An Empirical Study of the Effects of Relative Income and Income Inequality on Subjective Well-Being in the United Kingdom

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Declaration

I, Héctor Espinoza Bustos, hereby declare that the work presented in this dissertation is my own original work. Where information has been derived from other sources, I confirm that this has been clearly and fully identified and acknowledged. No part of this dissertation contains material previously submitted to the examiners of this or any other university, or any material previously submitted for any other assessment.

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Classification

This piece of research is primarily (please tick as appropriate):

✓ an empirical / econometric study

▪ the examination of a theoretical problem

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Abstract

The main objective of this empirical dissertation is to understand the effects of comparison income on individual well-being. In order to do this, elements of the value function of prospect theory (Kahneman and Tverky, ), such as reference dependence, asymmetry of valuations and loss aversion are considered. Several hypotheses are tested: 1) the importance of own income; 2) the relevance of the income of the reference group (reference income); 3) the relevance of relative income (distance between own income and reference income); 4) asymmetries of comparisons (i.e., the comparison income effect on subjective well-being (SWB) differing between people above or below the reference income); 5) the importance of income inequality on SWB; and 6) asymmetries of effects of inequality on SWB depending on position in the income distribution (i.e., for people above and below the reference income group). The analysis uses a self-reported measure of life satisfaction as a proxy for SWB. The data come from the first cross section of the Annual Population Survey (2011), dedicated to subjective well-being in the United Kingdom. The main conclusions, assuming causality of income on SWB, are that comparison income is more relevant than absolute income for SWB, the effect of the reference income on SWB is negative, individual well-being increases the larger the income is in comparison to the reference income, comparisons are upward looking i.e., only negative externalities from high earners, which means asymmetries of valuation on SWB, and suggests loss aversion (Kahnemann and Tversky, 1991). Furthermore, it is observed that inequality aversion is independent of position in the income distribution. Finally, considering that SWB is increasing in popularity and also that it is becoming relatively important in economics, further theoretical and empirical research is recommended, for instance with regard to causality and unobserved heterogeneity issues.

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Introduction

Discussing new ideas orientated towards improving people’s quality of life, the well known ‘Stiglitz Commission’ ordered by the former French president, Nicholas Sarcozy, recommended focusing on objective and subjective measures of well-being (Stiglitz et al., 2009). Objective measures have a long-standing tradition in economics, where the major measure is GDP per capita. However, subjective measures of well-being are considered a new area of development (Oswald, 2010).

Defining subjective well-being (SWB) is not an easy task. According to Hicks and Tinkler (2011), difficulties arise around its subjective nature (SWB does not represent factual evaluations), and because different (but not mutually exclusive) concepts such as happiness, life satisfaction and quality of life, have been used interchangeably. In this scenario, with some variations in the literature, subjective well-being is defined as a multidimensional, cognitive and affective, evaluation of life (Diener, Lucas and Oishi, 2003; Conceicao and Bandura, 2008).

As a multidimensional concept, and from a methodological point of view, subjective well-being can be divided into three different types of measures (Dolan, Layard and Metcalfe, 2011; Dolan, White and Peasgood, 2007; Hicks, 2011):

- Evaluation: a cognitive assessment of people’s life. This type of measure can influence relevant individual decisions, and is often used in public policy (Hicks, 2011). It is the most popular type of measure (incorporating, for instance, life satisfaction), and is usually present in large surveys.
- Experience: measures time use and feelings associated with everyday events. The Day Reconstruction Method (Kahnemann, Krueger, Schkade and Schwarz, 2004) and the Princeton Affects Time Use Survey (Kahnemann et al., 2004; 2006) are examples of different methodologies that collect SWB data based on the experience approach (using diaries and surveys).
• Eudemonic: measures the purpose and meaning of life. Less used, but increasingly prevalent in large surveys.

One of the most interesting topics in the economics of subjective well-being was established by Easterlin (1974 and 1995) and is based on the relationship between income and SWB. According to the *Easterlin Paradox*, in the long term and in international comparisons, there is no significant association between traditional objective measures of economic growth, such as GDP per capita, and levels of happiness (Easterlin, 1974; Oswald, 1997). Evidence supporting this hypothesis has been found using time series econometrics, mainly in developed countries, such as the US (Easterlin, 1974), Germany (Ferrer-i-Carbonell, 2004) and the United Kingdom (Blanchflower and Oswald, 2004; Waldrom, 2010; Clark, 2003; Clark and Oswald, 2003).

Figure 1: The Easterlin Paradox in the United States (source, Clark et al., 2008)

![Graph showing the Easterlin Paradox](image)

The main explanation for this paradox comes from the *relative income hypothesis* (Duesenberry, 1952), which states that an individual’s utility (or disutility) emerges from comparing incomes with relevant others, leaving, in this sense, little room for the potential effect of absolute income. This dependence of subjective well-being on relative income can be related to the reference dependence concept in Prospect Theory (Kahnemann and Tversky, 1979; 1995). Furthermore, the characteristics
of asymmetry and loss aversion described by Kahnemann and Tversky (1991), could be present in cases where the relative income effect is different for individuals above (gains) or below (losses) the reference income. In other words, this means that individuals value their subjective well-being depending on where they are situated in the income distribution (above or below the reference group), and in this sense it is observed that subjective well-being is also related to the concept of income inequality.

The main objectives of this empirical dissertation are to understand the effects of absolute income, relative income, and income inequality on subjective well-being in the United Kingdom, considering some of the most relevant elements of Prospect Theory (such as reference dependence, asymmetry of valuations and loss aversion). Absolute income is represented by self-declared income; reference income is defined as average regional income; relative income corresponds to the ratio between absolute income and reference income; and finally, the income inequality index correspond to the ratio between the 5th (richer) quintile and the 1st (poorer) quintile in the income distribution.

