Relative Concerns, Happiness, and Reproductive Behavior*

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Abstract

This study aims to understand how differences in relative concerns lead to different patterns of reproductive behavior and economic performance. For this purpose, this study incorporates cross-country differences in relative concerns into an economic model and demonstrates that, after controlling for income, countries with greater relative concerns are characterized by lower fertility, higher (more) education, faster economic growth, and, furthermore, lower happiness. These hypotheses are supported by regression analysis using cross-country data.

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1 Introduction

An increasing number of studies in economics search for biological bases of preferences. The biological basis of time preferences, for example, has been examined by Rogers (1994), Sozou and Seymour (2003), Robson and Samuelson (2009), Kageyama (2011b, 2012c), and Chowdhry (2011). The origin of relative concerns, likewise, has been investigated by Cole, Mailath and Postlewaite (1992, 1995), Robson (1996, 2001), Samuelson (2004), Nöldeke and Samuelson (2005), Rayo and Becker (2007), De Fraja (2009), and Kageyama (2012a).[1]

Yet, the aim of these studies is often limited to providing explanations for the preferences that have already been discovered and confirmed in empirical and experimental studies, such as the age-trajectory of time preference, hyperbolic discounting, and the happiness-income paradox. An attempt to make novel predictions on preferences purely from biological theories is still rare.

The contribution of such an attempt is not only to fulfill theoretical interests. More importantly, particularly in social science, its significance lies in its application to provide explanations for economic and social phenomena. A novel prediction on preferences inserts a unique perspective into the study of sociality.

Kageyama (2012a, 2013) are early efforts toward this direction. Employing a biological model, Kageyama (2012a) shows that naturally selected preferences include concerns for one's relative standing, providing an explanation for the happiness-income paradox (see, e.g., Easterlin, 1974; Clark, Frijters and Shields, 2008b), and further predicts that the degree of such concerns depend on income, likely to be increasing in income. Then, using an economic model, Kageyama (2013) demonstrates that such preferences induce fertility transition along with economic development. By incorporating biologically-predicted preferences into economics, it provides a novel explanation for the general pattern of modernization.

Along this line, the present study extends the economic model of Kageyama (2013). In particular, since Kageyama (2013) focuses on the general pattern of modernization and does not address the cross-country differences, the present study incorporates cross-country differences in relative concerns and examines how these differences lead to different patterns of reproductive behavior, which is characterized by the resource allocation between fertility and education, and economic performance.

The structure of this paper is as follows. The next section provides a theoretical model, and Section 3 performs regression analyses. The empirical results support the theoretical hypothesis that, controlling for income, countries with greater relative concerns are characterized by lower

[1]See Robson and Samuelson (2008) for the recent progress in this area.

fertility, higher (more) education, faster economic growth, and lower happiness. Section 4 concludes.

2 Theoretical Analysis

2.1 The setting

I assume that the model satisfies the following properties. First, individuals are homogenous. Second, individuals live for two periods, the first period we refer to as childhood, and the second period, adulthood. Third, individuals make all decisions in adulthood. Forth, at period t, income, y_t, is allocated to consumption, c_t, the number of children, m_t, and educational input, s_t. Thus, the budget constraint is given by

$$y_t \geq c_t + (\psi + \sigma s_t)m_t \tag{1}$$

where ψ and σ respectively denote the cost of raising a child and the price of educational input, both of which are time-invariant. Fifth, income depends on human capital, h_t, and human capital depends on educational input in the previous period. Specifically, they are respectively given by $y_t = \omega h_t$ and $h_t = s_{t-1}^{\beta}$ where ω is wage rate and $\beta < 1$ is an efficiency parameter.

Sixth, individuals are endowed with income-dependent relative preferences, meaning that individuals are concerned with their own relative standing and that the degree of such concerns is increasing in income. Seventh, parents care about the well-being of their children as well as their own. However, as parents cannot directly observe their children's utility, I assume that parents perceive children's utility through empathy. Empathy helps the parents understand the feelings of children but through the parents' own scale of utility.[2]

This has two implications. First, parents use the same income-dependent relative preferences to measure their children's well-being. Second, since parents obtain their own utility from consumption in adulthood, they care about their children's consumption in their adulthood. To capture this latter aspect, I assume that parents are concerned with their children's growth that signals the children's consumption after they grow up, and that they measure children's growth with educational output that becomes human capital in adulthood.

By putting these conditions together and by following Weber's law that suggests that we measure utility in logarithmic form, the utility function of the adult at period t can be written as

$$U_t = \gamma \ln(c_t - \hat{c}_t) + (1-\gamma) \ln \left[m_t \left(s_t^{\beta} - \widehat{s_t^{\beta}} \right) \right] \tag{2}$$

[2]The argument "we sympathize even with the dead (Smith, 1759)" is a good illustration of how we use our own scale of utility to measure the feelings of others.

where γ is the importance of one's own consumption relative to reproduction, and $\hat{c}_t$ and $\widehat{s_t^\beta}$ are the reference levels for comparison.

