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Abstract:

Easterlin and O'Connor (PNAS 2022) have investigated which economic, social, political, and ecological factors explain long-run (36-year) changes in European countries' happiness (life satisfaction). Considering six potential predictors advanced in the pertinent literature, they found only rising welfare state generosity to be significantly associated with rising happiness. Noticing a salient characteristic of the data used – a strong and significant association between happiness trends and initial happiness levels – I modify this analysis by controlling for initial happiness levels and by considering long-run relative changes in addition to absolute changes in happiness. Both modifications respond to the circumstance that happiness scales are bounded so that it is hard for happiness to increase – especially in absolute terms – if it is already high. I find the inclusion of initial happiness to greatly increase the explanatory power (R^2) of the regression models considered and, as a consequence, to raise the precision of coefficient estimates. Due to increased precision, not only welfare state generosity but also growth in per-capita GDP is found to significantly predict both absolute and relative long-run changes in countries' happiness, whereas other candidate explanatory variables remain insignificant. Welfare state generosity and GDP growth are not only statistically, but also economically significant.

Keywords: happiness; life satisfaction; welfare policy; economic growth; Easterlin Paradox
JEL codes: I31; D60; H53; I38; O10; O52

1. Introduction

As noted by Easterlin and O'Connor (2022), henceforth E&O, social science scholars have advanced several explanations of long-term changes in a country's well-being (happiness), the major factors considered being economic growth (Deaton 2008), social capital (Helliwell and Putnam 2004), welfare state policies (Pacek and Radcliffe 2007), and the quality of the environment (Welsch 2006). E&O criticize existing evidence that supports these arguments for typically being based on point-of-time (cross-section) data. To fix the short-term character of those analyses they present tests of the pertinent hypotheses with time-series data covering almost four decades (1981/82 to 2017/18) for 10 major Northern, Western, and Southern European countries. While the number of countries included is small, the data set's chief advantage is that it includes newly published high-quality data on welfare state policies. This offers a unique opportunity to study the role of welfare state generosity – along with other factors – in explaining long-term happiness trends in Europe.

While cross-section analyses of the data suggest that economic growth, social capital, and/or quality of the environment are driving happiness (measured as life satisfaction), long-term, time-series regressions reveal that these variables have no relation to happiness trends. By contrast, differences between the countries in the overall change in happiness since the early 1980s have been chiefly related to the generosity of welfare state programs – increasing happiness going with increasing generosity and declining happiness with declining generosity.

Using the same data set, the present paper modifies E&O's analysis of long-term happiness trends in Europe to accommodate a salient characteristic of the data: Spain, Italy and France had sustained large increases in happiness whereas initial happiness levels were low in these countries. Conversely, as noted by O'Connor (2024) in commenting on E&O, life satisfaction declined in Denmark and Sweden and "part of that is that they were already fairly high in the 1980s, so it's hard to move up". This comment highlights the possibility that between-country differences in happiness trends are likely to depend on differences in initial levels. In particular, given that life satisfaction scales are bounded (see section 2), it is difficult for life satisfaction to increase if it is already high. In addition, given that happiness "trends" in the sense of E&O are *absolute* changes over a long period of time, a rising trend (at a constant rate) would ultimately exceed the happiness scale – a phenomenon less likely (though not impossible) to arise in the case of (constant) percentage changes.

I address these concerns in two ways. First, by observing that the long-term trends in happiness are negatively and significantly related to the respective initial levels, I rerun the relevant happiness regressions while controlling for those initial levels. Second, by observing that E&O's analysis refers to long-term absolute changes (differences) in happiness, I check the robustness of the evidence to considering long-term relative changes (percentages).

With these modifications, I find E&O's results concerning welfare state generosity, social capital and environmental quality to be confirmed. However, different from E&O, I find not only welfare state generosity but also growth in real Gross Domestic Product (GDP) per capita to significantly predict long-run changes – both absolute and relative – in countries' happiness. The latter result arises because changes in happiness are strongly and significantly (negatively) related to initial happiness, so that the inclusion of initial happiness greatly increases the explanatory power (R^2) of the regression models considered and, consequently, the precision of coefficient estimates. Rising welfare state generosity and GDP growth are not only statistically, but also economically significant predictors of long-term happiness trends in Europe. These results are robust across several specifications.

The results presented in this paper belong in the context of previous findings – confirmed in various data sets – that *trends* in country-level happiness are not statistically significantly related to trends in GDP per capita (Easterlin 1974, 1995, Easterlin et al. 2010, Easterlin and O'Connor 2024). Together with evidence of happiness being significantly related to (business-cycle) *fluctuations* in per- capita GDP (Deaton 2010, De Neve et al 2018, Di Tella et al. 2003, Graham et al. 2011, Welsch and Kühling 2016,), the lack of a significant association between trends of happiness and GDP constitutes the Easterlin Paradox: In the short run happiness varies directly with income, both among and within nations, but in the long run happiness does not trend upward in correspondence with income growth (Easterlin and O'Connor 2024).[1]

The contrast between the findings regarding trends and fluctuations – the Paradox – can be resolved by viewing long-term GDP trends as a sequence of business-cycle changes of GDP and observing an asymmetry in happiness responses to recessions and upswings, where the loss in happiness from a recession is greater than the gain in happiness from an equally large recovery (De Neve et al. 2018). In the long run, GDP may thus increase without any corresponding increase in happiness. Other explanations of trends in happiness and GDP

