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

Beja Jr., Edsel

Ateneo de Manila University

2 September 2013

The Easterlin Paradox: Empirics on the long run relationship between economic growth and happiness sans happiness adaptation

EDSEL L. BEJA JR.

Department of Economics, Ateneo de Manila University, Quezon City, Philippines
Email: edsel.beja@gmail.com

Abstract

Analysis confirms a statistically significant positive but very small long run relationship between economic growth and happiness. Even so, the estimated long run relationship implies little, if any, economic significance. This paper argues that a statistically significant relationship is a refutation of the Easterlin Paradox if and only if its magnitude indicates economic significance. Indeed, an interpretation that puts emphasis on economic significance leads to a confirmation of the Easterlin Paradox.

Keywords: Easterlin Paradox; economic growth; happiness

JEL Classification: A20; C53; I30; O40

1. INTRODUCTION

This paper is an intervention to the ongoing discussions on the Easterlin Paradox: the presence of a relationship between economic growth and happiness at a point in time but the absence of a relationship between economic growth and happiness across time. In this context, Easterlin (1974, 2013a, 2013b) and colleagues (e.g., Easterlin and Angelescu 2009; Easterlin and Sawangfa 2010; Easterlin et al. 2010) maintain that the association between economic growth and happiness is nil. The Easterlin group further asserts that what critiques like Stevenson and Wolfers (2008) and colleagues (e.g., Deaton 2008; Sacks et al. 2010, 2012, 2013; Diener et al. 2013) obtain in their

analyses is actually a short run relationship between economic growth and happiness, and so their empirical findings do not provide the evidence to falsify the Easterlin Paradox. Meanwhile, the Stevenson and Wolfers (2008) and Sacks et al. (2010) point out that what the Easterlin group declares as a nil relationship between economic growth and happiness does not actually imply the absence of a relationship between the two variables, and so they do not see the empirical findings of the Easterlin group convincing.

The foregoing introduction suggests that the debate between the Easterlin and Stevenson-Wolfers groups is typical of situations wherein scholars pursue diverging perspectives but sound empirical strategies. I argue, however, that another interpretation of the estimated relationship between economic growth and happiness might help in resolving the disagreement. Specifically, I propose that a rejection of the Easterlin Paradox should not hinge on finding a statistically significant positive long run relationship but, rather, on finding an estimate that carries with it meaning and consequence in the context of happiness. In short, the basis for a rejection of the paradox should be finding an affirmative response to the following query: Does the long run relationship between economic growth and happiness indicate economic significance at all?

For this study, I take the Easterlin Paradox as the null hypothesis. My analysis also assumes zero happiness adaptation, an approach that Easterlin and Angelescu (2009), Easterlin and Sawangfa (2010), Easterlin et al. (2010), and Easterlin (2013a, 2013b) for the Easterlin group as well as Sacks et al. (2013) and Veenhoven and Vergunst (2013) for the Stevenson-Wolfers group have done as well. Fundamentally, zero happiness adaptation means a constant response of happiness to economic growth across time; but, I emphasize, it does not imply a censoring of the dynamic behavior of economic growth. I restrict the analysis to economic growth and happiness in order to obtain results that are comparable to those presented by the Easterlin and Stevenson-Wolfers groups. Thus, in taking these approaches, I am not only able to extract the nominal impact of

economic growth on happiness across time but, more importantly, I am also able to determine if the magnitude of the purported long run relationship is trivial or not.

The rest of the paper has the following structure. Section 2 presents the framework of the study. Section 3 presents the data and empirical strategy. Descriptive statistics and the empirical findings come in Section 4. The last section concludes the discussion.

2. FRAMEWORK

The Easterlin Paradox deals with two variables: economic growth and happiness. In this study, I focus on the same variables as well. Let economic growth g be $\frac{Y_t - Y_{t-1}}{Y_{t-1}} = \Delta \log Y_t$, where Y_t is a measure of aggregate income and t is time. The Easterlin group, however, obtains g using the model:

$$\log Y_t = a_0 + g \text{ time} + \text{error}_t \qquad 1$$

Notice that the g in Equation 1 is the long run average rate of economic growth but the g in the conventional setup is the annual rate of economic growth.

