opportunities and the rights to act, speak, and pursue their goals without any restriction. There is a significant difference between the within-R-squared and the between-R-squared (0.1416 and 0.7252, respectively), which indicates that the prediction power of the model is much higher when we use it to estimate the happiness level for different entities than that for different timemark. So briefly, as it turns out, when we control for the fixed effects in our panel data, GDP per capita and Freedom are the only two variables that show statistically significant in predicting people's happiness level. With this result, our testable hypothesis is again confirmed, that prosperity does bring happiness to a country. However, it's freedom, but not money, is the most crucial criteria for people to assess their own happiness. Based on the initial findings from the first three models, we have reassured that Easterlin's result, which utilized the data in 1970s, is still valid by using a more recent data.

Another scope of this research is to look at the difference between the sets of factors contributing to the happiness level of different regions in the world. Therefore, a one way fixed effect models has been applied to separate regions to see if money and freedom are still a good predictors for regions and if there are factors that specifically applicable to a region or not (Table 5). Since South East Asia, Commonwealth of Independent States, and Sub-Saharan region don't show any significant result, it's not shown in the result table. As the result table suggest, key independent variables log GDP per capita shows statistical significance in all region except for Middle East & North Africa , South Asia, and Western Europe. This is quite interesting because this implies money are not playing big roles in predicting happiness level for every part of the world. Freedom variable

shows statistical for all regions except for Western Europe. This exclusion might be resulted from the historical fact that previously, it's Western Europe countries that colonized other regions and never had experienced the colonization from others. Therefore, they had never gone through the difference between being free and enslaved and thus, don't know the value of freedom. Western Europe is also the only region shows statistical significance with the Corruption variable, which implies that the issue of corruption is prevalent in this region and citizens are showing concern about it. Another intriguing finding is that both Central & Eastern Europe and Middle East & North Africa don't show any statistical significance with the SocialSupport and LifeExpectancy variable whereas all other regions do. It's noticeable that these two regions are geographically close to each other. However, the underlying reason for this concatenation is still unknown. With the differentiation by region approach, we can see that money is not an indicator for some regions in the world, whereas, freedom still shows a strong relationship with happiness level. This has again bolstered the previous finding using the global data, which implies that it's freedom, but not money, the secret key for happiness. The result also proposed that each region has its own idiosyncratic standards on assessing its happiness.

Conclusion

Using the data from the World Happiness Report from 2015 to 2018, this study aims to examine the correlation between wealthiness and happiness. Since the data is a combination of several years data, we have been working with a panel dataset with countries being the entities and years being the time. With this nature of the dataset, the final model is an one way fixed effect model with robust standard error to control for the found heteroskedasticity issue. Briefly, our

hypothesis is confirmed and wealthiness, represented by log GDP per capita, does significantly affect the happiness level of people, represented by the life ladder value, at the 10% level. This means that people do get happier by earning more money. In the final model, when we controlled for the heterogeneity, if log GDP per capita changes by 1 percent, life ladder value will change by 0.0083. More interestingly, the freedom variable, indicating the freedom of people to make life choice, has shown statistical significant at the 1% level. A 0.1 increase in the national average response to the freedom survey question will lead to a 0.165 increase in the life ladder happiness. So people does get happier by earning more money but it's freedom that make them feel happy the most. Moreover, each region exhibit a different and diverse set of factors that contribute to its happiness level. Our key independent log GDP per capita doesn't show significance in some regions. It's also fascinating to see that based on the history of developments, Western Europe is the only group that doesn't have problem with Freedom. Instead, they are having an issue with corruption. Central & Eastern Europe and Middle East & North Africa does show some similar characteristic in predicting the happiness level.

The result from this study has provided reliable evidences on the factors affecting happiness level all around the world. Different countries has to constructed their own sets of policies in order to increase the happiness level because the factors are diverse between regions. Overall, developing the economy still have to be a goal for national policy makers since it does make their citizens feel happier. However. with freedom being the most significant result, government should try to increase the freedom level of their citizens. More budget should be spent in order to relieve the stress that burdening people's freedom to make their life choice. This should give people the rights to speak, act, and pursue their goal and eventually, they will be happier. And being happy is really all that matter in our lives.