[1] In order to study the long-term relationship between happiness and economic growth, it is important to use time series that cover several business cycles. Accordingly, while the absence of a long-term GDP-happiness relationship was called into question by scholars from several disciplines (e.g., Stevenson and Wolfers 2008, Diener et al. 2013, Veenhoven and Vergunst 2014), a rebuttal to the critics argues that they mistakenly present the positive relation of happiness to income in cross-section data or in short-term time fluctuations as contradicting the nil relation of long-term trends of happiness and aggregate income (Easterlin and O'Connor 2024). Bartolini and Sarracino (2014) empirically test the difference between fluctuations and trends, and find that the relation between happiness and GDP declines in magnitude as the time horizon increases. For a time horizon of 15 years or more, they find no significant relation between GDP and happiness.

being unrelated to each other rely on social comparison and habituation effects (Clark et al. 2008). Due to social comparison, a person's happiness depends on her income relative to average income. Thus, when everybody's income rises, average relative income does not change, nor does the average level of happiness (Easterlin 1995). In addition, people get habituated to the level of income they have attained (Di Tella et al. 2010), so that every increase in income raises their aspiration level for income and reduces income's ability to make them happy.

While rising aspiration levels are a major explanation for the Easterlin Paradox, Prati and Senik (2024) recently asked whether reported life satisfaction scores, measured on a bounded scale, are up to the task of documenting rising well-being trends over time. By constructing a measure of true (latent) life satisfaction, they showed that, in contrast to reported life satisfaction, this measure has substantially increased from the 1950s to the early 2000s, on par with GDP. This approach to addressing the issue of bounded life satisfaction scales is complementary to the present work.

The remainder of the paper is organized as follows. Sections 2 and 3 describe the data and empirical strategy, respectively. Section 4 presents the results. Section 5 provides a discussion and concludes.

2. Data and Variables

The data used in this paper are taken from E&O (Table S1), and the description of the data draws on E&O. Details on data sources and adjustments made, if any, can be found in E&O's "Materials and Methods" section.

The dependent variable is the change (absolute and relative) in country-level happiness, specified as life satisfaction (LS), from the early 1980s to the late 2010s. LS is measured by answers to the question in the European Values Study (EVS) "All things considered, how satisfied are you with your life as a whole these days?", with integer response options from 1 (dissatisfied) to 10 (satisfied). The earliest EVS survey was in 1981–1982 and the most recent (by the time of E&O's writing) 2017–2018. The EVS was chosen in preference to the Eurobarometer, because the country coverage in early years is better: in contrast to the Eurobarometer, the EVS also covers non-members of the European Union.

The independent variables comprise four possible determinants of LS: (1) economic conditions, indexed by real GDP per capita (USD) and the unemployment rate (percent); (2) social capital, as commonly measured by responses to a query on "trust in others" (scaled 0 to 1); (3) government welfare policies, as approximated by a measure of the generosity of social welfare programs (scaled 0 to 100) and government spending on such programs (percent of GDP); and (4) quality of the environment, as reflected in exposure to particulate matter 2.5 (PM 2.5), which measures fine particulate matter that poses the greatest risk to health ($\mu g/m^3$).

A special focus of E&O is on government welfare policies, approximated by two measures. The first is a measure of welfare state generosity taken from Scruggs et al. (2017). It covers three types of social welfare programs: unemployment insurance, pensions, and sickness insurance. It is distinct from spending measures, as it depends upon policies, that is, on the rights to benefits, as specified in the legislation and regulations relating to each of these social insurance programs in each country. Generosity increases with program characteristics, such as a higher benefit-replacement rate (the ratio of the after-tax cash benefit to after-tax wages), longer duration of benefits, and greater ease of qualification. Based on such characteristics, a generosity index is developed for each of the three programs, and these indexes are then combined to obtain a total generosity index (Scruggs and Ramalho Tafoya 2022).

As noted by E&O, changes in the generosity index can affect the happiness of a person whether or not that person actually collects benefits. Employed persons, for example, are not collecting unemployment insurance, but knowing that such support is available if they lose their jobs removes a source of anxiety and makes them happier (Di Tella et al 2003).

The second measure of welfare programs is government spending on such programs as percent of GDP. Although useful for some purposes, spending measures can be misleading with regard to happiness effects. Spending can increase without any change in policy or effect on happiness simply because of an increase in the number of persons collecting the benefit (e.g., more unemployed or more retirees). E&O try to control for such influences by using a social spending measure that controls for the unemployment rate and percentage of people over age 65 (E&O, “Materials and Methods”).

The variables used in the empirical analysis are changes of the respective data between 1981/82 and 2017/18. The set of countries for which all required data are available includes Denmark, Finland, France, Germany, Great Britain, Italy, the Netherlands, Norway, Spain and Sweden. The notation, description and summary statistics of the variables used can be found in Table 1. Table S1 in the appendix shows the correlation coefficients.

