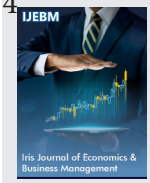

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Research Article

Happiness and Economic Growth in the Post–Cold War Decade

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Abstract

This paper examines the effect of residents' happiness on economic growth in the post–Cold War decade. We first document a positive correlation between happiness levels and economic growth across countries. We then use sex imbalance—which impedes normal matching in the marriage market and thereby reduces happiness—as an instrument for happiness. Our results indicate that happiness has a positive effect on economic growth, and this finding remains robust after accounting for a range of competing explanations. We further identify life expectancy and the investment ratio as two likely channels through which happiness affects economic growth.

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

Introduction

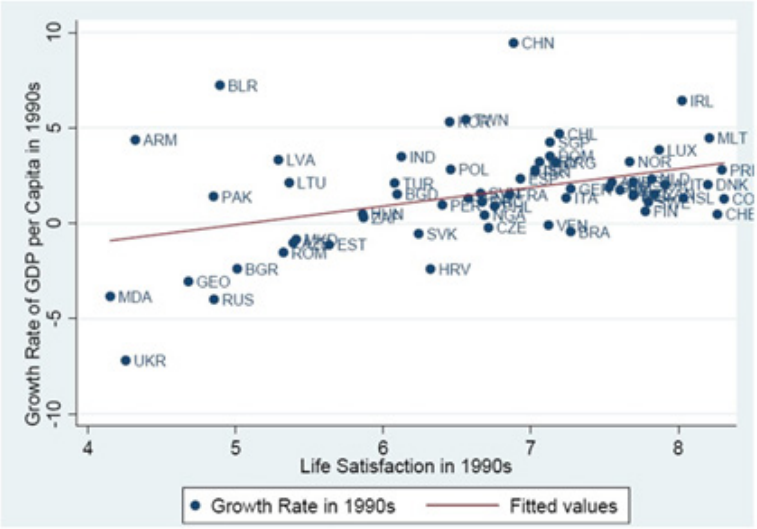
Happiness matters greatly for the life of an individual, as Russell observed[1]. Whether the happiness of a country's residents affects its economic growth, however, remains an open question. Figure 1 displays a positive correlation between the happiness level of residents and the growth rate of gross domestic product (GDP) per capita across countries in the 1990s. For example, Denmark (DNK), with a happiness level of 8.20, experienced an annual growth rate of 2.02%, whereas Moldova (MDA), with a happiness level of 4.15, recorded an annual growth rate of -3.84%.

We focus on the post–Cold War decade because, relative to the Cold War era, this period was geopolitically more stable for many countries. This reduces confounding effects from major military conflicts and allows for a cleaner examination of the relationship between happiness and economic growth. Moreover, comparable cross-country data on happiness and economic growth became widely available during this period. For the first time, both happiness and growth could be systematically examined on a global scale.

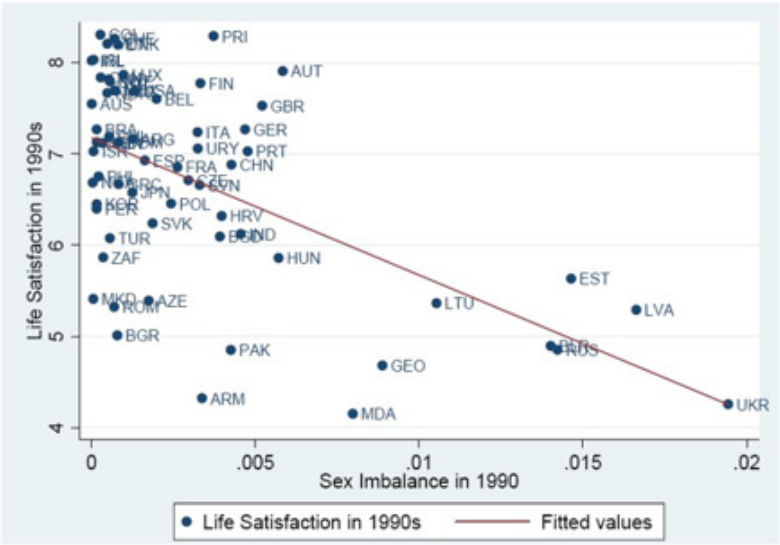
This correlation in Figure 1 may reflect factors that correlate with both economic growth and happiness, or the fact that economic growth itself fosters happiness. To isolate the effect of happiness on economic growth, we exploit the variation in sex imbalance as a source of variation in happiness. Sex ratios that deviate from the balanced level make mating more difficult and thereby depress the happiness[2] of the population, because partnership - including marriage and cohabitation - and sexual activity are important sources of happiness [1]. Defining sex imbalance as $(1-M/F)^2$, where M and F denote the male and female populations, respectively, Figure 2 exhibits a strong negative correlation between sex imbalance and happiness across countries.

[1] See Oswald, Proto, and Sgroi (2015) for econometric evidence.

[2] For the effect of income on happiness, see, e.g., Di Tella, MacCulloch, and Oswald (2003), Easterlin (1974, 1995, 2001), Frey and Stutzer (2002a, 2003), Frijters, Haisken-DeNew, and Shields (2004), Gardner and Oswald (2007), Oswald (1997), and Stevenson and Wolfers (2008).



Notes: The data of happiness measured by life-satisfaction index are from the World Database of Happiness (2007). Growth rates in GDP per capita are calculated based on the data from Penn World Table 6.2.
Figure 1: Happiness and Economic Growth.



