RELATIVE INCOME, SUICIDAL IDEATION, AND LIFE SATISFACTION: EVIDENCE FROM SOUTH KOREA*

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Abstract

The relative income hypothesis predicts that an individual's level of happiness decreases in others' income. We examine its empirical relevance in South Korea using large survey data from the Korea Welfare Panel Study. We find evidence that higher peer income is strongly correlated with life satisfaction, but its effect on suicidal ideation is modest and largely insignificant. We also find that the effect of peer income is highly heterogeneous; those who consider themselves relatively poorer seem to be more strongly (and adversely) affected by their relative disadvantage than those relatively richer are (positively) affected by their relative advantage.

Keywords: relative income, subjective well-being, life satisfaction, suicidal ideation
JEL Classification Codes: I14, I31

I. *Introduction*

The long-held view that income and happiness are closely related received renewed interest by economists in recent years (Duesenberry 1949; Frey and Stutzer 2002; Clark, Frijters, and Shields 2008). Many researchers studied determinants of happiness in various empirical settings, and several found evidence that an individual's level of happiness increases

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in his own income but decreases in others' income (Clark and Oswald 1996; McBride 2001; Blanchflower and Oswald 2004; Ferrer-i-Carbonell 2005; Luttmer 2005). The main objective of this paper is to explore the empirical relevance of this "relative income hypothesis" in South Korea.

Most studies on the relationship between relative income and happiness rely on large survey data on individuals' self-reported level of life satisfaction.[1] For example, the Behavioral Risk Factor Surveillance System (BRFSS), conducted by the Centers for Disease Control and Prevention (CDC), asks more than $400,000$ Americans each year to rate their level of life satisfaction ("In general, how satisfied are you with your life?") by choosing one of the following answers: "very satisfied", "satisfied", "dissatisfied", and "very dissatisfied" . Such survey data often contain information on respondents' income as well, making it straightforward to estimate the empirical relationship between income and life satisfaction. To explore the effect of relative income on life satisfaction, researchers usually construct a reference peer group based on respondents' age, sex, and place of residence, and estimate the relationship between life satisfaction and average peer income, while controlling for individuals' own income (Clark and Oswald 1996; McBride 2001; Blanchflower and Oswald 2004; Ferrer-i-Carbonell 2005; Luttmer 2005).

One potential extension of this literature is to look for empirical evidence of the relative income hypothesis using an alternative measure of happiness, preferably one based on observable behavior. Suicide appears to be a reasonable alternative here. It is plausible that suicide reflects an extremely low level of life satisfaction (Hamermesh and Soss 1974), and accurate data on suicide deaths are widely available in many countries. Indeed, several studies find that factors which increase life satisfaction tend to reduce the risk of suicide death (Koivumaa-Honkanen et al. 2001; Helliwell 2007; Daly and Wilson 2009). Most notably, based on individual-level income and suicide data in the U.S., Daly, Wilson, and Johnson (2013) find that high local area income is significantly and positively correlated with the risk of suicide death. However, research evidence on the relative income effect on suicide remains very much scarce.

In this paper, we aim to contribute to the relative income hypothesis literature by investigating the empirical relationship between peer income, suicidal ideation, and life satisfaction in South Korea. Specifically, our analysis utilizes nationally representative survey data from the Korea Welfare Panel Study, which contain detailed information about respondents' income, suicidal ideation and life satisfaction in a longitudinal setting. Consistent with the relative income hypothesis, we find that individuals' life satisfaction and peer income are strongly correlated under both cross-sectional and panel specifications. On the other hand, the link between suicidal ideation and peer income seems to be considerably weaker, especially when individual-level fixed effects are controlled for.

The rest of the paper is organized as follows. Section II provides a brief literature review on the relative income hypothesis. Section III describes the data we use. Section IV presents empirical strategy and findings. Section V concludes.

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[1] In this paper, we use the terms "happiness", "subjective well-being", and "life satisfaction" interchangeably. Benjamin et al. (2012) discuss how these terms relate to the notion of utility in the standard economics literature.

II.   *Literature Review*

The recent emergence of happiness economics is in large part due to economists' greater acceptance and willingness to use self-reported measures of subjective well-being (Frey and Stutzer 2002; Kahneman and Krueger 2006; Clark, Frijters, and Shields 2008). Several recent studies use large survey data to study determinants of happiness, and repeatedly find that those with higher income tend to be happier than others (Blanchflower and Oswald 2004; Frijters, Haisken-DeNew, and Shields 2004; Gardner and Oswald 2007).