Next, define happiness h as the change in average happiness H; or, simply, $h_t = \Delta H_t = H_t - H_{t-1}$. For brevity, I am excluding a discussion on the concepts relevant to happiness but Diener et al. (1999) and Veenhoven (2009), for example, contain details on them. In the context of the Easterlin Paradox, however, the Easterlin group obtains h using the model:[1]

[1] The Easterlin group actually estimates h using the model $H_t = a_0 + h \text{ time} + a_1 \text{ dummy} + \text{error}_t$, where the dummy controlling for the dissimilarities in rating scales used by the different well-being surveys.

$$H_t = a_0 + h\ time + error_t. \qquad 2$$

Notice that h in Equation 2 is the average change in average happiness across time but $h_t = \Delta H_t$ is the annual change in happiness. In Appendix, I demonstrate why $h_t = \Delta H_t$ implies zero happiness adaptation.

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

$$h_i = b_0 + b_1\ g_i + error_i, \qquad 3$$

where i = 1, …, n. Equation 3 defines the relationship between two time-invariant parameters g and h. If so, b_1 measures how much the average change in average happiness would change given a change in the average rate of economic growth. By construction, this model excludes the dynamics of economic growth and happiness because there is no time variable in it.

If the Easterlin Paradox is about the relationship between economic growth and happiness across time, then dynamics must also be an important element in the analysis. The point is that a model that uses the long run averages of variables loses valuable information linked to time.

The recent literature on the Easterlin Paradox has in fact stressed the foregoing issue concerning dynamics. In this regard, I am taking the lead of Stutzer (2004), Becchetti et al. (2008), Newman et al. (2008), Senik (2009), Binder and Coad (2010), Di Tella and MacCulloch (2010), Di Tella et al. (2010), Bottan and Perez Truglia (2011), Wunder (2012), Paul and Guilbert (2013), and Vendrik (2013) in applying dynamic analysis to the Easterlin Paradox. Naturally, the framework I present here would have similarities to these studies.

In particular, I re-state Equation 3 as Equation 4; that is, I specify an autoregressive distributed lag model with p lags on economic growth and q lags on happiness. This setup stipulates that both the current and past information on economic growth and happiness are relevant. That is,

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

where $\sum_{k=1}^{q} \delta_{k-1} \cdot h_{i,t-k}$ accounts for the historical information of happiness sans happiness adaptation, and $\sum_{j=0}^{p} \beta_j \cdot g_{i,t-j}$ represents the impact of economic growth on happiness across time. In Beja (2013), I explain that the negative coefficients on lagged happiness reflect the dynamics of happiness sans happiness adaptation, while the alternating signs on lagged economic growth reflect the dynamics of economic growth emerges (c.f., Bottan and Perez Truglia 2011). For n countries, the expression $\frac{\frac{1}{n}\sum_{i=1}^{p} \beta_j}{1 - \frac{1}{n}\sum_{i=1}^{q} \delta_{k-1}}$ gives the long run relationship between economic growth and happiness.

Still, the framework I present differs from that presented by the earlier cited studies in two ways. First, in contrast to the cited studies that focus on individual- or household-level data, I stick to the country-level analysis to be consistent with the approach of the Easterlin and Stevenson-Wolfers groups.[2] Another difference here is that my framework incorporates the data structure as another element in the analysis. In particular, a hierarchical data structure violates the assumption of independence in the data; and, consequently, standard errors of the coefficients turn out to be smaller than what they should be. As such, statistical inference is problematic because of spurious statistical significance.

[2] The cited studies in the earlier paragraph apply dynamic analysis to the Easterlin Paradox using individual or household-level data in their analyses.

A solution to the data structure problem is to use multilevel regression. For longitudinal datasets, Equation 4 becomes

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

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

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

where, in the context of this paper, the Level 1 equation includes the country-level information of economic growth and happiness, and the Level 2 equation includes γ_{00} for the between country-averages across time, γ_{10} for the between country-averages within time, and the u's are the error terms. For now, Equation 5a treats α_0 and α_1 as random parameters but β_j and/or δ_{k-1} can be random parameters as well. If there is no Level 2 explanatory variable, then Equation 4 takes the following multilevel regression specification:

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

For repeated cross-sectional datasets, Equation 4 becomes

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

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

where the Level 2 equation includes the between country-averages within time and u_{0t} is the error term. Notice that there is only one random parameter in Equation 6a; but, as argued for Equation 5a, β_j and/or δ_{k-1} can be random parameters as well. Equation 4 turns into the following multilevel

regression specification if there are no Level 2 explanatory variables:

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

By internalizing data structure, Equations 5b and 6b address the problem of spurious statistical significance.[3] Nevertheless, the computation of purported the long run relationship is the same as that shown earlier in Equation 4.

