Relative Deprivation and Suicide Risk in South Korea

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Abstract

Psychosocial stress and the related biochemical response have been hypothesized as a potential mechanism underlying the link between relative deprivation and mortality. While suicide is known as the likely manifestation of severe mental illness, less is known about the effect that relative deprivation has on suicide risk. Using the 2012 to 2018 waves of the Korean Welfare Panel Study, we examined the association between relative deprivation in income and suicide risk among South Koreans aged 25 or older. Relative deprivation is assessed with the Yitzhaki index, Deaton index, and income rank within the reference group, and suicide risk is measured as suicidal ideation and suicide planning or attempt in the preceding year. Adjusted for absolute income and other socioeconomic characteristics, the odds ratios of reporting suicidal ideation for each 10000k KRW (8300 USD) increase in the Yitzhaki index were around 1.42 (95% CI: 1.08-1.87) to 1.72 (95% CI: 1.30-2.28). The estimated odds ratios were in the range of 1.70 (95% CI: 1.04-2.78) to 1.95 (95% CI: 1.26-3.02) for suicide planning or attempt. The association between relative deprivation in income and suicidal ideation was found significant only for men, not for women. The inferences were robust to various definitions of relative deprivation and reference group. Taken together, our findings suggest that relative deprivation in income is independently associated with higher odds of suicidal ideation and suicide planning or attempt over and above the effect of absolute income and material living conditions. Narrowing the income gap between individuals would be an effective policy response to a suicide epidemic in South Korea.

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1 Introduction

Suicide is a priority public health issue in South Korea (henceforth Korea). In 2016, the age-adjusted rate of suicide in Korea was 24.6 per 100,000 people – the second-highest among OECD countries and as much as 2.1 times higher than the OECD average (OECD, 2019). Even more concerning is the number of population at high risk of suicide. Approximately 3% of the Korean population aged 18 or older have reported suicide planning of more than once in their lifetime, and 2.4% of the population have put their plan into action (Hong, 2017). This figure identifies about one million individuals as a high-risk group who can commit suicide at any time in their life. Despite proactive government measures to deter suicide, it remains the fifth leading cause of death among Korean adults (Korea National Statistical Office, 2018).

The influential role of economic factors in the etiology of suicide has been well established in the epidemiology literature. The empirical evidence linking low income to a higher risk of suicide has been reported in various settings, including Korea (Lee et al., 2017; Song and Lee, 2016) and other countries that share little sociocultural background (McMillan et al., 2010; Meltzer et al., 2011; Nock et al., 2008). A little-noted puzzle is that suicide occurs throughout the income distribution and not just below the threshold poverty level (Lee et al., 2017). Furthermore, the country-level time-series data shows strong collinearity between changes in suicide mortality and income inequality over time; suicide rate rises when income inequality worsens, and it declines when income inequality falls (Chen et al., 2009; Inagaki, 2010), as Korea had experienced over the last three decades (Kwon et al., 2009). Such observations have motivated researchers to move beyond objective living conditions, including absolute level of income and material hardship, but towards research that considers income disparity between individuals as a potential risk factor of suicide.

Various findings have emerged highlighting relative deprivation (RD, defined as one's income or socioeconomic status relative to other members of social group) as a critical factor driving people's health behaviors and outcomes (see Adjaye-Gbewonyo and Kawachi, 2012 for review). The concept of RD is based on the notion that individual evaluation of own position with respect to others captures some intangible aspects of the effect that socioeconomic status has on health (Wilkinson, 1999). Central to this concept is social comparisons triggered by unequal distribution of resources, which can result in feelings of unfairness, stress, and anxiety among those in the lower social position (Marmot and Wilkinson, 2001). While RD would be an important pathway leading to a higher risk of suicidal behaviors, our knowledge about this association is limited. Evidence is particularly sparse for countries at a transition phase, even though economic growth over the early stage of development

typically accompanies a rise in income inequalities (Kuznets, 1955).

This study shifts analytic attention to the role played by RD in income in suicidal ideation and behaviors (planned and attempted suicide) among Koreans aged 25 or higher. Following the previous studies, we hypothesize that RD in income is associated with an increase in suicidal ideation and behaviors, over and above the effects of absolute income and other material factors. We assume that emotional discomfort triggered by income inequality manifests through severe depressive symptoms (Eibner et al., 2004; Gero et al., 2017; Kuo and Chiang, 2013; Wildman, 2003) and in turn leads to suicidal ideation and behaviors (Wetherall et al., 2015). Our measures of RD are operationalized with a number of income-based measures reflecting both upward and downward comparisons and income rank within the reference group. This study extends the US-based studies of neighborhood income effect on suicide (Daly and Wilson, 2009; Daly et al., 2013) and provides the first evidence of the association between RD in income and suicide risk in the Korean context.

We contribute to the existing literature along several dimensions. First, this study is conducted in Korea where positional competition is a norm in many aspects of society. Rapid industrialization has transformed Korea into a hypercompetitive society in which comparative advantage is rewarded with significant economic gains (Hunt, 2015). Its social reward structure, coupled with a unique cultural background, has resulted in a high-stress environment that encourages extra efforts for social success. Under this competitive culture, suicide can be a likely option to escape from the reality of falling behind social competition. Findings from our study would offer an alternative explanation for high suicide rates in some developed countries. Second, taking advantage of high suicide rates in Korea, we examine suicide outcomes of higher mortality risk (i.e., suicide planning and attempt). Prior research on the suicide-RD link has been exclusively about suicidal ideation due to a small number of cases resulted in planning or action. While a few exceptions have been reported recently, limitations in data have prevented prior research from giving a reliable estimate in support of the research questions (Wetherall et al., 2015). A history of prior suicide attempt is a precursor to completed suicide (Melhem et al., 2007). Among ideators, suicide planning is associated with a high risk of attempt in later periods (Nock et al., 2008). We examine both domains of suicidal behaviors and produce results that have implications for suicide mortality.

2 Literature review

2.1 Relative deprivation and health

Epidemiologic research has identified income inequality as a major determinant of mortality. At the aggregate level, it was not just the absolute income but also the unequal distribution of income that predicts a range of poor health outcomes and higher mortality at a given income level. The empirical evidence linking income inequality to poor health or mortality has been robust for within-country level analyses in developed countries (Kahn et al., 2000; Kennedy et al., 1996, 1998; Lopez, 2004; Park et al., 2015), though the correlation was weak in more egalitarian countries like Australia, Japan, and Sweden (Bechtel et al., 2012; Gerdtham and Johannesson, 2004; Shibuya et al., 2002).