At the same time, it is well-documented that the rapid economic growth across the developed countries during the last century was not accompanied by a matching increase in the level of life satisfaction at the aggregate level (Easterlin 1995). A potential explanation for this "Easterlin paradox" is that life satisfaction depends on both absolute and relative income. If an individual's level of life satisfaction is strongly influenced by his economic success *relative* to others, the effect of economic growth on life satisfaction at the aggregate level may be modest, since those at the lower end of the income distribution would suffer from their relative disadvantage even if their absolute income rises over time. Several studies tested this relative income hypothesis by estimating the empirical relationship between individuals' self-reported level of life satisfaction and others' income (conditional on own income), and found that individuals' life satisfaction significantly decreases in peer income (Clark and Oswald 1996; Blanchflower and Oswald 2004; Ferrer-i-Carbonell 2005; Luttmer 2005). However, well-known problems regarding the use of subjective survey data, such as measurement errors, manipulability, and interpersonal and intrapersonal comparability, potentially make it less than straightforward to use and interpret survey data (Bertrand and Mullainathan 2001).

Suicide may be used as an alternative, complementary measure of subjective well-being. To the extent that suicide reflects an extremely low level of life satisfaction (Hamermesh and Soss 1974), it should be a good proxy for subjective well-being. Moreover, one may argue that suicide (action) is a more objective measure of life satisfaction than the self-reported level of life satisfaction (opinion). Indeed, several studies find evidence that supports the theoretical link between suicide and life satisfaction. For example, Helliwell (2007) and Daly and Wilson (2009) show that the factors that increase the risk of suicide death tend to decrease the reported level of life satisfaction as well. Koivumaa-Honkanen et al. (2001) conclude that a higher level of life satisfaction significantly decreases the risk of suicide, after following a sample of approximately 30,000 adults in Finland over a period of 20 years. On the other hand, Case and Deaton (2017) point out that the correlation between suicide and self-reported life satisfaction is not always consistent; for example, although the rate of suicide deaths in the U.S. has risen in recent years, there has not been a matching decline in the level of self-reported life satisfaction among the U.S. population.

In this paper, we examine the empirical relevance of the relative income hypothesis in South Korea using suicidal ideation and life satisfaction as the main outcomes of interest.[2]

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[2] Kang (2010) and Oshio, Nozaki, and Kobayashi (2011) study the effect of peer income on life satisfaction in South Korea using large survey data (Korean Labor and Income Panel Survey for Kang (2010); Korean General Social Survey for Oshio, Nozaki, and Kobayashi (2011)). Unlike the current study, however, they do not consider the relationship between relative income and suicide.

South Korea provides a highly relevant empirical setting to study the relative income effect. In spite of its drastic economic development over the past decades, South Korea noticeably lags behind many industrialized countries in terms of several happiness indicators. According to the 2012 Programme for International Student Assessment (PISA), South Korea ranks last in the share of students who feel happy at school (60 percent). In 2014, it had the highest poverty rate among the elderly (49 percent) and the second-highest suicide rate (26.7 per 100, 000 population, next to Lithuania) among OECD member countries (see Figure 1). As of 2017, suicide is the leading cause of death among South Koreans aged 10-39.