Here, $\hat{c}_t$ and $\widehat{s_t^\beta}$ depend on their social averages, $\bar{c}_t$ and $\overline{s_t^\beta}$, such that $\hat{c}_t = z_t \bar{c}_t$ and $\widehat{s_t^\beta} = z_t \overline{s_t^\beta}$ where z_t denotes the degree of concerns for the social averages. As z_t increases, the individual cares more about the social averages, and if $z_t = 0$, the individual cares only about absolute levels. Note that, given that $z_{\max}$ is the upper limit of z_t, I assume for technical simplicity that the condition $z_{\max} < 1 - \beta$ holds.

Furthermore, to capture the income-dependency and cross-country differences in relative concerns, I let $z_t = z(y_t, \alpha)$ where α denotes the country's basic level of relative concerns. A larger α means a greater level of relative concerns. I assume that $z_y(y_t, \alpha) > 0$ and $z_\alpha(y_t, \alpha) > 0$ hold for any $z(y_t, \alpha) \leq z_{\max}$ where the subscript denotes a partial derivative.

2.2 Solution

With these specifications, the Lagrangian for the adult at period t becomes

$$\begin{aligned} L(c_t, m_t, s_t, \lambda_t) &= \gamma \log(c_t - \hat{c}_t) + (1-\gamma) \log \left[m_t \left(s_t^\beta - \widehat{s_t^\beta} \right) \right] \\ &\quad + \lambda_t \left[y_t - c_t - (\psi + \sigma s_t) m_t \right]. \end{aligned} \tag{3}$$

where λ_t is the Lagrangian multiplier. Note that y_t is not controllable for the adult at period t as it is determined by educational input in the previous period. Subsequently, the first-order conditions are given by

$$\frac{\partial L}{\partial c} = \gamma \frac{1}{c - \hat{c}} - \lambda = 0, \tag{4}$$

$$\frac{\partial L}{\partial m} = (1-\gamma) \frac{1}{m} - \lambda (\psi + \sigma s) = 0, \tag{5}$$

$$\frac{\partial L}{\partial s} = (1-\gamma) \frac{\beta s^{\beta-1}}{s^\beta - \widehat{s^\beta}} - \lambda \sigma m = 0, \tag{6}$$

and

$$\frac{\partial L}{\partial \lambda} = y - c - (\psi + \sigma s) m = 0 \tag{7}$$

where period subscripts are suppressed whenever possible.

Next, assume that the population is sufficiently large that the changes in c and s at the individual level have a negligible impact on the social averages. Then, by applying the condition that adults are homogeneous and thus choose the same levels of c and s, $\bar{c}$ and $\overline{s^\beta}$ are respectively given by c and s^β. As a result, consumption, fertility, and education become

$$c = \frac{\gamma}{\gamma + [1 - z(y, \alpha)](1-\gamma)} y, \tag{8}$$

$$m = \frac{[1 - z(y, \alpha) - \beta](1 - \gamma)}{\gamma + [1 - z(y, \alpha)](1 - \gamma)} \frac{y}{\psi}, \tag{9}$$

and

$$s = \frac{\psi}{\sigma} \frac{\beta}{1 - z(y, \alpha) - \beta}. \tag{10}$$

At the same time, income depends on education. Education intertemporally affects income through the level of human capital. This intertemporal effect is summarized in the dynamics of human capital. By inserting equation (10) and $y_t = \omega h_t$ into $h_{t+1} = s_t^\beta$, h_{t+1} becomes

$$h_{t+1} = j(h_t, \alpha) = \left[\frac{\psi}{\sigma} \frac{\beta}{1 - z(\omega h_t, \alpha) - \beta} \right]^\beta. \tag{11}$$

Thus, given α as well as the other parameter values, human capital depends only on its past value.

To further examine the dynamics, consider the case, which I call the benchmark scenario, where $z(y, \alpha)$ is linear in y such that $z(y, \alpha) = \eta y + \alpha$ for $z(y, \alpha) \leq z_{\max}$. In this scenario, the dynamics of human capital can be separated into two cases, depending on the value of the educational cost, σ.

Figure 1 presents these two cases. The convex curve at the bottom represents the case for high σ (high education cost). In this case, there potentially exist three steady states, the two of which satisfy $h_{t+1} = h_t$, and, among these two, the one with the lower h_t is stable and the one with the higher h_t, which may or may not exist depending on the value of σ, is unstable. Here, the lower steady state can be regarded as the Malthusian trap because poverty, high fertility, low human capital, and the positive correlation between income and fertility coexist. The remaining steady state corresponds to the corner solution at $z_{\max}$ and satisfies $h_{t+1} = j(h_{\max})$ where $h_{\max} = \frac{z_{\max}}{\eta\omega}$. This steady state is either stable or unstable depending on σ.

