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# The Happiness and Relative Income Hypothesis in Contemporary Japan: A Study of Lifestyle and Values

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## Abstract

Previous studies have argued that higher reference income not only triggers feelings of envy, but also serves to signal ambition and bright future prospects; the relative importance of envy ("comparison effect") and ambition ("information effect") depends on both the degree of mobility in one's life stage and the reference group. Although the Japanese labor market and society are relatively immobile, individuals in the early part of their lives are more mobile and likely to have opportunities to change their career and residence than they will later in their lives. Thus, using a nationally representative individual-level data set from Japan, this study examined how reference income affects individual life satisfaction (LS) in both early and later life. We found that there was a significant negative association between LS and average income of the demographic reference group in the later life sample, but no association in the early life sample. Our findings suggest that the relative importance of comparison and information effects in Japan depend on the degree of mobility in one's life stage; specifically, the information effect from ambition cancels out the comparison effect in early life, while the comparison effect dominates the information effect in later life.

## Keywords

relative income hypothesis, life satisfaction, reference group, information effect, comparison effect

The relative income hypothesis, developed by Duesenberry (1949) and Friedman (1957), states that individuals evaluate their own income in comparison with the reference income, which is defined as the average income of one's reference group.[1] In other words, individual happiness is both positively affected by one's own income and negatively affected by reference income.

This relation between income and happiness has been the main subject of empirical studies (c.f., Frey and Stutzer 2002). However, while individual income has been found to have a significantly positive effect on happiness, no studies have reached a consensus on how reference income affects individual utility. Rather, prior studies on the association between individual happiness and reference income have mixed results: Senik (2004), Shields, Price, and Wooden (2009), and Mangyo and Park (2011) find no association between happiness and reference income in Russia, Australia, and China, respectively, whereas

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Luttmer (2005), Helliwell and Huang (2005), and Brown, Gray, and Roberts (2015) find a positive association between happiness and reference income in the United States, Canada, and the U.K. Additional studies, such as Blanchflower and Oswald (2004) in the United States and Clark, Westergård-Nielsen, and Kristensen (2009) in Denmark, argue that there is a negative association between happiness and reference income.[2]

### *Relative Importance of Comparison and Information Effects*

Reference income may affect individual happiness in two ways (c.f., Senik 2004; Senik 2008; and FitzRoy et al. 2014). One is that higher reference income triggers a feeling of envy or jealousy, and thus has a negative effect on individual happiness. The other is that higher reference income serves as a signal of future prospects and thus has a positive effect on individual happiness. The former is referred to as the comparison effect, and the latter is referred to as the information effect.

To formalize the role of reference income, we introduce utility function, which provides a theoretical framework in economics; we presume that utility can serve as a proxy for happiness in this study. Suppose that individual utility depends on one's own income $Y$, expected income $E$, and reference income $RI$. We assume that an individual's expected income depends on the reference group's observed income: $E = E(RI)$. In short, it is presumed that as an individual observes a change in the income of people with similar characteristics, he/she expects this as a signal that his/her own income is going to change in the same way under uncertainty. Thus, an individual's utility function can be expressed as:[3]

$$U=V(Y, E(RI), RI) \qquad [1]$$

It is clear that the marginal utility of $Y$ is positive ($\partial V/\partial Y>0$), as is the marginal utility of expected income $E$ ($\partial V/\partial E>0$). However, the marginal utility of reference income $RI$ is ambiguous. The partial derivative of utility with respect to $RI$ is:

$$\frac{\partial U}{\partial RI}=\left[\left(\frac{\partial V}{\partial E}\right)\left(\frac{\partial E}{\partial RI}\right)\right]+\frac{\partial V}{\partial RI} \qquad [2]$$

The first term of Equation [2], which represents the information effect of reference income on individual utility, is positive. As noted above, because the first part of this term, $\partial V/\partial E$, is the marginal utility of expected income $E$ and positive, the second part of this term, $\partial E/\partial RI$, represents the effect of reference income on expected income (i.e., the information effect) and is also positive. There are two types of information effects, one from ambition and one from the area wealth effect (c.f., Brown et al. 2015). The information effect from ambition means that higher reference income serves as a signal of an individual's higher own expected income ($\partial E/\partial RI>0$). The information effect from the area wealth effect means that higher reference income serves as a signal of higher own expected income through better public services and security in the local community ($\partial E/\partial RI>0$).[4] On the other hand, the second term, $\partial V/\partial RI$ represents the direct effect of $RI$ on individual utility (i.e., comparison effect); this sign depends on how an individual feels about their reference group. If individual feelings are dominated by envy (as suggested by the relative income hypothesis), then this term will be negative.

Hence the effect of an increase in reference income is unknown in advance and depends on the relative importance of the information and comparison effects. This suggests the need for an empirical examination of this term using regression analysis. If the coefficient of $RI$ in our regression model is negative, then the comparison effect has more impact than the information effect. Conversely, if the coefficient of $RI$ is positive, then the information effect dominates over the comparison effect. If the coefficient of $RI$ is statistically nonsignificant, then the information and comparison effects offset each other. Of course, if the coefficient of $RI$ is statistically nonsignificant, it is possible that both effects are too small to show up as

statistically significant.

One question about the relative importance of the comparison and information effects is which factors affect their relative importance. Senik (2008) finds that the relative importance of these effects depends on an individual's degree of societal mobility.[5] FitzRoy et al. (2014) argue that comparison effects are more prominent in individuals' later life, while information effects dominate in one's early life.[6] This is because young individuals are more mobile and likely to interpret the reference group's success as a signal that their position will improve soon. In other words, younger people see reference income not in comparison to their own income but rather as an information indicator of their own future prospects.

