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Inflation, Unemployment and Happiness: empirical evidences of the contribution of Economic Growth

Jalal El ouardighi and Francis Munier [1]

Abstract

This paper improves the understanding of the trade-off between inflation and unemployment and its impact on Subjective Well-Being (SWB), considering the role of the (Growth Domestic Product) GDP Growth and the issue of heterogeneity/nonlinearity. Effects on SWB depends on the spread between observed and potential GDP growth. The results point out country heterogeneity and nonlinearity of the marginal effects of macroeconomic variables on SWB. Economic growth moderates the relationship between unemployment as well as inflation and SWB. Both unemployment and GDP per capita growth rates have an important impact on Europeans' SWB. Fostering economic growth must be one of the priorities of European policy.

JEL C33, O10, I31

Key words: Subjective well-being, Economic growth, unemployment, inflation, heterogeneity / nonlinearity

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I. Introduction

Among the economic determinants of SWB, unemployment, inflation and GDP are frequently questioned. Considering the trade-off between unemployment and inflation, since the work of Di Tella *et al.* (2001), a consensual outcome shows that both inflation and unemployment reduce SWB (Clark and Oswald, 1994; Shiller, 1996; Frey and Stutzer, 2002; Wolfers, 2003; Clark, 2003; Blanchflower, 2007ab; Malesevic Perovic, 2008; Gandelman and Hernández-Murillo, 2009; Ruprah and Luengas, 2011; Blanchflower *et al.,* 2014). Various studies have shown that unemployment has a negative impact on SWB (Lucas *et al*., 2004, Clark *et al*., 2008; Ochsen and Welsch, 2011; Luhmann *et al*., 2012). According to this literature, the psychological costs of unemployment exceed the decline in income generated by job loss. Indeed, the unemployed face a loss of esteem and a feeling of loss of control over their lives that can generate a depressive state phase. Thus, unemployment permanently reduces an individual's declared well-being, with no return to the initial level of well-being. Therefore, regardless of methodology, period or countries samples show that, overall unemployment has a significantly larger impact on the reduction of SWB compared to inflation, not only because of less income but also because of non-monetary distresses. Many studies show a negative effect of unemployment on SWB and health. Unemployed people seem to be less happy than those with a job (Clark and Oswald, 1994; Oswald, 1997; Winkelmann and Winkelmann, 1998; Helliwell and Huang, 2014).

The contribution of GDP to SWB is another issue. Most arguments rely on the finding of Easterlin (1974, 2013). The result shows a paradox that is reflected in the contrast between two stylized facts: in a country at a given time, the richest people are on average happier. However, in this same country over time, when everyone gets richer, people have not become happier. In other words, in a static framework more income makes people happier, but in a dynamic perspective, there is no link between happiness and income. This result gives rise to

the eponymous paradox: Easterlin's paradox. The author hypothesized that there were two factors that were unfavorable to the impact of income on happiness. The first factor is social comparison in the sense that if other individuals become richer, it further reduces the effect of a given income on the happiness of the individual. If in the extreme case, individuals only care about their relative income, then economic growth cannot bring about an overall increase in happiness. Income variations are also subject to a process of social comparison. If income increases proportionally less than colleagues' income, the gain generated in terms of SWB will be less (Wolbring *et al*., 2013). Thus, SWB is subject to comparative effects in relation to the situation of reference groups, such as family, friends, and colleagues. The importance of relative income over happiness is questioned, particularly by Stevenson and Wolfers (2008) who suggest, on the other hand, that absolute income plays a major role in determining well-being and that national comparisons offer little evidence to support relative income theories.

The other factor is adaptation: the enjoyment of a given income is lower than the previous income, due to addiction. The increase in economic growth has been accompanied by a general increase in individual aspirations, supplanting the welfare gain it could have created. This discovery challenges public policies oriented towards a single growth objective and raises the need to develop SWB analysis to inform political decision-making. Most individuals want an increase in income. However, when income increases, SWB only changes in the short term and returns to its initial level some time later. The initial increase in income provides access to new consumer goods but then aspirations rise, for a desire for new, more luxurious consumer goods, this restores the gap between aspirations and consumption opportunities offered by current income.

Others conclude that the level of GDP and/or growth of GDP matters in happiness function (Di Tella *et al.*, 2003; Clark *et al.*, 2008). The level of GDP or per capita GDP is limited in affecting SWB, but there is evidence that growth rate of GDP has a significant

influence on SWB (Welsch and Bonn, 2008; Malesevic Perovic, 2008; Welch, 2011; Welsch and Kühling, 2016ab). Moreover, GDP' fluctuations are important drivers of SWB according to Welsch and Kühling (2016a). They argue in favor of GDP growth's impact on SWB and refer to the finding of previous works, which conclude zero or negative effects of GDP on SWB. Their argument for using growth rates of GDP (rather than levels of GDP) to assess a positive relationship with SWB is based on the human trait of habits. Hence, the growth rate of GDP will theoretically be positively related to SWB.

Considering these different results, the originality of our approach is first to focus on the interactions between the three macroeconomic variables and the income growth gap for a new interpretation, and secondly, to include the question of heterogeneity and nonlinearity in SWB function. Indeed, to our knowledge, only recently Hübner and Klemm (2015) really stand out individual's heterogeneity by considering country-specific estimations. The authors use country dummies to capture the differences in stability culture as measured by the degree of relative inflation aversion between European economies. Our article tries to extend this analysis by exploring how a country's economic growth affects the inflation-unemployment trade-off.