Place Figure 1 around here

The convex curve at the top represents the other case in which σ is low (low education cost). In this case, the steady state corresponding to the corner solution at $z_{\max}$ is unique and stable. Therefore, human capital continues to grow until it reaches its upper limit where $h_{t+1} = j(h_{\max})$ holds.

2.3 Hypotheses

These results provide the following testable hypotheses. The first set of hypotheses relates to the effect of income on reproductive behavior. By differentiating equations (9) and (10) with respect to y, we obtain:

Hypotheses 1 (Income effect on reproductive behavior). Controlling for α,

(a) The effect of income on fertility is contingent on how $z(y, \alpha)$ depends on income. In the benchmark scenario, fertility increases with income while income is low, and decreases with income while income is high (see the concave curve in Figure 1).

(b) Education increases with income.

The second set of hypotheses relates to the effect of cross-country differences in relative concerns on reproductive behavior. By differentiating equations (9) and (10) with respect to α, we obtain:

Hypotheses 2 (Concern effect on reproductive behavior). Controlling for income,

(a) Fertility decreases with α.

(b) Education increases with α.

The third hypothesis is about the effect of relative concerns on utility. Inserting the optimal values of c, m, and s into equation (2), and differentiating it with respect to α, we obtain:

Hypothesis 3 (Concern effect on utility). Controlling for income, utility decreases with α. In addition, as long as happiness captures utility, the same is true for happiness (see Figure 2 that presents examples of the utility curve with and without income-dependent relative preferences).[3]

Place Figure 2 around here

Turning to the intertemporal aspect and differentiating equation (11) with respect to α, we obtain the result that a larger α leads to a greater h_{t+1}. Thus, with respect to economic growth on the transitional path, we obtain:

Hypothesis 4. Given the same level of human capital, countries with a larger α experience a greater increase in human capital, and, thus, a higher rate of economic growth.

Therefore, putting Hypotheses 2, 3, and 4 together, we can hypothesize that, after controlling for income, greater relative concerns result in lower fertility, higher (more) education, faster economic growth, and lower happiness.[4]

[3] I use happiness as a proxy for utility because they are the closest data available to utility.

[4] We also obtain the following hypotheses. First, with respect to the fertility transition characterized by the initial increase in fertility and the reduction thereafter, we obtain:

Hypothesis n1. Countries with a larger α move to the fertility reduction phase at a lower level of income.

Second, concerning the Malthusian trap,

Hypotheses n2.

(a) Countries with a larger α attain a higher income level even in the Malthusian trap.

(b) Countries with a larger α move to growth transitional path with a smaller decline in education cost.

These hypotheses are not empirically tested in the present study and left for future research as they require

3 Regression Analysis

3.1 Methods

The next step is to test these hypotheses. To do this, however, we face the following problems. One is that the sample size is small. Due to limited data on happiness, the number of observations is only 60. Although using panel data provides a potential remedy, fertility and education decisions are made at the generational time scale, say, 20 to 30 years, and panel data covering such a long period of time are unavailable. Thus, I stick to cross-sectional analyses with 60 observations.

Another problem is that we do not have any measure of the country's basic level of relative concerns, denoted by α in the theoretical analysis. For this reason, I use happiness as an explanatory variable and test its correlations with fertility, education, and economic growth. Namely, I regress fertility, education, and economic growth respectively on happiness. Given that α and happiness are negatively correlated, happiness is expected to be correlated positively with fertility and negatively with both education and economic growth.

Here, it is worth noting the importance of controlling for income. As indicated in the theoretical analysis, income is expected to affect happiness, fertility, education, and economic growth. Thus, I always include income as an explanatory variable. Doing this does not only control its effects on fertility, education, and economic growth, but also removes the effect on happiness.

Finally, we also face the problem of reverse causality. Fertility, education, and economic growth potentially affect both happiness and income. To solve this problem, I use IV estimation.

3.2 Data

The data for happiness are taken from European and World Values Surveys, Wave 4 (1999—2004). Among others, one question asks, "Taking all things together, would you say you are: very happy (4), quite happy (3), not very happy (2), or not at all happy (1)?"

Following Ferrer-i-Carbonell and Frijters (2004), I treat the data as cardinal. Their study shows that, whereas happiness data are, by nature, ordinal, assuming cardinality makes little difference to the results. This provides a basis for employing the average level of happiness, *hpn*, as a national indicator of happiness.