In the United Kingdom, in the spirit of the Stiglitz Commission (Dolan and Metcalfe, 2011), the Government and the Office for National Statistics have launched, in November 2010, the ‘Measuring National Well-Being’ programme. In this initiative, one of the firsts actions was the creation of a large new dataset specifically dedicated to subjective well-being and suitable for research. The dataset is part of the Annual Population Survey, and in July 2012, the first cross-sectional measures were released. This dataset is used in this dissertation. The variable of life satisfaction (an evaluation measure) is taken as the dependent variable in this study, and the main explanatory variables outlined in the subjective well-being literature were included. This appears to be the first piece of empirical research that uses this new data, and with the combination of all of the elements mentioned above, this dissertation intends to advance the economics of subjective well-being.

The rest of the dissertation is structured as follows: Section 2 conducts a revision of the relevant literature. Section 3 defines hypotheses and the empirical approach, Section 4 explains the database,
and systematises the definition and operationalization of the main variables. Section 5 presents the results. Section 6 discusses the main findings from the investigation and concludes.
Background and Literature Review

The theoretical section of this dissertation is divided into five parts: 1) From revealed preferences to subjective well-being; 2) Subjective Well-Being Research: Validity, Reliability and Causality; 3) Elements of Prospect Theory: Reference Income, Asymmetries and Loss Aversion; 4) Inequality, Inequality Aversion and Loss Aversion; and 5) Main findings in the literature.

1) From Revealed Preference to Subjective Well-Being

The traditional approach in neoclassical economics utilises the revealed preferences approach. This theory stress the idea that rational\(^1\) agents can express their preferences over ranked commodity bundles (Fuentes and Rojas, 2001; Mas-Colell et al., 1995). The consumption of higher commodity bundles is preferred, because they give more satisfaction (more is better). This is the main idea of *utility*, which is therefore derived from consumption decisions. In this context, the natural goal of a rational agent is utility maximisation (to obtain more preferred bundles) within the confines of budget constraints\(^2\) in a fully informed market. If the budget constraint is expanded, which in this context means an increase in income, agents can obtain more utility and more preferred commodity bundles. In traditional economics notation:

\[
U = u(y), \ u' > 0 \text{ and } u'' < 0,
\]

where \(U\) is utility, \(y\) is income (a proxy for consumption), and \(u'\) and \(u''\) are the first and second

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\(^1\) According to the axioms of revealed preferences, preferences are *rational* if the preference relation \(\geq\) possesses the following two properties (Mas-Colell et al, 1995):

- Completeness: for all \(x, y \in X\), \(x \geq y\) or \(y \geq x\) or both. Preference (or indifference) can be expressed for any two goods.
- Transitivity: for all \(x, y, z \in X\), if \(x \geq y\) and \(y \geq z\) then \(x \geq z\). If \(x\) is preferred to \(y\), and \(y\) is preferred to \(z\), then it must be the case that \(x\) is preferred to \(z\). This also applies for indifference, instead of preference.

\(^2\) Other types of constraints are also possible; however, the budget constraint related to income is one of the most relevant constraints.
derivatives with respect to income.
From here, it is only natural to think that more income and economic growth produce well-being. This is the reason why objective economic growth\(^3\) has traditionally been considered the main goal of economic policy\(^4\) (Fuentes and Rojas, 2001; Mas-Colell et al., 1995).
However, some anomalies have been discovered in the preference approach (Kahneman et al, 2004; 2006 ; 2010). For instance, preference interdependence (e.g., comparison with peers); hedonic adaptation (e.g., the relevance of time-lagged income); heuristics (e.g., the use of rules of thumb that can lead to utility misprediction and/or the arbitrary use of preferences and valuations); and not-full rational agents (e.g., bounded rationality, where preferences are time and context-dependent) that do not take some of the opportunities to maximise utility. These anomalies show that utility maximisation is not always the case with *irrational* agents. Hence, preferences are not always complete and transitive (Fujiwara and Campbell, 2011). This is where the revealed preference approach fails, and where the subjective well-being approach has emerged as a valid complementary approach.

2) Subjective Well-Being Research: Validity, Reliability and Causality

**Validity in SWB research**

Validity is one of the big questions in subjective well-being research, and to address this issue, economists generally present the following relevant assumptions:\(^5\)

\[
\text{SWB}_i = f_i(u_i) + \epsilon_i
\]

- Reported SWB is considered an ordinal proxy for direct (true latent) cardinal utility;

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\(^3\) For instance, measured as GDP per capita.

\(^4\) More budget translates into more consumption, which means more preferred bundles, and finally, more utility.

\(^5\) Relevant literature in this section: Dolan, 2012 ; Layard, Mayraz and Nickell, 2008 ; Dolan, White and Peasgood, 2007 ; Ferrer-i-Carbonell and Frijters, 2004 ; Blanchflower and Oswald, 2004 ; Frey and Stutzer, 2002.
• Reported SWB is comparable between individuals (interpersonal ordinal comparability): the reporting function, $f_i$, produces monotonic transformations and is a common language between individuals;
• Reported SWB depends (linearly) on multiple variables and is independent of income;
• Reported SWB may contain errors, but if randomly distributed with mean $\varepsilon_i = 0$, it is possible to use ordered logit or probit regressions.

It is worth noting that some evidence supports validity in SWB research (Layard, Mayraz and Nickell, 2008; Kahneman et al, 2004; Blanchflower and Oswald, 2004; Clark and Oswald, 1996). First, reports of subjective well-being seem to be consistent with traditional measures of utility. Second, experiments show that brain activity is well correlated with reports of subjective well-being across people and over time. Third, subjective well-being measures correlate well with external factors such as smiles or signs of stress, and furthermore can predict future outcomes (such as divorce or quitting a job). Fourth, it has been demonstrated that individuals can recognize and predict the subjective well-being of other people from the same culture and from different cultures too (Clark, Frijters and Shields, 2011).

