Does economic prosperity bring about a happier society? Empirical remarks on the Easterlin Paradox debate

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Abstract

Empirical analysis confirms the Easterlin Paradox: there is indeed a statistically significant and positive, albeit very small, relationship between economic growth and happiness. Notwithstanding a conclusion based on statistical significance, economic analysis of the results, on the other hand, still affirms the Easterlin Paradox: there is little economic significance in a very small estimate of the relationship between economic growth and happiness. An argument can also be forwarded that the increase in happiness is not an automatic outcome of economic growth because happiness is more than about income.

Keywords: Easterlin Paradox; economic growth; happiness; time

JEL Classification: A20; C60; I30; O40

1. INTRODUCTION

This paper is an intervention to the continuing discussions on the relationship between economic growth and happiness, or the Easterlin Paradox debate. In this context, the so-called "Easterlin group" has repeatedly established that there is no statistically significant relationship between economic growth and happiness across time. Happiness, in this context, does not increase with

economic growth. The so-called "Stevenson-Wolfers group," on the other hand, has repeatedly asserted that there is in fact a statistically significant and positive, albeit very small, relationship between economic growth and happiness across time.[1] Happiness, in this context, can increase with economic growth.

Of course, a resolution to the debate has important public policy implications. If the Easterlin group prevails, then it can be argued that public policy would be more useful if it focuses on broad goals like full employment, universal schooling, and comprehensive health care as targets, in lieu of an obsession with economic growth. If the Stevenson-Wolfers group prevails, then there is at least an endorsement that economic growth can raise happiness. At the same time, economic growth becomes a means to achieving the said broad goals to raise happiness further.

In this study, I take the Easterlin Paradox as my null hypothesis. My analysis looks at time series dynamics of data that spans four decades. As a preview, I present two conclusions. First, an interpretation of the results based on statistical significance leads me to reject the Easterlin Paradox. That is, like the Stevenson-Wolfers group, I confirm a robust and positive, albeit very small, relationship between economic growth and happiness. Second, and perhaps the more important conclusion, an interpretation of the results based on economic significance leads to a counterintuitive view that the underlying proposition of the Easterlin Paradox is valid—that is, the paradox is really about the trivial impact of economic growth on happiness. This conclusion turns out to be a more decisive point if it is accepted that economic growth in and of itself does not routinely translate as an increase in happiness because happiness is more than about income.

[1] For ease of presentation, the "Easterlin group" means Easterlin (1974, 1995, 2005, 2010, 2013a, 2013b), Easterlin and Angelescu (2009), Easterlin and Sawangfa (2010), and Easterlin et al. (2010), as well as the associated studies of Oswald (1997), Blanchflower and Oswald (2004), Clark et al. (2008). The "Stevenson-Wolfers group" refers to Stevenson and Wolfers (2008, 2013), and Sacks et al. (2010, 2012, 2013), as well as the associated studies of Haggerty and Veenhoven (2003, 2006), Deaton (2008), Inglehart et al. (2008), Diener et al. (2013), and Veenhoven and Vergunst (2013).

The rest of the paper is structured as follows. Section 2 presents the framework for empirical analysis. Section 3 discusses the data, the empirical strategy, and the findings. The last section concludes with some thoughts on the implications of the findings to public policy.

2. FRAMEWORK

The Easterlin Paradox deals with two concepts: economic growth and happiness. First, economic growth g is defined as

$$g = \frac{Y_t - Y_{t-1}}{Y_{t-1}} = \Delta \log Y_t \qquad (1)$$

where Y_t is a measure of income. The average period economic growth of a country at one point is obtained using the model $\log Y_t = a_0 + g\ time + error_t$.

Happiness h is operationalized as the change, improvement, or increase in happiness H.[2] Specifically, Easterlin (2010, p. 61), Easterlin (2013a, p.5), Easterlin (2013b, p. 21) Easterlin and Sawangfa (2010, p. 172), Easterlin and Angelescu (2009, p. 4), Easterlin et al. (2010, p. 22467) indicate that the change, improvement, or increase in happiness "is measured in absolute terms". That is,[3]

$$h = \Delta H_t = H_t - H_{t-1}. \qquad (2)$$

[2] For brevity, a discussion on the concept of happiness is excluded in this paper. See, for example, Diener et al. (1999) and Veenhoven (2009) for discussions on the key concepts in happiness research.