Among 60 countries for which the data are available, the cross-country average of *hpn* is 3.04. The happiest country is Nigeria (3.58) and the least is Romania (2.39).[5] For calculating

historical data.

[5]Countries with an annual average growth rate of less than five percent are omitted considering that these

hpn, the number of respondents is on average 1,430 (740 women and 689 men). The largest number is 4,605 (2,301 women and 2,304 men) in Turkey, and the least is 809 (412 women and 397 men) in Lithuania.

The data for income, y, and economic growth, g, are taken form Penn World Tables. I use the purchasing-power-parity adjusted per-capita GDP and its growth rate. These data, as well as others presented below, are averaged over the period 2000-2004 unless otherwise noted. In fertility and education regression models, I use $\ln(y)$ and not y as it offers higher t-values.

The data for fertility and education are taken from the World Bank. Fertility is measured by total fertility rate, m. Education is measured by tertiary school enrollment ratio, ts, or net secondary school enrollment ratio, ss. The number of sample countries decreases to 48 when ss is used.

Turning to covariates that potentially influence fertility, education, or economic growth, I incorporate the women's labor force ratio, wl, the share of government final consumption expenditure in GDP, gs, and openness, op. The data for wl and gs are taken from the World Bank, and the data for op are taken from PWT.

I also include regional dummies using the UN regional code. However, I separate European countries into the former communist countries and the others as happiness data in the former communist countries often show unique patterns.

As for instrumental variables, I use the life expectancy gap between women and men, lg, to control for the reverse effect on happiness. Besides, I use the happiness gap between women and men, hg, or the price level, p, for testing the validity of lg. These variables are found significantly correlated with hpn in Kageyama (2011a, 2012b), and not expected to be correlated with either fertility, education, or economic growth. The data for lg are taken from UN, and the data for p are taken from PWT.

To control for the reverse effect on income, on the other hand, I employ the price level, p. With respect to the regression model for economic growth, however, I simply replace y by the data in the previous period (averaged over the period 1995-1999), $y(-1)$, since it is more efficient.

countries were in the midst of social upheaval. Zimbabwe, the growth rate of which was -6.56%, corresponds to this case. This figure is exceptionally low as the second lowest is -0.94% in Jordan.

3.3 Regression Results

3.3.1 Fertility

Table 1 presents the regression results on fertility. Equation (1-1) is the basic regression equation, which includes only hpn and $\ln(y)$ as explanatory variables. Equation (1-2) extends equation (1-1) by incorporating wl, gs, and regional dummies, and equation (1-3) removes variables with low t-value.

Place Table 1 around here

The results on hpn are consistent with Hypotheses 2(a) and 3. In these equations, the coefficients of hpn are significantly positive at least at the 5% level, supporting the hypothesis that a greater α, proxied by lower happiness, leads to lower fertility.

However, while equation (1-1) shows no sign of under- or weak-identification (Stock and Yogo, 2005; Kleibergen and Paap, 2006), equations (1-2) and (1-3) indicate that the instruments are potentially weak. This is due to the inclusion of regional dummies.

To solve this problem and test the validity of instruments, equation (1-4) adds hg as an instrument and use the LIML method that produces less biased estimates. The results show that, while the test score for weak-identification improves moderately, the coefficient of hpn is significantly positive at the 1% level. In addition, the test scores for over-identification (Hansen, 1982) shows no sign of endogeneity among instruments. These results point to the validity of the regression model. Putting these results together, we can estimate that an increase in happiness by 0.1 point is associated with a rise in fertility rate by about 0.3 point.

Turning to the other results, equation (1-5) shows that, under OLS estimation, the coefficient of hpn is much smaller. This suggests that fertility has a negative impact on happiness at the country level. As for $\ln(y)$, its coefficients are significantly negative at the 1% level in all equations, indicating that fertility is negatively correlated with income. This is consistent with Hypothesis 1(a) if it captures the negative income effect that goes through $z(y, \alpha)$. By contrast, wl and gs are insignificant even at the 10% level.

3.3.2 Education

Table 2 presents the regression results on tertiary education. Similar to the fertility regression model, equation (2-1) employs hpn and $\ln(y)$ as explanatory variables, equation (2-2) adds wl, gs, and regional dummies, and equation (2-3) omits variables with low t-value.

Place Table 2 around here

The results on *hpn* are consistent with Hypotheses 2(b) and 3. In equations (2-1) to (2-3), the coefficients of *hpn* are significantly negative at the 1% level, supporting the hypothesis that a greater α, proxied by lower happiness, leads to more education.

The first-stage regression results with respect to under- and weak-identifications are virtually the same as the fertility regression model. In equation (2-4) in which the LIML method is applied, the results do not change in any meaningful way. The test scores for over-identification points to the validity of the instruments. These results indicate that, after controlling for regional differences, an increase in happiness by 0.1 point is associated with a reduction in territory education rate by five to seven points.