One limitation of this study is that its scope is so broad as it looks at both the global and regional factors explaining the happiness level. With the broad scope and the limitation of a study, it doesn't meticulously investigate on the regional parts. Another constraint is that this dataset has only 5 independent variables and as the prediction power of models suggests, there are still another unobserved variables that haven't been controlled for. With all the limitations above, several future study paths can be built upon this project. Each region or even each country is deserved a full study on the factors affecting the happiness level with regards to the specific characters and history of that region or country. Moreover, it's also useful to try to combine this data with other dataset, other than variables provided in the World Happiness Report, to find more potential predicting variables in predicting the happiness level

Appendix

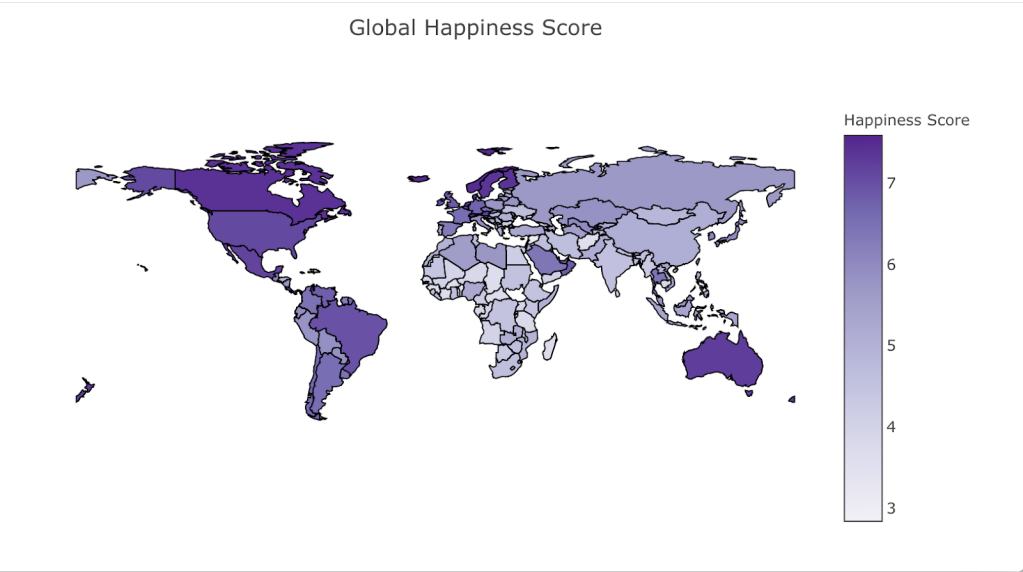


Figure 1: World map of happiness score in 2017

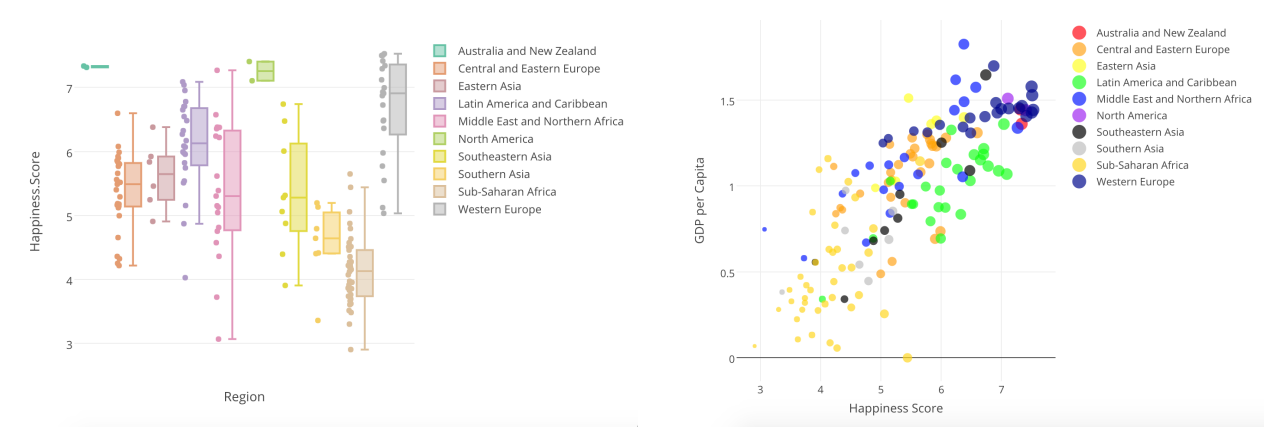