Notes: Sex imbalance in 1990 is calculated based on the medium-variant projections of "mid-year de facto female population" and "mid-year de facto male population" compiled by United Nations (2005). See Section 4 for the calculation details. The data of happiness measured by life-satisfaction index are from the World Database of Happiness (2007).
Figure 2: Sex Imbalance and Happiness.

Instrumented by sex imbalance, happiness is found to have a positive effect on economic growth. The validity of sex imbalance as an instrumental variable depends on whether it correlates with economic growth through channels other than happiness. After accounting for alternative channels - including war, institutional quality, political instability, population structure, income inequality, and crime - we find that the estimated effect persists. In fact, GDP per capita, as a summary statistic of overall economic and political fundamentals, does not correlate with sex imbalance at all, as shown in Figure 3. Robustness checks further indicate that our findings are not driven by outliers, such as Asian countries, where gender-specific infanticide, abortion, and birth misreporting occur with non-trivial frequency, or transition countries, where alcoholism affects the two sexes differently [2].

We then investigate the channels through which happiness affects economic growth[3]. The first possible channel operates through consumption and investment. Whether to save for rainy days or save on rainy days depends on whether happiness raises or lowers the marginal benefit of consumption [3], and happier people have been documented to save more, other things held equal [4]. Second, happiness is associated with prolonged life expectancy [5,6]. Short life expectancy depresses investment in physical and

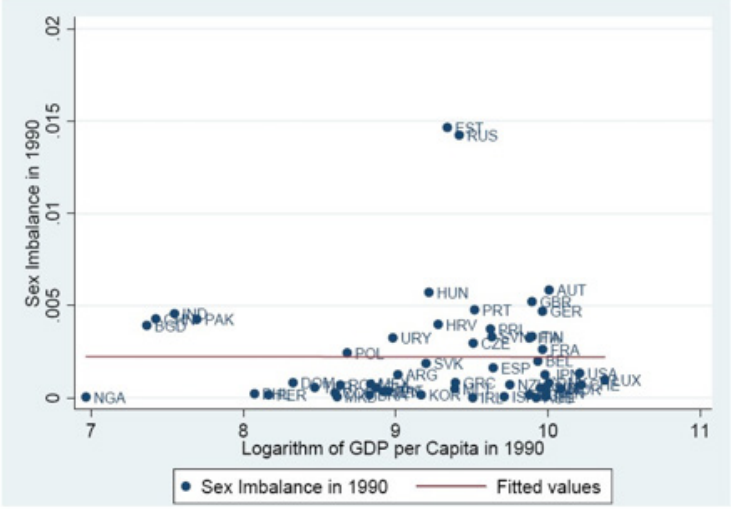
human capital [7], whereas longevity raises population and may therefore lower income per capita [8]. Third, happiness fosters generosity [9] and encourages prosocial behaviors [10]; a happier society may therefore exhibit a higher level of trust - a form of social capital that has been shown to promote economic growth [11-14]. Employing the three-stage least squares (3SLS) approach of Tavares and Wacziarg [15], Wacziarg [16], and Lorentzen, McMillan, and Wacziarg [7], we identify investment and life expectancy as the two most likely channels.

The literature on happiness economics has focused on three topics[4]: (i) the relationship between happiness and utility [17-19]; (ii) the determinants of happiness [20-30]; and (iii) the effects of emotions on human behavior [9,31-33]. This paper belongs to the third category but differs from prior work by identifying the effect of happiness at the country level. Our goal is not to develop a new theory but to document previously unnoticed facts and to motivate investigation of the underlying mechanisms. The remainder of the paper is organized as follows. Section 2 describes our dataset and the measurement of happiness. Section 3 presents the main results. Section 4 examines possible channels through which happiness affects growth. Section 5 concludes.

Data

The data on cross-country happiness levels are drawn from the World Database of Happiness compiled by Ruut Veenhoven and his team. We use two measures of happiness: the life-satisfaction index and the happy-life index. Both are aggregated from cross-country surveys in which residents are asked about their levels of subjective happiness. The survey question underlying the life-satisfaction index is "All things considered, how satisfied are you with your life as a whole now?" Respondents rate their answer on a 1-10 numerical scale, with higher values indicating greater life satisfaction.

The survey question underlying the happy-life index is more complex, encompassing three wording patterns with three corresponding numerical scales. The first asks, "In general, how happy would you say you are?" with answers ranging from "very happy (3)" to "not happy (1)." The second asks, "Taking all things together, would you say you are," with answers ranging from "very happy (4)" to "not at all happy (1)." The third asks, "How happy do you feel as you live now?" with answers ranging from "very happy (5)" to "very unhappy (1)." Veenhoven and his team apply a Thurstone transformation to these three sets of answers to obtain a 1-10 numerical scale[5], with higher values indicating a happier life. Owing to the complexity of the happy-life index, we use the life-satisfaction index as our primary measure.



Notes: Sex imbalance in 1990 is calculated based on the medium-variant projections of "mid-year de facto female population" and "mid-year de facto male population" compiled by United Nations (2005). See Section 4 for the calculation details. The data of happiness measured by life-satisfaction index are from the World Database of Happiness (2007).
Figure 3: Sex Imbalance and Initial Economic Condition.

[3] The possibility of bidirectional causality between economic growth and happiness was first raised by Kenny (1999).

[4] Di Tella and MacCulloch (2006) review the wide use of happiness data in economic research. For a discussion of policy implications, see Frank (1997) and Layard (2006).

