경제학 석사 학위논문

Health Perception Impact on Happiness

- In gender relative perspective -

건강 인식이 행복에 미치는 영향

- 성별 측면에서의 분석-

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Abstract

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The paper attempts to identify the relationship between health perception and happiness in gender relative perspective. Even there are large volumes of research, devoted to analyze gender happiness disparity, most of them neglected health perception aspect. Moreover, although it sounds quite obvious that happiness and health perception are correlated, it's rather unclear whether happiness disparity can be explained by health perception disparity. The results, based on World Value Survey panel data and IV regression, verifies that health perception gender disparity has strong impact on gender happiness disparity, which implies relatively better health perception can improve corresponding gender's relative happiness. It also can be interpreted as balanced health perception between gender will lessen gender happiness disparity. This paper analyzed happiness gender disparity in economic framework and shed light on the power of health perception on happiness in distinctive way.

Keywords: happiness; health perception; gender happiness disparity

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1. Introduction

Does happiness gender disparity exist? This is an interesting question. Gender is the most well studied and intriguing perspective, though there exist many different aspects such as age, country and time to analyze the happiness disparity. Moreover, as happiness is now a main source of country evaluation, happiness on gender issue is also an important thing to look at. Therefore, well balanced gender happiness (happiness ratio equal to 1) is the most desirable status in this paper regardless of absolute happiness level in both genders.

If happiness disparity does exist, then what may explain this gender gap? There are many researches on this subject in the aspects of gender role and its inequality, however, mostly ignored the health aspect. Health is essential part of human life and happiness. Moreover, happiness and subjective health perception are strongly connected to each other. According to Blazer and Houpt (1979), personal feeling or mood can affect to self-evaluation of health status, regardless of real physical health. In other words, gloomy people are more likely to assess themselves unhealthy even their physical health status is not different than the other un-depressed people. Additionally, various advanced research results verified that health perception can affect to happiness. For example, people who are satisfied with their current health conditions are more likely to satisfied with their lives. Likewise, happiness and health perception have significant impact on each other. Therefore, I tried to use health perception as explanatory variable of happiness gender disparity.

This paper attempts to measure the impact of health perception on happiness in gender relative way. The analysis will be based on World Value Survey data, which provide personal value assessment results since 1981 to 2014 for over 100 countries. The variables term, mainly used in this paper, is ratio. This is for representing gender relative status and gender disparity level. Ratio is presented as women status, relative to men, to follow the socio-economic normal sense of male standard. Therefore, the ratio term variable is not only representing the gender disparity level but also a women's standardized status on men.

The most important part of this paper is capture the exact impact of health perception on happiness, controlling endogeneity problem. There are two steps to estimate pure health ratio impact on happiness ratio; baseline estimation and IV estimation. Baseline estimation is on the basis of panel model, which include fixed effect, and contain many other happiness ratio control variables. Moreover, weighted regression is added, to reflect each cohort's happiness disparity level. IV

estimation benchmark baseline model, fixed effect and weighted regression, but differs in method. In IV regression, use BMI ratio and its square as IV, control the reverse effect, happiness impact on health perception. Next, conduct the subgroup estimation to observe whether health perception impact is changing by subgroups

Final result is 0.322, significant in 95% confidence level and has positive sign. Therefore, the result verifies that health perception disparity can explain or cause the happiness disparity. There are two implications in this finding. First, in happiness perspective, as happiness disparity by gender has been explained by health perception disparity, it has opened the possibility that happiness disparity on various standards can be explained by health assessment. Second, in health perception aspect, the finding clarifies health perception impact on happiness in gender relative perspective. In other words, health perception can affect to happiness not only in absolute way, but also in gender relative way. The paper analyzed happiness gender disparity in economic framework and shed light on the power of health perception on happiness in distinctive way.

2. Economics of Happiness

Happiness has been a main study subject in philosophy and psychology for many years. However, economists are just stepped into this area since standard economics treat happiness as consumer's utility and focus only on maximizing it within budget constraint. Standard economics measure utility by revealed choice of consumption and have evolved in a very quantitative way (Graham, 2005). In contrast, happiness economics measure welfare through survey response and try to verify the elements of it. The advantage of happiness economics is we can investigate the relationship between happiness and various other socio-economic variables including social values. According to this, we can find policy implication in many different aspects, and it's fairly applicable in our real world.

There have been many attempts to study on gender and happiness after economists starts to explore this area and brought many different points of view on this subject. Some researchers report that there exist gap between male and female in response of happiness and the other sides argue that there is no statistically significant happiness gender gap.

Mencarini and Sironi (2010) assert gender plays a very important role on individual's well-being. They conducted the research based on gender inequality and women's happiness. They find large share of housework negatively affect women's happiness especially who works over 30 hours

per week. This implies that women have to take dual burden in this modern era since the role of gender on housework still yet to be modernized and that makes women unhappier than men. However, Vieira (2011) observed that, generally, women have higher happiness level than men around the world and tried to explain the phenomenon in female right and inequality perspective. According to Vieira, paradoxically, country where women's right is not well established has higher female happiness level than the other countries. There are four hypothesizes to explain this phenomenon and one of them explains that higher right involves social conflicts and it eventually exceeds the benefits.