FIGURE 1.   SUICIDE RATES (PER 100,000 PERSONS) IN OECD MEMBER COUNTRIES, 2014
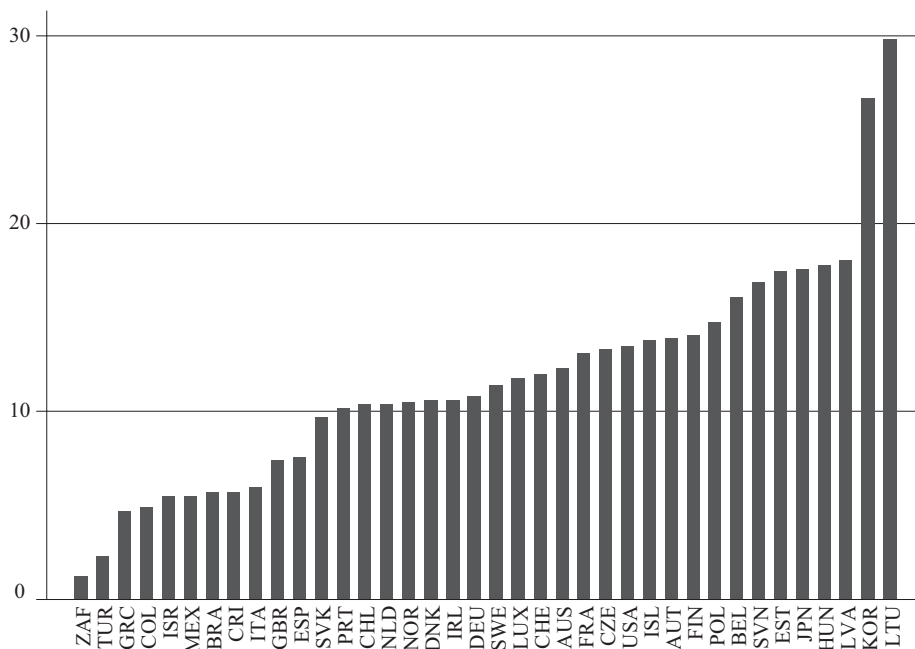
Source: OECD Health Statistics

III.   *Data*

Our analysis is based on data from the Korea Welfare Panel Study (henceforth KOWEPS), which is a nationally representative panel survey, designed and conducted by the Korea Institute for Health and Social Affairs (KIHASA) and Seoul National University (SNU). It has collected detailed information about employment, income, health, and transfers from more than 15, 000 respondents each year since 2006. KOWEPS data contain information on income, suicidal ideation and life satisfaction in a consistent large-panel setting, allowing us to estimate the magnitude of the relative income effect while accounting for individual-level fixed effects. Information on other individual characteristics, such as age, sex, region of residence, education level, marital status, household size, and the number of annual hospital visits, is also available

in KOWEPS data.[3] (See Appendix Table A.1 for more details on the variables used.)

Our main outcome variable is whether respondents had suicidal thoughts during the past 12 months ("Have you thought about committing suicide during the past 12 months?").[4] To explore the link between suicidal ideation and life satisfaction, we also consider the self-reported level of life satisfaction ("How satisfied are you with your life in general?") as an additional outcome measure. The level of life satisfaction is measured on a scale between 1 (lowest) and 5 (highest). Questions about suicidal thoughts were first introduced in the 2011 wave. Therefore, our analysis focuses on the five waves of KOWEPS data between 2011 and 2015.

An important advantage of KOWEPS data is that it contains detailed information about respondents' income and household. Several existing studies use individual-level income data to test the relative income hypothesis, but it may be more appropriate to consider household-level income when testing the relative income hypothesis. For example, a non-working member in an affluent household who consumes as much as his working peers may not necessarily consider himself poorer than his peers. Taking advantage of detailed information about household income and transfers in KOWEPS data, we measure respondents' household-level disposable income in the following way. First, we compute the amount of disposable income in the respondents' households by summing labor and capital income earned by all household members, net of any public and private pension contributions and transfers. To account for the difference in household size, we divide household disposable income by the square root of household size. We restrict the sample to working-age adults aged 25-64 in the 2011 wave (N= 8,456) and follow them for the four subsequent waves.

Table 1 presents descriptive statistics. Consider the 2011 wave first. 2.5 percent of the sample reported that they thought about committing suicide during the last 12 months, while 8.5 percent reported that their level of life satisfaction is either very low or fairly low. After normalizing for the household size, the average monthly disposable income among sample households was approximately $2,000,000$ KRW (roughly equivalent to $1,750$ USD). The average age of the KOWEPS respondents was 45.2 years old. 46.6 percent were male and 56.9 percent had less than high school education. 48.4 percent were household heads. 73.8 percent were married and 28.2 percent were either unemployed or out of the labor force. 19.7 percent did not go to hospital at all during the last 12 months, while 9.7 percent visited hospital more than 24 times. Each wave loses roughly 3 percent of the sample, but the average sample characteristics remain similar across all five waves. As a robustness check, we also ran regression analyses using a balanced panel of respondents who participated in all five waves and obtained similar estimation results. For brevity, we only present estimation results from the unbalanced panel below.

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[3] There are 17 administrative divisions in South Korea, including eight metropolitan cities and nine provinces. KOWEPS data further divide these divisions into seven regions, often combining a metropolitan city with a neighboring province. Appendix Table A.1 provides the list of regions and associated metropolitan cities and provinces.