Another question about the relative importance of these two effects is how to define the reference group. Previous studies defined reference groups based on individual characteristics ("people like you") and spatial groups ("people near you"). According to Brown et al. (2015), the positive coefficient becomes prominent in the latter case: they suggest that this is because individuals in wealthy areas enjoy better local public services and security, and refer to the information effect through the area wealth effect. In this study, we include both spatial groups (municipality[7] where an individual lives) and demographic reference groups based on age (20s, 30s, 40s, 50s, 60s) and gender.

### *Hypotheses*

We hypothesize that there will be a negative relative income effect, as stated by the relative income hypothesis. Alternatively, reference income may be positively associated with happiness (c.f., Senik 2008; FitzRoy et al. 2014; Brown and Gray 2016).

As mentioned above, we break the information effect into two kinds: the information effect from ambition and the information effect from the area wealth effect. We assume that for the demographic reference group, only the information effect from ambition will have an impact on happiness while for spatial reference groups, both the information effect from ambition and the information effect from the area wealth effect will have an impact. In other words, individuals will see the economic success of those who live near them as the increase of expected income through both ambition and high local public services.

In addition, to examine whether the effect of reference income on individual happiness is affected by one's mobility, we divided the entire sample into two sub-samples based on age: "early life" and "later life." We adopted two types of age categories for each life stage: ages 20–34 or 20–39 as the "early life" and ages 35–69 or 40–69 as the "later life." [8] Because Japanese society and labor markets are immobile, individuals aged 40 or over have little hope for a bright future and opportunities to change their career and residence. [9] In other words, when individuals are younger, changing their career and residence is easier. If higher reference income serves as a signal of bright future prospects, then its impact should be greater for individuals in their early life. In short, the information effect has a greater impact on individuals in their early life than in their later life.

Therefore, we used the following three hypotheses to test how reference income affects individual utility.

> Hypothesis 1: There is a positive association between happiness and the average income of people in the same demographic and spatial reference groups, because the information effect is likely to dominate the comparison effect in early life.
>
> Hypothesis 2: There is a negative association between happiness and the average income of people in the same demographic and spatial reference groups, because the comparison effect is likely to dominate the information effect in later life.
>
> Hypothesis 3: There is a positive or no association between happiness and the average income of people in the same spatial reference group, because both

the information effect through the area wealth effect and the information effect from ambition are likely to dominate or cancel out the comparison effect.

In this study, we used individual data from the 2015 Japanese International Comparative Survey on Lifestyle and Values, conducted by the Center for Social Well-being Studies at Senshu University.[10] This was an online survey of respondents between the ages of 20 and 69 who were randomly chosen from a survey agent's (Nikkei Research, Inc.) pre-registered monitors.[11] Participants were randomly selected using 240 stratified categories constituted in proportion to the national distribution in regard to age, gender, city size, and region. Populations were sampled proportionately from 2010 national census findings by gender, age, city scale, and region and were considered to be representative of Japan as a whole. There were 11,814 valid responses.

## METHODS

### *Model*

The empirical analysis uses a subjective measure of life satisfaction (LS) as the proxy for individual happiness.[12] To analyze the relative income hypothesis, we estimated individual LS function using an ordered logit regression:[13]

$$LS_i^* = \alpha + \sum_{q=1}^{l} \beta_q X_i^q + \delta Y_i + \pi RI_i + \varphi W_{ij} + u_i \quad [3]$$

$$\mathrm{LS}_i = \begin{cases} 0 \;\; if \;\; -\infty < LS^* \le k_1 \\ 1 \;\; if \;\; k_1 < LS^* \le k_2 \\ 2 \;\; if \;\; k_2 < LS^* \le k_3 \\ \vdots \\ 10 \;\; if \;\; k_{10} < LS^* < \infty \end{cases}$$

where $LS^*$ is a latent unobserved variable. $LS$ is recorded on an 11-point Likert scale (10 = very satisfied, 0 = very unsatisfied) and has 10 thresholds over the latent variables. $X$ is an individual-level variable, $Y$ is an individual's own income (equivalized income), $RI$ is reference income, $W$ is a vector of regional-level variables, $u$ is the error term,[14] and $\alpha$, $\beta$, $\delta$, $\pi$, $\varphi$, and the 10 threshold values $k$ are the parameters to be estimated. Moreover, $i$ and $j$ represent the individual and municipality, respectively.

### *Data*

*Dependent variable: Life satisfaction.* We assessed subjective overall life satisfaction based on answers to the following question: "How satisfied are you currently with life overall?" In the survey, this variable is scored on an 11-point scale, from 0 (very unsatisfied) to 10 (very satisfied). The median and the mode of overall LS are 6 and 7, respectively.

*Independent variables.* The independent variables were individual attributes, municipality size, individual income, and reference income. Individual attributes included age, gender, marital status, housing status, educational attainments, and occupational status. Our data included male and female Japanese residents between 20 and 69 years old. Among all respondents, 48.6% were female. The mean age was about 46 years old. Marital status was categorized into married, unmarried, and divorced (including widowed). In all, 64.7% of the respondents were married and 67.9% were homeowners. Educational attainment was categorized into high school degree or lower (25.0% of respondents), some college or associate degree (vocational school, junior college, vocational high school: 21.6% of respondents), and university or higher (53.5% of respondents). Occupational statuses were categorized into regular employees (company executives, permanent employees, and civil servants: 42.2% of respondents), non-regular employees (part-time workers, temporary staff, contract workers, and fixed-term staff: 19.5% of respondents), self-employed and family employees (9.0%), unemployed (2.4%), and non-workers (the retired, homemakers, and students: 26.9%).