We use an error component model (i.e. panel data regression) to assess the contribution of three macroeconomic variables: inflation, unemployment and GDP per capita growth rate on SWB. This first step allows us to find previous evidence in the literature. In a second step, we extend the approach to encompass the possibility of heterogeneity/nonlinearity in SWB function. We consider that the impact of the three macroeconomic variables depends on the spread between observed and potential GDP growth rate. In this way, our approach differs very much from studies dealing with economic growth. The empirical analysis examines the situation in 15 European countries of the EU (European Union) over the 1995-2015 period.

The main findings can be summarized as follows. First, the results point out that unemployment and GDP growth rates have a significant impact on SWB. In contrast, inflation

seems to have no influence on well-being, especially if one considers a model with homogeneity. Second, the hypothesis tests do not reject heterogeneity/nonlinearity in happiness function. Thus, a striking finding is that a higher average growth rate mitigates the negative impact on happiness of both inflation and unemployment. Third, the trade-offs between macroeconomic variables vary considerably across countries. In respect to the trade-offs between inflation and per capita growth rate or between inflation and unemployment, the results stress that Greece, Ireland and Germany are the only countries with significant trade-offs.

The remainder of the paper is structured as follows. Section II is devoted to the data. Section III presents the empirical specifications and methodology. Section IV discusses the results of estimation. The last section concludes by drawing some policy implications and underlines the possible directions for future research.

II. Empirical analysis: the data

The empirical analysis examines SWB in 15 European countries over the 1995-2015 period. To recall, we consider that both SWB and Life Satisfaction (LS thereafter) have the same meaning in terms of measuring happiness, so we use these concepts interchangeably. In this paper, we use LS data, thanks to its robustness and because it has a basement for comparison with most empirical studies. Indeed, the measure of happiness that most economists use is LS, as subjective well-being (SWB), therefore no partial own sight is imposed, and individuals can evaluate their happiness (Seaford, 2013; Kroll and Delhey, 2013; Helliwell *et al*., 2017). Frey and Stutzer (2002, 2013) consider that data on SWB are generally not used to compare levels of well-being between different people, but rather to identify the determinants of happiness. It is neither necessary to assume that the measurement of SWB is cardinal, nor is it necessary to allow inter-personal comparisons. Therefore, econometrically, SWB can be treated as an

ordinal variable, such that a higher well-being score reflects greater well-being. Similarly, Ferrer-i-Carbonell and Frijters (2004) demonstrate that treating life satisfaction as a cardinal or ordinal variable generates similar estimates. Sandvik *et al* (1993) show that different measures of SWB are strongly correlated with each other and with an external person's assessment of an individual's well-being. Reliability studies indicate that subjective well-being is relatively stable and sensitive to different life events (Ehrhardt *et al*., 2000). Diener (1984) concludes that the measure of SWB appears to contain a substantial amount of valid variance. Frey and Stutzer (2002) legitimize the use of SWB as a latent variable of happiness.

The data on LS are extracted from World Database of Happiness (WDH, 2017). The data are based of the Eurobarometer Survey Series in which the question is "how satisfied are you with the life you lead: very satisfied, fairly satisfied, not very satisfied or not at all satisfied?". The quantitative responses are rated from 4 (very satisfied) to 1 (not at all satisfied), and the variable (LS) is the average level of life satisfaction in each country i ($i = 1,\ldots,n$) at time t ($t = 1,\ldots,T$). Thus, column (2) of Table 1 shows that happiness in Denmark, Netherlands or Sweden, is on average about 1.4 times higher than that of Portugal or Greece.

The series of inflation and unemployment rates are extracted from OECD (Organization for Economic Cooperation and Development) databases. Columns (3) and (4) of Table 1 indicate that the mean level of inflation (i.e. 2%) is on average 4 times lower than that of unemployment (i.e. 8%). The data on GDP in PPPs (Purchasing Power Parities) at 2015 constant US dollars are extracted from the GGDC (Groningen Growth and Development Centre) database (GGDC, 2017). Columns (5) and (6) of Table 1 summarize the statistics of per capita GDP and GDP growth rates. Hence, Ireland experienced the highest growth rates while Italy shows the lowest ones.

Column (7) shows the potential GDP growth rate. We use Okun's law to estimate this variable.[2] We consider the following specification:

$$g_{it} = \widetilde{g}_{it} + \omega_i + \lambda_t + k(\Delta u_{it} - \Delta\widetilde{u}_{it}) + \xi_{it}, \quad (1)$$

Where u_{it} is the unemployment rate of country i at time t. $\widetilde{u}_{it}$ is the non-accelerating inflation rate of unemployment extracted from OECD databases, g_{it} is GDP growth rate and $\widetilde{g}_{it}$ is the potential growth rate of GDP. ξ_{it} is an error term.

We assume that $\widetilde{g}_{it}$ is approximately equal to its average level $\overline{\widetilde{g}}$, and the deviation from $\overline{\widetilde{g}}$ is captured by country specific effect ω_i and time specific effect λ_t. We performed fixed effects method to estimate equation (1). Thus, the last column of Table 1 indicates that the estimated potential growth rate varies from about 0.1% in Italy to about 3.1% in Ireland. On average, the estimation results show that $\overline{\widetilde{g}}$ is approximatively 1.35% across the 15 European countries during the 1995-2015 period.

[2] We do not discuss at length here the broad approaches and measures found in the literature, one cans refer for instance to Kiley (2013) for a discussion on the relationship between various definitions of potential growth rate.

