ECONOMIC GROWTH AND SUBJECTIVE WELL-BEING: PROVING THE ASYMMETRY USING A SEGMENTED REGRESSION

Master Thesis

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Abstract: In this master thesis I test how subjective well-being is affected differently by negative and positive quarterly GDP growth. Using subjective well-being data on 15 EU-countries over the course of 32 years, I find that individuals are affected more by negative growth rates than by equal positive growth rates, which is in line with the prospect theory and loss aversion theory. Moreover, by adding controls for employment status, I proof that increasing levels of economic uncertainty following decreases in real GDP growth rates do partially account for the decreases in subjective well-being, but do not explain the entire found asymmetry. This study further confirms that there is indeed a relationship between national income and subjective well-being.

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1. Introduction

Generally, economist have distinguished between several concepts of welfare. The term often coined up by economist is welfare in terms of economic output or national product, often denominated by GDP or GNP, an objective and measurable concept aimed to be maximized by many policy makers. However, the broader concept, the well-being of the individual is often disregarded. As Pigou (2001) suggests, economists often disregard potential differences between maximizing economic output and maximizing subjective well-being, implying that maximizing economic output will subsequently lead to an increase in subjective well-being. However, a strict one-on-one relationship between those two has not been proven, thus maximizing economic welfare does not necessarily lead to concurrently maximizing the subjective well-being of the related individuals.

In my thesis I try to estimate how maximizing economical welfare impacts individual levels of subjective well-being. Similar to the work of De Neve et al. (2018), I will try to uncover how average levels of subjective well-being adjust to changes in quarterly real GDP growth rates. De Neve, et al. (2018) use a reduced form analysis with annual growth rates as the independent variable, whereas I will use quarterly growth rates and interact them with other individual characteristics to further assist in finding the exact relationship between economic growth and subjective well-being for different subject groups. I use raw survey data on subjective well-being at the individual level from 15 countries in the EU from 1975 till 2017. Surveys are conducted one to three times a year, and one individual survey is conducted in the span of one month. I have found that subjective well-being is indeed affected positively by quarterly economic growth, but is affected disproportionately greater in times of negative economic growth, suggesting that stable growth rates are more beneficial to subjective well-being than high level, high variance growth rates. Moreover, my research has shown that the individual subjective well-being of every employment group is affected by economic growth to a different rate than others.

The remainder of my thesis will look as follows: in section two the theoretical framework and related literature will be illustrated, in section three I will describe the data used, in section four the methodology used will be described, section five will contain the regression results and implication, section six will contain the discussion and limitations and ultimately in section seven I will conclude.

2. Theoretical Framework

2.1 Subjective well-being

For a long time, researchers have been working on finding subjective and objective measures for utility. As Bentham (1996) specified back in 1789, the principle of utility describes that every action of either a private individual, a group or the entire government leads to either an augmentation or diminishing of the well-being of the party whose well-being is considered. Utility, in his case, refers to the sum of all pleasures deducted by the sum of all pains an individual can perceive. Therefore, when maximizing the utility of a group, one must understand what the cumulative utility of the corresponding individuals is and maximize it so that the sum of total pleasures is highest, and sum of total pain is lowest. According to Bentham, all actions performed, either by an individual or a government, are implicitly dictated by the principles of utility. A rational agent will always try to attain maximum utility.

However, in order for the government to know which policies maximize utility, utility must be measurable. Usually, it is relatively easy to appoint what increases utility and what decreases utility. A purchase of a new car is likely to increase the utility of someone who already has a car and of someone who has none, but it is unclear how much utility increases exactly as individual, hard-to-measure characteristics influence the utility received from a certain purchase. The purchase of new car increases the utility to a lesser extent for someone who likes cycling than for someone who prefers driving a car. The fact that someone already has one car is measurable and can thus be allowed for when calculating utility, but to which extent an individual prefers to cycle over taking the car are hidden characteristics, that are not easily quantified. Therefore, as many measures of experienced utility are subjective, they were not preferred. After all, they are difficult to measure by anyone else but the individual themselves (Kahneman et al., 1997).

In literature, self-reported measures of utility in the form of questions about an individual subjective well-being have become increasingly common. And albeit these measures of subjective well-being are self-reported and thus not objective, they seem to be rather robust indicators of utility (Dolan & White, 2007). Questions about life satisfaction and subjective well-being are nowadays included in national and international longitudinal surveys, such as German Socio-Economic Panel (SOEP) and Eurobarometer and are used by policymakers as benchmarks if welfare improving policies have their desired outcome (Halpern, Bates, Beales, & Heathfield,

2004). Using subjective well-being as proxy for utility does incur in two normative problems. The first being the so-called adaption theory or *hedonic treadmill*. Humans have the tendency to adapt quickly to changes to their health, economic well-being and other circumstances. Individuals use the weighted average of past experiences, recent health status or recent income as benchmark for estimating their utility (Brickman & Coates, 1978). An individual that earned €30.000 dollar the last year, will report high satisfaction from an increase in yearly income to €60.000. In the subsequent year however, the individual has adapted to their increase in income and will not report the same level of satisfaction with €60.000 as he did last year, but instead is likely to report a level of subjective well-being that is similar to when the individual received €30.000. In the extreme sense this could lead to policy makers failing to see if policies dictated at helping the underprivileged have any affect, as the subjective well-being of those individuals in the long run would remain the same regardless. On an objective standard the underprivileged would be the most deserving of favoring policy changes, but due to the subjective nature of this measure, policy makers can fail to appropriately identify where to intervene (Riis, Loewenstein, & Jepson, 2005).

A second issue is the effect of an individual's future expectations on subjective well-being now. An individual with high expectations for the future is likely to report levels of subjective well-being that are lower. This so-called satisfaction treadmill suggests that people with high objective welfare create high future expectations, thus requiring more positive experiences than individuals with lower expectations. Although the high-expectation individual does receive more positive experiences and does draw more objective satisfaction from these experiences, reported subjective well-being are similar to someone without comparable experiences (Kahneman, 2000). Stultzer (2004) demonstrated that an income increase of 10% lead to an increase in aspirations of 4,2%, suggesting that some kind of satisfaction treadmill does exist.

The determinants of subjective well-being are being researched more and more and subjective well-being is usually preferred over other measures of utility. Unlike decision utility, which measures utility based on future preferences, subjective well-being assesses an individual's overall well-being in life and incorporates more accurately to which degree external factors possibly influence one's overall assessment on life both in the past and in the future (Dolan, Peasgood, & White, 2008), whereas decision utility merely measures the preferable of existing options.

Moreover, the hedonic treadmill and satisfaction treadmill are not prevalent across all individuals and domains. Factors such as social capital, affectionate relationships, health, and personal financial uncertainty do influence subjective well-being both positively and negatively, without returning to a previous benchmark as the adaption and satisfaction treadmill suggest (Lamu & Olsen, 2016; Lucas, 2005; Lucas, Clark, Georgellis, & Diener, 2004). Regarding differences between individuals, research conducted with survey panel data in Germany finds that subjective well-being baseline levels did change over time for about 25% of the individuals in the sample (Fujita & Diener, 2005). Moreover, Lucas et al. (2003) find significant differences in the speed to which an individual adapts to their new status quo, suggesting a full adaption of the hedonic treadmill is not applicable to all individuals over all factors.

2.2 National income and subjective well-being

Easterlin's (1974) work is one of the pioneers in uncovering the relationship between nationwide economic determinants and subjective well-being. By using survey data from 1946 through 1970, Easterlin discovered that whereas an individual's income does influence the individual's subjective well-being, there is no significant relationship between national income and average levels of subjective well-being between countries, neither does he find a relationship between an increase in national income and subjective well-being within country. He suggests that subjective well-being is not shaped by absolute income itself. Instead, Easterlin proposes that subjective well-being is influenced by the relative income of a person to his direct surrounding. An individual allocates weights to specific reference groups relevant to his socio-economic position. An affluent person will compare his income to his wealthy counterparts and vis-à-vis a less affluent person with less wealthy individuals. The further someone is below his reference group, the lower his reported subjective well-being is expected to be. An increase in national income that benefits everyone equally, will thus not improve an individual's position relative to society and will thus not increase average national subjective well-being.

Easterlin's ideas are further supported by the relative income theory, which states that a person's subjective well-being is based on his relative position and income (Clark & Senik, 2010; Ferrer-i-Carbonell, 2005; Luttmer, 2005). They find that absolute income has only a small effect on subjective well-being when controlling for comparison income. Moreover, they find that increases in absolute income paralleled by increases in comparison income leads to no increases in

subjective well-being and that income comparisons are mostly upwards, meaning that being below the income of the reference group affects your subjective well-being adversely, whereas being above your reference group's income does not increase the individual's subjective well-being.