With respect to other results, equation (2-5) reports that the coefficient of *hpn* becomes much smaller in absolute value under OLS estimation. This points to the possibility that education positively affects happiness, supporting the view that education is not thoroughly positional.

Turning to $\ln(y)$, its coefficients are significantly positive at the 1% level in all equations. This is consistent with Hypothesis 1(b) if it captures the positive income effect that goes through $z(y, \alpha)$. In addition, the coefficients of *wl* are found significant at the 1% level with the expected sign, although we are unable to draw any conclusion on the direction of the causality from this result.

Next, Table 3 presents the regression results on secondary education. The results are, in general, similar to those on territory education. However, while equation (3-1) shows that the coefficient of *hpn* is significantly negative at the 1% level, equation (3-2) shows that it is insignificant even at the 10% level when *wl*, *gs*, and regional dummies are included. This is due to the weak instrument as Shea's partial R^2 (Shea, 1997) indicates. A small sample size reduces the explanatory power of the instruments in the first-stage regression. To solve for this problem, equation (3-3) applies the LIML method adding *hg* as an instrument, and, as a result, the coefficient of *hpn* becomes significantly negative at the 10% level. This is consistent with Hypotheses 2(b) and 3.

Place Table 3 around here

3.3.3 Economic Growth

Table 4 presents the regression results on economic growth. Equation (4-1) employs *hpn* and $y(-1)$ as explanatory variables, equation (4-2) adds *wl*, *gs*, *op*, and regional dummies, and equation (4-3) omits variables with low t-value. Note that $y(-1)$ is included regardless of its significance level to control the effect of income on happiness.

Place Table 4 around here

The results on *hpn* accord with Hypotheses 3 and 4. The coefficients of *hpn* are significantly negative at least at the 5% level, supporting the hypothesis that a greater α, proxied by lower happiness, leads to a higher growth rate. Equation (4-4) demonstrates that using the LIML method to control for the weak-identification problem does not change the result except lowering the significance level to the 10% level. The test scores for over-identification point to the validity of the instruments. Note that, in equation (4-4), I employ p as an additional instrument since it is available in the current regression model and is more significant than *hg* in the first-stage regression. These results suggest that an increase in happiness by 0.1 point is associated with a reduction in growth rate by about 0.8 point.

Turning to other results, equation (4-5) shows that, under OLS estimation, the coefficient of *hpn* becomes smaller in absolute value. This is consistent with the idea that the reverse effect of economic growth on happiness is positive. As for other variables, the coefficients of $y(-1)$ are insignificant at the 10% level. The coefficients of *wl* and *op*, on the other hand, are significant at least at the 10% level with the expected signs under IV estimation.

3.3.4 An application to the quality-quantity trade-off

As shown above, happiness is positively correlated with fertility and negatively with education. These relationships potentially provide an explanation for the quality-quantity trade-off. The negative happiness-fertility and the positive happiness-education relationships generate an artifactual negative correlation between fertility and education. To test this possibility, I again perform regression analyses.

Table 5 presents the results. I include $ln(y)$ as a covariate in all equations, and, as for education, I test both territory and secondary education. Equations (5-1) to (5-4) show the results without controlling for happiness, and equations (5-5) to (5-8) show the results controlling for happiness.

Place Table 5 around here

The results are consistent with the expectation. Without controlling for happiness, fertility and education are negatively correlated at least at the 10% level of significance. However, after controlling for happiness, the significant negative correlation between fertility and education disappears while the coefficients of *hpn* are significant at least at the 10% level with the expected signs. In equation (5-7), the coefficient of *ts* is significantly *positive* at the 10% level, potentially capturing the complementarity between fertility and education. These results support the idea that the quality-quantity trade-off is spurious.

3.4 Comparison with previous findings

The next step is to compare the present results to previous findings to assess consistency. First, with respect to the happiness-fertility relationship, the findings in previous studies are mixed. While studies using individual cross-sectional data show that children have a negative impact on happiness (see Hansen, 2012, for a review), studies using longitudinal data, which eliminate problems related to individual differences, indicate that happiness and fertility are positively correlated around the time of childbirth. For example, Parr (2010) examines the effect of happiness on fertility and finds a positive relationship between life satisfaction and fertility two years later. Similar results are found while examining the reverse effect (e.g., Clark, Diener, Georgellis and Lucas, 2008a; Myrskylä and Margolis, 2012), although whether children have a long-lasting positive effect is still debated. Using the data of identical twins, Kohler, Behrman and Skytthe (2003) also show that partnership and first-born children raises subjective well-being, especially, of females. These results point to the existence of complex relationships between fertility and happiness due to simultaneous causality. Nevertheless, these findings can be reconciled by considering that, while children exert a negative impact on happiness, happiness has a positive effect on fertility. This accords with the results in the present study and accounts for why the coefficient of happiness becomes smaller under OLS estimation.