There are also studies about the happiness gender gap variation through time. In Stevenson and Wolfers (2009)'s paper, women's happiness has been declined relative to men. Women's happiness was higher than men around 1970s but now it's reverse. Rudolf and Kang (2015) studied happiness variation in lifetime and its difference between gender. According to them, even men remain on a higher happiness level than women during marriage; they are readily more impacted by life events like divorce, death of a spouse and retirement and it causes the lower happiness level in their later lifetime. On the other hand, according to adaption model, women are better at adapting to such life events and it makes women are in higher happiness level. Arrosa and Gandelman (2013) argue women are happier than men because they respond to happiness determinants in a much favorable way than men do. This is called 'Female Optimism'.

On the contrary, Francis (1998) clearly expresses that there is no difference in happiness between two genders. According to Francis, reported data could prove that there is no significant difference between the mean scores of males and females on the Oxford Happiness Inventory. Myers (2000) also pointed out male and female has similar response pattern to happiness and unhappiness. Likewise, the results are quite controversial on gender and happiness issue. It is hard to tell which side of gender is happier than the other and why. Moreover, most of the advanced researches are use only socio-economic variables as explanatory variable. However, this paper approaches to happiness gender disparity in health aspect.

The importance of health in happiness is already proved by many researchers. Gerdtham and Johannesson (2001) prove that health has statistically significant positive effect on happiness. The paper investigated happiness in socio-economic aspect and used health as controlled variable. They did the research in sample of 5000 Swedish adult individual. The results clarifies that probability of being happy is 60% when individual is healthy, otherwise it's only 42%. Crivelli and Lucchini(2016) published the book named of Happiness and health. In the chapter 17 of this book, they constructed

analysis to verify the causal relationship between happiness and health by using panel data and panel data model. The model confirms that there exists strong association between well-being and health.

Blanchflower and Oswald (2008) used hypertension as representative of health. They tried to explain the difference in happiness level between nations by hypertension. They investigated 16 europe countries and find out happier nations report lower levels of hypertension than the other nations. They assert that health can be the part of national well-being index.

Carol Graham (2008) claims health is recognized to be one of the most important correlates of well-being. She also observed that subjective health status perception is more significant on happiness than physical health. Furthermore, Mahon and Yarcheski (2005) also figured out perceived health status has most powerful effect on happiness among three of health variables, perceived health status, wellness and clinical health.

Another line of researches have studied on whether there is no difference in perceived health status between male and female. Physical health difference upon gender is clear, but personal assessment on his/her health status is rather unclear. Beck *et al*. (1996)'s research examined the relationships among gender and selected health status indicators. The research results demonstrate that female report poorer subjective health status than male even they belong to same household.

On the other hand, Bambra *et al*. (2009) had somewhat different finding. They investigated relationship between gender and self-assessed health status based on socio-economic position in Europe. In some Europe countries like UK and Finland women were significantly more likely to report good health. However, in Denmark, Sweden, Norway, Holland, Italy, Spain and Portugal have a significantly higher proportion of women reported that their health status is not good. They explained this phenomenon in social regime and welfare policy respect.

However, Macintyre, Hunt and Sweeting (1996) mention that it is conventional wisdom in medical sociology and social epidemiology that in industrialized societies women have poorer health than men but higher male mortality rate.

Here by, we can extract four implications from advance studies. First, gender happiness gap might exist or not. Second, health can be primary explanatory variable for happiness. Third, subjectively perceived health status has stronger effect on happiness than any other physical health variables. Fourth, perceived health can be affected by gender.

In sum, even happiness and health perception are somewhat vague when it comes to a gender disparity, it has possibility that health perception gender disparity can explain that of happiness.

Moreover, we can expect that the relationship will be disclosed more precisely if the survey data is collected on wider range of place, not limited in one country or one continent but global.

3. Data and Empirical Methods

3.1 Data

The analysis based on World Value Survey panel data. The World Value Survey (WVS) has foundation purpose to study social science in value perspective; value assessment changing and its impact on society and political life. The survey is conducted on individual level and it contains the data such as personal grading on values, socio-economic status and propensity on various social issues. WVS covers 100 countries which includes almost 90 percent of world population from poorest to richest since 1981. Presently, six waves have been conducted and completed: 8 countries were included in wave 1 (1981-1984), 18 in wave 2 (1990-1994), 54 in wave 3 (1995-1998), 40 in wave 4 (1999-2004), 58 in wave 5 (2005-2009) and 60 in wave 6 (2010-2014). WVS data is recognized as highly confidential data and many other researchers are also utilized the data.

This paper used all 6 waves and manipulates individual level data into aggregated data, age group level. Since the paper based on the gender relative status concept, all variables are needed to be transformed into ratio term, female on male. Mean value of gender is needed in this process. Therefore, individual level responses had to be clustered on one cohort level. These ratio terms can be interpreted in two ways. First, it represents female status standardized by male status. Second, it implies gender balanced status, based on male.

The data have to be aggregated as small level as possible since aggregated level data shrink sample size. Therefore, subdivide one country data into 7 different age groups. Age group range is from 10 to 70. Group 70 contains the age seventies and above. All age groups have same portion in the whole sample. To sum up, this paper used World Value Survey data as aggregated level and all variables are in ratio term to stand for gender relative status.