Table 1: Descriptive statistics, 1995-2015

(1) Country	(2) Life satisfaction	(3) Inflation rate	(4) Unemployment rate	(5) GDP per capita growth	(6) GDP Growth rate	(7) Potential GDP growth
Belgium (1)	3.10	1.86	8.10	1,23	1,77	1.19
Denmark (2)	3.62	1.96	5.61	1,00	1,33	0.94
France (3)	2.92	1.45	9.88	1,03	1,56	0.97
Ireland (4)	3.20	2.15	8.50	3,46	4,93	3.14
Italy (5)	2.77	2.21	9.65	0,21	0,58	0.09
Luxembourg (6)	3.32	1.95	4.07	1,81	3,46	1.95
Netherlands (7)	3.40	1.98	4.82	1,46	1,92	1.50
United Kingdom (8)	3.21	2.05	6.27	1,64	2,12	1.54
Greece (9)	2.49	3.20	13.36	0,67	0,83	0.97
Portugal (10)	2.48	2.33	8.49	0,91	1,28	0.76
Spain (11)	2.93	2.48	16.74	1,27	2,19	0.86
Germany (12)	3.00	1.45	7.93	1,35	1,32	1.24
Austria (13)	3.08	1.85	4.83	1,42	1,79	1.44
Finland (14)	3.23	1.52	9.41	1,83	2,19	1.73
Sweden (15)	3.39	1.11	7.50	1,99	2,48	1.90
All	3.08	1.97	8.34	1.42	1.98	1.35

Notes: column (2): mean level of life satisfaction. The data are based on the Eurobarometer Survey Series, source: World database of happiness. Columns (3) and (4): mean in %, source: OECD. Column (5) and (6): mean in %, GDP in Purchasing Power Parities at 2015 constant US dollars, source: Groningen Growth and Development Centre. Column (7): our own estimates based on Okun's law.
Source: Authors' calculations.

III. Specifications estimated

We address that macro-empirical approach rests mainly on the following general specification:

$$SWB_{it} = \alpha + X'_{itk}\beta_{ik} + \varepsilon_{it}\ , \quad i = 1\ldots, N,\ t = 1\ldots, T, \tag{2}$$

where SWB_{it} is the indicator of subjective well-being of country i at time t. X_{itk} is a vector of k exogenous variables.

We consider the relative importance of inflation rate π_{it}, unemployment rate u_{it} and GDP per capita growth rate y_{it} on SWB. The error term ε_{it} is two-way error component, that is, $\varepsilon_{it} = \mu_i + \eta_t + v_{it}$ where μ_i denotes the unobservable country-specific effect on SWB, η_t is a time-specific effect capturing the global shocks common to all countries. v_{it} is the remainder random term assumed to be independently and identically distributed.

The specification (2) goes further than that considered by the literature supposing the parameters β_{ik} vary across countries. Hence, several situations may be analyzed, whether the heterogeneity is assumed random or fixed. In the first situation, β_{ik} is specified as $\beta_{ik} = \beta + \omega_{ik}$ where β is an average level and ω_{ik} is considered as random variable expressing the national specificities. In the second situation, a conceivable estimation would be to estimate the model for each county, an approach which remains interesting where the temporal dimension is sufficiently large to correctly apprehend the possible structural changes, or make β_{ik} dependent of other country-specific variables.

Thus, Hübner and Klemm (2015) adopt a specification where the parameter β_{ik} depends on that of a reference country (i.e. Germany) and the dummy variables relating to the country of residence of the individuals. We carry on in this direction, but we assume that β_{ik} is a functions of other exogenous variables. Specifically, we focus our investigation on the interactive effects between the three macroeconomic variables and the country-specific gap of GDP growth rate. Our intuition is that the economic growth interacts with the macroeconomic variables that affect SWB. That is, the higher the country's economic growth, the lower the negative effects of unemployment or inflation will be. Thus, we specify the marginal effects as follow:

$$\beta_{ik} = \sum_{\tau=0}^{l} \phi_{\tau k} Gap_{i\bullet}^{\tau}, \tag{3}$$

where the growth gap $Gap_{i\bullet} = g_{i\bullet} - \widetilde{g}_{i\bullet}$. $g_{i\bullet}$ and $\widetilde{g}_{i\bullet}$ are the country average of GDP growth rate and its potential, respectively. Equation (3) defines a polynomial function of the degree *l*. Hence, $l = 0$, $\beta_{ik} = \phi_{0k}$ corresponds to the case of homogeneity. Then, ϕ_{0k} captures the direct effect of the exogenous variable X_{itk}. This parameter is expected to be negative for inflation and unemployment rates, but positive for GDP per capita growth rate. The cases of $l \geq 1$ allow us to capture the homogeneity/nonlinearity in SWB function.

For $l = 1$, $\phi_{1k} > 0$ means that a positive GDP growth rate gap counteracts the negative effect of inflation or unemployment. With respect to the per capita GDP growth rate, $\phi_{1k} > 0$ ($\phi_{1k} < 0$ respectively), the growth gap strengthens (offsets, respectively) the positive impact of GDP per capita growth rate.