[3] The Easterlin group estimates h for a country using the model $H_t = a_0 + h\ time + a_1\ dummy + error_t$. A dummy is introduced in order to a control for the dissimilarities in rating scales used by the different well-being surveys.

From Equations 1 and 2, the Easterlin group estimates a specification for n countries like

$$h_i = b_0 + b_1 g_i + error_i, \quad (3)$$

where i = 1, …, n. Equation 3 is a relationship between two time-invariant parameters g and h. As such, it is silent about the dynamic relationship between g and h across time. Given Equation 2, b_1 therefore represents how much the *change in happiness* would change given a change in economic growth. Perhaps, then, b_1 is not exactly a long-run relationship between g and h.

If the Easterlin Paradox is about the relationship between economic growth and happiness across time, then time is a missing element in Equation 3. This proposition suggests that, across time, the dynamics of economic growth and the dynamics of happiness are relevant information. In the short-run, for instance, happiness can be sticky to economic growth, and so there is no obvious relationship between the two. Yet, after a period has lapsed, happiness can manifest the impact of economic growth. Furthermore, in the long-run analysis, changes in happiness can also be brought about by factors other than economic growth. Thus, ignoring such aspects of the element of time on economic growth and happiness in the long-run can lead to a false conclusion that the former has no impact on the latter.

With the foregoing description, I re-specify Equation 3 as an autoregressive distributed lag model with p lags on economic growth and q lags on happiness on the assumption that current and past information on economic growth and happiness are relevant. That is,

$$h_{it} = \alpha_0 + \sum_{j=0}^{p} \beta_j \cdot g_{i,t-j} + \sum_{k=1}^{q} \delta_{k-1} \cdot h_{i,t-k} + error_{it} \quad (4)$$

From Green (2008), $\sum_{k=1}^{q} \delta_{k-1} \cdot h_{i,t-k}$ controls the historical information of h and $\sum_{j=0}^{p} \beta_j \cdot g_{i,t-j}$ captures the

effect of new information on h. Moreover, the p lags represents event-specific adaptation whereas the q lags represents general adaptation (c.f., Bottan and Perez Truglia 2011). For n countries, the equilibrium conditions, $\frac{\overline{\beta}_0}{1-\frac{1}{n}\sum_{i=1}^{q}\delta_{k-l}}$ and $\frac{\frac{1}{n}\sum_{i=1}^{n}\beta_j}{1-\frac{1}{n}\sum_{i=1}^{q}\delta_{k-l}}$, are also the short- and long-run relationships between economic growth and happiness.

There is still another dimension to consider in a dynamic analysis of the Easterlin Paradox, and that concerns the data structure itself. If, for instance, the data exhibit a hierarchical structure, then Equation 4 could still obtain a misleading conclusion (Hox 2010; Snijders and Bosker 2012).

Consider the following two standard cases. First, data are from the same respondents across time. The data in this case are clustered within respondents. This structure is typical of within person or within country analyses that rely on longitudinal datasets. Panel datasets like the British Household Panel Data Survey fall under such case. The other case is when data are from different sets of respondents across time. The data in this instance are clustered within periods. This structure is typical of between persons or between countries analyses that rely on repeated cross-sectional datasets. Happiness ratings from multi-country datasets like the World Happiness Database, the World Values Survey, and the Gallup World Poll fall under the second case. Economic aggregates like gross domestic product belong to the same category.

Essentially, a hierarchical data structure violates the assumption of independence in the data; and, consequently, the standard errors of parameters are smaller than what they should be. As such, a conclusion derived from Equation 4 may be inaccurate because the parameters suffer from spurious statistical significance.

