Income, Happiness, and the Disutility from Inequality

This paper aims to empirically assess the effect of income changes on happiness levels. As such, it investigates the individual utility model based on income comparisons proposed by Clark and Frijters (2008) as a response to a paradox introduced by Easterlin (1974), namely that increases in individual income increase individual happiness, but that increases in average income do not increase average happiness. The paper lays out four hypotheses related to Clark and Frijters (2008): (1) increases in absolute income increase individual happiness, prone to adaptation and diminishing returns, (2) increases in relative income enduringly increase individual happiness with diminishing returns, (3) as a consequence of (1)-(2) distributional GDP growth changes average happiness levels, and (4) several predictors beyond individual income (absolute or relative) exist that affect happiness. The empirical application of Clark and Frijters' (2008) utility model includes a cross-sectional analysis via multiple linear regression, and a longitudinal analysis via a synthetic control method, the results of which largely support the hypotheses to be tested.

1 Introduction

Most states around the world use their gross domestic product (GDP) as the main indicator for capturing 'progress' as a measure of social welfare (van den Bergh 2009). Naturally, the question arises whether the inference from GDP to social welfare can be justified. An extensive body of literature subsequently studied two related relationships first noted by Easterlin (1974): (1) average happiness is unaffected by prolonged and large GDP growth (see Easterlin, 1995; Oswald, 1997; Layard, 2005), and (2) individual happiness increases with individual income (see Winkelmann and Winkelmann, 1998; Ravallion and Lokshin, 2002; Ferrer-i-Carbonell and Frijters, 2004; Senik, 2004; Ferrer-i-Carbonell, 2005).

Easterlin (1974) noted that (1) and (2) result in a paradox, because GDP growth translates into higher incomes and higher income translates into increased happiness for individuals, but GDP growth does not translate into higher happiness levels on average. Clark and Frijters (2008) study this paradox by introducing a utility function based on the concept of income comparisons and adaptation. They theoretically establish that changes in individual income have at least two effects on happiness: changes in absolute income affect happiness positively at a decreasing rate, and changes in relative income affect happiness positively, again at a decreasing rate. Further, any changes in happiness due to changes in absolute income are prone to adaptation, i.e., people are getting used to their new absolute income for which temporary changes in happiness fade over time (Di Tella et al. 2010).

Note that, according to Clark and Frijters (2008), distribution-neutral shifts in GDP – where everybody's income changes by the same relative amount – do not change average happiness, because relative income remains constant, and any changes in happiness due to changes in absolute income fade over time. Only distributional shifts in GDP change average happiness, where a shift toward a more equal society increases happiness levels and vice versa for a shift toward a more unequal society (Proto and Rustichini 2013). This has been explained by increased skew in the distribution of relative incomes, where an increased proportion of the overall population sees their relative incomes decrease.

This paper aims to empirically investigate the validity of Clark and Frijter's (2008) model and assess the effects of absolute and relative income as well as their distribution on happiness. Thereby, this paper first lays out the theoretical model proposed by Clark and Frijters (2008) in section 2. Section 3 translates the theoretical model into two separate empirical applications, one for cross-sectional analysis via multiple linear regression, and another for longitudinal analysis via a synthetic control method. Section 4 reports the results of both empirical applications. Section 5 discusses the results and its implications for the theoretical model from Clark and Frijters (2008). The last section of this paper concludes.

2 Outline of Theoretical Utility Model

The proposed utility function by Clark and Frijters (2008) is a simple extension of the standard economics textbook utility function:

$$U = U(u_1(Y), u_2(Y|Y^*), u_3(Z)) \qquad (1)$$

where $U(\,.\,)$ is a common function of three sub-functions (u_1, u_2, u_3).[*] Y refers to the vector of absolute incomes and u_1 is the classic utility function from income, which increases at a decreasing rate. Y^* refers to the 'comparison' income, and the ratio $Y \mid Y^*$ refers to the 'relative' income of an individual. u_2 is the return from relative income, assumed to increase at a decreasing rate in Y, and decrease at an increasing rate in Y^* (Kahneman and Tversky 2013). Z is a vector of non-pecuniary determinants of happiness. Thus, u_3 captures the effect of other socio-economic and demographic variables on individual utility.

The resulting theoretical implications of the above individual utility function are:

- **Hypothesis 1:** Increases in Y increase individual happiness at a diminishing rate (Kahneman and Deaton 2010). The increase in happiness is prone to adaptation, because of which little lasting effects of increases in absolute income remain (Stevenson 2013).
- **Hypothesis 2:** Increases in the ratio $Y \mid Y^*$ enduringly increase individual happiness at a diminishing rate (Kahneman and Tversky 2013).
- **Hypothesis 3:** Socio-economic and demographic factors beyond income affect happiness in several ways (Johns and Ormerod, 2007; Stiglitz et al., 2009).
- **Hypothesis 4:** In the long-run, distribution-neutral GDP growth does not affect individual happiness as the ratio $Y \mid Y^*$ stays constant. Increases in inequality have a negative effect on individual happiness as the ratio $Y \mid Y^*$ deteriorates, and vice versa for decreases in inequality (Proto and Rustichini 2013).

3 Translation of Theoretical Model into Empirical Application

Clark and Frijters (2008) build on a specific translation of reported happiness into underlying happiness. First, although the Easterlin paradox thematizes the relationship between income

[*] The original utility function proposed by Clark and Frijters (2008) features a term accounting for leisure. However, out of simplicity, this paper will include the leisure term in the vector Z.

and reported happiness scores, the authors argue that happiness scores provide meaningful information about underlying happiness. Their argument finds support in several studies which identified strong correlations between happiness scores and alternative measures of happiness – such as physiological measures and reports of good and bad feelings (Diener, 1984; Sutton and Davidson, 1997; Siedlitz et al., 1997). Further, happiness reports have been shown to be robust to linguistic and cultural differences (Ouweneel and Veenhoven 1991; Meyers and Diener, 1995). Consequently, this paper rests on the assumption that happiness scores represent underlying happiness correctly.

