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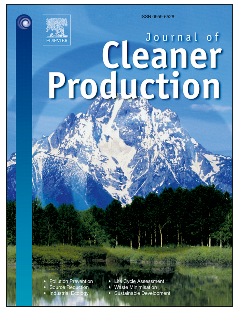

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Andrew L. Fanning, Daniel W. O'Neill

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The Wellbeing–Consumption Paradox: Happiness, Health, Income, and Carbon Emissions in Growing versus Non-Growing Economies

Andrew L. Fanning[a,] and Daniel W. O'Neill[a]*

[a] Sustainability Research Institute, School of Earth and Environment, University of Leeds, Leeds, LS2 9JT, United Kingdom

* Corresponding Author: a.l.fanning@leeds.ac.uk (A. Fanning)

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Abstract

We investigate the relationships between carbon-intensive consumption and two dimensions of human wellbeing (physical health and happiness) for ~120 countries over the 2005–2015 period. Long-term (~10-year) relationships are analysed to re-assess the "happiness–income paradox" (i.e. Easterlin paradox) which states that changes in national income and happiness are correlated in the short-term, but not in the long-term. We broaden the scope of Easterlin's analysis in two novel ways. First, the evidence for a "health–income" paradox is explored. Second, a parallel analysis using national consumption-based carbon footprints (instead of income) is conducted to explore complementary relationships with both of the wellbeing indicators. We show that countries with declining per capita consumption, measured in terms of either gross domestic product (GDP) or carbon footprint, have significant reductions in average happiness. In contrast, countries with growing per capita consumption have no significant change in happiness. There is no relationship between changes in per capita consumption and health, irrespective of whether GDP or carbon footprint is growing or not. These findings apply to rich and poor countries alike and are robust to the inclusion of other social indicators, such as social support and autonomy. We find that happiness is less sensitive to declines in carbon footprint than declines in GDP, thus lending support to calls for "decoupling" carbon emissions from economic growth. However, observed decoupling trends are insufficient to meet climate targets. If the 2 degree target is to be met without a decline in wellbeing, then either decoupling must be vastly improved, or happiness levels must be made less sensitive to declining consumption.

Keywords

Easterlin Paradox; Sustainable Consumption; Wellbeing; Carbon Footprint; Climate Change

Word Count

8,523 words (including 742 words in tables and figure captions)

1 Introduction

Nearly half a century has passed since Easterlin (1974) made the paradoxical observation that income and subjective wellbeing are correlated at a given point in time, but happiness does not rise with income over longer time periods (~10 years or more). This "happiness–income paradox" or "Easterlin paradox" is still relevant — and contested — because it challenges conventional economic policy which tends to promote income growth as the main way to increase human wellbeing (Stevenson and Wolfers, 2008; Easterlin et al., 2010).

Meanwhile, there is little debate that income growth is tightly coupled to an increase in carbon emissions, and that this increase risks pushing the climate system into a new, more hostile, state with potentially drastic consequences for society (Tapia Granados et al., 2012; Knight and Schor, 2014; Steffen et al., 2015a). It is a challenge for countries to achieve the mainstream goal of "green growth", i.e. to decouple carbon emissions from aggregate output at a rate that is sufficiently rapid to meet climate targets (Bassetti et al., 2013; Antal and van den Bergh, 2016). The decoupling challenge is more difficult for countries that are net importers of upstream carbon emissions after international trade is taken into account using a consumption-based approach, i.e. carbon footprint (Peters et al., 2011; Hoekstra and Wiedmann, 2014).

The debates over the Easterlin paradox and decoupling are both concerned with how changes in economic activity are related to changes in other important quantities over time, i.e. happiness and a stable climate. To date, however, there have been very few empirical studies that consider the dependence of happiness on carbon emissions directly, and none that investigate this relationship over time (cf. Knight and Rosa, 2011; Lenzen and Cummins, 2013; York and Bell, 2014; Ambrey and Daniels, 2017). That being said, there is an important body of sustainability research that analyses the relationships between carbon emissions and a number of objective wellbeing indicators, such as life expectancy (e.g. Steinberger et al., 2012; Lamb and Rao, 2015; Jorgenson et al., 2017).

Here, we adopt the approach taken by O'Neill et al. (2018), which views life satisfaction and life expectancy as complementary measures of wellbeing, and perform a comparative analysis of the relationship between both of these indicators and carbon-intensive consumption over time. We argue that per capita values of carbon footprint and national income can be seen as alternative proxies for the wellbeing gains of consumption based on different characteristics embodied within final goods and services (i.e. upstream carbon emissions versus market value). The inclusion of income in our analysis also permits the comparison of our results with other studies in the ongoing debate surrounding the happiness–income paradox (e.g. Stevenson and Wolfers, 2013).

Specifically, we explore the empirical relationships between each wellbeing–consumption pair across nearly 120 countries over the 2005–2015 period. Of particular relevance to the decoupling debate, we ask whether there is a fundamental difference in these relationships depending on whether consumption is increasing or decreasing. In short, we explore the evidence for a generalised "wellbeing–consumption paradox" with an explicit focus on differences in the relationships between growing and non-growing economies.

The remainder of the article is structured as follows. Section 2 reviews relevant literature on subjective and objective wellbeing and the environment. Section 3 includes an overview of the methods used in our empirical analysis, while Section 4 presents our findings on the relationships between wellbeing and consumption over the 2005–2015 period. Section 5 discusses the broader implications of our results for debates surrounding the Easterlin paradox, sustainable consumption, and human wellbeing. Section 6 concludes.

2 Wellbeing and the Environment

There are a number of different ways of conceptualising human wellbeing. The notion of wellbeing in mainstream economics draws on the utilitarianism of Mill (1863), who argued that the right action is the one that produces the greatest net happiness for all concerned. The Aristotelian notion of *eudemonia*, or “flourishing”, represents the main alternative to the utilitarian perspective (O’Neill, 2008). Eudemonic wellbeing argues that happiness is derived from becoming one’s best self, which is a process influenced by the surrounding contexts of people’s lives, notably their opportunities for good health, autonomy, and meaningful relations with others (Ryff and Singer, 2008). Eudemonic wellbeing underpins several prominent development approaches, including the capabilities approach (Nussbaum, 2003; Sen, 1985), human needs frameworks (Doyal and Gough, 1991; Max-Neef, 1991), and models of psychosocial wellbeing (Ryan and Deci, 2000; Ryff and Keyes, 1995).

2.1 Subjective Wellbeing

Subjective wellbeing measures people’s appraisals and evaluations of their own lives. It can be measured by asking people to evaluate their overall level of satisfaction with life (or health, finances, etc.), or by asking them to provide emotional responses in terms of pleasant versus unpleasant experiences (Diener et al., 2018). Here, we focus on the cognitive evaluation that people provide of their own lives (i.e. life satisfaction), as the latter is the most common measure used in the happiness–income literature. The terms “happiness” and “life satisfaction” are used interchangeably throughout the article to refer to this evaluative measure.

The relation between happiness and income over time has been the topic of much debate. Explanations by those who generally accept Easterlin’s (1974) finding that happiness does not increase as income rises over time focus on how people compare their incomes relative to others or to their past self (Clark et al., 2008). The idea is that the happiness you obtain from an increase in income can be offset if others get larger income increases, or if you get a smaller increase than you aspired to, thereby leaving the national happiness level unchanged despite sustained income increases (Easterlin et al., 2010; Layard et al., 2010).

However, there are a number of studies that find that average happiness levels *do* increase with income over time, but at a decreasing rate similar to the relation observed in the cross-section (Stevenson and Wolfers, 2008; Diener et al., 2013; Veenhoven and Vergunst, 2014). A lack of consistent time-series data across countries has been identified as a major challenge in the debate over the Easterlin paradox (Knight and Rosa, 2011; Stevenson and Wolfers, 2013).

The magnitude of the happiness–income relationship in the studies that do find a statistically significant result is typically quite small in terms of practical significance (Beja Jr., 2014). For example, despite Veenhoven and Vergunst’s (2014) eye-catching title “The Easterlin Illusion: Economic Growth Does Go With Greater Happiness”, the authors find that a 1% increase in annual gross domestic product (GDP) per capita is associated with an increase in average life satisfaction of only 0.003 points on a 0 to 10 scale. Put another way, this result suggests that to achieve a 1 point increase in happiness would require GDP per capita to grow at a rate of 5% per year for 60 years!

There has been relatively little research on income reductions in the happiness economics literature, with the few studies that do exist focussing on the individual (Vendrik and Woltjer, 2007; Di Tella et al., 2010; Boyce et al., 2013; Sekulova and van den Bergh, 2013; Boyce et al., 2016). Easterlin (2009) and De Neve et al. (2017) provide the only two analyses at the national level, as far as we are aware. Using a small sample of post-Soviet transition countries, Easterlin (2009) finds average happiness and national income moved together over a ~10-year collapse and recovery period. De Neve et al.

(2017) examine year-on-year changes for a large number of countries and find that average life satisfaction is more than five times as sensitive to income contraction as it is to income growth.

In general, income losses seem to have a stronger effect on happiness than income gains at both the individual and national level, a finding predicted by the concept of loss aversion in prospect theory (Kahneman and Tversky, 1979). That being said, there is debate as to the level of adaptation to such losses over time, and there is also a need for additional cross-country research to assess De Neve et al.'s (2017) findings from a longer-term perspective.