**Reliability in SWB research**

Subjective well-being reports are fairly stable through time, showing a test/re-test correlation near to 0.6 (Krueger and Schkade, 2008). However, it is worth noting that this indicator can be influenced by lags between times of asking, and by the scale of measurement used (Helliwell and Barrington-Leigh, 2009).

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6 Below it will be stated that also OLS regressions can be used in empirical SWB research.
7 According to Helliwell and Barrington-Leigh (2009), multi-item questionnaires are the most reliable.
Causality in SWB research

From a theoretical point of view, it is possible to assert that key explanatory variables impact directly on subjective well-being, but considering the state of the art of the subjective well-being topic, the best option is to be prudent\(^8\) (Bechetti and Pelloni, 2011; MacKerron, 2011). Major findings (correlations) come from cross-sectional data, and to date only some results have been confirmed thanks to panel data econometrics and new dataset availables for research. Therefore, it is necessary to be extremely cautious with respect to causality, conclusions and recommendations (Blanchflower and Oswald, 2011; Dolan, White and Peasgood, 2007). Econometric models must consider the possibility of omitted variable bias (variables not included in the model that indeed determine subjective well-being), unobserved heterogeneity (e.g., personality traits), reverse causation\(^9\) and endogeneity, which are also plausible here.

\(^8\) According to Dolan (2012), it is also possible to find an indirect effect of absolute income on subjective well-being. This indirect effect means that absolute income (assumed exogenous) also impacts on some of the independent variables in the subjective well-being regression:

\[
\text{SWB} = f(\text{y, X(y)})
\]

For instance, absolute income can be associated with health and the impact of this on subjective well-being. This is mainly an issue of multicollinearity. Therefore, Dolan (2012) states that the coefficient of absolute income is generally underestimated. In other words, it can increase if indirect effects are considered.

Following Dolan (2012), a possible methodology to obtain indirect effects is:

- Run a subjective well-being regression: \(\text{SWB} = \alpha + \beta y + \gamma X(y) + \varepsilon\)
- Run an income regression: \(y = f(\text{X}) + \varepsilon\)
- Klein’s rule of thumb: if the \(R^2\) value is greater in the income regression, this is evidence of multicollinearity.
- Run auxiliary SWB regressions, dropping relevant independent variables, in order to detect changes in the income coefficient (for instance: health or education).
- Sum all changes in the income coefficient, and the result is the indirect effect that can be added to the direct effect (\(\beta\) coefficient in step 1).

\(^9\) For instance, a researcher can state that ‘health’ can bring you ‘happiness’, but on the other hand someone could argue that ‘happiness’ brings you ‘health’. Finally, both perspectives can be considered together in the discussion. This complexity, with its opportunities and limitations, has to be acknowledged in econometrics models.
3) Elements of Prospect Theory: Reference Income, Asymmetries and Loss Aversion

Traditional expected utility theory\(^{10}\) in economics is applied to economic decisions to predict outcomes under the assumption of rationality (Mas-Colell et al., 1995). It is important to note that utility is treated as a function\(^{11}\) of outcomes (which are chosen rationally):

\[ x > y \iff u(x) \geq u(y), \]

where \(x\) and \(y\) represent outcomes and \(u(x)\) and \(u(y)\) represent levels of utility.

In this setting, an agent takes decisions to maximise the value of its expected utility, which is defined as:

\[ U(L) = \sum u_n p_n \]

where \(L\) represents the lottery (probability distribution), \(u\) is the utility function (concave), and \(p\) represents probabilities.

However, some empirical findings have generated problems for expected utility theory. For instance, Allais (1953) showed with experiments that no utility function can be constructed for some choices, Kahnemann et al. (1979 and 1991) stressed the point of overweighting and/or underweighting probabilities related to outcomes, and also importantly, the natural emergence of reference points between outcomes (gains and losses) in the contexts of decisions (Kahnemann and Tversky, 1979 and 1991). In this scenario, Kahneman and Tversky (1979 and 1991) developed a solution: prospect theory.

The essential elements of prospect theory are:

\(^{10}\) Linked to the work of Von Newmann and Morgenstern.

\(^{11}\) According to expected utility theory, utility functions exist if, and only if, preferences satisfy the following properties: completeness, transitivity, continuity and independence (Mas-Colell et al., 1995).
• A prospect, \((x_i; p_i)\) which is a contract of outcomes and probabilities.
• A weighting function, \(w(p_i)\), that weights probabilities.
• A value function, \(v(x)\), similar to the utility concept, which assigns a number to every outcome.\(^{12}\)
• The value of a prospect, \(V(x,p)\) is: \(V(x,p) = w(p_1)v(x_1) + \ldots + w(p_n)v(x_n)\)

The main aspects of prospect theory, which determine preferences, are:
  • The reference point determines outcomes in terms of gains or losses.
  • Individual probabilities are mediated by a nonlinear probability weighting function.

Figure 2: A possible interpretation of the Kahnemann and Tversky's Value Function (1991)

The value function (SWB) operates over gains and losses with respect to the reference point (here, 

\[^{12}\text{The most popular value function is the power function, } v(x) = x^\alpha, \text{ and the weighting function proposed by Kahnemann and Tversky is, } w(p) = (p^\gamma/(p^\gamma + (1-p)^\gamma))^{1/\gamma}, \text{ where } \alpha \text{ and } \gamma \text{ are the parameters to be estimated.}\]
reference income), and not only absolute measures (absolute income). It is concave for gains (above the reference income) and convex for losses (below the reference income). Furthermore, it is expected to be steeper for losses than for gains as a result of loss aversion\(^{13}\) (Kahneman and Tversky, 1979 and 1991). Moreover, the distance from the reference point is important, in the sense that marginal effects decrease with the distance therefrom. This is referred to as diminishing sensitivity (Kahnemann and Tversky, 1979).