As for the happiness-education relationship, previous results are inconclusive. As discussed in the literature review in Cunado and de Gracia (2011), while some studies demonstrate that education is positively correlated with happiness, others obtain the opposite result. The present study provides a comprehensive explanation for this latter result. By extending the idea of the present study as such that individuals with greater relative concerns demand more education not only for their children but also for themselves, we can expect a negative correlation between happiness and education at the individual level. Namely, “education is endogenous, being chosen by people who are naturally more difficult to please (Clark, 2003)," and, if this relationship dominates the positive effect of education on happiness, the net correlation between happiness and education becomes negative. The present results, including the result that the coefficient of happiness becomes smaller in absolute value under OLS estimation, supports this hypothesis.

Turning to the happiness-growth relationship, previous studies again show mixed results. Kenny (1999) hypothesizes that 'trust in people' positively connects happiness and economic growth and shows that happiness causes income growth using aggregate data. However, as he noted in the paper, the evidence is weak. In the fixed-effect model, happiness is positively correlated with income growth whereas, in the pooled OLS model, they are negatively correlated. This suggests that, after controlling for country-specific factors such as social differences, happiness positively influences income growth, whereas, without controlling for such aspects, happiness negatively influences growth. These results show no contradiction to the present results as the source of the negative correlation is the cross-country difference of relative concerns. In the fixed-effect model, this difference can be absorbed in the country-specific constant term.[6]

Furthermore, the present results are in line with studies that examine the reverse effect of economic growth on happiness. For example, Deaton (2008) use cross-country data from the Gallup World Poll and finds a negative correlation. The present study provides an explanation for this negative correlation. Inglehart, Foa, Peterson and Welzel (2008), by contrast, find a positive correlation using individual data. The result in the present study that the coefficient of happiness becomes smaller in absolute value under OLS estimation is consistent with this result.

Finally, as for the quality-quantity trade-off, the results in present study accord with the finding in Angrist, Lavy and Schlosser (2010) that an exogenous increase in fertility does not lower education at the individual level. Fertility and education are not necessarily directly related with each other.

4 Concluding Remarks

This study aims to understand how differences in relative concerns result in different patterns of reproductive behavior and economic performance. To do this, the theoretical model incorporates income-dependency and cross-country differences of relative concerns and demonstrates that, after controlling for income, countries with greater relative concerns are characterized by

[6]Among unpublished works, Li and Lu (2010) regress economic growth on life satisfaction with cross-country data, controlling for the endogeneity, and demonstrate that life satisfaction positively influences economic growth. The reason that Li and Lu (2010) and the present study obtain opposing results is yet to be solved.

lower fertility, higher (more) education, faster economic growth, and lower happiness. These hypotheses are supported by the empirical analysis.

Yet, it is worth emphasizing that these results are only one set of evidence. We need more evidence to thoroughly understand the significance of relative concerns. In particular, whereas a number of studies point to the validity of happiness data (See, e.g., Clark and Senik, 2011, for a review), the credibility of happiness data and the adequacy of using happiness as a proxy of utility are still being debated, pointing to the importance of employing multiple data sets and multiple perspectives to establish a stylized fact.[7]

Despite these drawbacks, happiness data are the closest data available for measuring utility. In this sense, happiness data deserve more attention in economics. By using happiness data together with objective data, we can enhance our understanding of human behavior and sociality.

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[7]The problems related to happiness data include the following. First, happiness data sets systematically deviate from one another, pointing to the existence of biases in, at least, some data sets (see, e.g., Deaton, 2008). Second, happiness may better be treated as an argument in utility, not as utility itself (Benjamin, Heffetz, Kimball and Rees-Jones, 2012). Third, the aggregate measure of happiness contains a demographic bias, which may or may not be ignorable (see, e.g., Kageyama, 2011a, 2012b).

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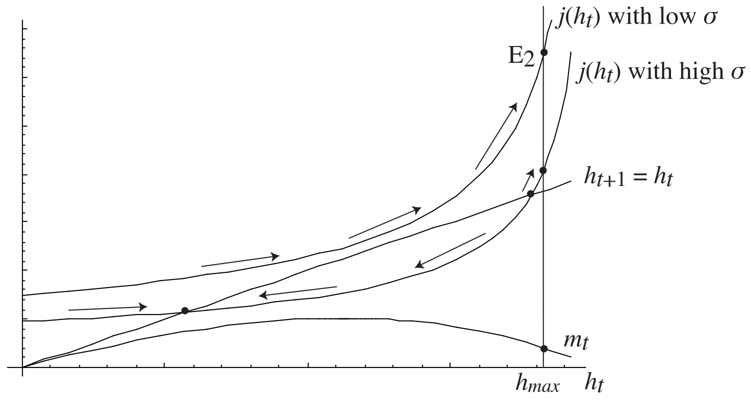

Figure 1: Steady states and dynamic paths.