Further, the marginal effect is nil, i.e. $\beta_{ik} = 0$, for a growth rate gap of $-\phi_{0k} / \phi_{1k}$. The quadratic formulation of the marginal effects is derived when $l = 2$. In this case, the value of the growth gap that would give maximum or minimum β_{ik} value is $-\phi_{1k} / 2\phi_{1k}$, that is, the turning point when the signs of the ϕ_{1k} and ϕ_{2k} are different. More precisely, $\phi_{1k} < 0$ and $\phi_{2k} > 0$ involve a U-shaped relation of the marginal effects with β_{ik} decreasing, reaching a minimum and increasing. The opposite pattern is observed when $\phi_{1k} > 0$ and $\phi_{2k} < 0$, i.e. a reversed U-shape, so that while growth gap is increasing, β_{ik} is increasing, reaching a maximum and decreasing after.[3]

Before discussing the estimates' results, the nature of the endogenous variable (SWB) and the structure of the error term ε_{it}, still raise the question of the appropriate method of estimation. It is worth noticing that little effects on empirical results have been observed depending on whether a linear-regression or ordered (logit or probit) is used (e.g., see Di Tella *et al*. 2001; Ferrer-i-Carbonell and Frijters, 2004; Welsch, 2011). Then, if both country-specific and time-specific effects are included in ε_{it} and if the hypothesis tests (i.e. F-test statistics) suggest so, the OLS (Ordinary least squares) method is not appropriate.

Consequently, two situations must be considered. The first one assumes that the specific effects are fixed. In this case, we can use the 'within' estimator by applying OLS to the

[3] Notice that, higher-order polynomial terms (e.g., degree 3 and above) may also be considered, but they are not as commonly found in the literature. Furthermore, our own empirical investigations do not provide any evidence of such formulation according to Wald-tests.

specification in terms of deviations from means of variables. The second method assumes that the specific effects are random. In this case, the GLS (Generalized Least Squares) provides efficient estimators (Baltagi 2001). The Hausman-test (Hausman, 1978) enables us to choose between the two approaches.

IV. Results of estimation

Table 2 reports the estimates of the specification (2) assuming parameters' homogeneity. These results allow us to find previous findings of the literature. Before proceeding, it is worthwhile to note that the F-test statistics for two ways component model strongly suggest including both country and time effects. Furthermore, the resulting Hausman-test statistics support the use of GLS-estimator. Therefore, we focus on columns (5)-(7) estimates.

These results point out that the effects of both unemployment and per capita GDP growth rates on SWB are strongly significant, while the inflation rate has no effect. Results remain similar if we remove GDP growth rate from the estimated specification (see column 2). Furthermore, these findings do not change when introduced to per capita GDP as a control and show a significant positive effect on SWB. Table 2 stresses that unemployment rate is costlier than inflation rate (i.e. the coefficient of unemployment relative to that of inflation) ranged from 4.2 (see column 5) to 2.6 (see columns 7). As the coefficient of inflation is not closed from zero, it suggests that the marginal rate of substitution between inflation and unemployment tends to be very large in Europe.

Our finding differs from Welsch and Bonn (2008) who found a larger weight both for inflation than unemployment in EU-12 during 1991-2003 period. Their results, based on a

macro-specification including a time trend, indicate a trade-off less than 1[4] . Our results also differ from Welsch (2011) who found the same magnitude of the marginal effects of inflation and unemployment across 12 European countries during the 1992-2002 period.

Apart from these exceptions, our findings remain consistent with main findings of the literature. For instance, during the period 1975-1991, Di Tella *et al.* (2001) find that unemployment rate has a larger weight than inflation rate in EU-12. That is, a 1 percentage point increase in unemployment rate lowers well-being by more than one-and-a-half times as much as a 1 percentage point increase in the inflation. Blanchflower (2007ab) also found that, across 25 OECD-countries during the 1973-2006, unemployment is costlier than inflation with a trade-off equivalent to that of Di Tella *et al.* (2001). Furthermore, one can observe a large cost of inflation in terms of unemployment in Wolfers (2003), Malesevic Perovic (2008), Ruprah and Luengas (2011).[5]

With respect to GDP per capita growth, the results point out a positive significant link with SWB. This finding is in accordance with Di Tella *et al*. (2003), Welsch and Bonn (2008), Malesevic Perovic (2008), Welsch (2011), Welsh and Kühling (2016a). Our results reveal an unemployment-growth trade-off of -1.6, i.e. -0.021/0.013, see column (7) of Table 2. That is, a 1%-point increase in unemployment has the same effect on SWB as does a decline of 1.6%-point in GDP per capita growth rate, *ceteris paribus*.

Finally, our results stress a positive and significant effect of per capita GDP on SWB. This is not in accordance with the study of Welsch (2011) who finds no evidence of a positive

[4] Notice that, by restricting our sample to that of Welch and Bonn (2008), i.e. the same countries but for the period 1995-2003, we observe almost the same results as the authors, namely, inflation weight (i.e. a value around -0.026) is more important than that of unemployment (i.e. a value around -0.014). These results remain robust for including time trend and or GDP per capita.

[5] Our results remain similar to that of the restricted regression to the 1995-2013 period considered by Hübner and Klemm (2015) (see Table 6) where the unemployment coefficient is of -0.021 and of 0.005 but not significant for inflation. Notice that, for the entire period 1973-2013, the authors point out that when accounting for country fixed effect, the trade-off is about 2.6, with both country and survey fixed effects, unemployment remains significantly negative, whereas the correlation between LS and inflation vanishes, i.e., a trade-off of 21.

relationship between the level of average per capita income and SWB. In contrast to Welsh and Kühling (2016b) who find a negative effect of GDP per capita, our finding shows a positive effect even when we introduce the variable in logarithm as suggested by Stevenson and Wolfers (2013). As a result, no evidence was found of the so-called Easterlin paradox. The data show rather a clear-cut positive relationship.