[4] KOWEPS also asks its respondents whether they planned to commit suicide ("Have you had a specific plan to commit suicide during the past 12 months?") and whether they actually attempted a suicide ("Have you attempted a suicide during the past 12 months?"), but the number of respondents who reportedly planned or attempted a suicide is too small to conduct a meaningful statistical analysis.

TABLE 1.   DESCRIPTIVE STATISTICS: KOWEPS SURVEY DATA

Year:	2011	2012	2013	2014	2015
	(1)	(2)	(3)	(4)	(5)
(A)Well-being Measures					
Suicidal Thought					
Yes	0.025	0.041	0.040	0.027	0.023
Life Satisfaction					
Very Low	0.008	0.005	0.004	0.003	0.004
Fairly Low	0.077	0.067	0.075	0.063	0.052
Neutral	0.360	0.327	0.335	0.309	0.281
Fairly High	0.544	0.585	0.568	0.604	0.627
Very High	0.011	0.016	0.018	0.022	0.037
(B) Individual Characteristics					
Household Income (in 1,000 KRW)	2080	2208	2292	2354	2484
Household Size	3.2	3.2	3.2	3.2	3.1
Age	45.2	46.2	47.2	48.2	49.1
Male	0.466	0.462	0.467	0.462	0.463
Educational Attainment					
Less than High School	0.569	0.571	0.577	0.580	0.584
High School	0.376	0.373	0.367	0.364	0.359
College and Above	0.055	0.056	0.056	0.055	0.057
Head of Household	0.484	0.488	0.495	0.504	0.509
Married	0.738	0.744	0.746	0.754	0.755
Unemployed/Out-of-the-Labor-Force	0.282	0.271	0.272	0.282	0.283
Number of Annual Hospital Visits					
None	0.197	0.191	0.203	0.194	0.181
Between 1 and 11	0.568	0.553	0.521	0.535	0.528
Between 12 and 24	0.138	0.144	0.156	0.158	0.167
More than 24	0.097	0.112	0.120	0.113	0.124
Obs.	8,456	8,180	7,973	7,710	7,404

Note: The sample consists of Korea Welfare Panel Study participants who were between age 25 and 64 at the time of the 2011 survey. Household income represents monthly household disposable income (in 1,000 KRW), divided by the square root of the household size.

IV.   *Empirical Analysis*

To examine the relationship between relative income, suicidal thought, and life satisfaction, we estimate the following fixed effects regression specification via OLS:[5]

$$Y_{irt} = \alpha_0 + \alpha_1 Log(OwnInc_{irt}) + \alpha_2 Log(PeerInc_{irt}) + X_{irt}\beta + \theta_i + \mu_r + \eta_t + \epsilon_{irt}. \qquad (2)$$

Y_{irt} represents the outcome of interest for individual i living in region r in year t. $OwnInc_{irt}$ represents individual i's (household-level) disposable income in year t. If individual i's

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[5] Alternatively, one may choose to preserve the discrete nature of suicidal ideation and life satisfaction levels by using a fixed effects discrete choice model. Recent studies show how a standard fixed effects binary choice model (Chamberlain 1980) may be extended into the multinomial case (Baetschmann et al. 2015). However, an important limitation of these models is that marginal effects cannot be computed, making it difficult to interpret the magnitudes of the estimates. To keep the presentation simple, we only report OLS estimation results here.

household income is less than or equal to zero, we set $OwnInc_{irt}$ equal to 1 and introduce a separate intercept. X_{irt} represents a vector of individual characteristics, namely, age, sex, educational level, marital status, number of annual hospital visits, household head, household size, and unemployment status.

Our key explanatory variable is $PeerInc_{irt}$, which represents the average (household-level) disposable income of individual i's peers, namely, those from the same sex, region, and age group (i.e., within a 2-year age difference).[6] For example, $PeerInc_{irt}$ for a 45-year old male living in Seoul in 2013 is equal to the average income of all 43-47 year old males living in Seoul in 2013. 23-24 and 65-66 year olds are not included in the estimating sample, but their income data are still used to construct peer income for 25 and 64 year olds.