So, is the notion "Money doesn't buy happiness" true? Or does absolute income still enter somewhere in the subjective well-being equation? Research using a flexible multiple-index ordered probit with German household data find an asymmetric relationship of absolute income on subjective well-being, individuals that are part of high absolute income groups being less likely to report low levels of life satisfaction, and individuals part of the low absolute income groups being strongly related to low scores of subjective well-being (Boes & Winkelmann, 2006).

Returning to Easterlin, albeit income does seem to affect subjective well-being within a country, predominantly through comparison with the individual's reference groups, Easterlin could not unveil any relationship between a country's average subjective well-being and national income. Assuming an increase in national income does benefit all members of society equally, this result would be in line with the relative income theory. As everyone's income increases equally, every individual's economic position will remain the same, thus keeping subjective well-being fixed. However, if increases in GDP do not affect every individual to the same extent, changes in average subjective well-being could be observable. Stevenson & Wolfers (2008) using a rich dataset from multiple decades over multiple countries do find evidence of GDP growth to be positively related to reported subjective well-being. They argue that either rising levels of income across single groups or a decrease in economic uncertainty is likely to be the cause of this positive relationship. A similar research conducted by Sacks et al.(2012), using subjective well-being data from the Eurobarometer surveys, find a long-term relationship between subjective well-being and GDP per capita for 7 out of 9 European countries, arguing against the Easterlin paradox. Researches widely have settled that when basic requirements in an economy are not met, increases in GDP do affect average subjective well-being positively, but when the majority of the population does not live in relative poverty, the relationship is ambiguous (Deaton, 2008).

2.3 The asymmetric experience of booms and recessions: the prospect theory

An extended research conducted by De Neve et al. (2018), that this thesis builds upon, tries to estimate the asymmetric experience of positive and negative economic growth on subjective well-being. The authors explore if subjective well-being is asymmetricly affected by positive and

negative economic growth and to which extent this asymmetry is visible. The main contribution to their hypothesis is the notion that humans are generally loss averse and experience a loss to be worse than an equal gain. Individuals reported higher distress over losing money than the reported joy of receiving an equal amount (Kahneman & Tvresky, 1984). Their empirical result was first theorized by Kahneman & Tvresky in 1979 in the prospect theory, in which individuals were said to base their preferences around a reference point. Losses that were a certain distance from the reference point had a greater impact on an individual's decision than equal gains, as depicted in figure 1 below.

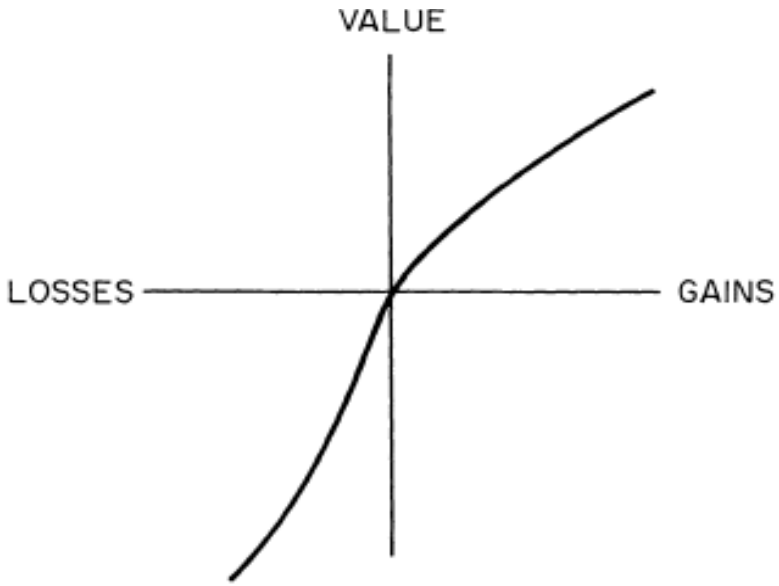


Figure 1. Depiction value function prospect theory (Kahneman & Tversky, 1991, p. 1040)

Furthermore, individuals showed a diminishing marginal (dis)utility to gains (losses), indicating that every next dollar gained would increase their utility by less than the last dollar gained (Kahneman & Tversky, 1991). As individuals are loss averse, De Neve et al. (2018) suggest that they would show similar responses to macroeconomic fluctuations, being affected stronger by economic downturns than by equal economic boosts. Analyzing subjective well-being data by using a piecewise standard OLS regression model De Neve et al. (2018) find robust evidence of this negativity bias. Reporterted levels of subjective well-being decreased more during economic downturns than they increased during equal economic upswings. Their findings could provide explanations to the ambigious results on the relationship between long-term economic growth and subjective well-being found in literature (e.g. *Easterlin et al., 2010*). Short periods of economic downturn could undo the effect of long periods of economic prosperity on subjective well-being,

leading to the effect of long-term economic growth on subjective well-being to be dependent on if an economy over the course of ten years had continuous growth or if the growth was interrupted by short periods of economic recession.

My research will be based on the paper of De Neve et al. (2018) and enhances it in order to obtain an even better understanding of the relationship between well-being and economic growth. Similar to De Neve et al. (2018), I will use eurobarometer survey data from 1975 to 2017 on subjective well-being in 15 countries. De Neve et al. (2018) use yearly real GDP growth rates as independent variable. However, the eurobarometer surveys are conducted multiple times a year not always conducted in the same month. Individuals who are interviewed in February 2017, will experience the economic growth from 2016 to 2017 discordantly from individuals interviewed in November 2017. However, this is not estimated as such by De Neve et al. (2018), as annual growth rates are used regardless of which month the survey is conducted in, which leads to biased estimates. Instead of using annual growth rates, I use quarterly growth rates to be able to utilize the frequency of the survey waves to estimate the effect of economic growth on subjective well-being, simultaneously removing the bias of using annual growth rates to try to explain its effect on subjective well-being retrieved at non-fixed time points.

Uncovering the exact relationship between economic growth and subjective well-being for the corresponding growth rates will further benefit policy makers by aiding them in the search for optimal growth rates. As the prospect theory suggests, individuals are more sensitive to losses than they are to equal gains. I expect this to propogate through subjective well-being. My first hypothesis is therefore:

> *H0: The relationship between subjective well-being and economic growth is linear.*
>
> *H1: The relationship between subjective well-being and economic growth is asymmetric, an individual is more sensitive to negative economic growth than positive economic growth.*

Moreover, the authors only imposed a piecewise linearity constraint, restricting their analysis to uncovering the effect of strictly positive and strictly negative growth on subjective well-being. However De Neve et al. (2018) disregard that an individual's subjective well-being could have diminishing sensitivity to economic growth and would thus have a concave shape above the

reference point and a convex shape below the reference point, as figure 1 of the prospect theory shows. This would mean that an individual would be diminishingly sensitive to every percent increase in growth rate the further the growth rate is from the individual's reference point. An increase in growth rate from 0% to 1% would thus have larger effect on subjective well-being than an increase from 1% to 2%. I will relax this constraint by including the squared of my independent variables to uncover potential convexity or concavity. My second hypthesis therefore is:

H0: Subjective well-being is equally sensitive to economic growth.

H1: Subjective well-being is diminishingly sensitive to positive and negative economic growth.

An individual without economic certainty is likely to be affected differently by changes in economic growth than people with a stable income. Increasing levels of economic uncertainty could lead to higher levels of stress or worry, which are detrimental for subjective well-being (Luechinger, Meier, & Alois, 2009). Multiple studies centred around discovering the relationship between unemployment and mental distress found robust evidence of reported mental well-being being significantly lower for the unemployed than for the employed (Clark & Oswald, 1994; Kassenboehmer & Haisken-DeNew, 2009). Theoretically, it is possible that individuals with lower average subjective well-being are less likely to find a job in the first place, however, Lucas et al. (2004) find strong evidence of individuals who become unemployed later in life to only see a reduction in subjective well-being after they become unemployed, suggesting that self-selection of non-happy individuals into unemployment is minimal.

Economic downturns often come hand in hand with economic uncertainty, for the unemployed this could lead to tougher searches for a job or cuts in unemployment benefits and thus an increase in personal economic uncertainty. Neve et al. (2008) do find that the non-monetary effects of changes in the unemployment rate contribute significantly to changes in life satisfaction. However, they do not explore the exact relationship between economic growth and subjective well-being for different employment groups. Similarly, self-employed are likely to be affected differently by changes in economic growth than contracted employees. During economic downturns, self-employed experience more economic uncertainty, which is offset by working more hours (Parker, Belghitar, & Barmby, 2005). Meier & Stutzer (2008) find that the relationship between number of hours worked and subjective well-being is an inverse U-shape, increasing with hours worked until

the number of hours worked seems excessive. Self-employed are thus likely to face lower levels of subjective well-being when experiencing economic downturns. Assuming the earlier described differences in economic uncertainty between different employment groups, I therefore come to my third and last hypothesis:

> *H0: The relationship between positive and negative economic growth and subjective well-being is not significantly different per employment status.*
>
> *H1: The relationship between positive and negative economic growth and subjective well-being is significantly different per employment status. The asymmetry being larger for the unemployed and the self-employed.*

In the next section I will discuss the data and methodology used in order to prove my hypotheses.