Second, albeit happiness being measured in discrete terms, it can be treated as a cardinal variable (see Ng, 1996; Ng, 1997; Kristoffersen, 2010). Blanchflower and Oswald (2004) identify an underlying stepwise linear relationship between actual and measured happiness – a condition for cardinality in measured happiness. Additionally, Blanton and Jaccard (2006) find that alternative measures of happiness increase linearly with reported happiness. Finally, Guttman (1977) argues that researchers should select data analysis methods based on loss minimization rather than a priori rules regarding what is permitted. Therefore, this paper treats happiness scores as a cardinal variable.

In line with the above arguments, this paper implements two empirical applications of Clark and Frijters' (2008) theoretical model that treat happiness as a cardinal variable representing underlying happiness. A cross-sectional analysis will look at **hypothesis 1-3**, i.e., the effect of absolute and relative income, inequality and several non-pecuniary predictors on happiness across individuals. A second longitudinal analysis will focus on **hypothesis 4**, i.e., the effect of income inequality on happiness over time.

3.1 Cross-sectional methods

Clark and Frijters' (2008) individual utility model translates into the following empirical baseline application for cross-sectional analysis:

$$U_i = \beta_1 y_i + \beta_2 \left(\frac{y_i}{y^*}\right) + Z_i' \qquad (2)$$

where, y_i is a measure of individual absolute income and y^* is median income; β_1 and β_2 are the coefficients for individual absolute and relative income respectively; Z_i' includes a vector of potential non-pecuniary explanatory variables alongside their coefficients.

The individual-level data used in this analysis are taken from 'wave' five of the World Values Survey (WVS) conducted between 2005 and 2009 (Inglehart et al. 2015). The happiness measure is the response to item A170 in the WVS, which asks individuals to rate their happiness on an integer scale of 1 (least satisfied) through 10 (most satisfied). This measure is called $satisfaction$.

The measures of absolute and relative income are derived from item X047 in the WVS, which asks individuals to select one of ten income brackets. To approximate the respective internationally comparable absolute income, the income distribution per country is used to divide net national income (in 2010 USD) into five brackets corresponding to the lowest earning 20% through the highest earning 20%. The income brackets are subsequently

clustered into five groups and assigned absolute incomes accordingly. Relative income corresponds to the ratio of absolute income over median income per country. The relative income of the third income group (percentile 41-60%) corresponds to the median income. The measures are called abs_inc and rel_inc.

This paper uses several additional individual-level variables from the WVS and country-level variables from the World Development Indicators (World Bank) as control variables:

Individual-level variables:

- $female = 1$ if the respondent is female and zero otherwise (Horley and Lavery, 1995; Lucas and Gohm, 2000).
- age represents the respondent's age in years. Previous studies have found a quadratic relationship between age and happiness, so this paper includes square age as $age2$ (Oswald, 1997; Blanchflower and Oswald, 2000).
- rep_health represents the self-reported state of health from 1 (Very good) to 5 (Very poor).
- $kids = 1$ if the respondent has at least one child and zero otherwise.
- $married = 1$ if the respondent is married and zero otherwise.
- $unemp = 1$ if the respondent is unemployed and $retired = 1$ if the respondent has retired. The baseline level is employed (Clark and Oswald 2004).

Country-level variables:

- $unemp\_rate$ represents the unemployment rates per country (Deaton 2008).
- $emissions$ captures the net emissions per country (in kt of CO2 equivalent) (Stiglitz et al. 2013).
- edu_exp and $health\_exp$ capture government expenditure (as % of GDP) on education and health services (Stiglitz et al. 2013).
- $gini$ captures the Gini-coefficient per country (Alesina et al., 2001; Graham and Felton, 2004).

The empirical application from equation (2) will be implemented for 11 high-income European countries. The total sample for which adequate data are available consists of 10.396 individual observations. The countries represented alongside basic descriptive statistics are listed in Appendix 1a. The 'Year' column represents the year of the WVS survey conducted. Appendix 1b includes basic descriptive statistics of abs_inc and rel_inc.

In the final multiple linear regression model, the latent happiness measure is assumed to be a linear function of a set of explanatory variables (or non-linear transformations of the explanatory variables) in line with the above argument for cardinality, plus a random error. Indexing individuals by subscript i, the estimated model, can be written as follows:

$$\hat{satisfaction}_i = \hat{\beta}_0 + \hat{\beta}_1 ln(abs\_inc_i) + \hat{\beta}_2 ln(rel\_inc_i) + \sum_{j=1}^{J} \hat{\gamma}_j z_{ji} + \sum_{c=1\ (c \neq C)}^{C} \hat{\lambda}_c s_{ci} \quad (3)$$

where $\hat{satisfaction}_i$ is individual i's estimated happiness score; $ln(abs\_inc_i)$ and $ln(rel\_inc_i)$ represent a log transformation of absolute and relative income, because of

heavy skew of both variables toward the lower end of the distribution (see Appendix 2); z_{ji} represents individual i's non-pecuniary predictors z_j; s_{ci} represents country dummies, with Switzerland as the baseline country; $\hat{\beta}_0, \hat{\beta}_1, \hat{\beta}_2, \hat{\gamma}_j, \hat{\lambda}_c$ represent the corresponding estimated coefficients.

This paper estimates three versions of equation (3), once for the full set of observations in the WVS, and twice for a subset, split by absolute income levels into a 'poor' and a 'rich' sample. The full set is split at a cut-off point of $\ln(abs\_inc) = 10.2$, leaving each sample with 4884 (with \$17978 mean absolute income) and 5512 (with \$44,288 mean absolute income) observations respectively. This allows the paper to identify differing effects of the included predictors on differing income levels. Table 1 reports the results.