Table 2. Estimation results, EU-15, 1995-2015, Dependent variable: *SWB*

(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Fixed effect – within estimator			Random effect – GLS estimator		
Constant				3.296***	3.273***	2.982***
				(0.072)	(0.071)	(0.093)
Inflation	0.003	0.003	-0.002	-0.006	-0.007	-0.008
	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)
Unemployment	-0.025***	-0.023***	-0.022***	-0.025***	-0.024***	-0.021***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
GDP per capita growth		0.017***	0.017***		0.010***	0.013***
		(0.003)	(0.003)		(0.002)	(0.002)
GDP per capita			0.007***			0.006***
			(0.002)			(0.001)
Hausman-test	2.868	4.54	3.28			
Specification-test	88.6***	96.6***	89.6***			
Poolability-test	3.91***	4.68***	5.58***	3.11***	3.99***	4.86***
R2-ajusted	0.366	0.410	0.432	0.362	0.398	0.439

Notes: Inflation, Unemployment and GDP growth rates are in percent. GDP per capita is in PPPs (Purchasing Power Parities) at 2015 constant US dollars. Specification-test: F-statistics for two ways effects. Robust Hausman-test: khi2-statistics for fixed or random model. Poolability-test: F-statistics. Numbers in parentheses are standard errors. (***), (**) and (*) significance at 1%, 5% and 10% levels respectively.
Source: Authors' calculations.

The results of Table 2 assume that the countries behaviors are homogeneous, i.e. that is $\beta_{ik} = \beta_k$ for all i. However, this hypothesis is strongly rejected as the poolability-tests are highly significant. Thus, Table 3 exhibits the results knowing that the marginal effects of the three macroeconomic variables depend on the gap between GDP growth rate and its potential. With respect to the robust Hausman-tests which support the random effect specification, only GLS estimates are reported in Table 3.

Overall, the results provide evidence of the homogeneity/nonlinearity in SWB function. Indeed, the null hypothesis that the interaction coefficients (linear or quadratic) are equal to zero is strongly rejected. Hence, the hypothesis that the marginal effects of the macroeconomic

variables on SWB vary according to the country's economic growth is not rejected by the data. This result is not affected by including per capita GDP as a control and shows positive and high significance influence on SWB. Thus, we focus the discussion on the estimates of column 5. Our results point out that economic growth mitigates the negative impact of both unemployment and inflation on SWB. In particular, the marginal effect of inflation, $\hat{\beta}_{i\pi}$, presents a reversed U-shape meaning that the maximum effect is reached at a gap of 0.9% , i.e. $0.056/2\times0.031$ (column 5). Thus, the negative effect of an inflation rate is fully absorbed for a range of a gap between 0.4% and 1.4%, i.e. the solution of the quadratic equation $\hat{\beta}_{i\pi} = -0.018 + 0.056\,Gap_{i\bullet} - 0.031\,Gap_{i\bullet}^2 = 0.$

The situation is different in the case of unemployment. Indeed, the estimated coefficient of the quadratic interactive term is not significant (column 5). Hence, the marginal effect of unemployment is linear of the growth rate gap, i.e. $\hat{\beta}_{iu} = -0.028 + 0.009\,Gap_{i\bullet}$ as shown in column 3. It follows that a gap of 3.1 percentage points (i.e. 0.028/0.009) leads to a nil effect of unemployment on SWB, and the larger the gap, the less adverse effects of unemployment are felt, all things being equal.

By linking these findings to data in Table 1, and as the observed growth-gap is 0.6% on average (i.e. 1.92 minus 1.35), the implication is that European countries need to achieve and maintain a GDP growth-gap of around 2.5% on average to erase the negative impact of unemployment rate (i.e., 3.1% minus 0.6%). In contrast, as the observed gap is within the interval 0.4% and 1.4%, our results suggest that the inflation no longer has any significant impact. This may explain the non-significance of the direct effect of inflation observed previously (see Table 2).

The marginal effect of GDP per capita growth rate shows a U-shape which means that the effect is negative for gap between 0.85% and 1% (i.e. the solution of the quadratic equation

$\hat{\beta}_{ig} = 0.017 - 0.037\,Gap_{i\bullet} + 0.020\,Gap_{i\bullet}^2$) with a minimum effect reached at approximately 0.93%, i.e. $0.037/2 \times 0.020 \cong 0.93$. This result is elusive. At first glance, we would be tempted to assume that a minimum gap has an influence on SWB as individuals turn away from this indicator for a low level. Whatever the low level of the marginal effect the impact remains important. We suggest a positive/optimistic or neutralized perception of the impact of marginal effect of GDP per capita growth rate on SWB. When the minimum is obtained (regardless of its absolute value), the perception remains while approaching a real impact on unemployment and thus on SWB. A finer analysis would undoubtedly provide answers, but at this stage we hypothesize a myopia of the growth effect on SWB for a weak marginal effect.

Table 3. Estimation results: Random effects, EU-15, 1995-15, Dependant variable: *SWB*

(1)	(2)	(3)	(4)	(5)
Constant	3.278***	3.038***	3.271***	3.028***
	(0.074)	(0.087)	(0.077)	(0.082)
Inflation	-0.012*	-0.012*	-0.018**	-0.018***
	(0.007)	(0.006)	(0.007)	(0.007)
Unemployment	-0.031***	-0.028***	-0.032***	-0.028***
	(0.003)	(0.003)	(0.003)	(0.003)
GDP p.c. growth	0.012***	0.013***	0.016***	0.017***
	(0.003)	(0.003)	(0.003)	(0.003)
Inflation ✕ GDP growth gap	0.009	0.006	0.067***	0.056***
	(0.006)	(0.006)	(0.019)	(0.019)
Unemployment ✕ GDP growth gap	0.011***	0.009***	0.014	0.011
	(0.003)	(0.003)	(0.008)	(0.008)
GDP p.c growth ✕ GDP growth gap	-0.005*	-0.003	-0.035***	-0.037***
	(0.003)	(0.003)	(0.009)	(0.009)
Inflation ✕ GDP growth gap²			-0.035***	-0.031***
			(0.010)	(0.010)
Unemployment ✕ GDP growth gap²			-0.002	-0.002
			(0.005)	(0.005)
GDP p.c growth ✕ GDP growth gap²			0.018***	0.020***
			(0.005)	(0.005)
GDP per capita		0.005***		0.006***
		(0.001)		(0.001)
Specification-test	85.4***	82.7***	91.2***	88.2***
Hausman-test	4.77	8.75	5.10	14.90
F-statistics on interactive terms				
all interactions =0	8.59***	6.04***		
all interactions =0			8.30***	7.00***
all second order interactions = 0			7.52***	7.61***
R2	0.442	0.464	0.482	0.497