A solution to hierarchical data is to use multilevel regression. For longitudinal datasets, Equation

4 can be re-specified as

$$\text{Level 1:} \quad h_{ti} = \alpha_0 + \alpha_1 \cdot \text{time}_{ti} + \sum_{j=0}^{p} \beta_j \cdot g_{t-j,\,i} + \sum_{k=1}^{q} \delta_{k-1} \cdot h_{t-k,\,i} + \text{error}_{ti} \qquad (5a)$$

$$\text{Level 2:} \quad \alpha_0 = \gamma_{00} + u_{0i}$$

$$\alpha_1 = \gamma_{10} + u_{1i}$$

where, in the context of this paper, Level 1 includes country-level information at time t, Level 2 represents country-averages across time, and the u's are the corresponding error terms. Assuming no Level 2 explanatory variables in order to make the presentation uncomplicated, Equation 4 can be re-estimated as

$$h_{ti} = \gamma_{00} + \gamma_{10} \cdot \text{time}_t + \sum_{j=0}^{p} \beta_j \cdot g_{t-j,\,i} + \sum_{k=1}^{q} \delta_{k-1} \cdot h_{t-k,\,i} + (\text{error}_{ti} + u_{0i} + (u_{1i} \cdot \text{time}_t)) \qquad (5b)$$

In the case of repeated cross-sectional datasets, Equation 4 can be re-specified as[4]

$$\text{Level 1:} \quad h_{it} = \alpha_0 + \sum_{j=0}^{p} \beta_j \cdot g_{i,t-j} + \sum_{k=1}^{q} \delta_{k-1} \cdot h_{i,t-k} + \text{error}_{it} \qquad (6a)$$

$$\text{Level 2:} \quad \alpha_0 = \gamma_{00} + u_{0t}$$

where Level 2 includes the country-averages within time t and u_{0t} is the error term. Again, with no Level 2 explanatory variables, Equation 4 can be re-estimated as

[4] DiPrete and Grusky (1990) is the first to use multilevel regression on repeated cross-sectional data. In their procedure, the independence of random effects in Level 2 is expressed an autoregressive process; that is, $u_{0t} = \rho u_{0\,t\,1} + \varepsilon_{0t}$ and $|\rho| < 0$ for stationarity. If $u_{0t} = \varepsilon_{0t}$, then the setup is similar to a standard multilevel regression setup with two levels.

$$h_{it} = \gamma_{00} + \sum_{j=0}^{p} \beta_j \cdot g_{i,t-j} + \sum_{k=1}^{q} \delta_{k-1} \cdot h_{i,t-k} + (error_{it} + u_{0t}) \quad (6b)$$

The equilibrium conditions from Equations 5b and 6b are computed in the same manner as those from Equation 4.

3. RESULTS

3.1. Data Sources and Description

This paper takes 1973-2012 as its timeframe for the study. Belgium, Denmark, France, Germany, Ireland, Italy, Luxembourg, Netherlands, and United Kingdom have data for the period.

Data for economic growth are from the World Development Indicators. For the analysis, economic growth is operationalized as annual gross domestic product (GDP) per capita growth in constant 2005 US dollar prices and, like the Easterlin group, reported in percentage terms. I use the Penn Tables 7.1 (in particular, the purchasing power parity converted GDP per capita in chain series at 2005 constant prices) in order to extrapolate Ireland's GDP per capital growth because the information from the World Development Indicators is incomplete.

Data for happiness are from the Eurobarometer. Specifically, happiness is operationalized in the same way as the Easterlin group, namely as the change in life satisfaction between two years. Average life satisfaction in a country is derived using data on the responses to the query:

> *On the whole, are you very satisfied, fairly satisfied, not very satisfied, not at all satisfied with the life you lead?*

The four subjective ratings are coded using the numerals 4, 3, 2, and 1, respectively. (The rest of Section 3 uses "life satisfaction" to refer to happiness.) The technical notes of the Eurobarometer indicate that independent samples are used in each round of survey. The information is therefore repeated cross-sectional not longitudinal in structure.