The RD hypothesis has been proposed as an explanation of the individual-level mechanism underlying the association between income inequality and population health (Kawachi and Kennedy, 1999; Wilkinson, 1997). An important snapshot of high income inequality is a growing economic distance between individuals with similar characteristics. According to the interdependent utility framework by Duesenberry (1949), individual utility depends on consumption subject to absolute income constraints and prices as well as upon one's income relative to others. Under this theory, not only does absolute income earned matter to utility, one's relative position within the income distribution is also critically important. A rising income inequality suggests an increase in the degree to which an individual for not being able to conform to the normative standard of consumption, even if his or her income remains unchanged, thereby deriving disutility. For instance, a family in a wealthy neighborhood may not be income poor in absolute terms, yet be considered relatively deprived if they are less affluent than their neighbors. Based on the RD hypothesis, slipping down the social hierarchy can reduce individual well-being beyond that which would be expected from reductions in absolute living standards (Kawachi and Subramanian, 2014; Walker and Smith, 2002).

RD was conceptualized as "the extent of the difference between the desired situation and that of the person desiring it" (Runciman, 1966, p. 10). Using this definition, Yitzhaki (1979) modeled RD as an increasing function of the proportion of those in the reference group who are better off regarding their income. Relative to the mean dependence framework, where individuals compare themselves only to the average person, the Yitzhaki measure and its variants have the advantage of reflecting individual differences in concerns resulting from upward and downward social comparisons. These indices of RD have been extensively examined in empirical studies and have shown an association with negative health behaviors

and outcomes, including depression and anxiety disorders (Cuesta and Budria, 2015; Eibner et al., 2004; Gero et al., 2017; Kuo and Chiang, 2013; Wildman, 2003), smoking (Eibner and Evans, 2005; Kuo and Chiang, 2013; Lhila and Simon, 2010), functional disability (Kondo et al., 2009), poor self-rated health (Eibner and Evans, 2005; Kondo et al., 2008; Kuo and Chiang, 2013; Salti and Abdulrahim, 2016; Subramanyam et al., 2009), and increased probability of death (Eibner and Evans, 2005; Kondo et al., 2015; Salti, 2010; Yngwe et al., 2012), in both young and older adults.

2.2 Transmission mechanisms

The primary mechanism leading to poor health is psychosocial distress, which accompanies a heightened neuroendocrine response and maladaptive coping response through smoking, drinking, and poor eating habits (Eibner and Evans 2005; Marmot, 1994; Wilkinson, 1997). The concept of allostatic load suggests that repeated exposure to stress (e.g., invidious social comparisons) leads to a disruption of immune and metabolic systems, thereby increasing susceptibility to illness (Marmot and Wilkinson, 2001). Subsequent studies provided supporting evidence through an association between subordinate social rank, stress, and mortality in primates (Sapolsky, 2005) as well as in humans (Mendelson et al., 2008). Second, RD can also increase social distance among individuals. Those in a lower rank may lack social cohesion with others and become excluded from the health benefits of social relationships (House et al., 1988). Lastly, the relative poor may exhibit limited usage of healthcare and health-enhancing goods if access to healthcare is rationed by or subject to the political influence of higher-ranked people (Mangyo and Park, 2011).

2.3 Relative deprivation and suicide

In the early literature, the potential impact of RD on suicide has been studied at the ecological level in terms of the correlation between income inequality and the suicide rates of different countries. Despite the use of long time-series data, the previous attempts have been unsuccessful in finding the evidence of rising suicide mortality when income inequality worsens. For instance, Andres (2005) examined the determinants of suicide rates in 15 European countries from 1970 to 1998 but found no changes in suicide rates in response to an increase in the Gini coefficient. Leigh and Jencks (2007) examined mortality data over a decade (from 1903 to 2003) for 12 developed countries (Australia, Canada, France, Germany, Ireland, Netherlands, New Zealand, Spain, Sweden, Switzerland, the UK, and the US) and estimated a weak correlation between suicide rates and the income share of the top decile. The null effect of income inequality was also reported in Germany for the period of 1980 to

2000, where the association between income inequality and suicide rates at the state-level was estimated using a dynamic panel regression specification (Neumayer, 2004). A notable exception was reported from the Japanese-based studies: Inagaki (2010) demonstrated that income inequality was a granger-cause of higher suicide rates in 1951 to 2007; and Chen et al. (2009) showed that a correlation between income inequality and suicide rates was more pronounced in Japan, as compared to other OECD countries.

Individual-level analyses have produced more consistent evidence of the suicide-RD relation. Daly and Wilson (2009) and Daly et al. (2013), for instance, found that individual suicide risk is positively related to local area median income, conditioned on own income as well as other individual and environmental characteristics. Dupere et al. (2009) examined the association between neighborhood disadvantage and the risk of suicide and showed that neighborhood poverty is associated with higher odds of reporting suicidal thoughts and suicide attempts, net of underlying hardship and health effect. The three studies all have modeled the effect of RD using the difference between individual income and the average income of the geographic location (mean dependence framework), given that neighbors living in close proximity are a particularly important reference group. To the best of our knowledge, the only research that linked suicidal thought and attempt to income differences relative to other people within the relevant social comparison group as suggested by the Yitzhaki's conceptualization of RD is Wetherall et al. (2015). This study examined suicide-related experiences of the British aged 16 years or older and found that the income rank within the reference group has an inverse relationship with lifetime suicidal thoughts and attempts. Unfortunately, their analysis could not produce reliable estimates for regressions that had suicide attempt as an outcome variable, due in large part to a small number of negative cases.

Currently, the question of whether RD is correlated with suicidal ideation and behaviors remains unsettled. As reviewed, many of the previous studies were limited to the role of socioeconomic disadvantages in suicidal behaviors or investigating the association between RD and health outcomes, without considering suicide. While a few studies examined neighborhood effects on suicide risk (Daly and Wilson, 2009; Daly et al., 2013), their empirical approach did not specifically address the degree to which one's relative social position in the reference group influences suicide. This paucity of research is puzzling given that clinical depression, which is a likely mental state of RD, is an important pathway leading to more severe suicidal behaviors (Nock et al., 2008). More importantly, it remains unclear whether RD leads to a concrete plan and attempt of suicide. Looking at suicide planning or attempt allows us to provide baseline information for estimating the social cost of suicide and assessing related emotional toll on families and friends. Our analyses below fill this gap in

the literature using validated measures of RD and by examining both suicidal ideation and suicide planning or attempt.