To date, only a few studies have analysed the relationship between happiness and carbon emissions directly. At the national level, O'Neill et al. (2018) examine a cross-section of more than 150 countries and find a bivariate relationship between life satisfaction and carbon footprint that exhibits diminishing returns at higher emission levels. At the household level, surveys in Canada, Sweden, and Australia suggest a weak to non-existent relationship between life satisfaction and carbon emissions after controlling for other explanatory variables, including income (Ambrey and Daniels, 2017; Andersson et al., 2014; Wilson et al., 2013).

One potential explanation for the lack of a relationship when controlling for explanatory variables could be the very high correlation between carbon emissions and income shown by previous research (Lamb et al., 2014). Given the fossil fuel dependence of modern economic activity, we suspect both indicators are measuring the same thing, i.e. variation in the aggregate consumption of goods and services.

Other environmental factors that have received attention in the subjective wellbeing literature include air pollution, natural disasters, and bad weather (which seem to make people less happy), while being outdoors and nice weather seem to make them happier (Ferreira et al., 2013; MacKerron and Mourato, 2013; Maddison and Rehdanz, 2011; Sekulova and van den Bergh, 2016). Non-environmental factors which have been shown to affect happiness include genetic predisposition, personal circumstances such as marriage or unemployment, and social issues such as inequality, corruption, social support, and personal autonomy (Bartels, 2015; Helliwell et al., 2016; Luhmann et al., 2012; Oishi et al., 2011; Tay et al., 2014).

2.2 Objective Wellbeing

Income is the most widely used indicator of objective wellbeing in the climate change literature, thanks to the widespread use of integrated assessment models (IAMs). IAMs analyse the costs and benefits of climate mitigation versus damages in monetary terms, and the results of these cost–benefit analyses are often used to estimate least-cost mitigation pathways and the "social cost of carbon" (Nordhaus, 2017).

National pledges to reduce emissions still remain far below the rapid and sustained reductions needed to keep warming below 2 °C (Rogelj et al., 2016). At least part of this gap can be explained using IAM results, which generally suggest the forgone income growth associated with stringent mitigation policy would be too costly for society, since wellbeing is equated with income under the assumptions of welfare economics (van den Bergh, 2010).

A growing number of studies are moving beyond the narrow focus on income by adopting eudemonic perspectives to analyse the empirical relationships between wellbeing and carbon-intensive development across countries (Abdallah et al., 2012; Brand-Correa et al., 2018; Jorgenson, 2014; Lamb and Rao, 2015; Steinberger et al., 2012). In contrast to the coupling observed between income and carbon emissions, a host of non-income measures of wellbeing show steep diminishing returns with increasing levels of environmental impact across countries (Mazur and Rosa, 1974; O'Neill et al., 2018). The levels of income and carbon emissions associated with a high level of life expectancy, probably the most common indicator of wellbeing after income, have been shown to be declining steadily over time across countries (Preston, 2007; Steinberger and Roberts, 2010).

In summary, a number of research gaps emerge from the diverse strands of literature that inform our analysis. First, there is virtually no empirical understanding of the relationship between wellbeing and the long-term reductions in carbon emissions needed for a chance of meeting the 2 °C climate target. Second, although the empirical relation between happiness and income growth has received considerable attention, there is a surprising lack of cross-country research on the role of income contractions on wellbeing. Finally, a growing number of studies analyse resource use in relation to the achievement of basic needs and capabilities based on a eudemonic notion of wellbeing, but few studies include subjective measures of wellbeing alongside objective indicators. The remainder of this article discusses our contribution to filling these gaps in current knowledge.

3 Analytic Framework, Data, and Methods

We adopt the analytic approach proposed by O'Neill et al. (2018), who envision life satisfaction and life expectancy as complementary indicators of wellbeing within a broader analytic framework that links biophysical resource use to basic needs via the mediating role of provisioning systems. Within this approach, human wellbeing is seen as a function of both the level to which basic needs are met, and the degree to which people are satisfied with this level (Costanza et al., 2007). As empirical support for this view, O'Neill et al. (2018) find that the more social thresholds associated with the provision of basic needs a country achieves, the healthier and happier its citizens generally are.

We build on O'Neill et al.'s (2018) cross-sectional study by exploring the effects of reductions in carbon-intensive consumption on wellbeing over time. We test the authors' suggestion that resource use (in particular carbon footprint) could be reduced significantly without affecting social outcomes (i.e. life satisfaction and life expectancy) in wealthy countries.

Our analysis considers the period from 2005 to 2015, which was chosen for two reasons. First, there is little doubt that the severity of the 2008–09 global economic recession was a defining feature of the period that was felt to a greater or lesser degree by all countries. In contrast (and less well-known), the 2006–07 period stands out as one in which the number of countries experiencing recessions was at a historical low (IMF, 2009). These two features make 2005–2015 a singular period that encompasses the ~10-year contraction and recovery phases of economic activity experienced simultaneously by an unprecedented number of countries. In the absence of ambitious mitigation policy, this period provides a natural experiment to analyse current relationships between wellbeing and the rate of emissions mitigation that climate science suggests is required.

3.1 Dependent Variables

We include life satisfaction and life expectancy as complementary measures of wellbeing in our analysis. Both indicators are widely used in their respective domains with relatively well-known advantages and disadvantages (see Stiglitz et al., 2009 for a useful discussion).

Average life satisfaction at the national level is based on individual responses to the Cantril ladder question, which states: "Please imagine a ladder with steps numbered from 0 at the bottom to 10 at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time?" National average life satisfaction data from 2005 to 2015 were obtained from the *World Happiness Report* (Helliwell et al., 2016), and these data were in turn aggregated from the 26 January 2016 release of the Gallup World Poll.

Life expectancy at birth estimates the number of years that a newborn infant would live if the prevailing patterns of mortality at the time of its birth were to stay the same throughout the course of its life. National average life expectancy data for the 2005–2015 period were obtained from the World Bank's (2018) *World Development Indicators*.

3.2 Independent Variables

To measure the change in consumption levels over time we selected two alternative indicators: GDP per capita and carbon footprint per capita. GDP measures the total market value of all final goods and services purchased within a country over the course of a year. Carbon footprint, on the other hand, is an indicator of environmental pressure that places the ultimate responsibility for upstream carbon emissions embodied in final goods and services with the individuals who consume them, regardless of where the emissions actually occur (Hoekstra and Wiedmann, 2014). Our approach views GDP per capita and carbon footprint per capita as alternative proxies for the wellbeing gains of consumption based on different characteristics embodied within final goods and services (i.e. market value versus upstream carbon emissions).

Carbon footprint is an economy-wide measure associated with a single environmental impact (i.e. climate change). It therefore has a relatively well-defined global boundary in terms of how much carbon dioxide can be safely emitted into the atmosphere (Steffen et al., 2015b). As a result, national carbon footprints can be compared to disaggregated shares of a "safe" cumulative global emissions budget (Fanning and O'Neill, 2016; Peters et al., 2015).

Two other important elements of wellbeing are included in the analysis: social capital and autonomy. Social capital is generally conceived as the level of networks, norms, and trust that facilitate mutually beneficial coordination and cooperation (Putnam, 2001). In our study, average levels of national social capital are indicated by a measure of perceived social support, namely the percentage of people responding that they have someone to count on for help in times of need. Autonomy is a widely recognized element determining individuals' capabilities (Sen, 2001). It refers to the capacity to choose some internally conceived values and commitments without external constraint. Here, average perceived autonomy is measured as the percentage of people satisfied with their freedom to make life choices.

GDP is reported in terms of purchasing power parity (PPP) adjusted to constant 2011 international dollars. Population and GDP data were obtained from the World Bank (2018). Consumption-based carbon emissions were obtained from the updated Peters et al. (2011) dataset published in the *Global Carbon Budget 2017* (Le Quéré et al., 2018). Social support and autonomy data were obtained from the *World Happiness Report* (Helliwell et al., 2016).

3.3 Long-Run Trends: Extending the Easterlin Paradox

Following Easterlin et al.'s (2010) method, long-run trends in life satisfaction, life expectancy, GDP per capita, and carbon footprint per capita were calculated by regressing each of the indicators over time. Long-run changes in wellbeing are presented in absolute terms for each indicator (i.e. on the 0–10 Cantril ladder scale for happiness, and in years for life expectancy). Long-run growth rates for GDP per capita and carbon footprint per capita were calculated by regressing the log-transformed values of each indicator over time, and are presented in percentage terms.

Countries were selected using a two-step process. First, only countries with observations spanning at least nine years over the 2005–2015 period were included. This step yielded unbalanced datasets of 119 countries for the GDP per capita analysis (*N* = 1,084), and 100 countries for the carbon footprint per capita analysis (*N* = 919). The correlation between GDP per capita and carbon footprint per capita was extremely high in the panel (Pearson coefficient between 0.90 and 0.95, depending on the year). This observation is similar to comparisons reported elsewhere (e.g. Lamb et al., 2014), and lends support to our view that the two indicators represent alternative proxies for aggregate consumption.

Second, following the standard "outlier rule", countries were not included if their long-run trends were more than 1.5 times the interquartile range observed for any indicator. This second step yielded 117 countries for the happiness–income pair, 99 countries for the happiness–carbon pair, 109 countries for the health–income pair, and 91 countries for the health–carbon pair.

3.4 Model Estimation Techniques

We used four methods to estimate the dynamic relationships between the wellbeing and consumption indicators. We estimated cross-sectional relationships at the beginning and end of the period to investigate changes between the end-points of the analysis period (Section 3.4.1). Long-run changes were analysed using three different model specifications to test for differences in growing and non-growing economies (Section 3.4.2). We characterised the resilience of wellbeing to changes in consumption, and assessed whether this resilience was desirable based on long-run growth rates (Section 3.4.3). Finally, multiple regression panel analysis was conducted to estimate the contributions of consumption, social support, and autonomy to wellbeing, while controlling for unobserved heterogeneity across countries and over time (Section 3.4.4).

