Happiness and Development: the Effect of Mental Well-being on Economic Growth

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Abstract

This paper examines the impact of overall happiness of citizens on economic performances across countries. We exploit the variation in sex imbalance, a factor that impedes normal mating and thus lowers overall happiness level, to identify the causal effect of happiness on economic growth. The results show that happiness has a positive and statistically significant effect on economic growth. Specifically, other things being equal, a one-standard-deviation higher happiness could raise growth rate by two percentage points. Moreover, we investigate the possible channels through which happiness affects economic growth and find that the effect of happiness is likely to work through life expectancy and investment.

Keywords: Happiness, Economic Growth, Economic Development, Life Satisfaction, Channel Investigation, Mental Well-Being

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> The good life, as I conceive it, is a happy life. I do not mean that if you are good you will be happy; I mean that if you are happy you will be good.
>
> – Bertrand Russell

1 Introduction

Mental well-being matters much for the life of humankind, just as Russell said. For example, happiness[1] generates intelligence and vigor, while sadness causes apathy and indolence.[2] Does improving people's mental well-being have impacts on accelerating economic growth? Conceivably it can.

Figure 1

Figure 1 displays a strong correlation between happiness levels and growth rates across countries in the 1990s.[3] For example, Denmark with an average happiness level of 8.20 experienced an average annual growth rate of 2.02% in the 1990s, while the GDP per capita in Moldova, with an average happiness level of 4.15, fell at an average annual rate of 3.84% during the same period. Admittedly, this does not necessarily signify causality. The rise of household income can improve people's living conditions, and thus their happiness, which leads to the effect of growth on mental well-being.[4]

This paper empirically investigates the causal impacts of happiness on economic growth and identifies several possible channels through which happiness may affect economic growth. We exploit the exogenous variation in sex imbalance,[5] a phenomenon which impedes normal mating in the current monogamy-dominated world, to pin down the causality. Partnership, including marriage and cohabitation, and sexual activities have been found by researchers as important sources of happiness (*e.g.*, Blanchflower and Oswald, 2004). Sex ratios that deviate from the normal level cause difficulty in mating, and thus raise obsess normal reproduction and mental well-being of populace.

[1] Henceforth, we use mental well-being and happiness interchangeably.

[2] Diener (1984) provides a review of the literature in psychology about the effects of emotion on human behaviors.

[3] Happiness index comes from the World Database of Happiness (2007) while the growth rate is calculated using Penn World Table 6.2. We thank Dr. Ruut Veenhoven for letting us access the World Database of Happiness (2007).

[4] A number of studies have investigated the effects of income on people's mental well-being, *e.g.*, Easterlin, 1974, 1995, 2001; Oswald, 1997; Frey and Stutzer, 2002a, 2003; Di Tella, MacCulloch, and Oswald, 2003; Gardner and Oswald, 2007.

[5] Sex imbalance is a measure of the deviation in sex ratio from the normal level. This measure would be discussed in Section 5.1.

After using sex imbalance to instrument happiness, we find that happiness does have a positive effect on economic growth. Specifically, a one-standard-deviation higher happiness can raise growth rate by two percentage points. The results are robust when we adopt an alternative measure of happiness, introduce more control variables, and use different sub-samples.

The exclusion restriction implied by the instrumental variable estimation is that sex imbalance affects the growth rate only through the happiness level. A potential concern is that both sex imbalance and growth rate may be affected by some unobservable variables. Arguably if there exist such unobservable variables, these effects should already be absorbed by the initial economic situation, measured by the logarithm of GDP per capita in 1990. As shown in Figure 2, that there is no observable correlation between sex imbalance and the initial economic situation, suggesting that the concerns over unobservable variables are not relevant in our case. Furthermore, we include sex imbalance as an additional control in happiness-growth regressions, examine possible channels other than happiness through which sex imbalance may affect economic growth, and use suicide rates as an alternative instrumental variable. The results are robust in all these experiments.

Figure 2

Meanwhile, to investigate the potential channels through which happiness may affect economic growth, we follow Tavares and Wacziarg (2001), Wacziarg (2001), and Lorentzen, McMillan, and Wacziarg (2008) in adopting three-stage-least-squares (3SLS) estimation. The results show that investment and life expectancy are two potential channels through which happiness affects growth.

The paper contributes to the literature on happiness economics. In the past decades, economists have regained interests in mental issues such as happiness (Dixon, 1997). This line of research focuses on three questions: (i) the relationship between happiness and utility (*e.g.*, Frey and Stutzer, 2002b, 2003; Kahneman 2003), (ii) determinants of happiness (*e.g.*, Easterlin, 1974, 1995, 2001; Clark and Oswald, 1994; Oswald, 1997; Easterly, 1999; Di Tella, MacCulloch, and Oswald, 2001, 2003; Frey and Stutzer, 2002a, 2002b; Helliwell, 2002; Alesina, Di Tella, and MacCulloch, 2004; Frijters, Haisken-Denew, and Shields, 2004; Garden and Oswald, 2007), and (iii) the effects of emotions on human behaviors (*e.g.*, Elster, 1998; Loewenstein, 2000; Bosman and van Winden, 2002; Kirchsteiger, Rigotti, and Rustichini, 2006; Hermalin and Isen, 2008).[6] This paper belongs to the third category but differs from

[6]There is large literature in psychology studying the effects of emotions on human behaviors, *e.g.* Isen (2001), Lyubomirsky, King, and Diener (2005), Boehm and Lyubomirsky (2008). Organizational science has extensive studies about the happiness-productivity relation at the individual level, *e.g.* Wright and Staw

previous literature by identifying the casual effect of happiness at the macro-level, namely, on economic growth.

Our paper is also related to recent empirical literature on growth and development. New factors that have been found to affect growth and development include religion (Barro and McCleary, 2003), life expectancy and death (Acemoglu and Johnson, 2007; Lorentzen, McMillan, and Wacziarg, 2008), culture (Guiso, Spaienza, and Zingales, 2006), trust (Zak and Knack, 2001; Beugelsdijk, de Groot, and van Schaik, 2004), and so forth.

The rest of the paper is organized as follows. Section 2 discusses how happiness affects economic growth. Section 3 describes our dataset and the measurement of happiness. OLS estimates, main results, and channel investigation are presented in Sections 4-6, respectively. Section 7 concludes.

2 How does happiness affect economic growth?[7]

The possibility of bidirectional causality between economic growth and happiness was first raised by Kenny (1999). Frey and Stutzer (2002b) echoed this open question as a research topic worth further investigation. Since then, several models have emerged to explain the effects of emotion on behaviors. For example, Hermalin and Isen (2008) added a modest assumption, $u_t = U(x_t, u_{t-1})$, to a standard macroeconomic model and then the model could explain a wider range of facts than conventional models. Here, u_t is the emotional state at time t, x_t is a vector describing the decisions made at time t, and $U(.)$ is a function that determines the emotional state at time t. In other words, current emotional state is a function of previous emotion and current decisions (*e.g.*, saving or consumption).

This paper focuses on the empirical side by investigating the causality between happiness and economic growth rather than incorporating happiness into growth theory.[8] Notice that a large concern over the effect of happiness on economic behaviors and outcomes is that happiness, if considered as a transitory mood, dies away quickly and thus has no long-lasting effect. Nevertheless, this should not be a concern in our paper due to two important reasons. First, our measure of happiness can capture long-term mental status rather than transitory

(1999), Wright, Cropanzano, Denney, and Moline (2002).

[7] Unlike psychological or organization sciences studies, this paper does not distinguish mental (psychological) well-being, emotions, and affect, but recapitulates them under happiness, a general and intuitive name. Section 3 would discuss the measure of subjective mental well-being.

[8] This resembles the process of studying trust and growth. The concept of social capital was first proposed by Putnam (1993), and then Helliwell (1996) and Knack and Keefer (1997) empirically documented the positive association between trust and growth. Later, more empirical studies came about (*e.g.*, Temple and Johnson, 1998), and then Zak and Knack (2001) built the first general-equilibrium growth model embedding the trust. Afterwards, other theoretical exercises as well as critique flourished (Durlauf, 2002; Beugelsdijk, de Groot, and van Schaik 2004; Beugelsdijk and Smulders, 2004; among others).

mood, which is to be discussed in Section 3.1. Second, even if happiness is considered as a one-shot mood, rational decision models such as Hermalin and Isen (2008) could still assure us that happiness has long-lasting consequences.