3 Methods

3.1 Data

Data for this study comes from the 2012-2018 waves of the Korean Welfare Panel Study (KoWePS), a nationally representative longitudinal study of households in Korea. The KoWePS began in 2006 with 18,856 participants from 7072 households and has tracked their demographic and socioeconomic characteristics annually henceforth. Households were selected using a stratified multistage probability design, based on the 2005 Korean Census. The interviews have been conducted face-to-face by trained interviewers at the participants' household. Questions about suicidal behaviors in the preceding year were first asked in the 2012 survey to a householder in each household. Using this data does not require a separate human subject review; all survey participants provided informed consent prior to each interview.

The study sample is limited to householders aged 25 or higher. We did not specify the upper age limit to secure enough cases with suicidal experiences and to reflect a higher risk of suicide among Korean seniors (Kim et al., 2010). After excluding observations with missing values (3559 observations), the final sample includes 36,452 observations from 7722 respondents.

3.2 Suicide outcomes

Suicide outcomes were assessed with the following questions: "*Have you had any serious thoughts of suicide in the preceding year?*", "*Have you had any concrete plan of committing suicide in the preceding year?*", and "*Have you made any attempt of suicide in the preceding year?*". Each question was answered dichotomously for the presence or absence of suicidal experiences (1=yes; 0=no). We constructed a binary variable of suicidal ideation using the first suicide question and defined a binary variable of suicide planning or attempt using the next two questions. In particular, the suicide planning or attempt variable takes on one if a respondent made any plan or attempt of suicide and zero otherwise. Since only a few respondents answered that they have tried committing suicide last year, we combined the planning and attempt category.

3.3 Relative deprivation

The first measure of RD is based on Runciman's conceptualization of upward social comparison (Runciman, 1966) and subsequent operationalization proposed by Yitzhaki (1979). For person i with income y, the upward comparison to those in the reference group can be summarized as,

$$Yitzhaki_i = \frac{1}{N}\sum_j (y_j - y_i) I_{ij}, \quad I_{ij} = \begin{cases} 1, & \text{if } y_j > y_i \\ 0, & \text{if } y_j \leq y_i \end{cases}$$

where N is the number of individuals in person i's reference group and y_j is every income above individual i's income. Normalizing $\sum(y_j - y_i)$ by N makes the index insensitive to the size of reference group. The Yitzhaki index then shows the average difference between an individual's income and the incomes of others having a higher income in a reference group. Conceptually, it is the aggregate shortfall in income from person i's perspective relative to everyone else with higher incomes in his/her reference group. The index is defined to be zero for a person with the highest income in a reference group.

The main challenge inherent in this approach is identifying relevant reference group (Eibner and Evans, 2005). The general practice in the literature is to approximate reference group with a combination of demographic traits and geographic proximity, given the assumption that individuals compare themselves to others with whom they share similar characteristics (Goethals and Darley, 1977). Following this approach, we define reference group as combinations of (a) gender, education (less than high school, high school graduate, college educated or higher), age (25-39, 40-49, 50-59, 60-69, 70+), and municipality of residence (Seoul, metropolitan city, city, rural area). The reference groups with less than ten observations are merged into the nearest group to secure enough number of observations in each group. The total number of reference groups under this categorization is 114, with the average group size of 321. To confirm that our results are robust to the definition of reference group, we also consider reference groups categorized by (b) gender, (c) gender $\times$ education, (d) gender $\times$ age, and (e) gender $\times$ education $\times$ age.

The second measure is based on Deaton's variation of the Yitzhaki index. Deaton (2001) suggested scaling the Yitzhaki measure to the mean income in the reference group, μ,

$$Deaton_i = \frac{1}{N\mu}\sum_j (y_j - y_i) I_{ij}, \quad I_{ij} = \begin{cases} 1, & \text{if } y_j > y_i \\ 0, & \text{if } y_j \leq y_i \end{cases}$$

so that the index captures the proportion of total community income earned by people who

are higher on income, instead of the sum of their absolute incomes. This reformulation has the benefit of capturing both upward and downward comparisons to the referenced individuals and making the index unit-free. Possible values range from 0 to 1, with a higher score representing an individual of lower ranking.

The third measure is the ordinal rank of an individual's income within a reference group. The implicit assumption of the Yitzhaki index is that people know exactly how much they fall behind other people in income (Boyce et al., 2010; Gero et al., 2017). To relax this assumption, the concept of income rank posits that people form a judgment about their relative position using rough information conferred by income. The income rank, R_i, is defined as the number of individuals with lower income than person i's, divided by the total number of individuals within i's reference group minus 1.

$$R_i = \frac{i-1}{N-1}$$

Possible values are defined on a scale of 0 (the lowest rank) to 1 (the highest rank), which is opposite to the Yitzhaki and Deaton index. For consistency in interpretation, the income rank is reverse coded in our analyses. All three indexes were constructed using an equivalized household income, which divides household income by the square root of the number of household members (Buhmann et al., 1988).

Unlike other studies' approach to use personal income to calculate RD, our income variable is defined at the household level. The Korean labor market is characterized as a high share of self-employed workers and limited labor force participation among women (Lee, 2017). Among self-employed workers, a vast majority are family business owners or those who live on capital income generated from estates. Under this setting, it is difficult to discern how much contribution to family finance is made by each spouse and how much is earned as a result. Therefore, we proceed with a plausible assumption that household financial resources are pooled and used jointly by husband and wife (Cuesta and Budria, 2015).

3.4 Covariates

Age, age squared, gender, education background (less than high school, high school graduate, college educated or higher), marital status (married, separated or divorced or widowed, never married), self-rated health, chronic disease, severe illness, number of private health insurance coverages, religion, employment status (full-time job, temporary job, part-time job, self-employed, not in the labor force), equivalized household income, total net worth, province of residence, and year of survey are included as covariates in regression models. Self-rated health is binary coded into good, very good, or excellent versus poor or fair. Chronic

disease is captured by whether or not the respondent has been hospitalized or has taken a prescription medicine to treat one or more chronic conditions. Severe illness identifies individuals with life-threatening conditions, such as cancer, hepatitis, liver cirrhosis, myocardial infarction, angina, stroke, and cerebrovascular disease. A measure of religion takes on one if a respondent has any religion and zero otherwise. Total net worth is defined as the sum of checking and savings account, bonds, stocks, lodge money, agricultural machinery and livestock (if any), club membership, vehicles, business equity, home equity, real estate, and other assets, minus the value of loans from the primary and secondary lending institutions (including mortgage), credit card debt, security deposit from renters, outstanding credit transactions, and other debts. The income and wealth measures are converted to 2018 KRW using the Korean Consumer Price Index for all items.