3.4.1 Comparison of Cross-Sectional Relationships

We draw upon O'Neill et al.'s (2018) finding that a linear-log model provides the best-fit curve to estimate cross-sectional relationships between carbon footprint and both wellbeing indicators compared to alternative functional forms, namely linear and saturation curves. The linear-log ordinary least squares (OLS) model was specified as follows:

$$WB_i = \alpha + \beta \log(C_i) + \varepsilon_i \qquad (1)$$

where WB_i is the wellbeing indicator (either life satisfaction or life expectancy) of country i, α is the intercept, β is the effect on wellbeing of a one-unit change in that country's log-transformed level of consumption C_i (either GDP per capita or carbon footprint), and ε_i is the country-specific error term.

To test for changes in the cross-sectional relationships at the beginning and end of the 2005–2015 period, we took 3-year average values for each indicator (i.e. from 2005 to 2007, and from 2013 to 2015, respectively). Average values were used to decrease the sensitivity of the estimates to year-specific variation, and also to ensure that the full sample of countries was included for each wellbeing–consumption pair since not every country has an observation for every year in the unbalanced panel. The analysis is similar to previous studies on the changing relations between carbon emissions and objective wellbeing (Steinberger et al., 2012; Steinberger and Roberts, 2010), but represents the first time the method has been applied to subjective wellbeing measures, as far as we are aware.

3.4.2 Long-Run Relationships: Growing versus Non-Growing Economies

Three different functional forms were used to test which model explains the most cross-country variation in the long-run change of each wellbeing–consumption pair. We compared a linear model, a quadratic model, and an interaction model as follows:

$$\Delta WB_i = \alpha_1 + \beta_1 \Delta C_i + \varepsilon_i \quad (2)$$

$$\Delta WB_i = \alpha_2 + \beta_2 \Delta C_i + \beta_3 \Delta C_i^2 + \varepsilon_i \quad (3)$$

$$\Delta WB_i = \alpha_3 + \beta_4 \Delta C_i + \beta_5 NoGrow_i + \beta_6 \Delta C_i * NoGrow_i + \varepsilon_i \quad (4)$$

Equation (2) estimates a continuous linear relationship between the (long-run) change in wellbeing ΔWB_i for country i, and the change in the country's level of consumption ΔC_i, where α_1 is the intercept, β_1 is the predicted change in wellbeing from a 1% change in long-run consumption growth, and ε_i is the country-specific error term.

Equation (3) estimates a continuous non-linear (curvilinear) relationship between the change in wellbeing and consumption of country i. In this case, β_2 is the rate of change in wellbeing when consumption growth is equal to zero, while β_3 gives both the direction and steepness of the curvature.

Equation (4) is an interaction model that estimates an asymmetrical relationship between the change in wellbeing and consumption that depends on whether country i's consumption is growing or not, as indicated by a dummy variable $NoGrow_i$ (equal to 1 if consumption is not growing). Here, β_4 is the predicted change in wellbeing from a 1% change in country i's consumption when it is growing (and α_3 is the intercept). If country i's consumption is not growing, then the predicted effect on wellbeing is given by adding the interaction coefficient $\beta_4 + \beta_6$, and the non-growing intercept is given by adding the dummy coefficient $\alpha_3 + \beta_5$. Given the potential sensitivity of this approach to the threshold between "growing" and "non-growing" consumption, we tested three models (i.e. the threshold was set at zero, a percentage point above zero, and a percentage point below zero).

In total, five models were specified to estimate the relationship between long-run changes in wellbeing and consumption (one linear model, one quadratic model, and three interaction models with the non-growing consumption dummy set to -1%, 0%, and 1%, respectively). The best-fit model for each wellbeing-consumption pair was chosen in two steps. First, the linear model was chosen if none of the larger models explained significantly more variation than the simplest model based on the F-test of an analysis of variance (ANOVA). Second, if any of the larger models were found to explain significantly more variation than the linear model in the first step, we chose the model with the highest adjusted R^2 value.

3.4.3 The Resilience of Wellbeing to Changes in Consumption

The concept of "resilience" offers a way to interpret different relationships between wellbeing and consumption in growing and non-growing economies. Resilience refers to (i) the capacity of a system to self-organize and absorb shocks without shifting to a different state, and (ii) the ability to re-organize and take advantage of new opportunities opened up by disturbances (Folke, 2006). A key insight is that resilience can be "good" if the system is in a desirable state, or "bad" if the system is in an undesirable state (Tanner et al., 2015). For example, macro-algae dominated reefs or urban slums are systems in undesirable states that may be highly resilient, which is to say they withstand attempts to transform them into different, more desirable states (Angeler and Allen, 2016).

We characterised the resilience of wellbeing to changes in consumption in three steps. First, for each country we calculated an annual rate-of-change index (relative to a base year) for each wellbeing and consumption indicator. Second, national wellbeing was characterised as “resilient” if it changed by less than consumption over the same period, or “sensitive” if it changed by more than consumption. Third, the relationship was characterised as “desirable” if wellbeing increased by more than consumption, or if it declined by less than consumption. We characterised the relationship as “undesirable” if wellbeing increased by less than consumption, or if it declined by more than consumption.

3.4.4 Multiple Regression Panel Analysis

Multiple regression panel analysis provides a useful robustness check to test the results of the long-run analysis described in Section 3.4.2. It is also the method employed by studies that tend to find a significant relation between income growth and happiness, allowing our results to be directly compared to those on both sides of the Easterlin paradox debate. Pooled OLS multiple regression analysis was used to estimate the contribution of consumption to national average wellbeing alongside perceived levels of social capital and autonomy. The estimated model is as follows:

$$WB_{it} = \beta x_{it} + u_i + w_t + \varepsilon_{it} \qquad (5)$$

where WB_{it} is the national average wellbeing indicator for country i in year t, β is the vector of coefficients for independent variables that vary over time, x_{it} is the matrix of independent variable values for each country and year, u_i is the country-specific term that controls for unobserved heterogeneity within countries, and w_t is the year-specific term that controls for unobserved heterogeneity over time. Individual country and year fixed effects were included in the preferred model based on their significance compared to alternative models with no such effects (F-test). Robust standard errors controlling for heteroskedasticity and autocorrelation were estimated after testing for their presence in the unbalanced panel dataset.

4 Results

This section presents the findings of each of the four methods described in Section 3.4. We find that for a given level of consumption, life expectancy is increasing over time, but happiness is not (Section 4.1). In fact, life expectancy increases steadily in all countries with no relation to consumption, while happiness shows an asymmetrical relationship that depends on whether consumption is growing or not (Section 4.2). When consumption does not grow, happiness tends to decrease, although it is more sensitive to declines in income than declines in carbon footprint (Section 4.3). The relationship for each wellbeing–consumption pair holds when additional indicators are included (social support and autonomy) using multiple regression panel analysis (Section 4.4).

4.1 Comparison of Cross-Sectional Relationships

The relationship between happiness and consumption is fairly stable over the 2005–2015 time period considered in our analysis (Figure 1a, b), while the relationship between life expectancy and consumption has changed over time to be less consumption-intensive (Figure 1c, d). The results are remarkably similar when consumption is measured in terms of either GDP or carbon footprints.

For a given level of income or carbon footprint, life expectancy is increasing over time but happiness is not. Or seen the other way, a given level of life expectancy is associated with a lower level of income and emissions at the end of the period compared to the beginning, whereas happiness shows no such change. Indeed, the level of happiness associated with a given level of income decreases slightly over the analysis period.

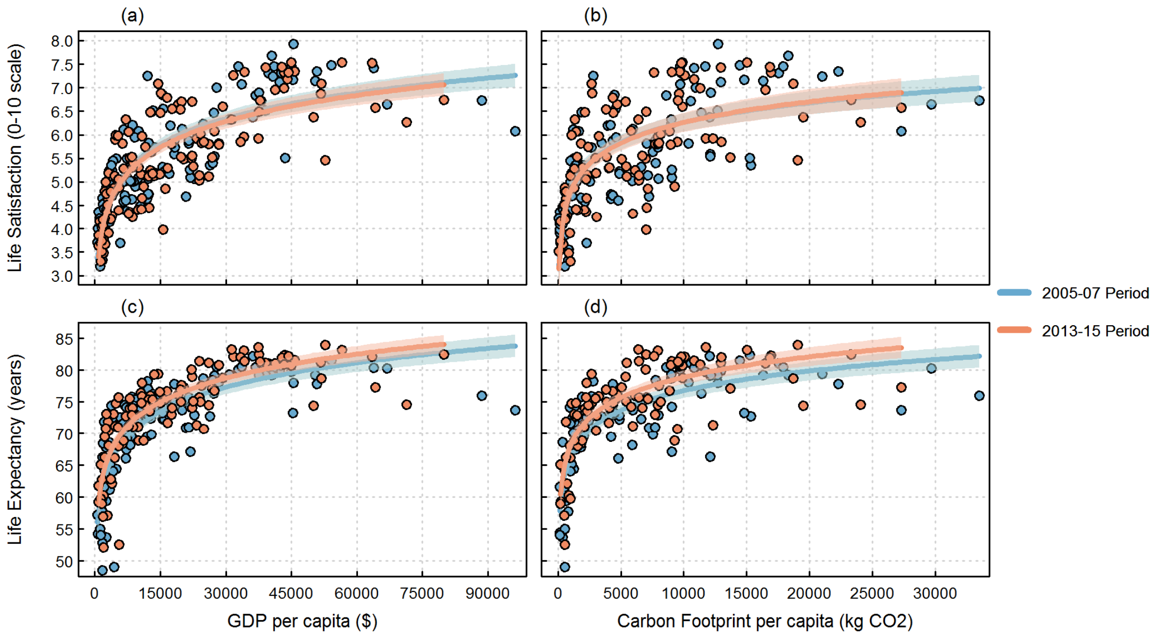

Figure 1. Cross-sectional relationships for (a) life satisfaction and GDP per capita, (b) life satisfaction and carbon footprint per capita, (c) life expectancy and GDP per capita, and (d) life expectancy and carbon footprint per capita, using 3-year averages at the beginning (blue) and end (orange) of the 2005–2015 period. 95% confidence interval bands are shown with a lighter tint around each regression curve. See Table 1 for regression coefficients and Supplementary Data for country-level data.