3.2 Variables and Descriptive Findings

Dependent variable is happiness ratio. Measuring happiness is conducted as follows; “Taking all

things together, would you say you are very happy, rather happy, not very happy or not at all happy?"(Responses of "Missing; Unknown", "Not asked in survey", "No answer" and "Don't know" are treated as missing data). Score the answers either 1 or 0; 1 is for the answers "Very happy" and "Rather happy", and 0 is for "Not very happy" and "Not at all happy". Categorizing the answers into happy or not happy is to maximizing the happiness ratio variation. This is because large portion of people were choosing either "Rather happy" and "Not very happy" which makes hard to observe the clear contrast between two gender.

Table1. Summary statistics for Happiness ratio, Health ratio and Control variables

		Ratio Interval				
	Total Average	0.7-	0.7~1	1~1.3	1.3+	Total observations
Panel A: Happiness ratio						
Total	1.01	0.54	0.92	1.07	1.53	
		(22)	(742)	(790)	(43)	1597
Younger	1.02	0.70	0.94	1.07	1.47	
		(1)	(386)	(498)	(18)	903
Older	0.99	0.54	0.90	1.07	1.57	
		(21)	(356)	(292)	(25)	694
Panel B: Health ratio						
Total	0.90	0.52	0.89	1.08	1.52	
		(232)	(913)	(414)	(40)	1599
Younger	0.94	0.61	0.90	1.06	1.43	
		(33)	(611)	(252)	(7)	903
Older	0.84	0.51	0.86	1.10	1.53	
		(199)	(302)	(162)	(33)	696
Panel C: Control Variables						
Employment ratio	0.65	0.39	0.83	1.11	2.01	1,534
Religious ratio	1.22	0.46	0.93	1.12	1.66	1,546
Social ratio	1.05	0.46	0.85	1.13	1.84	1,364
Income ratio	0.95	0.44	0.85	1.13	1.96	1,488
Education ratio	0.99	0.55	0.86	1.11	1.60	1,480
Think ratio	1.04	0.52	0.93	1.09	1.47	1,560

Notes: Ratio intervals have the range 'less than' or 'same or more' or both. Numbers that are represented as decimals are ratio average for corresponding ratio interval. Observation numbers for intervals are in parenthesis below (Control variable's observation numbers for each interval are not provided). All statistics are based on age by country group level aggregated data. Moreover, row name 'Younger' and 'Older' means groups that are divided by age; 'Younger' is 40s or younger and 'Older' is 50s or older. In panel C, not all control variables are included; only include the variables that are able to transform as ratio term. Thus, average children number and marriage rate is not included the control variables list.

