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Subjective Well-Being:
Easterlin Paradox, the (decreasing) Return(s)?

From log to square, new evidence from wealthier data

By

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Abstract:

The quest for happiness is neither new for human beings, nor for economists. With the systematization of household surveys, Subjective Well-Being studies have flourished. Discussions now focus on the slope of the virtually unchallenged curvilinear functional form between income and life satisfaction. Indeed, if growth positive returns are not -yet- contested for societies that have difficulties satisfying their population's basic needs, the correlation between income and Subjective Well-Being in wealthier countries has no consensus; from flat to steep, researchers dither…

Benefitting from larger datasets, recent papers have attempted to debunk the Easterlin paradox. They show that self-reported well-being is steadily and positively correlated with income and growth, even in developed countries.

However, using the most up-to-date global surveys, calculations cast doubt upon the belief in an eternal sunshine relation between income and "happiness". Indeed, we observe that the curvilinear relation between income and happiness could be challenged by the quadratic one. Thus, it now appears difficult to reject the possibility of decreasing returns, to the extent that it might be possible to consider, not only a weak, but a negative correlation between income and happiness for wealthier countries. Nevertheless, this perspective is likely dependent on the sample size. Moreover, we claim no direct causality for the uncovered negative slope. Further investigations would be necessary to prove, inform - or disprove - these new findings.

Résumé :

La recherche du bonheur n'est pas une quête nouvelle pour les humains, ni pour les économistes ! Avec la systématisation des enquêtes ménages, les études sur le bien-être subjectif se sont multipliées. Si le caractère curvilinéaire de l'association entre revenu et bien-être subjectif n'est pas, jusqu'ici, remise en question, les débats se sont récemment concentrés sur la pente de celle-ci. En effet, bien que l'impact positif de la croissance sur le bien-être dans les pays en développement ne soit pas contesté, pour les pays industrialisés, la corrélation entre bien-être subjectif et revenu est loin de faire l'objet d'un consensus.

Récemment, en utilisant des bases de données de plus en plus larges, certaines recherches ont remis en cause le paradoxe d'Easterlin. D'après ces travaux, il serait désormais clair que le bien-être subjectif soit durablement et positivement corrélé avec le revenu et la croissance, même pour les pays industrialisés. Néanmoins, nos observations réalisées grâce aux plus complètes bases de données actuellement disponibles, montrent que la relation idyllique entre revenu et bien-être subjectif peut être remise en question. La forme curvilinéaire pourrait en effet, cacher une forme quadratique. Il deviendrait alors difficile de rejeter l'existence de gains marginaux décroissants. Néanmoins, il serait imprudent d'établir un lien de causalité pour la partie décroissante de la pente ainsi mise à jour. De nouvelles recherches et des données plus longues seront nécessaires pour alimenter, ou réfuter, nos observations.

JEL - codes: D60, O1, I0, C81, C3.
Keywords: Happiness, Subjective Well-Being, life satisfaction, quality of life, economic growth, development, Easterlin Paradox , Econometrics, Behavioral Economics

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The views expressed in this paper are those of the author alone. [Do-file download]

I. Introduction

The quest for happiness is neither new for human beings, nor for economists. If well-being alchemy was previously theorized by Bentham and Edgeworth, following Joseph Priestley's predication for the "greatest happiness of the greatest number", impressive progress has been achieved recently in quantifying happiness based on individual's perceptions.

Richard Easterlin pioneered the use of a Subjective Well-Being poll to evaluate life satisfaction.

In 1974, Easterlin's starting point was the conclusion of M. Abramovitz's essay (1959): "We must be highly skeptical of the view that long term changes in the rate of growth of welfare can be gauged even roughly from changes in the rate of growth of output"[1]. Easterlin, using self-reported well-being evaluations in the United States, showed that despite an overall positive correlation between "happiness" and income, it was possible to observe "decreasing happiness returns". Grateful, Abramovitz coined the expression "Easterlin Paradox", stating that a rise in income does not necessarily drive an increase in life satisfaction.

Well-being and Subjective Well-Being (SWB) studies are now flourishing as perception data becomes available on a global scale.

Until recently, most of the econometrical studies focus on SWB determinants for any country or case study, mainly in developed countries. Cross-sectional analyses are predominantly undertaken using the World Values Surveys, whose coverage remains limited. However, since 2006, Gallup International has innovatingly polled a population which is representative of 98% of adult humankind.

In 2003, M. Hagerty and R. Veenhoven contested Easterlin Paradox using Veenhoven's (1999) World Database of Happiness. Drawing upon a Gallup World Poll, B. Stevenson and J. Wolfers (2008), tend to confirm an Easterlin Paradox failure, stating that "we […] find no evidence of a satiation point beyond which wealthier countries have no further increases in Subjective Well-Being. […] we find economic growth associated with rising happiness"[2].

Now, 5 years of Gallup World Polls are available for analysis and enable the construction of a panel dataset from 2006 to 2010. These new data facilitate more thorough global comparisons, to enrich the Easterlin paradox debate.

Why Subjective Well-Being matters? Individual's evaluation of their own satisfaction raises fundamental questions. First of all, in an economical perspective, it underlines decreasing returns and satiety phenomena. It raises the inequality issue and nuanced the role of income and consumption on life quality, once again questioning the way societies evolve (See Abramotivz, M. 1979, Scitovsky, T. 1976.)

In a philosophical perspective, Subjective Well-Being highlights static and dynamic mechanisms, taking into account human mind stability and adaptation ability.
Furthermore, life satisfaction surveys illuminate what people values, and question what is worth valuing (See Alkire, S. 2010; UNDP, 2010). It thereby underlines the role of capabilities, empowerment and agency while re-introducing the debates surrounding universalism versus relativism, positive versus normative.

[1] Abramovitz, M. (1959)
[2] Stevenson, B., Wolfers, J (2008)

II. Subjective well-Being, how to measure it

The well-being literature usually draws a distinction between three notions. Individual welfare mostly refers to one's financial situation, while well-being reflects a much broader multi-dimensional concept, including non-monetary aspects of life such as leisure, family, health, employment etc. (See Ferrer-i-Carbonnell 2002). Subjective well-being (SWB) refers to individuals own evaluation of their well-being. The terms happiness and life satisfaction also appear in the literature to refer to SWB. However, one can argue that "happiness" reflects a narrower concept that focuses on emotions rather than objective evaluation of life quality.

A. The Subjective Well-Being question

Well-being evaluations using subjective questions were initiated in psychology with Hadley Cantril (1965) and Warner Wilson (1967) – See Kahneman & al. (1999) and Ferrer-i-Carbonnell (2002). The Cantril question and its derivatives are now widely used, from Veenhoven's World database of Happiness to the Gallup World Poll. This question uses the ladder metaphor to help people evaluating their own situation. The Cantril question takes this form:

"Here is a picture of a ladder, representing the ladder of life. Suppose we say the top of the ladder (step 10) represents the best possible life for you, and the bottom (step 0) represents the worst possible life for you. Where on the ladder do you feel you personally stand at the present time?"[3]

Since first SWB surveys, many social surveys have flourished encompassing SWB evaluations. National surveys were conducted such as the *British Household Panel Survey* or the *General Social Survey* which polled a little less than 27 000 people in the US from 1972 to 1994 (Conceição & Bandura 2008). International surveys are also implemented such as the *Eurobarometers,* the *World Value Surveys*, or the *Gallup World Poll*. This last survey conducted on a global scale since 2006, has pushed the frontier quiet far in terms of coverage. Gallup World Polls now cover a sample representing 98% of the world adult population in approximately 150 countries.

B. Strengths and weaknesses

Two main advantages are usually flagged regarding self-reported happiness. First, it is quite easy to incorporate in standard surveys. Moreover, SWB questions appear to be understood across cultures. Clark & Senik (2010) report that non-response rates are very low. SWB evaluations appear also quite consistent with facts: "many of the correlations make sense" (Clark & Senik, 2010). Finally, the subjective nature of happiness is considered a strength, to the extent that it reflects the aspects of life that people value.

If SWB is now recognized as an interesting tool, some limitations have been raised. Researchers have questioned human emotion stability. Some state that asking people's opinions about their life may not be consistent as human emotions fluctuate. Meanwhile, a bunch of psychology studies have shown that happiness remains quite stable during a person's life. Moreover, it seems that behaviors and happiness disposition would be affected by biology and genetics (Clark & Senik, 2010).

In a more methodological perspective, SWB indictors are bounded e.g. the Cantril question ranked happiness on a 0 to 10 scale. Thus, comparing a bounded index to a continuous variable like income or GDP, raises some methodological issues as bounded indicators behave like relative evaluations. Thus, cross-country analyses should be taken with a pinch of salt. Nevertheless, Subjective Well-Being surveys illuminate what people value, avoiding the use of common external criteria, and for this reason, provides valuable insights.

[3] In Ferrer-i-Carbonnell (2002) p.5.

III. Subjective Well-Being and Income, the functional form quest

A. The functional form debates: the slope issue

The main debates on analyzing the association between income and happiness focus on the functional form. If the contribution of growth to life satisfaction in developing countries is not much disputed, Conceição and Bandura (2008) report that for developed countries, many studies underline that "aggregate national happiness over time is essentially flat, seemingly irresponsive to sustained increase in GDP per capita"[4].

Considering cross-section analysis, the association between SWB and income is mostly described as curvilinear: Veenhoven (1991); Inglehart (2000); Blanchflower & Oslwad (2000); Frey & Stutzer (2002); Hagerty & Veenhoven (2003); Clark, Frijters & Shields (2008); Stevenson & Wolfers (2008); etc. Thereby, discussions ultimately crystallize around the slope of the virtually unchallenged curvilinear functional form. Indeed, if growth positive returns are not -yet- contested for societies that have difficulties satisfying their population's basic needs, the correlation between income and Subjective Well-Being in wealthier countries has no consensus; from flat to steep, researchers hesitate.

Ferrer-i-Carbonnell (2002) suggests that growth is weakly correlated to SWB in western economies. Frey & Stutzer (2002) flag that "The empirical research on happiness […] found that at a particular point in time, and within a particular country, higher income is associated with higher individual happiness. In contrast, higher per capita income in society seems not to raise reported satisfaction with life in rich western countries. Even at an income level half that of the US, there are only small effects of higher average income on Subjective Well-Being."[5]

Inglehart (2000) identifies a $10 000 threshold above which life satisfaction appears barely correlated with income. The threshold supporters suggest that when basic needs are fulfilled other aspects of life - including family, free time, relationship with friends- matters more than income.

B. The Easterlin versus Hagerty & Veenhoven debate

Easterlin (1975; 1995; 2001; 2004) steadily suggests the lack of correlation between self-reported well-being and national income growth in developed countries:

> "The United States experience does not support H-V's [Hagerty & Veenhoven] assertion that 'happiness… can be raised by growth in national income' (p.24). H-V's result arises from mixing together two sets of non-comparable surveys. […] The results of studies by other scholars of European countries and of the United States do not support their claim either. Nor does the experience of non-European countries support their claim."[6]

On the other hand, Hagerty & Veenhoven (2003; 2006) with longer time series keep challenging Easterlin findings, defending the coexistence of the relative and absolute effect of income:

> "increasing national income does go with increasing national happiness, consistent with a needs theory and contrary to strict relative utility models. […] Higher income countries show smaller effects of absolute income than lower income countries, consistent with diminishing marginal utility of money. We [..] showed not only a significant absolute effect of income, but also a relative effect due to adaptive expectations such that a nation adapts somewhat over a two-year period to increased income."[7].