Municipality size was controlled using a regional-level variable (towns and villages, small cities [population < 200,000], medium-

sized cities [population 200,000–700,000], and 20 major cities [population > 700,000]).[15]

Household income was categorized into 25 income segments ranging from under 500,000 yen a year to 20,000,000 yen or more a year. For individual's own income, we adopted an equivalized income calculated by dividing household income[16] by the square root of household size. As noted above, we used two types of reference groups. The average income of spatial reference groups was determined from the mean personal income in each municipality in 2015.[17] The average income of demographic reference groups was determined as the mean annual income of each age and gender group in 2015.[18]

Table 1 presents the descriptive statistics for LS, individual-level variables, regional-level variables, and income variables. The sample included 10,416 respondents living in 1,162 municipalities[19] across the nation.

## RESULTS

We performed ordered logit regression with overall LS as the dependent variable.[20] All models included all individual and regional variables, allowing us isolate the association between LS and income after controlling for all variables, as shown in Equation 3. Model A uses individuals living in the same municipal area as the spatial reference group. Model B uses individuals with the same gender and age as the demographic reference group. In addition, to examine the relative importance of the comparison and information effects at different stages in life (Hypotheses 1 and 2), we divided the entire sample into two sub-samples: "early life" and "later life." We then defined Model 1 as including the entire sample, Model 2 as including the "early life" sample, and Model 3 as including the "later life" sample. The empirical results are shown in Table 2.

**Table 1.** Descriptive Statistics of Dependent and Independent Variables

| Variables | | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Life Satisfaction | | 5.922 | 2.383 | 0 | 10 |
| Age | | 46.105 | 13.599 | 20 | 69 |
| Gender | [Male] | 0.514 | 0.500 | 0 | 1 |
| | Female | 0.486 | 0.500 | 0 | 1 |
| Marital Status | [Married] | 0.646 | 0.478 | 0 | 1 |
| | Divorced | 0.062 | 0.242 | 0 | 1 |
| | Unmarried | 0.291 | 0.454 | 0 | 1 |
| Home Ownership | [Renter] | 0.321 | 0.467 | 0 | 1 |
| | Owner | 0.679 | 0.467 | 0 | 1 |
| Occupational Status | [Regular] | 0.423 | 0.494 | 0 | 1 |
| | Non regular | 0.195 | 0.396 | 0 | 1 |
| | Unemployed | 0.024 | 0.153 | 0 | 1 |
| | Retired | 0.269 | 0.444 | 0 | 1 |
| | Self employed | 0.090 | 0.286 | 0 | 1 |
| Educational Attainment | [High school degree or lower] | 0.250 | 0.433 | 0 | 1 |
| | Some college or associate degree | 0.216 | 0.411 | 0 | 1 |
| | University or higher | 0.535 | 0.499 | 0 | 1 |
| Municipality Size | [Town and Village] | 0.082 | 0.275 | 0 | 1 |
| | Small cities | 0.373 | 0.484 | 0 | 1 |
| | Medium-sized cities | 0.251 | 0.433 | 0 | 1 |
| | 20 Major cities | 0.294 | 0.456 | 0 | 1 |
| Own Income | | 407.142 | 286.793 | 17.7 | 3,260 |
| Reference Income | Municipality | 149.756 | 45.646 | 56.2 | 548.5 |
| | Age and Gender | 396.481 | 144.796 | 209.3 | 661.6 |

*Note*: Unit of income: 10 thousand yen. Reference is shown in brackets.

*Individual attributes.* These results regarding individual attributes were generally as expected; overall LS was affected by certain individual attributes. For example, LS and age showed a U-shape association. The LS of individuals between ages 45 and 50 was rather low. Women reported higher LS than men. Unmarried and divorced individuals reported lower satisfaction than married people. Homeowners reported higher satisfaction than renters. Individuals with junior college or vocational school degrees, and undergraduate or postgraduate degrees reported higher satisfaction than other groups. Non-regular employees and unemployed individuals reported lower satisfaction than regular employees.

*Municipal-level variables.* We found no associations between municipality size and LS in any model.

### *Comparison Effect vs. Information Effect*

Our findings regarding the reference group were contradictory. First, the empirical results from the spatial reference group (Model A-1 in Table 2a) showed no significant associations between LS and average income of the spatial reference group. However, the empirical results from the demographic reference group (Model B-1 in Table 2b) showed a negative association between LS and average income among individuals of the same age and gender at the 1% significance level, and the comparison effect dominated the information effect.

The sub-samples showed similar contradictory findings. First, the empirical results from the spatial reference group (Models A-2 and A-3 in Table 2a) showed no association between LS and municipal average income. For the demographic reference group (Models B-2 and B-3 in Table 2b), the empirical results for the 35–69 and 40–69 age groups showed negative associations between LS and average income among individuals in the same age and gender group at the 1% significance level. However, empirical results for the 20–34 and 20–39 age groups showed no association between LS and average income among individuals in the same age and gender group. These results suggest that the information effect has a greater impact on individuals in their early life than in their later life; the information effect from ambition cancels out the comparison effect in early life. However, another possibility is that the effect of reference income is nonsignificant because both effects were originally very small and nonsignificant, rather than because of the cancellation.