3. Data

3.1 Subjective well-being data

To have a clear overview of the exact welfare costs of negative economic growth I use subjective well-being as proxy for utility. The data on subjective well-being is taken from the Eurobarometer survey conducted one time or several times a year from 1975 until 2017 on behalf of the European Commission in most member countries of the European Union. In my thesis I will focus on the 15 longest-participating countries from the Eurobarometer surveys[1]. In the appendix I provide an overview of the participating countries in the related year-quarters in table A.1. As visible, the survey started with only nine countries, but until the 1995 more countries were gradually introduced to the survey. The survey is conducted in waves and in every wave roughly 1.000 individuals per member country are surveyed. In the survey the respondents are asked a wide array of questions about the respondent's life, their thoughts on subjects as the current political and socio-economic climate, their current economic situation, their family life and so on. Included in the survey is the question "How satisfied are you currently with your life as a whole" to which to respondent are allowed to answer: "very satisfied", "fairly satisfied", "not satisfied" and "not at all satisfied". Coded as "1", "2", "3" and "4" in the data.

[1] Countries interviewed are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Portugal, the Netherlands, Spain, Sweden, United Kingdom.

One issue with using life satisfaction questions is that it might not reflect the actual objective state of well-being of the respondent, but is instead formed by events that happen in the days prior to the interview (Strack & Schwarz, 1999). However, in similar studies, steady sequences of individual subjective well-being have been found and in literature the consensus is that subjective well-being is not excessively dependent on recent experiences and does reflect the actual inner-state of the respondent (Fujita & Diener, 2005). Another potential issue is the lack of possible responses, only ranging from 1 "very satisfied" to 4 "not at all satisfied", could lead to sensitivity issues in the data. Although at micro level, individual levels of subjective well-being can only be exactly 1, 2, 3 or 4, at macro level average subjective well-being scores could be anywhere between 1-4. Provided that the average levels of subjective well-being are statistically significant, the derived results can be adequately used for interpretation (Dolan & White, 2007).

A last important issue is related to the validity of using subjective well-being. As there is no clear objective definition of high life satisfaction or high levels of subjective well-being itself, the questions are open to the respondent's interpretation. Imagine two respondents, due to differences in interpretation one individual could report a lower level of subjective well-being than the other, even though his objective well-being is higher. This problem however is solved by assuming that the experiment is a random trial, where the respondents are randomly selected, which is the case in the Eurobarometer surveys. If randomness is present, interpersonal differences in interpretation cannot attribute to bias in the sample. Furthermore, studies conducted where trained observers or significant others had to evaluate if individual well-being report converged to their actual state of well-being or if the respondent answered to social norms claimed the validity of these reports (Lepper, 1998; Kahneman & Redelmeier, 1996). All considering, individual reports of subjective well-being seem to be rather robust and relatively indifferent to measurement error and unreliability.

In order to make the interpretation of the results more straightforward and increase comparability to similar studies, subjective well-being is constructed so that it has a mean of 0 and a standard deviation of 1. An increase in absolute growth rate of 1% from $t-1$ to t will then increase or

decrease life satisfaction with the respective coefficient multiplicated by one standard deviation divided by 100[2].

3.2 Macro-economic variables

Macroeconomic data on quarterly GDP is retrieved from the Organization for Economic Co-operations and Development (OECD). Population and unemployment data until 1975, the first survey year, was not available in the OECD database and was thus retrieved from the World Bank's world development indicators database. GDP is measured in US dollars at current prices and purchasing power parity (PPP) and adjusted for seasonal differences. GDP per capita was then constructed by dividing the national GDP with the population data. In the case of gaps in the macroeconomic data, government websites were used instead. The datapoints correspond to the respective country-quarter. In the table below a summary is given of life satisfaction and the main macro-economic variables. The dataset contains 1,267,757 micro observation related to life satisfaction ad 1,070 macro observations, that correspond with the country-quarters that the surveys were conducted in. All in all, about 15% of the economic growth variable corresponds to negative growth, and 85% corresponds to positive growth.

Table 1: Descriptive statistics

	Obs.	Mean	S.D.	Min.	Max.
Life satisfaction (1-4)	1,267,757	3.084	0.755	1.00	4.00
Economic Growth (Qtly)	1,070	0.011	0.014	-0.06	0.11
Positive Growth (Qtly)	912	0.029	0.022	0.00	0.254
Negative Growth (Qtly)	158	0.029	0.024	0.00	0.101
Unemployment Rate	1,070	0.088	0.045	0.00	0.27
Inflation	1,070	0.010	0.012	-0.03	0.10
GDP per capita (U.S$)	1,070	29021.68	15494.49	3896.31	105368.93
Positive Growth (An.)	817	0.009	0.009	0.00	0.104
Negative Growth (An.)	252	0.009	0.010	0.00	0.068

3.3 Control variables

In order to single out the effect of economic growth on subjective well-being and reduce individual heterogeneity, I include age, age squared, education, marital status and gender as controls. Age

[2] Growth is coded so that a 1% growth rate appears in the data as 0,01. An increase to 2%, will appear in the data as 0,02. Therefore, if growth increases with 1%, subjective well-being changes by the reported standard deviation divided by 100.

and age squared both enter the model as there is evidence of a U-shaped relationship between age and subjective well-being. Younger people tend to be happier than adults, however once a certain age is reached, research finds that age has a positive effect on subjective well-being, possibly due to older people experiencing less stress and being more able to recognize what they want in life (Diener & Chan, 2013). Moreover, older people are more likely to be financially stable and ae therefore influenced less by economic fluctuations (Blanchflower & Oswald, 2004; Ferrer-i-Carbonell & Gowdy, 2007). The influence of gender on subjective well-being does not have an unambiguous answer, however in developed countries women tend to report higher levels of subjective well-being than men (DiTella, MacCulloch, & Oswald, 1999). Education years likely influences subjective well-being through an array of unobservable traits as intrinsic motivation, ability and intelligence, moreover it is correlated with health and income and therefore an important control, as data on health and income are both not present in the survey data (Blanchflower & Oswald, 2004). In my third hypothesis I want to find evidence of a disparity in the relationship between economic growth and subjective well-being for different employment groups. In the Eurobarometer survey, the type of occupation of the respondent is one of the questions asked. As these occupation groups were too broad to be able to draw coherent conclusions, I have recoded so that an individual is either *"employed", "unemployed", "self-employed"* and "*other*". The group "*other*" contains individuals that are not working, but are also not looking for a job, e.g. students, housewives and individuals enlisted in the military. Lastly, dummy variables are created per individual survey and per country to reduce the bias due to unobserved heterogeneity between countries and between surveys.

4. Methodology

The following baseline equation is estimated to proof the hypotheses:

$$SWB_{ijt} = \beta_1 Growth^{+}_{jt} + \beta_2 |Growth|^{-}_{jt} + \beta_3\, x_{ijt} * Growth^{\pm}_{jt} + X'_{ijt} + D_t + \gamma_j + q_t + \varepsilon_{ijt}$$

Where SWB_{ijt} corresponds to the subjective well-being of individual i, in country j in the year-quarter t when the survey is conducted. $Growth_{jt}$ corresponds to the real GDP growth from $t-1$ to t, in this case the real GDP growth from the previous quarter to the quarter of the interview. $Growth_{jt}$ has two terms, the first being positive economic growth (> 0%) in the corresponding country-quarter, identifiable by the + sign above it. The latter being strictly negative growth in the

corresponding country-quarter (< 0%), identifiable by the – sign above. Negative growth is computed in absolute values as to simplify the interpretation of the obtained coefficients. X_{ijt} is a set of individual specific control variables, as age, marital status, education and gender. $x_{ijt} * Growth_{jt}^{\pm}$ is an interaction between x_{ijt}, a subset of the individual specific control variables, and economic growth, in order to unveil heterogeneity within different socio-economic groups. D_t contains all survey fixed effects, in order to control for differences between surveys over the years, such as minimal differences in interview methods[3]. q_t includes quarter fixed effects to control for seasonal adjustments, such as lower subjective well-being levels in winter, and other quarter specific shocks that could influence the estimates. γ_j denote country-specific intercepts in order to reduce omitted variables bias by taking into account unobserved heterogeneity between countries, like geographical position, culture, religion and many others. Due to small differences in survey wave set-up and removal of extreme values of survey answers the panel data is unbalanced. However, as the respondents are randomly selected by Eurobarometer and are accordingly a good representation of the population, the results are not likely to be biased. Moreover, the usage of individual characteristic controls in addition to country- and wave-specific controls, to control for unobserved heterogeneity, should reduce the bias to a minimum. A standard fixed effects regression with standard errors clustered on country-quarters is used.