How does happiness affect economic growth? Based on past studies in economics and sociology, we propose three possible channels. The first channel is consumption and investment. According to the theoretical model by Hermalin and Isen (2008), emotion could affect consumption. Whether to save *for* rainy days or save *on* rainy days depends on whether happiness raises or lowers the marginal benefit of consumption. Recent experimental studies also provide supports on this:[9]

> The researchers concluded sadness can trigger a chain of emotions leading to extravagant tendencies. Sadness leads people to become more focused on themselves, causing the person to feel that they and their possessions are worth little. That feeling increases willingness to pay more – presumably to feel better about themselves.

Second, both anecdotal and scientific evidence have illustrated that happiness predicts longevity (*e.g.*, Deeg and van Zonneveld, 1989) while life expectation may have two competing effects on economic performance. On the one hand, short life expectation causes riskier behaviors and lowers investment in physical and human capital (Lorentzen, McMillan, and Wacziarg, 2008); on the other hand, longevity increases population of a given country and thus depresses income per capita, especially when the effect of longevity on national income is limited (Acemoglu and Johnson, 2007).

Third, experiments show that good mood implies generosity (Kirchsteiger, Rigotti, and Rustichini, 2006) and psychologists argue that happiness encourages likability and positive construals of others, sociability, and prosocial behaviors (Lyubomirsky, King, and Diener, 2005). We accordingly conjecture that a society filled with more happiness should have higher levels of social capital (trust), which in turn has been shown to affect economic growth (*e.g.*, Helliwell, 1996; Knack and Keefer, 1997; Hall and Jones, 1999; Zak and Knack, 2001).

3 Data

3.1 The Happiness Dataset

The data of cross-country happiness levels are from the World Database of Happiness (2007), compiled by Dr. Ruut Veenhoven and his team. We use two variables to measure happi-

[9] See "Sadness May Encourage More Extravagance," available at `http://biz.yahoo.com/ap/080208/sadness_spending.html`.

ness, Life Satisfaction index and Happy Life index, both averaged in the 1990s.[10] They are aggregated from cross-country surveys that ask residents about their levels of subjective happiness.

The survey question regarding life satisfaction index is that "all things considered, how satisfied are you with your life as-a-whole now?" The respondent is required to rate on a 1-10 numerical scale, with higher value indicating more satisfied life. The survey question regarding happy life index is more complex. Three similar wording patterns and corresponding numerical scales are used in the surveys across countries over time. The first one is a 3-scale question, asking people "in general, how happy would you say you are?" and the answers range from "very happy (3)" to "not happy (1)." The second one is a 4-scale question, asking people "taking all things together, would you say you are _____" and the answers range from "very happy (4)" to "not at all happy (1)." The third one is a 5-scale question, asking people "how happy do you feel as you live now?" and the answers range from "very happy (5)" to "very unhappy (1)." Then the researchers do Thurstone transformation on the answers to obtain a 1-10 scale numerical measure,[11] with higher value indicating happier life. Since we do not have a thorough knowledge about the differences among these three questions and the transformation, we use life satisfaction index as the primary measure, and happy life index for robustness check when necessary.

Two issues are worth elaborating here. First, these measures are subjective measures of happiness. Respondents rate on a numerical scale according to their understanding of happiness. Happiness also has objective measures, which are obtained by recording respondents' physical representation such as brain waves. It should be admitted that the subjective measure is less precise than the objective one; however, there are at least two advantages of adopting the subjective measure. On the one hand, objective measuring is neither convenient nor economical enough to implement at a cross-country level, especially when researchers need a large number of observations. Second, happiness *per se* has a bearing on social aspects, which provides rationale behind subjective measures (Frey and Stutzer, 2002a, Chapter 1). Being happy or not cannot be purely measured with external and fixed rules, because human beings adjust their feelings to certain social contexts.

Second, people may have concerns over the reliability of subjective measure due to the

[10] The average values in the 1990s are used here in order to maximize coverage of countries and minimize measurement bias. Hauk and Wacziarg (2007) show that when there exist both measurement bias and heterogeneity bias, within-group estimation will exaggerate measurement bias though reduce heterogenous bias. By using Monte Carlo simulation, they demonstrate that when measurement problem is significant, the between-group estimation has lower bias than within-group estimation. Recognizing that there may exist significant measurement problem with happiness, we use between-group estimation.

[11] Detailed descriptions of the variables are available at `http://worlddatabaseofhappiness.eur.nl/hap_quer/hqi_fp.htm`.

fluctuations in human feelings. Krueger and Schkade (2007), two economists, designed life satisfaction questions similar to the one mentioned above and surveyed a sample of 229 women with Day Reconstruction Method in 2005. They found that life satisfaction index is reliable enough "to support much of the research that has been undertaken on subjective well-being." Before them, Lyubomirsky and Lepper (1999), two psychologists, reached a similar conclusion regarding the reliability of subjective happiness measurement with a sample of 2,732 college students. Moreover, researchers find that self-reported happiness is highly correlated with that reported by friends and family members (Sandvik, Diener and Seidlitz, 1993; Costa and McCrae 1988), with reports from clinical experts (Goldings, 1954), and with the duration of Duchenne smiles (Ekman, Davidson and Friesen, 1990).[12]

3.2 Other Data

In line with the happiness data, most of the economic variables are measued as the averages in the 1990s. Gross domestic product (GDP), population, GDP per capita, the shares of investment and government spending in GDP, and trade (measured as (import+export)/GDP) are from Penn World Table 6.2. Growth rates in GDP per capita and population are measured as annual averages.[13]

Educational level, measured as average years of schooling, comes from the dataset of "Educational Attainment of the Total Population Aged 25 and Over" built by Barro and Lee (2000). The measure of social capital (trust) and suicide rates are also from World Database of Happiness (2007). Specifically, trust is obtained in the same fashion as happiness indices: respondents report whether they agree with "most people can be trusted," with "yes" referring to numerical value 3 and "no" to 1. This measure is also used in studying the effect of social capital on economic performance (e.g. Knack and Keefer, 1997; Zak and Knack, 2001). Crime rates, measured by "total recorded intentional homicide, completed, per 100,000 inhabitants," are from United Nations Surveys of Crime Trends and Operations of Criminal Justice Systems (covering the period 1990 – 2000). Gini coefficient, which measures income inequality, is extracted from World Income Inequality Database (v2.0a, June 2005). Measures of political rights and civil liberties are computed based on Freedom in the World Country Ratings (1972-2006), with a lower value indicating better political rights and civil liberties. Life expectation at birth is from World Development Indicator Database compiled and maintained by the World Bank. The data of political instability, measured by the percentage of veto players who drop, come from the Database of Political Institutions compiled by the World Bank (2004). Sex imbalance is calculated from the

[12] See Konow and Earley (2007) for a comprehensive list of the papers that support these correlations.

[13] Appendix 1 provides the details on the construction and sources of the variables.

estimates and medium-variant projections of "Mid-year de facto female population" and "Mid-year de facto male population" compiled by the United Nations (2005).

Table 1

Table 1 summarizes the descriptive statistics of the variables and Appendix 2 lists the main variables across countries.

4 OLS Estimates

To investigate the impacts of happiness on economic growth, we estimate the following equation

$$y_c = \alpha + \beta Happiness_c + \delta Initial\ Level_c + X_c \cdot \gamma + \varepsilon_c \quad (1)$$

where y_c is the growth rate in country c in the 1990s, $Happiness_c$ is the measure of happiness in country c in the 1990s, $Initial\ Level_c$ is the logarithm of GDP per capita in country c in 1990, which is used to capture the catch-up effect, X_c is a vector of control variables, and ε_c is the error term.

Table 2 reports the ordinary-least-square (OLS) estimates. Column 1 shows the regression of growth rates on happiness measured by life satisfaction index in the 1990s, as well as the initial level of GDP per capita, measured as the natural logarithm of GDP per capita in 1990. The coefficient of happiness is positive and statistically significant, showing that a one-scale increase in happiness is associated with an increase in growth rate by 1.39 percentage points. This association is quantitatively important, since a country with one standard-deviation (1.12) higher happiness would have about 1.5 percentage-points higher growth rate. In column 2, we include a set of control variables that are commonly used in growth regressions, *i.e.*, investment ratio, government consumption, educational level, and trade.[14] The coefficient of happiness index shows little change in either magnitude or significance level after these control variables are included. Meanwhile, the coefficient of initial GDP per capita turns out to be negative and significant, supporting the convergence hypothesis. Regression results with happy life index as an alternative measure of happiness are reported in columns 3-4 of Table 2. The results confirm the findings in columns 1-2 in that happiness is positively and significantly correlated with growth rate.