[5] Detailed descriptions of the variables are available at https://worlddatabaseofhappiness.eur.nl/.

One might be concerned about the reliability of subjective measures of happiness. In fact, such measures are stable over time, because the factors that influence individual happiness - income, marital status, health, and education - change only slowly. Krueger and Schkade [34] document that subjective measures of mental well-being, including the life-satisfaction index, exhibit correlation over time sufficient to support research, and Lyubomirsky and Lepper [35] reach a similar conclusion. Self-reported happiness is also strongly correlated with happiness reported by friends and family members [36,37] and by clinical experts [38].

GDP per capita, population, the investment ratio, the share of government expenditure in GDP, and openness (measured as (imports + exports)/GDP) are drawn from the Penn World Table. Growth rates of GDP per capita and population are annual averages[6]. Education data, measured by average years of schooling, are drawn from the dataset "Educational Attainment of the Total Population Aged 25 and Over" compiled by Barro and Lee [39]. The data on trust (social capital) are also from the World Database of Happiness (2007). The trust index is constructed in the same manner as the happiness indices: respondents indicate whether they agree with the statement "most people can be trusted," with "yes" coded as 3 and "no" coded as 1. This measure is widely used to study the effect of social capital on economic performance [11,13].

Crime rates, measured by total recorded intentional homicides, completed, per 100,000 in-habitants, are from the United Nations Surveys of Crime Trends and Operations of Criminal Justice Systems (1990–2000). The Gini coefficient, which measures income inequality, is drawn from the World Income Inequality Database. Measures of political rights and civil liberties are constructed from the ratings reported in Freedom in the World, with lower values indicating stronger political rights and civil liberties. Life expectancy at birth is from the World Bank's World Development Indicators. Data on political instability, measured by the percentage of veto players who leave the government[7], are from the Database of Political Institutions compiled by the World Bank. Data on war casualties per capita, averaged over the period 1980–1988, are from Barro and Lee [40]. Sex imbalance is computed from United Nations (2005) estimates and medium-variant projections of "mid-year de facto female population" and "mid-year de facto male population." Table 1 reports descriptive statistics for the variables, and Appendix 2 lists the main variables by country.

Table 1: Descriptive Statistics.

Variable	Obs.	Mean	Std.Dev.	Min	Max
Average Annual Growth Rates of GDP per Capita, 1990s	65	1.57	2.66	-7.2	9.44
Life-satisfaction Index	65	6.69	1.12	4.15	8.31
Happy-life Index	65	6.83	0.81	5.06	8.1
Sex Imbalance	64	0	0	0	0.02
Logarithm of GDP per Capita in 1990	56	9.25	0.81	6.97	10.37
Investment Ratio	56	19.1	7.92	4.51	41.61
Government Expenditure Share	56	19.24	6.67	7.63	35.51
Education	57	7.68	2.32	2.19	12
Openness	56	70.04	57.22	13.97	358.11
Population Growth	65	0.81	0.92	-1.3	3.18
Gini Coefficient	40	35.6	11.02	20	64.7
Civil Liberties	64	2.66	1.39	1	6.8
Political Rights	64	2.26	1.48	1	7
Crime Rate	58	6.43	11.9	0.06	66.58
Political Instability	64	0.16	0.11	0	0.43
War Casualties per Capita	56	0	0.0002	0	0.0009
Suicide Rate	50	13.69	9.6	0.9	38.7
Life Expectancy	64	72.07	5.99	47.46	79.73
Trust	65	1.58	0.28	1.08	2.3

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

[7] Veto players are defined as "the president and the largest party in the legislature for a presidential system" or "the prime minister and the parties in the government coalition for a parliamentary system." See Beck, Clarke, Groff, Keefer, and Walsh (2001) for details.

Empirical Results

OLS Results

We estimate the following regression:

$$GR_c = \alpha + \beta \cdot HAPPINESS_c + \delta \cdot \ln GDPPC90_c + X_c\gamma + \varepsilon_c, \quad (1)$$

where GR_c is the growth rate of GDP per capita in country c, $HAPPINESS_c$ is the overall happiness level in country c, $\ln GDPPC90_c$ is the logarithm of GDP per capita in country c in 1990, X_c is a vector of control variables, and ε_c is the error term. We use averages over the 1990s to maximize country coverage and minimize measurement error[8].

Table 2 reports the OLS estimates. In column 1, happiness is measured by the life-satisfaction index, and its coefficient is positive and statistically significant. The coefficient on $\ln GDPPC90_c$ is negative, consistent with the convergence hypothesis of growth theory, which holds that poorer countries grow more quickly on average. Column 2 adds common control variables used in growth regressions - the investment ratio, the government expenditure share, education, and openness - and the coefficient on happiness rises and remains significant. Columns 3 and 4 repeat the specifications of columns 1 and 2 using the happy-life index as the measure of happiness and yield similar results.

Table 2: OLS Estimates.