I use zero growth as the natural reference point for economic growth. Meaning that growth above zero percent is considered positive relative to expectations, growth below zero percent is considered to be a negative experience. The main independent variables are thus separated at 0% growth. At which level the reference point should be established is up for discussion. It could be entirely possible that individuals would regard growth of 1% as "bad" if the average economic growth rate in the previous quarters was 3%, similarly individuals could regard economic growth of -1% as good if the economy had an average growth rate of -5% in the earlier quarters. However, this will be discussed and tested in a later chapter.

[3] Such as using "Not satisfied at all" instead of "Not at all satisfied" as one of the possible responses on the life-satisfaction question asked in a survey.

5. Results

5.1 Hypothesis 1:

Across my sample I find strong evidence of the first hypothesis being true. Subjective well-being is affected less by economic growth than by economic downturns. Table 2 provides a clear overview of the obtained results. The first regression shows that subjective well-being is positively affected by economic growth as was found by De Neve et al. (2018). A 1% increase in quarterly real GDP growth increases subjective well-being by approximately 0,015 standard deviations. After imposing a piecewise restriction on real GDP growth rate in column 2, I again find significant coefficients. The coefficients are larger for negative economic growth than for positive economic growth. An individual's subjective well-being is affected three times stronger by economic downturns than by equivalent economic growth. Implying that one quarter of economic downturn offsets the gains of three quarters of equivalent economic growth.

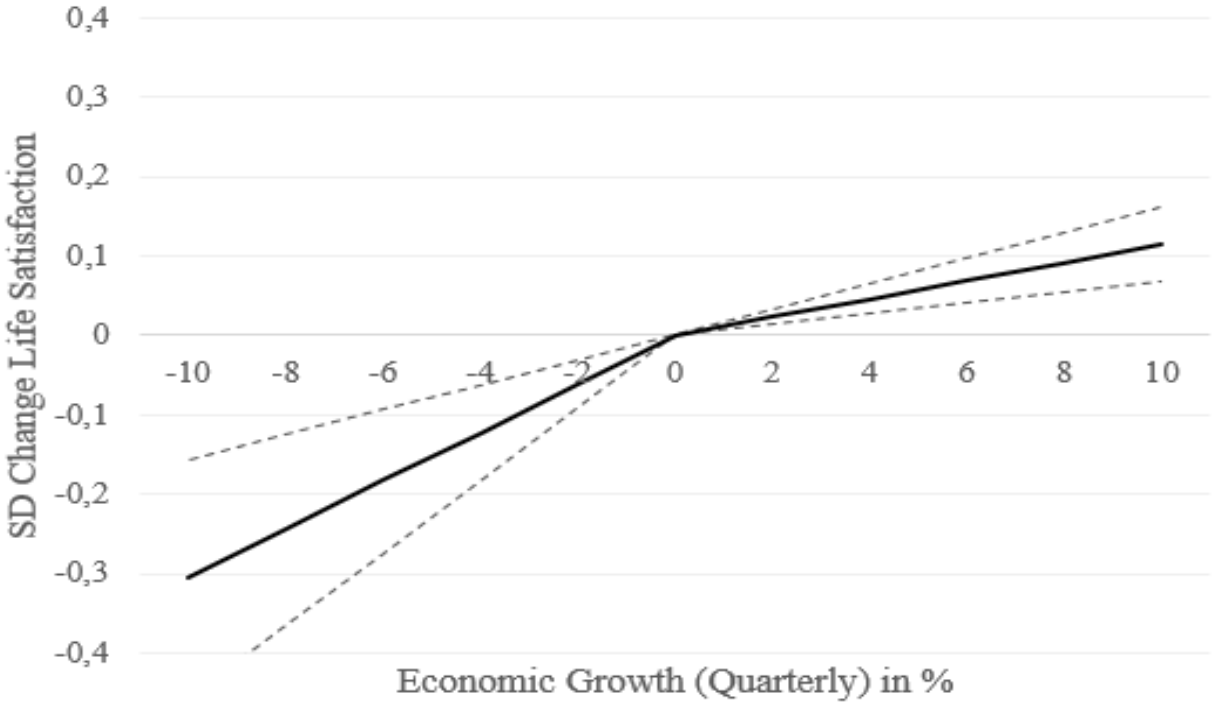
The retrieved piecewise asymmetry is similar to the function of the prospect theory, where gains are overshadowed by losses in terms of value (Kahneman & Tversky, 1991). I repeat the estimation in column (3) and (4), but with annual real GDP growth rates instead of quarterly real GDP growth rates as it is possible that individuals feel the effects of an economic contraction only after a certain amount of time. The results obtained in column (3) are similar to column (1), providing evidence that individuals benefit from economic growth even after one year. The asymmetry between positive and negative economic growth is however not evident in the fourth regression. Using annual growth rates instead of quarterly growth rates, I obtain a statistically significant coefficient for positive growth, confirming the positive relationship between economic growth and an individual's subjective well-being. The coefficient of negative growth is negative, albeit not significant, providing insufficient proof that the asymmetric relationship also holds for annual growth rates. This shows a remarkable difference with the results obtained by De Neve, et al. (2018), who find robust proof of this asymmetric relationship, obtaining significant results for both positive and negative growth. It seems that using the real GDP growth rates related to the actual respective survey quarters, instead of survey years, does make a difference. Figure 2 provides a graphical representation of the piecewise asymmetric relationship found between quarterly growth rates and subjective well-being.

Table 2: The asymmetric relationship between Subjective Well-being and Economic Growth (1975-2017)

	Quarterly		Annually	
	(1)	(2)	(3)	(4)
Economic Growth$_{jt}$	1.590***		1.815***	
	(0.268)		(0.529)	
Positive Growth$_{jt}$		1.142***		2.230***
		(0.237)		(0.562)
Negative Growth$_{jt}$		-3.056***		-0.939
		(0.763)		(1.420)
Adjusted R^2	0.042	0.043	0.042	0.042
F	168.2	167.4	167.2	165.3
Observations	1,267,757	1,267,757	1,267,757	1,267,757

Standard errors in parentheses. Standard errors are adjusted for clustering at the country-yearquarter level. Coefficients reflect the change in standard deviation of subjective well-being with 100% increase in quarterly real GDP growth rate from t-1 to t. Individual specific regression controls included are age, age², education, marital status and sex. Country fixed effects and survey wave dummies are present in all regressions. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure 2: Graphical representation of asymmetric relationship between GDP growth and subjective well-being



Graphical representation of the coefficients retrieved in the second column of table 2, 95% confidence intervals are illustrated with dashed lines.

In the previous regression I have showed that an asymmetric relationship between positive and negative economic growth and subjective well-being does exist. Nevertheless, the previous analysis was in reduced form, merely using real GDP growth as macroeconomic indicator. There is a wide array of macroeconomic fluctuations that can be both the cause or consequence of GDP

growth and downturns and as such could be the main determinants of changes in subjective well-being instead of purely real GDP growth. Indeed, DiTella, MacCulloch, & Oswald (1999) have shown that macroeconomic variables, such as unemployment and inflation, are indicators of variation in life satisfaction and could be the main force of decreasing life satisfaction during a recession. Alternatively, disproportionally high growth rates in sectors that predominantly the affluent benefit from, increase income inequality, which in turn could affect average levels of subjective well-being (Alesina, Di Tella, & MacCulloch, 2004). Simply putting it, stating that purely economic growth always improves subjective well-being and economic downturns always reduce subjective well-being would be rash and premature. In order to see how economic growth affects subjective well-being, while allowing for the potential consequences of economic growth or economic downturn itself to enter the equation, I regress the base regression including macroeconomic variables likely to be affected by variations in real GDP, such as unemployment and inflation. The obtained coefficients are displayed in table 3.