[4] Conceção, P. Bandura, R. (2008).
[5] Frey, B. Stutzer, A. (2002) p.13.
[6] Easterlin, R.A. (2004) p.14.
[7] Hagerty, Veenhoven (2003), p.13.

Hagerty & Veenhoven finally conclude that "Happiness is apparently not a zero-sum game and can be raised by improving living conditions. This has been a central but until recently untested belief of economists and public policy analysts. Some may be disappointed at the small size of income's effect on happiness. Future research should investigate how to increase this effect size further, in the same way that suppliers improve the efficiency of production inputs."[8]

In a more philosophical perspective, we strongly disagree with Hagerty and Veenhoven conclusion. For us, the matter is definitely not to artificially reconnect people's happiness to income, but on the contrary to release people from this constraint!

Measurement pitfalls such as the bounded scale of happiness indexes may also explain Easterlin previous findings. Ultimately, these authors recall that further research is necessary to identify likely omitted variables such as governance, democracy, pollution, inequality, etc.

The steady positive correlation is also supported by Stevenson & Wolfers (2008) using Gallup World Poll (2006 wave).

C. Beyond the Easterlin vs. Hagerty & Veenhoven debate

As we previously described, Easterlin found that SWB remains steady for developed countries. In his study (1975), he suggests that if income rises for everyone, life satisfaction remains equal. He embraced the relative income approach, defending the idea that income satisfaction depends rather on wealth differentiation toward a prior situation and among a reference group than on the absolute income one can earn. Thereby, Easterlin suggests that the relative approach is predominant in developed economies:

> "There are a number of reasons why an interpretation based chiefly on 'relativity' notions seems more plausible. First, a certain amount of empirical support has been developed for the relative income concept in other economic applications, such as savings behavior and, more recently, fertility behavior and labor force participation"[9].

Nevertheless, Easterlin conclusion suggests that growth does not affect income distribution unequally:

> "While the goods aspirations of higher status people probably exceed those of lower status people, the dispersion in reference norms is less than in the actual incomes of rich and poor. Because of this, those at the bottom of the income distribution tend to feel less well off than those at the top. Over time, however, as economic conditions advance, so too does the social norm […] As a result, the positive correlation between income and happiness that shows up in within-country comparisons appears only weakly, if at all, in comparisons among societies in time or space [..] In a sense, these results are a testimony to the adaptability of mankind."[10]

Easterlin seems to suggest that economic conditions advance uniformly – which was the case in the 1970s. However, inequality has risen in western economies since the 1980s. For SWB to remain steady while income increases, we have to assume that the satisfaction benefit due to income would be compensated by inequality expansion. Nevertheless, doing so, we must assume that inequality lower life satisfaction.

The question of the role of inequality rapidly arises. We may roughly formulate the puzzle this way: does feeling underpaid, in a situation of economic expansion, drive lower satisfaction loss than feeling overpaid drives happiness benefit?

[8] Hagerty, Veenhoven (2003), p.14.
[9] Easterlin, R.A. (1975) p.113.
[10] Easterlin, R.A. (1975) p.118 - 119.

Exploring this question would allow to state whether or not income inequality among a reference group increases the average satisfaction. Obviously, the answer depends on the cultural preferences of the reference group. The reference group selection indeed appears crucial (Hagerty & Veenhoven, 2003);

Comparison among individuals with respect to income and consumption has been theorized by Thorstein Veblen (See Frey and Stutzer, 2002). James Duesenberry (also cited by Easterly, 1975) questioned the relative income assumption econometrically and showed that "Wealthier people impose a negative external effect on poorer people but not vice versa"[11].

Thus, following Duesenberry (1949) and adding the decreasing returns to income once reaching a threshold, the balance in the case of inequality expansion could ultimately lean towards dissatisfaction : no or weak happiness increase through the income channel and rising dissatisfaction resulting from inequality expansion.

Layard (2005b) used micro evidence to show that within countries relative income has an important influence on self-reported satisfaction:

> "The great majority of these studies show a strong negative effect of other people's incomes (rivalry) and of own lagged income (habit). On rivalry, in the US Blanchflower and Oswald (2000) found that a rise in the average income in the state where you live reduces your happiness by one third as much as a rise in your own income increases it.
>
> In Britain, Clark and Oswald (1996) found that a rise in the wages of comparable workers reduces your job satisfaction by as much as a rise in your own wage increases it. Clark (1996) also showed that job satisfaction was adversely affected by the pay of your spouse."[12]

Nevertheless, Stevenson & Wolfers (2008) tested the relative income hypothesis and found that absolute income effect was more significant. Justin Wolfers in the New York Time Freakeconomics blog[13], conclude that "There's no longer any doubt that people in richer countries report being more satisfied with their lives. Is this relevant? Easterlin argues it isn't — that he's only concerned with changes in GDP. But the two are inextricably linked. If rich countries are happier countries, this begs the question: How did they get that way? We think it's because as their economies developed, their people got more satisfied. While we don't have centuries' worth of well-being data to test our conjecture, it's hard to think of a compelling alternative."

As we can read, there is no consensus among researchers regarding the impact of income and growth on SWB. Finding Justin Wolfers conclusion somewhat hasty, we propose to analyze the impact of income and growth on life satisfaction, using the same Gallup question but taking into account the latest data available.

[11] Frey, B. Stutzer, A. (2002) p.9.
[12] Layard, R. (2005b) p3 – 4.
[13] http://www.brookings.edu/opinions/2010/1213_debunking_easterlin_wolfers.aspx (consulted the 01.21.2011)

D. SWB and Income: new clues, less evidence?

1. Functional form investigation: Subjective Well-Being and income

From the last available Gallup World Poll waves (2006 to 2010), we constructed a panel dataset with Subjective Well-Being variables aggregated at the national level. As measure of happiness we used the "life satisfaction today" question, ranked from 0 to 10; 10 standing for the best life possible. The exact question formulation is available in annex 1, p.32.
Contrarily to Stevenson and Wolfers (2008) who used GDP per capita, we found reasonable to measure national income using Gross National Income (GNI) per capita, provided by the World Development Indicators (World Bank). However, the same representation using GDP per capita is available in annex 3, page 32.

The following chart presents the curve estimations of the relationship between life satisfaction and GNI per capita. We investigated three different functional forms: linear, curvilinear and quadratic.

Figure 1. Subjective Well-Being and Income per capita, functional form investigation (pooled dataset)

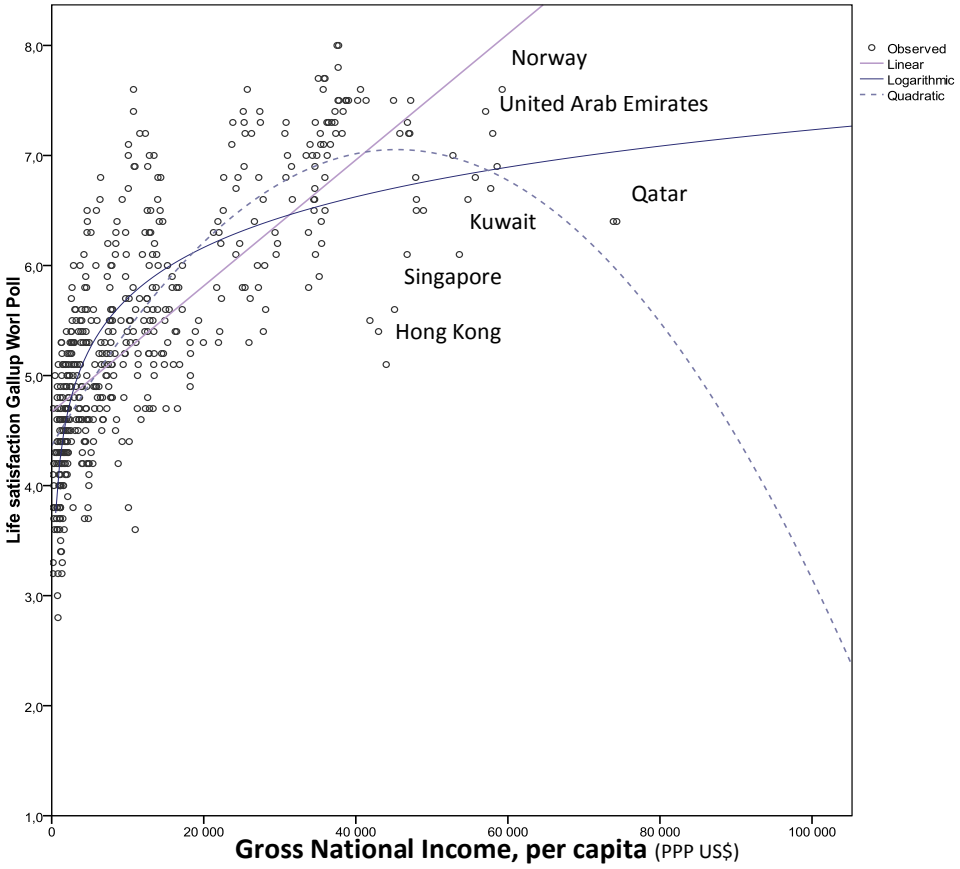

Table 1, presents the R^2 and estimated coefficients, for each functional from, using our pooled dataset. We also disaggregated our results by year, from 2006 to 2010. We underlined in grey the best overall curve fit, according to their adjusted R^2.

The clearest observation is that for every single estimation, linear adjustment provides the weakest results. The spread between quadratic and curvilinear forms appears more contrasted. Considering the adjusted R^2, the quadratic functional form seems to prevail in four cases out of six. It seems this study is one of the first to uncover such a result.

Nevertheless, it appears that the curvilinear and quadratic R^2 are pretty close. Without the "outliers" we flagged, we assume that the log form would become more appropriated. However, we see no objective reason to get rid of these cases that clearly illustrate the fact that income doesn't necessarily bring happiness... Excluding these cases obviously hides a part of the story.

We suggest that the notion of "outlier" in regards to Subjective Well-Being is misleading. Indeed, Subjective Well-Being precisely draws its singularity and strength from taking into account the diversity of what matters to people. Hence, referring to "outliers" re-introduces a normative framework and disqualifies the very nature of this kind of studies. The issue at stake is not to maximize a model fit to draw stylized facts but to reveal human-beings differentiated aspirations.