Figure 1. Relationship between happiness ratio and health ratio

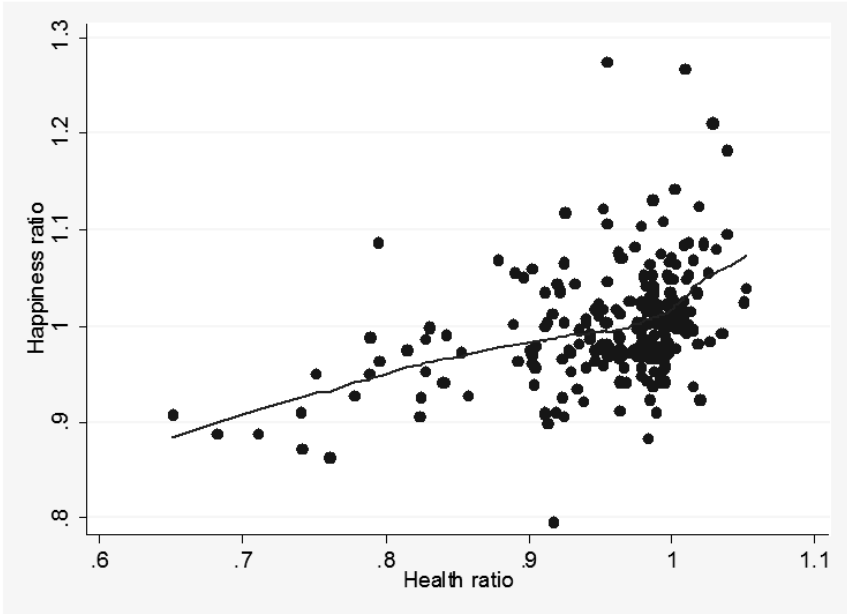

Figure 1_A. Country level

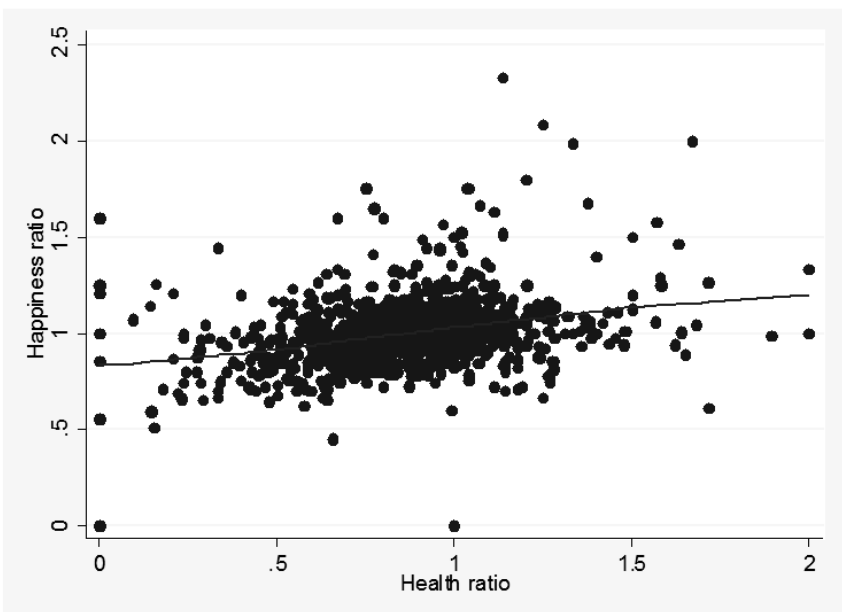

Figure 1_B. Age by country group level

Notes: Figure 1 shows the data scatter points and weighted regression line between happiness ratio and health ratio. Figure A and B differ in data aggregated level. Both figures indicate that happiness ratio and health ratio are positively correlated.

Some people may think quantifying personal perception or feeling is not reliable and it's inappropriate for rigorous statistical research. Alesina *et al.* (2004) rebut this critical viewpoint. They summarize the arguments about advantage of using happiness data, based on advanced researches. According to Alesina *et al.* (2004) there are two reasonable grounds to use happiness data in the analysis. First, psychologists, who major in studying welfare and happiness, widely use the happiness survey data for their work. Second, many study results verify that happiness response can reflect internal happiness. Therefore, it is appropriate using happiness data in economic analysis. In this regards, happiness ratio represents the meaning of women's relative happiness and gender happiness disparity. Happiness ratio bigger or less than 1 implies imbalanced status of gender happiness.

Main independent variable is health ratio. Perceived health status can be measured as follows; "All in all, how would you describe your state of health these days? Would you say it is very good, good, fair, and poor". The data organizing process of health status is same as happiness[1]; sort the answers into two groups, healthy or not healthy, and score them either 1 or 0. Health ratio variable also imply gender health perception disparity. If health ratio is bigger than 1, it means women perceive themselves relatively healthier than men, vice versa.

In Figure 1, both A and B illustrate the relationship between happiness ratio and health ratio. Figure 1_A is based on country level cohort and figure 1_B is based on age group level cohort. The curve in the graph displays weighted regression curve of happiness ratio on health ratio. We can simply discover that happiness ratio has positive correlation with health ratio through the slope of the line. This positive correlation is also represented in Table 1. Table 1 provide the summary statistics for happiness ratio, health ratio and control variables, used in later regression part. Each numbers represents the average ratio value for corresponding interval. Average ratios are almost same in panel A and B, regardless of division category in each panel. This implies positive correlation between happiness ratio and health ratio.

In addition to that, spots are concentrated on near around 1 for both happiness and health ratio. This condensed point's pattern is also presented in Table 1 more clearly. In panel A and B, observation numbers in parenthesis show that the data peak dispersion in interval 0.7 ~ 1 and 1 ~ 1.3 in total sections. This peak distribution around 1 for both ratios represent that happiness ratio 1 has

[1] People who chose the answer "Very good" and "Good" are grouped as 'Good health' and the other people who answered "Fair" and "Poor" are in 'Not in good health' group. The proportion of 'Good health' group might be over 95% if the answer "Fair" is categorized as 'Good health'.

highly correlated with health ratio 1.

Furthermore, we can observe that this correlation seems stronger when health and happiness ratio is less than 1 through the dispersion of the points in Figure 1. The variation of the happiness ratio is higher when health ratio is bigger than 1 in both figures. This may imply that relative health perception impact on relative happiness is more explicit when women's relative health perception is unhealthier than men. In other words, if men assess themselves healthier than women, it plays more significant role on their relative happiness improvements, vice versa.

Therefore, descriptive findings give us some implications. First, happiness ratio is positively correlated with health ratio. Second, if health ratio is close to one, happiness ratio is also close to one with high possibility. Third, positive relationship pattern seems more explicit when both ratios are less than one.

3.3 Empirical Methods

3.3.1 Baseline estimation

In order to examine the pure impacts of the health ratio on the happiness ratio, happiness ratio is needed to be controlled by the other determinants factors. Furthermore, the estimation model has to be panel model, using fixed effect, since I took the advantage of cross country and time series variation from the panel data. The regression used age by country group level data. The baseline regression model is as follows:

$$Happiness\ ratio_{ijs} = \alpha + \beta\ Health\ ratio_{ijs} + X_{ijs}\Gamma + \delta_i + \delta_j + \delta_s + \epsilon_{ijs} \qquad (1)$$

where $Happiness\ ratio_{ijs}$ is the standardize female happiness of age group, i , in period, j , living in country s. The vector X_{ijs} refers to control variables, aggregated in age by country group level. X_{ijs} include macro-economic variables and personal characteristic variables; macro-economic variables are employment, social class, income and education, and the personal character variables are age group, religious, thinking, average children number and marriage rate. All variables, except average children number and marriage rate, are in ratio term, which represents relative female status.