Individual (θ_i), region (μ_r), and year (η_t) fixed effects are included to account for unobserved individual, region, and time-specific characteristics. ϵ_{irt} is an idiosyncratic error. Our regression analysis uses the sampling weights provided by KOWEPS, which can be used to correct heteroscedasticity and endogenous sampling problems (Solon, Haider, and Wooldridge 2015).

In the first two columns of Table 2, we use suicidal ideation (1 if the respondent thought about committing suicide during the last 12 months, 0 otherwise) as an outcome variable. Column (1) estimates the relationship between suicidal ideation, peer income and own income while controlling for individual characteristics as well as year and region fixed effects, and column (2) additionally controls for individual fixed effects. Overall, the estimation results show that the risk of suicidal ideation decreases in own income and increases in peer income, although the estimated effects become smaller and statistically insignificant when individual fixed effects are controlled for. We also observe that the coefficients on several covariates either change their signs (e.g., household size) or lose statistical significance (e.g., marital status) under the fixed effects specification, which may be explained by either a high degree of self-selection (e.g., a lower chance of getting married for highly suicidal individuals from the 2011 wave) or little variation in such characteristics within individuals (e.g., low rates of divorce and marriage among respondents over a 5-year period). On the other hand, unemployment and adverse health conditions (proxied by the number of hospital visits) significantly increase the risk of suicidal ideation under both specifications.

In columns (3) and (4), we repeat the regression analysis using the level of life satisfaction as an outcome measure (5 if very high, 1 if very low). Consistent with the results on suicidal ideation, the level of life satisfaction significantly increases in the individual's own income and decreases in peer income. When individual fixed effects are controlled for (column 4), the estimated effects of own and peer income again become smaller and less significant. However, the coefficient on own income is highly significant, and that on peer income remains marginally significant (p=0.056). Overall, our findings are consistent with the existing literature and suggest that own income and peer income are both important predictors of life satisfaction.

Estimation results in Table 2 indicate that higher peer income is strongly correlated with

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[6] The relative income hypothesis literature has not reached a clear consensus on the choice of a reference group, but variables commonly used to construct the reference group include the region of residence (Blanchflower and Oswald 2004; Ferrer-i-Carbonell 2005; Luttmer 2005; Daly, Wilson, and Johnson 2012), age (Ferrer-i-Carbonell 2005; McBride 2001), and sex (Oshio, Nozaki, and Kobayashi 2011). Motivated by these studies, we use three variables, namely, region of residence, age, and sex to construct the reference group in our analysis. In Table 3, we present estimation results based on alternative reference groups and show that our results remain qualitatively similar.

TABLE 2.   RELATIVE INCOME EFFECT ON SUICIDAL THOUGHT AND LIFE SATISFACTION

Outcome:	Suicidal Thought		Life Satisfaction	
	(1)	(2)	(3)	(4)
Log(Own HH Income)	-0.028***	-0.015***	0.378***	0.116***
	(0.002)	(0.003)	(0.006)	(0.011)
Log(Peer HH Income)	0.035***	0.013	-0.192***	-0.075
	(0.008)	(0.011)	(0.028)	(0.039)
Age Group (Baseline: 25-34)				
35-44	0.015***	0.009	-0.083***	-0.032
	(0.003)	(0.006)	(0.011)	(0.022)
45-54	0.019***	0.002	-0.203***	-0.028
	(0.003)	(0.009)	(0.011)	(0.031)
55-64	0.017***	0.008	-0.179***	-0.011
	(0.004)	(0.011)	(0.014)	(0.040)
Male	-0.007*		-0.107***	
	(0.003)		(0.010)	
Education (Baseline: < High School)				
High School Graduate	0.003		-0.044***	
	(0.002)		(0.007)	
College and Above	-0.002		0.032*	
	(0.004)		(0.013)	
Married	-0.013***	0.001	0.188***	0.022
	(0.003)	(0.008)	(0.010)	(0.028)
Annual Number of Hospital Visits				
Between 1 and 11	0.004	0.000	-0.044***	-0.047***
	(0.002)	(0.003)	(0.009)	(0.010)
Between 12 and 24	0.016***	0.005	-0.122***	-0.078***
	(0.003)	(0.004)	(0.012)	(0.014)
More than 24	0.049***	0.019***	-0.201***	-0.096***
	(0.004)	(0.005)	(0.014)	(0.017)
Household Head	0.011***	0.030**	0.068***	-0.022
	(0.003)	(0.010)	(0.011)	(0.034)
Household Size (Baseline: 1)				
2	-0.010*	0.031**	-0.049**	-0.006
	(0.005)	(0.010)	(0.018)	(0.036)
3	-0.011*	0.024*	-0.125***	-0.027
	(0.005)	(0.011)	(0.018)	(0.038)
More than 3	-0.017***	0.031**	-0.117***	-0.029
	(0.005)	(0.011)	(0.018)	(0.040)
Unemployed/Out-of-the-Labor-Force	0.013***	0.007*	-0.010	-0.021
	(0.002)	(0.004)	(0.008)	(0.013)
Constant	-0.023	-0.027	2.270***	3.263***
	(0.059)	(0.089)	(0.222)	(0.312)
Observations	39,723	39,723	39,723	39,723
Year FE	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Individual FE	No	Yes	No	Yes
F-test for Individual FE		1.66***		2.43***