At the beginning of the period, 75 years of life expectancy and a life satisfaction of 6 out of 10 were both associated with a per capita income of \$20,000 and a carbon footprint of 6.7 tonnes CO_2. By the end of the period, the same 75 years of life expectancy could be achieved with 25% less income and 35% less carbon (i.e. \$15,000 and 4.3 tonnes CO_2, respectively). In contrast, the same life satisfaction of 6 out of 10 at the end of the period was associated with slightly more income and carbon (\$21,500 and 6.8 tonnes CO_2).

Table 1. Cross-Sectional Regression Results for Wellbeing–Consumption Pairs at the Beginning and End of the 2005–2015 period

	Dependent variables:							
	Life Satisfaction (0–10 Cantril Scale)				Life Expectancy (years)			
	2005–07 (1)	2013–15 (2)	2005–07 (3)	2013–15 (4)	2005–07 (5)	2013–15 (6)	2005–07 (7)	2013–15 (8)
Log GDP per capita	0.784*** (0.045)	0.796*** (0.043)			5.554*** (0.416)	5.453*** (0.378)		
Log CO_2 Footprint			0.597*** (0.048)	0.634*** (0.049)			4.465*** (0.427)	4.626*** (0.470)
Constant	-1.742*** (0.395)	-1.919*** (0.390)	0.762* (0.385)	0.423 (0.387)	20.09*** (4.044)	22.53*** (3.722)	35.66*** (3.696)	36.30*** (4.012)
Countries	117	117	99	99	109	109	91	91
Adjusted R^2	0.698	0.660	0.554	0.503	0.688	0.710	0.625	0.614

Notes: OLS regression on 3-year averages of each wellbeing–consumption pair at the beginning (2005–07) and end (2013–15) of the 2005–2015 analysis period. Robust standard errors are shown in parentheses. **p*<0.05; ***p*<0.01; ****p*<0.001.

4.2 Long-Run Relationships: Growing versus Non-Growing Economies

Our analysis of long-run changes in wellbeing and consumption over the 2005–2015 period finds that consuming less is generally associated with a decline in happiness, while consuming more has no discernible effect on happiness (Figure 2a, b). This finding suggests a fundamental difference in the relationship between happiness and consumption in growing versus non-growing economies. In contrast, life expectancy increases steadily in all countries, and appears unaffected by changes in consumption (Figure 2c, d).

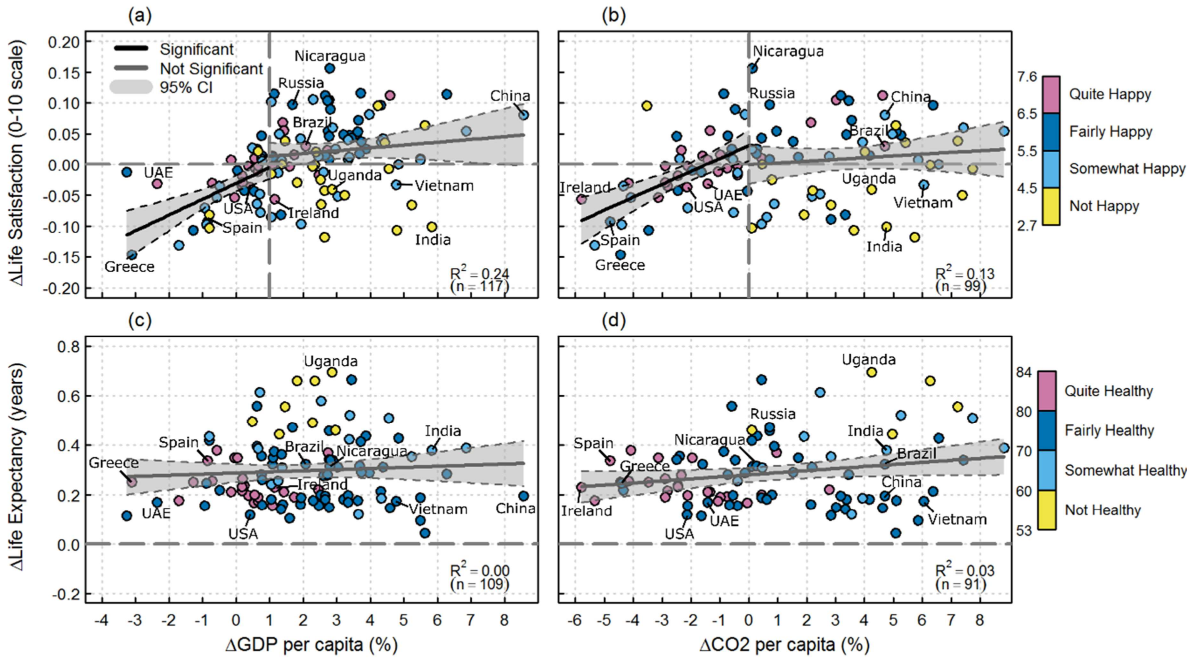

Figure 2. The relationship between long-run annual trends (denoted by Δ) in: (a) life satisfaction and GDP per capita, (b) life satisfaction and carbon footprint per capita, (c) life expectancy and GDP per capita, and (d) life expectancy and carbon footprint per capita, across countries over the 2005–2015 period. Best-fit curves and adjusted-R^2 values are shown on each plot. The best-fit threshold between "growing" and "non-growing" consumption groups is shown by the vertical dashed line in (a) and (b), while the horizontal dashed line shows zero change in the dependent variable. Slopes are significant at $p<0.05$ with 95% confidence interval (CI) bands shown in light grey. See Table 2 for regression coefficients and Supplementary Data for country-level data.

For the happiness–income pair (Figure 2a), we find no evidence that happiness increases across countries with rising income ($N = 80$), but we do find evidence that happiness declines across countries with incomes that do not rise ($N = 37$). These asymmetrical long-run results are consistent with De Neve et al.'s (2017) short-run findings. Out of the five models that we tested, the interaction model that categorises countries with growth rates less than 1% per year as non-growing provides the best-fit model for GDP per capita (see Section 3.4.2 for a description of the linear, quadratic, and interaction models tested).

Each percentage point drop in long-run GDP per capita below 1% per year is associated with a significant decline in happiness of 0.03 points per year. In other words, we find that a decline in income of 5% per year would be associated with a 1-point decline in happiness after only 8 years, based on current relationships. In contrast, the happiness–income relation across countries in the growing group is not statistically significant, and even if it were, the estimated effect is less than one fifth the size of the relation in non-growing countries.

Table 2. Long-Run Regression Results for Wellbeing-Consumption Pairs (2005-2015)

	Dependent variables:			
	ΔLife Satisfaction (0-10 scale)		ΔLife Expectancy (years)	
Independent variable	(1)	(2)	(3)	(4)
ΔGDP per capita	0.005 (0.004)		0.005 (0.006)	
ΔCO_2 Footprint per capita		0.003 (0.003)		0.008 (0.004)
$NoGrow_{Dummy}$	-0.040* (0.016)	0.031 (0.021)		
ΔGDP per capita x $NoGrow_{Dummy}$	0.021* (0.011)			
ΔCO_2 Footprint per capita x $NoGrow_{Dummy}$		0.018** (0.006)		
Constant	0.287*** (0.016)	0.280*** (0.013)	0.009 (0.015)	-0.0002 (0.016)
Countries	117	99	109	91
Adjusted R^2	0.25	0.13	0.00	0.03

Notes: Best-fit OLS models for explaining long-run trends in each wellbeing-consumption pair (robust standard errors). *p<0.05; **p<0.01; ***p<0.001.

For the happiness–carbon pair (Figure 2b), the relationships are similar to the happiness–income findings (Figure 2a). That is, we find an asymmetrical relationship in which happiness is not related to carbon footprint when the latter is growing (N = 56), but happiness is related to carbon footprint when the latter is not growing (N = 43). The interaction model that categorises countries with long-run growth rates less than 0% per year as non-growing provides the best-fit model for carbon footprint.

In contrast to the happiness–income results, where non-growing income is always associated with a decline in happiness, a mild decline in carbon footprint (i.e. between -2% and 0% per year) is not significantly associated with a decline in happiness. However, we find that a larger decline in carbon footprint per capita of 5% per year would be associated with a 1-point decline in happiness after 10 years, based on current relationships. This finding is troubling from a climate change perspective because a global mitigation rate of 5% per year would take around 80 years to decarbonise the economy (Le Quéré et al., 2018). For the group of countries with growing carbon footprints, the estimated happiness–carbon relationship is one seventh the size of the non-growing relationship, and not statistically significant.