3.2 Longitudinal methods

To empirically investigate the effect of income inequality on happiness over time, this paper implements a synthetic control method (Abadie et al. 2015). The synthetic control method utilizes that there is a 'treated' unit and several 'comparison' units in an overall sample of J units, where $j = 1$ is the 'treated' and units $j = 2, \dots, J$ are potential 'comparison' units. For the synthetic control method to capture the 'treatment' effect, the 'comparison' units need to be affected by the same structural processes as the 'treated' unit except for shocks to the outcome variable after treatment. These processes need to be observed via longitudinal data at identical time periods, $t = 1, \dots, T$, where these time periods include a positive number of pre-treatment periods, T_0, and post-treatment periods, T_1, with $t = T_0 + T_1$. The 'treated' unit is exposed to the 'treatment' at any time during T_1 and this 'treatment' has no effect during T_0.

The 'treated' unit will be approximated by a weighted average of the set of 'comparison' units, i.e., a synthetic control. The weights $W = w_j$ (for $j > 1$ subject to $0 \leq w_j \leq 1$ and $W = 1$) assign a certain weight to each 'comparison' unit and should approximate the pre-intervention characteristics of the 'treated' unit. Let X_1 and X_j (for $j > 1$) be vectors containing the values of the pre-intervention characteristics of the 'treated' and 'comparison' units respectively, which may contain pre-intervention values of the outcome variable. The difference between the pre-intervention characteristics of the 'treated' unit and synthetic control is given by the following expression for $t < T_0$, where the optimal weights w_j^* (for $j > 1$) minimize the size of this difference:

$$X_{1t} - \sum_{j=2}^{J} w_j^* X_{jt} \tag{4}$$

To identify the effect of 'treatment' on the 'treated' unit, let Y_{jt} be the outcome of unit j at time $t \geq T_0$, where Y_1 and Y_j (for $j > 1$) are vectors containing the post-treatment outcomes for the 'treated' and 'comparison' units. The 'treatment' effect is estimated by the difference of post-intervention outcomes between the 'treated' unit and synthetic control:

$$Y_{1t} - \sum_{j=2}^{J} w_j^* Y_{jt} \tag{5}$$

The synthetic control method picks up the 'treatment' effect on the 'treated' unit, because the synthetic control is supposed to be alike the 'treated' unit in observed and unobserved determinants of the outcome variable. Consequently, post treatment the synthetic control should produce trajectories of the outcome variable similar to the 'treated' unit had the 'treated' unit not received 'treatment'. Hence, the difference in the outcome variable between the 'treated' unit and synthetic control can be interpreted as the effect of the 'treatment'.

This paper runs a synthetic control method for Spain to investigate the effect of rising income inequality on happiness, as it saw increases in income inequality between 2005 and 2015 (see Figure 1). The 'comparison' units are all countries that saw income inequality stay constant or fall slightly over the entire period, i.e., the United Kingdom, Germany, Netherlands and Norway. The predictor characteristics are taken from the country-level variables according to the regression specified in section 3.1 in addition to GDP/capita. The unit weights and predictor balance can be found in Appendix 3 for the treatment period 2008. The treatment period equals 2008, because it coincides with the global financial crisis, an event that severely adversely impacted every country in Europe, and thus presents an opportunity to investigate the effect of inequality on the robustness of happiness levels over time. The result of the synthetic control is shown in Figure 2.

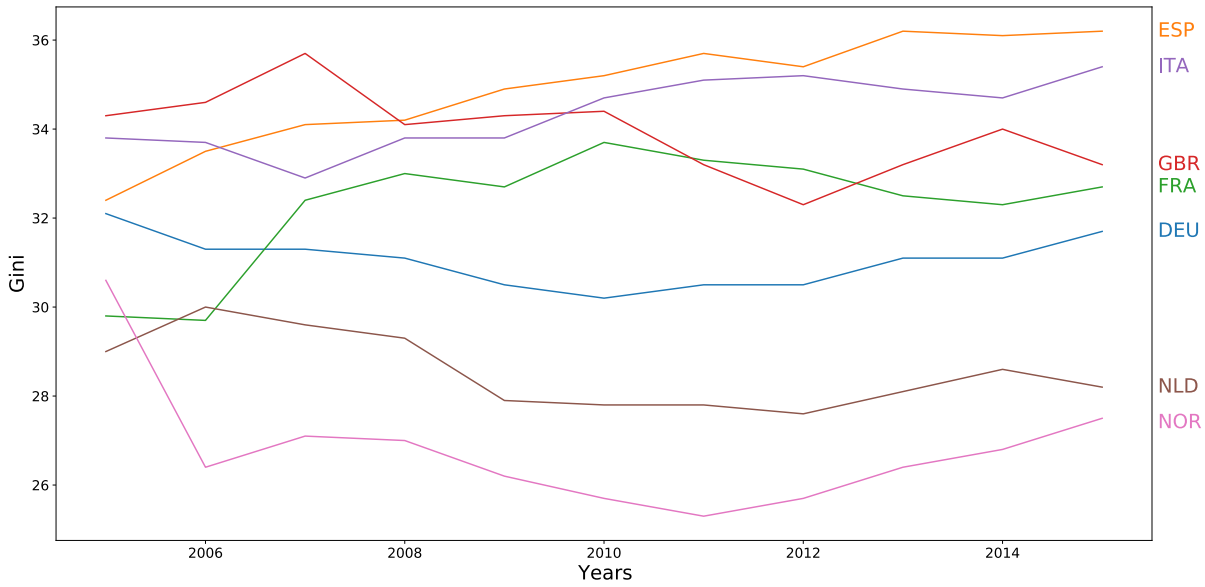

Figure 1: Gini Coefficient per Country over Time

4 Results

4.1 Cross-sectional results

Even though this paper is largely interested in the effect of income on happiness levels, it is worth commenting on the individual and country variables included as controls, to show that the results are in line with previous research later on in the discussion.