[Insert Tables 1 and 2 here]

Table 1 presents the averages of economic growth for the nine countries in the study. The long-run average of economic growth is low, which is expected; but notice its range for 1973-2012. In closer inspection of the annual data, I find that the range of economic growth is connected to crisis periods in the late 1970s and in the late 2000s. Ireland is an interesting case because it had rapid economic growth in the late 1990s, then lower economic growth in the 2000s, and economic contraction in the 2010s. The global economic crisis that began in the late 2000s and its attendant problems remains a continuing difficulty to the nine countries. Further inspection of the annual data also suggests that economic growth displays a cyclical pattern across decades with large volatilities characterizing the within cycle pattern.

Table 2 presents the averages of life satisfaction for the nine countries in the study. It indicates relatively high averages in life satisfaction for the period 1973-2012, but the figures are expected for the nine countries. Life satisfaction is highest in Denmark (3.56) and lowest in Italy (2.76). The range across the nine countries for 1973-2012 is 0.80, which translates as 2 units change on a 1 to 10 scale. For each country, the changes in life satisfaction is between 0.21 (United Kingdom) and 0.44-0.45 (Belgium and Italy), which translate as a half unit to full unit change on a 1 to 10 scale. Relative to 1973 levels, three countries had a net fall in life satisfaction by 2012. Ireland had the largest drop in life satisfaction, which can be linked to its economic contraction in the 2010s. Still, for the group, Table 2 indicates a very small increase in life satisfaction after four

decades at 0.02 (i.e., 3.16 in 1973 versus 3.18 in 2012). In closer inspection of the annual data, I also find that life satisfaction exhibits a mild cyclical pattern across decades with relatively tight movements characterizing the within decade pattern. In a way, life satisfaction appears relatively steady in the long-run perspective.

3.2. Empirical Strategy

My empirical strategy is to first estimate Equation 4 using dynamic panel regression.[5] I resort to a stepwise approach in determining the p lags on economic growth and q lags on the change in life satisfaction. In particular, the lagging of a variable stops at its (t-j)th lag when the coefficient on its t-(j+1)th lag changes sign and/or the coefficient on its t-(j+1)th lag turns out not statistically significant (Gujarati 1995). Additionally, I also use the Arellano-Bond autocorrelation tests as guide in the determination of the p and q lags.

I then proceed to estimate Equation 6b using multilevel regression taking the same p and q lags derived from Equation 4 and taking country-level (Level 1) data as clustered across time (Level 2). The choice of the final model is based on the Akaike Information Criterion and the Bayesian Information Criterion because the results are from non-nested specifications.

3.3. Findings

Table 3 summarizes the results of dynamic panel regression. The preferred specification is Model 2, which has one lag on economic growth and two lags on the change in life satisfaction. The Arellano-Bond test results indicate that Model 2 is an appropriate specification.

[5] Panel OLS estimates are unbiased but not efficient given the lags on g and h for the case of n countries.

Notice that, in Model 2, current economic growth has weak statistical significance ($p = 0.09$) with the change in life satisfaction. What needs pointing out is that the coefficient on current economic growth in Model 2 is similar to those found by the Stevenson-Wolfers group using Eurobarometer data.[6] In Stevenson and Wolfers (2008; Figure 16 in page 43), for instance, the average coefficient on current economic growth for the period 1973 to 2007 is 0.0025. Their results indicate an average coefficient of 0.0019 on current economic growth when they estimate a panel model with fixed effects or both fixed and wave effects (*ibid*; Table 4 page 47). Sacks et al. (2010; Figure 6 in page 42), Sacks et al. (2012; Figure 3, page 1185), and Sacks et al. (2013; Table 1 in page 17) also present comparable estimates on current economic growth, albeit their results cover different periods but still based on the Eurobarometer.