Table 1. Life satisfaction and GNI, functional form investigation

OLS estimation	**Coefficients** ***Pooled dataset***	**Coefficients 2006**	**Coefficients 2007**	**Coefficients 2008**	**Coefficients 2009**	**Coefficients 2010**
Linear adjustment						
GNI per capita ($100)	0.006***	0.006***	0.007***	0.006***	0.005***	0.005***
t	(25.494)	(13.888)	(13.182)	(13.078)	(8.907)	(9.152)
R^2	0.556	0.611	0.642	0.600	0.410	0.567
Adjusted R^2	0.555	0.607	0.638	0.597	0.405	0.560
Number of observations (N)	524	125	100	116	117	66
Log adjustment						
Ln(GNI per capita)	0.665***	0.732***	0.675***	0.723***	0.574***	0.566***
t	(29.800)	(15.964)	(14.246)	(16.331)	(10.753)	(9.611)
R^2	0.631	0.674	0.677	0.701	0.504	0.591
Adjusted R^2	0.630	0.672	0.673	0.698	0.499	0.584
Number of observations (N)	524	125	100	116	117	66
Quadratic adjustment						
GNI per capita ($100)	0.012***	0.013***	0.012***	0.013***	0.010***	0.011***
t	(20.295)	(10.026)	(7.101)	(11.827)	(7.634)	(6.202)
GNI^2 per capita ($100)	-1.311E-5***	-1.547E-5***	-1.378E-5***	-1.357E-5***	-1.064E-5***	-1.188E-5***
t	(-11.201)	(-5.507)	(-3.280)	(-6.720)	(-4.396)	(-3.521)
R^2	0.642	0.688	0.678	0.714	0.496	0.638
Adjusted R^2	0.641	0.683	0.671	0.709	0.488	0.627
Number of observations (N)	524	125	100	116	117	66

Dependent variable: Life satisfaction today, Gallup World Poll

One would argue that through much of our data time coverage, the world was facing the worst financial and economic crisis since 1936. This chaotic context might have an impact on self-reported well-being. However, the way individuals react and the way the association between happiness and GNI would be affected are almost unpredictable as we recall the exceptional physiognomy of this crisis.

We would believe in a more prosaic, but less optimistic, explanation: taking into account the decreasing returns of an unshared growth, populations that have plentifully fulfilled their basic needs - and beyond – are no longer satisfied with an "overall" income increase.

As bivariate analysis does not provide a strong statistical proof, these first results establish no decisive evidence of an eventual flat or steep happiness in western economies. We will present further analysis in section IV of this study.

2. Subjective Well-Being and consumption

Before using multivariate analysis, we choose to better explore the relationship between consumption and happiness. Therefore, we also performed curve estimations for this specific association. Household consumption per capita data are drawn from the World Bank (WDI).

Figure 2. Life satisfaction and household consumption per capita

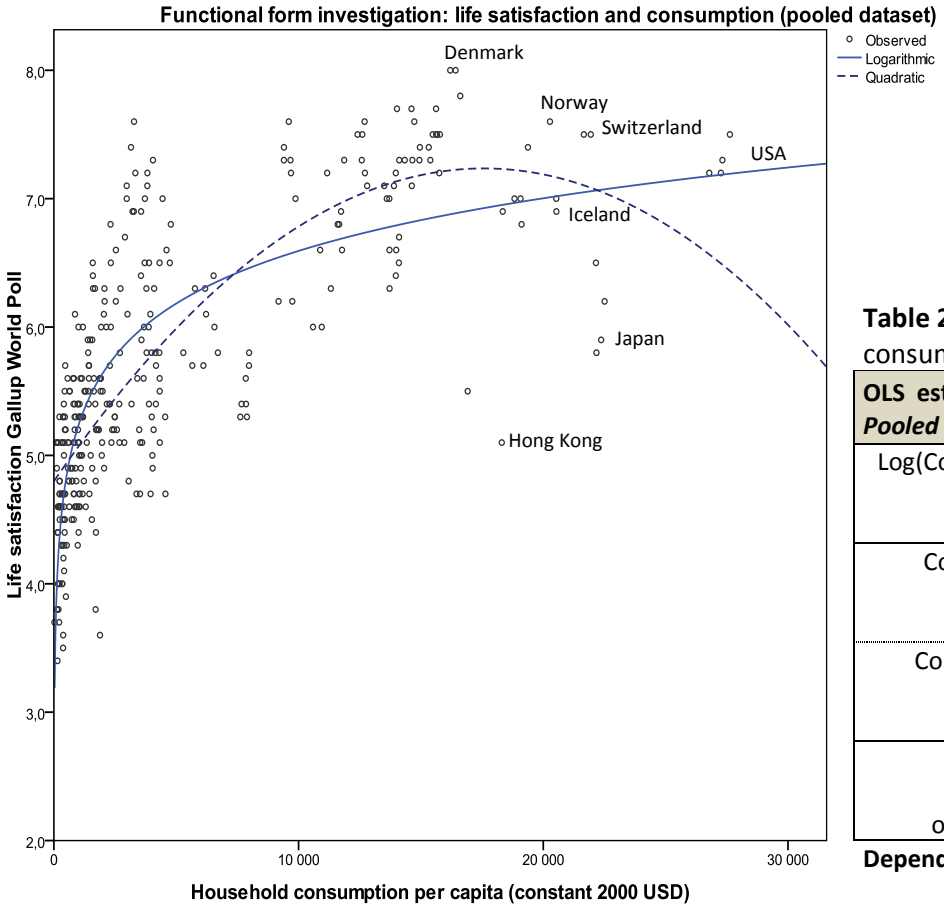

Table 2. Life satisfaction and household consumption, functional form investigation

OLS estimation ***Pooled dataset***	**Log adjustment**	**Quadratic adjustment**
Log(Consumption *per capita*)	0.591***	
t	(24.432)	
Consumption *per capita* ($100)		0.028***
t		(15.629)
Consumption² *per capita* ($100)		-7.891E-5***
t		(-9,287)
R^2	0.642	0.619
Adjusted R^2	0.641	0.617
observations (N)	335	335

Dependent variable: Life satisfaction today, Gallup WP

Table 2, displays the coefficients and R^2 estimations for the curvilinear and quadratic curve fit.

Interpretation

Our results indicate that the curvilinear functional form prevail in the interaction between self-reported well-being and consumption. Japanese and people from Hong Kong steadily appear to disconnect their happiness from income and consumption. The cases of Japan and USA have been extensively documented through SWB literature.

Figure 2 suggests that the threshold hypothesis may be valid. The correlation between household consumption and life satisfaction become vague once reached a consumption level around $10 000 per capita. Our previous observations now need to be enforced statistically using multivariate analysis.

3. Conclusion

So far, our analyses have cast some doubts on the belief of an eternal sunshine relation between income and happiness. It becomes tangible that decreasing returns may hide a negative correlation. However, these results need to pass the multivariate crash-test before suggesting secure evidence.

IV. Multivariate analysis

A. Methodological issue

Most of the Subjective Well-Being studies performed ordered probit models to take into account the discrete nature of the data. Indeed, the answer to the Cantril question leads the respondent to provide an integer representing his satisfaction.

Using aggregated data at the national level, we no longer obtain integers but float numbers. Unless transforming the data, and lose some precision, an ordered probit estimation no longer appears as the most suitable method. Nonetheless, to address potential critics, we will also display in an annex a bunch of results using ordered probit with re-categorized data. Thus, readers will notice that the difference between the two methodologies does not appear substantially significant.

We constructed a panel dataset using the last five waves of the Gallup World Poll. We now need to undertake different tests to evaluate the more appropriate methodology to use.
We first constructed a basic model of SWB determinants. Using the distinction described by Diener & Lucas (1999), we selected as internal factors (subjective variables), three other Gallup World Poll variables: local job situation[14], personal health satisfaction[15] and self-reported highest education level[16]. As external factors (objective variables) we use the log of Gross National Income *per capita* (World Bank, WDI).

1. We first compared fix (a.) and random (b.) effect models

(a.) $\text{Life satisfaction}_{ij} = \alpha_{ij} + \beta_1 \text{logGNIper capita}_{ij} + \beta_2 \text{ job situation}_{ij} + \beta_3 \text{ health satisfaction}_{ij} + \beta_4 \text{ education level}_{ij} + \varepsilon_{ij}$ with $i = 1,..,N$; $j = 1,\ldots, N$

(b.) $\text{Life satisfaction}_{ij} = \alpha_{ij} + \beta_1 \text{logGNIper capita}_{ij} + \beta_2 \text{ job situation}_{ij} + \beta_3 \text{ health satisfaction}_{ij} + \beta_4 \text{ education level}_{ij} + u_i + \varepsilon_{ij}$ with $i = 1,..,N$; $j = 1,\ldots, N$

Table 3. Fix effects estimation of life satisfaction determinants

Parameter	Coefficient	Standard error	t	P>|t|	Confidence Interval 95%	
					lower bound	upper bound
Log GNI per capita	2.250***	0.706	3.19	0.002	0.85966	3.64072
Job situation	0.006***	0.002	3.10	0.002	0.00211	0.00946
Health satisfaction	0.016***	0.005	3.03	0.003	0.00575	0.02703
Education level	0.007*	0.003	1.94	0.053	-0.00010	0.01367
Constant	-4.934*	2.710	-1.82	0.070	-10.2702	0.40275
F(4,266) = 10.20						
Prob > F = 0.000						
N= 421						

Dependent variable: *Life satisfaction today*

[14] "Thinking about the job situation in the city or area where you live today, would you say that it is now a good time or a bad time to find a job?" NB. The answer is the % of the population declaring it is a good time.
[15] "Are you satisfied or dissatisfied with your personal health?" NB. The answer is the % of the population declaring being satisfied with their health.
[16] "What is your highest completed level of education?" NB. The answer is the % of the population whose highest education level is secondary.

To isolate the existence of random effect we use the Breusch- Pagan Lagrangian multiplier test. The Breusch-Pagan Lagrangian multiplier statistic is given by:

$$\mathcal{L} = T * [S_{m=1}^{m=M} [S_{n=1}^{n=m-1} [r_{mn}^2]]$$

With r_{mn}^2 the estimated correlation between the residuals of the M equations; and T, the number of observations; $\mathcal{L}$ is distributed following a χ^2, M(M-1)/2 degrees of freedom.

Breusch and Pagan Lagrangian multiplier test for random effects
Life satisfaction today [code,t] = Xb + u[code] + e[code,t] ; Estimated results:

	var	sd=sqrt(Var)
Life satisfaction	1.12185	1.05918
e	0.08515	0.29181
u	0.23045	0.48005

Test: Var (u) = 0
Chi² (1) = 189.59
Prob > chi² = 0.000

The null hypothesis stands for Var (u) = 0, a significant result reject Var (u) =0. As the result appears strongly significant we must reject the fix effect model in favor of the random one. Table 4, displays the estimation of the basic model using random effect estimation:

Table 4. Random effects estimation of life satisfaction determinants

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
Log GNI per capita	1.239***	0.085	14.59	0.000	1.07259	1.40545
Job situation	0.008***	0.002	5.01	0.000	0.00485	0.01110
Health satisfaction	0.025***	0.004	6.92	0.000	0.01792	0.03210
Education level	0.007***	0.002	3.31	0.001	0.00298	0.01165
Constant	-1.863***	0.344	-5.42	0.000	-2.53662	-1.18864
Wald chi2(4) = 553.34						
Prob > chi2 = 0.000						
N= 421						

***Dependent variable**: Life satisfaction today*

2. Heteroskedasticity test

The number of missing values in our dataset may lead to an unbalanced panel that frequently introduces heteroskedasticity. In order to detect it, we run a **Likelihood-ratio (LR) test** for **heteroskedasticity.**

Likelihood-ratio test: LR chi² (150) = 196.72
Prob > chi² = 0.0063

As the null hypothesis for this test stands for homoskedasticity, the Likelihood-ratio test indicates that our panel faces a heteroskedasticity issue. Therefore, the most accurate estimation is provided by a Generalized Least Square (GLS) estimator.