4) Inequality, Inequality Aversion and Loss Aversion

Research about subjective well-being and inequality is progressively increasing in the economics literature. Income inequality is ‘an indicator of how material resources are distributed across society’ (OECD, 2011). A priori, it is possible to think that a society with more inequality is negatively associated with subjective well-being. In fact, an important finding in previous research states that the marginal utility of income is decreasing (Layard, Nickell and Mayraz, 2008). Therefore, by the concavity of the SWB function with respect to income, more inequality is associated with less subjective well-being. In this setting, inequality aversion is defined by the (negative) slope of the income inequality measure used in this dissertation (Verme, 2007). A possible explanation for this income inequality aversion comes from the ‘relative deprivation’ hypothesis, which states that individuals situated below the reference group experience a negative sense of deprivation (Verme, 2011). Therefore, as a mechanism of defence, inequality aversion\(^{14}\) is developed in order to avoid relative deprivation (Verme, 2011).

Nevertheless, it is also plausible to think about a positive effect of inequality on subjective well-being. For example, the ‘tunnel effect’ hypothesis interprets income inequality as an ‘opportunity for upward social mobility’ (Hirschman and Rothschild, 1973). In theory, it is linked to developing countries in periods of socio-economic transformation (Senik, 2005). Following this definition, it

\(^{13}\) According to prospect theory (Kahnemann and Tversky, 1979) people are more sensitive to losses than to gains, relative to a reference point.

\(^{14}\) Inequality aversion can be interpreted as a form of risk aversion (Senik, 2005), such as uncertainty regarding future wages.
means that the reference group ‘above’ in the income distribution produces a positive externality.

The common factor behind the theory is the importance of comparisons and reference groups. According to Ferrer-i-Carbonell (2005), by asymmetry, people below the reference group report lower levels of subjective well-being (a negative externality from high earners), which can be interpreted as loss aversion (Wunder and Schwarze, 2006) and is also consistent with inequality aversion. In this context, it is observed that upward comparisons seem to dominate.

**Main Findings in the Literature**

Research about subjective well-being has mainly been conducted with cross-sectional data, and some time series and panel data.15

*Absolute Income*

Surprisingly, contrary to what neoclassical economics expects, empirical research has found only a small effect of absolute income on subjective well-being (Mackerron, 2011). This gives a limited role to economic growth and well-being. Subjective well-being has shown only a weak positive correlation with income in cross-sectional studies, across countries and with panel data conducted in developed countries (Clark and Oswald, 1994; Gardner and Oswald, 2006; Layard, Mayraz and Nickell, 2009). Furthermore, some of this positive effect seems to be related to reverse causation and/or personality traits, such as extraversion or self-esteem (Kahneman and Krueger, 2006).

A different result comes from Deaton (2007). Using only cross-sectional data, found that absolute income produces an important effect on subjective well-being (in other words, an important role for economic growth). Also, Stevenson and Wolfers (2008) and Sacks, Stevenson and Wolfers (2010),

15 The literature review can be found in several papers. Some of these are: Dolan, Layard and Metcalfe (2011); Dolan and Metcalfe (2011); Dolan, White and Peasgood (2007); Oswald (1997); Blanchflower and Oswald (2011); Kahneman, Krueger, Schkade, Schwarz, and Stone (2004); Kahneman and Krueger (2006); Frey and Stutzer (2010).
obtained similar results to Deaton (2007), with data from less developed and developed countries. However, much of their data is cross-sectional too, and they do not consider the effects of inequality in their conclusions (Layard, Mayraz and Nickell, 2009).

It is also important to note that within countries and with cross-sectional data, people with higher incomes report slightly higher levels of subjective well-being (this result is consistent across different studies). Additionally, because absolute income has shown positive but diminishing returns to income (Dolan, Layard and Metcalfe, 2011; Layard, 1980) absolute income seems to be more important in low income countries (Clark, Frijters and Shields, 2011).

**Reference Income (or Comparison Income)**

The reference income is the income against which people compare themselves. Empirical research (mainly conducted in developed countries) has consistently shown a significant negative effect on subjective well-being (Layard, 1980; Clark and Oswald, 1994). Therefore, subjective well-being depends on comparisons. However, it is also worth noting that social comparisons have been positively associated to subjective well-being in some developing countries, where people perceive more job opportunities and socioeconomic mobility (Senik, 2008).

**Relative Income**

Relative income is defined as the ratio between absolute income and reference income. Previous research, also mainly in developed countries, has shown a moderate positive correlation between relative income and subjective well-being. In this context, it has been demonstrated that when absolute income and reference income increase in the same proportion, subjective well-being remains at the same level (Easterlin, 1974; Ferrer-i-Carbonell, 2005). Thus, considering the effect of absolute income and reference income together, and using time series data, the relative income hypothesis is confirmed (Duesenberry, 1949), and the Easterlin Paradox is explained (1974):
'...raising the incomes of all does not increase the happiness of all, because the positive effect of higher income on subjective well-being is offset by the negative effect of higher living level norms brought about by the growth in incomes generally’ (Easterlin, 1995).

Finally, there is little evidence about relative income in poorer countries. However, it is expected that the relative income hypothesis is not valid in this social context (Clark et al., 2008; Akay and Martinsson, 2008) and absolute income should play a more important role.

**Inequality**

The empirical literature in the economics of inequality and subjective well-being adds complexity to the topic. First, some studies do indeed show that inequality has reduced well-being in the United States and Europe (Alesina, Di Tella and MacCulloch, 2001 and 2004; Verme, 2011); second, some cross-sectional studies state that inequality has little or no impact on subjective well-being (Senik, 2004; Verme, 2007); and third, other studies state that income inequality is positively related to subjective well-being (Clark, 2003; Haller and Hadler, 2006). According to Verme (2011), this heterogeneity of results can be explained by the selection of countries, the operationalisation of income inequality, or by a different selection of control variables, but also by different interpretations of income inequality (Dolan, White and Peasgood, 2007).