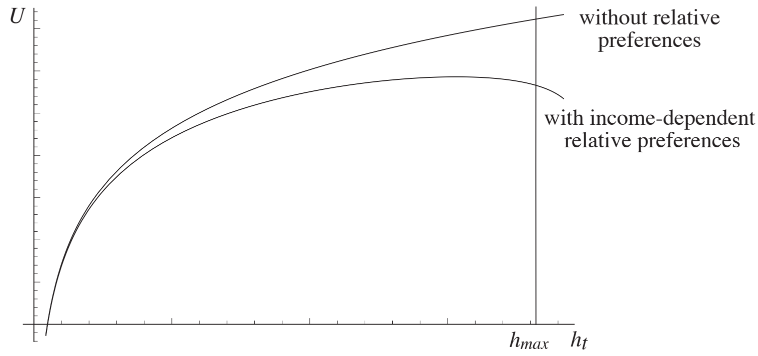

Figure 2: The effect of income-dependent relative preferences.

Table 1: Regression Results (Dependent Variable: *m*)

	(1-1)	(1-2)	(1-3)	(1-4)	(1-5)
Method	2SLS	2SLS	2SLS	LIML	OLS
Instruments	*lg*, *p*	*lg*, *p*	*lg*, *p*	*lg*, *p*, *hg*	
hpn	2.839	2.945	3.224	2.826	1.211
	6.13 ***	2.06 **	2.30 **	2.89 ***	2.10 **
ln(*y*)	-1.029	-0.892	-0.865	-0.825	-0.727
	-6.50 ***	-3.63 ***	-3.23 ***	-3.34 ***	-3.85 ***
wl		-0.016			
		-0.72			
gs		0.022			
		0.85			
Regional Dum.	excl.	incl.	incl.	incl.	incl.
Shea's partial *R-sq*, *hpn*	0.48	0.14	0.13	0.20	
Shea's partial *R-sq*, ln(*y*)	0.75	0.56	0.44	0.50	
Under-ID	13.18	8.88	7.89	13.70	
Test	0.00	0.00	0.01	0.00	
Weak-ID	32.11	7.00	5.29	5.24	
Test	7.03	7.03	7.03	5.44	
R-sq	0.64	0.68	0.64	0.67	0.73

Note: The number of observation is 60. The top figures are the estimated coefficients, and the bottom figures are heteroskedasticity-robust *t*-statistics. ***, **, and * respectively indicate the significance level at $p<0.01$, $p<0.05$, and $p<0.10$. Under-ID test: Kleibergen-Paap rk LM statistic at the top, and the corresponding *p*-value at the bottom (Kleibergen & Paap, 2006). Weak-ID test: Kleibergen-Paap rk Wald *F* statistic at the top, the Stock-Yogo weak ID test critical value for the Cragg-Donald i.i.d. case for a 10% bias at the bottom (Kleibergen & Paap, 2006; Stock & Yogo, 2005). Over-identification test statistics in equation (1-4): Hansen *J* statistic (Hansen 1982) is 0.361 and the corresponding *p*-value is 0.55.

Table 2: Regression Results (Dependent Variable: *ts*)

	(2-1)	(2-2)	(2-3)	(2-4)	(2-5)
Method	2SLS	2SLS	2SLS	LIML	OLS
Instruments	*lg, p*	*lg, p*	*lg, p*	*lg, p, hg*	
hpn	-36.84	-69.96	-64.70	-54.57	-18.86
	-4.44 ***	-3.10 ***	-2.76 ***	-2.43 **	-2.21 **
ln(*y*)	23.16	22.32	25.91	25.28	16.57
	8.10 ***	4.30 ***	6.17 ***	6.63 ***	5.32 ***
wl		1.137	1.143	1.103	0.910
		3.51 ***	3.48 ***	3.65 ***	3.55 ***
gs		0.961			
		1.47			
Regional Dum.	excl.	incl.	incl.	incl.	incl.
Shea's partial *R-sq*, *hpn*	0.48	0.14	0.15	0.20	
Shea's partial *R-sq*, ln(*y*)	0.75	0.56	0.52	0.56	
Under-ID	13.18	8.88	8.45	13.83	
Test	0.00	0.00	0.00	0.00	
Weak-ID	32.11	7.00	6.31	5.43	
Test	7.03	7.03	7.03	5.44	
R-sq	0.48	0.52	0.48	0.54	0.66

Note: Over-identification test statistics in equation (2-4), Hansen *J* statistic is 0.779 and the corresponding *p*-value is 0.38. For other information, refer to Table 1.