Happiness Measure	1	2	3	4
	Life Satisfaction		Happy Life	
Happiness	1.39***	1.62***	1.44***	1.64***
	(3.39)	(3.81)	(3.11)	(3.03)
Initial Logarithm of GDP per Capita	-0.92	-2.26***	-0.53	-1.90**
	(-1.63)	(-3.28)	(-1.09)	(-2.31)
Investment Ratio		0.13***		0.11**
		(2.69)		(2.08)
Government Expenditure Share		0.04		0.05
		(0.96)		(1.04)
Education		0.05		0.16
		(0.34)		(0.94)
Openness		0.01		0.01
		(1.51)		(1.40)
Constant	0.63	7.43*	-3.42	3.12
	(0.17)	(1.75)	(-0.81)	(0.60)
Number of observations	56	53	56	53
R-square	0.23	0.42	0.18	0.34
F- statistic	6.77	5.83	4.93	3.14
p -value for F-statistic	0.00	0.00	0.01	0.01

Note: t-values, adjusted for heteroskedasticity, are reported in parentheses. *, **, *** represent significance levels of 10%, 5%, and 1%, respectively.

[8] Happiness is measured with error, and the within-group estimator can amplify measurement error (see Hauk and Wacziarg, 2009).

We then account for a number of variables that correlate with both economic growth and happiness. First, a country with a younger age structure may be happier, and age structure can affect productivity and the size of the labor force. Second, income inequality affects both economic growth [41-42] and happiness [23,43]. Third, the effect of institutions on economic performance is well established in the literature [15,44,45], and institutions are also associated with happiness [46]. Fourth, crime depresses investment and reduces quality of life. As shown in Table 3, the main findings from Table 2 hold after accounting for all of these factors.

2SLS Results

We then instrument happiness with sex imbalance, which prevents normal partnership formation and sexual activity from generating happiness. Happiness is strongly associated with marriage [47-49] and with sexual activity [1]; therefore, sex imbalance produces mating failures and reduces happiness in a given society. Sex imbalance is measured by $(1-M/F)^2$, where M and F denote the shares of male and female population, respectively. The 2SLS results are reported in Table 4. Sex imbalance has a negative effect on happiness, which in turn has a positive effect on economic growth. These findings are robust to the inclusion of the control variables described above (column 2) and to the use of an alternative measure of *HAPPINESS* (columns 3 and 4).

The validity of sex imbalance as an instrumental variable rests on two conditions: (i) sex imbalance must be strongly correlated with happiness, as shown earlier[9]; and (ii) sex imbalance must not correlate with economic growth through any channel other than happiness. Condition (ii) is not directly testable, so we conduct five robustness checks to address it indirectly[10]. The first check examines whether sex imbalance correlates with economic growth through known channels. In Table 5, the regression includes the crime rate, political instability, population growth, the Gini index, civil liberties, political rights, and war casualties per capita; the previous findings continue to hold.

The second check examines whether the results are driven by outliers. In some Asian countries, son preference leads parents to engage in infanticide, gender-specific abortion, and concealment of births [50], while in transition countries alcoholism is a severe social problem that may affect the two sexes differently [2]. In Table 6, we add dummy variables for Asian and transition countries. Again, the findings are unchanged.

Table 3: OLS Estimates, Robustness Check.

Happiness Measure	1	2	3	4	5
	Life Satisfaction				
Happiness	1.60***	1.79***	1.48***	1.58***	1.76***
	(3.51)	(3.13)	(3.15)	(3.60)	(5.02)
Logarithm of GDP per capita in 1990	-2.23***	-3.06***	-2.63***	-2.50***	-2.19***
	(-2.92)	(-3.31)	(-3.56)	(-3.12)	(-3.47)
Investment Rate	0.13**	0.1	0.14***	0.14**	0.13**
	(2.57)	(1.54)	(2.70)	(2.63)	(2.30)
Government Expenditure Share	0.04	-0.01	0.04	0.04	0.06
	(0.99)	(-0.09)	(0.83)	(0.86)	(1.30)
Education	0.06	-0.03	0	0.04	-0.11
	(0.37)	(-0.16)	(0.01)	(0.24)	(-0.96)
Trade	0.01	0.01**	0.01	0.01	0
	(1.41)	(2.12)	(1.50)	(1.35)	(0.31)
Population Growth	0.06				
	(0.19)				
Gini Index		-0.06			
		(-1.10)			
Civil Liberties			-0.34		
			(-0.80)		
Political Rights				-0.18	
				(-0.44)	-0.03
Crime Rate					(-1.23)

Constant	7.18	18.06	12.67*	10.19	6.95
	(1.51)	(1.64)	(1.94)	(1.57)	(1.65)
Number of observations	53	34	52	52	47
R-square	0.42	0.53	0.44	0.43	0.56
F- statistic	6.05	4.45	4.84	4.8	5.08
p -value for F-statistic	0.00	0.00	0.00	0.00	0.00

Notes: t-values, adjusted for heteroskedasticity, are reported in parentheses. *, **, *** represent significance levels of 10%, 5%, and 1%, respectively.

Table 4: 2SLS Results.