Table 1: Description of Variables and Summary Statistics

Variable Name	Description	Mean	SD	Min	Max
Initial LS	Life satisfaction in 1981/82	7.45	0.197	6.600	8.210
Change LS	Difference between LS in 2017/18 and 1981/82	0.215	0.131	-0.370	0.890
Relative Change LS	Change LS divided by Initial LS	0.033	0.019	-0.046	0.135
Generosity	Difference between welfare state generosity in 2017/18 and 1981/82	-0.031	1.72	-9.340	7.260
Social Expenditures	Difference between social protection expenditures (% GDP) in 2017/18 and 1981/82	1.135	1.003	-4.340	4.460
GDP pc	Ratio of GDP p.c. in 2017/18 to 1981/82	2.26	0.077	1.890	2.750
Unemployment	Difference between unemployment ratse in 2017/18 and 1981/82	0.059	1.136	-6.400	3.600
Trust	Difference between trust in 2017/18 and 1981/82	0.292	0.088	-0.020	0.720
Air Pollution	Ratio of PM 2.5 in 2017/18 to 1981/82	0.865	0.166	0.028	2.29

Data source: European Values Study (data taken from E&O 2022).

Figure 1 illustrates an important characteristic of the data: the circumstance (mentioned in the introduction) that the countries with the lowest initial level of LS (Spain, Italy and France) saw the largest increase in LS whereas the countries with the highest initial level (Denmark and Sweden) experienced a decrease in LS. Figure As seen in Figure 2a, a negative relationship between *Change LS* and *Initial LS* is not restricted to those countries, but is a characteristic of the sample overall. As seen in Figure 2b, a negative relationship also exists between *Relative Change LS* and *Initial LS*. These relationships are not only highly significant (in terms of *p*-values) but very strong as indicated by R^2-values of 0.901 and 0.927, respectively.

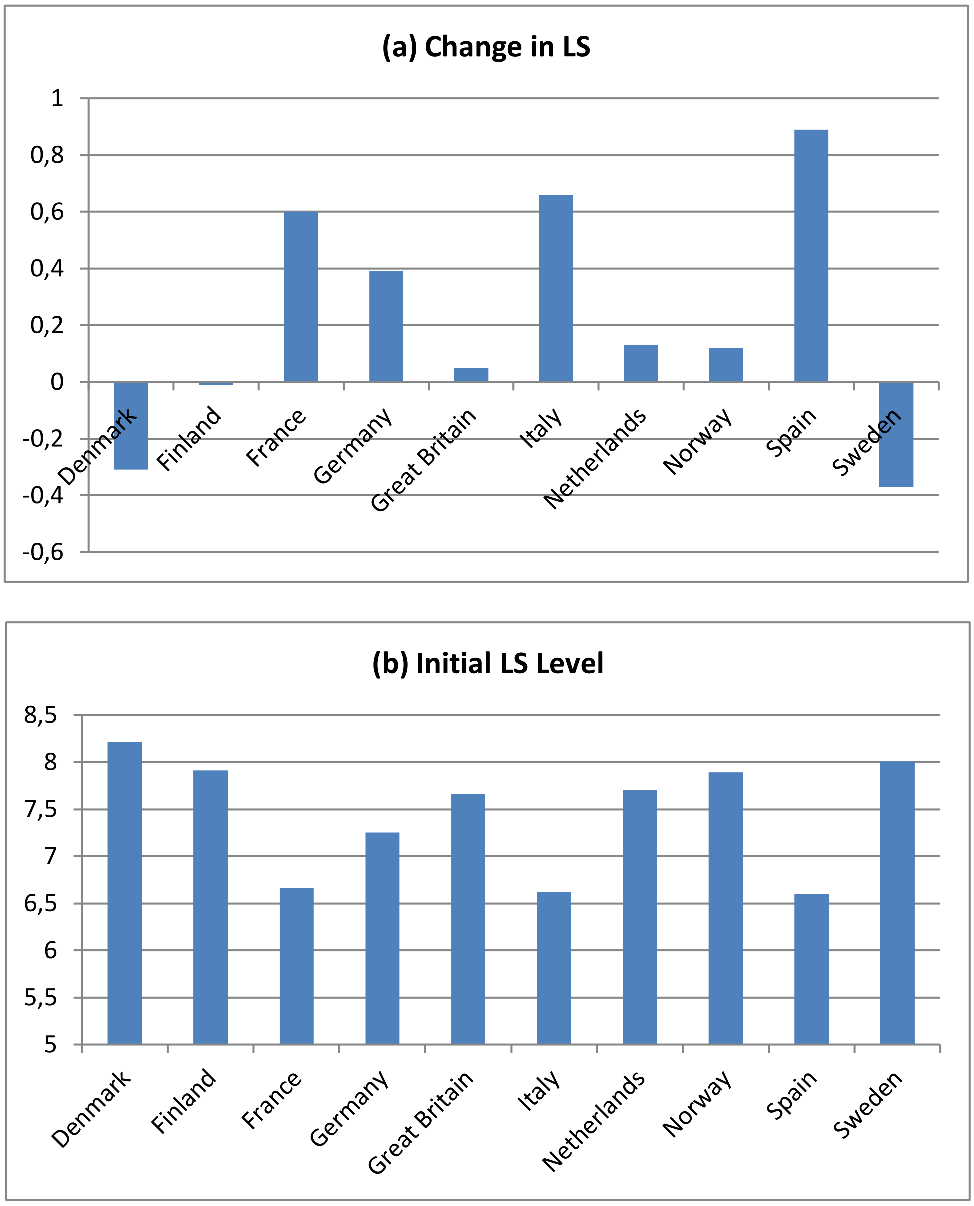

Figure 1. This figure compares changes in LS (1981/82 to 2017/18) to initial levels of LS (1981/82). Data source: European Values Study (data taken from E&O 2022).