3. First order autocorrelation test

We finally performed a **first-order autocorrelation** test, using the **Wooldridge test**, described by Drukker, D.M. (2003). The null hypothesis stands for no first-order autocorrelation.
We display above the F-Test:

F (1, 64) = 22.862
Prob > F = 0.000

The null hypothesis is rejected; we will therefore need to correct our estimations.

4. Conclusion

The different tests we performed show that the **Generalized Least Square model**, **corrected for first-order autocorrelation** would provide reliable estimators. Table 5, displays the GLS estimation of the basic Life satisfaction determinants:

Table 5. Generalized Least Square estimation of life satisfaction determinants : basic model

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
Log GNI per capita	1.163***	0.038	30.50	0.000	1.08814	1.23761
Job situation	0.008***	0.001	8.59	0.000	0.00626	0.00996
Health satisfaction	0.028***	0.002	15.63	0.000	0.02432	0.03129
Education level: Secondary	0.009***	0.001	10.26	0.000	0.01125	0.01125
Constant	-1.921***	0.171	-11.21	0.000	-2.25725	-1.58557
Wald chi2(4) = 2592.00						
Prob > chi2 = 0.000						
N= 397						

Dependent variable: *Life satisfaction today*

NB. The estimation of the very same model using an ***ordered probit*** *is available* in ***annex 5 – table 5.1***

Interpretation

These results show that our predictors provide a strong overall explanatory power supported by 397 observations. The positive influence of income on self-reported well-being is thus flagged. Health, education and job situation display lower coefficients although significant and positive.
These results appear consistent with well-being literature; the next section will address our less consensual findings in regards to income and SWB functional form.

B. From log to square, further functional form investigations

The previous functional form investigations showed that the quadratic shape seems to prevail, however a multivariate analysis remains necessary to confirm these findings. Thus, we introduce the square of GNI to question the quadratic association, searching for a loss of significance.

1. Using our basic model with quadratic form:

$$\text{Life satisfaction}_{ij} = \alpha_{ij} + \beta_1 \text{GNI per capita}_{ij} + \beta_2 \text{GNI}^2 \text{ per capita}_{ij} + \beta_3 \text{ job situation}_{ij} + \beta_4 \text{ health satisfaction}_{ij} + \beta_5 \text{ education level}_{ij} + u_i + \varepsilon_{ij}$$

Table 6. GLS estimation of life satisfaction determinants : functional form investigation with basic model

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
GNI per capita ($ hundreds)	0.011***	0.001	15.03	0.000	0.00947	0.01231
GNI² per capita ($ hundreds)	-1.280E-05***	1.510E-06	-8.52	0.000	-0.00002	-0.00001
Job situation	0.006***	0.001	6.19	0.000	0.00406	0.00783
Health satisfaction	0.022***	0.002	10.02	0.000	0.01783	0.02650
Education level: Secondary	0.009***	0.001	6.58	0.000	0.00599	0.01107
Constant	2.097***	0.171	12.25	0.000	1.76149	2.43256
Wald chi2(5) =1463.64						
Prob > chi2 = 0.000						
N= 397						

Dependent variable: Life satisfaction today

NB. The estimation of the very same model using an ***ordered probit*** *is available* in ***annex 5 – table 6.1***

Interpretation

The Generalized Least Square model estimation does not provide any R^2 and adjusted R^2. The general Wald test for all predicators is not a reliable fit diagnostic. Thus, comparing two different models fit relatively to their predictors appears not possible. As GNI per capita & its square and Log GNI provide the same level of significance, it appears quite difficult to state whether the curvilinear or the quadratic form provides the higher explanatory power.

Our previous bivariate analyses show that the quadratic functional form may provide a stronger explanation. However, this picture remains a light statistical proof.

2. Conclusion

As previously explained, using a GLS model, it becomes quite difficult to compare the overall fit between two different models, especially if the challenged variables are strongly significant.
Nevertheless, considering the different test we performed and taking into account the curve fit investigation, we are at least able to state that **it is not possible to reject the quadratic functional form**. Moreover, in the following sections we introduce various controls, associated with different sample sizes. Each time GNI and its square appear significant. We are therefore tempted to rely on the bivariate analysis to state that **potentially, the quadratic functional form would provide a more complete picture.** This possibility should therefore be more investigated.

Nevertheless, we don't claim any causality and we take these results cautiously as it has been shown that SWB studies are very dependant of the sample composition and questions formulation (Graham & al.). However, with a little imagination it becomes possible to consider the eventual side effect of growth and high unbalanced level of income: pollution, inequality, extended hours of work, road network saturation etc.

C. The threshold hypothesis

Targeting to solve the functional form mystery, we tried to corroborate the threshold hypothesis by using different categorization variables.
We therefore created two binary variables in order to test the threshold theory. The first variable explores the $10 000 GDP threshold (Inglehart, 2000) while the other refers to the basic needs assumption. We created the latter using the Multidimensional Poverty Index provided by UNDP-HDRO - Oxford Poverty and Human Development Initiative (Alkire & Santos, 2010). This last index appears the most suitable indicator to test the basic needs assumption as it takes into account deprivation.

1. The $10 000 GDP per capita threshold

Splitting our dataset according to the $10 000 threshold, we assume that the functional form of the relationship between income and life satisfaction is no longer curvilinear in the resulting sample.
Therefore, to test the threshold hypothesis we used our basic model avoiding the use of the log for GNI and excluding the level of education that already appears discriminating. Thus, we created a binary variable taking these values: GDP per capita =< $10 000: GDP binary = 1; 0 if not.
We then run a regression sorted by our GDP binary variable:

For binary = 0 (GDP per capita > $10 000)

Table 11. GLS estimation of life satisfaction determinants, GDP threshold hypothesis

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
GNI per capita ($ hundreds)	0.002***	1.80E-04	8.43	0.000	0.00117	0.00187
Job situation	0.014***	0.001	9.38	0.000	0.01068	0.01632
Health satisfaction	0.048***	0.003	16.00	0.000	0.04223	0.05403
Constant	1.811***	0.201	9.00	0.000	1.41670	2.20531
Wald chi2(3) = 969.67						
Prob > chi2 = 0.000						
N= 109						

Dependent variable: Life satisfaction today

For binary = 1 (GDP per capita =< $10 000)

Table 12. GLS estimation of life satisfaction determinants, GDP threshold hypothesis

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
GNI per capita ($ hundreds)	0.012***	2.911E-04	40.21	0.000	0.01113	0.01227
Job situation	0.005***	0.001	4.94	0.000	0.00293	0.00679
Health satisfaction	0.030***	0.002	18.86	0.000	0.02699	0.03325
Constant	1.914***	0.092	20.81	0.000	1.73382	2.09439
Wald chi2(3) = 15164.51						
Prob > chi2 = 0.000						
N= 297						

Dependent variable: Life satisfaction today

Interpretation

Splitting our dataset, we are able to confirm that for wealthier countries, income is less closely associated with increasing life satisfaction. Thus, in richer countries health and job situation appear to weight heavier than income. According to these results, the $10 000 GDP threshold hypothesis appear to be valid. Nevertheless, in order to better reflect the impact of basic needs deprivation, we decided to use also a multidimensional poverty threshold.

2. The Multidimensional Poverty Index threshold

We generated a poverty oriented binary using the Multidimensional Poverty index. The MPI takes into account the extent of non-income poverty in 3 dimensions (Alkire & Santos, 2010). Thus, we created the MPI binary this way:

MPI index >0.15: Poverty binary =1 (Poor country); 0 if not.

Table 13 and 14 display the estimation of life satisfaction determinants using our dataset, split according to the MPI binary

For binary = 0 (MPI =< 0.15; Country considered not poor)

Table 13. GLS estimation of life satisfaction determinants: poverty threshold investigation

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
GNI per capita ($ hundreds)	0.004***	3.75E-04	11.4	0.000	0.00354	0.00501
Job situation	0.011***	0.002	7.29	0.000	0.00837	0.01452
Health satisfaction	0.016***	0.002	6.71	0.000	0.01141	0.02083
Constant	3.319***	0.179	18.52	0.000	2.96783	3.67040
Wald chi2(3) =212.37						
Prob > chi2 = 0.000						
N= 199						

Dependent variable: Life satisfaction today

For binary = 1 (MPI >0.15; Country considered as poor)

Table 14. GLS estimation of life satisfaction determinants: poverty threshold investigation

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
GNI per capita ($ hundreds)	0.025***	2.45E-03	10.22	0.000	0.02029	0.02991
Job situation	0.001	0.002	0.50	0.614	-0.00244	0.00413
Health satisfaction	0.033***	0.002	13.65	0.000	0.02850	0.03806
Constant	1.486***	0.199	7.47	0.000	1.09605	1.87576
Wald chi2(3) = 255.68						
Prob > chi2 = 0.000						
N= 133						

Dependent variable: Life satisfaction today

Interpretation

Once again, GNI coefficients appear significant, positive and more important for poorer countries. It suggests a higher valuation of income for the deprived population. These results are consistent with the $10 000 GDP threshold. Moreover, with 15% as MPI threshold, we put the cursor lower. In other words, the countries associated with binary = 1 in the case of the MPI binary, are poorer than in the previous case. These results confirm this new classification as we do observe a greater gap between the two GNI coefficients.

With both basic needs (MPI) and $10 000 GDP per capita, the threshold theory appears strongly consistent and tends to confirm the existence of income decreasing returns in a life satisfaction perspective.

3. Testing higher incomes thresholds

Testing both the $10 000 and the basic needs thresholds, we explored the stronger correlation between SWB and income for developing countries. Once this phenomenon confirmed, it becomes interesting to investigate its opposite, using this time, a high level income threshold. Thus we tested two different thresholds using two different levels of income per capita: $20 000 and $25 000.