[14]Note that there has been no consensus regarding what regressors should be included in a growth regression (see, for example, Levine and Renelt, 1992; Sala-i-Martin, 1997). In this paper, we are parsimonious in choosing regressors and mainly focus on the most commonly used ones in literature. By doing so, we could keep more observations.

Table 2

As a robustness check, Table 3 reports the results with controls that are likely to be associated with both growth and happiness. The regression in column 1 includes the average annual growth rate of population in the 1990s. On the one hand, population growth affects GDP per capita by increasing population. On the other hand, population growth may reflect the age structure of the whole population in an economy. A country with younger age structure is presumably energetic, aspiring, and optimistic, and children is argued to be one of the sources of happiness (Kohler, Behrman, and Skytthe, 2005). Regressing happiness measured by life satisfaction index on population growth, we obtain

$$\begin{aligned} Happiness &= -0.35 + 0.41 popgr + 0.75 \log GDPPC \\ &\qquad\qquad (2.49)^{**} \qquad (5.08)^{**} \end{aligned}$$

with $R^2 = 0.39$ and $F(2, 53) = 13.09$, where *popgr* is the average annual growth rate of population in the 1990s. Although this regression does not necessarily capture the causality between happiness and population growth, it illustrates why we include population growth. Results in column 1 of Table 3 show that incorporating the growth rate of population does not change the benchmark findings in Table 2. Meanwhile, the coefficient of population growth is negative though not statistically significant, implying a negative effect of rising population on economic performance.

Table 3

Income inequality has been considered as a factor that affects both economic growth (*e.g.*, Barro, 2000; Voitchovsky, 2005) and happiness (Alesina, Di Tella, and MacCulloch, 2004). Column 2 of Table 3 reports the results with Gini coefficient included and there is no change in the estimated effects of happiness on economic growth in terms of both magnitude and significance. The coefficient of Gini coefficient is negative though not statistically significant, suggesting the negative effect of inequality on growth.

Frey and Stutzer (2001a, Chapter 8) document that political and personal freedom are positively associated with happiness in developed countries while the association between political institution and economic performance has long been established in literature (*e.g.*, Acemoglu, Johnson, and Robinson, 2001, 2002; Tavares and Wacziarg, 2001). We therefore control for the levels of civil liberties and political rights in regressions and results are reported

in columns 3-4 of Table 3. Clearly, happiness still has a positive and statistically significant effect on growth rate though the estimated coefficient drops a little bit (now, 1.19) when civil liberties is included, suggesting that civil liberties might explain a small amount of the correlation between growth and happiness. Meanwhile, civil liberties has a marginally significant and negative coefficient, confirming the importance of institutional quality in promoting economic growth.

Finally, we include crime rates because crimes may dampen investments and thus the growth in a country, and have substantial influences on people's daily life quality at the same time. The result reported in column 5 of Table 3 shows that happiness is still positively and significantly correlated with growth rate when crime rates are also controlled for.

5 Main Results

The OLS results in Table 2 and Table 3 could be biased if happiness is endogenous. To address this issue, we adopt instrumental variable (IV) method. Below, we first present an intuitive description of the relationship between our instrument, sex imbalance, and happiness. Then two-stage-least-squares (2SLS) estimates are discussed and several robustness checks are conducted.

5.1 Sex Imbalance and Happiness

In order to investigate the causal effect of happiness on economic growth, we exploit the exogenous variation in sex imbalance to instrument happiness. We define sex imbalance as $(1 - M/F)^2$, where M and F refer to the shares of male and female population, respectively.[15] The rationale of using sex imbalance as the instrument for happiness comes from the importance of partnership, including marriage and cohabitation, and sexual activity in generating happiness, and the failures and difficulties in mating caused by sex imbalance.

Marriage is believed to bring happiness (or utility, in economics terms) to people (Becker, 1981) and several empirical studies show that married people are happier than singles (*e.g.*, Myers, 1999; Clark and Oswald, 2002; Frey and Stutzer, 2006). Clark and Oswald (2002) find that getting married brings the same amount of happiness as 70,000 pounds of income per year. Furthermore, to identify the causal effect of marriage on happiness, Kohler, Behrman, and Skytthe (2005) utilize a unique dataset covering identical twins in Denmark and find that people in a partnership report substantially higher levels of happiness than those who

[15] Notice that this formula removes the direction of the imbalance. For instance, five-percent larger male population is equivalent to five-percent larger female population under this measure.

are not.

Meanwhile, sexual activity has been found to strongly affect happiness (*e.g.* Blanchflower and Oswald, 2004). Using a sample of 16,000 adult Americans, Blanchflower and Oswald (2004) obtain several interesting results about the relation between sexual activity and happiness: (i) sexual activity is positively related with happiness; (ii) money does not buy more sex or more sexual partners; (iii) the number of sexual partners that maximizes happiness is one; (iv) homosexuality does not have statistically significant effect on happiness.

Sex imbalance causes failures in mating and thus reduces the happiness of the whole society. Failures in mating can be decomposed into "bare branches" effect (Den Boer and Hudson, 2002) and family disruption effect (Messner and Sampson, 1991).[16] "Bare branches" refer to the extra men (or women) who fail to find partners. The more unbalanced the sex ratio is (in either direction), the more people fail in mating and thus are left over as losers in societal competition. Family disruption happens more frequently in societies with larger sex imbalance because the individuals of gender in short supply are advantaged in establishing new relationships with those of gender in over supply. Such re-mating causes high divorce rates, single-parent families, and mental health problems of children. Hudson and Den Boer (2002) document several historical cases where sex imbalance caused serious failures in mating. For instance, the sex ratio was 129:100 in *Huai-pei* of China in the nineteenth century and thus twenty-five percent of men were unable to marry. Similarly, the sex ratio was 112:100 in medieval Portugal, where not only low-status men, but also some high-status men could not marry.

The validity of the instrumental variable estimation requires sex imbalance be exogenous, *i.e.*, sex imbalance should not affect the economic growth through channels other than happiness, and sex imbalance is not affected by unobservable characteristics that also affect growth. To determine the validity of our instrumental variable, we conduct several empirical experiments. First, if sex imbalance affects growth only through happiness, sex imbalance should not have a significant impact on growth when happiness is also included in the regression. Furthermore, we investigate two potential channels other than happiness through which sex imbalance may affect economic growth: crime rates and political instability. Finally, we admit that there may exist gender-specific infanticide, abortion, and birth misreporting, which might distort the sex ratio at birth (Hull, 1990) and cause endogeneity in sex imbalance. Fortunately, the practices are, to our knowledge, only reported in some Asian countries nowadays, and consequently we exclude Asian countries from the sample as a robustness check.

[16] See Messner and Sampson (1991), and Hudson and Den Boer (2002) for literature reviews.

5.2 2SLS Estimates

Table 4 reports the 2SLS estimates. Panel B reports the first-stage results, showing that sex imbalance is positively and significantly correlated with happiness and the Shea test rules out the concern about possible weak instrument. Column 1 in the Panel A of Table 4 shows that happiness has a statistically significant and positive effect on economic growth. The estimated coefficient of happiness is now 1.79, higher than that in the OLS regression (1.39), suggesting that a country with one-standard-deviation higher happiness has an approximately two percentage points higher growth rate. The sign of initial GDP per capita is negative and significant, confirming the convergence-growth hypothesis. In column 2, we control for conventional regressors that are used in OLS regressions, and the results are robust in that sex imbalance is positively and significantly correlated with happiness, and happiness has a positive and significant effect on growth. Regressions with our alternative measure of happiness are reported in columns 3-4, and the results are consistent with those in columns 1-2.

Table 4

As discussed in Section 5.1, in some Asian countries, son preference causes parents to commit infanticide, gender-specific abortion, and concealment of births, which may introduce endogeneity in sex imbalance. Facing such a concern, we exclude Asian countries in the estimation and the results are reported in columns 5-6 of Table 4, where life satisfaction index is used as the measure of happiness. Our findings are robust in this sub-sample.

5.3 Robustness Check

In this sub-section, we conduct several experiments to check the robustness of our findings in Table 4. First, we include the control variables considered in Table 3 that may affect both economic growth and happiness. Results are reported in Table 5. Column 1 adds the average annual growth rate of population in the 1990s, column 2 controls for income inequality measured by Gini index, column 3 includes civil liberties index, and column 4 includes political rights index. The first-stage results in the Panel B of Table 5 show that sex imbalance has a significant and positive coefficient, which is consistent with the results in Table 4. The second-stage results in the Panel A of Table 5 show that our findings are robust to these additional control variables.