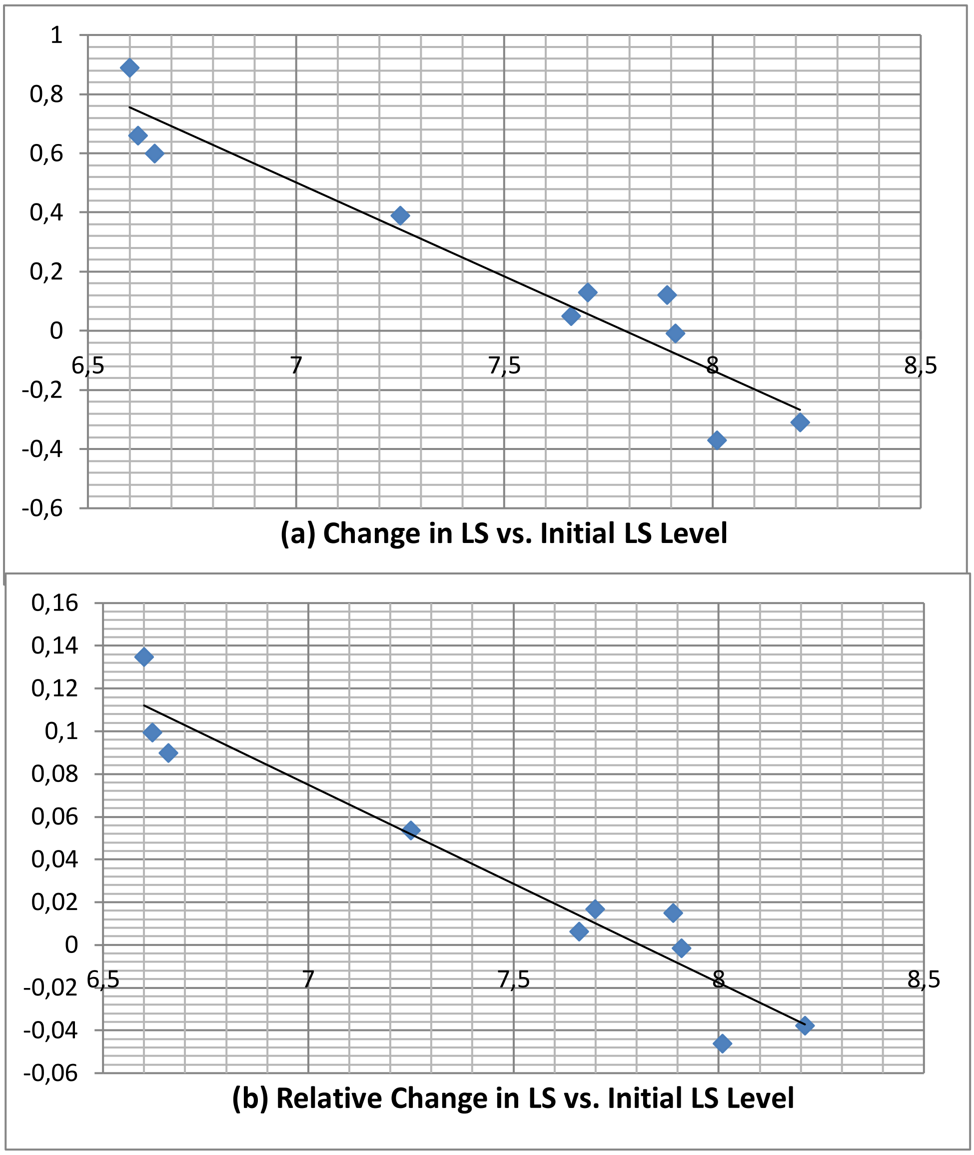

Figure 2. This figure plots (a) the change in LS and (b) relative change in LS against the initial LS level. The regression lines are (a) *Change LS* = 4.949 – 0.635**Initial LS* + *Residual* (R^2 = 0.901) and (b) *Relative Change LS* = 0.724 – 0.093**Initial LS* + *Residual* (R^2 = 0.927). All coefficients in the regressions (a) and (b) are significant at $p < 0.001$.

3. Empirical Strategy

I estimated several models (*Models B – E*) that build upon the bivariate and trivariate specifications used by E&O.[2] The latter are stated as follows (omitting country indices):

Model A (E&O). $$Change\ LS = \alpha + \beta X + \varepsilon\ ,$$

[2] In addition to these specifications, which involve the overall change between 1981/82 and 2017/18 in life satisfaction and the explanatory variables described above, E&O ran fixed effects regressions that split the overall time period into sub-periods to test the robustness of the results.

where X is any of the explanatory variables described in Table 1 (except for *Initial LS*) or a pair of those variables and ε is the error term.

