Are the Roads to Happiness the Same

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Abstract. The question of whether increasing income increase happiness has long been a concern, but consensus is hard to reach. The divergences mainly lie in studies of time series itself and the results of time series and cross-section studies. This paper uses 8-10 years of data from 124 countries to further explore this issue through three methods: Time series analysis, cross-section analysis and panel data analysis. We find that 33 out of 124 countries show no significant effect of income on happiness, while 56 countries show slightly positive effects and 35 countries show extremely high positive effects. Moreover, contrary to the intuition, there is no evidence that income no longer increases happiness in high-income countries, or that income can easily increase happiness in low-income countries.

Keywords: happiness, income, Easterlin paradox, panel data.

1. Introduction
Traditionally, happiness has been equated with a country's material status, measured in terms of income or GDP, and the logic is that income makes it possible to increase consumption, which in turn automatically increases utility [1]. Easterlin's discovery that wealth in the United States doubled from 1946 to 1970 while happiness fluctuated but did not increase or decrease significantly challenged this view [2]. If happiness and income were truly unrelated, the utility functions in economics would become meaningless. Therefore, whether income can improve happiness is an important question, which has aroused heated debate among scholars.

However, consensus has not yet been reached on this issue and the biggest divergence comes in the time series research. On the one hand, Easterlin's series of studies concludes that a country's economic development does not lead to major changes in happiness, at least in the long run [3-6]. This result has also been explained by many theories, among which adaptation [7] and social comparison [3, 8] are most popular. Clark, Frijters and Shields [9] claim that about 87 percent of the effect of income on happiness can't be sustained because of self-adaptation and comparison with others. Lykken and Tellegen [10] takes a more extreme view. They even believe that happiness has a fixed point, which is innate and cannot be changed by nurture. On the other hand, some scholars hold the opposite view and find evidence of the significant positive correlation between income and happiness in time series research [11-13]. And they proved that some changes do have permanent effects on happiness [14], social comparison has no significant effect while the positive effect of absolute income on happiness dominates [15] and happiness has not yet reached a saturation point [16], at least in terms of life
satisfaction [17]. There are many reasons why time series studies yield different results, such as the use of multiple databases, or even the sequence of questions in the survey.

The other important divergence is the inconsistency between the cross-sectional studies and the time series studies. These two kinds of studies are supposed to have the same results, because the developing countries are now standing where the developed countries have gone before. Actually, the results in these two kinds of studies are not consistent. Cross-section studies have obtained significantly positive correlation without exception, but they are often not readily available in time series studies. In cross-section studies, not only are the happiness income gradients remarkably similar across countries; they are also typically quite close to happiness income gradients between countries [18]. However, as mentioned in the previous paragraph, many time series studies have shown that there is no significant relationship between income and happiness. Even if the positive significant happiness income gradient is obtained in time series results, it is not the same as that in cross-section results in magnitude. Ferrer-i-Carbonell and Frijters [19] has also pointed out that whether or not individual fixed effects are taken into account will have a great impact on the results, especially in cross-cultural studies. Our study shows that the inconsistency between the results of cross-sectional studies and the time series studies is mainly due to individual heterogeneity, which caused by time-invariant unobserved factors, such as the social system, natural conditions and demographic structure of the country. We find that though cross-sectional results appear to be more stable than the time series results, they tend to distort the outcome by not excluding individual effects.

This paper aims to answer the question “Does increasing income increase happiness” by using time series samples of more countries and taking individual fixed effects into account. At the beginning, we tried to get a universal answer, but the results showed that multiple answers might be more appropriate.

2. Materials and methods

2.1. Data. (Income data in survey are not uniform)

We use data of life satisfaction and control variables from Gallup’s World Poll, which typically surveys 1,000 individuals aged 15 and over in each country and has been conducted annually in more than 150 countries since 2005. Life satisfaction in the survey is measured using Cantril’s Self-Anchoring Scale (the ladder), worded as follows: “Please imagine a ladder with steps numbered from 0 at the bottom to 10 at the top. The top of the ladder represents the best possible life for you, and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time?” Most of the GDP data at purchasing power parity in constant 2011 international dollars come from the World Bank, only those of three places including Taiwan, Venezuela and Yemen are complemented by information from International Monetary Fund.