		Full	Poor	Rich
Income	ln(abs_inc)	0.4037***	0.3860***	0.4116***
		(0.0236)	(0.0829)	(0.0591)
	ln(rel_inc)	0.1228***	0.3465***	0.0308
		(0.0399)	(0.0937)	(0.0638)
	gini	0.1177***	0.1242***	0.0941***
		(0.0053)	(0.0119)	(0.0098)
Individual Variables	female	0.1243***	0.1345***	0.1196***
		(0.0311)	(0.0508)	(0.0380)
	age	-0.0394***	-0.0433***	-0.0328***
		(0.0058)	(0.0087)	(0.0079)
	age2	0.0004***	0.0005***	0.0004***
		(0.0001)	(0.0001)	(0.0001)
	rep_health	-0.7378***	-0.8114***	-0.6506***
		(0.0201)	(0.0318)	(0.0252)
	unemp	-0.7210***	-0.6799***	-0.7636***
		(0.0691)	(0.0884)	(0.1300)
	retired	0.1786***	0.1516*	0.1768**
		(0.0574)	(0.0887)	(0.0748)
	married	0.4237***	0.4091***	0.4330***
		(0.0366)	(0.0571)	(0.0471)
	kids	0.0050	-0.0005	0.0285
		(0.0368)	(0.0609)	(0.0441)
Country Variables	unemp_rate	0.0408***	-0.0226	0.0485***
		(0.0086)	(0.0234)	(0.0122)
	emissions	-0.000001***	-0.000002***	-0.000001***
		(0.0000)	(0.0000)	(0.0000)
	edu_exp	0.1487***	0.1774***	0.2735***
		(0.0222)	(0.0659)	(0.1017)
	health_exp	0.1732***	0.2920***	0.0681
		(0.0153)	(0.0405)	(0.0437)
Country Dummies		Yes	Yes	Yes
Observations		10,396	4,884	5,512
R^2		0.2280	0.2109	0.1800
Adjusted R^2		0.2265	0.2078	0.1771
Residual Std. Error		1.5615	1.7238	1.3902
F Statistic		153.1987***	68.4195***	60.2869***
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 1: Regression Results

Individual-level variables:

- The coefficients on $female$ are positive and significant for all regressions.
- The coefficients on age and $age2$ are negative and positive respectively, both with high significance.
- The coefficients on rep_health are negative and significant, where this effect is more extreme for 'poor' individuals.
- The coefficients on $unemp$ are negative and significant, where this effect is more extreme for 'rich' individuals.
- The coefficients on $retired$ are positive with mixed significance, where the positive effect is more extreme and significant for 'rich' individuals.
- The coefficients on $married$ are positive and significant across all regressions.
- The coefficients on $kids$ are insignificant for all regressions.

Country-level variables:

- The coefficients on $unemp\_rate$ are positive and significant for the whole and 'rich' sample, but insignificant for 'poor' individuals.
- The coefficients on $emissions$ are negative and significant, where this effect is more extreme for 'poor' individuals.
- The coefficients on government expenditure (edu_exp, $health\_exp$) show mixed results. The coefficient on edu_exp is positive and significant for all three regressions, while the coefficient on $health\_exp$ is significant and positive for 'poor' individuals and insignificant for 'rich' individuals.

Before reporting on the results of individual absolute and relative income, it is interesting that the coefficient on $gini$ is significant and positive for all regressions. Note, that because absolute and relative income have been accounted for in the regression, the positive coefficient on $gini$ does not necessarily mean that inequality makes people happy, as it affects happiness through other variables, such as absolute and relative income, as well. The coefficients on abs_inc and rel_inc are largely positive and significant. In particular, increases in relative income have a decreasingly positive effect on happiness levels, with an insignificant effect on happiness levels for 'rich' individuals, and absolute income has a non-decreasing positive effect on happiness.

All in all, four results can be drawn from the above:

- **Result 1:** The effect of absolute income on happiness levels is positive at a constant rate.
- **Result 2:** The effect of an increase in relative income has a decreasingly positive effect on happiness.
- **Result 3:** 'Poor' individuals are, ceteris paribus, more positively affected by inequality.
- **Result 4:** Several non-pecuniary predictors have significant and differing effects on happiness levels for individuals of different income levels. Relevant predictors for the remainder of this study include unemployment and government expenditure.

4.2 Longitudinal results

Confidence in the validity of a synthetic control method rests on a sizeable number of pre-intervention periods, and the fit of the synthetic control to the 'treated' unit's pre-treatment characteristics (Abadie et al., 2015). In this analysis, the synthetic control matches Spain's pre-treatment characteristics, with notable exceptions in GDP/capita and unemployment rate, where GDP/capita is lower and unemployment rate higher than in the synthetic control (see Appendix 3b). Nevertheless, the root mean squared prediction error equals only 0.02 over three pre-intervention periods (2005-2007). Additionally, all *J* units share a single market with common shocks (notably the financial crisis 2007-2008 and sovereign debt crisis 2010-2012) throughout the entire period, although Spain did see larger effects of those common shocks, notably a manifold rise in the unemployment rate (see Appendix 4a).

Further, although the 'comparison' units included in the synthetic control for Spain see an absolute decline in or constant levels of income inequality over the entire period of 2005-2015, all comparison units saw an increase in income inequality between 2012-2015. In other

words, the synthetic control receives the same treatment as Spain from 2012 onwards. Consequently, the actual treatment effect of a rise in income inequality on happiness levels needs to be restricted to 2009-2011.