The long-run health–income (Figure 2c) and health–carbon (Figure 2d) relationships across countries are also very similar to one another. Essentially, the number of years an infant can expect to live is increasing in all countries (the average increase is an additional 3.6 months per year), and the increase bears no relation to whether income or carbon footprint is growing or not. None of the alternative models that we tested provide a better fit than the linear model for the long-run health–income and health–carbon relationships. These findings are more promising than the happiness results because they suggest the universal trend towards longer, healthier lives may be compatible with ambitious mitigation policy.

4.3 The Resilience of Wellbeing to Changes in Consumption

The results presented so far have focused on the general relationships between wellbeing and consumption in growing versus non-growing economies. However, there is also considerable variability in how these indicators have changed over time in individual countries (with the exception of life expectancy which increases steadily in all countries). Here, we illustrate possible pathways countries may follow by characterising the resilience or sensitivity of wellbeing to changes in consumption in four nations (Figure 3).

In Spain (Figure 3a), life satisfaction declined by more than GDP did in percentage terms—a case of *undesirable sensitivity* of happiness to declining income levels. It would clearly be preferable for life satisfaction to decline by less than GDP, a situation exemplified by Ireland (Figure 3b), which we label as *desirable resilience*. By contrast, life satisfaction increased by much less than income and carbon footprint in Vietnam (Figure 3c), a case of the *undesirable resilience* of happiness to increasing consumption levels. If consumption increases, then the hope would be for life satisfaction to increase by at least as much, a situation observed in Nicaragua (Figure 3d), which we characterize as *desirable sensitivity*.

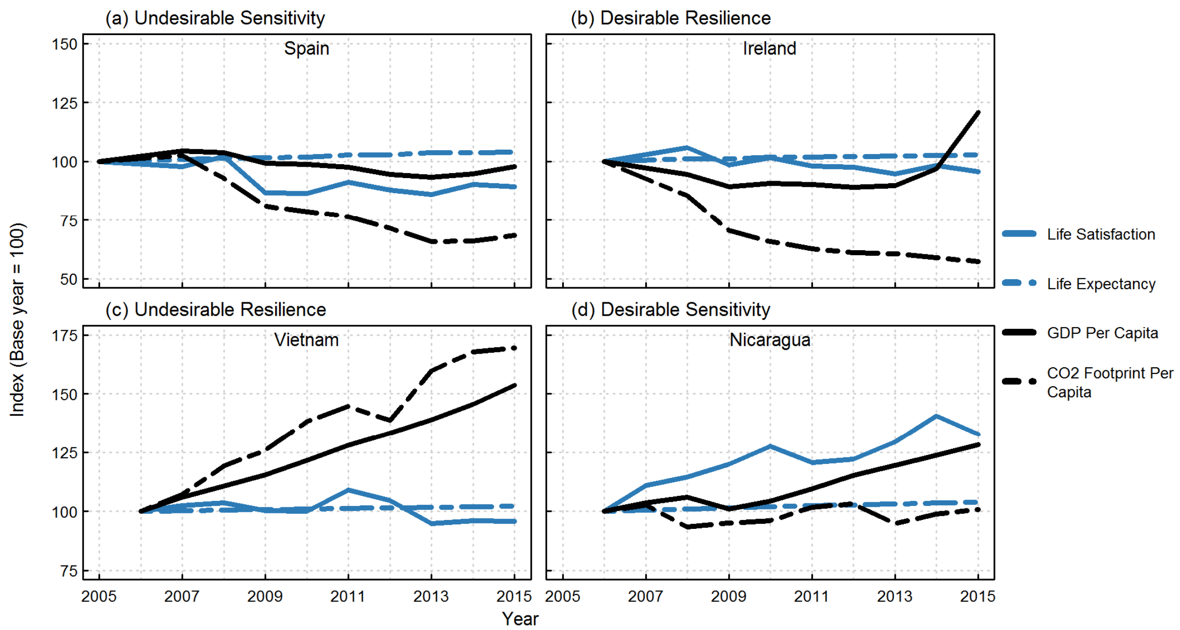

Figure 3. Country plots of annual rate-of-change indices over time (relative to a base year), illustrating four wellbeing–consumption pathways. The top two panels show countries where GDP is largely declining, while the bottom two panels show countries where it is increasing. In Panel (a) for Spain, life satisfaction declines by more than GDP, a case of "undesirable sensitivity". In Panel (b) for Ireland, life satisfaction declines by less than GDP, a case of "desirable resilience". In Panel (c) for Vietnam, life satisfaction increases by less than GDP, a case of "undesirable resilience". In Panel (d) for Nicaragua, life satisfaction increases by more than GDP, a case of "desirable sensitivity". Life expectancy increases steadily in all cases. See https://goodlife.leeds.ac.uk/paradox for an interactive website that produces plots for all countries.

In the majority of the 100 countries that we analysed, happiness is either undesirably sensitive to decreases in income (*N* = 29) or undesirably resilient to increases in income (*N* = 60). Only 6 countries are desirably sensitive to income growth, while 5 countries are desirably resilient to income contractions. At the same time, happiness in most countries is generally resilient to changes in carbon footprint: it is desirably resilient when carbon footprint declines (*N* = 35), and undesirably resilient when it increases (*N* = 51). This latter finding is particularly worrying because it suggests that emissions growth brings very little (if any) return in terms of wellbeing, but it does have an unambiguous cost in terms of climate stability.

4.4 Multiple Regression Panel Analysis

The results presented so far suggest that whether changes in consumption are relevant to explaining changes in wellbeing across countries depends on whether consumption is growing or not, and diverse pathways are possible notwithstanding the general trends. Clearly, consumption is only one potential factor that determines overall wellbeing. Table 3 therefore presents multivariate panel regression results for each wellbeing indicator. The panel includes consumption indicators (using GDP and carbon footprint as alternative proxies) alongside two other well-known determinants of wellbeing: social capital and personal autonomy.

The panel analysis (Table 3) reaffirms the earlier findings. It suggests that per capita GDP and carbon footprint are important predictors of life satisfaction in non-growing economies, but not in growing economies, even after controlling for additional explanatory variables and unobserved heterogeneity across countries and over time. Neither consumption indicator is an important predictor of life expectancy.

Table 3. Multiple Regressions to Explain National Wellbeing

	Dependent variables:					
	Life Satisfaction (0-10 scale)				Life expectancy (years)	
Independent variable	ΔGDP ≤ 1% (1)	ΔGDP > 1% (2)	ΔCO2 ≤ 0% (3)	ΔCO2 > 0% (4)	Full Sample (5)	(6)
Log GDP Per Capita	1.483* (0.732)	0.452 (0.366)			0.169 (0.511)	
Log CO2 Footprint Per Capita			1.146*** (0.254)	0.389 (0.231)		0.437 (0.314)
Social Support	0.013 (0.007)	0.016*** (0.004)	0.017* (0.007)	0.016** (0.005)	0.012* (0.006)	0.009 (0.007)
Autonomy	0.013** (0.004)	0.007* (0.003)	0.012** (0.004)	0.009* (0.004)	-0.001 (0.004)	-0.001 (0.004)
Countries	36	73	41	50	109	91
Observations	302	670	361	455	972	816
Adjusted R^2	0.941	0.898	0.918	0.872	0.996	0.996

Notes: Pooled OLS models for unbalanced panels with country and year fixed effects included. ΔGDP denotes long-run change in annual GDP per capita. ΔCO2 denotes long-run change in annual carbon footprint per capita. Only countries with observations spanning at least 9 years over the 2005–2015 period are included. Robust standard errors of the coefficients are reported in parentheses. $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$.

The sizes of the wellbeing–consumption effects in the multivariate panel analysis are only marginally smaller than the results using Easterlin's bivariate long-run method, which suggests that omitted variables and/or unobserved heterogeneity play a minor, albeit significant, role. The panel results estimate that a 1 point decline in happiness would take 17 years (13 years) with a 5% per year decline in carbon footprint per capita (GDP per capita), compared to 10 years (8 years) with Easterlin's method. For growing economies, the happiness–income and happiness–carbon panel coefficients are not statistically significant, and even if they were, their magnitude suggests a 1 point increase in happiness would take ~50 years to achieve with income or carbon footprint growth of 5% per year.

Autonomy and social support are both statistically significant across four of the six models, which suggests they are important features of wellbeing irrespective of whether consumption is increasing or decreasing. Social support has the most consistent effect on wellbeing across all models, and it is also generally the largest single predictor of national average happiness and health. Although autonomy contributes significantly to happiness, our results suggest its effect on health is negligible. Indeed, we find that the steady increase in life expectancy observed across countries is not explained at all by changes in consumption or autonomy after taking into account country- and year-specific fixed effects.

5 Discussion

When countries are compared at a point in time, wellbeing and consumption appear to be linked, but only up to a point after which more consumption contributes little to wellbeing (Figure 1). It has been suggested that wealthy countries that have crossed this turning point could reduce resource use considerably with little effect on wellbeing, thereby freeing up ecological space for poorer countries to increase consumption to meet basic needs (Kerschner, 2010; Raworth, 2017). If life expectancy is used to measure wellbeing, then our results support this view because people are living longer irrespective of whether consumption declines or increases. However, if happiness is used to measure wellbeing, then our results do not support this view, as a decline in consumption is associated with a decline in happiness.

Most of the countries with increasing income and carbon footprint are nations with relatively low levels of wellbeing that arguably have the most to gain from increasing consumption, but we see no such effect on either wellbeing indicator. These findings suggest Easterlin's happiness–income paradox can be seen as a specific case of a general "wellbeing–consumption paradox" where consumption and wellbeing are correlated at a point in time, but increasing consumption does not significantly increase wellbeing (although decreasing consumption may still reduce it, as with happiness).