Happiness Measure	1	2	3	4
	Life Satisfaction		Happy Life	
Panel A: Second-stage estimates. Dependent variable: Growth rate				
Happiness	1.79***	2.01***	2.07***	2.53***
	(3.18)	(3.55)	(3.08)	(3.58)
Logarithm of GDP per Capita in 1990	-1.16**	-2.58***	-0.7	-2.39**
	(-2.38)	(-4.09)	(-1.63)	(-2.99)
Investment Rate		0.14***		0.12***
		(3.57)		(2.65)
Government Expenditure Share		0.06		0.08
		(1.37)		(1.62)
Education		0.07		0.26
		(0.48)		(1.33)
Openness		0.00		0.01
		(1.38)		(1.29)
Constant	-0.1	6.99*	-6.31	0.02
	(-0.02)	-1.88	(-1.10)	(0.00)
Panel B: First-stage estimates. Dependent variable: Happiness				
Sex Imbalance	-124.08***	-125.24***	-107.51***	-99.66***
	(-4.40)	(-4.94)	(-4.27)	(-3.69)
Logarithm of GDP per Capita in 1990	0.55***	0.69**	0.26***	0.47**
	(4.86)	(2.64)	(3.05)	(2.25)
Investment Rate		-0.02		-0.01
		(-1.01)		(-0.64)
Government Expenditure Share		-0.01		-0.01
		(-0.46)		(-0.99)
Education		-0.01		-0.09
		(-0.26)		‘(-1.64)
Openness		0.00		0.00
		(0.40)		‘(0.16)
Constant	2.15*	1.55	4.86***	3.99**
	(1.95)	(0.82)	(6.04)	(2.58)
Panel C: Test statistics				
Anderson Canonical Correlation LR Statistic	[15.11]***	[15.93]***	[15.45]***	[14.07]***
Cragg-Donald Chi-Statistic	[17.39]***	[18.63]***	[17.83]***	[16.16]***
Shea Test of Excluded Instruments	[19.33]***	[24.37]***	[18.21]***	[13.62]***
Cragg-Donald F-Statistic	16.44	16.12	16.86	13.98
Number of observations	55	52	55	52

Notes: t-values, adjusted for heteroskedasticity, are reported in parentheses. *, **, *** represent significance levels of 10%, 5%, and 1%, respectively.

Table 5: 2SLS Estimates, Robustness Check I.

	1	2	3	4	5	6	7
Panel A: Second-stage estimates. Dependent variable: Growth rate							
Happiness	2.18***	2.05***	2.12***	2.37***	1.90***	1.96***	2.25***
	(5.44)	(3.95)	(2.88)	(4.23)	(3.45)	(3.85)	(4.74)
Logarithm of GDP per Capita in 1990	-2.50***	-2.62***	-2.69***	-3.27***	2.90***	-2.97***	-3.31***
	(-4.44)	(-4.45)	(-3.49)	(-4.66)	(-4.44)	(-4.08)	(-6.42)
Investment Rate	0.13***	0.15***	0.14***	0.13**	0.15***	0.15***	0.15***
	(2.67)	(3.15)	(3.47)	(2.38)	(3.34)	(3.47)	(3.47)
Government Expenditure Share	0.07	0.06	0.05	0.01	0.05	0.05	0.07
	(1.49)	(1.35)	(1.35)	(0.20)	(1.25)	(1.22)	(1.53)
Education	-0.09	0.06	0.06	0.08	0.03	0.05	0.23
	(-0.86)	(0.43)	(0.41)	(0.48)	(0.20)	(0.38)	(1.45)
Openness	0	0	0	0.01**	0.01	0.01	0.01*
	(0.32)	(0.94)	(1.34)	(1.96)	(1.34)	(1.37)	(1.76)
Crime Rate	-0.03						
	(-1.17)						
Political Instability		-0.65					
		(-0.30)					
Population Growth			-0.11				
			(-0.28)				
Gini Index				-0.03			
				(-0.76)			
Civil Liberties					-0.29		
					(-0.85)		
Political Rights						-0.28	
						(-0.87)	
War Casualties per Capita							-2238.01**
							(-2.06)
Panel B: First-stage estimates. Dependent variable: Happiness							
Sex Imbalance	-134.67***	-138.08***	107.91**	119.93**	-117.87***	-127.63***	-146.16***
	(-5.02)	(-5.56)	(-2.75)	(-4.83)	(-4.27)	(-5.32)	(-7.07)
Panel C: Test statistics							
Anderson Canonical	[16.79]***	[19.95]***	[9.32]***	12.30]**	[15.18]***	[16.90]***	[4.15]**
Correlation LR Statistic Cragg-Donald Chi-Statistic	[20.18]***	[24.42]***	[10.21]***	[14.91]**	[17.68]***	[20.03]***	[60.77]***
Shea Test of Excluded Instruments	[25.22]***	[30.92]***	[7.58]***	[23.30]**	[29.74]***	[28.29]***	[49.97]***
Cragg-Donald F-Statistic	16.74	20.59	8.64	11.3	14.91	16.89	49.97
Number of observations	47	51	52	33	51	51	45

Notes: Constant terms are not reported. t-values, adjusted for heteroskedasticity, are reported in parentheses. *, **, *** represent significance levels of 10%, 5%, and 1%, respectively.

[9] The Anderson canonical correlation test, the Cragg–Donald test, and the Shea test all confirm the strong correlation.

[10] For the robustness checks, we use the life-satisfaction index as the measure of happiness. The corresponding results using the happy-life index (available upon request) are very similar.

Table 6: 2SLS Estimates, Robustness Check II.