The restricted results show that Spain saw a significant decline in happiness levels after 2008, when the financial crisis struck. Interestingly, although Spain saw constantly increasing income inequality, happiness levels stayed relatively constant after declining initially in 2009. The synthetic control did not see such a sharp decline after 2008. Notably, although all 'comparison' units saw at least some decreases in income inequality between 2009 and 2011, happiness levels did not increase. Although outside the scope of the restricted results, once the 'comparison' units saw income inequality rise from 2012 onwards, happiness levels of the synthetic control started to decline as well.

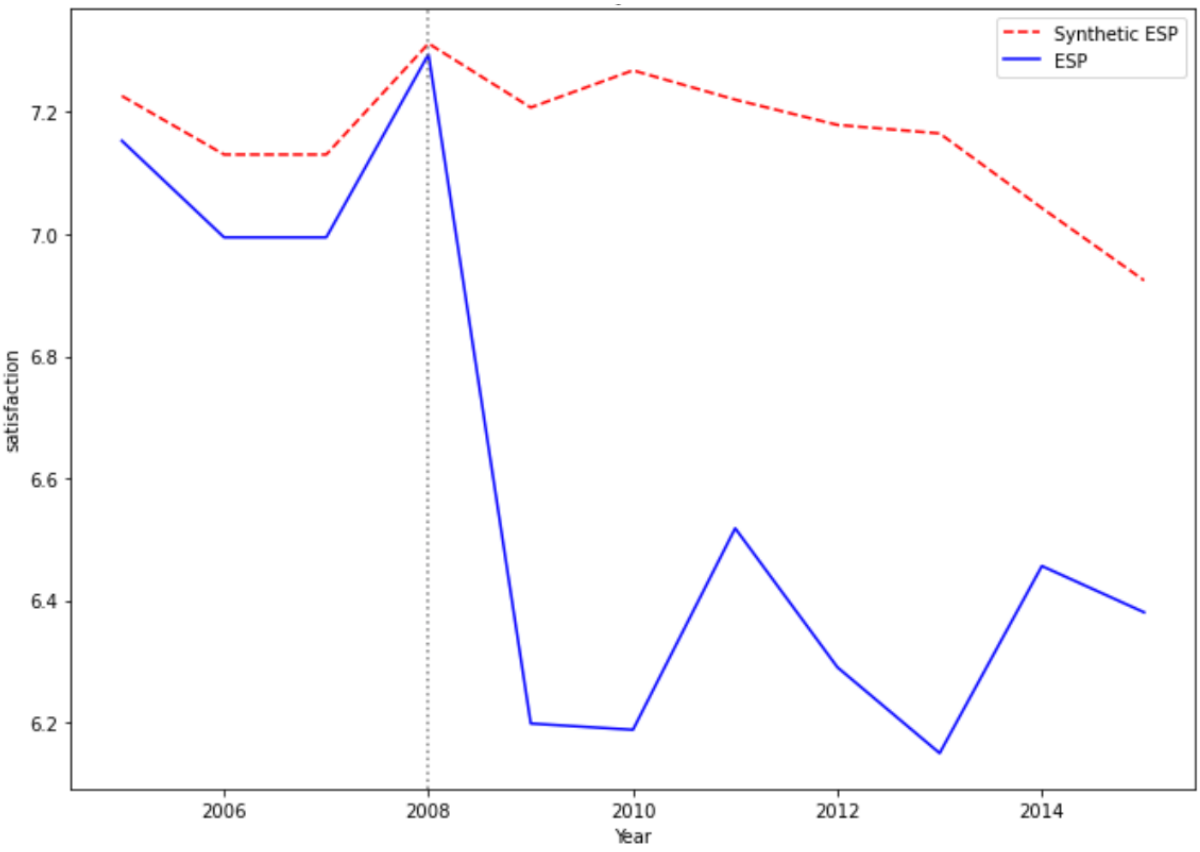

Figure 2: Synthetic Control Method for Spain

The result from the synthetic control can be summarized as follows:

- **Result 5:** Happiness levels decline as income inequality rises over time, possibly due to a range of factors, as the financial crisis affected the 'treated' unit to a different extent compared to the 'comparison' units in the synthetic control. Notable confounding factors beyond the effects of changes in relative incomes to be discussed include increased dependency on governmental services and adverse effects from further individual-level variables, such as unemployment.

5 Discussion

The aim of this paper was to empirically evaluate the individual utility function proposed by Clark and Frijters (2008), as outlined in equation (1). The function features hypotheses about the effect of individual income, relative income, and income distribution on happiness as well as room for importance of several non-pecuniary predictors of happiness. In this section, the paper will discuss the implications of the **results 1-5** regarding **hypothesis 1-4**.

Before discussing the specific results of income and its distribution on happiness, it is useful to note that the multiple linear regression results are largely in line with previous research. In specific, for previous studies confirming the results of the individual-level predictors, see Diener et al. (1999) for the coefficient on $female$; Oswald (1997) and Blanchflower and Oswald (2000) for the effect of age and $age2$; Frey and Stutzer (2002) for rep_health; Campbell et al. (1976) and Warr and Payne (1982) for the coefficient on $retired$; Argyle (1999) on the effect of $married$. Notable differences include the coefficients on $kids$, where previous research found an insignificant effect of one child on happiness, but a significant and positive effect of two or more children on happiness (Ball and Chernova, 2008). Regarding the country-level variables, previous research supports all findings of this paper. Olmo et al. (2011) support the positive and more extreme coefficient for 'poor' individuals on $emissions$. Further non-pecuniary predictors will be discussed below, but for the present being, it suffices to state that the results of this paper are largely in line with previous research, giving it predictive confidence and confirming **hypothesis 3**.