Notes: Inflation, Unemployment and GDP p.c. (per capita) growth rates are in percent. GDP growth gap: country mean of (GDP growth minus potential GDP growth). GDP per capita is in PPPs (Purchasing Power Parities) at 2015 constant US dollars. Specification-test: F-statistics testing the existence of country and Time effects. Hausman-test: khi2-statistics of the correlation between country-time effects and explanatory variables. Numbers in parentheses are standard errors. (***), (**) and (*) significance at 1%, 5% and 10% levels respectively.
Source: Authors' calculations.

Using Equation (3) and the estimation relative to column 5 of Table 3, we can derive the estimated country-specific coefficients. As it is seen in Table 4, there are considerable differences between countries of the impact of the macroeconomic variables on SWB (columns 2-4). Ireland is characterized by the lowest impact of unemployment (-0.014), while Greece shows the highest marginal effect of unemployment on well-being (-0.030). Notice that the estimated coefficients of unemployment effect are highly significant for all countries, which reinforces the importance of this variable on SWB. By contrast, significant marginal effects of inflation are only found in three countries, namely Greece, Ireland and Germany.

As for GDP per capita growth rate, the results show that Greece stands out with the highest marginal effect (column 4). Netherlands and Finland are characterized by the lowest marginal effects.

To draw up a clearer picture, columns 5-7 present the trade-offs between the three macroeconomic variables, i.e. the marginal rates of substitution. Thus, column 6 shows the relative importance of the marginal effect of GDP per capita growth rate with respect to unemployment rate. The results stress that, on average, 1% increase in per capita income growth rate has the same effect on SWB as 0.3% decline in unemployment rate. The trade-off ranges from 1% for Ireland to 0.1% for Belgium, France, UK and Sweden.

In respect to the trade-off between inflation and per capita growth rate (column 7) or unemployment rate (column 5), the results only make sense in three countries. Hence, a 1% increase in inflation rate has the same effect on SWB as 1.2% decrease of GDP per capita growth rate in Greece, as a 1.1% in Ireland or as a 0.9% in Germany (column 7). For the degree of inflation aversion relative to unemployment, Column 5 indicates that to maintain the same level of SWB, a 1%-point increase in inflation rate can be offset by a 1.1% decline in unemployment rate in Ireland, 0.9% in Greece and 0.5% in Germany.

Even though our analysis highlights across-country heterogeneity underlined by Hübner and Klemm (2015), our results show the sharp contrasts with respect to their findings. Indeed, on one hand, the authors found that, during the 1973-13 period, Austria, France, Germany and United-Kingdom have the highest degrees of inflation aversion relative to unemployment aversion. On the other hand, the lowest degrees have been observed in Spain, Greece, Ireland and Portugal. Our data do not support these results. Thus, for instance and irrespective of the statistical significance, Ireland, Greece and, to a lesser extent, Germany, exhibit the highest degrees of inflation aversion (column 5 of Table 4), while the values of the other countries are negative and not significant. It should be noted, however, that our methodological approaches

differ in many respects. First, Hübner and Klemm's (2015) approach is based on dummy variables to capture heterogeneity, while our approach highlights the importance of economic growth disparities to explain nonlinearity/heterogeneity in SWB function. Second, the authors do not include per capita GDP growth rate in their model. Finally, the sample period used by Hübner and Klemm (2015) is long enough to capture the high levels of inflation recorded in 1970s and in 1980s.

Table 4: Country-specific results, EU-15, 1995-2015

(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Estimated coefficient			Trade-off		
Country	Inflation	Unem-ployment	GDP per capita growth	(2)/(3)	(4)/(3)	(2)/(4)
Belgium (1)	0.005	-0,023***	0,002			
	(0.007)	(0.003)	(0.003)	-0,21	-0,09	2.24
Denmark (2)	-0,000	-0,024***	0,006**			
	(0.006)	(0.003)	(0.003)	0,01	-0,22	-0.04
France (3)	0,005	-0,023***	0,002			
	(0.007)	(0.003)	(0.003)	-0,21	-0,09	2.34
Ireland (4)	-0,015**	-0,014***	0,014***			
	(0.009)	(0.004)	(0.004)	1,09	-1,02	**-1,07**
Italy (5)	0,002	-0,023***	0,004			
	(0.006)	(0.003)	(0.003)	-0,11	-0,15	0,69
Luxembourg (6)	-0,003	-0,016***	0,006**			
	(0.007)	(0.003)	(0.003)	0,17	-0,40	-0.42
Netherlands (7)	0,000	-0,024***	0,005*			
	(0.006)	(0.003)	(0.003)	-0,02	-0,21	0.08
United Kingdom (8)	0,005	-0,023***	0,002			
	(0.007)	(0.003)	(0.003)	-0,21	-0,09	2.18
Greece (9)	-0,027***	-0,030***	0,023***			
	(0.009)	(0.004)	(0.004)	0,88	-0,75	**-1.17**
Portugal (10)	0,003	-0,023***	0,003			
	(0.006)	(0.003)	(0.003)	-0,13	-0,14	0.98
Spain (11)	0,003	-0,017***	0,003			
	(0.007)	(0.002)	(0.003)	-0,17	-0,17	1.05
Germany (12)	-0,013**	-0,028***	0,014***			
	(0.006)	(0.003)	(0.003)	0,48	-0,51	**-0.95**
Austria (13)	0,002	-0,025***	0,006**			
	(0.006)	(0.003)	(0.003)	0,07	-0,26	-0.26
Finland (14)	0,002	-0,024***	0,004*			
	(0.006)	(0.003)	(0.003)	-0,07	-0,18	0.38
Sweden (15)	0,005	-0,023***	0,002			
	(0.007)	(0.003)	(0.003)	-0,21	-0,09	2.24
Mean	-0,002	-0,023	0,006	0.09	-0.29	0.55