The data set provided by Gallup is worldwide and of large sample size, however, the form of the panel data is highly unbalanced (only 37 out of 166 countries have complete and continuous 12 years' data). We balanced it by deleting observations. First, we deleted observations in year 2005, 2006 and 2007 (most of countries were unrecorded in early years), as well as those from countries that omitted more than two years of data between 2008 to 2017 (a total of 385 observations out of 1537). Then all of the remained countries had time series of at least 8 y length, and 46% of them (58 out of 124) had the full time series.

2.2. Method

We consider the regression model:

\[ Y_{it} = \beta x_{it} + \delta_i + \mu_t \]

\[ i = 1, 2, 3, \ldots, 124 ; t = 1, 2, 3, \ldots, 10 \]
"i" represents the observed country, and "t" represents the observed time. For a specific country, "\( \hat{\alpha}_i \)" represents the individual fixed effects. If the slope coefficient and intercept coefficient of the overall regression line \( \beta_0 x_i + \hat{\beta} \) are considered to be the same for all countries, the estimates of the slope coefficient are likely to be distorted. Such individual fixed effects can be removed through decentralization. After doing so, the variables of happiness and logarithmic GDP per capita are grouped by country, and the mean value of each group becomes zero, but the variance, skewness, kurtosis and standard deviation remain unchanged.

3. Results
There are certain advantages in our sample size and time length. On the one hand, our sample was collected from 124 countries, covering more than 80% of the world's population; On the other hand, every country has 8-10 years of data from 2008-2017, although 54% of countries do not have full 10-year data, 8-9 years is a relatively long period. The two main variables in our study are happiness and income. As for happiness, the structure of it has been conceptualized as two major components: the affective component and the cognitive component [20, 21]. The happiness in this paper refers to the cognitive component, which has also been conceptualized as life satisfaction [22]. Although the other side of happiness, affective happiness, has been paid a lot of attention, earlier researches on the relationship between income and happiness have tended to use the concept of life satisfaction only, so we follow the tradition. The individual data of life satisfaction came from the Gallup World Poll, and we aggregated it into the national level. For economic indicator, we use logarithm GDP per capita instead of directly using GDP per capita in dollars for two reasons. First of all, the logarithmic form fits better [18]. Secondly, according to weber's law, happiness, as a psychological quantity, grows more slowly than physical quantity—GDP per capita, thus the logarithmic form is more suitable to describe this relationship [17]. GDP per capita data is mainly from the world bank database, supplemented by IMF data in a few countries and regions.

To find out the effect of increased income on happiness, we adopted three methods, namely time series analysis, cross section analysis and panel data analysis. The results are shown below.

From the perspective of time series studies, income has a positive effect on happiness in general. Figure 1(a) shows that the average annual change of Life satisfaction and log GDP per capita of 124 countries and regions from 2008 to 2017 are positively and significantly correlated. The slope coefficient is 0.98, which means that if a country's GDP per capita doubles, its average life satisfaction will increase by one point on the scale of 10. Since the gap between the happiest country and unhappiest country is only about 3.5, it's a considerable improvement in life satisfaction.
Figure 1. (a) Average annual change in life satisfaction and GDP per capita, 124 countries and regions, 2008-2017. The fitted OLS regression is $y = 0.98x - 0.00303$ : (adj $R^2 = 0.0453$, t stats 2.61 -0.29). The shaded area represents the 95% confidence interval; (b) Life Satisfaction and log GDP per capital (PPP), after decentralization, 100 countries and regions, 2017. The fitted OLS regression is $y = 1.071x - 0.0096$ : (adj $R^2 = 0.0458$, t stats 2.40 -0.18). The shaded area represents the 95% confidence interval.