Moreover, both lagged economic growth and the two lagged changes in life satisfaction have robust statistical significance ($p < 0.01$ for the three parameters). The larger size of the coefficient of lagged economic growth ($\beta_1 = 0.004$) relative to that of current economic growth ($\beta_0 = 0.002$) is an indication that there are indeed delayed impacts from economic growth on life satisfaction. Their sum is statistically significant, indicating thus not only a positive nominal amount of impact on life satisfaction across time ($\beta_0 + \beta_1 = 0.005$, $p < 0.01$) but also an inertia to economic growth lasting two periods. The progressively smaller coefficients (in absolute values) on lagged changes in life satisfaction ($\delta_0 = -0.393$ and $\delta_1 = -0.181$, respectively) is an indication that current life satisfaction reflects less and less information from the past changes in life satisfaction.[7] In fact, the negative coefficients on lagged life satisfaction reveal an oscillation process of adjustment toward the long-run equilibrium.

[Insert Tables 3 and 4 here]

[6] The same observations can be seen for Models 4 to 5.

[7] The coefficient on the three-period lagged change in life satisfaction (Model 3) is very small and not statistically significant.

The results from multilevel regression are summarized in Table 4. Regardless of the covariance structure I use in the estimation, the coefficient on current economic growth always turns out to be not statistically significant (all β's have $p > 0.15$), which suggests that the estimated short-run relationship from Table 3 is due to spurious statistical significance. The sum of the two economic growth parameters is statistically significant, thus confirming the results in Table 3 about a positive nominal amount of impact on life satisfaction across time ($\beta_0 + \beta_1 = 0.005$, $p < 0.01$) but inertia to economic growth is not confirmed. The lagged economic growth and the two lagged changes in life satisfaction across the three specifications are all statistically significant ($p < 0.05$ for the three parameters). Results in Table 4 confirm oscillation movement of life satisfaction as it adjusts to its long-run equilibrium. Both the Akaike Information Criterion and the Bayesian Information Criterion indicate that Model 1 is the appropriate specification.

From Model 1 in Table 4, I estimate the long-run relationship between economic growth and life satisfaction at 0.0032. The figure is similar to what I obtain using the results of Model 2 in Table 3. Nevertheless, it must be stressed that the estimated relationship is a very small number and, as such, economic growth alone cannot have a significant impact in raising life satisfaction. In fact, Oswald (1997), Clark and Senik (2011), and Veenhoven and Vergunst (2012) also make similar observations, albeit covering different sets of countries and datasets.

Notwithstanding the empirical findings, McCloskey (1985, 1992) and Ziliak and McCloskey (2004a, 2004b) explain that there are serious weaknesses to an interpretation that relies solely on statistical significance. In the context of the empirical findings, then, there are serious implications to a rejection of the Easterlin Paradox based on statistical significance alone. Does it mean an acceptance of the alternative hypothesis that economic growth is a decisive ingredient for raising life satisfaction in a country? The alternative view looks at the economic significance of the results and argues that the rejection of the Easterlin Paradox makes little economic sense. First,

the estimated size of the relationship between economic growth and life satisfaction is very small; and, second, the limited scope that the nine countries covered in the study can pursue in terms of economic growth alone (Table 1) limits the role in which economic growth can play in raising life satisfaction. In a best case scenario of 2 percent economic growth, for example, Luxembourg and Netherlands would take 20 to 30 years, Belgium, Ireland, and United Kingdom would take would take 50 to 60 years, or France and Italy would take at least 100 years of continuous expansion just to raise life satisfaction to 3.50.[8] Raising life satisfaction through economic growth becomes a much more difficult endeavor when other factors are included in the picture. The configuration of the international economic regime that makes economic growth cycles not only intense but also more volatile, the challenges in the European Union politics that limit economic coordination, and uncertainties in the global arena that can dislodge economic growth from its trajectory like disruption in oil supply because of armed conflict are among the most important to consider.

Even with the findings that indicate high statistical significance on a non-zero relationship between economic growth and happiness, the size of the relationship nonetheless indicates little economic significance. In the context of the countries covered in this study and given the practical meaning of the coefficients, a counterintuitive argument that the Easterlin Paradox is a valid proposition is not dismissible.

4. CONCLUSION

This paper analyzed the Easterlin Paradox, or the long-run relationship between economic growth and happiness. The findings of a positive relationship between the two variables are statistically significant and, thus, lead to a rejection of the Easterlin Paradox.