Turning to the discussion about the effect of income on happiness, **result 1** is somewhat at odds with the **hypothesis 1**. It indicates that happiness does increase with increases in income but fails to support that this relationship is diminishing with absolute income. This shortcoming may be due to the relatively low variability in absolute incomes caused by the method used in deriving absolute incomes from income brackets. Given this and the strong support for diminishing marginal utility of income from previous literature, the results presented in this paper should not be interpreted as a counterexample to diminishing marginal utility from income (see Easterlin, 1995; Kahneman, 1999; Helliwell, 2003; Van Praag et al., 2004; Layard et al., 2008). Further, it has not been tested empirically whether the effect of increases in absolute income fades over time due to adaptation. Because of extensive support in previous literature, however, this line of argument will be adapted within this discussion (see Frank, 1985; Burchardt, 2005; Luttmer, 2005; Oswald and Powdthavee, 2008; Di Tella et al., 2010). Evidence in support of **hypothesis 2** is much clearer. **Result 2** establishes a positive and diminishing effect of relative income on happiness.

Regarding the distribution of income, **result 3** states that increases in the Gini coefficient increase happiness. Alesina et al. (2004) argue that for societies with strong perceived social mobility, 'poor' individuals tend to favor inequality, as they perceive the chance of climbing the 'social ladder' and fear paying large sums to redistribution measures once they did. In contrast, 'rich' individuals favor inequality if they perceive their society to be immobile, benefiting from inequality through likely lower redistribution measures while not fearing to fall down the social ladder. However, the authors report consistent perceptions across groups. Here, the paper's findings suggest a change in perception about social mobility as income grows. Nevertheless, the positive effect of inequality on happiness levels decreases

as income increases, lending some support to the hypothesis of Alesina et al. (2004). Note that, as argued above, this paper can only make the argument about preferences over inequality, because absolute and relative income have been accounted for in the regression.

Albeit the signs of the coefficients on absolute and relative income supporting the hypothesis that increases in income inequality adversely affect happiness, the effect picked up by the coefficient on $gini$ across individuals predicts the opposite, and it remains to be discussed what the net effect of increases in income inequality on happiness is. Notable findings of non-pecuniary predictors from the multiple linear regression relevant to this discussion, and regarding **result 4,** include the coefficients on unemployment and government expenditure. First, the coefficient on $unemp$ and $unemp\_rate$ are in line with previous research (Clark and Oswald, 1994). Note that individuals who are unemployed are, on average, less happy than employed individuals. Because the regression estimates of employment status on happiness are ceteris paribus, the increases in happiness upon finding employment must be attributed to something other than changes in income, such as a feeling of purpose. Because the coefficients found are more extreme for 'rich' individuals, this hypothesis is supported by the data, since 'rich' individuals are more likely to have 'post-materialist' values as compared to 'poor' people for which employment is likely a means to an end (Argyle 1999). This is a crucial result, as with adverse economic shocks, 'poor' individuals are more likely to lose their employment but are less severely affected by being unemployed. Second, the results for the coefficients on government expenditure (i.e., edu_exp, $health\_exp$) are supported by Inglehart (1997) and Ball and Chernova (2008). Note, again, that the coefficient on edu_exp is positive and significant for all three regressions, while the coefficient on $health\_exp$ is significant and positive for 'poor' individuals and insignificant for 'rich' individuals, indicating that higher government expenditure benefits 'poor' individuals the most. Previous research suggests that 'rich' individuals compensate for lacking governmental services with costlier private substitutes. This is a crucial result as with inequality growth, more individuals become welfare reliant for their happiness, meaning that cuts in government spending per capita have an overly adverse effect on a larger fraction of the population.

To start the discussion about the net-effect of an increase in income inequality on average happiness levels, remember that **hypothesis 4** includes that a shift towards a more unequal income distribution supposedly adversely affects average happiness levels, as the proportion of low relative incomes increases, and only a small fraction of the overall population sees their relative income levels rise, for which there is diminishing returns. Thus, when adding up individual utilities, increased income inequality has negative effects on average happiness. It has already been established that **hypothesis 4** is supported by **result 1-2** and contradicted by **result 3**. The synthetic control method has been introduced to find a net effect of the two contradicting predictions. This method finds that increases in income inequality are at least correlated with lower happiness levels. Thus, the remainder of this paper discusses whether the lower happiness levels summarized in **result 5** are due to a net negative effect of rising income inequality or other confounding factors, for which three interpretations are given.

First, in line with equation (1), a rise in income inequality introduces a stronger skew toward lower relative income levels (Clark and Frijters, 2008; Proto and Rustichini, 2013). This interpretation would mean that with rising inequality levels, happiness levels would decrease proportionately. Figure 2, instead, shows a steep initial decline and subsequently constant

happiness level. However, this interpretation finds some support in the slight decline in happiness levels of the synthetic control after its 'comparison units' saw slight increases in income inequality from 2012 onwards. Nevertheless, changes in relative incomes cannot fully explain the change in happiness.

Second, increases in income inequality see larger parts of the overall population become increasingly welfare dependent (Inglehart, 1997 Alesina et al., 2004; Ball and Chernova, 2008). If government spending remains constant for a growing proportion of the population dependent on it, then governmental expenditure per capita decreases. Indeed, the trend in government spending was similar in Spain and all 'comparison' units until 2011, which all saw a slight rise (see Appendix 4b). What was different for Spain was the increase in income inequality, meaning that Spain likely saw increased welfare dependence. Thus, Spain experienced relatively decreased government spending per capita as compared to the synthetic control. Because government services have a positive effect on individual happiness, a decline in government expenditure per capita may explain lower average happiness levels. Nevertheless, this process was only gradual, but the decline in happiness abrupt. Hence, changes in welfare dependence can, again, not fully explain the change in happiness.

Third, developments in some non-pecuniary individual-level variables severely adversely affected the population of Spain while they did not affect the population of the 'comparison' units to the same extent. An important variable is unemployment, which has been majorly affected by the financial crisis (see Appendix 4a). However, 'poor' individuals are more likely to become unemployed during crises and, as argued above, are also less severely affected by unemployment regarding their happiness (Bitler and Hoynes 2015). Additionally, the pattern of unemployment does not coincide entirely with the trend in happiness levels of Spain and the synthetic control. While Spain saw an immediate increase in the unemployment rate after 2008, it kept increasing until 2014. Happiness dropped only instantly and subsequently stayed constant. Thus, changes in unemployment can, again, not entirely explain the happiness decrease for Spain over time, as compared to its synthetic unit.