3.5 Regression analysis

Logistic regression with random effects (specified for individuals) is used to estimate the association between RD in household income and suicide risk. Our regression models link suicide outcomes measured at $t + 1$ to RD and other covariates at time t where t is 2012, 2013, 2014, 2015, 2016, and 2017. This formulation prevents the possibility of suicide measures observed prior to RD is used for regression, thereby further reducing the potential for reverse causality. The outcome variables are operationalized with one of the two binary variables for suicide, and the key explanatory variable in the regression is the Yitzhaki index, Deaton index, or income rank. With two outcome variables and three measures of RD, we estimate a set of six regressions for each reference group. The coefficient estimate on the measures of RD captures the association between an increase in RD by one unit and the log odds of suicidal ideation or the log odds of suicide planning or attempt during a year post-interview. The analyses involving the Deaton index use a sample of 36,338 observations, not including negative household income. Our result tables below report odds ratio and their 95% confidence interval.

4 Results

Descriptive statistics of the study sample are presented in Table 1. Of the 36,452 person-level observations, 68.1% were men, 23.7 were college educated, 59.3% were married, 22.0% were full-time employees, and the mean age was 61.4. In terms of health status, 64.5% reported one or more chronic conditions, and 25.6% assessed their overall health poor or fair. Those who thought about suicide over the last 12 months consist of 3.8% of the sample

(1402 observations), and those who planned or attempted suicide account for 0.5% (194 observations; 143 observations for suicide planning and 51 observations for suicide attempt).

[Insert Table 1 about here]

Summary statistics in Table 2 show the mean of the Yitzhaki index, Deaton index, and income rank by suicide outcomes. Across all three measures of RD, the means of the RD indexes are higher for those who thought about suicide or those who planned or attempted suicide ($p < 0.05$ for all pairs of comparisons), and the magnitude of difference by yes/no response is more pronounced for suicide planning or attempt. This pattern is consistent with various definitions of reference group, measures of RD, and suicide outcomes examined.

[Insert Table 2 about here]

Table 3 provides the association between RD in income and odds ratio of suicidal ideation and odds ratio of suicide planning or attempt, conditional on covariates. To improve the interpretability of odds ratios, the Yitzhaki index is scaled down by division of 10,000k KRW (8300 USD), and the Deaton index and income rank are scaled up by multiplying 10. The estimates for covariates are omitted for brevity.

Looking at our preferred specification in panel A, we find that increasing an individual's RD in income by 10,000k KRW is associated with 1.42 (95% CI: 1.08-1.87) times higher odds of suicidal ideation and 1.70 (95% CI: 1.04-2.78) times higher odds of suicide planning or attempt. The odds ratios in the following regressions range from 1.58 (95% CI: 1.20-2.07) to 1.72 (95% CI: 1.30-2.27) for suicidal ideation and from 1.71 (95% CI: 1.02-2.89) to 1.95 (95% CI: 1.26-3.02) for suicide planning or attempt, depending on the choice of reference groups. The effect of RD is overall larger when the reference group is defined more broadly.

For the Deaton index, each 0.1 unit increase in the index is associated with odds ratio for suicidal ideation of 1.09 (95% CI: 1.04-1.14) – 1.10 (95% CI: 1.05-1.15) and odds ratio for suicide planning or attempt of 1.17 (95% CI: 1.07-1.28) – 1.20 (95% CI: 1.09-1.32). For regressions involving the income rank, the estimated odds ratios are in a range of 1.06 (95% CI: 1.03-1.10) to 1.07 (95% CI: 1.03-1.10) for suicidal ideation and in a range of 1.10 (95% CI: 1.03-1.18) to 1.12 (95% CI: 1.05-1.21) for suicide planning or attempt. Much like the results in panel A, the association between suicide outcomes and measures of RD is robust to the choice of reference group.

[Insert Table 3 about here]

Next, the correlation between RD in income and odds of reporting suicidal ideation is examined separately for women and men (Table 4). For women, the estimated odds ratios

are not significant at the 5% level with all three indexes and across all possible combinations of reference groups. For men, the estimated odds ratios are greater than one and statistically significant at the 5% level in all cases. For instance, a 10,000k KRW increase in the Yitzhaki index is estimated to increase the odds ratio of suicidal ideation by 1.51 (95% CI: 1.00-2.27), and a 0.1 unit increase in the Deaton index and income rank is associated with odds ratio for suicidal ideation of 1.08 (95% CI: 1.02-1.15) and 1.06 (95% CI: 1.02-1.11), respectively. Moreover, the confidence intervals related to these estimates generally overlap with the corresponding confidence intervals in Table 2. This evidence of gender gradient shows that a link between RD in income and suicide risk holds only for men, not for women. In the present analyses by gender, the odds ratio of suicide planning or attempt could not be examined due to a small number of negative cases in each gender group.

[Insert Table 4 about here]

5 Conclusion

In recent years, a great deal of attention has centered on the question of whether or not RD has an effect on health outcomes, independent of absolute deprivation. However, relatively little evidence exists about how RD correlates with suicide risk. This question is critical for understanding the association between income inequality and mortality and assessing its social cost implication.

This study examined the association between income-based measures of RD and suicide risk for Korean adults aged 25 or higher. The suicide risk is measured with suicidal ideation and suicide planning or attempt over a year, and RD is measured as the average difference between a respondent's household income and that of all those with higher incomes in a reference group and a position in the income hierarchy. Conditional on absolute income and socioeconomic characteristics, a low relative position in income was associated with higher odds of suicidal ideation and higher odds suicide planning or attempt. The estimated associations were consistent with three deprivation indexes and alternative definitions of reference group.

A noteworthy finding is a gender gradient in the association between RD in income and suicide. Our analyses stratified by gender showed that RD is associated with higher odds of suicidal ideation for men, but not for women. A potential explanation would be that relative deprivation in income is a poor indicator of relative socioeconomic position among women, given that women's participation in the labor force has been limited in the past decades (Eibner and Evans, 2005). For those who have been economically inactive during

most of their lifetime, income might not be an important standard of social comparison. The weak association between relative deprivation in income and health among women has been reported in studies based on the elderly sample (Kondo et al., 2009, 2015).