### *Evaluation of Marginal Effects: Own Income vs. Reference Income*

In the previous section, our empirical results indicated that higher own income increases one's LS while higher demographic reference income decreases one's LS in later life. To examine how increases in both individual's own income and reference income affect one's LS in later life, we compared the marginal effects of own income with reference income obtained from ordered logit estimation results. A marginal effect measures the change in probability of LS = $m$ for a change in the independent variable $x_l$. According to Long and Freese (2014), discrete change is the change in the probability of LS = $m$ for change in $x_l$ from the start value to the end value, holding all other variables constant. For example, a discrete change is the change in the probability of LS = $m$ for a change in any amount (such as 1 million yen) of income, holding all other variables constant. Thus, we used discrete change in our analysis.

The average discrete change (ADC) is the mean of the discrete change calculated at the observed values for all observations in the sample:

$$\text{ADC} = \frac{1}{N}\sum_{i=1}^{N}\frac{\Delta \Pr(LS_i=m|\text{X}=x_i)}{\Delta x_l} \quad [4]$$

Here, $m$ = 0, …,10. ADC implies, on average, that a discrete change in $x_l$ increases the probability of LS = $m$ by z percentage points. [21]

Table 3 shows how increases in both one's own and reference income affect the

**Table 2a.** Ordered Logit Regression Estimation Results: Model A (Spatial Reference Group)

| | | [A-1] | | [A-2] | | | | [A-3] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Entire | | Age 20-34 | | Age 20-39 | | Age 35-69 | | Age 40-69 | |
| **Variables** | | **Coef.** | **[Z-value]** | **Coef.** | **[Z-value]** | **Coef.** | **[Z-value]** | **Coef.** | **[Z-value]** | **Coef.** | **[Z-value]** |
| **Individual Attributes** | | | | | | | | | | | |
| Age | Age | -0.1405 | [-13.102]*** | -0.6097 | [-4.796]*** | -0.3984 | [-6.052]*** | -0.1862 | [-7.525]*** | -0.1998 | [-4.939]*** |
| | Age(squared) | 0.0015 | [13.032]*** | 0.0093 | [4.249]*** | 0.0056 | [5.409]*** | 0.0019 | [8.007]*** | 0.0020 | [5.475]*** |
| Gender [Male] | Female | 0.4494 | [11.164]*** | 0.4176 | [5.721]*** | 0.4684 | [7.702]*** | 0.4467 | [9.011]*** | 0.4122 | [7.448]*** |
| Marital Status | Divorced | -0.6366 | [-8.520]*** | -1.6493 | [-4.983]*** | -1.0607 | [-6.011]*** | -0.5571 | [-7.197]*** | -0.4995 | [-6.012]*** |
| [Married] | Unmarried | -1.0670 | [-23.078]*** | -1.3135 | [-15.471]*** | -1.2693 | [-19.124]*** | -0.9366 | [-16.560]*** | -0.8329 | [-12.340]*** |
| Home Ownership [Renter] | Owner | 0.3029 | [7.627]*** | 0.1657 | [2.374]** | 0.1785 | [3.205]*** | 0.3979 | [8.146]*** | 0.4721 | [8.197]*** |
| Educational Attainment | Some college or associate degree | 0.1751 | [3.364]*** | 0.2209 | [1.982]** | 0.2818 | [3.177]*** | 0.1696 | [2.862]*** | 0.1221 | [1.887]* |
| [High School degree or lower] | University or higher | 0.3010 | [6.774]*** | 0.3449 | [3.834]*** | 0.3933 | [5.333]*** | 0.2950 | [5.679]*** | 0.2434 | [4.269]*** |
| Occupational Status | Non regular | -0.2815 | [-5.407]*** | -0.4514 | [-4.499]*** | -0.4345 | [-5.414]*** | -0.2174 | [-3.492]*** | -0.1609 | [-2.299]** |
| [Regular] | Unemployed | -1.0823 | [-9.235]*** | -1.0368 | [-5.038]*** | -1.0755 | [-6.482]*** | -1.1144 | [-7.829]*** | -1.0923 | [-6.628]*** |
| | Retired | 0.0903 | [1.724]* | -0.0074 | [-0.077] | 0.0276 | [0.343] | 0.1028 | [1.589] | 0.1216 | [1.696]* |
| | Self employed | -0.1428 | [-2.164]** | -0.2278 | [-1.311] | -0.1336 | [-1.037] | -0.1234 | [-1.698]* | -0.1255 | [-1.590] |
| **Municipality Size** | | | | | | | | | | | |
| [Town and Village] | Small cities | 0.0735 | [1.098] | 0.1118 | [0.798] | 0.1395 | [1.237] | 0.0512 | [0.670] | 0.0292 | [0.350] |
| | Medium-sized cities | 0.0070 | [0.099] | -0.1004 | [-0.690] | -0.0308 | [-0.262] | 0.0388 | [0.480] | 0.0319 | [0.359] |
| | 20 Major cities | 0.0068 | [0.092] | 0.0501 | [0.334] | 0.0853 | [0.702] | -0.0181 | [-0.214] | -0.0495 | [-0.533] |
| **Income** | | | | | | | | | | | |
| Own Income | | 0.0011 | [16.474]*** | 0.0010 | [6.938]*** | 0.0011 | [9.500]*** | 0.0012 | [15.186]*** | 0.0012 | [13.822]*** |
| Reference Income | Municipality | -0.00003 | [-0.073] | -0.00005 | [-0.056] | 0.0003 | [0.464] | -0.0002 | [-0.331] | -0.0005 | [-0.859] |
| K1 | | -5.9962 | [-22.683]*** | -13.1720 | [-7.108]*** | -10.0815 | [-9.504]*** | -7.1055 | [-11.126]*** | -7.4891 | [-6.805]*** |
| K2 | | -5.5177 | [-21.049]*** | -12.7169 | [-6.867]*** | -9.6031 | [-9.066]*** | -6.6161 | [-10.381]*** | -7.0093 | [-6.374]*** |
| K3 | | -4.8437 | [-18.626]*** | -12.0816 | [-6.530]*** | -8.9448 | [-8.457]*** | -5.9242 | [-9.313]*** | -6.3201 | [-5.751]*** |
| K4 | | -4.1292 | [-15.972]*** | -11.3258 | [-6.128]*** | -8.2214 | [-7.785]*** | -5.2237 | [-8.225]*** | -5.6085 | [-5.107]*** |
| K5 | | -3.6339 | [-14.098]*** | -10.8111 | [-5.853]*** | -7.6984 | [-7.296]*** | -4.7339 | [-7.460]*** | -5.1314 | [-4.674]*** |
| K6 | | -2.7649 | [-10.771]*** | -9.9306 | [-5.382]*** | -6.7690 | [-6.424]*** | -3.8655 | [-6.099]*** | -4.3005 | [-3.919]*** |
| K7 | | -2.1860 | [-8.531]*** | -9.3210 | [-5.054]*** | -6.1522 | [-5.844]*** | -3.2942 | [-5.201]*** | -3.7413 | [-3.411]*** |
| K8 | | -1.3341 | [-5.212]*** | -8.4959 | [-4.610]*** | -5.2840 | [-5.022]*** | -2.4293 | [-3.837]*** | -2.8924 | [-2.638]*** |
| K9 | | -0.0923 | [-0.360] | -7.4043 | [-4.018]*** | -4.1416 | [-3.936]*** | -1.1358 | [-1.794]* | -1.5886 | [-1.449] |
| K10 | | 0.8641 | [3.341]*** | -6.5936 | [-3.576]*** | -3.3312 | [-3.162]*** | -0.1233 | [-0.194] | -0.5339 | [-0.487] |
| N | | 10,416 | | 2,680 | | 4,173 | | 7,736 | | 6,243 | |
| LR Chi2 | | 1,713.2 | *** | 500.8 | *** | 821.0 | *** | 1,233.2 | *** | 908.9 | *** |