All in all, it is likely that a combination of explanations can account for the sudden decrease and constantly lower happiness levels in Spain as compared to the synthetic control. Nevertheless, it is likely that increases in income inequality play a role in the relatively worse performance of Spain as compared to its synthetic control, due to stronger skew in relative income levels as well as decreased government spending per capita. Because the drop in happiness is so large, it can be concluded that even if the decrease is not entirely due to rising inequality and its consequences (i.e., increased welfare dependence), rising income inequality (i) has a net negative effect on average happiness and (ii) increases the adverse effects of crises on happiness. Consequently, this paper concludes that **hypothesis 4** is likely to hold in the real world. GDP growth promoting a more unequal income distribution is likely to lead to decreases in happiness over time, although individuals perceive more unequal societies as more beneficial for themselves.

It should be noted that the results of the present study are, per data collection, limited to Europe only. Further research may replicate the findings for further regions of the world.

6 Conclusion

This paper investigated the effect of absolute and relative income, as well as their distribution on individual and average happiness. It has been established that absolute income increases have diminishing marginal effects on happiness, while adaptation leads these effects to fade over time. It has also been established that relative income has enduringly diminishing marginal effects on happiness. Together, these results imply that GDP growth accompanied with increases in income inequality has adverse effects on average happiness. Nevertheless, results from cross-sectional analysis showed that individuals express a preference for inequality, especially when they are 'poor', raising questions about the net effect of distributional GDP growth on average happiness. A longitudinal analysis showed, however, that income inequality and its consequences are likely to have a net negative effect on average happiness levels, meaning that Clark and Frjters' (2008) individual utility models is likely to hold. As a result, pure GDP growth cannot be considered a panacea when it comes to achieving social progress.

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Appendix

Appendix 1

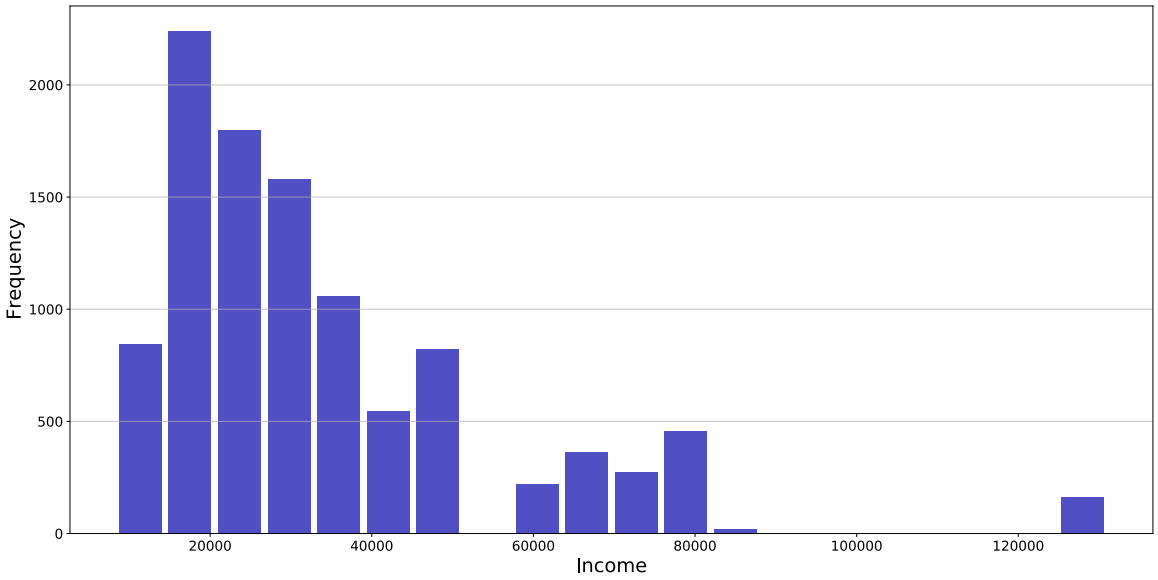
Code	Year	mean(satisfaction)	mean(abs_inc)	gdp_cap	growth	gini	Count
CHE	2007.0	7.92	51558.59	56269.16	1.04	34.3	1027
CYP	2006.0	7.36	16781.17	34599.02	1.12	31.1	989
DEU	2006.0	6.92	25810.16	39143.17	1.03	31.3	1640
ESP	2007.0	7.34	20432.61	34329.65	1.10	34.1	1052
FIN	2005.0	7.81	31053.87	39115.76	1.12	27.6	899
FRA	2006.0	6.87	23755.08	37113.18	1.05	29.7	871
GBR	2005.0	7.58	40880.12	37159.80	1.12	34.3	767
ITA	2005.0	6.91	24571.74	37604.36	1.03	33.8	611
NLD	2006.0	7.75	28333.59	44965.88	1.04	30.0	709
NOR	2007.0	7.99	68500.08	65083.26	1.08	27.1	929
SWE	2006.0	7.75	48888.47	42918.01	1.12	26.4	902