Table 5

Next, we check the validity of our instrumental variable. A valid instrumental variable

should be closely correlated with the endogenous variable (relevance assumption), and does not correlate with the dependent variable through channels other than the endogenous variable (orthogonality assumption). The first test on the orthogonality assumption is to regress growth rate on both happiness and sex imbalance. If sex imbalance is found to still have a strong explanatory power, this would suggest that sex imbalance may affect growth rate through channels other than happiness. Column 1 of Table 6 shows the regression of growth rate on sex imbalance, in which sex imbalance is closely associated with growth rate. However, when we include life satisfaction index, the result in column 2 shows that sex imbalance no longer has any explanatory power. Not only the coefficient of sex imbalance drops dramatically from -222.51 to -54.21, the t-statistics also fells from -2.22 to -0.54. We further include conventional control variables and use alternative measures of happiness. The results are shown in columns 3-5 of Table 6. The effect of sex imbalance is still not significant and sometimes even turns out to be positive.

The second test on the orthogonality assumption is to directly look at those potential channels other than happiness through which sex imbalance may affect economic growth. We identify two such potential channels: crime rate and political instability. Sex imbalance is documented by some sociologists to affect crime rates and political stability (Messner and Sampson, 1991; Messner and Rosenfeld, 1997; Den Boer and Hudson, 2002; among others). Regression results are shown in columns 6-7 of Table 6, and the effect of happiness is consistent with those found in Tables 4-5 in terms of both magnitude and significance. Note that, in these two regressions, we include the same set of control variables in the first-stage but do not report their coefficients to save space. The first-stage results are similar to those in Table 4. The results from these two tests suggest that the orthogonality assumption associated with our instrumental variable cannot be rejected.

Table 6

Last, we use an alternative instrumental variable, namely, suicide rate, to further check the robustness of our findings. One may argue that suicide may not be fully exogenous, *e.g.*, there are more reports of suicide cases during financial crises and economic recessions. To alleviate this concern, we include the growth rate in the 1980s and the results are reported in column 8 of Table 6.[17] Although incorporating past growth rate reduces the total sample size by almost a half, our result, namely the positive effect of happiness on economic growth, is still significant at the 5% significance level.

[17]The results are similar when we do not include the 1980s growth rates in the regression. Results are available upon request.

6 Channel Investigation

We mention in Section 2 that happiness is likely to affect economic growth through investment, life expectation, and social capital (trust). In this section, we provide quantitative estimation to identify these possible channels. The econometric methodology used here is three-stage-least-squares (3SLS) estimation, following that used by Tavares and Wacziarg (2001), Wacziarg (2001), and Lorentzen, McMillan, and Wacziarg (forthcoming). The advantage of 3SLS is the improvement in efficiency by cross-equation error correlations. Moreover, 3SLS also lets us to compute a single covariance matrix for all the estimates and then establish possibly complex inferences on functions of the parameters even if they belong to different equations.

In the estimation, we use life satisfaction index as the measure of happiness and instrument it by sex imbalance. The results are reported in Table 7. Consistent with the results in Tables 4-6, sex imbalance is positively and significantly correlated with happiness index as shown in column 2. Meanwhile, happiness has strong and significant impacts on investment ratio and life expectation, as shown in columns 3-4 of Table 7, which are positively and significantly correlated with growth rate, as shown in column 1 of Table 7. Happiness has little explanatory power on social capital (trust), and social capital is not significant in the growth equation. The results suggest that investment and life expectation are two possible channels through which happiness affects economic growth.

Table 7

To gain a rough picture about the relative importance of these channels, we summarize the results from channel and growth equations in Table 8. The first two columns report the effect of each channel on economic growth and the effect of happiness in each channel, respectively. The last column displays the product of the coefficient of happiness in each channel and the coefficient of the channel in growth equation.[18] The combined effects suggest that happiness affects economic growth mainly through life expectation (65.7% of the total effect) and then investment (33.6% of the total effect).

Table 8

[18] t-statistics following the coefficients are obtained by "computing linear approximations of the products of the parameters around the estimated parameter values and applying the usual formula for the variance of linear functions of random variables to this linear approximation" (Wacziarg, 2001). Admittedly, such approximation may bring some estimation errors, and thus the t-statistics are just listed for reference.

7 Conclusion

Mental well-being is an important and decisive factor in determining people's behaviors. Much of the effort has been put into understanding the determinants of happiness and the impacts of happiness on human behaviors at the micro level. This paper takes a different approach by studying the impact of happiness at the macro-level, *i.e.* on economic growth. To address endogeneity, we instrument happiness by sex imbalance, which impedes normal mating and thus negatively affects happiness. The 2SLS results show that countries with happier citizens grow faster. Other things being equal, a one-standard-deviation higher happiness could generate two percentage points higher growth rate. The results are robust in several experiments, *e.g.* alternative measure of happiness, additional control variables, alternative sub-samples, validity check on the instrumental variable, and alternative instrumental variable. Meanwhile, to understand how happiness affects economic growth, we start a channel investigation by using 3SLS estimation, and find that it is likely that happiness encourages investment as well as extends individuals' longevity, which in turn affects economic growth.

The results shed some lights on our understandings regarding how to promote economic growth in a country. Given the strong and significant impacts of happiness found in this paper, policy makers should reevaluate some policies that potentially make citizens happier, such as welfare program, medical care for the whole population, and some labor regulations. Similarly, as a general development issue, it is advisable to address the mental misery of populace in low-income countries in addition to treating their economic difficulties. Not only poverty itself, but also the absence of hope and mental suffering associated with poverty are fearful. Happiness helps to guide people in struggling out of poverty by appropriate consumption and investment, as well as prolonging their life spans.

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Appendix 1: Data

The data of *Political Rights* and *Civil Liberties*, two institution measures, are available at http://www.freedomhouse.org/uploads/fiw/FIWAllScores.xls We use the averages of countries during the 1990s. The data of GDP per capital are from the *Penn World Table 6.2*, and the average growth rates per year are calculated by the formula y=x(1+r)^n, where r is the growth rate, x and y are the GDP values of the initial year (1989) and the last year (1999), and n=10. The same data source and method are used when calculating average growth rates of population per year. The data of the shares of investment and government spending in GDP, GDP per capita in the 1990, and trade are also from the *Penn World Table 6.2*. Trade is measured as (import+export)/GDP. We use the natural log of GDP per capita.

Happy life index of the 1990s and life satisfaction index of the 1990s are extracted from the *World Database of Happiness*, which we received from Ruut veenhoven on March 6, 2007. In particular, these two measures belong to the subset *Happiness in Nations*. The details of these two happiness measures have been discussed in the text. Suicide rates and our trust measure are also from this database.

The data of female and male population are from United Nations Statistics Division. They are compiled in 2005 and available at http://unstats.un.org/pop/dVariables/DRetrieval.aspx.

Education is measured as "educational Attainment of the Total Population Aged 25 and Over" and the data are from "International Data on Educational Attainment: Updates and Implications" by Barro and Lee (2001). See http://www.economics.harvard.edu/faculty/barro/data_sets_barro for details.

Our measure of political instability is from the database of political institutions compiled by the World Bank in 2004. It is measured by "percent of veto players who drop from the government in any given year."

Life expectancy at birth (unit: years) are from the WDI database of the World Bank. The WDI database is publicly available as long as one's institution subscribes to it. We calculate the averages of countries during the 1990s.

Gini coefficients are from the *World Income Inequality Database*, V 2.0a, June 2005. We calculate the averages of countries during the 1990s. The crime rates are the "total recorded intentional homicide, completed," given per 100,000 inhabitants. They are from *United Nations Surveys of Crime Trends and Operations of Criminal Justice Systems*, which can be downloaded at http://www.unodc.org/unodc/en/data-and-analysis/Seventh-United-Nations-Survey-on-Crime-Trends-and-the-Operations-of-Criminal-Justice-Systems.html. We calculate the averages of countries during the 1990s.