Note: Peers are defined as individuals from the same region, age group (within a 2-year age difference), and sex. All specifications also control for an indicator for "zero earnings". Robust standard errors are in parentheses. *** $p < 0.001$, ** $p<0.01$, * $p<0.05$.

life satisfaction, but its effect on suicidal ideation is rather modest, especially when individual-level fixed effects are controlled for. What can explain this disparity between the estimated relative income effects on suicidal ideation and life satisfaction? One potential explanation is that the risk of suicidal ideation is largely driven by health conditions, personality traits and other individual characteristics unrelated to relative income. Indeed, a large body of medical literature finds a strong link between suicide and mental disorders such as depression and alcohol use disorders (Harris and Barraclough 1997). Moreover, one may argue that suicide is often impulsive and should be minimally affected by relative income and life satisfaction, which tend to be relatively stable over time (Case and Deaton 2017).

At the same time, a weak correlation between peer income and suicidal ideation does not necessarily rule out the relative income effect on actual suicide. Our outcome measure for suicidal ideation is based on a simple question ("Have you thought about committing suicide during the past 12 months?") and does not reflect the frequency and intensity of such thoughts. In fact, the share of KOWEPS respondents who reportedly thought about committing suicide during a 12-month span (3.1 percent) is substantially higher than the rate of actual suicide death in South Korea (29 per 100,000 persons as of 2013), suggesting that there may be important disparities between the "suicidal" KOWEPS respondents and those at high risk of actually committing suicide. Unfortunately, without individual-level data on income and actual suicide death, it is difficult to determine whether our null finding on suicidal ideation is driven by the absence of the causal link between suicide and relative income or the disparity between (observed) suicide death and (self-reported) suicidal ideation.

Another key observation here is that accounting for individual fixed effects can substantially change the estimated effects of income on suicidal ideation and life satisfaction, which echoes an earlier study by Ferrer-i-Carbonell and Frijters (2004). This finding should not be surprising, as omitted variable bias is likely to remain even after commonly-observed individual characteristics such as age, sex, and education attainment are controlled for. Indeed, the F-test statistic for individual-level fixed effects, reported in the bottom row of Table 2, strongly suggests that unobserved individual-level characteristics play an important role in the determination of suicidal ideation and life satisfaction.

Lastly, it is noteworthy that our analysis uses the level of average peer income (observed by researchers) to test the relative income hypothesis, but the actual peer income observed may differ from the level of peer income perceived by individuals (Cruces, Perez-Truglia, and Tetaz 2013; Karadja, Mollerstrom, and Seim 2017). Since the relative income effect should operate via individuals' perception of their relative economic advantage and disadvantage, our estimates of the relative income effect is likely to be biased if working age adults in South Korea do not have accurate information on their relative position in the income distribution.

1. Sensitivity Check and Subgroup Analysis

Our analyses thus far considered the average income of peers from the same age group (within a 2-year age difference), sex, and region at the time of survey as the main explanatory variable. To explore whether our findings are driven by this particular choice of a reference group, we construct several alternative reference groups and repeat the regression analysis. Table 3 presents the results from this sensitivity check. Panels (a) and (b) of Table 3 use all working-age KOWEPS respondents from the same region (panel a) and those from the same