**Age**

The literature consistently shows a U-shaped relation between age and subjective well-being, where the lowest scores are concentrated in the middle age range. In other words, what has been observed is a negative correlation between age and SWB and a positive correlation between age squared and SWB (Dolan, White and Peasgood, 2007; Blanchflower and Oswald, 2011).
Gender

While some studies show that women report higher levels of SWB, others do not show significant differences (Oswald, 1997; Blanchflower and Oswald, 2011). This could be the result of cultural differences, but also suggests that other correlates are more relevant, given that different studies have different dependent variables (Dolan, White and Peasgood, 2007).

Marital Status

A generalised result is that married people tend to have higher levels of subjective well-being. This finding seems to also be applicable to people with civil partners or in cohabitation (Dolan, White and Peasgood, 2007; Blanchflower and Oswald, 2011).

Health

All empirical economics papers about subjective well-being show a strong (positive) correlation between [good] health and subjective well-being.

Education

The relationship between education and subjective well-being is not clear. Some studies have found a positive correlation (Blanchflower and Oswald, 2011), others have found a correlation only with a middle level of education (Frey and Stutzer, 2004), and others have observed no correlation at all (Clark, 2003). Additionally, it is interesting to note that Ferrer-i-Carbonell (2005) observed a stronger correlation in low income countries.

Unemployment

Studies have consistently shown the negative effects of unemployment on SWB (Dolan, White and
Ethnicity

The relationship between ethnicity and subjective well-being varies strongly according to social context and between cultures. The comparison group is important (e.g. whites vs others or whites vs hispanics, etc.). In the US, whites show higher scores than African Americans, and at the same time, hispanics show higher levels of subjective well-being than white people (Dolan, White and Peasgood, 2007; Oswald, 1997; Blanchflower and Oswald, 2011).

Religion

Religious people consistently report higher levels of subjective well-being (Dolan, White and Peasgood, 2007). This finding is independent of religion type and mode of practice.
Hypotheses and Econometric Models

The research questions emerge considering advances in economics research related to subjective well-being and particularly focusing on the possibilities of investigation that arise from behavioural economics. The following hypotheses are to be tested:

**Hypothesis 1**: the association between absolute income and subjective well-being is positive and modest. The confirmation of this hypothesis would be aligned with previous cross-sectional results. The model to test hypothesis 1 is as follows:

- Theoretical model: \( SWB = f(y, X) \). Subjective well-being as a function of absolute income, \( y \), and a vector of control variables, \( X \). This is a standard utility function in economics, where SWB depends positively on income.
- Empirical form: \( SWB = \alpha + \beta \ln y + \delta X + \epsilon \)

Absolute income, \( y \), corresponds to the individual net income of full-time workers. Income is self-declared and measured in continuous form. Almost all studies of SWB in economics also assume a linear relationship between subjective well-being, income and control variables (Mackerron, 2011). The same approach is taken here. Following Layard, Nickell and Mayraz (2008) and Ferrer-i-Carbonel (2005), absolute income is included in logarithmic form in order to address concavity and the diminishing marginal utility of income.\(^{16}\)

**Hypothesis 2**: Subjective well-being correlates negatively to the reference income. This hypothesis focuses on the idea of social references (Festinger, 1954) and Kahnemans and Tversky’s (1991) value function. It is expected that reported subjective well-being decreases with higher levels of income in the reference group. Also, it is expected that reference dominance (Kahnemann and

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\(^{16}\) According to Layard et al (2008) the marginal utility of income (or diminishing returns to income) is inversely proportional to income in cross-sectional studies.
Tversky, 1979 and 1991), i.e. expected negative coefficient of reference income is greater in magnitude than the positive coefficient associated with absolute income. The model to test hypothesis 2 is as follows:

- Theoretical model: \( SWB = f(y, y^*, X) \). Subjective well-being as a function of absolute income, \( y \), reference income, \( y^* \), and a vector of control variables, \( X \). This is not a standard function in economics because it means that utility (SWB) is decreasing in terms of reference income.
- Empirical form: \( SWB = \alpha + \beta \ln y + \gamma \ln y_r + \delta X + \varepsilon \)

Where \( y_r \) is the average income of the reference group (region). This definition is standard in the literature. Reference income also is transformed into its logarithmic form.

**Hypothesis 3**: SWB is positively associated to the difference (distance) between absolute income and reference income, controlling for absolute income and other relevant variables. This hypothesis is also based on the reference dependence theory (Kahneman and Tversky, 1991. The model to test hypothesis 3:

- Theoretical model: \( SWB = f(y, y / y^*, X) \). Subjective well-being as a function of income, the ratio between absolute income, \( y \), and reference income, \( y^* \), and a vector of control variables, \( X \). This is not a standard function in economics, where relative income enters into the utility (SWB) function.
- Empirical form: \( SWB = \alpha + \beta \ln y + \gamma (\ln y - \ln y_r) + \delta X + \varepsilon \)

Where relative income, \( (\ln y - \ln y_r) \), corresponds to the ratio between absolute income and reference income. This specification (which is another expression of the model for hypothesis 2) allows the separation of the influence on SWB of absolute income relative to the reference income from the effect of absolute income on SWB.
**Hypothesis 4**: income comparisons are asymmetric. On the one hand, individuals below the reference group are negatively affected, on the other hand, individuals above are not affected (upward comparisons). Related to Kahneman and Tversky’s value function, a steeper slope is expected when absolute income is less than the reference income, which in a wide sense suggests loss aversion. The model to test hypothesis 4 is:

- Theoretical model: \( SWB = f(\text{gains, losses, } X) \).
- To test for asymmetries, two new variables were generated following the methodology previously used in the influential work of Ferrer-i-Carbonell (2005): ‘Gains’ and ‘Losses’.
  - Gains: If \( y > y_r \) then \( \text{Gains} = \ln y - \ln y_r \); \( \text{Losses} = 0 \)
  - Losses: If \( y < y_r \) then \( \text{Gains} = 0 \); \( \text{Losses} = \ln y_r - \ln y \)
  - And, if \( y = y_r \) then, \( \text{Gains} = 0 \) and \( \text{Losses} = 0 \)
- Empirical form: \( SWB = \alpha + \beta \text{gains} + \gamma \text{losses} + \delta X + \varepsilon \)

**Hypothesis 5**: subjective well-being reports are negatively associated with the inequality index (suggesting inequality aversion).

