Health Perception Impact on Happiness Disparity in Gender

Soohyun Choi

This paper attempts to explain the happiness gap between men and women using health perception difference. Results show that health perception disparity can be a determinant factor of happiness disparity. The study uses body mass index (BMI) as an instrumental variable (IV) to eliminate the reverse causality problem caused by a strong correlation between self-evaluation of health and happiness. Results suggest that if health perception disparity increases by 1, happiness disparity increases by 0.325, implying relatively better or poorer evaluation of health can generate happiness gap between genders. This study analyzes the happiness disparity between the sexes in an economic framework and clarifies the effect of health perception using an IV.

Keywords: happiness; health perception; happiness disparity in gender; body mass index; instrumental variable

JEL Classification: I14, I31, J16

I. Introduction

Happiness disparity in gender has been studied in psychology, sociology, and economics. Most of the studies show that happiness differences exist between men and women and that such differences are correlated with socioeconomic variables. This study clarifies one of the factors that could cause happiness inequality between genders—

Soohyun Choi, Associate Research Fellow, Korea Research Institute for Vocational Education & Training, 370 Sicheong-daero, Sejong-si, Korea, 30147 (Email): shch@krivet.re.kr, (Tel): [redacted]

This paper is a revised version of Soohyun Choi's master's dissertation in 2017. I thank professor Sok Chul Hong for helpful comments and advice.

[**Seoul Journal of Economics** 2021, Vol. 34, No. 4]
DOI: 10.22904/sje.2021.34.4.002

subjective health perception. Though health perception is widely known as a decisive element of happiness, it has rarely been studied to explain the happiness gap in gender.

Controversy exists over gender differences in happiness, but the main consensus is that women are happier than men and these differences vary across countries and time. According to Blanchflower and Oswald (2004), women report better happiness scores than men for the United States and Britain. Similarly, Stevenson and Wolfers (2009) showed that women's subjective well-being has declined in the last 35 years and eroded the gender disparity in happiness, which implies women were happier than men for the last three decades. Graham and Chattopadhyay (2013) also proved that women are more satisfied than men, except in low-income countries.

Meisenberg and Woodley (2015) investigated the social and cultural conditions that bring higher happiness levels for females; high in Muslims, low in Catholics, and no communist history. Zweig (2015) found that women are happier than men in almost 73 countries and examined characteristics, such as economic development, religion, and women's rights to explain this worldwide happiness gender gap. The inequality, however, is not associated with country-level variables. Arrosa and Gandelman (2016), therefore, consider "female optimism" the reason for happier women given that any other objective individual characteristic does not explain the gap.

This study attempts to analyze happiness gap between genders using health perception difference, given that self-evaluation of health and happiness is strongly correlated. Blazer and Houpt (1979) unveiled that the impact of self-awareness of health can be stronger than actual physical condition, given that people with a poorer health perception tend to be more depressed and less satisfied with their life even if they are healthy. Similarly, Okun and George (1984) found that self-rated health is highly correlated with neuroticism, a significant part of subjective well-being. One significant disadvantage of health awareness is that happiness can also affect health perception. Piko (2007) verified that psychosomatic conditions and depressive moods can cause a low level of health evaluation among adolescents, which implies that psychological conditions are also vital factors in health perception.

This study measures the impact of health perception on gender disparity in happiness. The analysis is based on World Value Survey (WVS) data, which provides individual happiness levels and subjective descriptions of health, including socioeconomic status information from 1981 to 2014 for over 100 countries. The analysis uses ratio terms, the average of females to males in cohorts, to capture gender disparity. The cohort size is defined as wave by country or wave by country by age group. The dependent variable of the empirical model is happiness ratio (HR), which represents happiness disparity in gender and the main independent variable is health perception ratio (HPR). All the other control variables are also in ratios, and these ratio terms can also be interpreted as female status standardized by male.

The most important question of this study is: how can the reverse causality between HR and HPR be resolved? To mitigate this problem, body mass index (BMI) is used as an instrumental variable (IV). According to Cornelisse-Vermaat *et al.* (2006), BMI indirectly affects happiness through perceived health and is perfectly suited to satisfy the exogeneity and endogeneity properties of an IV.

The results are consistent in all the analyses; as HPR increases by 1, HR increases by 0.322. The finding suggests that happiness inequality between genders can be traced to their health perception inequality. This study contributes to the literature in two ways. First, it analyzes happiness gender disparity in an economic framework and sheds light on the power of health perception on happiness uniquely. Second, it uses an appropriate IV that resolves endogeneity issues in the empirical model.

The rest of this paper is organized as follows. Section 2 describes the data set. Section 3 illustrates the empirical model of the study. Section 4 presents the results of the baseline model, IV regression, robustness check, and subgroup estimation. Section 5 concludes.