The pursuit of economic growth appears to be a dangerously inefficient strategy to increase wellbeing in a climate-constrained world. We find that there is no statistically significant relationship between income growth and happiness, and even if there were, the size of the effect suggests that a 1 point increase in happiness would require ~50 years of income growth at 5% per year. This 12-fold increase in economic activity would take place over a period when global carbon emissions already need to decline by ~10% per year for a likely chance to meet the 2 °C target without negative emissions technologies (Anderson, 2015). In other words, to keep warming below 2 °C and increase world average happiness by a single point over the next 50 years would require carbon emissions to be decoupled from global economic activity at an implausibly high rate of ~15% per year.

While life satisfaction and life expectancy tend to follow a parallel trajectory in growing economies, the same is not true for non-growing economies. Non-growing consumption is associated with significant declines in happiness, but not with declines in life expectancy. These diverging findings highlight the complementary nature of objective and subjective measures of wellbeing. Together, the two indicators suggest that the 2005–2015 period was a difficult time for many people (as indicated by declines in happiness), but it was not so difficult that the provision of basic needs broke down (as indicated by the lack of effect on life expectancy).

The finding that a decrease in carbon footprint is associated with a decline in happiness represents a major challenge to the achievement of the 2 °C climate target. A mitigation rate of ~6% per year would be needed to reduce the average carbon footprint of countries in our non-growing group from 10 t CO_2 per capita in 2015 down to 1.6 t by 2050, a level proposed to be broadly consistent with the 2 °C target (O'Neill et al., 2018). However, happiness in these predominantly wealthy countries would decline by 2.5 out of 10 points over the same period, based on current relationships (and assuming that countries did not adapt to sustained declines in emissions to some degree).

For the majority of countries with non-growing consumption, happiness fell by more than income over the past decade, but less than carbon footprint (in percentage terms). This finding generally supports the green growth view of emissions mitigation, which argues that the way to achieve climate objectives without sacrificing current well-being is to avoid contractions in GDP (New Climate Economy, 2014). That said, current mitigation rates are too slow to meet climate targets and an unplanned economic contraction (as observed in many countries over the past decade) could have a rather different effect on happiness than a voluntary transition to a non-growing economy.

In this sense, our findings could be interpreted by advocates of "degrowth" as evidence that societies must "decolonize their imagination" from growth to achieve the required decreases in carbon emissions without undue hardship (D'Alisa et al., 2014). Degrowth and postgrowth scholars seek to liberate public debate from unquestioned reliance on economic growth to imagine radical alternatives that equitably downscale consumption to sustainable levels, while maintaining or enhancing human wellbeing (Büchs and Koch, 2017; Schneider et al., 2010). In a recent review of the degrowth literature, Kallis et al. (2018) find that economic contractions need not lead to declines in happiness if accompanied by redistribution and a shared sense of prosperity that values community and the environment.

Our results also contribute to growing interest in "demand-side" climate solutions that target strategies to change consumption behaviour and understand their wellbeing implications alongside the mainstream focus on supply-side technical solutions (Creutzig et al., 2018). The upcoming sixth assessment report of the Intergovernmental Panel on Climate Change (IPCC) will feature a chapter on demand that asks how demand-side mitigation measures impact on human wellbeing, among other questions (Ibid.). Our findings provide a baseline that suggests people in countries with mitigation rates relatively close to the rates required to meet climate targets can expect to live longer, but less happy lives, on average.

Overall, the asymmetrical results on happiness in growing versus non-growing economies are consistent with previous research at national and individual levels, with the added concern that these happiness–income relations also apply to carbon footprint. The concept of loss aversion is the most common explanation for why growth does not make people happier, while a lack of it makes them unhappier (De Neve et al., 2017). Unfulfilled expectations appear to play a central role via the associated frustration and futility (anticipated or experienced) that arise when plans go worse than expected.

Interestingly, Boyce et al. (2016) find that highly conscientious, goal-oriented people experience large losses in happiness when their incomes decline, while people low in conscientiousness experience no significant reduction in happiness. Thus, our finding that non-growing consumption is accompanied by declines in happiness could be driven by a subset of people high in conscientiousness who experience very large losses. In short, it seems that the less people aspire towards high levels of consumption, the smaller the loss in their wellbeing when material aspirations are not fulfilled (Matthey, 2010). There is evidence that major life events can result in changes to individual personality (Boyce et al., 2015), which provides one possible avenue for future research to better understand how to steer aspirations towards low-carbon lifestyles during economic downturns.

Finally, our empirical analysis of the relationships between wellbeing and consumption in growing versus non-growing economies has some important limitations. Although we argue that the 2005–2015 period provides a natural experiment to explore wellbeing implications of fairly deep emissions cuts in the absence of ambitious mitigation policy, we also recognize that a single decade is barely sufficient to assess long-run trends. As more time-series data become available, further research will be able to re-assess our findings. Additionally, current relationships may not be a good guide for the future if ambitious action is successful in eliminating the fossil fuel dependence of modern economies in the coming decades. Still, it is useful to have an idea of where we currently stand even if the goal is to end up elsewhere. Last but not least, our analysis provides an indication of the relationships between changes in consumption and wellbeing across countries, but it provides little guidance on how to manage the social and technical processes that drive these relationships towards climate-friendly outcomes. Additional research is needed to better understand cross-country differences in the social and technical provisioning systems that mediate the relationships between resource use, consumption, the achievement of basic needs, and ultimately, human wellbeing.

6 Conclusions

This study examined the relationships between wellbeing and consumption in countries with growing versus non-growing economies over the 2005–2015 period. By integrating insights from happiness economics and sustainability science, our analysis makes three contributions.

First, we have expanded Easterlin's happiness–income work by including two additional indicators, namely life expectancy and carbon footprint per capita. Our approach views life satisfaction and life expectancy as complementary measures of wellbeing, whereas GDP and carbon footprint are seen as alternative measures of consumption. We find that the happiness–income paradox can be seen as a specific case of a generalised "wellbeing–consumption paradox". Each wellbeing–consumption pair is strongly correlated at a point in time, but wellbeing does not increase with either GDP per capita or carbon footprint per capita in the long-run.

Second, the wellbeing–carbon relationships are remarkably similar to the wellbeing–income relationships, which demonstrates the continued fossil fuel dependence of consumption. Of particular concern from a climate change perspective, we show for the first time that there is currently an asymmetrical relationship between happiness and carbon footprint that depends on whether emissions are growing or not. For the group of countries with declining carbon footprint, happiness tends to decline as well. In contrast, for the group of countries with growing carbon footprint, the relationship is nil. More optimistically, life expectancy increases in all countries, and bears no relation to consumption whatsoever. These results are robust to the inclusion of additional explanatory variables (social support and autonomy) and after controlling for unobserved heterogeneity across countries and over time.

Finally, in recognition of the variability across countries for each wellbeing–consumption pair, we characterised four illustrative pathways that countries have followed. The criteria were based on (i) the resilience or sensitivity of wellbeing to changes in consumption, and (ii) the desirability of that resilience or sensitivity based on growing and non-growing consumption trends. The vast majority of countries have happiness levels that increase by less (or even decrease) in percentage terms compared to consumption growth (i.e. undesirable resilience). In most countries with non-growing income, happiness decreased by more than the associated drop in income (i.e. undesirable sensitivity). In contrast, happiness declined by less than carbon footprint in most of the countries with non-growing per capita carbon footprints (i.e. desirable resilience).

Overall, our findings suggest that in order to achieve climate targets without sacrificing current well-being, non-growing GDP per capita should be avoided — at least based on current relationships. However, observed decoupling trends are insufficient to meet climate targets. If the 2-degree target is to be met, then either decoupling must be vastly improved, or happiness must be made more resilient to a decline in income.

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References

Abdallah, S., Michaelson, J., Shah, S., Stoll, L., Marks, N., 2012. The Happy Planet Index: 2012 Report. A Global Index of Sustainable Well-Being. nef, London.

Ambrey, C.L., Daniels, P., 2017. Happiness and footprints: assessing the relationship between individual well-being and carbon footprints. Environ Dev Sustain 19, 895–920. https://doi.org/10.1007/s10668-016-9771-1

Anderson, K., 2015. Duality in climate science [WWW Document]. Nature Geoscience. https://doi.org/10.1038/ngeo2559

Andersson, D., Nässén, J., Larsson, J., Holmberg, J., 2014. Greenhouse gas emissions and subjective well-being: An analysis of Swedish households. Ecological Economics 102, 75–82. https://doi.org/10.1016/j.ecolecon.2014.03.018

Antal, M., van den Bergh, J.C., 2016. Green growth and climate change: conceptual and empirical considerations. Climate Policy 16, 165–177. https://doi.org/10.1080/14693062.2014.992003

Bartels, M., 2015. Genetics of Wellbeing and Its Components Satisfaction with Life, Happiness, and Quality of Life: A Review and Meta-analysis of Heritability Studies. Behav Genet 45, 137–156. https://doi.org/10.1007/s10519-015-9713-y

Bassetti, T., Benos, N., Karagiannis, S., 2013. CO2 Emissions and Income Dynamics: What Does the Global Evidence Tell Us? Environ Resource Econ 54, 101–125. https://doi.org/10.1007/s10640-012-9583-1

Beja Jr., E.L., 2014. Income growth and happiness: reassessment of the Easterlin Paradox. Int Rev Econ 61, 329–346. https://doi.org/10.1007/s12232-014-0211-y

Boyce, C.J., Wood, A.M., Banks, J., Clark, A.E., Brown, G.D.A., 2013. Money, Well-Being, and Loss Aversion: Does an Income Loss Have a Greater Effect on Well-Being Than an Equivalent Income Gain? Psychological Science. https://doi.org/10.1177/0956797613496436

Boyce, C.J., Wood, A.M., Daly, M., Sedikides, C., 2015. Personality change following unemployment. J Appl Psychol 100, 991–1011. https://doi.org/10.1037/a0038647

Boyce, C.J., Wood, A.M., Ferguson, E., 2016. Individual Differences in Loss Aversion: Conscientiousness Predicts How Life Satisfaction Responds to Losses Versus Gains in Income. Personality and Social Psychology Bulletin. https://doi.org/10.1177/0146167216634060

Brand-Correa, L.I., Martin-Ortega, J., Steinberger, J.K., 2018. Human Scale Energy Services: Untangling a ‘golden thread.’ Energy Research & Social Science 38, 178–187.