TABLE 3.   SENSITIVITY CHECK: ALTERNATIVE PEER GROUPS

Outcome:	Suicidal Thought		Life Satisfaction	
	(1)	(2)	(3)	(4)
(a) Peer = Region				
Log(Own HH Income)	-0.027***	-0.015***	0.373***	0.116***
	(0.002)	(0.003)	(0.006)	(0.011)
Log(Peer HH Income)	-0.014	0.000	-0.272*	-0.291*
	(0.036)	(0.035)	(0.135)	(0.122)
(b) Peer = Region x 2-year Age Gap				
Log(Own HH Income)	-0.028***	-0.015***	0.376***	0.117***
	(0.002)	(0.003)	(0.006)	(0.011)
Log(Peer HH Income)	0.023**	-0.008	-0.183***	-0.121**
	(0.009)	(0.013)	(0.032)	(0.045)
(c) Peer = Region x 2-year Age Gap x Sex				
Log(Own HH Income)	-0.028***	-0.015***	0.378***	0.116***
	(0.002)	(0.003)	(0.006)	(0.011)
Log(Peer HH Income)	0.035***	0.013	-0.192***	-0.075
	(0.008)	(0.011)	(0.028)	(0.039)
(d) Peer = Region x 2-year Age Gap x Sex x Educ.				
Log(Own HH Income)	-0.029***	-0.015***	0.362***	0.118***
	(0.002)	(0.003)	(0.007)	(0.011)
Log(Peer HH Income)	0.009*	0.006	0.071***	-0.042
	(0.004)	(0.008)	(0.015)	(0.027)
(d) Peer = Region x 1-year Age Gap x Sex				
Log(Own HH Income)	-0.029***	-0.015***	0.377***	0.117***
	(0.002)	(0.003)	(0.006)	(0.011)
Log(Peer HH Income)	0.028***	0.013	-0.123***	-0.063
	(0.006)	(0.009)	(0.024)	(0.033)
(d) Peer = Region x 3-year Age Gap x Sex				
Log(Own HH Income)	-0.028***	-0.015***	0.378***	0.116***
	(0.002)	(0.003)	(0.006)	(0.011)
Log(Peer HH Income)	0.039***	0.012	-0.239***	-0.099*
	(0.008)	(0.013)	(0.031)	(0.045)
Individual Covariates	Yes	Yes	Yes	Yes
Year and Region FE	Yes	Yes	Yes	Yes
Individual FE	No	Yes	No	Yes

Note: Robust standard errors are in parentheses. N=39,723. All specifications also control for an indicator for "zero earnings". The F-test statistic for individual fixed effects is statistically significant at the 0.001 level for all individual fixed effects specifications (columns 2 and 4). *** p<0.001, ** p<0.01, * p<0.05.

region and age group (panel b) as the reference group, respectively. Panel (c) repeats our main regression specification in which peers from the same age group, region and sex are considered as the reference group. Panel (d) further narrows down the reference group using one's age group, region, sex and education level. Finally, the last two panels use different age thresholds for peer groups: within a 1-year age difference (panel e) and 3-year age difference (panel f). Overall, the estimated income effects on suicidal ideation and life satisfaction remain largely similar across alternative specifications. Individuals' own income is significantly and positively correlated with suicidal ideation and negatively with life satisfaction. On the other hand, peer income seems to be an important determinant of life satisfaction, but its effect on suicidal ideation is small and insignificant when individual fixed-effects are controlled for.

TABLE 4.   RELATIVE INCOME EFFECT ON SUICIDAL THOUGHT AND LIFE SATISFACTION,
BY SELF-REPORTED INCOME CLASS

Self-reported Income Class:	Below Middle		Middle or Above	
	(1)	(2)	(3)	(4)
(a) Outcome: Suicidal Thought				
Log(Own HH Income)	-0.032***	-0.018***	-0.010***	-0.010**
	(0.003)	(0.004)	(0.002)	(0.004)
Log(Peer HH Income)	0.045***	0.035*	0.016	-0.012
	(0.011)	(0.017)	(0.009)	(0.013)
(b) Outcome: Life Satisfaction				
Log(Own HH Income)	0.353***	0.098***	0.239***	0.137***
	(0.009)	(0.014)	(0.010)	(0.016)
Log(Peer HH Income)	-0.233***	-0.117*	-0.066	-0.008
	(0.039)	(0.054)	(0.041)	(0.058)
Individual Covariates	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Individual FE	No	Yes	No	Yes
Observations	19,001	12,009	19,001	12,009

Note: Robust standard errors are in parentheses. All specifications also control for an indicator for "zero earnings". The F-test statistic for individual fixed effects is statistically significant at the 0.001 level for all individual fixed effects specifications (columns 2 and 4). *** $p<0.001$, ** $p<0.01$, * $p<0.05$.