Our findings extend the state of knowledge about how RD translates into an increase in mortality. The basic premise of this study is that psychosocial stress and related mental disorder is the likely mechanism that may link RD to suicidal ideation and behaviors. The poor mental health of those who intend or attempt suicide is well described in psychiatric research (Alexopoulos et al., 1999; Johnson et al., 1990). It has been estimated that more than two-thirds of people who attempted suicide have a major depressive disorder, 5% suffer from schizophrenia, and 10% have the symptoms of other affective disorders, such as bipolar disorder and anxiety disorder. This clinical background suggests that a potential pathway through which RD leads to higher mortality would be a severe mental illness and its manifestation to suicidal behaviors. Public health interventions may need to prioritize those with symptoms of mental illness who are living in relatively deprived conditions.

Perceived fairness signaled through the position in income hierarchy may have played a role in a link between RD and suicidal behaviors. Recently, the term "spoon theory" has emerged in Korea to denote the problem of inherited privilege (Kim, 2017). The theory is a twist of the English idiom about being born with a silver spoon and has been used to describe how wealthy Koreans are using their social status to pass their privilege onto offspring. A recent study by Oh and Ju (2017) showed that the spoon theory is indeed an accurate reflection of Korean society, as evidenced by the limited opportunity for quality education and regular job among low-income households. A possible explanation underlying the RD-suicide link in Korea may include frustration and anger against those with an inherited social position in the reference group. More study is needed to parse out the psychosocial effect of perceived fairness and its mortality implications.

Cultural background offers some explanations as to why the association between suicide and RD in income (or income inequality) was more evident in Korea and Japan (Chen et al., 2009; Inagaki, 2010). East Asian countries share the beliefs of Confucianism, which emphasizes diligence, modesty, and stoicism, as well as keeping family honor intact (Hunt, 2015). The Confucian notion of hierarchy used to put the image of high social status on certain occupations, such as doctor and lawyer, and portray career success as a worthy pursuit. A strong family orientation often ties family prestige and honor to the success of a particular family member and socializes other members to follow a similar path. In this culture, it is customary to work or study long hours into the night and compete for a higher social status (Park, 2013). Our findings and evidence from Japan suggest that suicide might be a serious side effect of living in a hypercompetitive environment. The combination

of the Confucian notion of hierarchy and competitive social structure may have intensified psychological effect of being in a lower social position and lead individuals to consider suicide as an option.

Findings presented above should be viewed in light of some data limitations. First, our suicide outcomes are self-reported. Subjective measures are known to be less reliable and valid than objective indicators, and can be biased by different standards of defining suicidal experiences. Further studies are required to confirm our findings in the domain of objective suicide indicators (e.g., count of suicide cases). Second, it is unclear whether and to what extent the Yitzhaki index and income rank capture respondents' subjective feelings about their relative position in the reference group. The implicit assumption in the RD theory is that those in a lower socioeconomic position perceive themselves as deprived relative to others and feel emotional reactions to it. While we are unable to evaluate this assumption, prior studies argued that the disparity between objective and subjective assessment of RD is minor and has only limited influence on empirical assessment of the RD effect (Gero et al., 2017; Subramanyam et al., 2009). Third, our estimate of the RD effect could be biased downward due to sample attrition. Those who died by suicide and left a survey may have carried the highest risk of suicide in the sample. Losing these participants raises the concern that our results may over-represent those with a mild risk of suicide and understates behaviors of a higher risk group. If RD increases the chance of committing suicide, this attrition indicates a further downward bias in our estimates of the RD effect. Additionally, we are unable to rule out reverse causality. If, for instance, the psychosocial consequences of suicide risk have a negative impact on job market performance or productivity at workplace, it will lower a person's income rank in the reference group. Unfortunately, the KoWePS data does not contain information needed to address this bias or to isolate the causal effect of RD. A stronger inference about causality will be drawn from an instrumental variable analysis or the natural experiment using exogenous variation in RD due to unexpected institutional change (e.g., regime change or political revolution) or policy reform (e.g., expansion of redistribution policy).

Our findings give further support to redistribution policy as a tool to curb rising suicide risk (Dow et al., 2019). Though not explicitly tested, our results highlight the importance of monitoring income disparities in a fight against high suicide rates in disadvantaged population. To date, RD or income inequality has been discussed predominantly in the context of economic development and is rarely viewed as a modifiable risk factor of suicide. A growing economic distance between individuals has been considered an immutable fixture of the capitalist economy or unrelated to mortality. A key implication of this study is that addressing suicide epidemic in Korea may require more than just media campaign and education but a

fundamental change in social and economic policy. There needs to be a mix of redistributive tax and welfare system as well as a shift in policy direction from norms of efficiency to norms of fairness.

References

Adjaye-Gbewonyo, K., Kawachi, I., 2012. Use of the Yitzhaki Index as a test of relative deprivation for health outcomes: A review of recent literature. Soc. Sci. Med. 75 (1), 129-137.

Alexopoulos, G.S., Bruce, M.L., Hull, J., Sirey, J.A., Kakuma, T., 1999. Clinical determinants of suicidal ideation and behavior in geriatric depression. Arch. Gen. Psychiatry 56 (11), 1048–1053.

Andres, A.R., 2005. Income inequality, unemployment, and suicide: A panel data analysis of 15 European countries. Appl. Econ. 37 (4), 439–451.

Bechtel, L., Lordan, G., Rao, D.P., 2012. Income inequality and mental health - Empirical evidence from Australia. Health Econ. 21, 4–17.

Boyce, C.J., Brown, G.D.A., Moore, S.C., 2010. Money and happiness: Rank of income, not income, affects life satisfaction. Psychol. Sci. 21 (4), 471–475.

Buhmann, B., Rainwater, L., Schmaus, G., Smeeding, T.M., 1988. Equivalence scales, well-being, inequality, and poverty: Sensitivity estimates across ten countries using the Luxembourg Income Study (LIS) database. Rev. Income Wealth 34 (2), 115–142.

Chen, J., Choi, Y.J., Sawada, Y., 2009. How is suicide different in Japan?. Jpn. World Econ. 21 (2), 140–150.

Cuesta, M.B., Budría, S., 2015. Income deprivation and mental well-being: The role of non-cognitive skills. Econ. Hum. Biol. 17, 16–28.