**Hypothesis 6**: the effects of inequality are asymmetric. The model to test hypothesis 5 and 6 is as follows:

- Theoretical Model: \( SWB = f(\text{y, inequality, gains, losses, } X) \). Subjective well-being as a function of absolute income, \( y \), an income inequality index, gains and losses defined as before, and a vector of control variables \( X \).
- Empirical Form: \( SWB = \alpha + \beta \ln y + \gamma \text{inequality} + \delta \text{inequality} \cdot 1\{\text{gains}\} + \theta X + \varepsilon \)

The standard measure of inequality considered is the quintiles ratio, which corresponds to the ratio between the average income of the richest quintile divided by the average income of the poorest
quintile by region. It is simple and effective. Also, the interaction \((\text{inequality} \times \mathbb{1} \{\text{gains}\})\) between inequality and the indicator function for gains and losses has been added in order to understand if there are asymmetries in the effect of inequality on SWB, depending on the relative income position of individuals.

The models’ specifications are assumed to be valid and, importantly, it is assumed that subjective well-being depends on income and inequality (plus other relevant explanatory variables). This is in line with the economics literature. However, it is fundamental to consider that these are strong assumptions in a cross-sectional setting (Clark and Senik, 2009), and causality will not be proved here.\(^{17}\)

According to the formal theoretical approximation of subjective well-being, some empirical research considers the dependent variable as ordinal and appropriated to ordered logit and ordered probit regressions. These models implicitly cardinalise the dependent variable through the cardinal continuous latent variable underlying them (Mackerron, 2011). However, the use of Ordinary Least Squares regressions it also widely found in the empirical literature, and treats the subjective well-being variable as cardinal (Dolan, White and Peasgood, 2007). This empirical decision is only possible because estimations are almost not affected if the assumption of ordinality is changed to

\[^{17}\text{Taking into account several potential difficulties such as endogeneity problems (possible income and/or other variables), omitted variable bias, unobserved heterogeneity (personality traits) and cultural norms, it is recommended (if data is available) to use panel data (Dolan, White and Peasgood, 2007; Knight et al., 2007). Panel data integrates cross-section and dynamics allowing, for instance, the use of time dummies, lags variables and, importantly (for the study of subjective well-being), the fixed effects treatment. The subjective well-being equation with fixed effects would be: }\]

\[ \text{SWB}_i = \beta \log(y_{it}) + \alpha_i + \epsilon_{it} \]

\[^{17}\text{where, } \alpha_i (i=1,\ldots,n) \text{ is the unknown intercept for each individual, SWB}_i \text{ is the dependent variable, } Y_{it} \text{ represents absolute income and } \epsilon_{it} \text{ is the error term. The individual fixed effect approach can capture unobservable and persistent personality traits (such as intelligence, negativism or extroversion), and usually gives more reliable results than cross-sectional data (Budría, 2012; Ferrer-i-Carbonell, 2005; Senik, 2005). However, it is important to also consider that fixed effects are based on assumptions of linearity and cardinality (therefore, ordered logit and ordered probit regressions are not allowed).}\]
cardinality (Ferrer-i-Carbonell and Frijters, 2004; Layard, 2009; Blanchflower and Oswald, 2011; Clark and Oswald, 1994; Clark and Senik, 2009). Consequentely, this dissertation uses the Ordinary Least Squares method that facilitates interpretations, but also presents the ordered logit estimations in the appendix for completeness purposes.
Data Description

The ‘Measuring National Well-Being’ programme was launched in November 2010. The Office for National Statistics is the institution in charge of this, and its main objective is to generate objective and subjective measures of well-being for the United Kingdom (ONS, 2012; Hicks and Tinkler, 2011). In this context, the Annual Population Survey 2011\(^1\) (which is one of the largest surveys in the United Kingdom) was carried out with a focus on subjective well-being for the first time (ONS, 2012). The data, cross-sectional in nature, contains reliable information about 16,789 individuals, full time workers, aged 16 years old and over from the all of the regions of England,\(^2\) and was released in July 2012.\(^3\)

Descriptive Statistics

**Dependent Variable: Subjective Well-Being**

Subjective well-being is represented in this research by the variable *Life Satisfaction*.\(^4\) This is in line with previous research in the field, and therefore facilitates comparability. The average score of the SWB variable is 7.48, and the standard deviation is 1.6.

**Explanatory Variables:**

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\(^1\) The Annual Population Survey is one of the largest surveys in the United Kingdom, and currently part of the Integrated Household Survey and the Opinions Survey.

\(^2\) Regions of Wales, Ireland and Scotland were not considered, due to the fact that ONS does not consider this information as reliable at the regional level (ONS, 2012).

\(^3\) The access is public and the file, the serial number for which is 6994, can be downloaded at [http://www.esds.ac.uk/](http://www.esds.ac.uk/).

\(^4\) Question: *Overall, how satisfied are you with your life nowadays?* From a 0 to 10 scale, where 0 means ‘not at all’ and 10 means ‘completely’.  

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27
**Absolute income:** the average income in England (based on quarterly data) is £4,450. It is clear from the distribution of income that higher incomes are associated with higher levels of subjective well-being.