Ratio of employment, social class, income and education are female's current status

standardized by male. Among personal character variables, religious ratio represents the gender ratio of response, “I am a religious person”. Moreover, thinking ratio is from a question “How often, if at all, do you think about the meaning and purpose of life?”. The answers are also classified into two groups ‘often think’ and ‘rather think’. The ratio represents how often females think meaning of their lives relative to male. The other personal variables like age group, average children number and average marriage rate represents the cohort feature.

δ_i, δ_j and δ_s are dummy variables, each stands for age group i, wave j and country s. Dummy variables are included to filter out fixed effect. Age group dummies can be deleted if control variable vector contains age group. Age group has its fixed effect on happiness. According to Blanchflower and Oswald (2008) paper ‘Is well-being U-shaped over the life cycle?’, happiness change through lives in approximately U-shape; lowest happiness level during middle age. Furthermore, happiness level can change through era, especially women’s happiness. Same logic can be linked to country fixed effect. According to World Happiness Report 2016, Denmark is the happiest country and Burundi is the unhappiest country. This national happiness variation has to be considered. Likewise, these various habituation channels need to be check for accurate penal data analysis.

Additionally, as relative gender status can be represented in two ways, ratio term and difference term, regression coefficient can also be measured by two different terms. Term ‘difference’ is subtraction male status from female status. Furthermore, weighted regression provides more precise results. Weight regression is used to weight on groups where happiness difference is significant, by using absolute t-value. This is because if the absolute t-value is big, it implies that the difference is statistically significant. This process will estimate the magnitude of health perception impact more accurately.

3.3.2 IV estimation

Most important thing that needs to be considered in this estimation is reverse causality problem between happiness and health. Though health can make people happy, happiness also can make people healthy. The main causality relationship in this paper is health perception impact on happiness in gender relative way. Therefore, reverse effect must be controlled by an instrument variable (IV). If the result stays significant after using IV in the estimation, then we can say the impact of health ratio

on happiness ratio has been verified.

There are 4 conditions for ideal IV. First, it must be relevant to health ratio. Second, it has to be irrelevant to happiness ratio[2], except through health ratio. Third, it has feature of gender disparity. Fourth, it can represent age by country level cohort's characteristic. However, it's hard to satisfy all these four conditions due to data limitation problem. Therefore, loose the third and fourth conditions.

BMI can fulfill the first and second conditions. Conceptually, correlation between perceived health and BMI is highly reasonable and understandable. Moreover, it does have correlation in real. Additionally, ratio term does not harm the relationship. Therefore, it satisfies the first condition. For second condition, according to Cornelisse-Vermaat *et al*. (2006), BMI has indirect effect on happiness via perceived health. This indirect route to happiness can satisfy second condition. However, it's hard to meet the third and fourth conditions. This is because; BMI gender disparity is not significant in most of the countries. Additionally, there is no BMI data of age by country level cohort's. The BMI data contains each country's average BMI value for both genders and it's calculated as if all countries have same composition of age as the world population. Therefore, same country level data has to be assigned for corresponding 7 different age groups.

BMI index panel data is downloaded from gapmider web site. Gapmider provides the collection of various welfare and health index data from many different sources. MRC-HPA Centre for Environment and Health is the original source of BMI index in gapminder data site. It has yearly data from 1980 to 2008 for both genders for 200 countries. There is no BMI data for wave 6 period. I average the BMI index out for wave periods (four to five years) to match the data size.

After finding IV and its data, we need to construct the IV regression to wipe out reverse causality problem. IV regression method is 2SLS and on the basis of baseline estimation model. Therefore, fixed effect and weighted regression is also included. However, country fixed effect is not considered in IV regression. This is because health ratio variation on country is not significant enough to include its fixed effect.

Regression results will be shown in the subsequent section.

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[2] I added BMI ratio to baselines estimation model and the results show that it does not have explanatory power on happiness ratio. This verifies that BMI ratio satisfy the second condition.