Table 3: Main Regression with Macro-economic variables

	Log GDP (1)		Unemployment Rate (2)		Inflation (3)		All Macro (4)	
Economic Growth$_{jt}$	1.214***		0.791***		1.628***		0.784***	
	(0.298)		(0.204)		(0.262)		(0.204)	
Positive Growth$_{jt}$		0.656**		0.383**		1.167***		0.365*
		(0.279)		(0.185)		(0.232)		(0.197)
Negative Growth$_{jt}$		-2.954***		-2.134***		-3.137***		-2.112***
		(0.703)		(0.508)		(0.725)		(0.505)
log GDP per Capita$_{jt}$	0.296***	0.312***					-0.0113	0.00403
	(0.0512)	(0.0507)					(0.0377)	(0.0375)
Unemployment Rate$_{jt}$			-2.709***	-2.702***			-2.766***	-2.735***
			(0.132)	(0.133)			(0.148)	(0.146)
Inflation$_{jt}$					3.101***	3.129***	-0.399	-0.361
					(0.674)	(0.677)	(0.481)	(0.476)
Adjusted R^2	0.043	0.044	0.049	0.049	0.043	0.043	0.049	0.049
F	164.6	164.3	172.3	173.7	166.0	165.3	171.4	172.4
Observations	1,267,757	1,267,757	1,267,757	1,267,757	1,267,757	1,267,757	1,267,757	1,267,757

Standard errors in parentheses. Standard errors are adjusted for clustering at the country-quarter level. Coefficients reflect the change in standard deviation of subjective well-being with 100% increase in quarterly real GDP growth rate. Individual specific regression controls included are age, age², education, marital status and sex. Country fixed effects and survey wave dummies are present in all regressions. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Despite the addition of the macroeconomic variables, the coefficients of *Positive Growth* and *Negative growth* still reflect the value curves as depicted in the prospect theory. As expected, the unemployment rate has a negative effect on subjective well-being. Individuals are met with higher job uncertainty, increasing stress and decreasing subjective well-being. However, the main independent variables are robust to the inclusion of unemployment, albeit coefficients on positive and negative growth do both decrease in value. This suggests that decreases in subjective well-being do not only propagate through increases in unemployment but are still partially predicted by economic growth rates or other non-included macroeconomic variables. A similar conclusion can be drawn about the inclusion of the logarithm of the GDP per capita. But with a note of caution, the logarithm of GDP per capita becomes statistically insignificant when including all macro-economic controls. Controversially, in column (5) and (6) the coefficient on inflation is positive and highly significant, which is in stark contrast with the literature (Alesina, Di Tella, & MacCulloch, 2004; DiTella, MacCulloch, & Oswald, 1999). However, previous research has not consistently obtained negative estimates, the cause often being contributed to a lack of other macroeconomic indicators that correlate with inflation (Dolan, Peasgood, & White, 2008). This could be the case in column (5) and (6), as no other macroeconomic indicators are included except for real GDP growth rates. When including other macroeconomic indicators, the effect of inflation on subjective well-being becomes statistically insignificant. In all four of the estimations the coefficients of negative and positive economic growth are consistently robust to the inclusion of any macroeconomic variables, remaining statistically significant and keeping its asymmetry over all estimations.

It is entirely possible that a multitude of other macroeconomic variables are necessary to provide an exhaustive answer to the question through which channels economic growth influences subjective well-being. However, as de Neve et al. (2018) advocate, the simultaneous inclusion of too many macroeconomic indicators is likely to bias the estimates, which leads to a more parsimonious model. Given the robustness of my independent variables, there are likely other avenues how exclusively the economic growth rate affects subjective well-being. For example, the disproportionate frequency that negative news is reported over positive news, which could prompt individuals to experience economic downturns as worse than it truly is (Soroka, 2006). However, further research on this topic is necessary to explore the exact avenues how subjective well-being is altered by economic growth rates.

5.2 Hypothesis 2:

In order to try to reject the null-hypothesis of my second hypothesis, I rerun the baseline regression adding two new separate independent variables. The new variables being positive growth rate squared and negative growth rate squared. The inclusion of the squared growth rates will allow me to check if the relationship between growth and subjective well-being is not merely asymmetric and linear, but possibly concave or convex. Implying that subjective well-being is less or more sensitive to economic growth the further the growth rate is from the chosen reference point. This leads to the following regression:

$$SWB_{ijt} = \beta_1 Growth^{+}_{jt} + \beta_2 \left(Growth^{+}_{jt}\right)^2 + \beta_3 |Growth|^{-}_{jt} + \beta_4 (|Growth|^{-}_{jt})^2 + X'_{ijt} + D_t + \gamma_j + q_t + \varepsilon_{ijt}$$

All other listed variables are identical to the baseline regression used for my first hypothesis.

Table 4: Non-linear relationship between positive and negative economic growth on subjective well-being

	(1)	(2)
Positive $Growth_{jt}$	1.586***	0.647**
	(0.381)	(0.320)
Positive $Growth_{jt}^2$	-3.772**	-2.480
	(1.721)	(1.630)
Negative $Growth_{jt}$	-5.486***	-3.992***
	(1.819)	(1.176)
Negative $Growth_{jt}^2$	33.14	25.28*
	(21.53)	(13.64)
Log GDP per $Capita_{jt}$		0.0144
		(0.0379)
$Inflation_{jt}$		-0.222
		(0.482)
Unemployment $Rate_{jt}$		-2.693***
		(0.149)
Adjusted R^2	0.043	0.049
F	166.4	170.0
Observations	1,267,757	1,267,757

Standard errors in parentheses. Standard errors are adjusted for clustering at the country-quarter level. Coefficients reflect the change in standard deviation of subjective well-being with 100% increase in quarterly real GDP growth rate. Individual specific regression controls included are age, age², education, marital status and sex. Column (1) is in reduced form, column (2) includes relevant macroeconomic variables. Country fixed effects and survey wave dummies are present in all regressions.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The retrieved coefficients do provide evidence of subjective well-being being somewhat diminishingly sensitive to economic growth. The original main independent variables, positive quarterly growth and negative quarterly growth, remain statistically significant and indicate a similar asymmetry as proved in the baseline regression and are thus robust to the inclusion of the

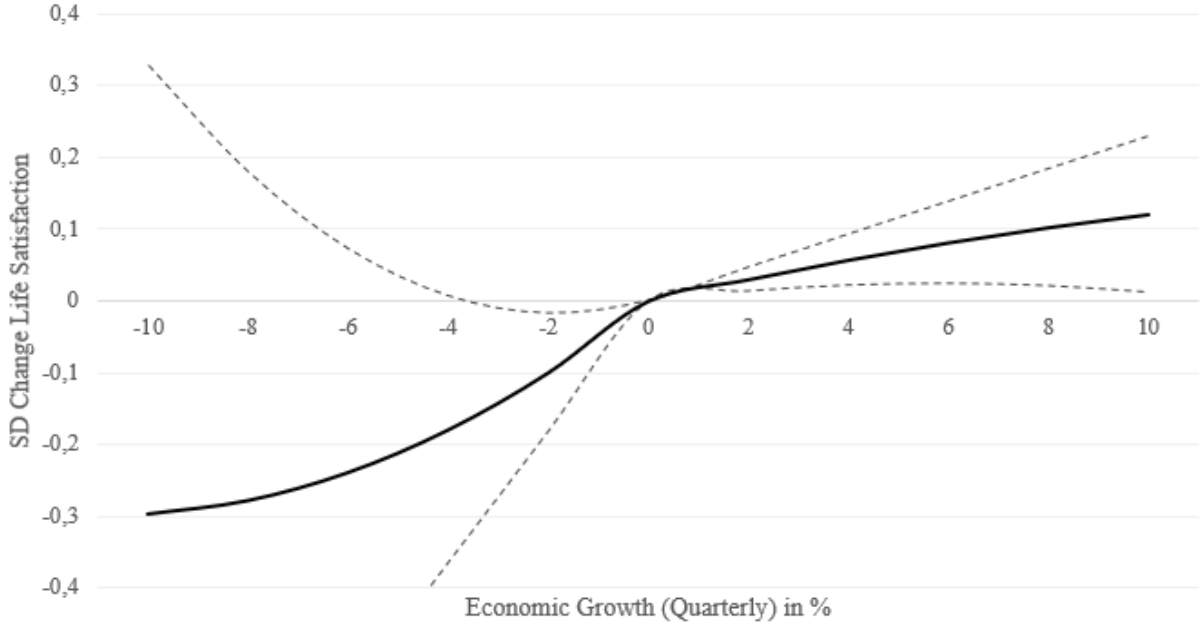
squared terms of the independent variables, also when controlling for related macroeconomic variables as seen in column (2). The coefficients on the squared independent variables do not provide indisputable proof of diminishing returns on economic growth. In the reduced form analysis positive economic growth has a concave relationship with subjective well-being, following the relationship portrayed in the prospect theory. However, it cannot be proven that the squared negative economic growth is significantly different from zero. Thus, a convex relationship, as portrayed in the prospect theory, between negative economic growth and subjective well-being cannot be confirmed with substantial certainty. In column (2), in which relevant macroeconomic determinants are included in the regression, I find the opposite. Positive economic growth squared is still negative, indicating a concave relationship between positive growth and subjective well-being, but it is not statically significant (P-value equals 0.128). Negative economic growth squared however is statistically significant to the 10% level.