*Note*: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The variable in brackets is reference.

**Table 2b.** Ordered Logit Regression Estimation Results: Model B (Demographic Reference Group)

| | | [B-1] | | [B-2] | | | | [B-3] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Entire | | Age 20-34 | | Age 20-39 | | Age 35-69 | | Age 40-69 | |
| **Variables** | | **Coef.** | **[Z-value]** | **Coef.** | **[Z-value]** | **Coef.** | **[Z-value]** | **Coef.** | **[Z-value]** | **Coef.** | **[Z-value]** |
| **Individual Attributes** | | | | | | | | | | | |
| Age | Age | -0.1178 | [-8.625]*** | -0.6062 | [-4.693]*** | -0.3960 | [-6.006]*** | -0.1084 | [-3.375]*** | -0.1136 | [-2.468]** |
| | Age(squared) | 0.0012 | [8.571]*** | 0.0093 | [4.086]*** | 0.0056 | [5.424]*** | 0.0011 | [3.525]*** | 0.0011 | [2.629]*** |
| Gender [Male] | Female | 0.2705 | [3.468]*** | 0.4327 | [3.252]*** | 0.4036 | [3.517]*** | 0.0042 | [0.033] | -0.1440 | [-0.941] |
| Marital Status | Divorced | -0.6413 | [-8.586]*** | -1.6495 | [-4.984]*** | -1.0674 | [-6.047]*** | -0.5583 | [-7.216]*** | -0.4992 | [-6.014]*** |
| [Married] | Unmarried | -1.0704 | [-23.167]*** | -1.3142 | [-15.480]*** | -1.2680 | [-19.117]*** | -0.9417 | [-16.668]*** | -0.8330 | [-12.359]*** |
| Home Ownership [Renter] | Owner | 0.3050 | [7.683]*** | 0.1657 | [2.376]** | 0.1774 | [3.189]*** | 0.3980 | [8.149]*** | 0.4748 | [8.244]*** |
| Educational Attainment | Some college or associate degree | 0.1667 | [3.201]*** | 0.2214 | [1.984]** | 0.2791 | [3.142]*** | 0.1639 | [2.771]*** | 0.1146 | [1.773]* |
| [High School degree or lower] | University or higher | 0.3017 | [6.830]*** | 0.3448 | [3.850]*** | 0.3948 | [5.375]*** | 0.2969 | [5.748]*** | 0.2348 | [4.144]*** |
| Occupational Status | Non regular | -0.2983 | [-5.690]*** | -0.4507 | [-4.486]*** | -0.4402 | [-5.456]*** | -0.2467 | [-3.932]*** | -0.2113 | [-2.969]*** |
| [Regular] | Unemployed | -1.0881 | [-9.283]*** | -1.0356 | [-5.027]*** | -1.0770 | [-6.489]*** | -1.1266 | [-7.911]*** | -1.1188 | [-6.786]*** |
| | Retired | 0.0769 | [1.464] | -0.0067 | [-0.070] | 0.0240 | [0.297] | 0.0872 | [1.346] | 0.0911 | [1.263] |
| | Self employed | -0.1460 | [-2.212]** | -0.2283 | [-1.314] | -0.1339 | [-1.038] | -0.1316 | [-1.810]* | -0.1465 | [-1.853]* |
| **Municipality Size** | | | | | | | | | | | |
| [Town and Village] | Small cities | 0.0717 | [1.077] | 0.1112 | [0.798] | 0.1443 | [1.287] | 0.0474 | [0.624] | 0.0207 | [0.250] |
| | Medium-sized cities | 0.0048 | [0.069] | -0.1012 | [-0.703] | -0.0237 | [-0.203] | 0.0331 | [0.415] | 0.0174 | [0.199] |
| | 20 Major cities | 0.0021 | [0.030] | 0.0475 | [0.336] | 0.1028 | [0.895] | -0.0319 | [-0.403] | -0.0823 | [-0.950] |
| **Income** | | | | | | | | | | | |
| Own Income | | 0.0011 | [16.700]*** | 0.0010 | [6.984]*** | 0.0011 | [9.699]*** | 0.0012 | [15.334]*** | 0.0012 | [13.850]*** |
| Reference Income | Age and gender | -0.0008 | [-2.678]*** | 0.0001 | [0.136] | -0.0004 | [-0.668] | -0.0016 | [-3.789]*** | -0.0019 | [-3.887]*** |
| K1 | | -5.9108 | [-22.515]*** | -13.0807 | [-6.736]*** | -10.2245 | [-9.556]*** | -6.1547 | [-9.047]*** | -6.5160 | [-5.806]*** |
| K2 | | -5.4323 | [-20.869]*** | -12.6257 | [-6.506]*** | -9.7460 | [-9.121]*** | -5.6650 | [-8.342]*** | -6.0359 | [-5.382]*** |
| K3 | | -4.7581 | [-18.427]*** | -11.9904 | [-6.183]*** | -9.0876 | [-8.518]*** | -4.9725 | [-7.334]*** | -5.3456 | [-4.769]*** |
| K4 | | -4.0431 | [-15.750]*** | -11.2346 | [-5.799]*** | -8.3640 | [-7.851]*** | -4.2711 | [-6.307]*** | -4.6326 | [-4.135]*** |
| K5 | | -3.5473 | [-13.860]*** | -10.7199 | [-5.537]*** | -7.8408 | [-7.367]*** | -3.7804 | [-5.586]*** | -4.1544 | [-3.710]*** |
| K6 | | -2.6776 | [-10.505]*** | -9.8395 | [-5.087]*** | -6.9112 | [-6.503]*** | -2.9101 | [-4.303]*** | -3.3211 | [-2.967]*** |
| K7 | | -2.0984 | [-8.246]*** | -9.2298 | [-4.774]*** | -6.2944 | [-5.928]*** | -2.3379 | [-3.458]*** | -2.7608 | [-2.467]** |
| K8 | | -1.2462 | [-4.902]*** | -8.4048 | [-4.350]*** | -5.4263 | [-5.114]*** | -1.4723 | [-2.179]** | -1.9112 | [-1.708]* |
| K9 | | -0.0041 | [-0.016] | -7.3131 | [-3.785]*** | -4.2841 | [-4.036]*** | -0.1787 | [-0.264] | -0.6076 | [-0.543] |
| K10 | | 0.9524 | [3.706]*** | -6.5024 | [-3.364]*** | -3.4738 | [-3.269]*** | 0.8339 | [1.232] | 0.4469 | [0.399] |
| N | | 10,416 | | 2,680 | | 4,173 | | 7,736 | | 6,243 | |
| LR Chi2 | | 1,720.1 | *** | 500.6 | *** | 820.8 | *** | 1,247.5 | *** | 923.9 | *** |