As for cross-sectional studies, the positive correlation coefficient between income and happiness is usually about 0.4. However, after considering the heterogeneity among countries, the results of cross section studies are similar to that of time series studies not only in the direction of slope but also in the magnitude of slope. In order to understand the influence of individual heterogeneity, let's take a simple example of observing two people running. Suppose that, at a point of time, we can observe that people A is running ahead of people B, but we can't observe that people B starts closer to the finish line than people A. Then the running distance between A and B that we observe at a moment will be distorted and not as much as it should be. To assure each country at the same starting line, what we do is to center the 8-10 years' data of each country. By centering, the average happiness and GDP per capita of each country becomes zero, so when the GDP per capita is zero, the happiness of each country is also zero. Figure 1(b) is the regression result of a single cross section after the centralization of the main variables. The regression slope coefficient of 100 countries and regions in 2017 is 1.071, which is very close to 0.98 obtained in time series regression (Fig. 1). The results also suggest that the effect of income on happiness is often greatly underestimated in ordinary cross-sectional studies, which do not take individual effects into account.

As for the third method, we use panel data with country and time dimensions. The time dimension enables the panel data-based studies to address individual heterogeneity problem in the way as the cross-sectional study above; In addition, compared with cross-sectional data, the sample size of panel data is greatly increased, thus improving the estimation accuracy. Table 1 displays the estimated results of different models on the relationship between happiness and income in 124 countries over 8-10 years. Columns 1 in table 1 is pooled OLS model, which assumes that there are no individual fixed factors (changing individually but not changing over time) or time fixed factors (changing over time but not changing individually). The results of the individual fixed effect model considering individual fixed factors are shown in table 1, column 2; And the results of the two-way fixed effect model considering both individual fixed factors and time fixed factors are shown in table 1, column 3. It can be note that, compared with OLS model, the estimation of happiness income gradient by individual fixed effect
model and two-way fixed effect model is greatly improved, and the outcome is similar to that obtained by the other two methods above.

Table 1. Regressions of life satisfaction and GDP per capita.

| VARIABLES | (1) OLS | (2) Country Effects | (3) TW Effects | (4) GROUP |
|-----------|---------|---------------------|----------------|-----------|
| logPGDP   | 0.478*** (0.0165) | 0.967*** (0.220) | 1.221*** (0.291) | 1.300*** (0.210) |
| 1.clu#c.logPGD P | | | | 3.848*** |
| 3.clu#c.logPGD P | | | -2.727*** | |
| Constant | 1.680*** (0.153) | -2.877 (2.051) | -5.226* (2.691) | -9.079*** (1.920) |
| Observations | 1,152 | 1,152 | 1,152 | 1,152 |
| R-squared | 0.356 | 0.063 | 0.075 | 0.307 |
| Number of country | 124 | 124 | 124 | |
| Country FE | YES | YES | | YES |
| Year FE | YES | YES | YES | |

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

The foregoing results seem to suggest that we have obtained a universal rule about happiness and income, which has been tested by three methods. However, it may not be the truth. It is worth noting that difference regression in time series studies, cross-section regression after decentralizing and fixed effect regression all have only an explanatory level of less than 10%, while the R2 of pooled OLS regression is up to 35%. Does that mean it's better not to consider fixed effects? The answer is yes, the results of the F test indicated that fixed effect regression was superior to mixed OLS regression. Thus the goodness of fit of the model is very low probably because different countries not only have different intercepts, but also have different slopes.

Figure 2. Frequency distribution diagram of regression coefficients of 124 countries.

At the other extreme, the assumption is not that income has the same effect on happiness in all countries, but that income has a different effect on happiness in each country. The regression coefficient of log GDP per capita predicating life satisfaction in each country is shown in figure 2. The average value of the coefficient is 1.261.