3. METHODOLOGY

3.1. Data Sources and Description

Data for economic growth are from the World Development Indicators. In this paper, "economic growth" is a country's annual growth rate of gross domestic product (GDP) per capita in constant 2005 US dollar prices and reported in percentage terms. I also use the Penn Tables 7.1 in order to complete the data for Ireland since the data from the World Development Indicators is incomplete.

Data for happiness are from the Eurobarometer. Average life satisfaction or average happiness takes a value from one (minimum) to four (maximum).[4] Accordingly, "happiness" is a country's

[3] The choice between Equation 5b and Equation 6b is a matter of empirical strategy especially when the analysis of the Easterlin Paradox is at the country-level. That is, at one level, Equation 5b would be the appropriate specification because the analysis uses same set of countries; but, at another level, Equation 6b would be the appropriate specification because the raw data came from independent samples.

[4] The Eurobarometer obtains data for life satisfaction using the following query: "On the whole, are you very satisfied, fairly satisfied, not very satisfied, not at all satisfied with the life you lead?" Individuals use the four subjective ratings in their responses, which, in turn, take the values 4, 3, 2, and 1, respectively. The country-level data is simply the mean of the responses. Eurobarometer uses new and independent samples

annual change in average life satisfaction.

The timeframe of this study is 1973 to 2012. Belgium, Denmark, France, Germany, Ireland, Italy, Luxembourg, Netherlands, and United Kingdom form a convenient sample because data are not only available for the indicated period but are also comparable across the nine countries.[5]

3.2. Empirical Strategy

The empirical strategy in this paper is two fold. I first estimate Equation 4 using dynamic panel regression, resorting to a stepwise procedure in the determination of the lags on economic growth and happiness. In particular, the lagging of a variable stops when the coefficient on the subsequent lag becomes not statistically significant. I also use the Arellano-Bond autocorrelation test as guide in the determination of the p and q lags.

Second, I proceed to re-estimate the fitted dynamic panel model using multilevel regression. That is, I stick to the identified number of lags from the dynamic panel in the estimation of the multilevel model. Since both economic growth and happiness are aggregated information from repeated cross-section surveys, Equation 6b is the appropriate specification for the multilevel regression. The Akaike's Information Criterion and Schwarz's Bayesian Information Criterion determine the "best" model because the results come from non-nested specifications.

---

for each survey round.

[5] The World Happiness Database has data not only for the same nine European countries but also for Japan and the United States and also for the same period covered in my study. There is, however, an issue with regard to data comparability given that the survey procedures and measures for happiness are different in the case of Japan and of the United States.

4. FINDINGS

4.1. Descriptive Findings

Table 1 presents the averages of economic growth for the nine European countries included in this study. The figures are usual for the industrialized nations. In closer inspection of the annual data, there appears a link between the range of economic growth and crisis periods like those in the late 1970s and the late 2000s. Ireland is an interesting case because it reported high economic growth in the late 1990s, then low economic growth in the 2000s, and recently economic contraction in the 2010s. A further inspection of the data finds that economic growth for the sample countries follows a cyclical pattern across the decades with large volatilities characterizing each cycle.

Of course, the global economic crisis that erupted in the late 2000s and its associated effects are still producing difficulties in Europe. Other problems can also contribute in dislodging economic growth from its recovery trajectory, such as a configuration of the international economic regime that makes economic growth cycles not only intense but also more volatile and the challenges in the European Union politics that not only limit policy coordination but also promote economic contraction. The convergence of these problems in turn restricts the capacity of governments in raising economic growth.

[Insert Tables 1 and 2 here]

In Table 2, I summarize the data for average happiness. The figures are high relative to the 4-unit scale of happiness used in the Eurobarometer, but they are also usual for this set of countries. The table furthermore shows that average happiness is highest in Denmark (3.56) and lowest in Italy (2.76). The range of the data is 0.80, which is equivalent to two units on a 10-unit scale (i.e., 0.80

x 2.5). The change in average happiness across time is between 0.21 (United Kingdom) to 0.44-0.45 (Belgium and Italy), which is equivalent to about half to 1-unit change in happiness on a 10-unit scale (i.e., 0.21 x 2.5 and 0.44 (0.45) x 2.5). Relative to their 1973 levels, three countries indicate a net reduction in average happiness by 2012 with Ireland reporting the largest drop—which can be linked to its economic contraction in the 2010s.