*Note*: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The variable in brackets is reference.

predicted probability on the basis of the estimation result from Model B.[22] Because the median value of LS was 6, we adopted LS = 7 as the threshold of relatively higher satisfaction. For the entire sample (Model B-1), a 2.5 million yen increase (about $20,000 [$1 = \120]) in own income increased the probability of choosing 7 and over by 6.4 percentage points (ΔPr(LS ≥ 7)/ΔY). On the other hand, a 2.5 million yen increase in reference income decreased the probability of choosing 7 and over by 4.3 percentage points (ΔPr(LS ≥ 7)/ΔRI). Among those between the ages of 35–69 (Model B-3), a 2.5 million yen increase in own income increased the probability of choosing 7 and over (LS ≥ 7) by 6.9 percentage points. On the other hand, a 2.5 million yen increase in reference income decreased the probability of choosing 7 and over (LS ≥ 7) by 8.9 percentage points. Among those between the ages of 40–69 (Model B-3), a 2.5 million yen increase in own income increased the probability of choosing 7 and over (LS ≥ 7) by 6.8 percentage points. On the other hand, a 2.5 million yen increase in reference income decreased the probability of choosing 7 and over (LS ≥ 7) by 10.9 percentage points.

In Table 3, "difference" represents the difference (i.e., (|ΔPr/ΔY|–|ΔPr/ΔRI|) between absolute value of marginal effect of the predicted probability for increase in an individual's own income (|ΔPr/ΔY|) and marginal effect of the predicted probability for increase in reference income (|ΔPr/ΔRI|). When "difference" is positive, then the marginal effect of increase in own income is larger than the marginal effect of increase in reference income (i.e. |ΔPr/ΔY | > |ΔPr/ΔRI|). Inversely, when "difference" is negative, then the marginal effect of increase in reference income is larger than the marginal effect of increase in own income (i.e., |ΔPr/ΔY| < |ΔPr/ΔRI|). The "difference" of the entire sample was positive. On the other hand, the "difference" of the later life sub-sample was negative (for example, the probability of choosing high LS (Pr(LS ≥ 7) was –2.0 point in age 35–69 and –3.8 point in age 40–69 sub-samples), which means that the marginal effect of an increase in reference income is larger than the marginal effect of an increase in own income as one ages.[23]