Appendix 2: Main Variables across Countries

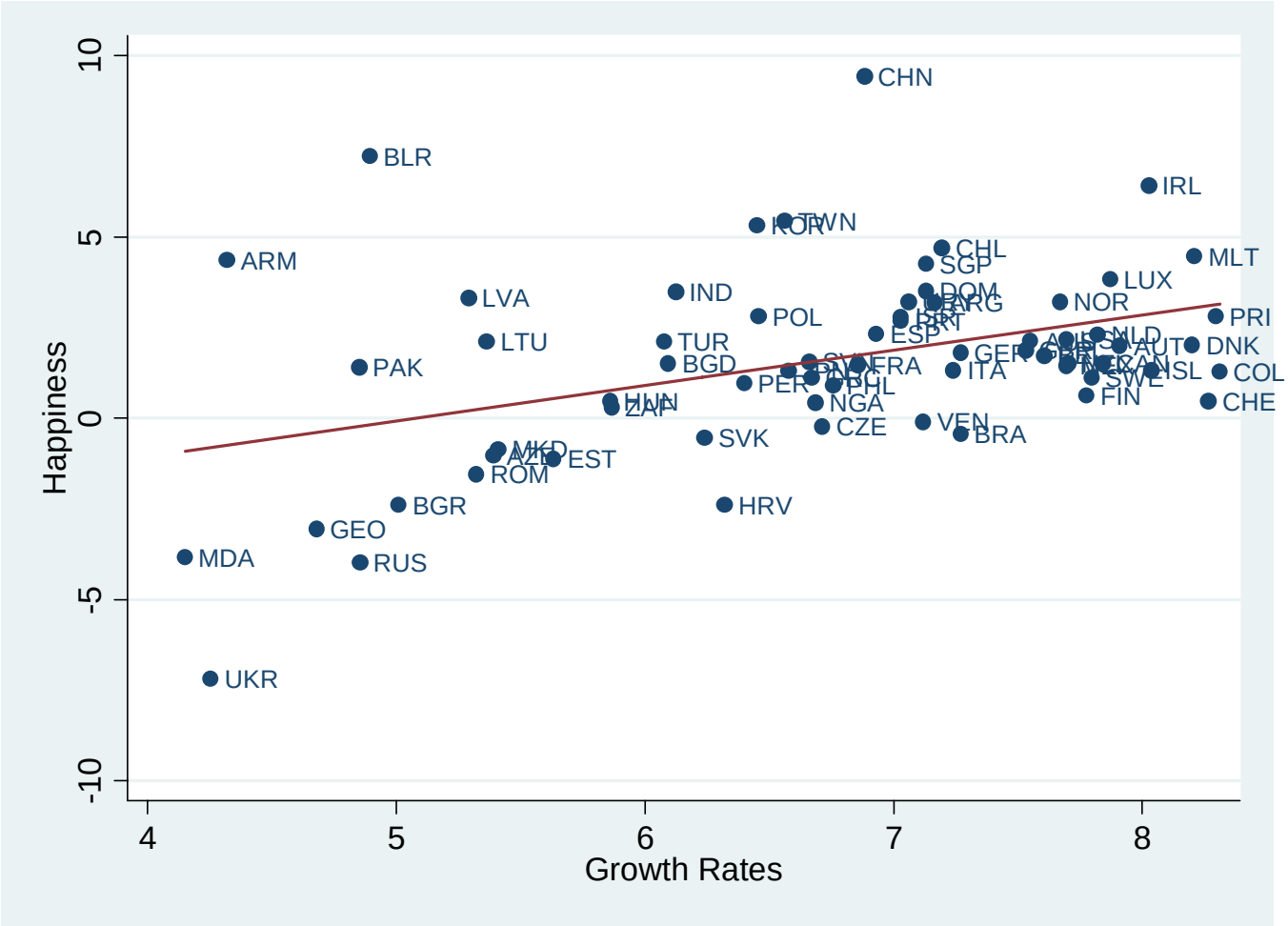
Country	Growth rate in the 1990s	Life-satisfaction index in the 1990s	Happy-life Index in the 1990s	Sex imbalance in 1990
Argentina	3.19	7.17	7.06	0.0013
Armenia	4.36	4.32	5.61	0.0034
Australia	2.14	7.55	7.88	0.0000
Austria	2.01	7.91	7.54	0.0058
Azerbaijan	-1.04	5.39	6.63	0.0017
Bangladesh	1.52	6.10	7.01	0.0039
Belarus	7.23	4.89	5.22	0.0140
Belgium	1.73	7.61	7.74	0.0020
Brazil	-0.44	7.27	6.90	0.0002
Bulgaria	-2.40	5.01	5.24	0.0008
Canada	1.51	7.84	7.34	0.0003
Chile	4.69	7.19	6.94	0.0005
China	9.44	6.88	6.86	0.0043
Colombia	1.27	8.31	7.61	0.0003
Croatia	-2.41	6.32	6.43	0.0040
Czech Republic	-0.24	6.71	6.80	0.0030
Denmark	2.02	8.20	7.90	0.0008
Dominican Republic	3.50	7.13	6.93	0.0008
Estonia	-1.13	5.63	5.93	0.0146
Finland	0.62	7.78	7.30	0.0033
France	1.47	6.86	7.50	0.0026
Georgia	-3.06	4.68	6.01	0.0089
Germany	1.80	7.27	6.57	0.0047
Greece	1.11	6.67	6.65	0.0008

Hungary	0.47	5.86	6.22	0.0057
Iceland	1.31	8.04	8.06	0.0001
India	3.48	6.12	6.79	0.0046
Ireland	6.42	8.02	7.75	0.0000
Israel	2.80	7.03	6.16	0.0001
Italy	1.33	7.24	6.54	0.0032
Japan	1.29	6.58	7.28	0.0012
Korea, Republic of	5.31	6.45	6.62	0.0002
Latvia	3.32	5.29	5.82	0.0166
Lithuania	2.12	5.36	5.86	0.0105
Luxembourg	3.83	7.87	7.71	0.0010
Macedonia	-0.86	5.41	6.11	0.0001
Malta	4.46	8.21	7.32	0.0005
Mexico	1.44	7.69	6.72	0.0007
Moldova	-3.84	4.15	5.16	0.0080
Netherlands	2.31	7.82	7.92	0.0005
New Zealand	1.51	7.70	7.36	0.0007
Nigeria	0.42	6.69	6.95	0.0000
Norway	3.22	7.67	7.32	0.0005
Pakistan	1.40	4.85	6.95	0.0043
Peru	0.96	6.40	6.48	0.0002
Philippines	0.89	6.76	7.24	0.0002
Poland	2.81	6.46	6.09	0.0024
Portugal	2.68	7.03	6.69	0.0048
Puerto Rico	2.80	8.30	7.77	0.0037
Romania	-1.54	5.32	5.60	0.0007
Russia	-3.99	4.85	5.06	0.0142

Singapore	4.24	7.13	7.77	0.0002
Slovak Republic	-0.56	6.24	5.84	0.0019
Slovenia	1.56	6.66	6.07	0.0033
South Africa	0.29	5.87	6.49	0.0004
Spain	2.33	6.93	7.12	0.0016
Sweden	1.10	7.80	7.73	0.0006
Switzerland	0.46	8.27	7.84	0.0007
Turkey	2.10	6.08	7.46	0.0006
Ukraine	-7.20	4.26	5.24	0.0194
United Kingdom	1.87	7.53	7.41	0.0052
United States	2.17	7.69	7.40	0.0013
Uruguay	3.21	7.06	6.87	0.0032
Venezuela	-0.11	7.12	8.10	0.0003