Figure 2: Happiness among different regions in 2017

Figure 3: The relationship between happiness score and GDP per capita in 2017

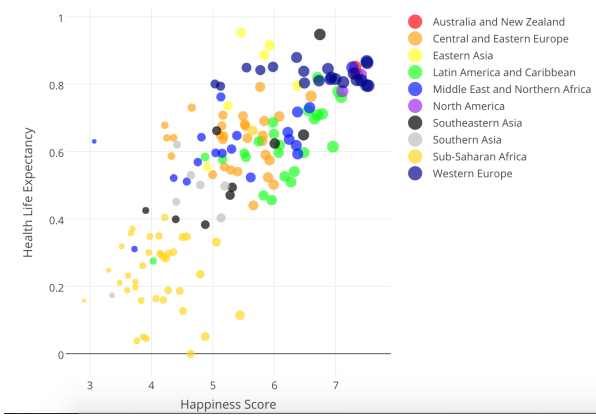


Figure 4: The relationship between happiness score and life expectancy in 2017

	loggdpp~a	health~h	freedom~s	genero~y	percep~n	social~t
loggdpperc~a	1.0000					
healthylif~h	0.8562	1.0000				
freedomtom~s	0.3658	0.3380	1.0000			
generosity	0.0946	0.0866	0.2657	1.0000		
perception~n	-0.3713	-0.3240	-0.4786	-0.3074	1.0000	
socialsupp~t	0.7157	0.6704	0.3940	0.1225	-0.2533	1.0000

Figure 5: The correlation matrix of independent variables (with 6 variables)

Variable	VIF	1/VIF
loggdpperc~a	5.20	0.192301
healthylif~h	4.37	0.228730
socialsupp~t	2.31	0.433444
perception~n	1.47	0.678480
freedomtom~s	1.47	0.680840
generosity	1.14	0.879774
Mean VIF	2.66	

Figure 6: Result of VIF test with 6 variables

Variable	VIF	1/VIF
loggdpperc~a	2.33	0.429837
socialsupp~t	2.28	0.439117
perception~n	1.48	0.677417
freedomtom~s	1.47	0.682072
generosity	1.14	0.880183
Mean VIF	1.74	