Table 3: Regression Results (Dependent Variable: *ss*)

	(3-1)	(3-2)	(3-3)	(3-4)
Method	2SLS	2SLS	LIML	OLS
Instruments	*lg, p*	*lg, p*	*lg, p, hg*	
hpn	-45.99	-71.15	-72.96	-26.62
	-4.04 ***	-1.33	-1.94 *	-4.71 ***
ln(*y*)	22.42	21.85	21.94	18.50
	7.08 ***	3.58 ***	3.87 ***	6.41 ***
wl		0.311	0.313	
		0.72	0.72	
gs		0.604	0.616	
		1.01	0.99	
Regional Dum.	excl.	incl.	incl.	excl.
Shea's partial *R-sq*, *hpn*	0.38	0.06	0.12	
Shea's partial *R-sq*, ln(*y*)	0.69	0.49	0.54	
Under-ID	10.27	3.84	7.18	
Test	0.00	0.05	0.03	
Weak-ID	21.94	2.19	2.27	
Test	7.03	7.03	5.44	
R-sq	0.59	0.51	0.49	0.67

Note: The number of observation is 48. Over-identification test statistics in equation (3-3): Hansen *J* statistic is 0.003 and the corresponding *p*-value is 0.96. For other information, refer to Table 1.

Table 4: Regression Results (Dependent Variable: *g*)

	(4-1)	(4-2)	(4-3)	(4-4)	(4-5)
Method	2SLS	2SLS	2SLS	LIML	OLS
Instruments	*lg*	*lg*	*lg*	*lg, p*	
hpn	-7.66	-9.40	-9.20	-7.49	-2.68
	-5.09 ***	-2.27 **	-2.11 **	-1.96 *	-2.08 **
y(-1)	0.024	0.010	-0.002	-0.014	-0.047
	0.544	0.19	-0.03	-0.25	-1.31
wl		0.124	0.125	0.119	0.104
		2.21 **	2.26 **	2.32 **	2.72 ***
gs		-0.030			
		-0.35			
op		0.015	0.015	0.013	0.006
		1.78 *	1.78 *	2.08 **	1.30
Regional Dum.	excl.	incl.	incl.	incl.	incl.
F for instruments	45.54	11.98	8.40	7.59	
Under-ID	12.49	7.58	6.18	9.79	
Test	0.00	0.01	0.01	0.01	
Weak-ID	45.54	11.98	8.40	7.59	
Test	16.38	16.38	16.38	8.68	
R-sq	0.23	0.31	0.32	0.43	0.55

Note: y(-1): thousands of dollars. Over-identification test statistics in equation (4-4): Hansen *J* statistic is 0.553 and the corresponding *p*-value is 0.46. For other information, refer to Table 1.

Table 5: Regression Results on the QQ Trade-off

	(5-1)	(5-2)	(5-3)	(5-4)	(5-5)	(5-6)	(5-7)	(5-8)
Dep Var	*m*	*m*	*ts*	*ss*	*m*	*m*	*ts*	*ss*
hpn					3.04	2.95	-84.20	-35.35
					5.13 ***	2.21 **	-2.95 ***	-1.91 *
ln(*y*)	0.060	0.266	14.25	9.29	-1.152	-0.864	40.32	18.98
	0.29	1.41	3.90 ***	4.81 ***	-4.41 ***	-1.40	3.65 ***	3.41 ***
m			-4.03	-9.33			16.68	-3.03
			-1.74 *	-6.81 ***			1.74 *	-0.82
ts	-0.03				0.005			
	-3.39 ***				0.67			
ss		-0.053				-0.012		
		-3.91 ***				-0.45		
Shea's partial *R-sq*, *hpn*					0.34	0.15	0.18	0.16
Shea's partial *R-sq*, ln(*y*)	0.49	0.62	0.70	0.73	0.39	0.21	0.26	0.27
Under-ID	11.42	18.75	26.60	22.73	11.43	5.49	5.70	4.82
Test	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.03
Weak-ID	37.19	56.04	109.4	92.42	13.90	4.46	4.95	3.65
Test	16.38	16.38	16.38	16.38	7.03	7.03	7.03	7.03
R-sq	0.35	0.59	0.55	0.74	0.62	0.48	0.06	0.68

Note: All equations are regressed with 2SLS. Equations (5-1) to (5-4) use *p* as the instrument, and equations (5-5) to (5-8) use *lg* and *p* as the instruments. Region dummies are excluded in all equations. The number of observation is 48 when *ss* is included, and is 60 otherwise. For other information, refer to Table 1.