We constructed the $20 000 binary this way: **for GNI per capita =< $20 000: GNI binary = 1; 0 if not.**
And for the $25 000 binary: **GNI per capita =< $25 000: GNI binary = 1; 0 if not.**

The following table displays the estimation of the coefficients for these two high income thresholds:

Table 15. Higher income thresholds

Parameters / Tested model	GNI per capita > $20 000	GNI per capita =< $20 000	GNI per capita > $25 000	GNI per capita =< $25 000
GNI *per capita* ($ hundreds)	9.55E-05	0.010***	- 0.001***	0.009***
Z	(0.25)	(56.82)	(-3.01)	(127.03)
Job situation	0.013***	0.003***	0.015***	0.005***
Z	(6.68)	(2.99)	(7.58)	(22..69)
Health satisfaction	0.039***	0.031***	0.047***	0.027***
Z	(8.41)	(25.48)	(9.74)	(21.83)
Constant	3.085***	1.93***	2.98***	2.18***
Z	(8.79)	(26.18)	(8.13)	(24.85)
Wald	172.38	5497.64	216.89	23704.35
Prob > chi2	0.000	0.000	0.000	0.000
Sample size N=	101	386	87	400

Dependent variable: Life satisfaction today

Interpretation
Using the $20 000 threshold, we observe that for countries with an income per capita higher than $20 000, the **correlation between happiness and GNI no longer** appears **significant.**
Moreover, putting the step a little higher, our results become again significant, but associated with a negative coefficient. Thus, **using the $25 000 threshold**, the **correlation** between **income and self-reported well-being** becomes **negative.**
Using such a high level of income threshold, our sample size reduces to 87 observations. Moreover, in this context the influence of income appears very weak in comparison to employment and health satisfaction. Nevertheless, these results keep casting doubt on an irreversible correlation between income and life satisfaction.

4. Conclusion

Questioning the threshold assumption, we confirmed the importance of income for developing countries. We also find out that job situation always appear less critical than health.
Nevertheless, we suppose that health might be less a matter of concern for countries with efficient health system. The same reasoning applies for the job market where shadow economy and subsistence farming help to provide a job for people excluded from the market economy in developing countries. This assumption may explain the observed tendency: the poorer country, the lower coefficient for job situation.

As less consensual findings, we uncovered that **for the wealthiest countries**, a **negative correlation between income per capita and Subjective Well-Being** appears validated. Once again, we don't claim for any causality link, but we suggest researchers should be cautious in claiming a steady positive link between happiness and income. Obviously, our results leave room for a re-consideration of the Easterlin Paradox.

D. Growth, the rising puzzle?

If the relation between income and life satisfaction leads to numerous debates, the role played by growth on life satisfaction is far more controversial.
We previously highlighted Easterlin observations: using time series he notes the absence of correlation between growth and self-reported well-being.

On the other hand, Hagerty and Veenhoven (2003, p.4) suggested the contrary: "increasing national income does go with increasing national happiness, consistent with a needs theory and contrary to strict relative utility models. Of the 21 countries, 7 now show a significant positive coefficient of income growth, and only one shows a negative coefficient" (p.13)

Stevenson and Wolfers (2008) also support a positive correlation between growth and happiness: "we find economic growth associated with rising happiness" (p.1); "The positive relationship between life satisfaction and economic growth is not a feature of Europe alone." (Stevenson and Wolfers, 2010, p.16)

Senik and Clark (2010, p.24) appear more nuanced in regards to the evidence supporting a positive correlation between growth and life satisfaction, although they suggest a theoretical link:
"Whether the co-movements between growth and quality of life indicators are causal is indeed controversial and difficult to establish (see also Easterly (1999). However, it is undeniable that there is no progress in quality of life without GDP growth."

Searching for new evidence, we decided to test the impact of growth; therefore we introduced GDP growth as control variable. We first tested a model using log GNI, keeping in mind that using the log likely smooth the threshold by transforming the income/satisfaction relationship into a linear association. Thus, it tends to soften the distinction between developed and developing countries.

Table 16. GLS estimation of life satisfaction determinants: the role of GDP growth

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
Log GNI per capita	1.605***	0.065	24.51	0.000	1.47619	1.73284
Job situation	0.008***	0.001	12.72	0.000	0.00650	0.00887
Health satisfaction	0.022***	0.001	41.18	0.000	0.02083	0.02291
GDP growth	0.002	0.002	0.97	0.333	-0.00215	0.00635
Constant	-3.075***	0.227	-13.54	0.000	-3.51965	-2.62946
Wald chi2(3) = 6484.21						
Prob > chi2 = 0.000						
N= 385						

Dependent variable: Life satisfaction today

Interpretation

Using GNI log as control variable, GDP growth appears not correlated with life satisfaction. This observation contradicts Stevenson and Wolfers (2008, 2010) and Hagerty Veenhoven (2003).
One may argue these results could be influenced by the methodology we used; thus, we also performed an **ordered probit model** with re-categorized data. Using this methodology, GDP growth becomes **significant but, associated with a negative coefficient**. (Cf. Annex 5, table 16.1 - p. 34).

As we reminded, log GNI, smoothing the distinction between developed and developing countries, may have an impact on the behavior of GDP growth variable. Therefore, we decided to test the same model with GNI per capita instead of its logarithm. Table 17, summarizes these new results.

Table 17. GLS estimation of life satisfaction determinants: the role of GDP growth

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
GNI per capita ($ hundreds)	0.006***	0.000	30.43	0.000	0.00546	0.00621
Job situation	0.005***	0.001	5.83	0.000	0.00352	0.00709
Health satisfaction	0.028***	0.002	14.07	0.000	0.02407	0.03186
GDP growth	-0.005**	0.002	-1.99	0.047	-0.00936	-0.00007
Constant	2.362***	0.130	18.2	0.000	2.10749	2.61627
Wald chi2(3) = 3577.04						
Prob > chi2 = 0.000						
N= 385						

Dependent variable: Life satisfaction today

*NB. The estimation of the same model using an **ordered probit** is available* in ***annex 5 – table 17.1***

These results confirm our intuition: excluding the log form, GDP growth becomes significant. However, our observations now appear far less consensual. Indeed we show that GDP growth is adversely correlated with SWB. Once again, and in a much cutting way, our results deviate from Stevenson and Wolfers (2008, 2010). Nevertheless, our first scatter plot (Figure 1) and multivariate analysis tend to show that for developing countries a gain in income drives growing satisfaction. Thereby, we need to go further in our analysis, taking into account the level of GDP.

3. Testing the threshold assumption with the GDP growth

Searching for a positive influence of growth in low level of GDP countries, we used the threshold discrimination.

For GDP binary = 0 (GDP per capita > $10 000)

Table 18. GLS estimation of life satisfaction determinants: the role of GDP growth

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
GNI per capita ($ hundreds)	0.002***	0.000	5.65	0.000	0.00103	0.002
GDP growth	-0.066***	0.011	-6.17	0.000	-0.08640	-0.045
Job situation	0.017***	0.001	13.25	0.000	0.01446	0.019
Health satisfaction	0.040***	0.004	9.31	0.000	0.03148	0.048
Constant	2.477***	0.351	7.06	0.000	1.78983	3.165
Wald chi2(3) = 1319.74						
Prob > chi2 = 0.000						
N= 96						

Dependent variable: Life satisfaction today

For binary = 1 (GDP per capita =< $10 000)

Table 19. GLS estimation of life satisfaction determinants: the role of GDP growth

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
GNI per capita ($ hundreds)	0.011***	0.001	19.07	0.000	0.00986	0.012
GDP growth	-0.007**	0.003	-2.19	0.028	-0.01384	-0.001
Job situation	0.004**	0.002	2.26	0.024	0.00048	0.007
Health satisfaction	0.028***	0.002	12.97	0.000	0.02384	0.032
Constant	2.149***	0.145	14.78	0.000	1.86376	2.434
Wald chi2(3) = 665.06						
Prob > chi2 = 0.000						
N= 282						

Dependent variable: Life satisfaction today

Interpretation

Introducing growth, the threshold assumption remains consistent. Nevertheless, we were not able to isolate a positive influence of growth on life satisfaction. Whatever the level of income, it appears that growth remains adversely correlated with Subjective Well-Being.
However, to provide a more precise picture of the role of growth within different development context, we decided to use a Human Development level discrimination.

5. Testing GDP growth by Human Development Index levels

Thus, we estimated the previous model for different "cohorts" of countries, according to their Human Development Index. As reminder, readers will find above the four Human Development categories:

1. Low Human Development *(bottom quartile)*
2. Medium Human Development
3. High Human Development
4. Very High Human Development *(top quartile)*

Nevertheless, sorting our observations, we merged the "High HD" and "Very High HD" categories in order to have enough cases for our analysis to remain robust.

For low human development countries

Table 20. GLS estimation of life satisfaction determinants: the role of GDP growth

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
GNI per capita ($ hundreds)	0.029***	0.007	3.94	0.000	0.01462	0.044
GDP growth	0.012	0.008	1.54	0.123	-0.00314	0.026
Job situation	4.91E-04	0.002	0.21	0.834	-0.00411	0.005
Health satisfaction	0.024***	0.005	5.12	0.000	0.01455	0.033
Constant	2.120***	0.308	6.88	0.000	1.51624	2.724
Wald chi2(3) = 82.85						
Prob > chi2 = 0.000						
N= 77						

Dependent variable: Life satisfaction today

For medium human development countries

Table 21. GLS estimation of life satisfaction determinants: the role of GDP growth

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
GNI per capita ($ hundreds)	0.007***	0.000	23.64	0.000	0.00650	0.008
GDP growth	-0.019***	0.004	-4.62	0.000	-0.02735	-0.011
Job situation	0.015***	0.001	10.90	0.000	0.01263	0.018
Health satisfaction	0.021***	0.002	10.51	0.000	0.01714	0.025
Constant	2.824***	0.164	17.19	0.000	2.50214	3.146
Wald chi2(3) = 1409.67						
Prob > chi2 = 0.000						
N= 168						

Dependent variable: Life satisfaction today

For High and Very High Human development countries

Table 22. GLS estimation of life satisfaction determinants: the role of GDP growth

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
GNI per capita ($ hundreds)	0.003***	0.000	6.31	0.000	0.00214	0.004
GDP growth	-0.022***	0.003	-6.70	0.000	-0.02885	-0.016
Job situation	0.009***	0.001	7.82	0.000	0.00666	0.011
Health satisfaction	0.040***	0.006	6.38	0.000	0.02788	0.053
Constant	2.214***	0.573	3.86	0.000	1.09073	3.338
Wald chi2(3) = 301.30						
Prob > chi2 = 0.000						
N= 93						

Dependent variable: Life satisfaction today

Interpretation

While GDP growth coefficient appears **positive for low human development** countries, **it does not appear significant** at the 10% level.
For the two other categories, GDP growth remains substantially adversely correlated with life satisfaction. Furthermore, a higher level of Human Development drives a stronger GDP growth coefficient. In other words, these results suggest that the higher Human Development Index, the more GDP growth affects self-reported well-being in a corrosive way.

So far, we were not able to establish a positive relation between growth and Subjective Well-Being. GDP growth tends to lower life satisfaction and it appears that **the higher level of income, the stronger adverse influence**. Nevertheless, we postulate that these results are likely influenced by the sample size and the choice of control variables. Thus, we introduced a few more controls.

6. Introducing more controls : "omitted variables" and GDP growth delayed

In order to check whether or not our previous findings were driven by some specific variables and sample size, we introduced different new controls:

As external factors (objective variable):

- **Inflation rate** from the World Bank – World Development Indicators;
- The *Polity IV* **democracy index**, provided by the *Center for Systemic Peace*[17], and ranked from 0 to 10, 10 standing for the most democratic regime;
- As **decentralization proxy** we used the **Sub-national revenues (% of GDP)** provided by the World Bank - decentralization indicators[18];
- The **ease of access to small arms and light weapons** (SALW), provided by the *Economist Intelligence Unit*. This variable is ranked from 1 to 5, 5 standing for a country where it is easy to obtain a SALW;
- As environmental variable, we introduced a measure of CO^2 emissions. World Bank – World Development Indicators. The measure is expressed metric tons per capita.