Oversimplification cannot describe the complex real world, while over realism may obscure the common rules. Therefore, we divided the 124 countries and regions into three groups: group Middle, group Low and group High, allowing each group to have a different slope. The group Middle included 56 countries with coefficients within 0.5 standard deviations of the mean; The group Low included 33
countries with coefficients within -4 to -0.5 standard deviations of the mean; The group High included 35 countries with coefficients within 0.5 to 4 standard deviations of the mean. The positive overall correlation between income and happiness may be the result of group High and group Low offsetting each other. Table 2 shows that the coefficient of the group High is surprisingly large, while that of the group Low is negative. After adding the cross terms (group×log PGDP) on the basis of the two-way fixed effect regression model, the adjusted R² increased to 0.307 (column 4 of table 1). In addition, the cross term was significant, indicating that the slope of each group was indeed different. The group Middle has a slope of 1.138, while the group High has a slope of 5.133, which was 5 times of the group Middle, and the group Low has a slope of -0.962, which was -1 times of the group Middle.

Table 2. Fixed effect regression of group high, middle and low.

| VARIABLES | (1) | (1) | (3) |
|-----------|-----|-----|-----|
| logPGDP   | 5.133*** | 1.138*** | -0.962*** |
|           | (0.588) | (0.192) | (0.333) |
| Constant  | -42.11*** | -4.501** | 15.40*** |
|           | (5.511) | (1.750) | (3.078) |
| Observations | 318 | 524 | 310 |
| R-squared  | 0.525 | 0.160 | 0.242 |
| Number of code | 35 | 56 | 33 |
| Country FE | YES | YES | YES |
| Year FE    | YES | YES | YES |

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

The differences in the relationship between income and happiness are stable across the three groups, although they are narrowed after adding other control variables. The control variables selected here are: income inequality (as expressed by the Gini coefficient), employment, health, marriage, urbanization and education. Table 3 shows that after adding other variables, the coefficients of log GDP per capita of group High and group Low tend to approach that of group Middle, but it doesn’t change much. For group High, education and employment have significantly positive effects, so the popularization of education and the increase of employment rate are part of the reasons why happiness is higher than predicted. For group Low, employment and divorce have significantly positive effects, while urbanization has a significantly negative effect. The decrease in employment rate and divorce rate and the increase in urbanization are part of the reasons why happiness is lower than predicted.

As above, the three groups did differ in the relationship between happiness and income, even after accounting for other variables. Nor can this distinction be simply attributed to the saturation point of happiness. In figure 3, the countries where income has no significant effect on happiness are mainly the United States, Finland, India, Australia, north Africa, South Africa and central Asia. Except for the United States, Finland and Australia, other countries have neither high income nor high happiness. And countries where happiness and income increase obviously are mainly Russia, Thailand, Europe countries, Argentina and other South American countries, Malaysia and other southeast Asian countries and African countries, such as, Mali. Except for Thailand, Africa and South America, other countries have reached the high income level, especially some European countries also reached a high level of happiness. Therefore, the saturation point for happiness has yet to emerge, and even the current level of happiness or income has reached a high level, there is an opportunity to promot happiness through income increasing.
Table 3. Adding other control variables.

| VARIABLES  | (1)      | (2)      | (3)   |
|------------|----------|----------|-------|
|            | High     | Middle   | Low   |
| logPGDP    | 4.523*** | 1.110*** | -0.396|
|            | (1.019)  | (0.219)  | (0.383)|
| gini       | 0.0941   | -0.475   | -0.111|
|            | (0.793)  | (0.320)  | (0.332)|
| emp        | 0.0426** | 0.0114   | 0.0316*|
|            | (0.0192) | (0.0141) | (0.0161)|
| Health_pro | 0.457    | -0.853   | -0.504|
|            | (0.722)  | (0.589)  | (0.476)|
| Divorce    | 3.139    | 1.189    | 3.007*|
|            | (1.911)  | (2.111)  | (1.593)|
| up         | 0.0205   | -0.00699 | -0.0448*|
|            | (0.0331) | (0.0226) | (0.0241)|
| M_Education| 1.414*   | 0.789    | -0.261|
|            | (0.789)  | (0.583)  | (0.402)|
| Constant   | -40.79***| -4.487** | 10.97***|
|            | (9.930)  | (2.035)  | (3.010)|
| Observations | 253     | 400      | 243   |
| R-squared  | 0.555    | 0.202    | 0.248 |
| Number of code | 34        | 54       | 33    |
| Country FE | YES      | YES      | YES   |
| Year FE    | YES      | YES      | YES   |