In figure 3, the coefficients on economic growth of column (1) are graphically represented. This figure does show a remarkable resemblance with the relationship as depicted in the prospect theory in figure 1. As in column (1), the coefficient on negative economic growth squared is only statistically significant to the 13%, therefore the reported confidence intervals do show values that are unlikely to happen. Such as subjective well-being increasing as negative economic growth further decreases. Furthermore, due to the squared formulation of my regression, as absolute growth rates increase, the relationship between subjective well-being and economic growth will eventually follow a U-shape in the case of negative economic growth and an inverse U-shape in the case of positive economic growth. Contradictory, this would thus lead to increases in subjective well-being when absolute negative growth rates go from 15% to 16%, as shown in figure A.1 listed in the appendix. Realistically, the line would near an asymptote at a certain growth rate, where a one percent increase in growth rate would not have any more effect on the subjective well-being of the individual. After all, if the economy is collapsing, what is the difference between a 20% or a 21% decrease to an individual.

Nevertheless, as in both regressions the coefficients do not give indisputable proof of a diminishing relationship between subjective well-being and economic growth, but also do not show a clear absence of this relationship, it is hard to conclude if the relationship is purely linear or might have

some convexity/concavity. More research on it, possibly using non-linear regression methods, is needed to unveil the true relationship between subjective well-being and economic growth.

Figure 3: Graphical representation of non-linear asymmetric relationship between GDP growth and subjective well-being



Graphical representation of the coefficients retrieved in column (1) of table 4, 95% confidence intervals are illustrated with dashed lines.

5.3 Hypothesis 3:

In order to explore if increasing economic uncertainty is an important determinant of the significance of the found asymmetric relationship, I use the individual's occupation to estimate the magnitude of the previously found asymmetry in different employment groups. In all Eurobarometer surveys, the respondent is asked to report their current occupation. The answers are coded slightly different in certain waves, but I have recoded them so that in the data they are consistent over all waves. The Eurobarometer surveys distinguish between employed, self-employed, employed and not-working and therefore lends itself perfectly for my next regression. Table 5 provides evidence of the negative relationship between unemployment and subjective well-being, as often found in literature. The coefficient on self-employed is also in line with literature having a positive relationship on subjective well-being. However, robust conclusion cannot be drawn as bias is likely to be present due to unaccounted variables that correlate with

employment status, such as income or stability of family life. Nevertheless, the coefficients are in line with literature.

Table 5: Regression results included employment status

	(1)	(2)	(3)	(4)
Economic Growth$_{jt}$	1.166***		1.242***	
	(0.286)		(0.301)	
Positive Growth$_{jt}$		0.625*		0.693*
		(0.265)		(0.283)
Negative Growth$_{jt}$		-2.843***		-2.945***
		(0.674)		(0.702)
Unemployed$_{it}$	-0.495***	-0.495***		
	(0.00688)	(0.00688)		
Self-employed$_{it}$			0.0828***	0.0828***
			(0.00425)	(0.00425)
Adjusted R^2	0.059	0.060	0.044	0.044
F	203.0	202.3	164.2	163.9
Observations	1,261,792	1,261,792	1,261,792	1,261,792

Standard errors in parentheses. Standard errors are adjusted for clustering at the country-quarter level. Coefficients reflect the change in standard deviation of subjective well-being with 100% increase in quarterly real GDP growth rate. Individual specific regression controls included are age, age², education, marital status and sex. Country fixed effects and survey wave dummies are present in all regressions. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Now that there is clear evidence of the robustness of employment status, I test if employment status also affects how negative and positive economic growth are perceived in relation to subjective well-being. I run the baseline regression on a subsection of the sample, only including the subsample of interest (self-employed, unemployed and employed), including the standard controls plus macroeconomic indicators in order to account for macroeconomic fluctuations caused by changes in real GDP. The obtained coefficients provide evidence of the unemployed being more adversely affected by negative economic growth than the self-employed and employed. With the coefficient of negative economic growth being 0,3 and 0,6 standard deviations larger respectively. However, when controlling for macroeconomic fluctuations following changes in economic growth, this effect disappears and is only discernible in the unemployment rate, again being larger for the unemployed relative to other employment statuses. This could be largely due to a "fear of unemployment" effect (DiTella, MacCulloch, & Oswald, 1999), or in the case of the unemployed, a fear of not finding employment.

Table 6: Sub-sample regression results

	Unemployed		Self-employed		Employed	
	(1)	(2)	(3)	(4)	(5)	(6)
Positive Growth$_{jt}$	2.273***	1.107**	0.912**	0.0588	1.000***	0.539**
	(0.397)	(0.353)	(0.328)	(0.312)	(0.247)	(0.206)
Negative Growth$_{jt}$	-3.583***	-2.112***	-3.205***	-2.218***	-2.984***	-2.305***
	(0.805)	(0.597)	(0.918)	(0.635)	(0.665)	(0.516)
Unemployment Rate$_{jt}$		-3.374***		-2.806***		-2.090***
		(0.221)		(0.194)		(0.151)
Adjusted R^2	0.056	0.068	0.031	0.040	0.038	0.041
F	35.94	45.20	25.22	26.25	92.77	92.72
Observations	78,788	78,788	113,415	113,415	511,438	511,438

Standard errors in parentheses. Standard errors are adjusted for clustering at the country-quarter level. Coefficients reflect the change in standard deviation of subjective well-being with 100% increase in real GDP growth rate. Individual specific regression controls included are age, age^2, education, marital status and sex. Unemployment rate, Inflation growth, the log of GDP per capita and log private consumption are used as macroeconomic indicators in column (2), (4) and (6). Country fixed effects and survey wave dummies are present in all regressions. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

6. Discussion

The regressions indicate that there is strong proof of piecewise asymmetry between negative and positive economic growth within the sample. Several quarters of positive economic growth can be offset by just one or two quarters of economic recession. From a societal point of view, it is thus arguably more beneficial for the economy to have stable low growth rates than high volatile growth rates, including high booms but also deep recessions. Policies directed at increasing the average societal well-being should thus not be focused on merely maximizing growth rates, but instead on high but stable economic growth.

All in all, the results argue against the work of Easterlin (1974, 2010) and further supports the work of Sacks et al. (2012) and De Neve et al. (2018) that higher levels of GDP do have a positive effect on subjective well-being within a country. One of Easterlin's main arguments against the relationship between national income and subjective well-being is that if everyone benefits no-one benefits, however it could be very well true that not everyone benefits or is hindered to the same extent by changes in national income. Moreover, non-pecuniary effects as economic uncertainty could play a large roll in explaining why changes in economic growth do affect subjective well-being. For example, Winkelmann & Winkelmann (1998) show that the non-pecuniary effects of unemployment on subjective well-being, for example through increases in economic uncertainty,

are much larger than that of the related income changes. Arguably, similar effects are likely to be present for the non-pecuniary costs of economic downturns.

In this section I want to further focus on how economic uncertainty influences the experience of positive and negative economic growth. One possible explanation for the found loss aversion is that the disproportionately negative experience of negative growth is mostly due to increases in stress and worry due to rising economic uncertainty. Using differences in economic uncertainty across workers in the private and in the public sector, a research conducted by Luechinger, Meier, & Alois (2009) provided evidence that the subjective well-being of individuals with higher economic uncertainty, individuals working in the private sector, is more senstive to changes in the unemployment rate than the subjective well-being of individuals working in the public sector. In order to estimate if differences in economic uncertainty across individuals can explain the found loss aversion, I utilize that, starting from 1990, the eurobarometer surveys include the question "*What are your expectations for the year to come (the next twelve months): will the economic situation in (our country) be better, worse or the same?*". I generated dummies for each of the three possible answers. Assuming individuals with high (low) expectations for the future economic situation have lower (higher) economic uncertainty, as they have less (more) to worry about, the inclusion of this variable can serve as a proxy for high or low economic uncertainty. If coefficients on negative economic growth reduce significantly with the inclusion of this variable, it can be concluded that not negative growth rates, but increases in perceived economic uncertainty are the likely cause of the found loss aversion.

Reported in table 7 are the results obtained from the inclusion of economic expectations in my reduced form baseline regression. The results confirm the assumption that certain economic expectations do influence current subjective well-being. Individuals with a positive outlook on the economy report higher levels of subjective well-being, whereas the opposite is true for individuals with a negative outlook on the economy. Nevertheless, despite the inclusion of the future economic expectation variable, the coefficients on positive and negative economic growth remain robust and show an identical asymmetry as in the initial baseline regression. Admittedly, the inclusion of future economic expectations has reduced (in absolutes) the effect of economic growth on subjective well-being, indicating that changes due to economic uncertainty are present, but do not explain the entire relationship between economic growth and subjective well-being.