II. Data

The analysis is based on WVS panel data, individual survey asking questions, such as personal grading on values, socio-economic status, and propensity on various social issues. The WVS covers almost 100 countries since 1981, which include nearly 90 percent of the world population from the poorest to the richest. This dataset is the largest, cross-country, longitudinal data on human beliefs, with roughly 400,000 respondents. Thus far, six waves have been 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). This data is well known and credible and many other researchers have also utilized the same.

This study used all 6 waves and manipulated individual-level data into age group aggregated level. Given that the study is based on gender-related differences, all variables were transformed into ratio terms—females to males. The mean value of gender is needed in this process. Individual level responses, therefore, were clustered into one cohort level. These ratio terms can be interpreted in two ways. First, it represents a standardized female status on male. Second, it represents the gender inequality level.

The dependent variable is HR. Happiness is measured 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). Most of the respondents replied "rather happy" or "not very happy." Given that this study compares the happiness between genders, a clear distinction between them is necessary. To maximize the HR variation in the cohort, these four categories were made binary—happy or not happy (by combining "very happy" and "rather happy" as "happy" and "not very happy" and "not at all happy" as "not happy").

Some researchers think quantifying personal perceptions or feelings is not reliable and inappropriate for rigorous statistical research. Alesina *et al.* (2004) rebutted this viewpoint by summarizing the arguments of the advantage of using happiness data from previous studies. According to Alesina *et al.* (2004), two reasonable grounds exist for using happiness data in an analysis. First, psychologists studying welfare and happiness widely use happiness survey data. Second, many studies demonstrate that happiness responses can reflect internal happiness.

Main independent variable is HPR. Perceived health status is 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, or poor?" The data organization process of health status is the same as that of happiness[1]; change the variable to a binary one—healthy or not healthy.

[1] People who responded with "Very good" and "Good" are grouped as "Good

The HPR variable also implies a gender health perception disparity. If HPR is greater than 1, it means that women perceive themselves to be relatively healthier than men in that cohort, and vice versa.

Not only HR or HPR, the other variables are all in ratio term to match the format. The other variables are also transformed into binary to calculate ratio between men and women. For example, employment status, people who have paid employment are coded as 1, otherwise 0. Social class, which originally had 5 sub-classes, is also changed to binary by dividing the top two classes and the others. For subjective income, which had 10 categories, the fifth and sixth observations were dropped and separated into two groups. Educational attainment was grouped on the basis of the criteria of university education. Religious ratio represents the gendered ratio of response: "I am a religious person." The thinking ratio is from the question: "how often do you think about the meaning and purpose of life?" The other personal variables, such as age group, average number of children, and average marriage rate represent the cohort feature. BMI ratio represents women's BMI relative to men.

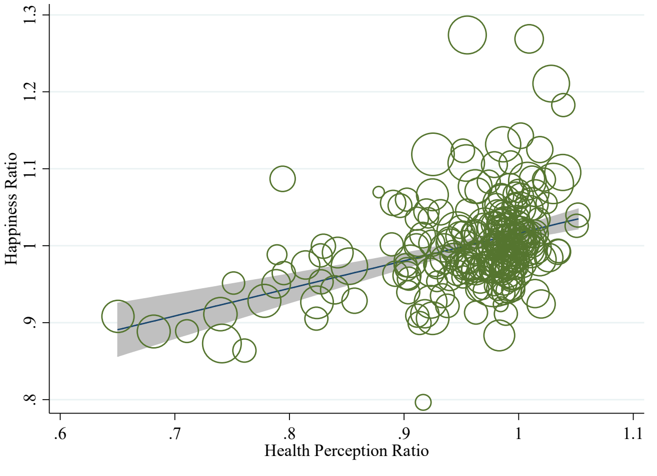
Table 1 shows summary statistics of all variables used in the paper. In terms of total mean, health perception has a larger difference between gender than happiness. Some people, therefore, may think that no happiness gap exists between men and women, and health perception has a far more serious problem in the perspective of gender gap. The average, however, can nullify the variations and simplify the problem. The variation and relationship between HR and HPR can be seen in Figures 1 and 2.

Figures 1 and 2 illustrate the relationship between HR and HPR. Figure 1 is based on the country level cohort and Figure 2 is for the age group level. The line in the graphs displays the prediction for HR from a linear regression of HR on HPR. Two things are discovered from the graphs: first, HR positive correlates with HPR and second, the spots are concentrated around 1. These indicate that happiness and health awareness of men and women in most of the groups do not differ significantly, but in the groups that do, happiness disparity is closely related to that of health perception.

health" and the others who answered "Fair" and "Poor" are in the "Not in good health" group. The proportion of "Good health" group might be over 95 percent if the answer "Fair" is categorized as "Good health."