4. Empirical Findings

4.1 Baseline Estimation Results

Table 2. Baseline Estimation

Dependent variable: Happiness Ratio

Control Variable	Cluster on Country					Cluster on Age group	
	No control	Full control	+Age FE	+ Wave FE	+Country FE	+Country FE	Weighted (t-value)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Health ratio	0.210***	0.206***	0.206***	0.204***	0.216***	0.216***	0.325***
	(0.030)	(0.030)	(0.031)	(0.031)	(0.037)	(0.029)	(0.064)
Age group		-0.001***					
		(0.000)					
Employment ratio		-0.011	-0.008	-0.008	0.005	0.005	0.016
		(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)
Religious ratio		-0.002	-0.002	-0.001	-0.008	-0.008	-0.008
		(0.010)	(0.011)	(0.011)	(0.010)	(0.010)	(0.019)
Social class ratio		-0.002	-0.001	-0.001	-0.006	-0.006	-0.013*
		(0.011)	(0.011)	(0.011)	(0.011)	(0.009)	(0.014)
Income ratio		0.016**	0.015**	0.014**	0.013*	0.013*	0.013
		(0.009)	(0.009)	(0.009)	(0.008)	(0.010)	(0.015)
Education ratio		0.166	0.018	0.021	-0.04	-0.04	-0.067*
		(0.015)	(0.015)	(0.016)	(0.038)	(0.040)	(0.053)
Thinking ratio		0.063***	0.069***	0.07***	0.097***	0.097***	0.166***
		(0.033)	(0.033)	(0.033)	(0.040)	(0.021)	(0.040)
Children		0.02***	0.02***	0.019***	0.017***	0.017***	0.024***
		(0.007)	(0.008)	(0.008)	(0.008)	(0.007)	(0.010)
Marriage		-0.022	0.033	0.038	-0.001	-0.001	-0.001
		(0.025)	(0.043)	(0.042)	(0.057)	(0.025)	(0.049)
Observations	1597	1172	1172	1172	1172	1172	1158

Notes: Estimate Equation 1 by steps. Each cell reports only the coefficient and robust SE. In column (2), age group variable is included as control variable; columns (3)-(7) considered the age group effect on happiness ratio through fixed effect. T-value is in its absolute value. Robust SEs are in parentheses; single asterisk denotes statistical significance at the 90% level of confidence, double 95% and triple 99%.

Table 2 presents the results from baseline estimation by steps. There are 1599 cohorts in total sample. From column 1 to 7 the table shows the changing health ratio coefficient by adding control variables and fixed effects. If the coefficient is barely changed by including other explanatory variables and fixed effect, the coefficient is fairly robust. The results are quite satisfactory in the sense: health ratio

is significant in 99% confidence level for all steps and its magnitude seems consistent except for column 7. Column (1) presents result when happiness ratio is not controlled by other variables. Following the steps through column (2) to (6), we can observe that health ratio coefficient is stable as 0.2~0.21. However, it's increased by 0.11 on the weighted regression. In other words, relative health perception impact gets stronger when happiness gender disparity level is considered in estimation. Therefore, the most accurate baseline estimation result is in column (7)

The results in Table 2, by themselves, demonstrate interesting features. Happiness ratio increased by 0.2~0.3 when health ratio increased by 1 unit. This can be explained in two ways. If the health ratio is less than 1, (women felt unhealthier than men) enhanced women's relative health perception would improve their relative happiness (happiness ratio goes to 1). Therefore, in this situation, women's relatively better health perception will cause balanced gender happiness. However, if the health ratio is bigger than 1, increasing health ratio is no more than inducing gender happiness imbalance. Therefore, it's hard to say that simply increasing health ratio is good for reducing happiness gender disparity. However, as we observed by Figure 1, this positive relationship between health ratio and happiness ratio is clearer when health ratio is less than 1. Furthermore, more than 70% of the data has the health ratio less than 1. Therefore, we can expect that health ratio increasing can improve imbalanced happiness status.

The other control variables also have explanatory power on happiness ratio. Income ratio importance becomes insignificant when happiness gets controlled. Moreover, as women think more about the meaning of life than men, their relative happiness increase. Furthermore, the power and magnitude of thinking ratio is getting increase as the regression model becomes more rigorous. Having more children contribute to women's relative happiness improvement.

Table 3 presents the alternative estimation results. In this section, relative health status impact is tested in various ways. To observe further aspects of relative health status impact on relative happiness, change the term of variable and impose different weight. In this regards, we can check the coefficient magnitude changing. Impact of health disparity can be magnified or attenuated by different term and different weighted regression. In Table 3, there are three regression weights, absolute t-value, sample size and square root of inverse p-value. T-value and square root of inverse p-value have same implication as weight on higher gender happiness disparity group. T-value is in its absolute value since bigger absolute t-value has higher possibility to reject the null hypothesis, there is no difference between gender in happiness. In the same vein, inverse p-value has the same meaning; small p-value

Table 3. Alternative Estimation

Weight Materials		
T-value	Sample size	Sqrt(1/p-value)
Panel A : Health ratio		
Dep = Happiness ratio		
(1)	(2)	(3)
0.325***	0.243***	0.395***
(0.064)	(0.014)	(0.081)
Panel B : Health difference		
Dep = Happiness difference		
(4)	(5)	(6)
0.371***	0.290***	0.384***
(0.05)	(0.013)	(0.049)
1158	1172	1159

Notes: Change the variable terms and impose different regression weight to observe the coefficient variation. First row represents different weight material. Relative health status has been represented as health ratio and health difference in each panel A and B. Similarly, dependent variable is also represented in two ways, ratio and difference. Term difference is subtraction male average status from female average status. T-value is in its absolute value. Sample size represents the number of people in one cohort. To prevent divergent, take root for inverse P-value. Bottom row is total observations number. Robust SEs are in parentheses; single asterisk denotes statistical significance at the 90% level of confidence, double 95% and triple 99%. All regressions are cluster on age group.

refers to bigger happiness disparity. Therefore, inverting p-value to impose more weight on the cohort which gender happiness disparity is significant. Square root term is to prevent divergent of inverse p-value, in case of p-value is almost same as zero. Sample size represents a cohort size, number of respondents in one cohort.