Model B accounts for the circumstance, discussed before, that the change in LS is strongly and significantly related to the initial LS level by including *Initial LS* as an additional explanatory variable:

Model B. $$Change\ LS = \alpha + \beta X + \gamma\ Initial\ LS + \ \varepsilon.$$

Model C additionally accounts for the circumstance, also discussed previously, that absolute increases in LS cannot be sustained in the long run (since the LS scale is bounded) by replacing the dependent variable, *Change LS*, with *Relative Change LS*:

Model C. $$Relative\ Change\ LS = \alpha + \beta X + \gamma\ Initial\ LS + \ \varepsilon.$$

To better understand some of the results (reported later) for Models B and C in comparison to Model A, it is useful to be clear about the consequences of including an additional explanatory variable (Wooldridge 2015). A first consequence is that the degrees of freedom get reduced which, *per se*, implies larger standard errors for the (OLS) regression coefficients. This effect is amplified if introducing an additional explanatory variable leads to multicollinearity problems. On the other hand, if introducing an additional variable improves a model's explanatory power (R^2), this reduces the standard errors of all regression coefficients. The overall effect on the standard errors is indeterminate. If and how changes in the standard errors, arising from these effects, influence the (statistical) significance of coefficients depends on how the introduction of an additional explanatory variable affects the size of those coefficients (since the *t*-statistic used to assess significance is the ratio of coefficient size and standard error).

Models D and *E* deal with the issue of few degrees of freedom – which in the present circumstances is especially relevant in the case of trivariate, rather than bivariate, regressions. To address this concern, I use a two-step regression approach. Specifically, *Model D* replaces the dependent variable *Change LS* with the residual of a first-step regression of *Change LS* on *Initial LS*:

Model D. $$Residual\ Change\ LS = \alpha + \beta X + \ \varepsilon,$$

where *Residual Change LS* is the residual from regression (a) stated in the captions of Figure 2.

Similarly, *Model E* replaces the dependent variable *Relative Change LS* with the residual of a first-step regression of *Relative Change LS* on *Initial LS*:

Model E. $$Residual\ Relative\ Change\ LS = \alpha + \beta X + \varepsilon.$$

where *Residual Relative Change LS* is the residual from regression (b) stated in the captions of Figure 2.

The two-step approach permits to control for the initial level of LS without compromising the available degrees of freedom and inflating standard errors. Related to this, the two-step regression approach avoids multicollinearity problems that may arise in a single individual-level regression model and are a bigger problem in smaller samples compared to larger samples.[3]

4. Results

Table 2 shows the results of OLS regressions of Models A – C. The results for Model A are those of the bivariate regressions reported by E&O (Table S2): The long-term trend in Europeans' life satisfaction is positively and significantly related to *Generosity* –the trend in welfare state generosity – and not significantly related to any of the other candidate explanatory variables. In quantitative terms, a 1-point increase in the (0 to 100) generosity index is associated with an increase in (1 to 10) LS by 0.051 points. This implies that the country with the strongest increase in generosity (by 7.26 points) is predicted to experience a change in LS that is almost 0.85 points larger than the change in LS experienced by the country with the strongest *decrease* in generosity (by 9.34 points). This is about two thirds of the observed range of *Change LS* (Table 1). In terms of the standardized regression coefficient (0.670), the substantive (economic) significance of *Generosity* is large (Cohen 1988). It should also be noted that the explanatory power (R^2) of the regression that includes *Generosity* is of medium size (0.445), whereas R^2 is much smaller in the other individual regressions (between 0.001 and 0.221). This further supports the important role of *Generosity*.

[3] While multicollinearity affects both small and large samples by increasing the standard errors of the coefficient estimates, the impact is exacerbated in smaller samples due to the limited amount of data available to provide stable and precise estimates (Wooldridge 2015).

Nevertheless, however, all R^2-values for Model A are much smaller than R^2 of the regression of *Change LS* on *Initial LS* shown in Figure 2a ($R^2 = 0.901$).

Model B includes *Initial LS* as an additional explanatory variable. This addition leads to a large increase (in comparison to Model A) of R^2 in all individual regressions, which underscores the importance of *Initial LS* in explaining *Change LS* already noted. Consistent with this, *Change LS* is negatively and highly significantly related to *Initial LS* in all individual regressions. The size of the coefficients is very similar to that in the simple regression (a) shown in Figure 2. *Generosity* attracts a positive coefficient, which is marginally significant and whose magnitude (0.017) is one third of the corresponding coefficient in Model A, as is the standardized coefficient (0.223). *GDP pc* attracts a positive and marginally significant coefficient.[4] The estimated coefficient (0.304) is not only statistically but economically significant: The fastest and the slowest growing country are predicted to differ in *Change LS* by 0.261 points (0.304*(2.75-1.89)) or one fifth of the observed range of *Change LS* (Table 1). The standardized regression coefficient on *GDP pc* (0.179) is of a similar magnitude as that on *Generosity*. All other explanatory variables are not statistically significant in Model B.

Model C differs from Model B by using *Relative Change LS* (*Change LS* divided by *Initial LS*) as the dependent variable. This leads to a (small) further increase (in comparison to Model B) of R^2 in all individual regressions. As in Model B, *Initial LS* attracts highly significant negative coefficients in all individual regressions, and their magnitude is similar to regression (b) in Figure 2. Whereas *Generosity* is not significant in this specification, *GDP pc* attracts a marginally significant positive coefficient (0.044). The fastest and the slowest growing country are predicted to differ in *Relative Change LS* by 0.038 (0.044*(2.75-1.89)), which is one fifth of the range of *Relative Change LS* (Table 1). The standardized regression coefficient on *GDP pc* (0.178) is similar to Model B. All other explanatory variables are insignificant in Model C.