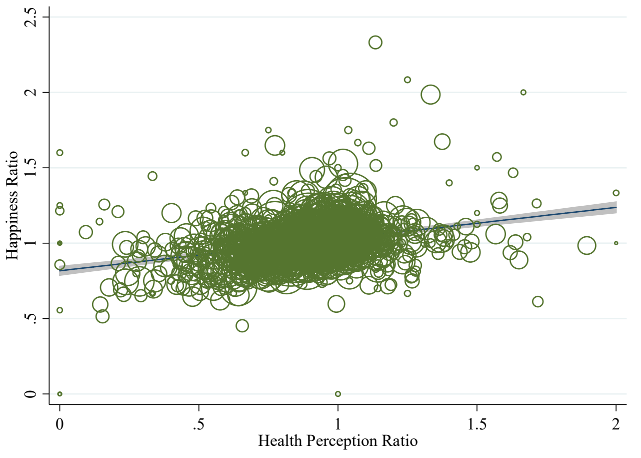
Table 1
Summary Statistics

Variable	Obs	Mean	Std.Dev	Min	Max
HR	1,595	1.004	0.142	0	2
HPR	1,595	0.897	0.220	0	2
Employment ratio	1,531	0.653	0.468	0	8
Religious ratio	1,543	1.219	0.411	0	9
Social class ratio	1,362	1.055	0.605	0	6
Income ratio	1,486	0.949	0.607	0	7
Eduaction ratio	1,477	0.985	0.264	0	2
Thinking ratio	1,556	1.039	0.165	0	2
Avg # of Children	1,559	2.121	1.444	0	7
Avg Marriage rate	1,595	0.600	0.268	0	1
BMI ratio	1,170	1.014	0.050	1	1



Notes: Figure 1 shows the data scatter points and regression line between HR and health ratio. Figures 1 and 2 differ in data aggregation level. The size of the circle represents the cohort size.

Figure 1
Relationship between HR and HPR at the country level



Source: World Value Survey

Figure 2
Relationship between HR and HPR at country by age group level

III. Empirical Methods

A. Baseline estimation

The empirical model is based on ordinary least squares (OLS) with fixed effects. The regression uses country by age group cohort data. The baseline regression model is as follows:

$$HR_{itc} = \alpha + \beta HPR_{itc} + X_{itc}\Gamma + \delta_i + \delta_t + \delta_c + \varepsilon_{itc}, \tag{1}$$

where *Happiness Ratio*$_{itc}$ is the happiness disparity level of age group *i*, in period *t*, living in country *c*. The vector refers to control variables that include macro-economic variables and personal characteristics: employment status, subjective social class and income level, education level, age group, religion, frequency of thinking about the meaning of life, average number of children, and marriage rate are included and are in ratio terms, except for the last two variables.

δ_i,δ_t and δ_c are dummy variables for fixed effects and stand for age group *i*, wave *j*, and country *c*, respectively. The age group dummies can be deleted if the control variable vector contains age group. Based on Blanchflower and Oswald (2008)'s study "Is well-being U-shaped over the life cycle?" happiness levels change over a person's lifetime in a U-shape; the lowest happiness level is during middle age. Furthermore, happiness levels also change over an era, especially women's happiness. The data showed that women's happiness has improved over time. Similarly, country is a critical variable in personal well-being. According to the World Happiness Report 2019, Finland is the happiest country and South Sudan is the unhappiest. These differences in happiness by nation have been reflected as fixed effects in the model.

Further, the inequality of happiness by gender is also analyzed in terms of difference, not ratio, by subtracting men's from women's. Weight regression is used to infer a more accurate magnitude of the impact by using absolute t-value, extracted from the happiness t-test in each cohort.

B. IV estimation

The most serious problem of this study is: how can the reverse causality between happiness and health awareness be resolved? Although better health perception can make people happier, better mood with less stress also makes people perceive themselves as healthier. Given that this study aims to clarify the impact of HPR on HR, this opposite channel must be controlled. Therefore, IV method is used to capture reverse causality. If the result remains significant after using IV, then HPR has an independent impact on HR.

In this study, IV has four ideal conditions as follows. First, to satisfy the endogeneity condition, it must be related to health awareness. Second, for exogeneity condition, it should not be correlated with the error term of the model. Third, it should have gender-specific data. Fourth, it has age group level information given that the cohort is defined by age group. However, finding a variable that satisfies all four conditions is difficult due to data limitations. Therefore, the fourth condition is relaxed. BMI fulfills all the conditions except the fourth. First, assuming that BMI is correlated with people's cognition of their health is reasonable, given that obesity is one of the main criteria for health assessment. For the exogeneity condition, whether BMI is uncorrelated with the error term ε_{itc} in the baseline equation is tested. The results show that the second condition for IV holds.