Daly, M.C., Wilson, D.J., 2009. Happiness, unhappiness, and suicide: An empirical assessment. J. Eur. Econ. Assoc. 7 (2-3), 539–549.

Daly, M.C., Wilson, D.J., Johnson, N.J., 2013. Relative status and well-being: Evidence from US suicide deaths. Rev. Econ. Stat. 95 (5), 1480–1500.

Deaton, A., 2001. Relative deprivation, inequality, and mortality (NBER Working Paper 8099). Cambridge, MA: National Bureau of Economic Research.

Dow, W.H., Godøy, A., Lowenstein, C.A., Reich, M., 2019. Can economic policies reduce deaths of despair? (NBER Working Paper 25787). Cambridge, MA: National Bureau of Economic Research.

Duesenberry, J. S., 1949. Income, savings, and the theory of consumer behavior. Cambridge, MA: Harvard University Press.

Dupéré, V., Leventhal, T., Lacourse, É., 2009. Neighborhood poverty and suicidal thoughts and attempts in late adolescence. Psychol. Med. 39 (8), 1295–1306.

Eibner, C., Evans, W.N., 2005. Relative deprivation, poor health habits, and mortality. J. Hum. Resour. 40 (3), 591–620.

Eibner, C., Sturn, R., Gresenz, C. R., 2004. Does relative deprivation predict the need for mental health services. J. Ment. Health Policy Econ. 7 (4), 167–175.

Gerdtham, U.G., Johannesson, M., 2004. Absolute income, relative income, income inequality, and mortality. J. Hum. Resour. 39 (1), 228–247.

Gero, K., Kondo, K., Kondo, N., Shirai, K., Kawachi, I., 2017. Associations of relative deprivation and income rank with depressive symptoms among older adults in Japan. Soc. Sci. Med. 189, 138–144.

Goethals, G. R., Darley, J., 1977. Social comparison theory: An attributional approach, in Suls, J.M., Miller, R.L. (Eds.), Social Comparison Processes: Theoretical and Empirical Perspectives. Halsted/Wiley, Washington, DC, pp. 259–278.

Hong, J.P., 2017. The epidemiological survey of mental disorders in Korea. Sejong, South Korea: Ministry of Health and Welfare.

House, J.S., Landis, K.R., Umberson, D., 1988. Social relationships and health. Science 241 (4865), 540–545.

Hunt, J. G., 2015. Suicide mortality among students in South Korea: An extended discussion. Int. Forum 18 (2), 105–120.

Inagaki, K., 2010. Income inequality and the suicide rate in Japan: Evidence from cointegration and LA-VAR. J. Appl. Econ. 13 (1), 113–133.

Johnson, J., Weissman, M.M., Klerman, G.L., 1990. Panic disorder, comorbidity, and suicide attempts. Arch. Gen. Psychiatry 47 (9), 805–808.

Kahn, R.S., Wise, P.H., Kennedy, B.P., Kawachi, I., 2000. State income inequality, household income, and maternal mental and physical health: Cross sectional national survey. BMJ 321 (7272), 1311.

Kawachi, I., Kennedy, B.P., 1999. Income inequality and health: Pathways and mechanisms. Health Serv. Res. 34, 215–227.

Kawachi, I., Subramanian, S.V., 2014. Income inequality, in: Berkman, L.F., Kawachi, I., Glymour, M.M. (Eds.), Social Epidemiology. Oxford University Press, Oxford, UK, pp.126–152.

Kennedy, B.P., Kawachi, I., Glass, R., Prothrow-Stith, D., 1998. Income distribution, socioeconomic status, and self rated health in the United States: Multilevel analysis. BMJ 317 (7163), 917–921.

Kennedy, B.P., Kawachi, I., Prothrow-Stith, D., 1996. Income distribution and mortality: Cross sectional ecological study of the Robin Hood index in the United States. BMJ 312 (7037), 1004–1007.

Kim, H., 2017. "Spoon Theory" and the fall of a populist princess in Seoul. J. Asian Stud. 76 (4), 839–849.

Kim, M.H., Jung-Choi, K., Jun, H.J., Kawachi, I., 2010. Socioeconomic inequalities in suicidal ideation, parasuicides, and completed suicides in South Korea. Soc. Sci. Med. 70 (8), 1254–1261.

Kondo, N., Kawachi, I., Hirai, H., Kondo, K., Subramanian, S.V., Hanibuchi, T., et al., 2009. Relative deprivation and incident functional disability among older Japanese women and men: Prospective cohort study. J. Epidemiol. Community Health 63 (6), 461–467.

Kondo, N., Kawachi, I., Subramanian, S.V., Takeda, Y., Yamagata, Z., 2008. Do social comparisons explain the association between income inequality and health?: Relative deprivation and perceived health among male and female Japanese individuals. Soc. Sci. Med. 67 (6), 982–987.

Kondo, N., Saito, M., Hikichi, H., Aida, J., Ojima, T., Kondo, K., et al., 2015. Relative deprivation in income and mortality by leading causes among older Japanese men and women: AGES cohort study. J. Epidemiol. Community Health 69 (7), 680–685.

Korea National Statistical Office, 2018. 2017 annual report of cause of mortalities. Daejeon, South Korea: Korea National Statistical Office.

Kuo, C.T., Chiang, T., 2013. The association between relative deprivation and self-rated health, depressive symptoms, and smoking behavior in Taiwan. Soc. Sci. Med. 89, 39–44.

Kuznets, S., 1955. Economic growth and income inequality. Am. Econ. Rev. 45 (1), 1–28.

Kwon, J. W., Chun, H., Cho, S. I., 2009. A closer look at the increase in suicide rates in South Korea from 1986–2005. BMC Public Health 9 (1), 72.

Lee, J., 2017. The labor market in South Korea, 2000-2016. IZA World of Labor 405.

Lee, S. U., Oh, I. H., Jeon, H. J., Roh, S., 2017. Suicide rates across income levels: retrospective cohort data on 1 million participants collected between 2003 and 2013 in South Korea. J. Epidemiol. 27 (6), 258–264.

Leigh, A., Jencks, C., 2007. Inequality and mortality: Long-run evidence from a panel of countries. J. Health Econ. 26 (1), 1–24.

Lhila, A., Simon, K.I., 2010. Relative deprivation and child health in the USA. Soc. Sci. Med. 71 (4), 777–785.