[17] Marshall, M.T., Gurr, G.R. and Jaggers, K., (2009)
[18] These data are the average between 1994-2000.

As internal factors (subjective variable):

- We introduced Gallup World Poll **worry** question: "Did you experience the following feelings during a lot of the day yesterday? How about: Worry?"
  NB: the variable is the percentage of the population declaring they were worried.

We did not choose these variables randomly. Indeed, Di Tella & MacCulloch (2008) cited by Senik & Clark (2010) suggest that "omitted variables could hide the positive influence of GDP growth"[19]. These potentially "omitted variables" are listed by Senik & Clark (2010): pollution, work stress and inequality. We therefore gathered variables reflecting these concerns. (*NB: we devote our last section to inequality).*

Aiming to question the influence of the current crisis on the relationship between growth and Subjective Well-Being, we decided to introduce another GDP growth variable, replacing the yearly growth rate, by a growth rate over a 10 year period. Therefore we computed a new variable this way:
GDPgrowth $D_{i,j}$ = GDPgrowth$_i$ between year j and year j-10.

We display in **table 23,** p.23, the GLS estimations of the 8 models we constructed with these new controls.

Interpretation

The new controls we introduced provide intuitive and already observed results. Democracy and decentralization seem to improve life satisfaction, whereas inflation, worry feelings, CO^2 emissions, and easy access for weapons tend to lower satisfaction.

As noted previously, **growth steadily reduces Subjective Well-Being**, whatever the controls. Moreover, introducing a GDP growth over a 10 years period does not change growth behavior towards life satisfaction. Thus, we are bound to conclude that growth is adversely associated with life satisfaction.

We computed a Variance Inflation Factor (VIF) test for multicolinearity, in order to detect any abnormally lowered coefficients. The VIF mean for model (9.) - that gathers the largest number of controls- is just above the critical value[20] (Mean VIF: 10.89). However, this multicolinearity issue appears to be the fact of the correlation between Log GNI and the worry variable. Once the worry variable excluded, the VIF mean value plummets to 5.91.

Therefore, we suggest that the "omitted variables" and their side effects do not disturb coefficient estimations. Nevertheless, we obviously need to investigate the reasons of such a negative correlation between growth and SWB.

In the last section, trying to understand better growth side effects, we question the role of inequality. The rehabilitation of the relative income theory, challenged by Hagerty and Veenhoven (2003), Stevenson and Wolfers (2008; 2010) may indeed explain our findings.

[19] Senik, C. Clark, A. (2010) p.25.
[20] VIF critical value is 10 for this test.

Table 23. GLS estimation of life satisfaction determinants

Tested models	Model 1.	Model 2.	Model 3.	Model 4.	Model 5.	Model 6.	Model 7.	Model 8.	Model 9.	Model 10
Log GNI *per capita*		1.330***		2.376***		1.453***			1.625***	1.869***
Z		(15.12)		(5.49)		(17.35)			(17.52)	(11.38)
GNI *per capita* ($ hundreds)	0.010***		0.009***		0.010***			0.010***		
Z	(13.20)		(17.56)		(15.90)			(15.52)		
GNI² *per capita* ($ hundreds)	- 1.32E-05***		-1.04E-05***		- 1.12E-05***			- 1.18E-05***		
Z	(-7.41)		(- 12.89)		(- 10.90)			(- 8.90)		
GDP growth	- 0.020***	- 0.018***	- 0.016***	- 0.010***	- 0.012***	- 0.017***	- 0.034***			
Z	(- 7.06)	(- 4.78)	(- 5.19)	(- 7.20)	(-4.40)	(- 4.35)	(- 17.23)			
GDP growth 10years								- 0.001***	- 0.001***	- 0.001***
Z								(-5.81)	(- 6.07)	(- 5.24)
Health satisfaction	0.030***	0.031***								
Z	(13.48)	(10.53)								
Job situation	0.013***	0.012***	0.016***	0.010***	0.010***	0.016***	0.027***	0.012***	0.010***	0.025***
Z	(9.80)	(7.78)	(13.06)	(17.31)	(7.79)	(11.45)	(23.57)	(8.66)	(7.43)	(8.45)
Democracy	0 .036***	0 .038*								
Z	(5.69)	(3.78)								
Weapon access	0.044*	0.041								
Z	(1.78)	(1.14)								
Inflation			- 0.008***	-0.007***	- 0.009***	- 0.013***	- 0.066***	- 0.005	- 0.005	0.010
Z			(-2.67)	(-7.03)	(- 3.62)	(- 3.74)	(- 14.04)	(- 1.23)	(-1.37)	(1.60)
Sub-national revenues			0.022***	- 0.013	0.018***	0.027***	0.073***	0.018***	0.027***	0.030***
Z			(3.46)	(-0.16)	(2.26)	(4.15)	(17.52)	(3.16)	(3.99)	(6.91)
Worry yesterday					- 0.013***	- 0.009***	0.004*	- 0.008***	- 0.014***	- 0.011***
Z					(- 4.92)	(- 3.27)	(1.71)	(- 3.54)	(- 5.31)	(- 3.52)
CO² emissions *per capita*										- 0.079***
Z										(- 5.55)
Wald	2068.34	821.75	3908.11	628.67	1482.41	1951.53	2752.76	1602.85	1075.36	10202.39
Prob > chi2	0.000	0.000	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
Sample size N=	239	239	226	226	226	226	227	228	228	70

Dependent variable: *Life satisfaction today*

V. Inequality and relative income: l'enfer c'est les autres[21] ?

As previously suggested, the key to the growth puzzle may lie in growth side effects. As reminded by Clark and Senik (2010) inequality is one of the "usual suspects". The underlying theory is the consideration of relative rather absolute income.

The relative income theory, as formulated by Easterlin, states that if income increases for everyone, satisfaction does not improve. Easterlin suggests that Subjective Well-Being depends on the comparison of consumption levels among a reference group. For Easterlin, this matter of fact would explain the lack of correlation between growth and life satisfaction.

Nevertheless, as we underlined, this statement is based on the assumption of a balanced growth that would affect everyone to the same extent. Thus, an unbalanced growth, with room for increasing inequality, may undermine SWB more than sustain it.

On the other hand, positive correlation supporters suggest that the absolute income effect oversteps the relative one. Hagerty and Veenhoven (2003), using time series, argued that a combination of relative and absolute income is involved in SWB variations. Nonetheless, they observed that in cross-section studies, social comparisons and relative income were no longer detected.

Questioning the relative income hypothesis, we introduced two different variables. We first used the **Gini index,** to investigate the influence of income inequality on life satisfaction. We assumed a significant correlation between inequality and SWB tend to prove the prevalence of the relative income assumption.

Furthermore, we also computed an **internal** variable, as the **difference between population's evaluation of their country situation and population's evaluation of their own situation**. Gallup World Poll provides a "Country today question"; its formulation is described in Annex 2, p.32.
We computed this subjective inequality variable, with the following formula:

Diff life country $_{ij}$ = abs (Life satisfaction today$_{ij}$ - country today$_{ij}$)

For the relative income assumption to be validated we should observe a significant correlation - whatever its direction - between happiness and the **Diff life country** $_{ij}$ variable; the more perceived income gap, the greater - or the less - satisfaction.

To give the reader more information on the distribution of this gap, we display above the variable summary, before applying the absolute value:

Variable	Observation	Mean	Standard Deviation	Min	Max
Diff life country	182	0.2379	1.594	-3.7	3.8

As no trend between positive or negative seems to emerge, the sign question is worth investigating. In this perspective, we created a binary variable taking into account gap directions.
This dummy variable takes the following values:

0, if: Satisfaction life today - country situation today <0;
1, if: Satisfaction life today - country situation today >0.

Sorting observations using this binary, we will be able to differentiate the impact of the sign upon self-reported well-being. First, we will use the Gini index to test the relative income hypothesis.

[21] *Hell, is the others*, Jean-Paul Sartre.

A. Introducing the Gini index

We use the Gini index provided by the Human Development Report Office - UNDP. This index is scaled from 0 to 100; **0** standing for a **perfect equal income** distribution. Taking into account the limited availability of the Gini index and in order to increase our sample size, we had to use a delayed Gini index. Thus, the data we gathered is the Gini index from 2003 to 2007. However, this limit will have little influence since income structures within countries are not quite sensible to short run events. We tested the influence of income distribution on three different models:

(a.) $\text{Life satisfaction}_{ij} = \alpha_{ij} + \beta_1 \text{logGNI per capita}_{ij} + \beta_2 \text{GDP growth}_{ij} + \beta_3 \text{ job situation}_{ij} + \beta_4 \text{ health satisfaction}_{ij} + \beta_5 \text{weapon access}_{ij} + \beta_6 \text{ Democracy}_{ij} + \beta_5 \text{Gini}_{ij} + u_i + \varepsilon_{ij}$

(b.) $\text{Life satisfaction}_{ij} = \alpha_{ij} + \beta_1 \text{ GDP growth}_{ij} + \beta_2 \text{ job situation}_{ij} + \beta_3 \text{ health satisfaction}_{ij} + \beta_4 \text{ weapon access}_{ij} + \beta_5 \text{Democracy}_{ij} + \beta_5 \text{Gini}_{ij} + u_i + \varepsilon_{ij}$

(c.) $\text{Life satisfaction}_{ij} = \alpha_{ij} + \beta_1 \text{GNI per capita}_{ij} + \beta_2 \text{GDP growth}_{ij} + \beta_3 \text{worry}_{ij} + \beta_5 \text{Gini}_{ij} + u_i + \varepsilon_{ij}$

We displayed in table 24, the estimations of these three models:

Table 24. GLS estimation of life satisfaction determinants: the relative income hypothesis

Parameters / Tested model	Model (a.)	Model (b.)	Model (c.)	Model (d.)	Model (e.)	Model (f.)
Log GNI *per capita*	0.937**			0.518**		
Z	(2.46)			(2.48)		
GNI *per capita* ($ hundreds)			0.010***			0.006***
Z			(10.83)			(20.83)
GDP growth	- 0.067***	- 0.069***	- 0.028***	- 0.040***	0.008	- 0.001***
Z	(- 4.37)	(- 8.44)	(- 4.62)	(- 4.99)	(0.76)	(- 0.12)
Health satisfaction	0.043***	0.065***		0.046***	0.056***	
Z	(5.09)	(5.31)		(5.78)	(5.69)	
Job situation	0.047***	0.033***		0.016***	0.052	
Z	(6.90)	(4.70)		(4.42)	(1.34)	
Democracy	0.045	0.064****		0 .048**	0.134****	
Z	(1.64)	(2.89)		(2.22)	(3.36)	
Weapon access	-0.016	0.028		-0.217***	-0.388***	
Z	(-0.18)	(0.31)		(-2.89)	(-4.76)	
Worry yesterday			- 0.017***			- 0.010***
Z			(- 3.23)			(- 4.95)
Gini Index	0.046***	0.045***	0.054***			
Z	(5.47)	(4.14)	(10.69)			
Abs(life - country)				0.226***	0.086	0.133***
Z				(10.89)	(1.55)	(4.43)
Wald	333.85	232.60	697.62	452.58	75.06	712.27
Prob > chi2	0.000	0.000	0.000	0.000	0.00	0.000
Sample size N=	24	24	51	40	40	90

Dependent variable: *Life satisfaction today*

Interpretation

Gini index coefficients are all positive and significant confirming that inequality seems to have a positive impact on life satisfaction. Furthermore, income distribution seems to have a strong impact on life satisfaction as Gini index coefficient is comparable to the ones of job situation and health satisfaction. Nevertheless, the limited sample size - developed countries oriented - does not allow drawing very strong conclusions. However, using different controls the sign and significance of Gini index coefficients remain steady, corroborating the relative income assumption.