Büchs, M., Koch, M., 2017. Postgrowth and Wellbeing: Challenges to Sustainable Welfare. Palgrave MacMillan, Basingstoke.

Clark, A.E., Frijters, P., Shields, M.A., 2008. Relative Income, Happiness, and Utility: An Explanation for the Easterlin Paradox and Other Puzzles. Journal of Economic Literature 46, 95–144.

Costanza, R., Fisher, B., Ali, S., Beer, C., Bond, L., Boumans, R., Danigelis, N.L., Dickinson, J., Elliott, C., Farley, J., Gayer, D.E., Glenn, L.M., Hudspeth, T., Mahoney, D., McCahill, L., McIntosh, B., Reed, B., Rizvi, S.A.T., Rizzo, D.M., Simpatico, T., Snapp, R., 2007. Quality of life: An approach integrating opportunities, human needs, and subjective well-being. Ecological Economics 61, 267–276. https://doi.org/10.1016/j.ecolecon.2006.02.023

Creutzig, F., Roy, J., Lamb, W.F., Azevedo, I.M.L., Bruin, W.B. de, Dalkmann, H., Edelenbosch, O.Y., Geels, F.W., Grubler, A., Hepburn, C., Hertwich, E.G., Khosla, R., Mattauch, L., Minx, J.C., Ramakrishnan, A., Rao, N.D., Steinberger, J.K., Tavoni, M., Ürge-Vorsatz, D., Weber, E.U.,

2018. Towards demand-side solutions for mitigating climate change. Nature Climate Change 8, 260–263. https://doi.org/10.1038/s41558-018-0121-1
D'Alisa, G., Demaria, F., Kallis, G., 2014. Degrowth: A Vocabulary for a New Era. Routledge.
De Neve, J.-E., Ward, G., De Keulenaer, F., Van Landeghem, B., Kavetsos, G., Norton, M.I., 2017. The Asymmetric Experience of Positive and Negative Economic Growth: Global Evidence Using Subjective Well-Being Data. The Review of Economics and Statistics 100, 362–375. https://doi.org/10.1162/REST_a_00697
Di Tella, R., Haisken-De New, J., MacCulloch, R., 2010. Happiness adaptation to income and to status in an individual panel. Journal of Economic Behavior & Organization 76, 834–852. https://doi.org/10.1016/j.jebo.2010.09.016
Diener, E., Oishi, S., Tay, L., 2018. Advances in subjective well-being research. Nature Human Behaviour 2, 253–260. https://doi.org/10.1038/s41562-018-0307-6
Diener, E., Tay, L., Oishi, S., 2013. Rising income and the subjective well-being of nations. Journal of Personality and Social Psychology 104, 267–276. https://doi.org/10.1037/a0030487
Doyal, L., Gough, I., 1991. A Theory of Human Need. Palgrave, Basingstoke, Hampshire.
Easterlin, R.A., 2009. Lost in transition: Life satisfaction on the road to capitalism. Journal of Economic Behavior & Organization 71, 130–145. https://doi.org/10.1016/j.jebo.2009.04.003
Easterlin, R.A., 1974. Does Economic Growth Improve the Human Lot? Some Empirical Evidence, in: David, P.A., Reder, M.W. (Eds.), Nations and Households in Economic Growth. Academic Press, pp. 89–125. https://doi.org/10.1016/B978-0-12-205050-3.50008-7
Easterlin, R.A., McVey, L.A., Switek, M., Sawangfa, O., Zweig, J.S., 2010. The happiness—income paradox revisited. Proceedings of the National Academy of Sciences of the United States of America 107, 22463–22468.
Fanning, A.L., O'Neill, D.W., 2016. Tracking resource use relative to planetary boundaries in a steady-state framework: A case study of Canada and Spain. Ecological Indicators 69, 836–849. https://doi.org/10.1016/j.ecolind.2016.04.034
Ferreira, S., Akay, A., Brereton, F., Cuñado, J., Martinsson, P., Moro, M., Ningal, T.F., 2013. Life satisfaction and air quality in Europe. Ecological Economics, Transaction Costs and Environmental Policy 88, 1–10. https://doi.org/10.1016/j.ecolecon.2012.12.027
Helliwell, J., Huang, H., Wang, S., 2016. The Distribution of World Happiness, in: Helliwell, J., Layard, R., Sachs, J. (Eds.), World Happiness Report 2016, Update (Vol. 1). Sustainable Development Solutions Network, New York, pp. 8–49.
Hoekstra, A.Y., Wiedmann, T.O., 2014. Humanity's unsustainable environmental footprint. Science 344, 1114–1117. https://doi.org/10.1126/science.1248365
IMF, 2009. World Economic Outlook (WEO): Crisis and Recovery. International Monetary Fund, Washington D.C.
Jorgenson, A.K., 2014. Economic development and the carbon intensity of human well-being. Nature Climate Change 4, 186–189. https://doi.org/10.1038/nclimate2110
Jorgenson, A.K., Dietz, T., Kelly, O., 2017. Inequality, poverty, and the carbon intensity of human well-being in the United States: a sex-specific analysis. Sustain Sci 1–8. https://doi.org/10.1007/s11625-017-0517-2
Kahneman, D., Tversky, A., 1979. Prospect Theory: An Analysis of Decision under Risk. Econometrica 47, 263–291. https://doi.org/10.2307/1914185
Kallis, G., Kostakis, V., Lange, S., Muraca, B., Paulson, S., Schmelzer, M., 2018. Research on Degrowth. Annu. Rev. Environ. Resour. https://doi.org/10.1146/annurev-environ-102017-025941
Kerschner, C., 2010. Economic de-growth vs. steady-state economy. Journal of Cleaner Production, Growth, Recession or Degrowth for Sustainability and Equity? 18, 544–551. https://doi.org/10.1016/j.jclepro.2009.10.019
Knight, K.W., Rosa, E.A., 2011. The environmental efficiency of well-being: A cross-national analysis. Social Science Research 40, 931–949. https://doi.org/10.1016/j.ssresearch.2010.11.002

Knight, K.W., Schor, J.B., 2014. Economic Growth and Climate Change: A Cross-National Analysis of Territorial and Consumption-Based Carbon Emissions in High-Income Countries. Sustainability 6, 3722–3731. https://doi.org/10.3390/su6063722

Lamb, W.F., Rao, N.D., 2015. Human development in a climate-constrained world: What the past says about the future. Global Environmental Change 33, 14–22. https://doi.org/10.1016/j.gloenvcha.2015.03.010

Lamb, W.F., Steinberger, J.K., Bows-Larkin, A., Peters, G.P., Roberts, J.T., Wood, F.R., 2014. Transitions in pathways of human development and carbon emissions. Environmental Research Letters 9, 1–10.

Layard, R., Mayraz, G., Nickell, S., 2010. Does Relative Income Matter? Are the Critics Right?, in: Diener, E., Helliwell, J., Kahneman, D. (Eds.), International Differences in Well-Being. Oxford University Press.

Le Quéré, C., Andrew, R.M., Friedlingstein, P., Sitch, S., Pongratz, J., Manning, A.C., Korsbakken, J.I., Peters, G.P., Canadell, J.G., Jackson, R.B., Boden, T.A., Tans, P.P., Andrews, O.D., Arora, V.K., Bakker, D.C.E., Barbero, L., Becker, M., Betts, R.A., Bopp, L., Chevallier, F., Chini, L.P., Ciais, P., Cosca, C.E., Cross, J., Currie, K., Gasser, T., Harris, I., Hauck, J., Haverd, V., Houghton, R.A., Hunt, C.W., Hurtt, G., Ilyina, T., Jain, A.K., Kato, E., Kautz, M., Keeling, R.F., Klein Goldewijk, K., Körtzinger, A., Landschützer, P., Lefèvre, N., Lenton, A., Lienert, S., Lima, I., Lombardozzi, D., Metzl, N., Millero, F., Monteiro, P.M.S., Munro, D.R., Nabel, J.E.M.S., Nakaoka, S., Nojiri, Y., Padin, X.A., Peregon, A., Pfeil, B., Pierrot, D., Poulter, B., Rehder, G., Reimer, J., Rödenbeck, C., Schwinger, J., Séférian, R., Skjelvan, I., Stocker, B.D., Tian, H., Tilbrook, B., Tubiello, F.N., Laan-Luijkx, I.T. van der, Werf, G.R. van der, Heuven, S. van, Viovy, N., Vuichard, N., Walker, A.P., Watson, A.J., Wiltshire, A.J., Zaehle, S., Zhu, D., 2018. Global Carbon Budget 2017. Earth System Science Data 10, 405–448. https://doi.org/https://doi.org/10.5194/essd-10-405-2018

Lenzen, M., Cummins, R.A., 2013. Happiness versus the Environment—A Case Study of Australian Lifestyles. Challenges 4, 56–74. https://doi.org/10.3390/challe4010056

Luhmann, M., Hofmann, W., Eid, M., Lucas, R.E., 2012. Subjective well-being and adaptation to life events: A meta-analysis. Journal of Personality and Social Psychology 102, 592–615. https://doi.org/10.1037/a0025948

MacKerron, G., Mourato, S., 2013. Happiness is greater in natural environments. Global Environmental Change 23, 992–1000. https://doi.org/10.1016/j.gloenvcha.2013.03.010

Maddison, D., Rehdanz, K., 2011. The impact of climate on life satisfaction. Ecological Economics 70, 2437–2445. https://doi.org/10.1016/j.ecolecon.2011.07.027

Matthey, A., 2010. Less is more: the influence of aspirations and priming on well-being. Journal of Cleaner Production, Growth, Recession or Degrowth for Sustainability and Equity? 18, 567–570. https://doi.org/10.1016/j.jclepro.2009.03.024

Max-Neef, M.A., 1991. Human Scale Development: Conception, Application and Further Reflections. Zed Books Ltd, New York.