Recent studies that analyzed the relationship between obesity

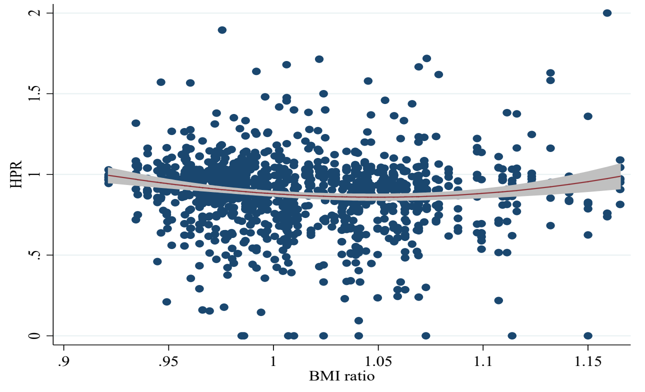


Figure 3
Relationship between BMI ratio and HPR

and happiness should be considered at this point. Katsaiti (2012) demonstrated that obesity negatively impacts well-being. However, health perception is not included as a control variable in the analysis and the result is not statistically different from zero for Britain. According to Cornelisse-Vermaat *et al.* (2006), BMI indirectly affects happiness through perceived health, which is a perfect condition for endogeneity and exogeneity of IV. Hence, BMI is an appropriate instrument for health perception and happiness.

Figure 3 shows the relationship between HPR and BMI ratio. Fitted line has slight U-shape at a lowest point around 1.05, suggesting HPR and BMI ratio may be correlated in quadratic form. The analysis, therefore, includes both BMI ratio and its square term as an instrument to capture more precise impact of BMI ratio on HPR.

The BMI panel data is downloaded from the Gapminder website, which provides various welfare and health index data from different sources. The MRC-HPA Centre for Environment and Health is the original source of BMI data on the Gapminder site. Although BMI data contains gender-specific information, no data exists for age groups. The data set comprises each country's average BMI value for males and females in each year and is calculated as if all countries have the same age composition as the world population. Therefore, the same country-level data must be assigned to seven age groups. The data is from 1980 to 2008 for 200 countries. Unfortunately, no available data exists for Wave 6. Moreover, the BMI data is averaged for the WVS data period (four to five years) for matching given that the WVS data is not annual.

One feature of the IV analysis in this study is that it does not include country fixed effect because the number of observations of the instrument is extremely limited—under 1,000. Moreover, the variation in HPR on country is not significant enough to include its fixed effect. For these reasons, only age group and wave fixed effects were included in IV estimation.

IV. Empirical Findings

A. Baseline Estimation Results

Table 2 presents the results from the baseline estimation by steps. There exist 1,158 cohorts in total. From Columns (1) to (7), the table shows the changing coefficient of HPR by adding control variables and fixed effects. If the coefficient barely changes by other explanatory variables and fixed effect, the impact is robust. The results are quite

TABLE 2
BASELINE ESTIMATION

Dependent variable: Happiness Ratio (HR)

Control Variable	SEs are Clustered on Country					SEs are Clustered 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)
HPR	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)
Avg # of 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)
Avg Marriage Rate		-0.022	0.033	0.038	-0.001	-0.001	-0.001
		(0.025)	(0.043)	(0.042)	(0.057)	(0.025)	(0.049)
N	1597	1172	1172	1172	1172	1172	1158
R-sq	0.10	0.16	0.16	0.17	0.29	0.29	0.47

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; colums (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 905% and triple 99%.

satisfactory in the sense that the health ratio stays significant for all steps and its magnitude seems consistent except for Column (7). Column (1) presents the impact of HPR when no other control variables exist. Following the steps from Columns (2) to (6), we find that the coefficient is stable at 0.2-0.21. In Column (7), however, it increases by 0.11 because of the t-value weight. Thus, the effect of health perception inequality intensifies when the happiness gender disparity level of the cohorts is considered. Therefore, the most accurate baseline estimation result is in Column (7).

The results show that when HPR increases by 1, HR increases by 0.2-0.3. Specifically, when HPR changes from 0 to 1 (when women's health awareness changes from bad to the same level as men), women's relative happiness rises by 20 to 30 percent. The greater the difference in health perceptions between men and women, the greater the inequality in happiness between them.

Other control variables do not have explanatory power on HR except the income ratio, thinking ratio, and average number of children. The income variable loses its effectiveness as fixed effects are added and at the end, its significance disappears completely. This implies that subjective income perception difference does not play a critical role in happiness difference. Conversely, thinking ratio becomes more influential as fixed effects and weight are added, which indicates those who think about the meaning of life more often have more life satisfaction than those who do not. Furthermore, the cohorts with a higher average number of children have a higher relative happiness in women.