If Gini index availability remains limited, Gallup "country today" question has a broader coverage.

B. Introducing subjective inequality

As previously discussed, we decided to use a subjective evaluation of the difference between country situation and personal situation. Thus, for the three previous models, we replaced Gini index by our gap variable: **Diff life country$_{ij}$.** A first observation suggest that subjective inequality seems strongly and positively correlated with happiness (cf. Annex 6. p.35).

The previous **table 24** also displays the resulting estimations of these new models:

(d.) $\text{Life satisfaction}_{ij} = \alpha_{ij} + \beta_1 \text{logGNI per capita}_{ij} + \beta_2 \text{GDP growth}_{ij} + \beta_3 \text{ job situation}_{ij} + \beta_4 \text{ health satisfaction}_{ij} + \beta_5 \text{weapon access}_{ij} + \beta_6 \text{ Democracy}_{ij} + \beta_5 \textbf{Diff life country}_{ij} + u_i + \varepsilon_{ij}$

(e.) $\text{Life satisfaction}_{ij} = \alpha_{ij} + \beta_1 \text{ GDP growth}_{ij} + \beta_2 \text{ job situation}_{ij} + \beta_3 \text{ health satisfaction}_{ij} + \beta_4 \text{ weapon access}_{ij} + \beta_5 \text{Democracy}_{ij} + \beta_5 \textbf{ Diff life country}_{ij} + u_i + \varepsilon_{ij}$

(f.) $\text{Life satisfaction}_{ij} = \alpha_{ij} + \beta_1 \text{GNI per capita}_{ij} + \beta_2 \text{GDP growth}_{ij} + \beta_3 \text{worry}_{ij} + \beta_5 \textbf{ Diff life country}_{ij} + u_i + \varepsilon_{ij}$

Interpretation

Except for model **(e.)** the coefficient of the "subjective inequality" variable appears much stronger than the one of the Gini index. This observation is consistent with findings of other researchers investigating the relative income assumption. Moreover, whatever the configuration, the sign of the coefficient remains positive. Model **(f.)** flags the broader coverage with 90 observations. So far, the relative income theory seems validated.

As final analysis, we will try to take into account the sign of the spread between individuals' evaluation of their situation and their view one the situation of their country.

C. Taking into account the gap direction

We previously described the way we computed a binary variable that takes into account the gap direction. Splitting our sample according to this binary, we estimated the three same models.

For binary = 0 (Life Satisfaction - Country situation <0)

Table 25. GLS estimation of life satisfaction determinants, relative income hypothesis

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
Log GNI per capita	0.876***	0.055	15.84	0.000	0.76770	0.98453
GDP growth	0.014***	0.002	5.89	0.000	0.00906	0.01810
Worry yesterday	-0.026***	0.006	-4.62	0.000	-0.03683	-0.01490
Abs (diff life country)	-0.196***	0.038	-5.13	0.000	-0.27059	-0.12107
Constant	2.493***	0.254	9.80	0.000	1.99420	2.99137
Wald chi2(4) = 583.81						
Prob > chi2 = 0.000						
N= 23						

Dependent variable: Life satisfaction today

For binary = 1 (Life Satisfaction - Country situation >0)

Table 26. GLS estimation of life satisfaction determinants, relative income hypothesis

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
Log GNI per capita	1.279***	0.105	12.15	0.000	1.07305	1.48563
GDP growth	-0.055***	0.010	-5.27	0.000	-0.07490	-0.03430
Worry yesterday	-0.006***	0.002	-2.80	0.005	-0.00990	-0.00176
Abs (diff life country)	0.559***	0.047	11.92	0.000	0.46668	0.65038
Constant	0.545	0.435	1.25	0.210	-0.30735	1.39800
Wald chi2(4) = 1904.06 Prob > chi2 = 0.000 N= 42						

Dependent variable: Life satisfaction today

Interpretation

The resulting estimations show that **both gaps** (positive and negative) **are significant**, validating the relative income theory. Moreover, the signs of the gap appear consistent : feelling better than others improves happiness, feeling worse than others reduces SWB.

We were not able to confirm Duesenberry's theory stating that "Wealthier people impose a negative external effect on poorer people but not vice versa"[22]. Indeed, it turns out that the coefficient for binary =1 is superior in absolute value: 0.559 > 0.196.

In other words, feeling better off than others, appears to provide a larger satisfaction than feeling worse off drives happiness reduction. Nevertheless taking into account the small size of our sample these results remain weak.

D. Conclusion

In sum, our findings strongly corroborate the relative income assumption. Using Gini index as objective evaluation of income distribution and a perceived inequality evaluation as a subjective measure, we observed the strong impact of inequality on life satisfaction.

While the introduction of the Gini index tends to show that inequality is positively correlated with life satisfaction, the story appears incomplete. Using macro data, we were not able to investigate individual positioning within local reference groups. To bypass this difficulty, we introduced a subjective evaluation. The resulting perceived inequality actually more reflects individuals' expectations and shows that the relation between SWB and inequality is way more complex than the Gini analysis we conducted suggests.

We invite our readers referring to the work of Carol Graham & Andrew Felton (2005) who conducted an in-depth analysis of the relationships between SWB and inequality.

Once again, our results appear contradictory with Stevenson and Wolfers (2008; 2010). The existence of a relative income effect would explain that an unbalanced growth adversely affects self-reported well-being.

[22] Frey, B. Stutzer, A. (2002) p.9.

VI. Conclusion

Using the most complete aggregated dataset available, we investigated the relation between Subjective Well-Being, income, growth and inequality. We find out that the curvilinear relation between income and self-reported well-being could be challenged by the quadratic one. It now appears difficult to reject the existence of income decreasing returns, so decreasing that it seems possible to consider, not only a weak, but negative correlation between income and happiness for the wealthiest countries. Nevertheless, this perspective is likely dependent on the sample size. However, we see no objective reasons to get rid of Japan, Hong Kong, Qatar, Kuwait, Singapore, countries with very high GDP per capita but average self-reported well-being.

These observations clearly contradict recent studies suggesting a steady positive correlation between income, growth and Subjective Well-Being.

Questioning the link between economic growth and happiness, we find strong evidence showing a significant negative correlation. We explain this paradox confirming the prevalence of a relative income effect. Indeed, testing both objective and subjective income inequality, we find out that inequality was strongly correlated with life satisfaction. However, we showed that inequality actually drives satisfaction in two opposite directions according to people perceived position among society.

Finally, we suggest that the disconnection between growth and well-being lies in growth inability to share its benefits. Nonetheless, the few inequality data available does not allow proving this assumption.

Keeping Abramovitz in mind, we suggest our readers to stay somehow skeptical with Subjective Well-Being studies; and researchers humble with what remains fragile conclusions. As under- lighted by Carol Graham, this kind of studies appears sensible to the sample size and context.

If our researches were conducted with the most up-to-date dataset, mind changes… This kind of study is by nature subject to human soul convolutions... However taking into account what the literature has long identified as life satisfaction determinants (e.g. friendship, family, health, work etc.) it seems difficult to contradict one of the oldest mankind saying: money can’t buy happiness.

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Annex

Annex 1. Gallup "life satisfaction" question

Life satisfaction today: "Please imagine a ladder with steps numbered from zero at the bottom to ten at the top. Suppose we say that 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, assuming that the higher the step the better you feel about your life, and the lower the step the worse you feel about it? Which step comes closest to the way you feel?"

Annex 2. Gallup "Country today" question

Country today question: "Now, I will ask you some questions about your country. Once again, imagine a ladder with steps numbered from o at the bottom to 10 at the top. Suppose the top of the ladder represents the best possible situation for your country and the bottom represents the worst possible situation. What is the number of the step on which you think your country stands at the present time?"

Annex 3. Subjective Well-Being and GDP per capita, functional form investigation (Pooled dataset)

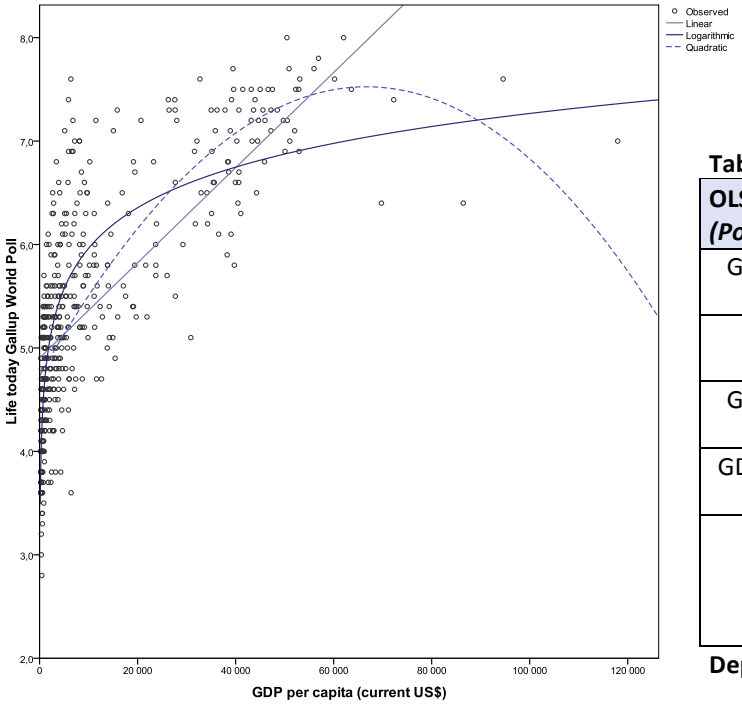
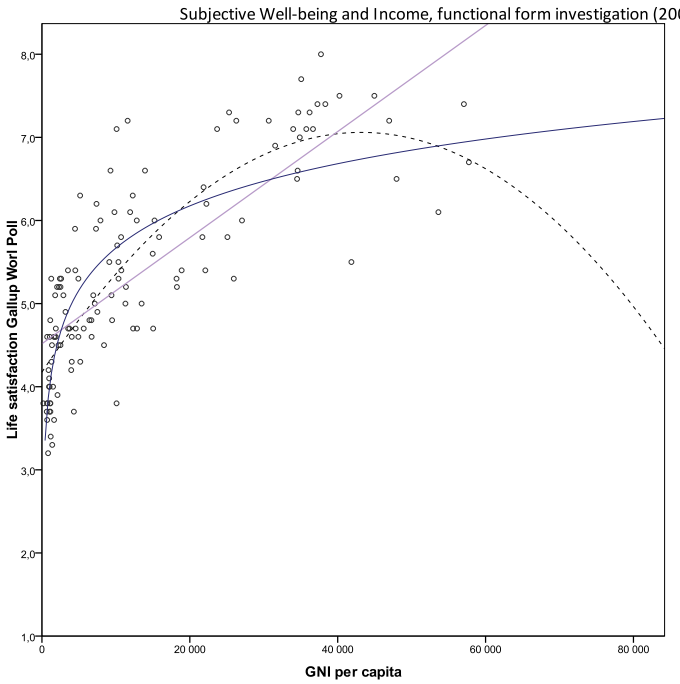