Table 7: Future Economic Expectations

	(1)	(2)
Economic Growth$_{jt}$	1.228***	
	(0.351)	
Positive Growth$_{jt}$		0.576*
		(0.325)
Negative Growth$_{jt}$		-2.283***
		(0.747)
Economic Expectations: Worse$_{it}$	-0.154***	-0.155***
	(0.00760)	(0.00759)
Economic Expectations: Better$_{it}$	0.0922***	0.0935***
	(0.00609)	(0.00601)
Adjusted R^2	0.059	0.060
F	215.5	212.7
Observations	473,913	473,913

Standard errors in parentheses. Standard errors are adjusted for clustering at the country-quarter level. Coefficients reflect the change in standard deviation of subjective well-being with 100% increase in quarterly real GDP growth rate. Individual specific regression controls included are age, age², education, marital status and sex. Country fixed effects and survey wave dummies are present in all regressions. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

6.2 Deviation from the natural reference point

Another potential limitation of the baseline regressions is the usage of zero growth as the natural reference point for an individual. Any economic growth above 0% is considered as a win and on the upper part of the prospect theory's value curve, whereas any growth below 0% is considered as a loss and below the value curve. However, as suggested by Köszegi & Rabin (2004), it is possible that this natural reference point differs across people across countries and could be calculated accordingly. Taking individuals living in China for example: China has experienced an average GDP annual growth rate of about 9% from 1981 until 2017, although for many developed countries annual GDP growth rates of 5% would be considered high, individuals in China could experience an annual growth rate of 5% as far worse than expected and could therefore be below the natural reference point. Whereas a real GDP growth rate of 5% for an individual living in the Netherlands is likely to be considered as above the natural reference point. If past average economic growth would be a more concise natural reference point than a 0% percent growth rate, then in this case the reference point could be calculated by taking the average of last 12 quarters' quarterly growth. Growth rate from $t-1$ to t higher would then be considered as a gain, whereas a growth rate that is lower would be considered as a loss.

An alternative is that not national average growth rates, but relative real GDP growth rates, comparing it to countries that are similar to the individual's should be used as a natural reference point (Bechetti, Castriota, Corrado, & Ricca, 2013). If the entire continent is in an economic boom, but the economic growth rates in one single country remain low, it could be possible that individuals from that country still perceive this positive economic growth as a "loss" relative to the neighboring countries.

In order to check for the possibility of other optimal natural reference points, I rerun the baseline regression with a new reference point as indicator when economic growth is perceived as a gain or as a loss and thus at which point the linearity constraint comes into effect. First, for every country-quarter the reference point is calculated by taking the average of the growth rate in the last twelve quarters. If the corresponding country-quarter growth rate is below (above) the estimated natural reference point it will be perceived as a loss (gain). The absolute difference between the natural reference point and the corresponding growth rate is then estimated in order to be able to obtain clear and interpretable coefficients. Similarly, the natural reference point for relative real GDP growth rates is obtained by taking the average quarterly real GDP growth rate of the 15 European countries in the sample excluding the country of interest. A real GDP growth rate lower (higher) than the average of the other 14 countries will then be considered as a loss (gain).

In the regression reported below I find that using the deviation from the average quarterly growth rate of the previous 12 quarters does not obtain statistically significant coefficients. A potential reason is the lack of individual's awareness of the exact average quarterly growth rates, as often annual growth rates are reported by news media, but not quarterly. Moreover, negative economic developments are disproportionately more reported in the media than positive economic developments, leading to a bias as to which information reaches the individual (Soroka, 2006). As long as real GDP growth rates are not substantially low, individuals are possibly not even informed of its level relative to the average growth rate of the previous quarters. Adding macroeconomic variables does not affect the coefficients significantly.

Column (3) and (4) do provide evidence that a natural reference point different from zero growth rate could provide explanatory power too. In both regressions, the asymmetric piecewise relationship between economic growth and subjective well-being is present, indicating that the prospect theory does not only propagate through only absolute economic growth, but also through

relative economic growth. Whereas economic growth larger than EU-15 average only leads to small increases in subjective well-being, real GDP growth rates lower than the neighboring countries is strongly related to harsh decreases in subjective well-being. The obtained results are in line with the abundant literature on the effect of relative income on subjective well-being that generally points towards relative income affecting subjective well-being to a larger extent than absolute income, and in some cases even suggesting that only relative income affects subjective well-being (see Wolfers, Sacks, & Stevenson, 2013). And although the coefficients cannot attest for the latter, the regression results indicate that at least on international level both absolute and relative income play a significant role in determining an individual's subjective well-being.

Table 8: Different natural reference points

	Compared to 8 quarters average		Relative	
	(1)	(2)	(3)	(4)
Positive $Growth_{jt}$	0.460	0.379	0.746***	0.0961
	(0.556)	(0.347)	(0.260)	(0.237)
Negative $Growth_{jt}$	-0.383	-0.416	-2.692***	-1.696***
	(0.377)	(0.307)	(0.529)	(0.377)
log GDP per $Capita_{jt}$		0.0454		0.00565
		(0.0393)		(0.0379)
Unemployment $Rate_{jt}$		-2.824***		-2.689***
		(0.144)		(0.143)
Adjusted R^2	0.042	0.049	0.043	0.049
F	167.6	174.0	167.2	172.7
Observations	1,232,280	1,232,280	1,267,757	1,267,757

Standard errors in parentheses. Standard errors are adjusted for clustering at the country-quarter level. Coefficients reflect the change in standard deviation of subjective well-being with 100% increase in quarterly real GDP growth rate. Individual specific regression controls included are age, age², education, marital status and sex. Column (2) and (4) include the reported macro-economic variables. Country fixed effects and survey wave dummies are present in all regressions.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

6.3 Robustness checks

Historically, for most European countries there has not been such a consistent streak of negative growth rates as during the recession of last decennium (2007-2009). One potential issue could be that the great recession is the main cause of the found asymmetric relationship between positive and negative growth and subjective well-being. As the Eurobarometer data spans over a large period of time, I can rerun the baseline regression excluding subjective well-being data during the great recession in order to see if the main relationship still holds. The results are presented in table A.2 in the appendix and show that even with the exclusion of the great recession years the main

relationship is still supported by the data. If anything, the difference between experience of negative or positive real GDP growth rates becomes more profound.

Another potential cause for concern is that not every country in the dataset is represented equally. As discussed in the data part of my thesis, only nine countries have been participating in the Eurobarometer survey from the start in 1975, whereas the remaining six countries in my dataset joined in the course of time. A disproportionate amount of datapoints from a number of countries could lead to a lack of generalizability of my findings to the other countries in the sample, even when controlling for country fixed effects. I rerun the baseline regressions, omitting all years where not all countries in my dataset were represented (1975-1994) to check if my main findings are robust. Table A.3 in the appendix provides evidence of the robustness of the main results, coefficients only changing by a small margin when excluding years when not all countries were represented. From a similar point of view, I also rerun the baseline regression excluding all data point from the countries that are not represented in the earlier years, only using the nine countries that were present since 1975. Results are listed in table A.4 and show comparable results. Again, the main independent variables remain robust to the exclusion of the not equally represented countries and coefficients only change by a small margin. The outcome of the robustness checks does allow for some generalizability of the main finding, at least to countries that are socio-economically similar to the countries in the sample.

The research conducted so far has provided strong insights how business cycles influence subjective well-being. So far, robust evidence indicates that preventing negative economic growth is most beneficial to societal welfare. At least, stable growth rates are more beneficial than periods of high economic growth followed by periods of negative economic growth, as one period of negative economic growth could offset the former. Another way of looking at this is that volatility is potentially the reason of the asymmetric experience of positive and negative economic growth rate. One year of negative economic growth could offset multiple years of positive economic growth. In other words, high levels of real GDP growth rate paired with low volatility seems to be optimal for the maximization of subjective well-being. To test for this, Wolfers (2003) regresses the mean and volatility of several macroeconomic variables, including inflation and unemployment, and finds that high volatility does indeed decrease subjective well-being and similar measures of psychological well-being. Similar to Wolfers (2003), I regress the mean real

GDP growth rate of the previous 12 quarters and the associated standard deviation as proxy for GDP growth volatility and find results backing the piecewise asymmetry found in the previous regressions. The results in column (3) of table 9, in which both mean growth rate and its standard deviation are used as main independent variables, further solidifiy the fact that long term business cycle volatility is harmful to societal well-being and should be minimized.