Table 3 presents the alternative estimation results using variables indicating objective health status: life expectancy (LE) and disability-adjusted life years (DALYs). The LE data is from the World Bank, which provides yearly life expectancy information by gender and country. The DALY is an index established by the World Health Organization representing the sum of the potential life loss due to premature mortality and disability. Although DALYs are provided at the age group level, the LE data has only one value for each wave, country, and gender. Therefore, the same LE has been applied to all age groups. The reason for the smaller observations in Panel B is due to the shorter data period.

Objective health indicators are used to determine whether the impact of inequality of health perception comes from actual health differences.

TABLE 3
ALTERNATIVE ESTIMATION

	Weight Materials		
	T-value	Sample size	Sqrt(1/p-value)
ep = Happiness ratio			
	(1)	(2)	(3)
PR	0.325***	0.243***	0.395**
	(0.064)	(0.014)	(0.081)
	1158	1172	1159
-sq	0.47	0.40	0.75
.fe	(4)	(5)	(6)
xpectancy	0.247	-0.609	-0.253
tio (LER)	(0.828)	(0.517)	(1.015)
	1088	1102	1089
-sq	0.39	0.32	0.7
	(7)	(8)	(9)
ALYs ratio	-0.0904	-0.0841	0.0122
	(0.047)	(0.038)	(0.060)
	824	835	825
-sq	0.46	0.36	0.72
	(10)	(11)	(12)
PR	0.332***	0.222***	0.421***
	(0.047)	(0.008)	(0.080)
ER	3.039	1.391	3.443
	(1.760)	(0.999)	(1.489)
ALYs ratio	-0.016	-0.040	0.095
	(0.051)	(0.035)	(0.055)
	824	835	825
-sq	0.57	0.45	0.79

Notes: Change the variable terms and impose different regression weights to observe the coefficient variation. The first row represents different weight materials. Relative health status has been represented as health ratio, life, expectancy ratio, daily ratio in each panel. T-value is in its absolute value. Sample size represents the number of people in one cohort. To prevent divergence, take the root for inverse P-value. The bottom row is the total observations number. Robust SEs are in parentheses; single asterisk denotes statistical significance at 90% confidence level, double 95%, and triple 99%. All regressions are clustered on age group.

According to results in Columns (4)-(9), LE and DALYs have no explanation power on HR. Moreover, Columns (10)-(12) unveil that the effect of HPR barely changed even after including LER and DALYs ratio. These results in Table 3 demonstrate that the difference in happiness between genders is because of the difference in health perception rather than any physical difference.

B. IV Estimation Results

Table 4 reports the IV estimation results accordingly. The IV regression model is based on fixed effects and weighted regression. Weight regression is applied to all steps, unlike the baseline model. Furthermore, as mentioned in Section 3.2, country fixed effect is not included in the model due to the limited number of observations and the lack of variations in HPR by country.

Columns (1), (3), and (5) in Table 4 present the first-stage results and the other columns are the second-stage results. The results in

Table 4
IV Estimation

	Panel A : Full control		Panel B: + Age group FE		Panel C: +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
N						780

Notes: The first and second stages represent the IV estimation process. Section 1 only contains the IV estimation results, whereas Section 2 presents the result of the weighted regression of IV estimation. It is conducted as weighted regress on the corresponding Section 1 column. F-value is Cragg-Donald Wald F statistic. “Endo. Test” represents the endogeneity test. Endogeneity p-value presents the results of the test under null hypothesis, health ratio has endogeneity problem. SEs are in parenthesis; single asterisk denotes statistical significance at the 90% confidence level, double 95%, and triple 99%.

the odd-numbered columns show that the BMI ratio has a quadratic relationship with HPR, a U-shape with the lowest point where BMI ratio is around one. Specifically, in the cohorts where BMI ratio is less than 1, women's relative health perception decreases as their relative BMI ratio rise and vice versa in the group with BMI ration greater than 1.

The f-values in the corresponding columns are Cragg-Donald Wald F statistics under the null hypothesis that the equation is weakly identified. Fundamentally, if the f-value is greater than 10, we can reject the null hypothesis. Our instruments, BMI ratio and its square, are therefore not weak given that their f-values are all above 10.

Columns (2), (4), and (6) show the influence of HPR after reverse causality is controlled. While the significance levels decline, the magnitude of the coefficients are similar with the baseline result—0.325. The p-value of endogeneity test is the result under the null hypothesis that the specified endogenous regressor can be treated as exogenous. The test statistic is distributed as chi-squared with degrees of freedom equal to the number of regressors tested. Given that the p-value is high enough to accept the null hypothesis, it indicates that the expected problem of endogeneity in the baseline was not serious in the first place. Therefore, we can rely on the baseline results. The decline in significance could be due to the reduced sample size.