Happiness Measure	1	2
	Life Satisfaction	
Panel A: Second-stage estimates. Dependent variable: Growth rate		
Happiness Index	1.92***	1.94**
	(3.84)	(2.05)
Logarithm of GDP per Capita in 1990	-2.00***	-2.59***
	(-3.29)	(-4.13)
Investment Rate	0.10*	0.14***
	(1.96)	(3.46)
Government Expenditure Share	0.05	0.06
	(1.24)	(1.48)
Education	0.09	0.09
	(0.63)	(0.42)
Openness	0.00	0.01
	(1.29)	(1.14)
Asian Countries Dummy	1.31*	
	(1.83)	
Transition Countries Dummy		-0.18
		(-0.14)
Constant	2.89	7.49
	(0.73)	(1.36)
Panel B: First-stage estimates. Dependent variable: Happiness		
Sex Imbalance	-128.49***	-83.50***
	(-4.55)	(-2.73)
Panel C: Test statistics		
Anderson Canonical Correlation LR Statistic	[16.87]***	[3.60]*
Cragg-Donald Chi-Statistic	[19.93]***	[8.81]***
Shea Test of Excluded Instruments	[20.66]***	[7.45]***
Cragg-Donald F-Statistic	16.86	7.45
Number of observations	52	52

Notes: t-values, adjusted for heteroskedasticity, are reported in parentheses. *, **, *** represent significance levels of 10%, 5%, and 1%, respectively. The first stage of 2SLS includes the same controls as the second stage, and their coefficients are not reported due to space limit (available upon request).

The third check is based on the premise that, if sex imbalance correlates with economic growth only through happiness, it should be uncorrelated with economic growth conditional on happiness. Column 1 of Table 7 shows that sex imbalance is negatively and significantly associated with economic growth; however, this correlation disappears once happiness is included in the regression (column 2). The coefficient on sex imbalance shrinks substantially in magnitude, from -222.51 to -54.21, and its t-statistic falls from -2.22 to -0.54. Columns 3-5 incorporate additional control variables and the alternative measure of happiness, leading to the same conclusion.

A possible concern with Figure 2 is that the data pattern is skewed to the right. To address possible bias arising from this skewness, we follow Nunn and Puga [51] in transforming the sex-imbalance measure using two methods. As the fourth check, Figure 4 plots the correlation between happiness and the logarithm of sex imbalance, and column 1 of Table 8 reports the corresponding 2SLS estimates. The previous results are robust to this transformation. The log-transformed sex imbalance in Figure 4 is now slightly left-skewed; we therefore also apply the zero-skewness Box–Cox power transformation in Figure 5, with the corresponding 2SLS estimates reported in column 2 of Table 8. The relationship between happiness and transformed sex imbalance is clearly not driven by outliers. The fifth check repeats the analysis using two sub-samples - Western- and Eastern-Hemisphere countries - with results reported in columns 3 and 4 of Table 8. These produce the same finding as before.

Table 7: 2SLS Estimates, Robustness Check III.

Happiness Measure	1	2	3	4	5
	Life Satisfaction			Happy Life	
Happiness		1.36***	1.62***	1.18***	1.32***
		(2.80)	(3.70)	(2.30)	(2.39)
Sex Imbalance	-222.51**	-54.21	-49.67	-95.78	-120.68
	(-2.22)	(-0.54)	(-0.55)	(-0.95)	(-1.26)
Logarithm of GDP per Capita in 1990	-0.16	-0.91	-2.31***	-0.47	-1.82**
	(-0.34)	(-1.44)	(-3.22)	(-0.90)	(-2.07)
Investment Rate			0.13***		0.11**
			(2.76)		(2.04)
Government Expenditure Share			0.05		0.06
			(1.18)		(1.15)
Education			0.06		0.15
			(0.41)		(0.85)
Openness			0.01		0.01
			(1.34)		(1.32)
Constant	3.76	0.84	7.61*	-1.98	4.85
	(0.84)	(0.24)	(1.82)	(-0.49)	(0.93)
Number of observations	55	55	52	55	52
R-square	0.1	0.27	0.49	0.2	0.38
F- statistic	2.8	6.15	5.65	4.23	3.43
p -value for F-statistic	0.07	0.00	0.00	0.01	0.01

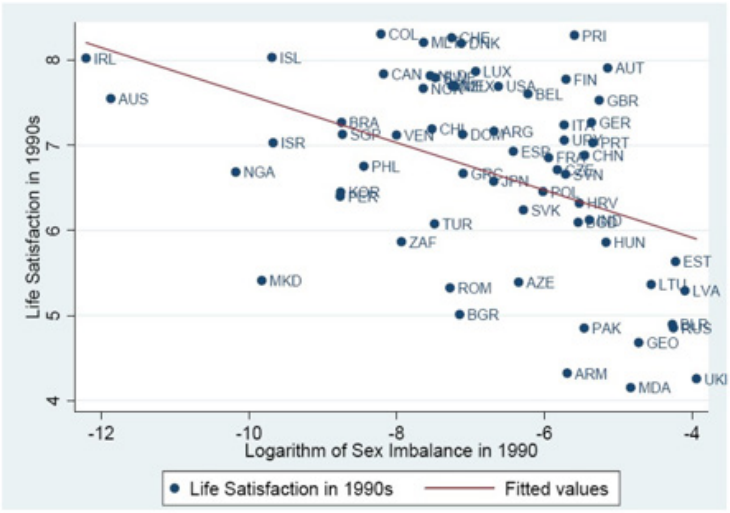
Notes: t-values, adjusted for heteroskedasticity, are reported in parentheses. *, **, *** represent significance levels of 10%, 5%, and 1%, respectively.

Table 8: 2SLS Estimates, Robustness Checks IV and V.