## CONCLUSIONS

While the relative income hypothesis states that higher reference income triggers a feeling of envy and thus has a negative effect on individual happiness, empirical studies have not yet reached a consensus on how reference income affects individual happiness. Thus, in this study, we distinguished the information effect from the comparison effect and examined which factors affect the relative importance of comparison and information

**Table 3.** Average Discrete Change (ADC) of Increased Income

(Unit: %, percentage point)

| Sample | LS | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | LS≥7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Entire** | Pr(LS) | 3.3 | 1.9 | 4.2 | 7.3 | 7.2 | 16.7 | 12.8 | 17.8 | 17.5 | 6.5 | 4.8 | 46.6 |
| **Entire** | ⊿ Pr/ ⊿ Y | –0.8 | –0.4 | –0.9 | –1.3 | –1.0 | –1.6 | –0.4 | 0.8 | 2.6 | 1.6 | 1.4 | 6.4 |
| | ⊿ Pr/ ⊿ RI | 0.7 | 0.3 | 0.7 | 1.0 | 0.7 | 0.9 | 0.1 | –0.8 | –1.8 | –0.9 | –0.8 | –4.3 |
| **Age 35–69** | ⊿ Pr/ ⊿ Y | –0.8 | –0.4 | –0.9 | –1.3 | –1.1 | –1.8 | –0.5 | 0.7 | 2.9 | 1.8 | 1.5 | 6.9 |
| | ⊿ Pr/ ⊿ RI | 1.4 | 0.7 | 1.4 | 2.0 | 1.5 | 1.8 | 0.1 | –1.7 | –3.8 | –1.9 | –1.5 | –8.9 |
| **Age 40–69** | ⊿ Pr/ ⊿ Y | –0.7 | –0.4 | –0.9 | –1.3 | –1.1 | –1.7 | –0.6 | 0.6 | 2.9 | 1.8 | 1.5 | 6.8 |
| | ⊿ Pr/ ⊿ RI | 1.7 | 0.8 | 1.7 | 2.4 | 1.7 | 2.1 | 0.1 | –2.0 | –4.6 | –2.3 | –1.7 | –10.6 |
| **Entire** | Difference | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | 0.7 | 0.3 | 0.0 | 0.8 | 0.7 | 0.6 | 2.1 |
| **Age 35–69** | Difference | –0.6 | –0.3 | –0.5 | –0.7 | –0.4 | 0.0 | 0.4 | –1.0 | –0.9 | –0.1 | 0.0 | –2.0 |
| **Age 40–69** | Difference | –1.0 | –0.4 | –0.8 | –1.1 | –0.6 | –0.4 | 0.5 | –1.4 | –1.7 | –0.5 | –0.2 | –3.8 |

*Note*: LS: Life Satisfaction, Y: Own Income, RI: Reference income.
Pr(LS): Predicted probability of choosing LS = m, Unit: %.
ΔPr/ΔY: Marginal effect of predicted probability for 2.5-million-yen increase in own income, Unit: percentage point.
ΔPr/ΔRI: Marginal effect of predicted probability for 2.5-million-yen increase in reference income,
Unit: percentage point.
Difference: |ΔPr/ΔY| − |ΔPr/ΔRI|, Unit: point.

effects using Japanese nationwide survey data from 2015. Our main findings are as follows. First, our empirical findings from the "later life" sample (ages 35–69 or 40–69) show a negative association between LS and average income of the demographic reference group. On the other hand, our empirical results from the "early life" sample (ages 20–34 or 20–39) show no association between LS and average income of the demographic reference group. These results indicate that the information effect from ambition cancels out the comparison effect in one's early life, while the comparison effect dominates the information effect in one's later life. In short, these results indicate that individuals in later life envy the increased income of their demographic reference group, while young individuals are more mobile and more likely to be ambitious when faced with the increased income of their demographic reference group. Consequently, our results partially support Hypothesis 1 and fully support Hypothesis 2.[24]

Second, our empirical results show no significant associations between LS and the average income of the spatial reference group. This result is consistent with Brown et al. (2015). This suggests that the information effect from both the area wealth effect and ambition canceled out the comparison effect. Therefore, our results support Hypothesis 3.[25]

Third, we found that among those in the "later life" sample, the marginal effect of an increase in reference income is larger than the marginal effect of an increase in individual own income. Individuals in their later life have faced severe employment reduction under Japan's long-term economic slump that began in the early 1990s. Thus, they may be more likely to feel jealousy at the economic success of their peers. However, further research is needed to provide a more detailed explanation of this larger comparison effect in one's later life.

Our contribution to the study of happiness is that we verified the relative importance of comparison and information effects depending on the degree of mobility in life stage in Japan. This is consistent with results of previous international studies such as Senik (2008) and FitzRoy et al. (2014). In addition, our results imply that the estimations of reference income across all age samples make the mistake of interpreting the relative importance of comparison and information effects.

Further research remains to be done. There is still no consensus as to which spatial reference groups have the most influence on individual happiness. Our results indicated that the information effect canceled out the comparison effect when municipality was adopted as the reference group. For example, this study could not examine prefectures as the spatial reference groups. Likewise, the effect of average prefectural income might depend on the relative importance of the information and comparison effects. Individuals might see an increase in average prefectural income as a signal of their own future prospects; benefits from the improvement of a local economy are not limited to a small area such as municipality but are spread across a wide area. On the other hand, the area wealth effect of a prefecture might be weak, because prefectural services are not closely related to residents' daily lives.[26] This issue must be addressed in the future.