C. Robustness Check

To confirm the robustness of the results, same analyses were conducted using another happiness index variable—life satisfaction. This variable is also from the WVS data. The survey question is: "All things considered, how satisfied are you with your life as a whole these days? Using this card on which 1 means you are "completely dissatisfied" and 10 means you are "completely satisfied" where would you put your satisfaction with your life as a whole?" The responses are divided into two groups: the responses of 1 to 5 into one group and the remaining responses in the other. Except for the dependent variable, the analyses are identical with the previous ones.

Table 5 shows the results of the baseline estimation model. After the dependent variable is changed, the effect of HPR is smaller and less significant than the original result. However, we can still see that the health perception disparity is a powerful factor that causes a satisfaction gap between genders. Furthermore, in Table 6 presenting

Table 5

Baseline Estimation Using Satisfaction of Life

Dependent variable: Satisfaction of life

Control Variable	SEs are Clustered on Country					SEs are Clustered 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)
HPR	0.172**	0.183***	0.189***	0.206***	0.208***	0.208**	0.216**
	(0.070)	(0.064)	(0.064)	(0.070)	(0.070)	(0.079)	(0.079)
Age group		-0.001					
		(0.001)					
Employment ratio		-0.017	-0.022	-0.000	-0.001	-0.001	0.011
		(0.014)	(0.013)	(0.017)	(0.018)	(0.007)	(0.017)
Religious ratio		0.000	0.002	-0.007	-0.009	-0.009	-0.017
		(0.016)	(0.015)	(0.015)	(0.015)	(0.023)	(0.020)
Social class ratio		0.023**	0.021**	0.019*	0.018*	0.018	0.013
		(0.010)	(0.010)	(0.010)	(0.010)	(0.016)	(0.016)
Income ratio		0.036**	0.039**	0.031*	0.030	0.030	0.029
		(0.016)	(0.016)	(0.018)	(0.019)	(0.017)	(0.021)
Education ratio		-0.020	-0.027	-0.097	-0.087	-0.087*	-0.120
		(0.038)	(0.039)	(0.083)	(0.078)	(0.039)	(0.066)
Thinking ratio		-0.005	-0.017	-0.013	-0.017	-0.017	-0.039*
		(0.073)	(0.070)	(0.068)	(0.068)	(0.027)	(0.017)
Avg # of Children		0.005	0.008	(0.001)	(0.003)	-0.003	-0.009
		-0.012	-0.012	-0.016	-0.015	(0.011)	(0.012)
Avg Marriage Rate		-0.029	-0.201**	-0.243**	-0.237**	-0.237*	-0.123
		(0.030)	(0.084)	(0.096)	(0.096)	(0.099)	(0.109)
N	1580	1172	1172	1172	1172	1172	1158
R-sq	0.03	0.07	0.09	0.24	0.25	0.25	1158

Notes: SEs are in parentheses; single asterisk denotes statistical significance at the 90% confidence level, double 95%, and triple 99%.

Table 6

IV Estimation using Satisfaction of Life

IV = BMI Ratio and its square

First Stage Dep= Health Perception Ratio

Second Stage Dep= Satisfaction Ratio

	Panel A : Full control		Panel B: + Age group FE		Panel C: +Wave FE	
	First Stage	Second Stage	First Stage	Second Stage	First Stage	Second Stage
	(1)	(2)	(3)	(4)	(5)	(6)
BMI Ratio	-17.851***		-18.601***		-17.798***	
	(4.662)		(4.691)		(4.704)	
BMI Ratio^2	8.396***		8.765***		8.389***	
	(2.25)		(2.264)		(2.270)	
Health Ratio		0.472**		0.462**		0.491**
		(0.210)		(0.204)		(0.218)
F-value	11.66		11.98		10.72	
Endo. Test (P-value)		0.081		0.089		0.080
Observations						789

the IV regression results, the p-value demonstrates that endogeneity problem exists between satisfaction of life ratio and HPR. Luckily, the BMI ratio and its square are also appropriate for the new happiness index as an instrument. Therefore, the coefficient of HPR in the second stage is higher than the baseline results almost twice as much. In sum, health perception difference can generate happiness difference between genders even if the happiness is measured as life satisfaction.

D. Subgroup Estimation Results

Table 7 shows the impact of HPR on the various subgroups. All subgroups were divided into two groups based on the variables' mean value except the age group. The younger group includes people who are in their forties or younger and the older group includes those in their fifties or older. The estimation is based on the baseline regression model, which includes age, wave, and country fixed effect and uses weight regression.