Results in Table 3 are all significant at 99% confidence level. This can verify the robustness of relative health perception impact on relative happiness. Moreover, the magnitude of coefficients in both panel are almost same, which implies variable term does not harm the relationship between health ratio and happiness ratio. Furthermore, weighted regression by square root of inverse p-value has biggest coefficient among them, regardless of variables term. This is a matter of scale. Therefore, except the matter of scale, the coefficients are quite stable. These fairly consistent coefficients clarify the relationship and power of relative health perception on relative happiness.

To sum up, we can learn three points from Table 2 and 3. First, relative health perception has statistically significant positive effect on relative happiness. Second, health ratio impact is intensified when gender happiness difference is considered in estimation as weighted regression. Third, even the magnitude of coefficient can be affected by the data scale and regression weight, significance level and sign is not changed. Therefore, the positive relationship between health perception and happiness in gender disparity is significant and robust.

4.2 IV Estimation Results

Table 4 reports IV estimation results by steps. First stage and second stage refers to 2SLS in IV regression. All IV regression steps are based on panel model and weighted regression. As explained in part 3.3.2, country fixed effect is not included since the health ratio is not vary through countries. IV estimation results would be nullified if country fixed effect was considered in IV regression.

Table 4. IV Estimation

IV= BMI Ratio and its square

First Stage Dep= Health ratio

Second Stage Dep= Happiness ratio

	Full control		+Age group FE		+Wave FE	
	First Stage	Second Stage	First Stage	Second Stage	First Stage	Second Stage
	(1)	(2)	(3)	(4)	(5)	(6)
BMI Ratio	-22.25***		-22.165***		-20.864***	
	(4.775)		(4.776)		(4.783)	
BMI Ratio^2	10.504***		10.452***		9.841***	
	(2.305)		(2.305)		(2.308)	
Health Ratio		0.331**		0.344**		0.322**
		(0.146)		(0.143)		(0.154)
F-value	15.67		15.91		13.82	
Endo.Test (P-value)		0.794		0.896		0.804
Observations						780

Notes: First stage and second stage represents the IV estimation process. The regression based on absolute t-value weighted regression. F-value is Cragg-Donald Wald F statistic. 'Endo.Test' represents the endogeneity test. Endogeneity test p-value is results of the test under null hypothesis, health ratio has endogeneity problem. SEs are in parentheses; single asterisk denotes statistical significance at the 90% level of confidence, double 95% and triple 99%.

Odd numbered columns represent the first stage results. According to the them, BMI ratio has quadratic relationship with health ratio. As BMI ratio increase, health perception ratio decrease, but it has lower bound since the health ratio changes through BMI ratio in U shape. This can be proven by BMI ratio and BMI ratio square coefficient result; BMI ratio has positive linear coefficient, and BMI ratio square has negative sign. Both coefficients are statistically significant in 99% confidence level. We can infer from this that endogeneity problem caused by reverse causality can be resolved by IV. F-value and endogeneity test p-value will verify this.

F-values in corresponding columns are Cragg-Donald Wald F statistic test results under the null hypothesis, equation is weakly identified. Therefore, if f-value is big, it can reject the null hypothesis with high possibility. In Table 4, all f-values are over 10. This implies that health ratio can be identified through BMI instrument variables. Furthermore, f test's p-value, not reported in Table 4, is 0.0000 for all f-values. This clarifies that BMI ratio and BMI ratio square are the valid IV for this estimation.

Endogeneity test p-value is results of the test under null hypothesis, health ratio has endogeneity problem. It has been tested under Chi-square distribution. As the p-value gets higher, possibility of reject the null hypothesis getting higher. In Table 4, most of the p-value are over 0.6 which confirms that health ratio's endogeneity problem was not serious in the first place. Therefore, we can rely on the regression results of health ratio coefficient.

In even numbered columns, health ratio impact is reported. The impact gets stronger as fixed effects are added. Big difference between baseline estimation and IV estimation is significance level of health ratio. In Table 2, all coefficients of health ratio are statistically significant at 99% confidence level. However, in IV estimation, all coefficients are significant at 95% confidence level. This is because the IV regression, manage reverse effect and sample size has been decreased. Nevertheless, the coefficient magnitude, it self, is almost same in both IV regression and baseline weighted regression. It can tell us that, endogeneity problem in baseline estimation was not serious in the first place.

The ultimate impact of health ratio on happiness ratio is 0.322, the value in column (6). This refers to, on the average, gender happiness ratio increase by 0.322 as health perception ratio increase by 1 unit. However, as the result is interpreted in two ways in section 3.1., increasing health ratio is not always end up reducing happiness gender disparity. If health ratio was smaller than 1, health ratio increasing is balancing the gender happiness level. Otherwise, women's better health perception than

men cause gender happiness gap.

Therefore, in sum up, health ratio increasing to 1 will cause happiness ratio 1, which represents most preferable status which has no happiness gender disparity. However, if health ratio is increased above 1, happiness gender disparity will be worse. Therefore, health ratio increasing is not always good. However, as most of the health ratio is less than 1, we can expect positive effect from health ratio increasing. In different perspective, exist of health perception gender disparity affects to happiness gender disparity. This result can give us implication that health perception can improve happiness not only in absolute term, but also in relative term.