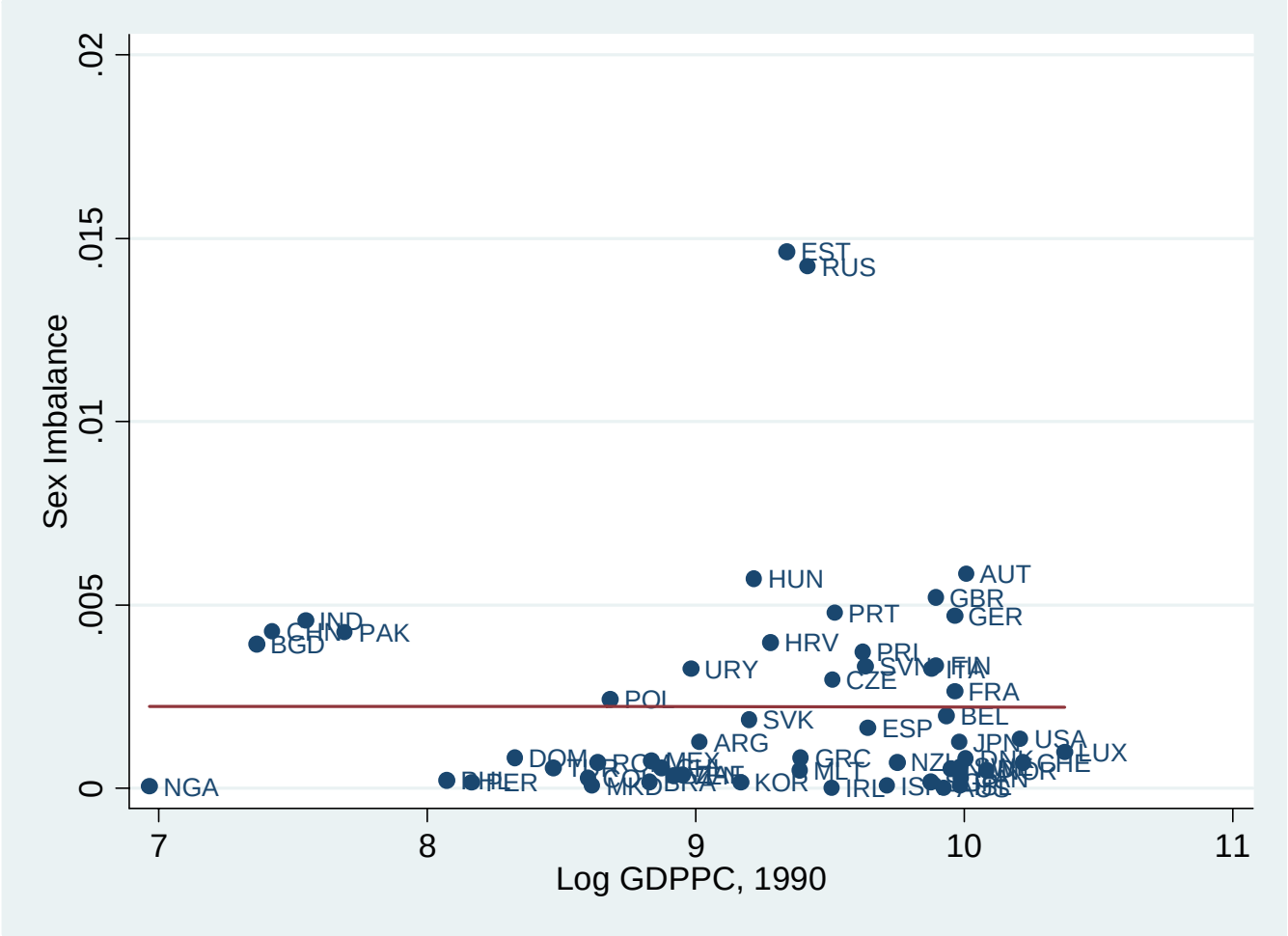
Note: Numbers are rounded to the nearest hundredth in this table in the 2nd, 3rd, and 4th columns, and to the nearest 10000th in the 5th column. More accurate data are available upon request.

Figure 1: Happiness and Economic Growth



Note: Values of happiness (life satisfaction index) are from World Database of Happiness (2007). Growth rates in GDP per capita are calculated based on the GDP and population data from Penn World Table 6.2.

Figure 2: Sex Imbalance and Initial Economic Conditions



Note: Sex imbalance is calculated from the estimates and medium-variant projections of "Mid-year de facto female population" and "Mid-year de facto male population" compiled by United Nations (2005). See Section 5.1 for the calculation details. Logarithm of GDP per capita in 1990 is from Penn World Table 6.2.

Table 1: Descriptive Statistics

Variable	Obs.	Mean	Std.Dev.	Min	Max
Life satisfaction index in the 1990s	65	6.69	1.12	4.15	8.31
Happy life index in the 1990s	65	6.83	0.81	5.06	8.10
Average annual growth rates of GDP per capita in the 1990s	65	1.57	2.66	-7.2	9.44
Average annual growth rates of GDP per capita in the 1980s	49	1.86	2.12	-3.0	7.97
Log GDP per capita in 1990	56	9.25	0.81	6.97	10.4
Average annual growth rates of population in the 1990s	65	0.81	0.92	-1.3	3.18
Government share in GDP in the 1990s	65	21.7	8.27	7.48	43.0
Investment share in GDP in the 1990s	65	18.0	6.98	4.68	39.8
Trade in the 1990s	65	76.4	50.4	17.8	335.9
Education attainment over 25 in the 1990s	57	8.02	2.24	2.32	12.1
Trust in the 1990s	65	1.58	0.28	1.08	2.30
Life expectation at birth in the 1990s	64	72.1	5.99	47.5	79.7
Gini coefficient in the 1990s	40	35.6	11.0	20	64.7
Crime rates in the 1990s	58	6.43	11.9	0.06	66.6
Political instability in the 1990s	64	0.16	0.11	0	0.43
Political rights in the 1990s	64	2.26	1.48	1	7.0
Civil liberties in the 1990s	64	2.66	1.39	1	6.80
Suicide rates in the 1990s	50	13.7	9.59	0.9	38.7
Sex imbalance in 1990	64	0.003	0.004	5.00e-06	0.019

Note: Life satisfaction and happy life indices are from World Database of Happiness (2007). Population, GDP per capita, the shares of investment and government spending in GDP, and trade (measured as (import+export)/GDP) are from Penn World Table 6.2. Growth rate in GDP per capita and population are calculated based on these variables. Education attainment over 25 is average years of schooling from the dataset by Barro and Lee (2000). Trust and suicide rates are from World Database of Happiness. For trust, respondents report whether they agree "most people can be trusted," and "yes" refers to numerical value 3, and "no" to 1. Crime rate, measured by "total recorded intentional homicide, completed, per 100,000 inhabitants", is from United Nations Surveys of Crime Trends and Operations of Criminal Justice Systems (covering the period 1990 – 2000). Gini coefficient, which measures income inequality, is extracted from World Income Inequality Database (V2.0a, June 2005). Measures of political rights and civil liberties are computed based on Freedom in the World Country Ratings (1972-2006) compiled by the Freedom House. The observed values range from 1(best) to 7(worst). The data of life expectation at birth are from World Development Indicator Database compiled and maintained by World Bank, and we calculate the averages of the 1990s. Sex imbalance is calculated from the estimates and medium-variant projections of "Mid-year de facto female population" and "Mid-year de facto male population" compiled by United Nations (2005). The data of political instability, measured as the percentage of veto players who drop, comes from the Database of Political Institutions compiled by the World Bank (2004).

Table 2: Ordinary-Least-Squares Estimation Results
(Dependent Variable: Average Annual Growth Rate of GDP per Capita in the 1990s)

	(1)	(2)	(3)	(4)
	Life Satisfaction	Life Satisfaction	Happy Life	Happy Life
Happiness index in the 1990s	1.39***	1.44***	1.44***	1.46***
	(3.39)	(4.01)	(3.11)	(3.24)
Log GDP per capita in 1990	-0.92	-2.29***	-0.53	-1.94***
	(-1.63)	(-4.11)	(-1.09)	(-3.03)
Share of investment in GDP in the 1990s		0.19***		0.19***
		(4.73)		(3.55)
Share of government spending in GDP in the 1990s		0.009		0.02
		(0.24)		(0.56)
Education attainment over 25 in the 1990s		0.06		0.13
		(0.43)		(0.83)
Trade in the 1990s		0.003		0.002
		(0.70)		(0.41)
Constant	0.63	8.39**	-3.42	4.25
	(0.17)	(2.40)	(-0.81)	(1.05)
Number of observation	56	53	56	53
R-square	0.23	0.52	0.18	0.45
F-statistic	6.77	7.27	4.93	4.54
(p-value)	(0.00)	(0.00)	(0.01)	(0.00)

Note: Life satisfaction (used in Column 1-2) and happy Life (used in Column 3-4) indices are from World Database of Happiness (2007). GDP per capita, the shares of investment and government spending in GDP, and trade (measured as (import+export)/GDP) are from Penn World Table 6.2. Growth rate in GDP per capita is calculated based on GDP per capita. Education attainment over 25 is average years of schooling from the dataset by Barro and Lee (2000). t-values, adjusted for the heteroskadesicity, are reported in parentheses. * $p<0.1$; ** $p<0.05$; *** $p<0.01$.