[8] For example, Luxembourg: 3.50 (target life satisfaction) – 3.31 (average life satisfaction in Table 2) = 0.19. So, 0.19/[2*(0.0032)] = 29.7 years.

The findings are also robust that the estimated size of the relationship between economic growth and happiness is very small in magnitude. Such findings bring little economic meaning and, thus, undermine the proposition that economic growth has a large impact on happiness. In terms of economic significance, therefore, a rejection of the Easterlin Paradox is not warranted.

Despite a two-layer conclusion, economic growth can still be viewed as necessary for raising happiness. While its benefits may not be apparent, the lack of economic growth is without a doubt detrimental to happiness. At a deeper level, economic growth must not only be sustained and stabilized in order for its accumulated impact to grow larger but it must also be felt by the people. Still, sustained and stable economic growth will be not enough to raise happiness by a large extent, so it must be complemented with public policy that deal with broad goals like full employment, universal schooling, and comprehensive health care in order that the context that allows for greater happiness is improved. Likewise, these goals are not easy to pursue if there is little or no economic growth.

What I call "broad goals" is not an arbitrary list for public policy. More goals can be added to the list, but I begin with three because they are parallel to the Human Development Index that represents an objective measure on the condition for human development.

There are actually findings in happiness research that validate the usefulness of having a list of goals for greater happiness. For instance, past unemployment, current unemployment, or the risk of future unemployment damages happiness (e.g., Clark et al. 2001; Di Tella et al. 2001, 2003; Knabe and Raetzel 2008). All things the same, the introduction of, say, an employment targeting and/or jobs security policy can help in raising happiness. Second, education and/or higher levels of education eventually translate as higher happiness (e.g., Witter et al. 1984; Powdthavee et al. 2013). If education and employment are linked, then there are gains from a conjunction of goals.

Thus, a universal schooling policy is not only sensible public policy but also helpful in raising happiness. In addition to knowledge and human capital accumulation, education policy can also be geared towards influencing a change in the way people form their values and how they pursue happiness so that more weight is placed on the person-being, social relations, and citizenship over status competition and material-based relations (e.g., Scitovsky 1976, 1986; Layard 1980). Lastly, illness and poor health have terrible impacts not only on income but also in the general outlook of human life (e.g., Ferrer-i-Carbonell and van Praag 2002; van den Berg and Ferrer-i-Carbonell 2007). Poor health can have negative spillover effects on employment and education that further worsen overall well-being (e.g., Graham et al. 2004). Thus, a type of comprehensive heath care policy can help in raising happiness.

Finally, the pursuit of the aforementioned goals may be less problematic in the context of the nine countries in this study given that their Human Development Indices are among the highest in the world. As a matter of principle, however, public policy in the context of happiness is necessary in order to secure the conditions that provide employment, education, and health care so that people at least enjoy the opportunities that permit them, on their own, to go as far as possible to advance their life circumstances. The evaluation of life in the end goes beyond economic growth and made concrete not only in terms of how people are able to pursue the "good life" but also in terms of the quality of the achieved life. It is in this economic interpretation that the results actually affirm the Easterlin Paradox.

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Table 1: Average rate of economic growth, 1973-2012

	Average	Maximum	Minimum	Range	Start 1973	End 2012
Belgium	1.73	6.05	-3.57	9.61	6.05	-1.13
Denmark	1.45	5.83	-6.17	12.00	3.13	-0.82
France	1.54	5.68	-3.64	9.33	5.68	-0.48
Germany	1.86	5.40	-4.89	10.29	4.45	0.56
Ireland	3.24	11.47	-6.16	17.63	6.40	-2.68
Italy	1.59	6.59	-6.06	12.65	4.91	-1.40
Luxembourg	2.59	9.49	-7.59	17.08	7.11	-0.48
Netherlands	1.72	4.91	-4.16	9.07	7.12	-2.16
United Kingdom	1.85	7.11	-4.62	11.73	6.25	0.67
Group average	1.95	6.95	-5.21	12.15	5.68	-0.88