The results in Table 7 are intriguing given that they are in clear contrast between two subgroups. Columns (1) and (2) present subgroup estimation results using variable "thinking meaning of life." HPR is more affective in the cohorts where people rarely think of meaning of life. In case of social class, happiness gap between genders is more affected by HPR if people perceive themselves belong to a lower social

Table 7

Subgroup comparison 1

Dependent variable : Happiness Ratio

Subgroup	By thinking		By social class		By marriage rate		By employment ratio		By age group	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Often think	Rarely think	High class	Low class	High marriage	Low marriage	High FLPR	Low FLPR	Younger	Older
HPR	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)
N	668	490	552	606	732	426	580	578	686	472
R-sq	0.54	0.59	0.54	0.51	0.46	0.70	0.59	0.55	0.53	0.55

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%.

TABLE 8

SUBGROUP COMPARISION 2

Dependent Variable = Happiness Ratio

	(1)	(2)	(3)	(4)
Country Group	Low	Lower Middle	Upper Middle	High
	HDI<0.7	0.7≤HDI<0.8	0.8≤HDI<0.9	HDI≥0.9
HPR	0.386***	0.178***	0.332***	0.284***
	(0.061)	(0.051)	(0.051)	(0.031)
N	183	332	252	407
R-sq	0.66	0.39	0.53	0.60

Notes: HDI is abbreviation of Human Development Index used by United Nations to determine a nation's developmental status. The countries are divided subjectively in to four groups using HDI 2019.

class. The cohort having following characteristics is more susceptible to HPR than the other; rarely thinking about the meaning of life, perceive themselves in a lower social class, lower marriage rate, lower female labor participation rate, and age under 50's. We can conjecture from the results that people in groups with completely opposite conditions are less likely to impacted by HPR given that their happiness is already fulfilled by those conditions. However, HPR can still be a decisive factor for HR, even in groups with favorable conditions.

To see how the impact of HPR on HR can differ by a country's developmental status, subgroup estimation has been held using Human Development Index data. Based on Table 8, countries included in low development status, such as Zambia, India, Bhutan, and so on have highest impact level of health perception. Meanwhile, countries of lower middle level, for example Indonesia, Jordan, Jamaica, and so on are less affected by HPR. Thus, whether the magnitude of the HPR effect can differ by a country's developmental status, HPR stays valid regardless of the socio-economic difference of each country.

V. Concluding Remarks

This study explores the question: what explains the happiness gap between men and women? Despite the extensive literature, the question has not been clearly and economically verified given that the trends vary by country and time. Thus, this study analyzes the gender disparity in happiness using health perception. Although subjective evaluation of health plays an important role in happiness, it has rarely been used as a variable to explain the happiness difference. To represent gender disparity, all variables are in ratio terms in this study—female over male.

This paper reveals that health perception inequality could causes happiness inequality between genders; HPR increases by 1, then HR increases by 0.325. The result consistently remained even after changing the dependent variable with different happiness index—life satisfaction. The impact of health perception on happiness disparity stays robust when the BMI ratio and its square are used as instrument variables to control reverse causality.

These findings demonstrate that the problem of happiness gap between genders can be alleviated by a balanced health perception. If one gender reports a significantly lower health perception level than the other, then there must be an issue with happiness. Health awareness improvement, such as health education or periodic medical checkups, would be helpful for diminishing the happiness imbalance.

(Received August 24, 2020; Revised November 19, 2021; Accepted November 19)

References

Alesina, A., Di Tella, R., & MacCulloch, R. “Inequality and happiness: are Europeans and Americans different?.” *Journal of Public Economics* 88 (No.9 2004): 2009-2042.

Arrosa, M. L., & Gandelman, N. “Happiness decomposition: Female optimism.” *Journal of Happiness Studies*, 17 (No.2 2016): 731-756.

Bambra, C., Pope, D., Swami, V., Stanistreet, D., Roskam, A., Kunst, A., & Scott-Samuel, A. “Gender, health inequalities and welfare state regimes: a cross-national study of 13 European countries.” *Journal of Epidemiology and Community Health* 63 (No.1 2009): 38-44.

Beck, R. W., Jijon, C. R., & Edwards, J. B. (1996). “The relationships among gender, perceived financial barriers to care, and health status in a rural population.” *The Journal of Rural Health* 12 (No. 3 1996): 188-196.

Blanchflower, D. G., & Oswald, A. J. “Well-being over time in Britain and the USA." *Journal of public economics* 88 (No.7-8 2004): 1359-1386.

Blanchflower, D. G., & Oswald, A. J. "Hypertension and happiness across nations." *Journal of health economics* 27 (No.2 2008): 218-233.

Blanchflower, D. G., & Oswald, A. J. "Is well-being U-shaped over the life cycle?" *Social science & medicine* 66 (No.8 2008): 1733-1749.