Overall, Table 2 discloses a slight increase in happiness after four decades at 0.02 (i.e., 3.16 in 1973 versus 3.18 in 2012). I also notice a mild cyclical pattern across decades with relatively tight movements characterizing the within decade pattern. In short, average happiness appears to be relatively steady in the long run perspective.

4.2. Empirical Findings

I summarize the results from the dynamic panel regression in Table 3. The "best" results are those reported as Model 4 in the table, namely: two lags on both economic growth and happiness. Further analyses (e.g., Model 5) suggest that the parameter estimates of Model 4 are robust to the addition of other aggregate explanatory variables, albeit their magnitudes are also smaller.

Model 4 in Table 3 leads me to the following observations. First, there is a confirmation of the conventional idea that economic growth has limited, if any, short run impact on happiness (β_0 = 0.0018, p = 0.19). What is more interesting with this result is that its magnitude is comparable to those found by the Stevenson-Wolfers group, who also use the Eurobarometer in their analyses. For instance, Stevenson and Wolfers (2008, Table 4) obtain an estimate of 0.0019 on current economic growth (c.f., Sacks et al. 2010, Figure 6; Sacks et al. 2012, Figure 3; Sacks et al. 2013, Table 1).

[Insert Tables 3 and 4 here]

Second, the opposing signs on the one-period lag economic growth ($\beta_1 = 0.0063$, $p < 0.01$) and on the two-period lag economic growth ($\beta_2 = -0.0042$, $p < 0.01$) confirm the nature of the impact of economic growth on happiness in a dynamic setup. These results further suggest that the impact of economic growth tapers off quickly (c.f., Di Tella et al. 2001, 2003, 2010). In addition, the estimate for the nominal impact of economic growth on happiness is small ($\beta_0 + \beta_1 + \beta_2 = 0.0039$, $p = 0.07$).

Meanwhile, the progressively smaller coefficients on lagged happiness ($|\delta_0| = 0.2878$, $p < 0.01$; $|\delta_1| = 0.1450$, $p < 0.05$) suggests that current happiness contains less and less information from past happiness, indicating a short memory in the adjustment process. The key interpretation, however, is that the negative coefficients on lagged happiness indicate an oscillatory adjustment in happiness as it moves toward its new long run equilibrium given that there is zero happiness adaptation.

Accordingly, from Model 4 in Table 3, I obtain 0.0027 as an estimate of the long run relationship between economic growth and happiness (i.e., (0.0018 + 0.0063 – 0.0042) / (1 + 0.2878 + 0.1450)). Put simply, a unit of economic growth can raise happiness by 0.0027. This estimate can also be viewed to mean that economic growth must reach 40 per cent in order to achieve an increase of 0.1 in happiness; or, equivalently, that an economic growth of 2 per cent must be sustained for 18.5 years in order to achieve the same increase of 0.1 in happiness. There is the same amount of increase in happiness if an economic growth of 5 per cent occurs for 7.4 years. In any case, what is apparent is that the long run impact of economic growth is very small. Indeed, what Model 5 in Table 3 suggests is that 0.0027 is probably an overestimated figure.

Reaching and maintaining a decent level of economic growth is a major challenge to the sample countries given the abovementioned circumstances in the global and European economy. In short, the possibility of achieving a decent increase in happiness is very low for the sample countries precisely because economic growth is not—and probably never was—an effective tool for it.

I, in turn, present the multilevel regression results. Recall that the fitted model from the dynamic panel regression is the baseline setup for the second set of regressions. The results in Table 4 essentially validate Model 4 in Table 3. The "best" model based on the Akaike's Information Criterion and Schwarz's Bayesian Information Criterion is Run 3 in Table 4.

Thus, observations made for Model 4 are the same for Run 3: there is no statistically significant short run relationship between economic growth and happiness ($\beta_0 = 0.0019$, $p = 0.223$), but there is indeed a statistically significant long run relationship between economic growth and happiness ($\beta_1 = 0.0046$, $p < 0.01$; $\beta_2 = -0.0033$, $p < 0.05$). From Run 3, I obtain 0.0022 as an estimate of the long run relationship of the two variables ((0.0019 + 0.0046 – 0.0033) / (1 + 0.3112 + 0.1342)). In addition, the interpretation made for Model 4 is the same for Run 3: economic growth must be extraordinarily high just to increase happiness by 0.1 or, if it is a modest amount, sustained for a long period to accomplish the same result. Likewise, given the same context, I again argue that the possibility of achieving the stipulated increase in happiness is low.