4.3. Subgroup Estimation Results

In Table 5, examine the health ratio effect on various subgroups. Each subgroup has been divided into two groups, on the basis of the variables' mean value except age group. Younger group is who are younger or in their forties and older group is for fifties or older people. Estimation is based on baseline regression model, which include age, wave and country fixed effect and using weight material absolute t-value.

The results in Table 5 are intriguing in the aspects of showing clear contrast in two subgroups. Column (2) and (3) presents the estimation results on the subgroups, which think meaning of life more or less often than the average. According to them, happiness ratio is impacted more by relative health perception if people rarely think meaning of life. On the contrary, 'often think' women's relative happiness is less impacted by their relative health perception than the other group. This kind of pattern can be observed by all subgroups; low class, low marriage rate, low female participation ratio and younger cohorts' relative happiness is readily more impacted by relative health perception. We can carefully conjecture from the results that people in higher class, married, working and older people are may not easily impacted by their health perception since most parts of their happiness is already controlled by those conditions.

Interestingly, age subgroup estimation results are quite opposite to what I expected. I thought older people are more sensitive to their health status, and therefore their perception might be critical to their happiness. However, older women's relative happiness is less impacted by their relative health perception, even their health ratio is far less than younger's (see Table1). This might be explained by higher health ratio variation in younger group.

5. Concluding Remarks

The paper is started from curiosity whether there is no difference between two genders in happiness. This paper analyzes the gender happiness disparity in their health perception disparity aspect. Happiness difference is represented as gender happiness ratio (standardized on male) and health perception difference is also represented as gender health perception ratio. Those two data has pattern of positive correlation. This pattern and correlation implies the causal relationship between gender health perception and gender happiness disparity.

The results from baseline and IV regression, demonstrate that while the magnitude of the impact differs depending upon regression methods and subgroups, the aggregated effects are substantial. Health perception disparity affects to happiness disparity in 95% significance level. In other words, decreasing gender health perception gap (health ratio goes to 1) contribute to balanced gender happiness (happiness ratio equal to 1). The paper results have two implications in different perspective. First, it gives the possibility that happiness disparity can be explained by health disparity. Therefore, happiness disparity research can be conducted on many different perspectives such as age, income level and time and so on, based on this paper. Second, in health perception aspects, the results find that health perception has impact on happiness in gender relative way also.

The important message of this finding is gender happiness disparity problem can be alleviated by balanced health perception between gender. These results can give political implication to country where one side of gender's relative happiness is significantly low. Health perception improvements policy such as health education program or periodic health examination for distinguishably unhappier gender would be helpful to diminish the happiness imbalance.

Table 5. Subgroup comparison

Dependent variable : Happiness Ratio

Subgroup	By thinking		By class		By marriage rate		By employment ratio		By age group	
	(1) Often think	(2) Rather think	(3) High class	(4) Low class	(5) High marriage rate	(6) Low marriage rate	(7) High FLPR	(8) Low FLPR	(9) Younger	(10) Older
Health Ratio	0.222***	0.406***	0.230***	0.343***	0.265***	0.382***	0.233***	0.334***	0.446***	0.262***
	(0.029)	(0.039)	(0.032)	(0.038)	(0.029)	(0.045)	(0.030)	(0.037)	(0.044)	(0.035)
observations	668	490	552	606	732	426	580	578	686	472

Notes: Each subgroup is divided into two groups on the basis of their mean value. FLPR stands for female labor participation ratio. FLPR is calculated as female employment rate(number of employed women/all women in the cohort) divided by male employment rate(number of employed men/ all men in the cohort). SEs are in parentheses; single asterisk denotes statistical significance at the 90% level of confidence, double 95% and triple 99%.

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국문초록

건강 인식이 행복에 미치는 영향; 성별 측면에서의 분석

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이 논문은 성별 측면에서 건강 인식이 행복 수준에 미치는 영향력을 파악하고자 하였다. 지금까지 성별 간 행복 수준의 차이에 대해 많은 연구가 진행 되어왔지만 대부분의 연구에서 건강 인식에 대한 측면을 놓치고 있었다. 더불어 건강 인식이 행복에 미치는 영향력은 당연하게 생각되어 왔지만 이 영향력에 대한 상대적 성별 측면에서의 연구는 아직 이루어지지 않았다. World Value Survey 데이터를 사용하여 분석한 결과 남성과 여성 사이의 상대적 건강 인식 차이는 매우 유의하게 성별 간 행복 수준 차이에 영향을 주고 있었다. 즉, 여성의 남성 대비 건강 인식이 더 좋은 그룹이 그렇지 않은 그룹보다 여성의 상대적 행복도가 더 높게 나타나는 것이다. 따라서 남녀간의 건강 인식 차이가 줄어든다면 이에 따른 행복의 차이도 줄어들게 될 것이다. 이 논문은 남녀간의 행복 차이를 경제학적 측면에서 분석하고자 하였으며 그 주요 원인을 남녀간 건강 인식 차이라는 변수에 초점을 맞추었다.

주요어: 행복, 건강 인식, 성별 행복 차이

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