Figure 14: Result of VIF test with life expectancy omitted

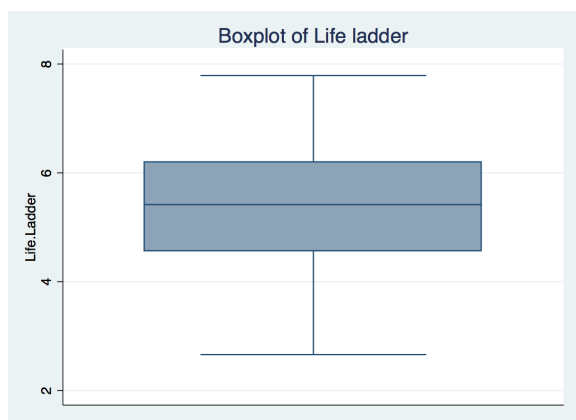


Figure 7: Box plot of Life ladder

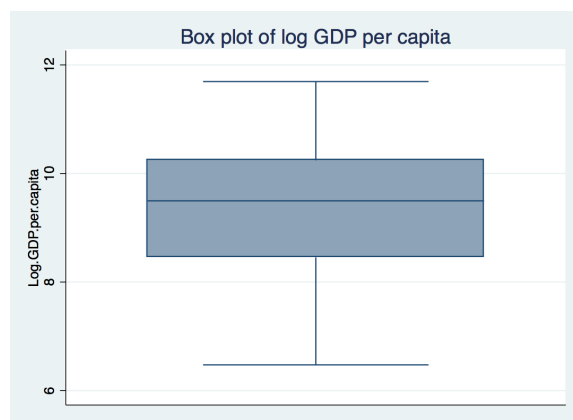


Figure 8: Box plot of log GDP per

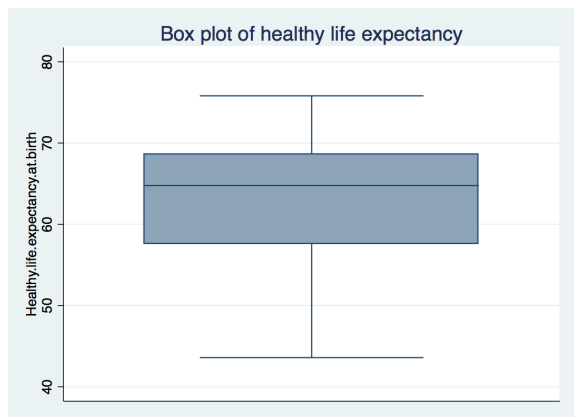


Figure 9: Box plot of healthy life expectancy

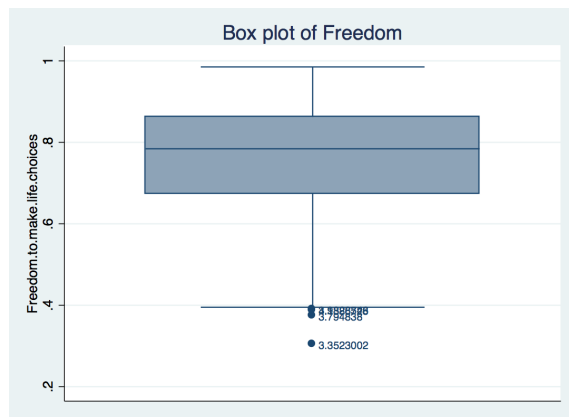


Figure 10: Box plot of freedom to make life choice

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: $\sigma(i)^2 = \sigma^2$ for all i

chi2 (143) = 8.9e+30
Prob>chi2 = 0.0000

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)⁽⁻¹⁾](b-B)
= 15.17
Prob>chi2 = 0.0190

Figure 11: Result of the modified Wald test for heteroskedasticity

Figure 12: Result of the Hausman test

. test (2016.year 2017.year 2018.year)

(1) 2016.year = 0
(2) 2017.year = 0
(3) 2018.year = 0

F(3, 364) = 1.87
Prob > F = 0.1341

Figure 13: Result of the F test

Country	Year	Life.Ladder
Finland	2018	7.632102
Norway	2018	7.593715
Denmark	2018	7.555278
Iceland	2018	7.495226
Switzerland	2018	7.487312
Netherlands	2018	7.441339
Canada	2018	7.328528
New Zealand	2018	7.323762
Sweden	2018	7.314524
Australia	2018	7.272051

Table 1: Top 10 countries with highest happiness score in 2018

Country	Year	Log.GDP.per.capita
Qatar	2018	11.693157
Luxembourg	2018	11.458786
Singapore	2018	11.308526
Kuwait	2018	11.130025
United Arab Emirates	2018	11.108859
Norway	2018	11.071932
Ireland	2018	11.046095
Switzerland	2018	10.956634
Hong Kong S.A.R. of China	2018	10.909534
United States	2018	10.886992

Table 2: Top 10 countries with highest GDP per capita in 2018

	OLS	Fixed effects, one way, with robust standard error	Fixed effects two way, with robust standard error
Cons	-2.233	-7.968	-0.187
	(-0.314)***	(7.146)	(11.520)
LogGDP_perCap	0.2907	1.483	1.060
	(0.046)***	(0.825)*	(1.034)
Life_Expectancy	0.033	-0.020	-0.084
	(0.006)***	(0.089)	(0.094)
Freedom	1.624	1.648	1.558
	(0.219)	(-0.385)***	(0.419)***
Generosity	0.146	0.360	0.254
	(0.12)***	(0.026)	(0.191)
Corruption	-0.578	-0.718	-0.597
	(0.157)***	(0.608)	(0.602)
Social_Support	2.547	0.318	0.403
	(0.300)***	(0.672)	(0.673)
i.2016			-0.002
			(0.041)
i.2017			0.072
			(0.065)
i.2018			-0.051
			(0.069)
N	516	516	516
Adjusted R-squared	0.7703	0.6954	0.5906
Root MSE	0.5444		
F-ratio	288.88***	5.47 ***	5.58***
SSR	150.878		
Rho		0.958	0.918
Clusters		143	143
Within R-squared		0.1416	0.1547
Between R-squared		0.7252	0.6090