In summary, results from both dynamic panel and multilevel regressions agree that a statistically significant positive long run relationship exists between economic growth and happiness. This finding is in fact robust to alternative specifications and addition of explanatory variables. The conclusion is therefore straightforward: reject the Easterlin Paradox. Nonetheless, I stress that a substantive interpretation of the estimated long run relationship leads to me to a reconsideration of the paradox because the estimates indicate trivial impacts no matter how it is estimated (c.f., Clark and Senik 2011; Veenhoven and Vergunst 2012). I agree with Ziliak and McCloskey (2008) who

assert that there is economic significance only when the size of the estimated relationship is large enough to matter—the so-called "oomph". My findings say there is in fact very little oomph. The conclusion becomes more compelling when it is recalled that my analysis of the paradox does not even allow for happiness adaptation—so, perhaps, 0.0022 or 0.0027 is an overestimate. As such, there might be no oomph at all.

Therefore, I am giving a "No" answer to the query raised in the introduction of this paper: "Does the long run relationship between economic growth and happiness indicate any economic significance at all?" A rejection of the Easterlin Paradox is not warranted because the long run relationship is trivial in magnitude. Let me point out, however, that a dismissal of statistical significance in favor of economic significance is not the same as a Type II error problem; rather, it is about doing an analysis that has meaning and consequence to people and society, an approach that is expected of the social sciences. Finally, I note that discussions on the Easterlin Paradox tend to focus on the statistical significance and, given my empirical findings, perhaps, it is now time that the discourse shifts to economic significance.

5. CONCLUSION

This paper analyzed the long run relationship between economic growth and happiness using data from the Eurobarometer. The empirics presented a statistically significant positive long run relationship between the two variables, which therefore meant a rejection of the Easterlin Paradox.

Even so, the empirics also revealed that the long run relationship between economic growth and happiness that is very small in magnitude. Such estimate suggests little economic meaning and undermines the proposition that economic growth plays a critical role for happiness. Therefore,

given the trivial estimate of long run relationship, a rejection of the Easterlin Paradox is not warranted.

I hope this paper highlighted what I think is the right interpretation of the empirical findings I presented but also by the extant literature, namely: a statistically significant long run relationship between economic growth and happiness can be a refutation of the Easterlin Paradox if and only if the estimated relationship has economic significance. Any thing less than economic significance should be viewed in favor of the paradox. I reiterate because the focus on statistical significance has, in a way, resulted in an impasse on the Easterlin Paradox, a shift to an economic significance interpretation of the empirical findings might lead to a resolution of the discussions.

Despite a two-layer conclusion, I do not wish to reject economic growth altogether because it is still a necessary ingredient in the formation of a society that is progressive and responsive to the needs of the people. While its benefits may not be apparent in the short run, the lack of economic growth even in the short run is harmful because it not only creates instability but also undermines the provision of public goods and services necessary to sustain a society. As argued, maintaining economic growth is important for a society to reap the benefits, but stabilizing economic growth is equally important in order that its accumulated impact not only becomes larger in the end but also felt by its ultimate recipients, the people.

Nevertheless, sustained and stable economic growth will be not enough in raising happiness to a significant degree. This problematique exists because happiness is more than about income and economic growth. Still, if economic growth is necessary, then it must be complemented by public policy that deals with broad goals like full employment, universal schooling, and comprehensive health care, to name but a few, in order that an environment that engenders happiness is not only established but also strengthened and enlarged. Naturally, these broad goals are not easy to pursue

if there is little or no economic growth.

While the pursuit of the aforementioned broad goals may be less difficult for the sample countries in this study, as a matter of principle, though, public policy must play a large role in ensuring that people get to enjoy the opportunities that permit them to go as far as possible in advancing their life circumstances. The evaluation of life as a whole then goes beyond economic growth and made more 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. Society in the end achieves the greatest happiness. It is in the context of this economic interpretation that my findings affirm the Easterlin Paradox.