Overall, the results for Models B and C shown in Table 2 suggest that both rising welfare state generosity and economic growth contribute to explaining long-term happiness trends in Europe in statistically and economically significant ways. However, Models A - C have considered the explanatory variables one at a time. To investigate the role of several

[4] The finding that *GDP pc* becomes significant when *Initial LS* is included (Model B) while being insignificant when it is omitted (Model A) arises because of the reduction in residual variance (increase in R^2) implied by introducing *Initial LS*. A lower residual variance leads to a smaller standard error for all coefficients (Wooldridge 2015). Since the introduction of *Initial LS* does not appreciably change the size of the coefficient on *GDP pc*, the reduced standard error translates into greater significance. The same logic applies to some findings to be discussed later (significance levels in regressions D3 compared to D1 and E3 compared to E1 in Table 3).

explanatory variables – in particular *Generosity* and *GDP pc* – jointly in one regression, we turn to Models D and E. These models use as dependent variables the residuals from the first-step regressions (a) and (b), respectively, shown in Figure 2. As argued in the preceding section, such a two-step procedure permits to control for the initial level of LS while minimizing the risk of standard errors being inflated by possible multicollinearity and a small sample size.

Table 2. Regression Results for Models A – C

	Model A E&O: Change LS	Model B With Initial LS: Change LS	Model C With Initial LS: Relative Change LS
Generosity	0.051** (0.046)	0.017* (0.077)	0.002 (0.109)
Initial LS		-0.553*** (0.000)	-0.083*** (0.000)
Constant	0.217* (0.070)	4.366*** (0.000)	0.654*** (0.000)
R^2	0.445	0.943	0.951
Soc. Expenditure	0.047 (0.186)	0.013 (0.416)	0.002 (0.401)
Initial LS		-0.617*** (0.000)	-0.090*** (0.000)
Constant	0.163 (0.245)	4.798*** (0.000)	0.704*** (0.000)
R^2	0.127	0.918	0.935
GDP pc	0.294 (0.694)	0.304* (0.093)	0.044* (0.054)
Initial LS		-0.635*** (0.000)	-0.093*** (0.000)
Constant	-0.451 (0.791)	4.262*** (0.000)	0.625*** (0.000)
R^2	0.030	0.941	0.959
Unemployment	0.027 (0.466)	-0.001 (0.918)	0.000 (0.914)
Initial LS		-0.638*** (0.000)	-0.092*** (0.000)
Constant	0.214 (0.148)	4.965*** (0.000)	0.722*** (0.000)
R^2	0.057	0.909	0.927
Trust	-2.167 (0.104)	0.144 (0.449)	0.022 (0.363)
Initial LS		-0.662*** (0.000)	-0.097*** (0.000)
Constant	0.461* (0.072)	5.107*** (0.000)	0.748*** (0.000)
R^2	0.221	0.917	0.936
Air Pollution	0.352 (0.938)	0.174* (0.069)	0.027** (0.021)
Initial LS		-0.556*** (0.000)	-0.081*** (0.000)
Constant	-0.054 (0.987)	4.202*** (0.000)	0.610*** (0.000)
R^2	0.001	0.945	0.968

Note: In Models A and B, the dependent variable (*Change LS*) is the difference between life satisfaction in 2017/18 and 1981/82. Results for Model A are taken from E&O (2022), Appendix Table S2. In Model C, the dependent variable (*Relative Change LS*) is *Change LS* divided by LS in 1981/82. The explanatory variables are changes from 1981/82 to 2017/18, except GDP pc and air pollution, which use the ratio of end of period divided by beginning of period values. The basic data are in E&O (2022), Appendix Table S1. Number of observations: 10; p-values in parentheses. *p < 0.10; **p < 0.05; ***P < 0.01.

The results for Models D and E are shown in Table 3. For comparison, the leftmost part of Table 3 reproduces the pertinent results from E&O's specification (Model A). Regressions A1 and A2 are the bivariate regressions (taken from E&O, Table S2) already displayed in Table

2, which show that *Change LS* is positively and significantly related to *Generosity* and not significantly related to *GDP pc*. The latter findings are preserved in regression A3 (taken from E&O, Table S4), which includes *Generosity* and *GDP pc* jointly.

Model D involves second–step regressions of *Residual Change LS* on *Generosity* and *GDP pc*. The bivariate regressions D1 and D2 yield an insignificant coefficient on *Generosity* and a marginally significant positive coefficient on *GDP pc*, respectively. The result for *GDP pc* (regression D2) is very similar to the counterpart regression that includes *Initial LS* as a control (Model B in Table 2) in terms of both size and significance. This provides strong support for the validity of the two-step approach to estimating the association between *Change LS* and *GDP pc*. Regression D3 is a key specification that includes *Generosity* and *GDP pc* jointly. Including both variables jointly leads to a large increase (in comparison to D1 and D2) of R^2, and the regression yields positive and significant coefficients not only on *GDP pc* but (in contrast to D1) also on *Generosity* (following the logic discussed in footnote 4). The standardized coefficient on *Generosity* is 0.523, that is, an increase in *Generosity* by 1 standard deviation (SD) is associated with an increase of the residual SD of *Change LS*, unaccounted for by *Initial LS*, by 0.523. The standardized coefficient on *GDP pc* is 0.607. Both of these associations can be considered to be strong (Cohen 1988) and indicate large economic significance.