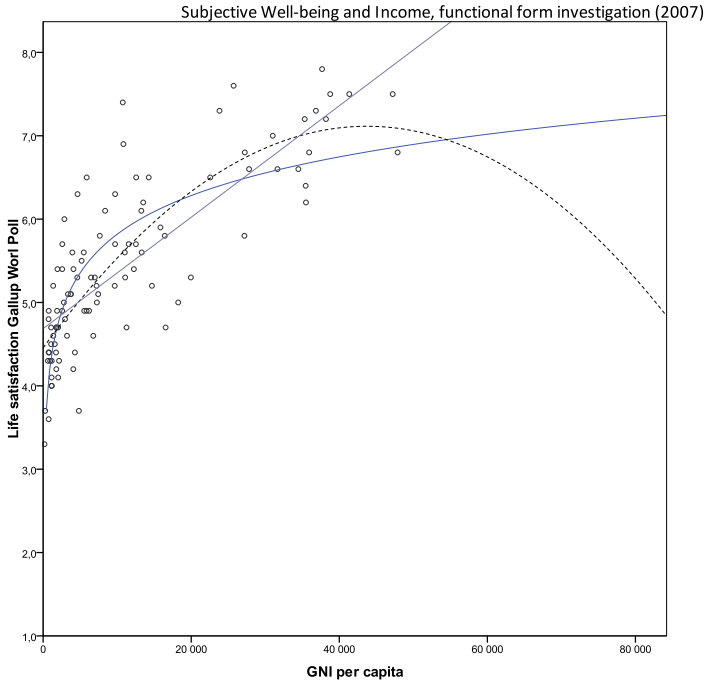
Table A. Life satisfaction and GNI, functional form investigation

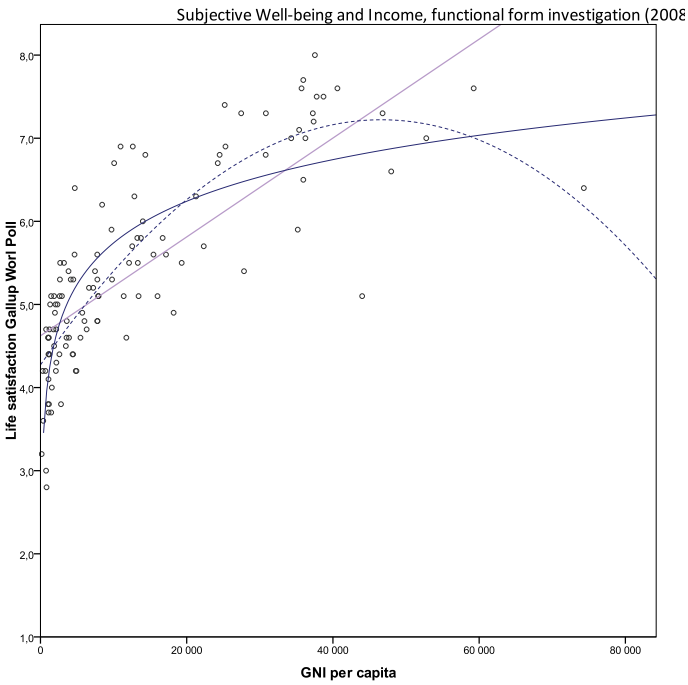
OLS estimation *(Pooled dataset)*	Linear adjustment	Log adjustment	Quadratic adjustment
GDP per capita ($100)	0.005***		
t	(21.921)		
Ln(GDP per capita)		0.566***	
t		(29.381)	
GDP per capita ($100)			0.008***
t			(18.732)
GDP² per capita ($100)			-6.28E-6***
t			(-9.357)
R^2	0.519	0.660	0.598
Adjusted R^2	0.518	0.659	0.597
Number of observations (N)	447	447	447

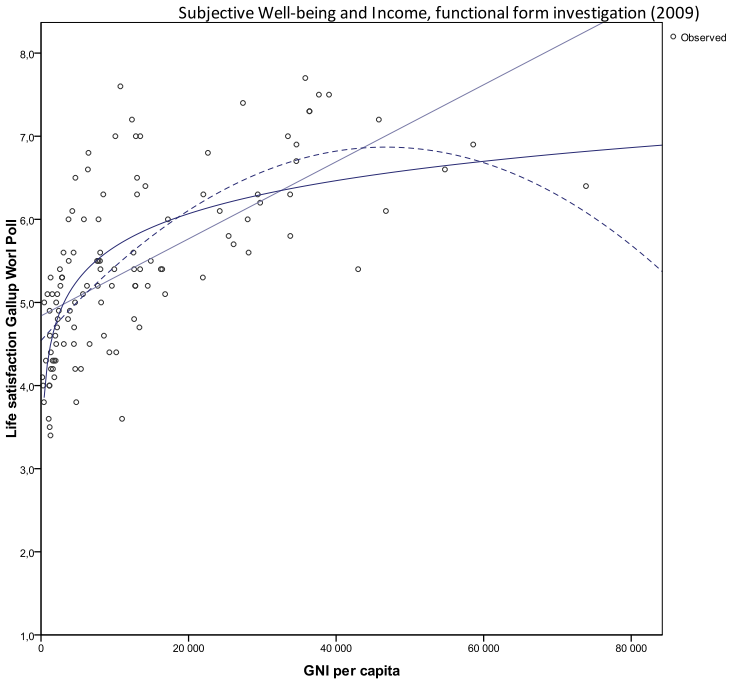
Dependent variable: Life satisfaction today, Gallup World Poll

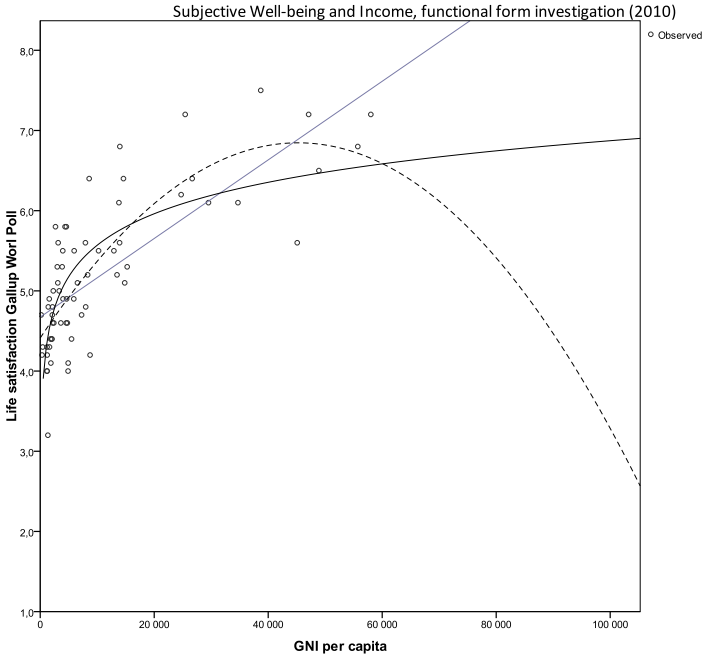
Annex 4. Subjective Well-Being and GNI per capita, functional form investigation from 2006 to 2010











Annex 5. Estimations using ordered probit method

Table 5.1 Ordered probit estimation of life satisfaction determinants : basic model

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
Log GNI per capita	3.914***	0.471	8.31	0.000	2.99039	4.83754
Job situation	0.035***	0.008	4.36	0.000	0.01926	0.05073
Health satisfaction	0.081***	0.016	5.17	0.000	0.04999	0.11106
Education level: Secondary	0.024***	0.009	2.70	0.007	0.00648	0.04092
rho Constant	0.647***	0.065	9.88	0.000	0.51889	0.77560

LR chi2(5) = 228.63
Prob > chi2 = 0.000
Log likelihood = -275.44552
N= 345

Dependent variable: *Life satisfaction today*

Table 6.1 Ordered probit estimation of life satisfaction determinants

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
GNI per capita ($ hundreds)	0.031***	0.004	7.54	0.000	0.02304	0.03923
GNI² per capita ($ hundreds)	-3.72E-05***	6.43E-06***	-5.79	0.000	-0.00005	-0.00002
Job situation	0.034***	0.008	4.20	0.000	0.01808	0.04976
Health satisfaction	0.086***	0.016	5.46	0.000	0.05502	0.11662
Education level: Secondary	0.030***	0.009	3.49	0.000	0.01302	0.04648
rho Constant	0.646***	0.065	9.89	0.000	0.51768	0.77355

LR chi2(5) = 228.51
Prob > chi2 = 0.000

Log likelihood = -275.50552
N= 345

Dependent variable: Life satisfaction today

Table 16.1 Ordered probit estimation of life satisfaction determinants : the role of GDP growth

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
Log GNI per capita	4.471***	0.482	9.28	0.000	3.52659	5.41460
Job situation	0.047***	0.010	4.93	0.000	0.02830	0.06566
Health satisfaction	0.082***	0.016	5.02	0.000	0.05002	0.11406
GDP growth	-0.058***	0.018	-3.16	0.002	-0.09365	-0.02189
rho Constant	0.678***	0.061	11.17	0.000	0.55935	0.79747

LR chi2(5) =231.85
Prob > chi2 = 0.000
Log likelihood = -273.83141
N= 345

Dependent variable: Life satisfaction today

Table 17.1 Ordered probit estimation of life satisfaction determinants : the role of GDP growth

Parameter	Coefficient	Standard error	Z	P>|Z|	Confidence Interval 95%	
					lower bound	upper bound
GNI per capita ($ hundreds)	0.016***	0.002	8.01	0.000	0.01188	0.01959
Job situation	0.039***	0.010	3.82	0.000	0.01912	0.05931
Health satisfaction	0.089***	0.018	4.87	0.000	0.05338	0.12530
GDP growth	-0.057***	0.019	-3.08	0.002	-0.09398	-0.02095
Constant	0.776***	0.045	17.07	0.000	0.68715	0.86548

LR chi2(5) =175.25
Prob > chi2 = 0.000
Log likelihood = -302.13216
N= 345

Dependent variable: Life satisfaction today

Annex 6. Life satisfaction and subjective inequality