REFERENCES

Becchetti, L., Pelloni, A., and Rossetti, F. (2008). "Relational goods, sociability, and happiness," *Kyklos*, 61(3): 343-363

Beja, E. (2013) "The Easterlin Paradox: Empirics on the long run relationship between income growth and happiness with happiness adaptation," unpublished manuscript

Binder, M. and Coad, A. (2010). "An examination of the dynamics of well-being and life events using vector autoregressions," *Journal of Economic Behavior & Organization*, 76(2): 352-371

Bottan, N. and Perez Turglia, R. (2011). "Deconstructing the hedonic treadmill: Is happiness autoregressive?," *Journal of Socio-Economics*, 40(3): 224-236

Clark, A. and Senik, C. (2011). "Will GDP growth increase happiness in developing countries?," Discussion Paper No. 5595, Institute for the Study of Labor

Deaton, A. (2008). "Income, health, and well-being around the world: Evidence from the Gallup World Poll," *Journal of Economic Perspectives*, 22(2): 53-72

Di Tella, R. and MacCulloch, R. (2010). "Happiness adaptation to income beyond "basic needs," in E. Diener, J. Helliwell, and D. Kahneman (eds.), *International differences in well-being* (pp. 217-246), New York: Oxford University Press

Di Tella, R., De New, J., and MacCulloch, R. (2010). "Happiness adaptation to income and to status in an individual panel," *Journal of Economic Behavior & Organization*, 76(3): 834-852

Di Tella, R., MacCulloch, R., and Oswald, A. (2001). "Preferences of inflation and unemployment: Evidence from surveys of happiness," *American Economic Review*, 91(1): 335-341

Di Tella, R., MacCulloch, R., and Oswald, A. (2003). "Macroeconomics of happiness," *Review of Economics and Statistics*, 85(4): 809-827

Diener, E., Suh, E., Lucas, R., and Smith, H. (1999). "Subjective well-being: Three decades of progress," *Psychological Bulletin*, 125(2): 276-302

Easterlin, R. (1974). "Does economic growth improve the human lot? Some empirical evidence," in David and Reder (eds.), *Nations and Households in Economic Growth: Essays in Honor of Moses Abramovitz* (pp. 89-125), New York: Academic Press

Easterlin, R. (2013a). "Happiness, growth, and public policy," *Economic Inquiry*, 51(1): 1-15

Easterlin, R. (2013b). "Happiness and economic growth: The evidence," Discussion Paper No. 7187, Bonn: Institute for the Study of Labor

Easterlin, R. and Angelescu, L. (2009). "Happiness and growth the world over: Time series evidence on the happiness-income paradox," Discussion Paper No. 4060, Bonn: Institute for the Study of Labor

Easterlin, R. and Sawangfa, O. (2010). "Happiness and economic growth: Does the cross section predict time trends? Evidence from developing countries," in Diener, Helliwell, and Kahneman (eds.), *International Differences in Well-being* (pp. 166-216), Oxford: Oxford University Press

Easterlin, R., McVey, L., Switek, M., Sawangfa, O., and Zweig, J. (2010). "The happiness paradox revisited," *Proceedings of the National Academy of Sciences*, 107(52): 22463-22468

Frederick, S. and Loewenstein, G. (1999). "Hedonic adaptation," in D. Kahneman, E. Diener and N. Schwarz (eds.), *Well-being: The foundations of hedonic psychology* (pp. 302-329), New York: Russell Sage Foundation

Newman, C., Delaney, L., and Nolan, B. (2008). "A Dynamic Model of the Relationship Between Income and Financial Satisfaction: Evidence from Ireland," *Economic and Social Review*, 39(2): 105-130

Paul, S. and Guilbert, D. (2013). "Income–happiness paradox in Australia: Testing the theories of adaptation and social comparison," *Economic Modeling*, 30(1): 900-910

Sacks, D., Stevenson, B., and Wolfers, J. (2010). "Subjective well-being, income, economic development, and growth," Working Paper No. 16441, National Bureau of Economic Research

Sacks, D., Stevenson, B., and Wolfers, J. (2012). "The new stylized facts about income and subjective well-being," *Emotion*, 12(6): 1181-1187

Sacks, D., Stevenson, B., and Wolfers, J. (2013). "Growth in income and subjective well-being over time," unpublished manuscript

Senik, C. (2009). "Direct evidence on income comparisons and their welfare effects," *Journal of Economic Behavior & Organization*, 72(1): 408-424

Stevenson, B. and Wolfers, J. (2008). "Economic growth and happiness: Reassessing the Easterlin Paradox," *Brookings Papers on Economic Activity*, 39(1): 1–87