![Distribution of Income vs Subjective Well-Being Scores](image)

**Reference Income:** average reference income is £4,355, which in the context of the graph above, corresponds roughly to scores of 6-7 on the scale of SWB (vs absolute income).

**Relative Income:** comparing relative income vs SWB scores, it is observed than on average, absolute income becomes greater than the reference income (a ratio greater than 1) after score 7. This suggests a positive correlation between both variables.

**Inequality index:** at a descriptive level, inequality does not show a defined trend with respect to SWB. Also, regions with higher levels of average income show, in general, higher levels of inequality.

**Gender:** males and females (dummy variable) report similar levels of subjective well-being – around 7.5.
Education: three categories are considered for education. First, people at degree level or above; second, people educated but below degree level; and third, people with no education. At a descriptive level, more education is associated with higher levels of subjective well-being.

Health: is divided into 5 categories (Very Good, Good, Fair, Bad and Very Bad). Also at a descriptive level, health is positively associated with subjective well-being.

Relationship: this variable is similar to marital status; however, it also includes people cohabiting or living with a civil partner. Individuals in a ‘relationship’ show higher average values of SWB (7.67) than people without a ‘relationship’ (7.12).

Religion: a dummy variable was created for religious and non-religious people. In line with the literature, religious people show higher levels of subjective well-being.

Ethnicity: White British individuals report higher levels of subjective well-being (7.49 in average) than other people (7.41).
Estimation Results

The focus and discussion of this section are related to the hypotheses stated before, and in this context are only brief comments regarding the explanatory variables. Age is positively correlated with SWB, and Age square is negatively correlated. This means that age has a U-shaped relationship with SWB, where the lowest part of the curve is around 40 years old. The same result has been found consistently in previous studies. Gender is not significant in the regressions, which means that other covariates are more relevant when determining SWB scores. Health is highly significant, and the association with SWB is positive (healthier people are happier). Regarding the level of education, individuals with degree level or above show higher levels of SWB than people below degree level (including those with no education), but these results are not significant. Also, similar to previous studies, dummies for religion (religious people = 1; 0 otherwise), ethnicity (white = 1; 0 otherwise) and relationship (married/civil partner/cohabiting = 1; 0 otherwise), are all significant and positively correlated with SWB.

Column 1 of Table 1 (below) shows the effect of absolute income on SWB. Similar to previous research, it is observed that absolute income is weakly positively correlated with subjective well-being. The coefficient is 0.0492, significant (p < 0.01), and the standard error is 0.01. This confirms Hypothesis 1, and means that within the country, higher income is positively correlated with subjective well-being, all the other variables being held constant.

OLS vs Ordered Logit Interpretation:

- OLS: The OLS regression is used after relaxing the ordinality condition in the SWB variable. A possible interpretation of the coefficient of logincome is: ∂SWB / ∂lnY = β. Here, β is simply the change in SWB associated with a 1 proportionate increase in income, all other variables held constant.
- Ordered Logit: the interpretation when ordinality in the dependent variable is maintained, for instance, using Ordered Logit regression can also be considered. The usual OLS interpretation is not possible. Then, β is the ordered log-odds estimate for a 1 proportionate increase in income on the expected SWB level given that the other variables are held constant. If an individual experiences a 1 proportionate increase in his/her income, the ordered log-odds of being in a higher SWB level would increase by β, all other variables held constant. Logit coefficients are in log-odds units, and therefore further interpretation is necessary to estimate the predicted probabilities of SWB=1.

Comparing both interpretations, it is easy to see why the OLS approach is preferred. The rest of the dissertation will continue with the OLS method considering that, in SWB research, there is no difference in results between the OLS and Ordered Logit / Probit (Ferrer-i-Carbonel, 2004 and 2005).

22 It is also possible to think that happier people are healthier. This variable is particularly difficult in terms of causation.
23 OLS vs Ordered Logit Interpretation:
Included in the basic model is also the effect of the average income of the reference group (Table 1, Column 2), and it is worth noting that the absolute income coefficient is almost unchanged. Now, it is 0.05, significant (p < 0.01) and with a standard error of 0.01. However, the important result is related to reference income, which shows a negative and significant association with subjective well-being. The coefficient is -0.16, and greater in magnitude than the absolute income's coefficient. Ceteris paribus, an increase in absolute income of 10% would raise the SWB of the average individual by 0.0048. On the other hand, if at the same time reference income rises by 10%, this would lower SWB by -0.015. Therefore, the net effect is negative. This result confirms Hypothesis 2, taking into account the negative correlation and the dominance of reference income over absolute income (suggested by comparing the magnitudes of coefficients). This result is also in line with previous findings in the literature.

Hypothesis 3 is also confirmed. Relative income (Lny – Lny_r) is significant (p < 0.01) and positively correlated with subjective well-being. It is interesting to note that the coefficient of absolute income becomes insignificant when relative income is present in the regression. This result stresses the importance of relative concerns and their impact on SWB. The positive coefficient also means that the richer the agent is compared with the reference income group, the happier s/he is.
Table 1: OLS regression, Hypotheses 1 – 3

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<th>(2)</th>
<th>(3)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
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<td>-0.364***</td>
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<td>(0.150)</td>
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<td>(0.0262)</td>
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<td>(lnY - lnY*)</td>
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<td>Constant</td>
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<td>16,789</td>
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<td>0.102</td>
<td>R-squared</td>
<td>102</td>
<td>0.098</td>
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</table>

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1
Table 2 presents the results of Hypotheses 4-6. Results in Column 1 show some evidence of
asymmetry, and hence, confirms Hypothesis 4. On the one hand, the variable ‘losses’ shows a modest, but negative and significant, correlation with SWB. On the other hand, the variable ‘gains’ has a very small coefficient (0.01) and is non-significant. This means that while the SWB of individuals is negatively affected by an income below that of their reference group, individuals with an income above that of their reference group do not experience a positive impact on happiness or well-being. In other words, SWB as a function of relative income is steeper for negative values of relative income than for positive values. This hypothesis suggests upward comparisons and corresponds to the loss aversion implied by Kahneman and Tversky’s value function.