Blazer, D. G., & Houpt, J. L. "Perception of poor health in the healthy older adult." *Journal of the American Geriatrics Society* 27 (No.7 1979): 330-334.

Cornelisse-Vermaat, J. R., Antonides, G., Van Ophem, J. A., & Van Den Brink, H. M. "Body mass index, perceived health, and happiness: Their determinants and structural relationships." *Social Indicators Research*, 79 (No.1 2006): 143-158.

Crivelli, L., Bella, S. D., & Lucchini, M. "Happiness and health." *In Handbook of research methods and applications in happiness and quality of life*. Edward Elgar Publishing, 2016.

Francis, L. J. "Happiness is a thing called stable extroversion: A further examination of the relationship between the Oxford Happiness Inventory and Eysenck's dimensional model of personality and gender." *Personality and Individual Differences* 26 (No.1 1998): 5-11.

Gerdtham, U. G., & Johannesson, M. "The relationship between happiness, health, and socio-economic factors: results based on Swedish microdata." *The Journal of Socio-Economics* 30 (No.6 2001): 553-557.

Graham, C. "The economics of happiness." *World economics* 6 (No.3 2005): 41-55.

Graham, C. "Happiness and Health: Lessons-And Questions-For Public Policy." *Health Affairs* 27 (No.1 2008):72-87

Graham, C., & Chattopadhyay, S. "Gender and well-being around the world." *International Journal of Happiness and Development* 1 (No.2 2013): 212-232.

Guven, C., Senik, C., & Stichnoth, H. "You can't be happier than your wife. Happiness gaps and divorce." *Journal of Economic Behavior & Organization* 82 (No.1 2012): 110-130.

Katsaiti, M. S. "Obesity and happiness." *Applied Economics* 44 (No.31 2012): 4101-4114.

Kirchengast, S., & Haslinger, B. "Gender differences in health-related

quality of life among healthy aged and old-aged Austrians: cross-sectional analysis." *Gender Medicine* 5 (No.3. 2008): 270-278.
Macintyre, S., Hunt, K., & Sweeting, H. "Gender differences in health: are things really as simple as they seem?." *Social science & medicine* 42 (No.4 1996): 617-624.
Mahon, N. E., Yarcheski, A., & Yarcheski, T. J. "Happiness as related to gender and health in early adolescents." *Clinical Nursing Research* 14 (No.2 2005): 175-190.
Meisenberg, G., & Woodley, M. A. "Gender differences in subjective well-being and their relationships with gender equality." *Journal of Happiness Studies*, 16 (No.6 2015), 1539-1555.
Mencarini, L., & Sironi, M. "Happiness, housework and gender inequality in Europe." *European Sociological Review* 28(No.2 2012): 203-219.
Mugford, S., & Lally, J. "Sex, reported happiness, and the well-being of married individuals: A test of Bernard's hypothesis in an Australian sample." *Journal of Marriage and the Family* 43 (1981): 969-975.
Okun, M. A., George, L. K. "Physician-and self-ratings of health, neuroticism and subjective well-being among men and women." *Personality and individual differences* 5(No. 5 1984): 533-539.
Parker, G., & Brotchie, H. "Gender differences in depression." *International review of psychiatry* 22 (No.5 2010): 429-436.
Piko, B. F. "Self-perceived health among adolescents: the role of gender and psychosocial factors." *European journal of pediatrics* 166 (No.7 2007), 701-708.
Pinquart, M., & Sörensen, S. "Gender differences in self-concept and psychological well-being in old age: A meta-analysis." *The Journals of Gerontology Series B: Psychological sciences and social sciences* 56(No.4 2001): 195-213.
Rudolf, R and Kang, S.J. "Lags and Leads in Life Satisfaction in Korea: When Gender Matters", *Feminist Economics* 21 (No.1 2015): 136-163.
Stevenson, B. & Wolfers, J. "The Paradox of Declining Female Happiness." *American Economic Journal: Economic Policy* 1(No.2 2009): 190-225.
Sachs, J.D., Layard, R., Helliwell, J.F. *World Happiness Report 2018.* (No. id: 12761)
Van de Velde, S., Bracke, P., & Levecque, K. "Gender differences in

depression in 23 European countries. Cross-national variation in the gender gap in depression." *Social science & medicine* 71 (No.2 2010): 305-313.

van Wijk, C. M. G., Kolk, A. M., van den Bosch, W. J., & van den Hoogen, H. J. "Male and female health problems in general practice: the differential impact of social position and social roles." *Social science & medicine*, 40 (No.5 1995): 597-611.

Zweig, J. S. "Are women happier than men? Evidence from the Gallup World Poll." *Journal of Happiness Studies* 16 (No.2 2015): 515-541.