Stutzer, A. (2004). "The role of income aspirations in individual happiness," *Journal of Economic Behavior & Organization*, 54(1): 89-109

Veenhoven, R. (2009). "How do we assess how happy we are? Tenets, implications, and tenability of three theories," in Dutt and Radcliff (eds.), *Happiness, economics, and politics: Towards a multi-disciplinary approach* (pp. 45-69), Cheltenham: Edward Elgar

Veenhoven, R. and Vergunst, F. (2013). "The Easterlin illusion: Economic growth does go with greater happiness," Working Paper No. 1, Rotterdam: Erasmus Happiness Research Organization

Vendrik, M. (2013). "Adaptation, anticipation and social interaction in happiness: An integrated error-correction approach," *Journal of Public Economics*, 105(1): 131-149

Wunder, C. (2012). "Does subjective well-being dynamically adjust to circumstances?," *Economic Letters*, 117(3): 750-752

Ziliak, S. and McCloskey, D. (2008). *The cult of statistical significance*, Ann Arbor: University of Michigan Press

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	0.0636	0.0418	0.0251	-0.0031	0.0024
	0.0057	0.1901	0.1677	0.8587	0.8908
Economic growth, t	0.0045	0.0024	0.0014	0.0018	0.0008
	0.0025	0.1371	0.3888	0.1999	0.6625
Economic growth, t-1		0.0034	0.0047	0.0063	0.0061
		0.0247	0.0010	0.0000	0.0014
Economic growth, t-2				-0.0042	-0.0033
				0.0006	0.0366
Happiness, t-1	-0.2514	-0.2594	-0.3004	-0.2878	-0.3123
	0.0000	0.0000	0.0000	0.0000	0.0000
Happiness, t-2			-0.1529	-0.1450	-0.1492
			0.0218	0.0254	0.0331
Unemployment, t					-0.0059
					0.2888
Unemployment, t-1					0.0085
					0.0883
Inflation, t					-0.0014
					0.2370
Inflation, t-1					0.0028
					0.0867
Arellano-Bond AR(1)	-2.7592	-2.7545	-2.772	-2.7833	-2.7749
	0.0058	0.0059	0.0056	0.0054	0.0055
Arellano-Bond AR(2)	-1.7613	-1.6035	1.5904	1.2525	0.7926
	0.0782	0.1088	0.1117	0.2104	0.4280
Time fixed effects	Yes	Yes	Yes	Yes	Yes

Notes:

1. Numbers below the estimated parameters are p values. The dependent variable is "happiness" h_t; that is, $\Delta H_t = H_t - H_{t-1}$, where H_t is the average life satisfaction of country i. Lagged happiness and economic growth are the "independent" variables. Note $g_t = \Delta y_t$, where y_t is the (natural) log of income Y_t, and it is expressed in percentage terms.
2. The third lag on both happiness and economic growth turn out to be not statistically significant. These results are not in the table.
3. Model 4 is the "best" fitted model. The introduction of unemployment rate and inflation rate in Model 5 serves as a robustness check on Model 4 (c.f., Di Tella et al. 2001, 2003). Data for the two additional variables are from the OECD Economic Outlook (various years). The data are expressed in percentage terms as well.

Table 4: Results of multilevel regression

	Model 1	Model 2	Model 3	Model 4	Model 5
Fixed Effects:					
Constant	-0.0018	-0.0019	-0.0051	-0.0047	-0.0020
	0.7890	0.7771	0.4387	0.4724	0.7746
Economic growth, t	0.0011	0.0011	0.0019	0.0018	0.0011
	0.4977	0.4863	0.2236	0.2631	0.4857
Economic growth, t-1	0.0049	0.0049	0.0046	0.0047	0.0049
	0.0037	0.0037	0.0058	0.0054	0.0037
Economic growth, t-2	-0.0034	-0.0034	-0.0033	-0.0034	-0.0034
	0.0259	0.0255	0.0270	0.0219	0.0254
Happiness, t-1	-0.3031	-0.3025	-0.3112	-0.3151	-0.3026
	0.0000	0.0000	0.0001	0.0001	0.0000
Happiness, t-2	-0.1413	-0.1405	-0.1342	-0.1248	-0.1409
	0.0107	0.0116	0.0746	0.0817	0.0114
Covariance Parameters (subj. = time):					
Residual	0.0025	0.0025	0.0022	0.0023	0.0025
	0.0000	0.0000	0.0000	0.0000	0.0000
Intercept	0.0010	0.0010	0.0008	0.0008	
	0.0010	0.0011	0.0038	0.0051	
Economic growth, t-1			0.0570	0.0589	
			0.1673	0.0620	
Economic growth, t-2			0.0714	0.0582	
			0.0800	0.0698	
HF lamda				0.0314	
				0.0491	
AR diagonal					0.0010
					0.0012
AR(1) rho					-0.0843
					0.8920
-2 Log likelihood	-991.28	-991.98	-1004.99	-1001.01	-991.98
Akaike's Information Criterion	-975.28	-975.98	-984.99	-979.01	-975.98
Schwarz's Bayesian Criterion	-944.82	-945.51	-946.91	-937.12	-945.51