Lopez, R., 2004. Income inequality and self-rated health in US metropolitan areas: A multi-level analysis. Soc. Sci. Med. 59 (12), 2409–2419.

Mangyo, E., Park, A., 2011. Relative deprivation and health which reference groups matter?. J. Hum. Resour. 46 (3), 459–481.

Marmot, M., 1994. Social differences in health within and between populations. Daedalus 123 (4), 197–216.

Marmot, M., Wilkinson, R.G., 2001. Psychosocial and material pathways in the relation between income and health: A response to Lynch et al. BMJ 322 (7296), 1233–1236.

McMillan, K. A., Enns, M. W., Asmundson, G. J., Sareen, J., 2010. The association between income and distress, mental disorders, and suicidal ideation and attempts: Findings from the Collaborative Psychiatric Epidemiology Surveys. J. Clin. Psychiatry 71 (9), 1168–1175.

Melhem, N. M., Brent, D. A., Ziegler, M., Iyengar, S., Kolko, D., Oquendo, M., et al., 2007. Familial pathways to early-onset suicidal behavior: Familial and individual antecedents of suicidal behavior. Am. J. Psychiatry 164 (9), 1364–1370.

Meltzer, H., Bebbington, P., Brugha, T., Jenkins, R., McManus, S., Dennis, M. S., 2011. Personal debt and suicidal ideation. Psychol. Med. 41 (4), 771–778.

Mendelson, T., Thurston, R.C., Kubzansky, L.D., 2008. Affective and cardiovascular effects of experimentally-induced social status. Health Psychol. 27 (4), 482–489.

Neumayer, E., 2004. Recessions lower (some) mortality rates: Evidence from Germany. Soc. Sci. Med. 58 (6), 1037–1047.

Nock, M.K., Borges, G., Bromet, E.J., Alonso, J., Angermeyer, M., Beautrais, A., et al., 2008. Cross-national prevalence and risk factors for suicidal ideation, plans and attempts. Br. J. Psychiatry 192 (2), 98–105.

OECD, 2019. Suicide rates (indicator). Paris, France: Organisation for Economic Cooperation and Development.

Oh, S.J., Ju, B.G., 2017. Inequality of opportunities for income acquisition in Korea. Korean J. Pub. Financ. 10, 1–30.

Park, B.C.B., 2013. Cultural ambivalence and suicide rates in South Korea, in: Colucci, E., Lester, D. (Eds.), Suicide and Culture. Understanding the Context. Hogrefe Publishing, Cambridge, MA, pp. 237–262.

Park, J., Ryu, S.Y., Han, M.A., Choi, S.W., 2015. The association between income inequality and all-cause mortality across urban communities in Korea. BMC Public Health 15 (1), 574.

Runciman, W.G., 1966. Relative Deprivation and Social Justice. Routledge, London.

Salti, N., 2010. Relative deprivation and mortality in South Africa. Soc. Sci. Med. 70 (5), 720–728.

Salti, N., Abdulrahim, S., 2016. The relationship between relative deprivation and self-rated health among Palestinian women in refugee camps in Lebanon. SSM Popul. Health 2, 317–326.

Sapolsky, R.M., 2005. The influence of social hierarchy on primate health. Science 308 (5722), 648–652.

Shibuya, K., Hashimoto, H., Yano, E., 2002. Individual income, income distribution, and self rated health in Japan: Cross sectional analysis of nationally representative sample. BMJ 324 (7328), 16.

Song, H.B., Lee, S.A., 2016. Socioeconomic and lifestyle factors as risks for suicidal behavior among Korean adults. J. Affect Disord. 197, 21–28.

Subramanyam, M., Kawachi, I., Berkman, L., Subramanian, S.V., 2009. Relative deprivation in income and self-rated health in the United States. Soc. Sci. Med. 69 (3), 327–334.

Walker, I., Smith, H.J., 2002. Relative deprivation: Specification, development, and integration. Cambridge University Press, Cambridge.

Wetherall, K., Daly, M., Robb, K.A., Wood, A.M., O'Connor, R.C., 2015. Explaining the income and suicidality relationship: Income rank is more strongly associated with suicidal thoughts and attempts than income. Soc. Psychiatry Psychiatr. Epidemiol. 50 (6), 929–937.

Wildman, J., 2003. Income related inequalities in mental health in Great Britain: Analysing the causes of health inequality over time. J. Health Econ. 22 (2), 295–312.

Wilkinson, R.G., 1997. Socioeconomic determinants of health: Health inequalities: relative or absolute material standards?. BMJ 314 (7080), 591–595.

Wilkinson, R.G., 1999. Health, hierarchy, and social anxiety. Ann. N. Y. Acad. Sci. 896 (1), 48–63.

Yitzhaki, S., 1979. Relative deprivation and the Gini coefficient. Q. J. Econ. 93, 321–324.

Yngwe, M.Å., Kondo, N., Hägg, S., Kawachi, I., 2012. Relative deprivation and mortality – A longitudinal study in a Swedish population of 4,7 million, 1990–2006. BMC Public Health 12 (1), 664.

Table 1: Sample characteristics

	N	Mean / %	SD
Total	36,452	100.0%	
Suicide outcomes:			
Suicidal ideation: yes	1402	3.8%	
Suicidal ideation: no	35,050	96.2%	
Suicide planning or attempt: yes	194	0.5%	
Suicide planning or attempt: no	36,258	99.5%	
Age	36,452	61.4	15.6
Equivalized household income (1k KRW)	36,452	10,267	9595
Total net worth (1k KRW)	36,452	106,944	309,069
No. of private health insurance	36,452	0.9	1.2
Gender			
Female	11,644	31.9%	
Male	24,808	68.1%	
Educational attainment			
Less than high school	17,808	48.9%	
High school graduate	9999	27.4%	
College or higher	8645	23.7%	
Marital status			
Married	21,603	59.3%	
Separated/divorced/widowed	12,805	35.1%	
Never married	2044	5.6%	
Health conditions			
SR health: poor or fair	9316	25.6%	
SR health: good or higher	27,136	74.4%	
One or more chronic disease	23,513	64.5%	
No chronic disease	12,939	35.5%	
One or more severe illness	2808	7.7%	
No severe illness	33,644	92.3%	
Religiosity			
Any religion	18,595	51.0%	
No religion	17,857	49.0%	
Employment status			
Full-time job	8002	22.0%	
Temporary job	3606	9.9%	
Part-time job	3031	8.3%	
Self-employed	8327	22.8%	
Not in the labor force	13,486	37.0%	

Notes: Korea Welfare Panel Study, 2012-2018. All monetary figures are adjusted to 2018 KRW using the Korean Consumer Price Index for all items. 1k KRW is equivalent to about 0.83 USD as of December 1, 2019.