Table 3: Extended Ordinary-Least-Squares Estimation Results
(Dependent Variable: Average Annual Growth Rate of GDP per Capita in the 1990s)

	(1)	(2)	(3)	(4)	(5)
	Population growth	Income inequality	Civil liberties	Political rights	Crime rate
Happiness index in the 1990s	1.52***	1.50***	1.19***	1.34***	1.58***
	(3.90)	(3.16)	(3.18)	(3.76)	(4.91)
Log GDP per capita in 1990	-2.45***	-3.02***	-2.88***	-2.75***	-2.28***
	(-4.17)	(-3.74)	(-4.63)	(-3.97)	(-4.47)
Share of investment in GDP in the 1990s	0.20***	0.17**	0.23***	0.22***	0.19***
	(4.78)	(2.63)	(4.69)	(4.69)	(4.36)
Share of government spending in GDP in	-.0002	-0.05	0.01	0.01	0.03
the 1990s	(-0.00)	(-0.67)	(0.28)	(0.30)	(0.90)
Education attainment over 25 in the	0.03	0.01	-0.02	0.04	-0.05
1990s	(0.24)	(0.10)	(-0.17)	(0.31)	(-0.46)
Trade in the 1990s	0.003	0.004	0.004	0.004	-0.0004
	(0.84)	(0.85)	(0.89)	(0.80)	(-0.12)
Average annual growth rates of	-0.28				
population in the 1990s	(-0.84)				
Gini coefficient in the 1990s		-0.05			
		(-1.12)			
Civil liberties in the 1990s			-0.55*		
			(-1.73)		
Political Rights in the 1990s				-0.34	
				(-1.02)	
Crime rate in the 1990s					-0.03
					(-0.89)
Constant	9.87**	18.9*	16.8***	13.5**	8.05**

	(2.54)	(1.77)	(3.06)	(2.40)	(2.30)
Number of observation	53	34	52	52	47
R-square	0.53	0.65	0.56	0.54	0.63
F-statistic	7.37	7.14	7.60	6.77	8.35
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Note: Life Satisfaction index from the World Database of Happiness (2007) is used to measure the level of happiness. Population, GDP per capita, the shares of investment and government spending in GDP, and trade ((import+export)/GDP) are from Penn World Table 6.2. Growth rate in GDP per capita and population are calculated based on these variables. Education attainment over 25 is average years of schooling from the dataset by Barro and Lee (2000). Gini coefficient is from World Income Inequality Database (V 2.0a, June 2005). Measures of political rights and civil liberties are computed based on *Freedom in the World Country Ratings (1972-2006)* compiled by the Freedom House, with a lower value indicating better political rights and civil liberties. Crime rate measured by "total recorded intentional homicide, completed, per 100,000 inhabitants" is from *United Nations Surveys of Crime Trends and Operations of Criminal Justice Systems (covering the period 1990 – 2000)*. t-values, adjusted for the heteroskadesicity, are reported in parentheses. * p<0.1; ** p<0.05; *** p<0.01.

Table 4: Two-Stage-Least-Squares Estimates

	(1)	(2)	(3)	(4)	(5)	(6)
	Life satisfaction	Life satisfaction	Happy-life index	Happy-life index	Without Asia	Without Asia
Panel A: Second-stage estimates. Dependent variable is economic growth rate						
Happiness	1.79***	1.50**	2.07***	2.03**	1.89***	1.70***
	(3.18)	(2.55)	(3.08)	(2.51)	(5.39)	(3.60)
Log GDPPC	-1.16**	-2.31***	-0.70	-2.19***	-0.59	-1.63**
	(-2.38)	(-4.08)	(-1.63)	(-3.41)	(-1.50)	(-2.32)
Share of investment in GDP		0.20***		0.19***		0.07
		(5.44)		(4.30)		(0.86)
Share of government spending in GDP		0.02		0.05		-0.04
		(0.60)		(1.11)		(-0.72)
Education attainment over 25		0.06		0.19		0.08
		(0.47)		(1.12)		(0.57)
Trade		0.002		0.002		0.009
		(0.60)		(0.32)		(1.28)
Constant		7.87**	-6.31	1.48	-6.50**	2.87
		(2.41)	(-1.10)	(0.29)	(-2.00)	(0.62)
Panel B: First-stage estimates. Dependent variable is happiness						
Sex imbalance	-124.08***	-125.11***	-107.5***	-92.69***	-144.14***	-123.52***
	(-4.40)	(-3.82)	(-4.27)	(-3.29)	(-5.74)	(-4.69)
Log GDPPC	0.55***	0.70***	0.26***	0.46**	0.68***	0.93***
	(4.86)	(2.85)	(3.05)	(2.23)	(4.12)	(3.62)
Share of investment in GDP		-0.013		-0.009		-0.007
		(-0.47)		(-0.50)		(-0.21)

Share of government spending in GDP		-0.008		-0.02		-0.04**
		(-0.44)		(-1.39)		(-2.34)
Education attainment over 25		-0.04		-0.10		-0.11**
		(-0.72)		(-1.72)		(-1.86)
Trade		0.0006		0.0007		0.004*
		(0.29)		(0.63)		(1.73)
Constant	2.15*	1.53	4.86***	4.29***	1.10	0.35
	(1.95)	(0.88)	(6.04)	(2.85)	(0.68)	(0.17)
Number of obs.	55	52	55	52	45	42
F-statistic	24.32	7.16	14.61	6.69	33.71	19.82
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Shea Test	19.33	14.61	18.21	10.84	32.90	22.02
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Note: Sex imbalance is calculated from the estimates and medium-variant projections of “Mid-year de facto female population” and “Mid-year de facto male population” compiled by United Nations (2005). See Section 5.1 for the calculation details. Life satisfaction and happy life indices are from World Database of Happiness (2007). GDP per capita, the shares of investment and government spending in GDP, and trade (measured as (import+export)/GDP) are from Penn World Table 6.2. Growth rate in GDP per capita is calculated based on GDP per capita. Education attainment over 25 is average years of schooling from the dataset by Barro and Lee (2000). t-values, adjusted for the heteroskadesicity, are reported in parentheses. * p<0.1; ** p<0.05; *** p<0.01.

Table 5: Robustness Check I: With more Controls

	(1)	(2)	(3)	(4)
	Population growth	Income inequality	Civil liberties	Political Rights
Panel A: Second-stage estimates. Dependent variable: economic growth rate				
Happiness index in the 1990s	1.76***	1.73***	1.26**	1.42***
	(2.59)	(3.17)	(2.54)	(2.96)
Log GDP per capita in 1990	-2.61***	-2.92***	-2.97***	-2.95***
	(-3.93)	(-4.60)	(-5.55)	(-4.98)
Share of investment in GDP in the 1990s	0.20***	0.19***	0.23***	0.23***
	(6.00)	(3.96)	(4.95)	(5.25)
Share of government spending in GDP in the 1990s	0.02	-0.01	0.03	0.03
	(0.46)	(-0.22)	(0.71)	(0.73)
Education attainment over 25 in the 1990s	0.04	0.09	-0.03	0.04
	(0.33)	(0.64)	(-0.23)	(0.34)
Trade in the 1990s	0.003	0.003	0.003	0.004
	(0.75)	(0.82)	(0.79)	(0.80)
Average annual growth rates of population in the 1990s	-0.30			
	(-0.85)			
Gini coefficient in the 1990s		-0.03		
		(-0.85)		
Civil liberties in the 1990s			-0.59**	
			(-2.04)	
Political Rights in the 1990s				-0.45
				(-1.63)
Constant	9.18***	13.6*	16.86***	14.47***
	(2.87)	(1.93)	(2.99)	(2.80)

Panel B: First-stage estimates. Dependent variable is Happiness index in the 1990s

Sex imbalance in 1990	-110.60**	-133.59***	-117.02***	-128.83***
	(-2.57)	(-3.42)	(-4.34)	(-4.31)
Log GDP per capita in 1990	0.75**	0.66*	0.37	0.56
	(2.63)	(1.73)	(1.54)	(2.60)
Share of investment in GDP in the 1990s	-0.02	0.008	0.009	0.001
	(-0.53)	(0.25)	(0.30)	(0.05)
Share of government spending in GDP in the 1990s	-0.005	0.03	-0.00007	0.0005
	(-0.25)	(0.72)	(-0.00)	(0.03)
Education attainment over 25 in the 1990s	-0.03	-0.07	-0.08	-0.05
	(-0.62)	(-1.14)	(-1.32)	(-0.96)
Trade in the 1990s	0.0003	-0.0007	0.0004	0.0001
	(0.13)	(-0.35)	(0.25)	(0.06)
Average annual growth rates of population in the 1990s	0.13			
	(0.69)			
Gini coefficient in the 1990s		-0.002		
		(-0.09)		
Civil liberties in the 1990s			-0.24*	
			(-1.96)	
Political Rights in the 1990s				-0.08
				(-0.60)
Constant	0.77	1.17	4.86	2.60
	(0.32)	(0.24)	(2.85)	(1.55)
Number of obs.	52	33	51	51
F-statistic	5.58	4.44	11.18	8.82
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)
Shea Test	6.59	11.69	18.83	18.59