We also ran a subgroup analysis to investigate the extent of heterogeneity in the relative income effect, i.e., whether low-income households are more strongly (and negatively) affected by their relative disadvantage than high-income households are (positively) affected by their relative advantage. To this end, we use a KOWEPS survey question from the 2011 wave which reads, "If our society is divided into five income classes—low, lower middle, middle, upper middle and upper—to which group do you think your household belong?" Based on the participants' response, we divide the sample into two groups: 1) those who classify themselves as low (22.6 percent) or lower middle class (38.7 percent) and 2) those who classify themselves as middle (34.6 percent), upper middle (3.9 percent), or upper class (0.2 percent). We then separately estimate the relative income effect on suicidal ideation and life satisfaction for the two groups using the main specification (Equation 2).[7]

Estimation results in Table 4 suggest that the effect of peer income is highly heterogeneous across economic classes. First two columns indicate that peer income is a strong, significant predictor of both suicidal ideation and life satisfaction among those who consider themselves low or lower middle class, regardless of whether individual fixed effects are controlled for or not. On the other hand, for those who consider themselves middle class or above (columns 3 and 4), the magnitude of peer income effects is noticeably smaller and statistically significant. In sum, those who consider themselves relatively poorer seem to be more strongly (and adversely) affected by their relative disadvantage in comparison to how those relatively richer are (positively) affected by their relative advantage.

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[7] 8,713 observations who did not report their income class are dropped from this analysis.

V.   *Conclusion*

In this paper, we examine the effect of relative income on suicidal ideation and life satisfaction in South Korea using nationally representative large survey data. Estimation results suggest that peer income is strongly and negatively correlated with the level of life satisfaction, whereas the effect of peer income on suicidal ideation is smaller and largely insignificant. We also find that the relative income effect on life satisfaction is likely to be heterogeneous, as the adverse effect of relative disadvantage seems to dominate the positive effect of relative economic advantage.

Given the high level of inequality across many countries, the relationship between relative income and subjective well-being is likely to attract more research interest. One potential avenue for future research is the possibility that individuals may have multiple reference groups with which they compare their economic performance and the extent of the relative income effect may vary across different reference groups considered. For example, individuals who earn less than their peers may incur utility costs because of their relative disadvantage, but at the same time, they may also view the economic success of others with similar earning potentials (e.g. similar educational and/or occupational background) as a positive signal that their own economic fortune is likely to improve in the future (Hirschman and Rothschild 1973). On the other hand, individuals may react more negatively to their disadvantage relative to peers with different earnings potential, parental transfers, or capital income, especially if the economic gap is expected to persist.

Future research should also investigate the possibility that relative economic disadvantage may have far-reaching consequences on the lives of affected individuals. For instance, existing studies find that relative economic disadvantage adversely affects physical and mental health conditions (Mangyo and Park 2011) and the likelihood of marriage (Watson and McLanahan 2011). Such effects may reinforce the adverse effect of relative income on life satisfaction, given the close link between health, marriage, and life satisfaction (see Table 2). A better understanding of the relative income effect should help researchers and policy-makers design interventions that can alleviate the adverse effects of high inequality without making a substantial change in the income and wealth distributions. For example, governments may be able to ameliorate the adverse consequences of relative disadvantage by offering more comprehensive healthcare and counseling services for relatively poorer households.

APPENDIX

TABLE A.1.   DATA DESCRIPTION

Variable	Description
Income	Household-level disposable income divided by the square root of the household size
Education	Indicator variables for 1) less than high school, 2) high school graduates, and 3) college and above
Married	Indicator variables for 1) currently married, and 2) never married, divorced, or widowed
Region	Indicator variables for 1) Seoul, 2) Incheon/Gyunggi, 3) Busan/Gyungnam/Ulsan, 4) Daegu/Gyungbook, 5) Daejeon/Chungnam/Sejong, 6) Gangwon/Chungbook, 7) Gwangju/Chunnam/Chunbook/Jeju.
Number of Hospital Visits	Number of outpatient treatments received during a 12-month period before the survey
Unemployed/Out-of-the-Labor-Force	Indicator variable for those out of the labor force and unemployed

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