Table 4: The first three models. Model 2, one way fixed effect with robust standard error is the final model

One Way Fixed Effect						
	Central & Eastern Europe	Latin American & Caribbean	Middle East & North Africa	North America & ANZ	South Asia	Western Europe
Cons	-18.649	-18.225	21.648	5.645	80.646	-30.411
	(10.235)*	(11.454)	(13.649)	(7.262)	(15.371)***	(7.784)***
LogGDP_perCap	1.942	6.232	-0.769	2.615	2.907	0.774
	(1.01)*	(1.057)***	(0.976)	(1.026)*	(2.273)	(0.793)
Life_Expectancy	0.043	-0.579	-0.169	-0.434	-1.792	0.356
	(0.126)	(0.151)***	(0.217)	(0.110)**	(0.382)***	(0.092)***
Freedom	1.218	1.819	2.938	0.691	3.241	0.660
	(0.609)*	(0.453)***	(0.617)***	(0.246)**	(1.774)*	(0.598)
Generosity	0.012	0.069	-0.007	-0.001	-0.242	-0.012
	(0.109)	(0.123)	(0.136)	(0.023)	(0.331)	(0.051)
Corruption	0.581	-0.421	-1.011	0.335	-0.176	-1.150
	(0.909)	(0.733)	(0.683)	(0.291)	(1.512)	(0.409)***
Social_Support	0.917	3.243	0.724	4.173	5.585	3.611
	(0.764)	(1.049)***	(0.780)	(0.582)***	(1.996)**	(0.864)***
N	64	79	39	15	25	80
Adjusted R-squared	0.6339	0.1932	0.5533	0.8414	0.0705	0.6530
Root MSE						
F-ratio	18.15 ***	17.88***	18.08***	38.99***	24.29***	36.65***
SSR						
Rho	0.954	0.997	0.996	0.999	0.998	0.963
Clusters	17	22	12	4	7	20
Within R-squared	0.4529	0.6494	0.6133	0.9757	0.8167	0.6466
Between R-squared	0.6215	0.1670	0.5707	0.9793	0.0813	0.6533

Table 5: One way fixed effect models separated by regions

Variable	Obs	Mean	Std. Dev.	Min	Max
year	573	2016.543	1.132948	2015	2018
lifeladder	573	5.422723	1.119314	2.661718	7.788252
loggdpperc~a	558	9.29034	1.191323	6.473706	11.69316
socialsupp~t	570	.8060372	.1218133	.3055654	.9873435
healthylif~h	568	63.0897	7.57165	43.58916	75.8124
freedomtom~s	566	.7620292	.1326213	.3035404	.9851778
generosity	558	.0828163	.2139355	-.296735	.8998865
perception~n	532	.7411602	.185436	.0473112	.969483

Table 3: Summary statistic of all variables in the dataset

Variable	Predicted Sign	Measurement
Log GDP per capita	Positive	The log GDP per capita in purchasing power parity (PPP) at constant 2011 international dollar prices of each country by year , reported in the dataset by United Nations
Social Support	Positive	The time series of healthy life expectancy at birth are calculated by the authors based on data from the World Health Organization (WHO), the World Development Indicators (WDI), and statistics published in journal articles
Healthy Life Expectancy	Positive	The national average of the binary responses (either 0 or 1) to the question “If you were in trouble, do you have relatives or friends you can count on to help you whenever you need them, or not?”
Freedom	Positive	The national average of responses to the survey question “Are you satisfied or dissatisfied with your freedom to choose what you do with your life?”
Generosity	Positive	The residual of regressing national average of response to the survey question “Have you donated money to a charity in the past month?” on GDP per capita.
Corruptions	Negative	The national average of the survey responses to two questions in the GWP: “Is corruption widespread throughout the government or not” and “Is corruption widespread within businesses or not?”

Table 6: Summary of independent variables, predicted signs, and their measurement

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