Notes:

1. Numbers below the estimated parameters are p values (based on the Wald Z-statistic). Estimation uses (full information) maximum likelihood.
2. Multilevel regression uses the Model 4 in Table 3 as the baseline setup. The "best" model in this case is Run 3.
3. The final specifications for the Level 2 equation are as follows. (a) Model 1: intercept is random with identity covariance structure of residuals. (b) Model 2: both intercept and lagged happiness are random with identity covariance structure of residuals. (c) Model 3: both intercept and lagged happiness are random with diagonal covariance structure of residuals. (d) Model 4: both intercept and lagged happiness are random with Huynh-Feldt structure of residuals. (e) Model 5: both intercept and lagged happiness are random with AR(1) structure of residuals.

APPENDIX

I derive the long run relationship between economic growth and happiness sans happiness adaptation. First, begin with a happiness function of the form

$$H_t = F[Y_t - AY_t] \qquad \text{i}$$

where H_t is average happiness, Y_t is income, AY_t is adaptation level, and t is time. A discussion on AY_t is available in Frederick and Loewenstein (1999). Assume $H_0 = F[Y_0]$ with $AY_0 = 0$.

Next, obtain the change in happiness ΔH between two periods as

$$\Delta H_t = F[\Delta Y_t - \Delta AY_t] \qquad \text{ii}$$

Equation ii essentially removes the time invariant factors and focuses the analysis on the two time varying factors relevant to the Easterlin Paradox. Moreover, define

$$AY_t = aY_{t-1} + (1-a)\,AY_{t-1} - [\sum_{i=1}^{t-1} a(1-a)^i Y_{(t-1)-i} + \sum_{i=1}^{t-1}(1-a)^{i+1} AY_{(t-1)-i}], \qquad \text{iii}$$

where a, the rate of adaptation, is between zero and 1. Equation iii stipulates that current income adaptation level is a weighted average of the immediate past income stimulus and adaptation level but net of the weighted average of all other periods' income stimuli and adaptation levels. Rearranging the terms in Equation iii obtains

$$\Delta AY_t = a(Y_{t-1} - AY_{t-1}) - [\sum_{i=1}^{t-1} a(1-a)^i (Y_{(t-1)-i} - AY_{(t-1)-i}) + \sum_{i=1}^{t-1}(1-a) AY_{(t-1)-i}] \qquad \text{iv}$$

Substituting Equation iv into Equation ii, using the definition in Equation i, and then rearranging the terms of the resulting expression obtains

$$\Delta H_t = F[\Delta Y_t - aH_{t-1} + \sum_{i=1}^{t-1} a(1-a)^i H_{(t-1)-i} + \sum_{i=1}^{t-1} (1-a) A Y_{(t-1)-i}] \quad \text{v}$$

Moving H_{t-1} from the left-hand side into the right-hand side of Equation v and setting $AY_{(t-1)-I} = AY_0 = 0$ at the long run equilibrium, simplifies Equation v into

$$H_t = F[\Delta Y_t + (1-a)H_{t-1} + \sum_{i=1}^{t-1} a(1-a)^i H_{(t-1)-i}] \quad \text{vi}$$

If a = 0 (i.e., zero happiness adaptation), then Equation vi reduces into

$$h_t = F[\Delta Y_t] \quad \text{vii}$$

where $h_t = \Delta H_t$. Equation vii is the basic setup of Equation 4 in the main text. It is apparent in Equation ii if $\Delta AY_t = 0$ (i.e., the adaptation level is zero). Taking the (natural) log form of Y_t, obtains y_t, and so Equation vii becomes $h_t = F[\Delta y_t]$ or, simply, $h_t = F[g_t]$, where g_t is growth rate.