Model E involves second–step regressions of *Residual Relative Change LS* on *Generosity* and *GDP pc*. The bivariate regressions E1 and E2 yield an insignificant coefficient on *Generosity* and a significantly positive coefficient on *GDP pc*, respectively. The coefficient on *GDP pc* is very similar to the counterpart regression that includes *Initial LS* as a control (Model C in Table 2) with respect to size, but it is more significant (p = 0.039). Regression E3, which includes *Generosity* and *GDP pc* jointly, yields positive and significant coefficients on both variables (*GDP pc* being significant at p = 0.016). The standardized coefficient on *Generosity* is 0.337 (which indicates a medium-sized association). The standardized coefficient on *GDP pc* is 0.664 (strong association), indicating large economic significance.

Table 3. Regression Results for Models A, D and E

	Model A E&O: Change LS			Model D Second Step: Residual Change LS			Model E Second Step: Residual Relative Change LS		
	A1	A2	A3	D1	D2	D3	E1	E2	E3
Generosity	0.051** (0.046)		0.051* (0.052)	0.012 (0.123)		0.012* (0.050)	0.001 (0.158)		-0.001* (0.051)
GDP pc		0.294 (0.694)	0.331 (0.555)		0.304* (0.071)	0.311** (0.032)		0.044** (0.039)	0.044** (0.016)
Constant	0.217 (0.070)	-0.451 (0.798)	-0.533 (0.677)	0.000 (0.992)	-0.687* (0.072)	-0.704 (0.032)	0.000 (0.993)	-0.099** (0.040)	-0.101** (0.016)
R^2	0.445	0.030	0.483	0.271	0.351	0.640	0.233	0.432	0.683

Note: Results for Model A are taken from E&O (2022), Appendix Tables S2 and S4. In Model D, the dependent variable (*Residual Change LS*) is the residual from a first-step regression of *Change LS* on *Initial LS* (see notes to Figure 2a). In Model E, the dependent variable (*Residual Relative Change LS*) is the residual from a first-step regression of *Relative Change LS* on *Initial LS (*see notes to Figure 2b*)*. Number of observations: 10; p-values in parentheses. *p < 0.10; **p < 0.05; ***P < 0.01.

The results for Models D3 and E3 (Table 3) confirm the findings for Models B and C (Table 2) that not only rising welfare state generosity but also economic growth contribute to explaining long-term happiness trends in Europe in statistically and substantively significant ways. Table S2 in the appendix shows that similar results are obtained when analogs to Models D3 and E3 are considered in which *Generosity* and *GDP pc*, respectively, are combined with all other candidate explanatory variables for life satisfaction trends in Europe.

5. Discussion and Conclusion

In their 2022 PNAS paper, Easterlin and O'Connor (E&O) have investigated which economic, political, social, and environmental factors explain long-term life satisfaction trends in a set of major Northern, Western and Southern European countries and found that improvements in welfare state policies predict long-term increases in life satisfaction since the early 1980s whereas all other candidate explanatory factors are not significantly related to trends in Europeans' life satisfaction.

In commenting on this study, O'Connor (2024) noted that life satisfaction declined in Denmark and Sweden and that these countries "were already fairly high in the 1980s, so it's hard to move up". Tying in with this observation, the present paper has focused on the possibility that between-country differences in life satisfaction trends depend on differences in initial levels. A possible reason for this possibility to arise is that life satisfaction scales are bounded, so that it is difficult for life satisfaction to increase if it is already high. In addition, conceptualizing life satisfaction "trends" as *absolute* changes over a long period of time (as do E&O) involves the possibility that a rising trend (at a constant rate) would ultimately exceed the life satisfaction scale – a phenomenon less likely (though not impossible) to arise in the case of (constant) percentage changes.

Motivated by these observations, the present paper has studied the possibility that life satisfaction trends in Europe depend on initial levels of life satisfaction and what that implies for explaining these trends in terms of the factors considered by E&O. The statistical procedure has involved augmenting E&O's regression models by including initial life satisfaction and by considering relative (percentage) life satisfaction changes in addition to absolute changes.

A major finding from this analysis is that European life satisfaction trends from 1981/82 to 2017/18 are negatively and statistically significantly related to initial levels and that the relationship is strong. Specifically, bivariate regressions of both absolute and relative life satisfaction trends on the initial level yield R^2 greater than 0.9 (which is about twice the R^2 in E&O's regression that includes welfare state generosity). As a consequence, adding initial life satisfaction to E&O's specifications implies greatly increased explanatory power (reduced residual variance) and, therefore, more precise coefficient estimates (smaller standard errors). The latter – precision of coefficient estimates – is crucial when it comes to assessing the (statistical) significance of the explanatory variables under consideration.

With respect to the explanatory variables considered by E&O, the following findings stand out. First, welfare state generosity continues to be a statistically significant predictor of life satisfaction trends, both absolute and relative, even when controlling for initial life satisfaction. The substantive (economic) significance (in terms of standardized regression coefficients) is medium-sized to large. Specifically, an increase in *Generosity* by 1 SD is associated with an increase of the trend in LS, unaccounted for by *Initial LS*, by 0.337 SD (relative trend) to 0.523 SD (absolute trend).

Second, when controlling for initial life satisfaction, long-term growth of GDP per capita also turns out to be a statistically significant predictor of (both absolute and relative) life satisfaction trends (due to increased precision of coefficient estimates). The substantive significance is large. Specifically, an increase in *GDP pc* by 1 SD is associated with an increase of the trend in LS, unaccounted for by *Initial LS*, by 0.607 (absolute trend) to 0.664 (relative trend).