Notes: The estimated marginal effects presented in columns 2-4 are derived from the estimation results shown in column 5 of Table 3. The columns 5-7 exhibit the trade-offs (i.e., the marginal rates of substitution) between inflation/unemployment (column 5), GDP growth rate/unemployment (column 6) and inflation/GDP growth rate (column 7). Numbers in parentheses are standard errors. (***), (**) and (*) significance at 1%, 5% and 10% levels respectively.
Source: Authors' calculations.

V. Conclusion

This paper improves the analysis of the trade-offs between inflation, unemployment and per capita GDP growth, considering the heterogeneity/nonlinearity in the so-called SWB function. Our hypothesis is that the effect of the macroeconomic variables on SWB in each country may be quite different depending on the economic performance, measured by the gap between observed and potential GDP growth. Thus, our analysis sheds light on the impact of inflation, unemployment and per capita GDP growth rates on SWB.

The results point out both country heterogeneity and nonlinearity of the marginal effects of macroeconomic variables on well-being. Thus, the findings reveal that economic growth moderates the relationship between unemployment as well as inflation and SWB. The study also reveals that both unemployment and GDP per capita growth rates have an important impact on Europeans' SWB.

In the light of these results, following notably Inder and Rupraha (2011) and Weijers and Jarden (2013), one can draw some policy implications. Indeed, the mandate of the European Central Bank (ECB) aims to maintain a low level of inflation in the European Union (EU). But we can, thanks to this work on happiness, also emphasize how GDP per capita growth and unemployment impact the SWB of individuals in Europe. The ECB policy should, like the U.S. Federal Reserve Bank, also be based on the criteria of low unemployment and high economic growth. Our research helps to show the need to rethink the ECB policy. Fostering economic growth, while aiming to reduce unemployment, must be one of the priorities of European policy.

With respect to our approach, numerous directions could be considered both at the theoretical and empirical levels. First, the possible endogeneity of the macroeconomic variables was not addressed, so it could be interesting to investigate the relationships between unemployment, inflation and economic growth. Second, it could be interesting to consider the

convergence process in inflation rates which, as shown by Welsch and Bonn (2008), has played a major role for the convergence in SWB. In the end, it would be particularly interesting to detail the results for sub-groups of countries, i.e., the euro-countries and sub-periods, for instance, before and after 2008-2009 crisis (Welsch and Kühling, 2016a).

References

Baltagi, B.H. *Econometric Analysis of Panal Data,* Wiley & Sons, incorporated John, London, 2001.

Blanchflower, D.G. "Trends in European labour markets and preferences over unemployment and inflation", *Bank of England Quarterly Bulletin*, 2007, 582-91.

_____. "Is unemployment more costly than inflation?", Working Paper n°13505, *National Bureau of Economic Research,* MA 02138, 2007.

Blanchflower, D.G., D.N.F., Nell, A., Montagnoli, and M., Mori. "The happiness trade-off between unemployment and inflation", *Journal of Money, Credit and Banking*, 46(2), 2014, 117-41.

Clark, A.E. "Unemployment as a Social Norm: Psychological Evidence from Panel Data", *Journal of Labor Economics*, 21, 2003, 323-351.

Clark, A.E. and A.J., Oswald. "Unhappiness and unemployment", *Economic Journal*, 104, 1994, 648-659.

Clark, A.E., P., Frijters, and M.A., Shields. "Relative income, happiness, and utility: an explanation of the Easterlin paradox and other puzzles", *Journal of Economic Literature,* 46(1), 2008, 95-144.

Diener, E. "Subjective well-being", *Psychological bulletin* 95(3), 1984, 542-575.

Di Tella, R., R.J., MacCulloch, and A.J., Oswald. "Preferences over inflation and unemployment: Evidence from surveys of happiness", *American Economic Review*, 91(1), 2001, 335–41.

_____. "The Macroeconomics of Happiness", *Review of Economics and Statistics*, 85(4), 2003, 809–27.

Easterlin, R.A. "Does Economic Growth Improve the Human Lot? Some Empirical Evidence" in Paul A. David and M.W. Reder, eds., *Nations and Households in Economic Growth: Essays in Honour of Moses Abramovitz*. London: Academic Press, 1974, 98-125.