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## Notes

1. The reference group is the set of relevant others to which individuals compare themselves; it is defined based on geographic location and demographic characteristics such as age, gender, and education.
2. Previous empirical studies in Japan of the relative income hypothesis examined the relationship between individual happiness and the Gini coefficient, which indicates income inequality in one's prefecture or municipality (e.g., Oshio and Kobayashi 2009; Oshio and Kobayashi 2011; Inaba et al. 2015; Sumi 2016). However, no Japanese studies have determined the effect of income inequality according to one's place of residence. See Sumi (2016) for more detailed

information.

3. See Hirschman and Rothschild (1973) and Senik (2008) for more information.
4. For example, if high-level public education in the local community provides residents high income earning opportunities, better public services are likely to increase individuals' expected income.
5. Senik (2008) examined how subjective well-being depends on both individual and reference income and found that information effects dominate in transitioning European countries and the United States, both of which have high social mobility, while comparison effects are dominant in stable European countries with low social mobility (such as the UK, Germany, the Netherlands, etc.).
6. FitzRoy et al. (2014) found positive effects of reference income on happiness for those under 45 and negative effects for those over 45 in Germany and the UK.
7. Alternatively, individual utility might be affected by a prefecture's average income. There is no consensus as to the spatial group that has an influence on individual happiness. Further research is needed to examine the association between happiness and average prefectural income.
8. As a reference, it is generally believed that a critical period for career change in the Japanese labor market is around age 35. To check the robustness of age categories in early life and later life, we adopted two types of age categories for each life stage.
9. According to analysis of the Japanese-style employment system in 2011 by Ministry of Health, Labor and Welfare (*Analysis of the Labor Economy 2015*), Japanese male workers aged 35–54 had the most seniority among main OECD countries (such as continental European counties and the United States), while Japanese male workers aged 15–34 had the average length of service among these countries. These data indicate that long-term employment practices still show little change and lower social mobility in later life in Japan. On the other hand, Japanese female workers aged 40–69 had relatively short-term seniority among the main OECD countries. This was because many females in this age group left their jobs because of childbirth and childcare and did not return to work. This also indicates female's low social mobility in later life in Japan.
10. Senshu University Center for Social Well-being Studies (2014–2018), led by Hiroo Harada, is conducting the International Comparative Survey on Lifestyle and Values to facilitate large-scale systematic exploration of determinants of well-being. Surveys have been completed in Japan (February 2015), South Korea (summer 2015), Vietnam (autumn 2015), the Philippines (autumn 2016), Thailand (winter 2016), and Indonesia and Taiwan (2017). In this study, we analyze findings from the February 2015 survey in Japan.
11. The survey consisted of four main categories: 32 questions on social well-being, 10 questions on social capital, eight on risk, and six on social networks.
12. Responses to the standard life satisfaction question, "How satisfied are you currently with overall life?" are used to measure happiness (c.f., Ferrer-i-Carbonell 2005; Goerke and Pannenberg 2015).
13. An ordered logit/probit estimation was also used by Blanchflower and Oswald (2004), Helliwell and Huang (2005), and Shields et al. (2009). This method is appropriate where the dependent variable has more than two categories and the values of each category have a meaningful sequential order where one value is higher than the previous one.
14. In the ordered logit model, $u$ is logistically distributed with $F(z) = e^z / (1+e^z)$.
15. These are formally government-designated cities with populations over 500,000. All 20 major cities had populations over 700,000 in 2015.
16. Median values are used as reference values for all segments, except for the group who earned 20,000,000 yen or more, for which 32,600,000 yen is used. According to the Statistical Survey of Actual Status of Salary in the Private Sector, conducted by the National Tax Agency, the average income of those who earn 20,000,000 yen or more was 32,600,000 yen in 2015.
17. Taxable income data do not include income earned by those whose income falls below the exemption limits, a category that accounts for almost 40% of income earners in Japan. The proportion of non-taxpayers in a region might differ slightly between regions, but in this analysis the differences are disregarded for the sake of simplicity.
18. Data on annual taxable personal income of municipality were derived from "Taxation Trends in the Municipal Tax" (Ministry of Internal Affairs and Communications). Data on annual personal income by gender and age were derived from the "Statistical Survey of Actual Status for Salary in the Private Sector" (National Tax Agency).
19. In 2015, there were 1,741 Japanese municipalities. Our sample covered 66.7% of these.
20. The null hypothesis of the log likelihood ratio chi-square ($LR\chi^2$) test that all predictor variables do not contribute to the model was rejected in all models.
21. Another measure of marginal effect is a discrete change in mean (MDC). The MDC was computed for all variables held at their means (MDC = $\Delta\Pr(LS_i = m|\overline{X}, x_l = \overline{x_l} / \Delta x_l)$.
22. For example, a 2.5 million yen increase in an individual's own income decreased the probability of choosing 5 (LS = 5) by 1.6 percentage points and increased the probability of choosing 8 (LS = 8) by 2.6 percentage points. On the other hand, a 2.5 million yen increase in reference income significantly decreased the probability of choosing 8 (LS = 8) by 1.8 percentage points and increased the probability of choosing 3 (LS = 3) by 1.0 percentage points, on average.
23. Any increase in the amount of income, such as 1.25 million yen (about 10,000 dollar) had the same marginal effect.
24. To assume that the insignificant effect means cancellation of the comparison effect by the information effect, we need to rigorously show that information and comparison effect have independently positive and negative effects on LS. Further research is needed to examine these effect.
25. However, as noted above, there is another possibility: the effect of reference income is insignificant because both effects are originally very small and insignificant, not because of the cancellation.
26. In Japan, prefectures provide local public services covering a broader area and coordinate affairs among municipalities. For example, prefectures are responsible for police, high schools, road networks, etc.

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