In contrast to welfare state generosity and GDP growth, the other candidate explanatory variables remain insignificant in all specifications studied.

As noted above, the initial level of life satisfaction appears to be particularly relevant for long-term life satisfaction trends because the life satisfaction scale is bounded. The issue of bounded scales was recently addressed by Prati and Senik (2024), who asked whether bounded life satisfaction scales are up to the task of documenting rising trends over time. To address this question, they considered the possibility of rescaling, that is, that the interpretation of the scale changes with the context in which respondents are placed. Using data on people's recollection of their life satisfaction in the past, they were able to derive a measure of true (latent) life satisfaction and showed that, in contrast to reported life satisfaction, this measure has substantially increased from the 1950s to the early 2000s, on par with GDP (as well as with health, education, and liberal democracy).

The present paper's (and E&O's) analysis is limited in terms of the focus on European countries and the small sample size (due to limited availability of data on welfare state generosity). The negative association between life satisfaction trends and initial levels found in the present study indicates a long-term convergence of country-level satisfaction within this set of countries. Whether such convergence exists with respect to other countries and what that implies for the relationship between life satisfaction trends and long-term economic growth remains to be studied in future work.

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Appendix: Supplementary Tables

Table S1. Correlation Coefficients

	Change LS	Relative Change LS	Initial LS	GDP pc	Generosity	Social Expenditures	Unemployment	Trust
Relative Change LS	0.998	1						
Initial LS	-0.953	-0.963	1					
GDP pc	0.179	0.178	-0.001	1				
Generosity	0.666	0.645	-0.534	-0.0282	1			
Social Expenditures	0.358	0.354	-0.282	-0.098	0.671	1		
Unemployment	0.237	0.2623	-0.261	0.033	0.424	0.192	1	
Trust	-0.319	-0.318	0.418	0.405	-0.328	-0.453	0.261	1
Air Pollution	0.669	0.684	-0.533	0.646	0.411	0.267	0.187	0.002

Table S2: Additional Regression Results

Model A (E&O). Dependent variable: *Change LS*								
Generosity	0.059* (0.078)	0.053** (0.026)	0.043 (0.139)	0.056** (0.017)				
GDP pc					0.368 (0.550)	0.292 (0.650)	0.627 (0.347)	-0.737 (0.230
Social Expenditures	-0.021 (0.679)				0.050 (0.307)			
Unemployment		-0.006 (0.776)				0.027 (0.543)		
Trust			-1.076 (0.315)				-0.700 (0.241)	
Air Pollution				-3.116 (0.356)				0.751** (0.024)
Constant	0.241* 0.091)	0.217* (0.089)	0.339* (0.051	2.597 (0.301)	-0.675 (0.630)	-0.447 (0.759)	-1000 (0.485	1.234 (0.315)
R^2	0.459	0.447	0.490	0.486	0.175	0.086	0.216)	0.557

Model D. Dependent variable: *Residual Change LS* (second-step regression)								
Generosity	0.013 (0.221)	0.015* (0,.092)	0.016* (0.500)	0.008 (0.298)				
GDP pc					0.322* (0.056)	0.305* (0.091)	0.298 (0.125)	0.219 (0.307)
Social Expenditures	-0.004 (0.836)				0.014 (0.231)			
Unemployment		-0.011 (0.377)				-0.002 (0.852)		
Trust			0.219 (0.134)				0.013 (0.934)	
Air Pollution				0.091 (0.275)				0.061 (0.528)
Constant	0.005 (0.918)	0.001 (0.976)	-0.064 (0.241)	-0.079 (0.351)	-0.744* (0.054)	-0.689* (0.093)	-0.677 (0.112)	-0.548
R^2	0.276	0.353	0.483	0.393	0.469	0.354	0.351	0.389

Model E. Dependent variable: *Residual Relative Change LS* (second-step regression)								
Generosity	0.001 (0.297)	0.002 (0.157)	0.002* (0.057)	0.001 (0.409)				
GDP pc					0.046** (0.027)	0.044* (0.055)	0.042* (0.080)	0.028 (0.257)
Social Expenditures	-0.000 (0.947)				-0.002 (0.175)			
Unemployment		-0.009 (0.594)				0.000 (0.950)		
Trust			0.031 (0.109)				0.003 (0.859)	
Air Pollution				0.016 (0.133)				0.011 (0.345)
Constant	0.000 (0.970)	0.000 (0.984)	-0.009 (0.207)	-0.014 (0.176)	-0.106** (0.025)	-0.098* (0.055)	-0.096* (0.070)	-0.074 (0.160)
R^2	0.233	0.265	0.482	0.457	0.572	0.433	0.435	0.505

Note: The results for the Model A regressions that include *Generosity* are taken from E&O, Table S4. In Model D, the dependent variable (*Residual Change LS*) is the residual from a first-step regression of *Change LS* on *Initial LS* (see notes to Figure 2a). In Model E, the dependent variable (*Residual Relative Change LS*) is the residual from a first-step regression of *Relative Change LS* on *Initial LS (*see notes to Figure 2b*)*. Number of observations: 10; p-values in parentheses. *$p < 0.10$; **$p < 0.05$; ***$P < 0.01$.

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