Sources of raw data: World Development Indicators and Penn Table 7.1

Table 2: Average life satisfaction, 1973-2012

	Average	Maximum	Minimum	Range	Start 1973	End 2012
Belgium	3.13	3.34	2.90	0.45	3.34	3.17
Denmark	3.56	3.67	3.42	0.25	3.45	3.66
France	2.86	3.07	2.71	0.36	2.89	3.02
Germany	2.98	3.14	2.73	0.40	2.97	3.14
Ireland	3.19	3.42	2.93	0.49	2.67	2.55
Italy	2.76	2.96	2.52	0.44	3.26	3.42
Luxembourg	3.31	3.41	3.13	0.29	3.15	3.28
Netherlands	3.38	3.49	3.25	0.24	3.26	3.31
United Kingdom	3.17	3.28	3.07	0.21	3.42	3.08
Group average	3.15	3.31	2.96	0.35	3.16	3.18

Source of raw data: Eurobarometer

Table 3: Results of dynamic panel regression

	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	0.0004	0.0003	0.0002	0.0001	0.0002
	(0.159)	(0.512)	(0.659)	(0.724)	(0.551)
Economic growth (t)	0.0040	0.0021	0.0024	0.0023	0.0021
	(0.001)	(0.089)	(0.095)	(0.062)	(0.077)
Economic growth (t-1)	0.0021	0.0039	0.0034	0.0032	0.0043
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Economic growth (t-2)				-0.0014	-0.0012
				(0.146)	(0.151)
Life satisfaction (t-1)	-0.3377	-0.3932	-0.4050	-0.3319	-0.3889
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Life satisfaction (t-2)		-0.1806	-0.1886		-0.1779
		(0.000)	(0.000)		(0.000)
Life satisfaction (t-3)			-0.0196		
			(0.671)		
Arellano-Bond AR(1)	-2.703	-2.740	-2.723	-2.698	-2.747
	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)
Arellano-Bond AR(2)	-2.014	0.934	1.956	-2.019	0.886
	(0.044)	(0.350)	(0.051)	(0.044)	(0.375)

Note: Numbers in parentheses are p-values.

Table 4: Results of multilevel regression

	Model 1	Model 2	Model 3
Fixed Effects:			
Constant	-0.0077	-0.0118	-0.0121
	(0.233)	(0.011)	(0.008)
Economic growth (t)	0.0015	0.0024	0.0025
	(0.327)	(0.194)	(0.166)
Economic growth (t-1)	0.0030	0.0042	0.0042
	(0.046)	(0.025)	(0.025)
Life satisfaction (t-1)	-0.2843	-0.3378	-0.3354
	(0.000)	(0.000)	(0.000)
Life satisfaction (t-2)	-0.1237	-0.1619	-0.1586
	(0.021)	(0.002)	(0.003)
Covariance Parameters:			
Residual	0.0025	0.0029	0.0029
	(0.000)	(0.000)	(0.000)
Intercept	0.0010		
	(0.001)		
AR1 diagonal		0.0000	
		(0.023)	
AR1 rho		-0.3758	
		(0.246)	
Compound sym. Diagonal			0.0000
			(0.086)
Compound sym. Covariance			0.0000
			(0.525)
-2 Log likelihood	-1037.98	-1003.61	-1003.00
Akaike's Information Criterion	-1023.97	-987.61	-987.00
Schwarz's Bayesian Criterion	-996.99	-956.77	-956.15

Notes:

1. Numbers in parentheses are p-values based on Wald Z-statistic. Results are results of (full) maximum likelihood estimation. Model 1: intercept is random with diagonal covariance structure of residuals. Model 2: intercept and parameters are random with autoregressive covariance structure of residuals. Model 3: intercept and parameters are random with compound symmetry covariance structure of residuals.
3. Deviance between Model 2 versus Model 1 (34.37) and that between Model 2 versus Model 1 (34.98) show that both Model 2 and Model 3 are better than Model 1 at $\alpha = 0.05$ and $\alpha = 0.01$ for $\chi^2(4)$.