Easterlin, R.A. "Happiness, Growth, and Public Policy", *Economic Inquiry*, Volume 51, Issue 1, January 2013, 1-15

Ehrhardt, J.J., W.E., Saris and R., Veenhoven. "Stability of life-satisfaction over time", *Journal of Happiness Studies* 1(2), 2000, 177-205

Frey B., and A., Stutzer. "What Can Economists Learn from Happiness Research?", *Journal of Economic Literature*, vol. 40, no. 2, June 2002, 402-435

Frey B., and A., Stutzer. "Recent Developments in the Economics of Happiness: A Selective Overview" In: Bruno S. Frey and Alois Stutzer (eds.). *Recent Developments in the Economics of Happiness.* Cheltenham, UK: Edward Elgar, 2013

Ferrer-i-Carbonell, A., and P., Frijters. "How Important Is Methodology for the Estimates of the Determinants of Happiness?", *Economic Journal*, 114 (497), 2004, 641–59.

Gandelman, N. and R., Hernández-Murillo. "The Impact of Inflation and Unemployment on Subjective Personal and Country Evaluations", *Federal Reserve Bank of St. Louis Review,* 2001, 107-26.

GGDC. The Conference Board Total Economy Database. Groningen Growth and Development Centre. 2017. http://www.conference-board.org/economics.

Hausman, J.A. "Specification Tests in Econometrics", *Econometrica*, 46(6), 1978, 1251-71.

Helliwell, J., R., Layard and J., Sachs. *World Happiness Report 2017*, New York: Sustainable Development Solutions Network, 2017

Helliwell, J. and H., Huang. "New measures of the Costs of Unemployment: Evidence from the Subjective well-being of 3.3 Million Americans", *Economic Inquiry*, Volume 52, Issue 4, October 2014, 1485–1502.

Hübner, M. and M., Klemm. "Preferences over inflation and unemployment in Europe: a north-south divide?", *International Review of Economics*. 62(4), 2015, 319-335.

Inder, J. and P.L., Rupraha. "Monetary policy and happiness: Preferences over inflation and unemployment", *The Journal of Socio-Economics*, 2011, 59-66.

Kiley, M.T. "Output gaps", *Journal of Macroeconomics*, 37, 2013, 1-18.

Kroll, C. and J., Delhey. "A Happy Nation? Opportunities and Challenges of Using Subjective Indicators in Policymaking", *Social Indicators Research Journal*, 114, 2013, 13–28.

Lucas, R.E.I, A.E., Clark, Y., Georgellis, and E., Diener, "Unemployment alters the set point for life satisfaction", *Psychology Science*. 2004 Jan;15(1), 8-13.

Luhmann, M., Hofmann, W., M., Eid and R.E., Lucas. "Subjective well-being and adaptation to life events: a meta-analysis", *Journal of personality and social psychology* 102(3), 2012, 592.

Malesevic Perovic, L. "Subjective economic well-being in transition countries: investigating the relative importance of macroeconomic variables", *Financial Theory and Practice*, 32(4), 2008, 519–37.

Ochsen, C. and H., Welsch. "The social costs of unemployment: accounting for unemployment duration", *Applied Economics*, vol. 43, issue 27, 2011, 3999-4005

Oswald, A.J. "Happiness and Economic Performance", *Economic Journal*, Volume 107, Issue 445, Nov., 1997, 1815–1831

Ruprah, I.J., and P., Luengas. "Monetary policy and happiness: preferences over inflation and unemployment in Latin America", *The Journal of Socio-Economics,* 40, 2011, 59-66.

Shiller, R.J. "Why Do People Dislike Inflation?", *NBER Working Paper* No. 5539, Issued in April, 1996

Sandvik, E., E., Diener and L., Seidlitz. "Subjective well-being: The convergence and stability of self-report and non-self report measures", *Journal of personality* 61(3), 1993, 317-342.

Stevenson, B. and J., Wolfers. "Economic Growth and Subjective Well-Being: Reassessing the Easterlin Paradox", *Brookings Papers on Economic Activity*, Spring, 2008, 2-102

Stevenson, B. and J., Wolfers. "Subjective well-being and income: is there any evidence of satiation?", *American Economic Review: Papers & Proceedings*, 103(3), 2013, 598–604.

Seaford, C. "The Multiple Uses of Subjective Well-Being Indicators", *Social Indicators Research Journal*, 114, 2013, 29–43.

Weijers, D. and A., Jarden. "The Science of Happiness for Policymakers: An Overview", *Journal of Social Research & Policy*, Vol. 4, Issue 2, 2013, pp 1-20

Welsch, H. "The magic triangle of macroeconomics: how do European countries score?", *Oxford Economic Papers*, 63, 2011, 71–93.

Welsch, H. and U., Bonn. "Economic convergence and life satisfaction in the European Union", *The Journal of Socio-Economics,* 37(3), 2008, 1153-67.

Welsch, H. and J., Kühling. "How has the crisis of 2008-2009 affected well-being? Evidence from 25 OECD countries", *Bulletin of Economic Research*, 68(1), 2016a, 34-54.

_____. "Macroeconomic performance and institutional change: Evidence from subjective well-being data", *Journal of Applied Economics*, 19, 2016b, 193-218

Winkelmann, L. and R., Winkelmann, "Why Are the Unemployed So Unhappy? Evidence from Panel Data", *Economica*, Volume 65, Issue 257, February, 1998, 1-15

Wolbring, T., Keuschnigg, M., and E., Negele. "Needs, Comparisons, and Adaptation: The importance of relative Income for life satisfaction", *European Sociological Review* 29(1), 2013, 86-104.

Wolfers, J. "Is Business Cycle Volatility Costly? Evidence from Surveys of Subjective Well-Being", *International Finance*, 6, 2003, 1-26.

WDH, World Database of Happiness, Erasmus University Rotterdam, Happiness Economics Research Organization, 2017, http://worlddatabaseofhappiness.eur.nl.