Appendix 1a: Country Summary Statistics

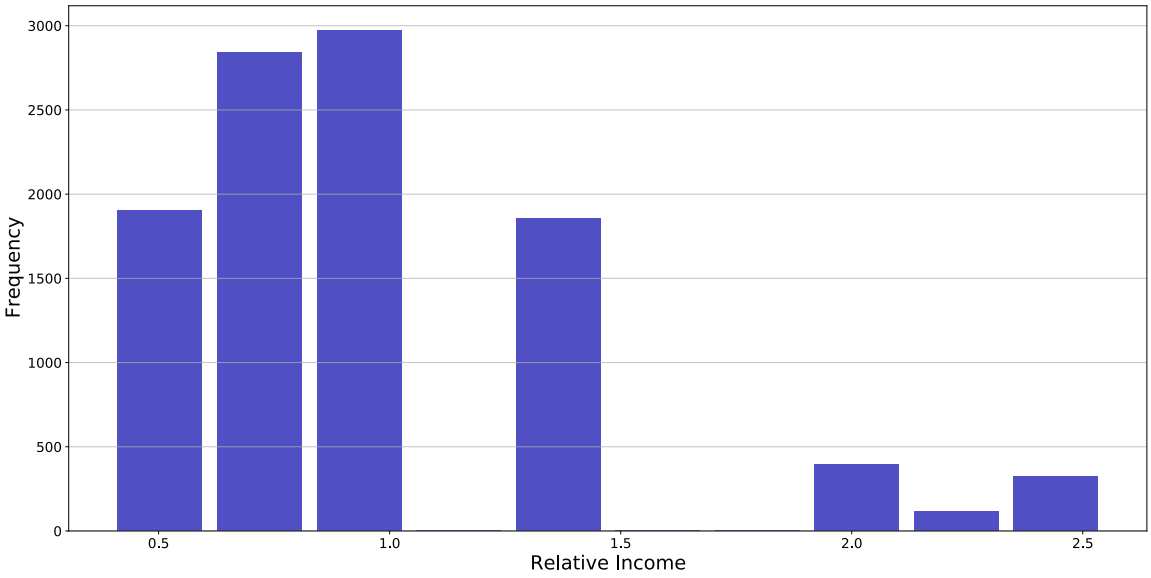
	abs_inc	rel_inc
Mean	34260	0.994
Median	28322	1.000
Std	22022	0.449
Count	10396	10396
Min	8284	0.395
Max	131026	2.548

Appendix 1b: Income Summary Statistics

Appendix 2



Appendix 2a: abs_inc Frequency



Appendix 2b: rel_inc Frequency

Appendix 3

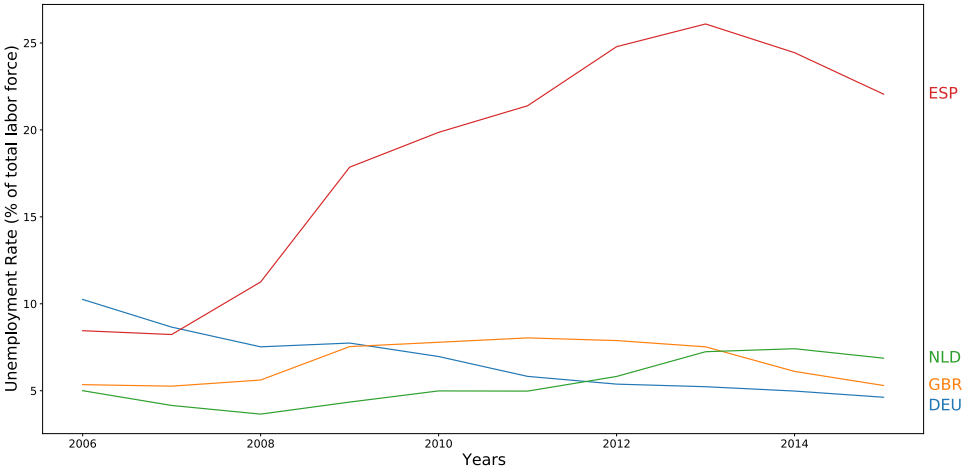
Country	Unit Weight (Spain)
Germany	0.059
United Kingdom	0.582
Netherlands	0.359
Norway	0

Appendix 3a: Synthetic Control Unit Weights

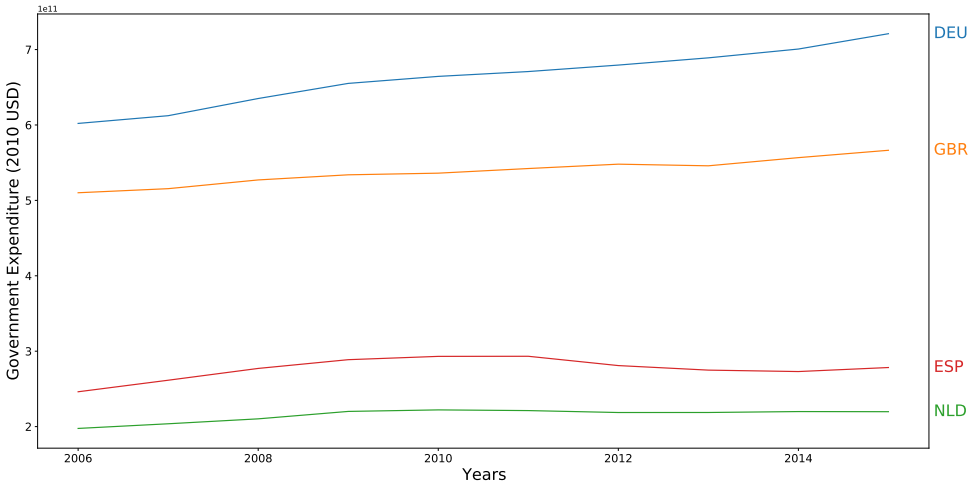
Predictors	Spain	Synthetic Control (Spain)
satisfaction	7.07	7.07
gdp_cap	33301	39959
unemp_rate	8.79	5.52
edu_exp	4.16	4.96
health_exp	7.78	8.88
emissions	433617	518644
gini	32.95	32.50

Appendix 3b: Synthetic Control Predictor Balance

Appendix 4[†]



Appendix 4a: Unemployment Rate



Appendix 4b: Government Expenditure

[†] Data taken from the World Development Indicators (World Bank)