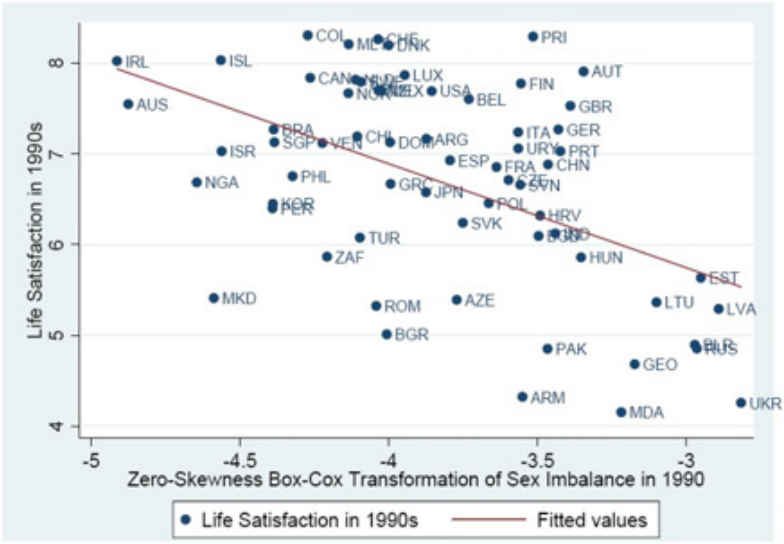
	1	2	3	4
Panel A: Second-stage estimates. Dependent variable: Growth rate				
Happiness	2.05**	1.84**	1.63**	2.41***
	(2.22)	(3.85)	(2.09)	(3.02)
Logarithm of GDP per Capita in 1990	-2.61***	-2.45***	-2.32***	-2.44**
	(-3.10)	(-3.22)	(-3.19)	(-2.50)
Investment Rate	0.14***	0.14***	0.18***	0.13
	(3.39)	(3.33)	(3.33)	(1.22)
Government Expenditure Share	0.06	0.05	0.07*	0.14
	(1.36)	(1.27)	(1.80)	(1.04)
Education	0.07	0.06	-0.12	0.38
	(0.49)	(0.44)	(-0.90)	(1.38)
Openness	0.00	0.00	0.00	0.02
	(1.36)	(1.42)	(0.30)	(1.29)
Constant	6.96*	7.14*	7.62**	-1.26
	(1.87	(1.85)	(1.97)	(-0.23)
Panel B: First-stage estimates. Dependent variable: Happiness				
Sex Imbalance	(-1.81)		-70.77*	-149.66***
			(-7.48)	
Logarithm of Sex Imbalance	-0.16**			
	(-2.65)			

Zero-Skewness Box-Cox Transformation of Sex Imbalance		-0.70***		
		(-2.79)		
Panel C: Test statistics				
Anderson Canonical Correlation LR Statistic	[7.90]***	[10.02]***	[2.82]*	[15.48]***
Cragg-Donald Chi-Statistic	[8.53]***	[11.05]***	[2.95]*	[23.92]***
Shea Test of Excluded Instruments	[7.00]**	[7.80]***	[3.29]*	[55.91]**
Cragg-Donald F-Statistic	7.38	9.56	2.32	15.11
Number of observations	52	52	33	19

Notes: t-values, adjusted for heteroskedasticity, are reported in parentheses. *, **, *** represent significance levels of 10%, 5%, and 1%, respectively. The first stage of 2SLS includes the same controls as the second stage, and their coefficients are not reported due to space limit (available upon request).



Notes: Sex imbalance in 1990 is calculated based on the medium-variant projections of "mid-year de facto female population" and "mid-year de facto male population" compiled by United Nations (2005). See Section 4 for the calculation details. The data of happiness measured by life-satisfaction index are from the World Database of Happiness (2007).
Figure 4: Logarithm of Sex Imbalance and Happiness.



Notes: Sex imbalance in 1990 is calculated based on the medium-variant projections of "mid-year de facto female population" and "mid-year de facto male population" compiled by United Nations (2005). See Section 4 for the calculation details. The data of happiness measured by life-satisfaction index are from the World Database of Happiness (2007).
Figure 5: Zero-Skewness Box-Cox Transformation of Sex Imbalance and Happiness.

Channel Investigation

As discussed above, happiness may affect economic growth through investment, life expectancy, and trust (social capital). This section evaluates the relative importance of these channels. Following Tavares and Wacziarg [15-16], and Lorentzen [7], we use 3SLS estimation, which produces a single covariance matrix for all estimates and thereby facilitates inference on functions of parameters across equations. The results are reported in Table 9. As columns 2 and 3 show, happiness significantly raises both the investment ratio and life expectancy, but its effect on trust is insignificant (column 4). Column 1 shows that the investment ratio and life expectancy are positively associated with the growth rate[12].

We combine the estimates in columns 2-4 with those in column 1 to compute the total effect of happiness on economic growth. Column 3 of Table 10 reports the relative importance of each channel, measured as the product of the coefficient on happiness in the channel equation (column 2 of Table 9)[13] and the coefficient on the channel in the growth equation (column 1 of Table 9).ss The total effect through these channels is 1.83, slightly smaller than the total effect of happiness estimated earlier (2.01, in column 2 of Table 4), which suggests that additional, unidentified channels may also be at work.

Table 9: 3SLS Estimates.