Mazur, A., Rosa, E., 1974. Energy and Life-Style. Science 186, 607–610.

Mill, J.S., 1863. Utilitarianism, 1st ed. Parker, Son and Bourn.

New Climate Economy, 2014. Better Growth, Better Climate: The New Climate Economy Report. Global Commission on the Economy and Climate, Washington, DC.

Nordhaus, W.D., 2017. Revisiting the social cost of carbon. PNAS 114, 1518–1523. https://doi.org/10.1073/pnas.1609244114

Nussbaum, M., 2003. Capabilities as Fundamental Entitlements: Sen and Social Justice. Feminist Economics 9, 33–59. https://doi.org/10.1080/1354570022000077926

Oishi, S., Schimmack, U., Diener, E., 2011. Progressive Taxation and the Subjective Well-Being of Nations: Psychological Science. https://doi.org/10.1177/0956797611420882

O'Neill, D.W., Fanning, A.L., Lamb, W.F., Steinberger, J.K., 2018. A good life for all within planetary boundaries. Nature Sustainability 1, 88–95. https://doi.org/10.1038/s41893-018-0021-4

O'Neill, J., 2008. Happiness and the Good Life [WWW Document]. https://doi.org/info:doi/10.3197/096327108X303819
Peters, G.P., Andrew, R.M., Solomon, S., Friedlingstein, P., 2015. Measuring a fair and ambitious climate agreement using cumulative emissions. Environ. Res. Lett. 10, 105004. https://doi.org/10.1088/1748-9326/10/10/105004
Peters, G.P., Minx, J.C., Weber, C.L., Edenhofer, O., 2011. Growth in emission transfers via international trade from 1990 to 2008. Proceedings of the National Academy of Sciences of the United States of America 108, 8903–8908.
Preston, S.H., 2007. The changing relation between mortality and level of economic development. Int J Epidemiol 36, 484–490. https://doi.org/10.1093/ije/dym075
Putnam, R.D., 2001. Bowling Alone. Simon and Schuster.
Raworth, K., 2017. Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist. Random House Business, London.
Rogelj, J., den Elzen, M., Höhne, M., Franzen, T., Fekete, H., Winkler, H., Schaeffer, R., Sha, F., Riahi, K., Meinshausen, M., 2016. Paris Agreement climate proposals need a boost to keep warming well below 2°C. Nature 534, 631–639. https://doi.org/10.1038/nature18307
Ryan, R.M., Deci, E.L., 2000. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist 55, 68–78. https://doi.org/10.1037//0003-066X.55.1.68
Ryff, C.D., Keyes, C.L., 1995. The structure of psychological well-being revisited. J Pers Soc Psychol 69, 719–727.
Ryff, C.D., Singer, B.H., 2008. Know Thyself and Become What You Are: A Eudaimonic Approach to Psychological Well-Being. Journal of Happiness Studies; Dordrecht 9, 13–39. https://doi.org/http://0-dx.doi.org.wam.leeds.ac.uk/10.1007/s10902-006-9019-0
Schneider, F., Kallis, G., Martinez-Alier, J., 2010. Crisis or opportunity? Economic degrowth for social equity and ecological sustainability. Introduction to this special issue. Journal of Cleaner Production, Growth, Recession or Degrowth for Sustainability and Equity? 18, 511–518. https://doi.org/10.1016/j.jclepro.2010.01.014
Sekulova, F., van den Bergh, J.C.J.M., 2016. Floods and happiness: Empirical evidence from Bulgaria. Ecological Economics 126, 51–57. https://doi.org/10.1016/j.ecolecon.2016.02.014
Sekulova, F., van den Bergh, J.C.J.M., 2013. Climate change, income and happiness: An empirical study for Barcelona. Global Environmental Change 23, 1467–1475. https://doi.org/10.1016/j.gloenvcha.2013.07.025
Sen, A., 2001. Development as Freedom. OUP Oxford.
Sen, A., 1985. Well-Being, Agency and Freedom: The Dewey Lectures 1984. The Journal of Philosophy 82, 169–221. https://doi.org/10.2307/2026184
Steffen, W., Broadgate, W., Deutsch, L., Gaffney, O., Ludwig, C., 2015a. The trajectory of the Anthropocene: The Great Acceleration. The Anthropocene Review 2, 81–98. https://doi.org/10.1177/2053019614564785
Steffen, W., Richardson, K., Rockström, J., Cornell, S.E., Fetzer, I., Bennett, E.M., Biggs, R., Carpenter, S.R., Vries, W. de, Wit, C.A. de, Folke, C., Gerten, D., Heinke, J., Mace, G.M., Persson, L.M., Ramanathan, V., Reyers, B., Sörlin, S., 2015b. Planetary boundaries: Guiding human development on a changing planet. Science 347, 1259855. https://doi.org/10.1126/science.1259855
Steinberger, J.K., Roberts, J.T., 2010. From constraint to sufficiency: The decoupling of energy and carbon from human needs, 1975–2005. Ecological Economics, Special Section: Ecological Distribution Conflicts 70, 425–433. https://doi.org/10.1016/j.ecolecon.2010.09.014
Steinberger, J.K., Roberts, J.T., Peters, G.P., Baiocchi, G., 2012. Pathways of human development and carbon emissions embodied in trade. Nature Climate Change 2, 81–85.

Stevenson, B., Wolfers, J., 2013. Subjective Well-Being and Income: Is There Any Evidence of Satiation? The American Economic Review; Nashville 103, 598–604. https://doi.org/http://0-dx.doi.org.wam.leeds.ac.uk/10.1257/aer.103.3.598
Stevenson, B., Wolfers, J., 2008. Economic Growth and Subjective Well-Being: Reassessing the Easterlin Paradox. Brookings Papers on Economic Activity 2008, 1–87. https://doi.org/10.1353/eca.0.0001
Stiglitz, J.E., Sen, A., Fitoussi, J.-P., 2009. Report by the Commission on the Measurement of Economic Performance and Social Progress. Commission on the Measurement of Economic Performance and Social Progress, Paris.
Tapia Granados, J.A., Ionides, E.L., Carpintero, Ó., 2012. Climate change and the world economy: short-run determinants of atmospheric CO2. Environmental Science & Policy 21, 50–62. https://doi.org/10.1016/j.envsci.2012.03.008
Tay, L., Herian, M.N., Diener, E., 2014. Detrimental Effects of Corruption and Subjective Well-Being: Whether, How, and When. Social Psychological and Personality Science 5, 751–759. https://doi.org/10.1177/1948550614528544
van den Bergh, J.C., 2010. Safe climate policy is affordable--12 reasons. Climatic Change 101, 339–385. https://doi.org/http://0-dx.doi.org.wam.leeds.ac.uk/10.1007/s10584-009-9719-7
Veenhoven, R., Vergunst, F., 2014. The Easterlin illusion: economic growth does go with greater happiness. International Journal of Happiness and Development 1, 311–343. https://doi.org/10.1504/IJHD.2014.066115
Vendrik, M.C.M., Woltjer, G.B., 2007. Happiness and loss aversion: Is utility concave or convex in relative income? Journal of Public Economics 91, 1423–1448. https://doi.org/10.1016/j.jpubeco.2007.02.008
Wilson, J., Tyedmers, P., Spinney, J.E.L., 2013. An Exploration of the Relationship between Socioeconomic and Well-Being Variables and Household Greenhouse Gas Emissions. Journal of Industrial Ecology 17, 880–891. https://doi.org/10.1111/jiec.12057
World Bank, 2018. World Development Indicators. World Bank, Washington D.C.
York, R., Bell, S.E., 2014. Life satisfaction across nations: The effects of women's political status and public priorities. Social Science Research 48, 48–61. https://doi.org/10.1016/j.ssresearch.2014.05.004

The Wellbeing–Consumption Paradox: Happiness, Health, Income, and Carbon Emissions in Growing versus Non-Growing Economies

Andrew L. Fanning and Daniel W. O'Neill

Highlights

- Happiness and health are used as separate indicators of wellbeing
- GDP and carbon footprint per capita are used as alternative consumption indicators
- Countries are split into "growing" and "non-growing" consumption groups
- Neither happiness nor health increase with growing consumption
- Happiness falls with non-growing consumption, with implications for climate policy