Figure 3. (a) The geographic distribution of three types of countries with different income happiness gradients, 124 countries, 2008-2017; (b) Average GDP per capita (PPP, in 2011 dollars) of each country, 124 countries, 2008-2017; (c) Average life satisfaction (in 10 scales) of each country, 124 countries, 2008-2017.
But for low-income countries, it could be worse than we think. Low-income countries may be more prone than high-income countries to encounter the problem that income does not increase happiness. As shown in Table 4, 30% of countries with GDP per capita below $6,000 have negative correlation between income and happiness, compared with 50% of countries with GDP per capita below $2,000. However, in high income countries, that is, countries with GDP per capita higher than $18,000, the percent of countries shown negative correlation between happiness and income is also about 30%. Thus, to say the least, it is not only a problem in developed countries, but also in low-income countries that income increases while happiness stays the same or even declines.

Table 4. Income distribution table of each group.

|       | Low | Middle | High |
|-------|-----|--------|------|
| < 2000 | 7   | 4      | 3    |
| 2000-6000 | 4   | 12     | 7    |
| 6000-18000 | 7   | 23     | 8    |
| 18000-54000 | 13  | 15     | 17   |
| > 54000 | 2   | 2      | 0    |
| Total  | 33  | 56     | 35   |

4. Summary

Our large sample data provide multiple answers to the question "Does increasing income increase happiness", which seems more appropriate than a simple "Yes" or "No". Specifically, 33 out of 124 countries show no significant effect of income on happiness, while another 35 show extremely high positive effects. Moreover, contrary to the intuition, there is no evidence that income no longer increases happiness in high-income countries, or that income can easily increase happiness in low-income countries.

These results actually very different from those in other literature. On the one hand, Veenhoven [11], Hagerty [23] and Stevenson [18] as the representatives believe that happiness and income are positively correlated, with the exception of a few countries showing a negative correlation. We also have obtained a positive correlation across the world, but the number of countries showing negative correlation is not small. On the other hand, Easterlin [5], Clark [9] and Schimmel [24] as the representatives believe that in the long run, income has nothing to do with happiness. However, our results are significantly correlated not only in country groups but also in all countries, mainly because the influence of the super-high positive correlation countries offsets the influence of the negative correlation countries. Therefore, we believe that previous studies either underestimated the size of countries where happiness is negatively correlated with income, or ignored the impact of countries where happiness is positively correlated with income.

However, there are still two major problems with control variables that should be explained. One is that most control variables are not significant. The other problem is that new control variables may exist. In recent years, scholars have explored more factors that influence happiness, such as the awareness of free choice [13] and the allocation of time [25]. But even if these factors have a certain degree of influence on happiness, the results of the fixed-effect model may not change much.

The results not only provide an answer to the controversial happiness-income riddle, but also provide a possible reason for the inconsistency of the current researches' conclusion. Easterlin's latest study used a sample of 42 countries (three of which are not included in this study) and 13, or 32.5%, of which are in the group Low, and up from 26.6% in this paper [5]. These 13 countries also have longer average year length than countries in group Middle and High. An excess of low country samples led Easterlin to conclude overall that happiness is not related to income. Similarly, using sample with different proportions of each group may produce different or even opposite results.
The conclusions of this paper also provide insights from a policy-making perspective. Some activists believe that for developed countries at least is that economic growth is of little importance, and should therefore not be the primary goal of economic policy [26]. But our results suggest that GDP growth in many high-income countries, such as Russia, Europe and southeast Asia, continues to provide a boost to happiness. It would be unwise for them to abandon economic development. On the contrary, people tend to overestimate the significance of GDP for low-income countries. Many low-income countries, such as north Africa, South Africa and central Asia, do not show significant improvement in happiness when their GDP grows. As for them, other efforts may be more important than economic development.

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