(p-value)	(0.01)	(0.00)	(0.00)	(0.00)

Note: Life satisfaction index from World Database of Happiness (2007) is used to measure the level of happiness. GDP, population, GDP per capita, the shares of investment and government spending in GDP, and trade (measured as (import+export)/GDP) are from Penn World Table 6.2. Growth rate in GDP per capita and population is calculated based on these variables. Education attainment over 25 is average years of schooling from the dataset by Barro and Lee (2000). Gini coefficient is from World Income Inequality Database (V 2.0a, June 2005). Measures of political rights and civil liberties are computed based on *Freedom in the World Country Ratings (1972-2006)* compiled by the Freedom House, with a lower value indicating better political rights and civil liberties. t-values, adjusted for the heteroskadesicity, are reported in parentheses. * $p<0.1$; ** $p<0.05$; *** $p<0.01$.

Table 6: Robustness Checks II: Validity of Instrumental Variable and Results with Alternative IV

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method	OLS	OLS	OLS	OLS	OLS	2SLS[a]	2SLS[a]	2SLS[a]
Happiness measure	Life satisfaction	Life satisfaction	Life satisfaction	Happy life index	Happy life index	Life satisfaction	Life satisfaction	Life satisfaction
Sex Imbalance in 1990	-222.51**	-54.21	7.00	-95.8	-67.13			
	(-2.22)	(-0.54)	(0.08)	(-0.95)	(-0.73)			
Happiness index in the 1990s		1.36***	1.56***	1.18**	1.30***	1.79***	1.57***	1.83**
		(2.80)	(4.13)	(2.30)	(2.84)	(4.32)	(3.11)	(2.13)
Log GDP per capita in 1990	-0.16	-0.91	-2.35***	-0.47	-1.86***	-2.42	-2.37***	-2.51***
	(-0.34)	(-1.44)	(-4.19)	(-0.90)	(-2.71)	(-5.12)	(-4.75)	(-3.67)
Share of investment in GDP in the 1990s			0.20***		0.19***	0.19***	0.20***	0.18***
			(4.74)		(3.24)	(4.87)	(5.41)	(3.18)
Share of government spending in GDP in the 1990s			0.02		0.04	0.04	0.03	0.02
			(0.60)		(0.82)	(1.04)	(0.84)	(0.55)
Education attainment over 25 in the 1990s			0.06		0.12	-0.04	0.05	0.19
			(0.45)		(0.73)	(-0.39)	(0.43)	(1.43)
Trade in the 1990s			0.002		0.002	-0.0004	0.001	0.002
			(0.54)		(0.37)	(-0.11)	(0.29)	(0.58)
Crime rate in the 1990s						-0.03		
						(-1.00)		
Political instability in the 1990s							-0.53	
							(-0.29)	
Growth rate in the 1980s								16.7
								(1.04)
Constant	3.76	0.84	7.79**	-1.98	4.59	7.77**	7.77**	6.62
	(0.84)	(0.24)	(2.36)	(-0.49)	(1.15)	(2.31)	(2.47)	(1.63)

Number of obs.	55	55	52	55	52	47	51	37
R-square	0.10	0.27	0.57	0.20	0.47	0.63[b]	0.58[b]	0.54[b]
F-statistic	2.80	6.15	7.43	4.23	4.30	12.04	9.34	8.04
(p-value)	(0.07)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Note: Sex imbalance is calculated from the estimates and medium-variant projections of "Mid-year de facto female population" and "Mid-year de facto male population" compiled by United Nations (2005). See Section 5.1 for the calculation details. Life satisfaction and happy life indices are from World Database of Happiness (2007). GDP, GDP per capita, the shares of investment and government spending in GDP, and trade (measured as (import+export)/GDP) are from Penn World Table 6.2. Growth rate in GDP per capita is calculated based on these variables. Education attainment over 25 is average years of schooling from the dataset by Barro and Lee (2000). Crime rate measured by "total recorded intentional homicide, completed, per 100,000 inhabitants" is from *United Nations Surveys of Crime Trends and Operations of Criminal Justice Systems (covering the period 1990 – 2000)*. The data of political instability are from the *Database of Political Institutions* compiled by the World Bank (2004). Column (8) uses suicide rate as the instrumental variable. The data of suicide rate are from World Database of Happiness (2007). t-values, adjusted for the heteroskadesicity, are reported in parentheses. * p<0.1; ** p<0.05; *** p<0.01.

[a] First-stage estimates are available upon request.

[b] This is centered R-square estimate.

Table 7: Channel Investigation: Baseline Model

	(1)	(2)	(3)	(4)	(5)
Dependent variable	Growth Rate	Happiness	Investment	Life Expectation	Trust
Happiness index in the 1990s			3.63**	2.52***	-0.01
			(2.04)	(2.81)	(-0.13)
Log GDP per capita in 1990	-4.76***	0.55***	2.19	4.49***	0.03
	(-3.02)	(4.94)	(1.24)	(6.58)	(0.38)
Share of investment in GDP in the 1990s	0.21***		0.23***		
	(2.61)		(4.69)		
Trust in the 1990s	-1.30		0.01		
	(-0.40)		(0.28)		
Life expectation at birth in the 1990s	0.58**		-0.02		
	(2.20)		(-0.17)		
Share of government spending in GDP in the 1990s	0.04		0.004	-0.02	0.07***
	(0.71)		(0.89)	(-0.34)	(3.10)
Education attainment over 25 in the 1990s	0.10		0.30		
	(0.41)		(0.78)		
Sex Imbalance in 1990		-130.51***			
		(-4.68)			
Log Population in the 1990s			1.76***		
			(3.80)		
Trade in the 1990s			0.06***		
			(4.08)		
Political Instability in the 1990s			-4.15***	1.33	
			(-0.66)	(0.45)	
Constant	0.07**	2.15**	-49.19***	13.79**	0.86*

	(0.01)	(2.05)	(-3.60)	(2.55)	(1.72)
Number of observation	51	51	51	51	51
R-square	0.08	0.49	0.35	0.76	0.27
Chi2	22.49	48.75	45.36	162.49	24.45
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Note: Life satisfaction index is from World Database of Happiness (2007). GDP, population, GDP per capita, the shares of investment and government spending in GDP, and trade ((import+export)/GDP) are from Penn World Table 6.2. Growth rate in GDP per capita is calculated based on these variables. Education attainment over 25 is average years of schooling from the dataset by Barro and Lee (2000). Trust is also from World Database of Happiness. For trust, respondents report whether they agree "most people can be trusted," and "yes" refers to numerical value 3, and "no" to 1. The data of life expectation at birth are from World Development Indicator Database compiled and maintained by World Bank. Sex imbalance is calculated from the estimates and medium-variant projections of "Mid-year de facto female population" and "Mid-year de facto male population" compiled by United Nations (2005). See Section 5.1 for the calculation details. The data of political instability comes from the Database of Political Institutions compiled by the World Bank (2004). t-values are reported in parentheses. * p<0.1; ** p<0.05; *** p<0.01.

Table 8: Channel Investigation: Summary

	Channel on Growth	Happiness on Channel	Happiness on Growth
Investment	0.206	3.627	0.749
	(2.61)	(2.04)	(1.54)
Trust	-1.304	-0.011	0.014
	(-0.40)	(-0.13)	(0.05)
Life Expectation	0.581	2.520	1.464
	(2.20)	(2.81)	(1.67)

Note: Life satisfaction index are from World Database of Happiness (2007). GDP per capita and the shares of investment are from Penn World Table 6.2. Growth rate in GDP per capita is calculated based on these variables. Trust is also from World Database of Happiness. For trust, respondents report whether they agree “most people can be trusted,” and “yes” refers to numerical value 3, and “no” to 1. The data of life expectation at birth are from World Development Indicator Database compiled and maintained by World Bank. t-values are reported in parentheses.