Table 9: Business Cycle Level & Volatility and Subjective Well-Being

	(1)	(2)	(3)
$Mean_{jt}$	3.694^{***}		3.938^{***}
	(0.358)		(0.366)
Standard $Deviation_{jt}$		1.045^{**}	-1.178^{**}
		(0.442)	(0.530)
Adjusted R^2	0.045	0.042	0.045
F	171.3	169.5	170.6
Observations	1,214,663	1,214,663	1,214,663

Standard errors in parentheses. Standard errors are adjusted for clustering at the country-quarter level. Coefficients reflect the change in standard deviation of subjective well-being with a 100 percentage points increase in mean or standard deviation of real GDP growth rate. Individual specific regression controls included are age, age², education, marital status and sex. Column (1) contains the mean GDP growth rate from t to t-12, column (2) contains the standard deviation over the same period and (3) includes both variables. Country fixed effects and survey wave dummies are present in all regressions. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

7. Conclusion

Using Eurobarometer survey data on individuals in 15 European countries over the course of 32 years, this study has confirmed that an individual's well-being is indeed disproportionately affected by negative economic growth relative to positive economic growth of the previous quarter. Furthermore, the relationship between real GDP growth and subjective well-being seems to be concave when faced with positive growth and convex when faced with negative growth, following the value curve of the prospect theory curve coined up by Kahneman & Tversky.

Moreover, using both employment status and future economic expectations as a proxy for economic uncertainty I have tested how economic uncertainty affects the relationship of economic growth with subjective well-being. Although economic uncertainty does seem to play an important role as to why people experience negative growth disproportionately large, it is not able to explain the entirety of an individual's loss aversion. And although the asymmetry is less profound, the main intendent variables are robust to the inclusion of the unemployment rate, the individual's employment status and the individual's economic. This suggests that there must be other psychological or monetary reasons for my found asymmetry. All-in-all my findings suggest that not high growth rates are most beneficial for a "happy" society, but instead steady growth rates with no economic contractions would benefit society most. One quarter of economic retraction could offset multiple quarters of positive real GDP growth. Considering societal well-being, we should try to attain stable long-term economic growth rates. Quite a useful notion for policy makers that are merely focused on policies that maximize short term real GDP growth rates.

8. References

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Appendix

Table A.1: Survey waves and participating countries

	FRA	BEL	NLD	DEU	ITA	LUX	DNK	IRL	UK	GRC	ESP	PRT	FIN	SWE	AUT
1975Q2	X	X	X	X	X	X	X	X	X						
1975Q4	X	X	X	X	X	X	X	X	X						
1976Q2	X	X	X	X	X	X	X	X	X						
1976Q4	X	X	X	X	X	X	X	X	X						
1977Q2	X	X	X	X	X	X	X	X	X						
1977Q4	X	X	X	X	X	X	X	X	X						
1978Q2	X	X	X	X	X	X	X	X	X						
1978Q4	X	X	X	X	X	X	X	X	X						
1979Q2	X	X	X	X	X	X	X	X	X						
1980Q2	X	X	X	X	X	X	X	X	X						
1981Q2	X	X	X	X	X	X	X	X	X	X					
1982Q1	X	X	X	X	X	X	X	X	X	X					
1982Q4	X	X	X	X	X	X	X	X	X	X					
1983Q1	X	X	X	X	X	X	X	X	X	X					
1983Q4	X	X	X	X	X	X	X	X	X	X					
1984Q1	X	X	X	X	X	X	X	X	X	X					
1984Q4	X	X	X	X	X	X	X	X	X	X					
1985Q1	X	X	X	X	X	X	X	X	X	X					
1985Q4	X	X	X	X	X	X	X	X	X	X	X	X			
1986Q1	X	X	X	X	X	X	X	X	X	X	X	X			
1986Q4	X	X	X	X	X	X	X	X	X	X	X	X			
1987Q2	X	X	X	X	X	X	X	X	X	X	X	X			
1987Q4	X	X	X	X	X	X	X	X	X	X	X	X			
1988Q1	X	X	X	X	X	X	X	X	X	X	X	X			
1989Q1	X	X	X	X	X	X	X	X	X	X	X	X			
1989Q3	X	X	X	X	X	X	X	X	X	X	X	X			
1989Q4	X	X	X	X	X	X	X	X	X	X	X	X			
1990Q2	X	X	X	X	X	X	X	X	X	X	X	X			
1990Q4	X	X	X	X	X	X	X	X	X	X	X	X			
1991Q1	X	X	X	X	X	X	X	X	X	X	X	X			
1991Q4	X	X	X	X	X	X	X	X	X	X	X	X			
1992Q1	X	X	X	X	X	X	X	X	X	X	X	X			
1992Q2	X	X	X	X	X	X	X	X	X	X	X	X			
1992Q3	X	X	X	X	X	X	X	X	X	X	X	X			
1992Q4	X	X	X	X	X	X	X	X	X	X	X	X			
1993Q1	X	X	X	X	X	X	X	X	X	X	X	X			
1994Q2	X	X	X	X	X	X	X	X	X	X	X	X			
1994Q4	X	X	X	X	X	X	X	X	X	X	X	X			
1995Q2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1996Q2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1997Q1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1998Q2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1999Q4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2000Q2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2000Q4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2001Q2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2001Q3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2002Q1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2002Q4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2003Q4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2004Q4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2005Q2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2005Q2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2006Q1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2006Q3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2007Q2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2007Q3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2008Q1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2008Q3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2009Q1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2009Q2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2009Q4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2010Q2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2010Q4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2011Q2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2011Q4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2012Q2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2012Q4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2013Q2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2013Q4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2014Q2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2014Q3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2014Q4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2015Q4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2016Q2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2016Q3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2016Q4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2017Q1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2017Q2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2017Q3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2017Q4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
81	81	81	81	81	81	81	81	81	81	71	63	63	43	43	43

Figure A.1: Graphical representation of relationship between subjective well-being and economic growth with high growth rates

Graphical representation of the coefficients retrieved in column (1) of table 4

Table A.2: Omission of Great Recession years

	(1)	(2)	(3)	(4)
Economic Growth$_{jt}$	1.852***		0.922***	
	(0.309)		(0.233)	
Positive Growth$_{jt}$		1.196***		0.335*
		(0.242)		(0.203)
Negative Growth$_{jt}$		-4.551***		-3.270***
		(0.896)		(0.578)
Log GDP per Capita$_{jt}$			-0.0151	0.00996
			(0.0397)	(0.0385)
Unemployment Rate$_{jt}$			-2.855***	-2.784***
			(0.155)	(0.156)
Inflation$_{jt}$			-0.554	-0.499
			(0.498)	(0.492)
Adjusted R^2	0.042	0.043	0.049	0.050
F	157.6	157.0	161.0	162.8
Observations	1,151,813	1,1518,13	1,151,813	1,151,813

Standard errors in parentheses. Standard errors are adjusted for clustering at the country-quarter level. Coefficients reflect the change in standard deviation of subjective well-being with 100% increase in quarterly real GDP growth rate. Individual specific regression controls included are age, age², education, marital status and sex. Country fixed effects and survey wave dummies are present in all regressions. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.3: Asymmetric experience of positive and negative economic growth on subjective well-being: balanced country-yearquarter (1995-2017)

	(1)	(2)	(3)	(4)
Economic Growth$_{jt}$	1.782***		0.615**	
	(0.391)		(0.279)	
Positive Growth$_{jt}$		1.206***		0.0619
		(0.363)		(0.252)
Negative Growth$_{jt}$		-3.277***		-2.069***
		(0.780)		(0.562)
lnGDPpC			0.304***	0.311***
			(0.112)	(0.112)
Unemployment Rate			-2.776***	-2.749***
			(0.210)	(0.201)
Inflation			-2.053*	-1.697
			(1.147)	(1.108)
Adjusted R^2	0.050	0.050	0.057	0.058
F	189.3	188.0	195.1	196.1
Observations	831,333	831,333	831,333	831,333

Standard errors in parentheses. Standard errors are adjusted for clustering at the country-quarter level. Coefficients reflect the change in standard deviation of subjective well-being with 100% increase in quarterly real GDP growth rate. Individual specific regression controls included are age, age², education, marital status and sex. Country fixed effects and survey wave dummies are present in all regressions. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.4: Asymmetric experience of positive and negative economic growth on subjective well-being: 9 longest surveyed countries (1975-2017)

	(1)	(2)	(3)	(4)
Quarterly Growth	0.861***		0.533***	
	(0.198)		(0.188)	
Pos Quarterly Growth		0.695***		0.312*
		(0.198)		(0.182)
Neg Quarterly Growth		-2.292***		-2.279***
		(0.787)		(0.760)
Log GDP per Capita$_{jt}$			0.0267	0.0359
			(0.0370)	(0.0378)
Unemployment Rate$_{jt}$			-1.303***	-1.316***
			(0.187)	(0.185)
Inflation$_{jt}$			-1.016*	-0.985
			(0.608)	(0.611)
Adjusted R^2	0.044	0.044	0.045	0.045
F	152.5	152.1	149.7	149.5
Observations	855,498	855,498	855,498	855,498

Standard errors in parentheses. Standard errors are adjusted for clustering at the country-quarter level. Coefficients reflect the change in standard deviation of subjective well-being with 100% increase in quarterly real GDP growth rate. Individual specific regression controls included are age, age², education, marital status and sex. Country fixed effects and survey wave dummies are present in all regressions. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.