Dependent Variable	1	2	3	4
	Growth Rate	Investment	Life Expectancy	Trust
Happiness		3.57**	2.57***	-0.02
		(2.02)	(2.97)	(-0.28)
Logarithm of GDP per Capita in 1990	-3.92***	2.25	4.50***	0.05
	(-3.28)	(1.27)	(6.64)	(0.53)
Investment Rate	0.19***			
	(2.87)			
Life Expectancy	0.45**			
	(2.27)			
Trust	-0.26			
	(-0.15)			
Sex Imbalance				
Government Expenditure Share			-0.00	
			(-0.05)	
Education		0.29		0.06***
		(0.75)		(3.01)
Openness		0.06***		
		(4.07)		
Population		1.74***		
		(3.76)		
Political Instability		-2.98	2.01	
		(-0.45)	(0.62)	
Constant	2.08	-49.22***	12.94**	0.85*
	(0.41)	(-3.60)	(2.44)	(1.7)
Number of observations	51	51	51	51
R-square	0.3	0.36	0.76	0.25
Chi2- statistic	23	44.26	161.98	24.26
p -value for Chi2-statistic	0.00	0.00	0.00	0.00

Notes: t-values are reported in parentheses. *, **, *** represent significance of 10%, 5%, and 1%, respectively.

Table 10: Channel Investigation, Summary.

	Channel on Growth	Happiness on Channel	Happiness on Growth
Investment	0.19	3.57	0.68
	(2.87)	(2.02)	(1.63)
Trust	-0.26	-0.02	0.01
	(-0.15)	(-0.28)	-0.13
Life Expectancy	0.45	2.57	1.15
	(2.27)	(2.97)	(2.21)

Notes: Columns 1-2 are extracted from Table 9. Coefficients in column 3 are products of their counterparts in Columns 1-2. Standard errors in column 3 are calculated by computing linear approximations of the coefficient products.

[11] An alternative approach is to exclude these countries. Doing so shrinks the sample size but yields the same findings. Details are available upon request.

[12] Lorentzen, McMillan, and Wacziarg (2008) find that early death discourages investment in human capital by reducing its return (p. 88).

[13] Following Wacziarg (2001), t-statistics 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."

Conclusion

Happiness is an important determinant of individual behavior. To date, most work in happiness economics has been devoted to understanding the determinants of happiness and the effects of happiness on microeconomic behavior. This paper takes a different approach by studying the effect of happiness on economic growth. We first document a robust correlation between happiness and economic growth and then instrument happiness using sex imbalance, which impedes normal mating and thereby reduces happiness. The 2SLS results show that countries with happier residents grow faster, and the results are robust across a range of specifications. To understand the underlying mechanisms, we conduct a channel investigation and find that happiness encourages investment and extends life expectancy, both of which promote economic growth. These findings suggest that addressing the mental well-being of the population in low-income countries should complement efforts to address their economic difficulties.

Data Sources

The data on political rights and civil liberties - two measures of institutional quality - are avail-able at http://www.freedomhouse.org/uploads/fiw/FIWAllScores.xls. We use country averages over the 1990s. GDP per capita is from the Penn World Table, version 6.2. Average annual growth rates are computed using y = x(1 + r) n, where r is the annual growth rate, x and y are GDP per capita in the initial year (1989) and the final year (1999), respectively, and n = 10. The same source and method are used for the average annual growth rate of population. The investment share, government expenditure share, GDP per capita in 1990, and trade are also from the Penn World Table 6.2. Trade is measured as (imports + exports)/GDP. We use the natural logarithm of GDP per capita.

The happy-life index and the life-satisfaction index for the 1990s are drawn from the World Database of Happiness, provided by Ruut Veenhoven; both indices belong to the Happiness in Nations subset. The two measures are described in detail in the main text. Suicide rates and our trust measure are also drawn from this database.

Data on female and male population are from the United Nations Statistics Division, 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," 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 defined as the "percent of veto players who drop from the government in any given year."

Life expectancy at birth (in years) is drawn from the World Bank's World Development Indicators database, which is publicly available to subscribing institutions. We compute country averages over the 1990s.

Gini coefficients are from the World Income Inequality Database; we compute country averages over the 1990s. Crime rates are measured as "total recorded intentional homicide, completed," per 100,000 inhabitants, and are drawn from the United Nations Surveys of Crime Trends and Operations of Criminal Justice Systems, available 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 compute country averages over the 1990s. War casualties per capita are from Barro and Lee (1994); see http://www.nber.org/pub/b arro.lee/readme.txt.

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
Bangla-desh	1.52	6.1	7.01	0.0039
Belarus	7.23	4.89	5.22	0.0140
Belgium	1.73	7.61	7.74	0.0020
0Brazil	−0.44	7.27	6.9	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	6.8	0.0030
Denmark	2.02	8.2	7.9	0.0008
Dominican Republic	3.5	7.13	6.93	0.0008
Estonia	−1.13	5.63	5.93	0.0146
Finland	0.62	7.78	7.3	0.0033
France	1.47	6.86	7.5	0.0026
Georgia	−3.06	4.68	6.01	0.0089
Germany	1.8	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	2.8	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	7.7	7.36	0.0007
Nigeria	0.42	6.69	6.95	0.0000
Norway	3.22	7.67	7.32	0.0005
Pakistan	1.4	4.85	6.95	0.0043
Peru	0.96	6.4	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	2.8	8.3	7.77	0.0037
Romania	−1.54	5.32	5.6	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	1.1	7.8	7.73	0.0006
Switzer-land	0.46	8.27	7.84	0.0007
Turkey	2.1	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	7.4	0.0013
Uruguay	3.21	7.06	6.87	0.0032
Venezuela	−0.11	7.12	8.1	0.0003

Note: Numbers in columns 2-4 are rounded to the nearest hundredth, and numbers in column 5 are rounded to the nearest ten-thousandth. More accurate data are available upon request.

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