Table 2: Mean values of relative deprivation by suicide outcomes

	Suicidal ideation		Suicide planning or attempt	
	No	Yes	No	Yes
Reference groups defined by:				
Yitzhaki index (1k KRW)				
Gender, age, education, municipality	3608	3952[a]	3618	4317[a]
Gender	3904	4517[a]	3923	4832[a]
Gender, education	3747	4061[a]	3756	4252[c]
Gender, age	3740	4278[a]	3755	4793[a]
Gender, education, age	3645	4023[a]	3656	4280[b]
Deaton index				
Gender, age, education, municipality	0.33	0.37[a]	0.33	0.40[a]
Gender	0.37	0.42[a]	0.37	0.45[a]
Gender, education	0.35	0.39[a]	0.35	0.41[a]
Gender, age	0.35	0.40[a]	0.35	0.43[a]
Gender, education, age	0.34	0.38[a]	0.34	0.41[a]
Income rank				
Gender, age, education, municipality	0.51	0.58[a]	0.51	0.61[a]
Gender	0.51	0.59[a]	0.51	0.63[a]
Gender, education	0.51	0.58[a]	0.51	0.61[a]
Gender, age	0.51	0.59[a]	0.51	0.63[a]
Gender, education, age	0.51	0.58[a]	0.51	0.61[a]

Notes: 1k KRW is equivalent to about 0.83 USD as of December 1, 2019. [a] denotes significant difference by a suicide outcome at the 0.1% level. [b] indicates significant difference by a suicide outcome at the 1% level. [c] represents significant difference by a suicide outcome at the 5% level.

Table 3: Adjusted odds ratio of suicidal ideation and suicide planning or attempt

Outcome variable:	Suicidal ideation OR (95% CI)	Suicide planning or attempt OR (95% CI)
Reference groups defined by:		
Panel A: Yitzhaki index (10000k KRW)		
Gender, age, education, municipality	1.42 (1.08, 1.87)	1.70 (1.04, 2.78)
Gender	1.69 (1.26, 2.27)	1.76 (1.03, 3.01)
Gender, education	1.72 (1.30, 2.27)	1.82 (1.09, 3.03)
Gender, age	1.62 (1.23, 2.13)	1.95 (1.26, 3.02)
Gender, education, age	1.58 (1.20, 2.07)	1.71 (1.02, 2.89)
Panel B: Deaton index (0.1 unit)		
Gender, age, education, municipality	1.09 (1.04, 1.14)	1.17 (1.07, 1.28)
Gender	1.10 (1.05, 1.15)	1.20 (1.09, 1.32)
Gender, education	1.10 (1.05, 1.15)	1.19 (1.08, 1.30)
Gender, age	1.10 (1.06, 1.15)	1.20 (1.09, 1.32)
Gender, education, age	1.10 (1.05, 1.14)	1.18 (1.07, 1.29)
Panel C: Income rank (0.1 unit)		
Gender, age, education, municipality	1.06 (1.03, 1.09)	1.10 (1.03, 1.18)
Gender	1.07 (1.03, 1.10)	1.12 (1.05, 1.21)
Gender, education	1.06 (1.03, 1.10)	1.11 (1.04, 1.19)
Gender, age	1.06 (1.03, 1.10)	1.12 (1.05, 1.20)
Gender, education, age	1.06 (1.03, 1.09)	1.11 (1.03, 1.19)

Notes: 1k KRW is equivalent to about 0.83 USD as of December 1, 2019. Panel A shows coefficient estimates on the Yitzhaki index, and panels B and C show coefficient estimates on the Deaton index and the income rank. All regressions were adjusted for age, education, gender, marital status, self-rated health, chronic health, health insurance ownership, religion, employment status, total net worth, equivalized income, province dummies, and year fixed effects. The sample for panels A and C includes 36,452 observations. The sample for panel B includes 36,338 observations.

Table 4: Adjusted odds ratio of suicidal ideation, by gender

Outcome variable:	Suicidal ideation	Suicide planning or attempt
Sample:	Women	Men
	OR (95% CI)	OR (95% CI)
Reference groups defined by:		
Panel A: Yitzhaki index (10000k KRW)		
Gender, age, education, municipality	1.00 (0.66, 1.50)	1.51 (1.00, 2.27)
Gender	0.94 (0.53, 1.65)	1.93 (1.28, 2.89)
Gender, education	1.02 (0.59, 1.76)	1.91 (1.26, 2.87)
Gender, age	0.98 (0.61, 1.57)	1.82 (1.23, 2.68)
Gender, education, age	0.98 (0.61, 1.58)	1.75 (1.18, 2.59)
Panel B: Deaton index (0.1 unit)		
Gender, age, education, municipality	1.03 (0.95, 1.12)	1.08 (1.02, 1.15)
Gender	1.04 (0.94, 1.14)	1.10 (1.03, 1.16)
Gender, education	1.04 (0.95, 1.14)	1.09 (1.03, 1.16)
Gender, age	1.04 (0.95, 1.14)	1.10 (1.04, 1.16)
Gender, education, age	1.05 (0.96, 1.14)	1.09 (1.03, 1.15)
Panel C: Income rank (0.1 unit)		
Gender, age, education, municipality	1.03 (0.97, 1.08)	1.06 (1.02, 1.11)
Gender	1.03 (0.97, 1.10)	1.06 (1.02, 1.11)
Gender, education	1.02 (0.96, 1.09)	1.06 (1.02, 1.11)
Gender, age	1.03 (0.97, 1.09)	1.07 (1.03, 1.11)
Gender, education, age	1.02 (0.96, 1.08)	1.06 (1.02, 1.11)

Notes: 1k KRW is equivalent to about 0.83 USD as of December 1, 2019. Panel A shows coefficient estimates on the Yitzhaki index, and panels B and C show coefficient estimates on the Deaton index and the income rank. All regressions were adjusted for age, education, gender, marital status, self-rated health, chronic health, health insurance ownership, religion, employment status, total net worth, equivalized income, province dummies, and year fixed effects. The sample for panels A and C includes 11,644 observations for women and 24,808 observations for men. The sample for panel B includes 11,625 observations for women and 24,713 observations for men.