Furthermore, according to the regression in Column 2 (Table 2), it is possible to state that, controlling for income and other relevant variables, inequality is negatively associated with subjective well-being, which according to the previous definitions suggests a moderated degree of inequality aversion. Therefore, Hypothesis 5 is confirmed. A possible interpretation (relaxing the assumption of ordinality in the dependent variable) says that, holding all other variables constant, an increase by one unit in the inequality index is associated with a decrease of -0.16 units of SWB.

Finally, it is worth noting that the effect of inequality on SWB does not vary between individuals above or below the reference income group. Controlling for income and other relevant variables,24 the interaction variable between inequality and the indicator function for gains and losses is not significant, with a coefficient close to zero. Therefore, with the specifications of this research, the effects of inequality on SWB are symmetric, and so Hypothesis 6 is rejected.

---

24 Also, the following alternative model was tested for Hypothesis 6, and the results (not shown) were almost unchanged: 
\[
SWB = \alpha + \beta_1\text{gains} + \beta_2\text{losses} + \gamma\text{inequality} + \delta\text{inequality}*1\{\text{gains}\} + \varepsilon
\]
Conclusions

The measurement of well-being requires one to go beyond traditional objectives measures, such as GDP per capita (Stiglitz et al., 2009). The subjective well-being approach has emerged in economics as a complement, and it seems to be a good, and valid, proxy for utility (Dolan et al., 2011). As such, it represents a new and developing area of research in economics.

In particular, subjective well-being appears as a good way to study the effect of income and its relativities, which is important in modern economics. In this regard, this dissertation has drawn on aspects of behavioural economics (Prospect Theory) and has used a new cross-sectional dataset available in the United Kingdom to study the effects of relative income and income inequality on subjective well-being.

The main empirical findings are the following:

1. Absolute income has only a small positive correlation with subjective well-being. This result is in line with the literature based on developed countries, but is contrary to what traditional neo classical economics expects, because it places economic growth in a secondary role.

2. Reference income and comparisons have a relevant role in subjective well-being evaluations. In general, reference income above absolute income shows an important negative association with subjective well-being, and the effect is greater in magnitude than the positive effect of absolute income on SWB. According to Prospect Theory (Kahnemann and Tversky, 1979), this evidence suggests that preferences are interdependent and that the reference income point is dominant.

3. Results suggest that income comparisons are asymmetric. Specifically, there is evidence of upward social comparison, which means that individuals below the reference group are more (negatively) affected than those above. This result, and the fact that individuals below the reference income have a steeper slope (coefficient) suggests loss aversion as defined by

25 Again, it is good to remember that causation has not been demonstrated in this cross-sectional research.
Kahneman and Tversky (Vendrik and Woltjer, 2006; Ferrer-i-Carbonell, 2005).

4. Inequality is negatively associated with SWB, which suggests an aversion to inequality. Moreover, the impact of inequality on SWB is independent of the relative position that individuals have in the income distribution. In other words, there is no evidence of asymmetry of valuations.

From the results presented above, it is worth noting that:

1. It seems to be a mistake to consider the maximisation of utility only with respect to absolute income. Negative income externalities must be taken into account, and this action implies the addition of more complexity to economics models, and new possibilities of equilibrium where traditional optimality might not be achieved (Clark and Oswald, 1994; Jorgensen and Herby, 2004). This changes the focus from economic growth to economic development (Rojas, 2011).

2. Relevant definitions of reference income and income inequality are crucial. Different approaches26 can lead to different results and recommendations for policy (Clark and Senik, 2009). In particular, considering that most of the current research ascribes the reference group somewhat arbitrarily, more investigation is needed in order to understand what a relevant reference group is for different individuals and regions in the United Kingdom. This can be very much influenced by culture and norms (Vendrik and Woltjer, 2006).

3. Asymmetry with respect to income externalities has implications for economic policy. For instance, a useful tax system might be progressive considering that high earners generate greater externalities (Jorgensen and Herby, 2004). However, it is important to note that in the presence of loss aversion, the redistribution of income has only limited effects, due to the fact that the effect of increasing (relative) income is smaller than that of decreasing it (Jorgensen and Herby, 2004).

4. The relevance of income inequality is confirmed. The effect of inequality on SWB is

26 A second definition of reference income was tested while developing this dissertation: expected income ‘for a person like me’. This variable contains predictive values from a typical earnings regression with log income as a dependent variable. The same methodology followed in this dissertation was also tested with expected income as the reference point, and the results are unchanged. Tables with these results are also attached in the appendix.
independent of the relative position of individuals in the income distribution. In other words, inequality aversion is transversal between people above and below the reference group. Theoretically, in a more equal society the externality from high earners would be smaller, and a high earner would not be affected (by asymmetry and upward comparisons). This important result also means that the inequality index is a better measure of subjective well-being than GDP per capita, for instance. In this sense, inequality can amplify or diminish the comparison effects, which are more relevant than absolute effects of income. Finally, it is also important to consider that different inequality indices might lead to different results (for instance, if it is considered instead that the Gini index focuses in the middle of the income distribution).

5. More theoretical and empirical research is needed in the field of the economics of subjective well-being, in particular with regard to other measures of SWB, new definitions of reference income, causality, endogeneity problems, the omitted variable bias, unobserved heterogeneity and cultural norms. In this context, if data is available, it is recommended that panel data be used.
References


## Appendix

### Table: OLS regressions, Reference Income: Expected Income

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<th>(3) SWB</th>
<th>(4) SWB</th>
<th>-5 SWB</th>
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<td>(0.0861)</td>
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Table: Ordered Logit regressions, reference income: average income of the reference group

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Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1
Table: Ordered Logit regressions, Reference Income: Expected Income

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