Journal of Applied Economics. Vol X, No. 2 (Nov 2007), 237-251

MACROECONOMICS AND LIFE SATISFACTION: REVISITING THE "MISERY INDEX"

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Submitted November 2006; accepted June 2007

Using data from surveys of life satisfaction, evidence has been presented that European citizens' subjective well-being is inversely related to inflation and unemployment. Motivated by the "Barro Misery Index", this paper reconsiders the relationship between macroeconomics and subjective well-being by including the growth rate and the long-term interest rate as additional variables in life satisfaction regressions. The paper finds that people care about growth and employment on the one hand and stability on the other, where stability may alternatively be captured by the inflation rate or the long-term interest rate. Stability, measured in whichever of these ways, does not seem to be less important to European citizens than growth and employment.

JEL classification codes: E61, I31
Key words: misery index, social welfare function, inflation, unemployment, subjective well-being, life satisfaction

I. Introduction

The literature on endogenous macroeconomic policy has long been using the concept of a social preference function over inflation and unemployment, either in models of the political business cycle (Nordhaus 1975, MacRae 1977) or in models of a benevolent government that wants to maximize the utility of the representative consumer (Barro and Gordon 1983). The welfare function over inflation and unemployment (loss function) has now become a standard tool in macroeconomic textbooks (see, e.g., Blanchard and Fischer 1989, Persson and Tabellini 1990, Burda and Wyplosz 1993 and Hall and Taylor 1997).

The particular specifications for the loss function differ in terms of functional form and the weights attached to the two components. An especially simple version

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is the so-called "misery index" which specifies the loss as the unweighted sum of the annual inflation and unemployment rate.[1]

In a pioneering study, Di Tella et al. (2001) have used data from surveys of life satisfaction to study how survey respondents' reports of their well-being vary as levels of unemployment and inflation vary. They find a statistically significant inverse relationship between European citizens' reported life satisfaction and these two variables, suggesting that a function reminiscent of the textbook loss function exists in the data. In this function, the weight placed on unemployment is considerably larger than the weight placed on inflation. Similar results were obtained by Di Tella et al. (2003) using a different econometric methodology. This has led to the conclusion that the "misery index" implies an overweighting of inflation.[2]

This paper reconsiders the relationship between macroeconomics and subjective well-being by including the growth rate and the long-term interest rate as additional variables in life satisfaction regressions.[3] Growth – in addition to low unemployment and inflation – is a standard goal of macroeconomic policy, see e.g. the European Union's "Stability and Growth Pact".[4] The long-term interest rate – on top of unemployment, inflation, and growth – has been invoked in the "Barro Misery Index" (BMI) in an attempt at assessing the economic performance of several U.S. presidents (Barro 1999). The BMI provides the motivation for undertaking the present study.[5]

Using data for the same set of countries but a more recent time frame, a regression comparable to the Di Tella et al. (2001) approach replicates their finding that unemployment affects life satisfaction more strongly than does inflation. Including the growth rate as an additional explanatory variable shows that citizens care about growth as well. Moreover, inclusion of growth leads to an increase in the emphasis placed on low inflation relative to low unemployment. The long-term interest rate is also found to be a strong and statistically significant covariate of

[1] This index can be attributed to Arthur Okun (see Barro 1999, Lovell and Tien 2000) and was initially named the Economic Discomfort Index.

[2] In a similar vein, Lovell and Tien (2000) have studied how inflation, unemployment and other indicators affect consumer sentiment.

[3] Di Tella et al. (2003) also control for GDP per capita and changes thereof.

[4] Accessible at http://europa.eu.int/comm/economy_finance/about/activities/sgp/sgp_en.htm.

[5] In contrast to the original misery index, the BMI uses changes instead of levels of the variables considered.

life satisfaction, in addition to unemployment and growth. However, its inclusion implies that inflation becomes insignificant. These findings are valid no matter whether levels or changes of the macroeconomic variables are considered.

Overall, it thus turns out that people care about growth and employment on the one hand and stability on the other, where stability may alternatively be captured by the inflation rate or the long-term interest rate. Stability, measured in whichever of these ways, does not seem to be less important to European citizens than growth and employment.

Section II describes the model, data, and estimation method. Section III presents and discusses the findings obtained. Section IV concludes.

II. Approach and data

A. The model

I consider a life satisfaction regression of the following form:

$$LS_{kit} = \alpha_u u_{it} + \alpha_p p_{it} + \alpha_g g_{it} + \alpha_r r_{it} + \beta_i + \gamma_t + \delta c_{kit} + \varepsilon_{kit} \qquad (1)$$

where LS_{kit} denotes life satisfaction of individual k in country i and year t and c_{kit} is a vector of socio-demographic characteristics. The variables u, p, g and r denote the unemployment, inflation, growth, and long-term interest rates, respectively, and α_u, α_p, α_g and α_r the associated coefficients. β_i and γ_t are country and year dummies, and ε_{kit} is an error term.

In order to follow the idea of the "Barro Misery Index" (Barro 1999) more closely, a version of (1) looks at changes of the macroeconomic indicators, instead of levels:

$$LS_{kit} = \alpha_u \Delta u_{it} + \alpha_p \Delta p_{it} + \alpha_g \Delta g_{it} + \alpha_r \Delta r_{it} + \beta_i + \gamma_t + \delta c_{kit} + \varepsilon_{kit} \qquad (2)$$

where $\Delta x_{it} \coloneqq x_{it} - x_{i,t-1}$ for any variable x.

It should be noted that the estimating equations do not include individual fixed effects (person dummies), since in our data source the persons surveyed change from year to year. We are thus unable to control for unobserved heterogeneity at the individual level.

B. Data

The data on life satisfaction and socio-demographic characteristics are taken from the *Eurobarometer* survey series. They cover the period 1992-2002 and refer to the following countries: Belgium, Denmark, France, Germany, Great Britain, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain.[6] The *Eurobarometer* survey is a representative survey of approximately 1000 persons per country (Germany: 2000, Luxembourg: 600).[7] Given a lack of data for some of the socio-economic characteristics in several country-year configurations, the data base refers to 51,207 individuals.

The life satisfaction question reads as follows: "On the whole, are you very satisfied, fairly satisfied, not very satisfied or not at all satisfied with the life you lead." The responses are rated as follows: "Very satisfied" = 4, "fairly satisfied" = 3, "not very satisfied" = 2, "not at all satisfied" = 1.

The unemployment, inflation, growth, and long-term interest rates are taken from AMECO, the annual macro-economic database of the European Commission's Directorate General for Economic and Financial Affairs.[8] They are entered in our data as percentages. The time frame considered is restricted to the post-1991 period because AMECO data prior to that date show West Germany only, not unified Germany.

As background, Table 1 sets out correlation coefficients among the variables. Life satisfaction is negatively correlated with unemployment, inflation, and the interest rate and positively correlated with the growth rate. Unemployment and inflation are negatively correlated with growth. There is a negative correlation between growth and the interest rate and a strong positive correlation between inflation and the interest rate.

[6] Di Tella et al. (2001) use the same source and type of data to construct their dependent variable and the same set of countries. Their data refer to 1975 – 1991.

[7] The Eurobarometer public opinion surveys are conducted on behalf of the European Commission, DG Press and Communication. Each consists of approximately 1000 face-to-face interviews per Member State of persons aged 15 and over.

[8] See: http://europa.eu.int/comm/economy_finance/indicators/annual_macro_economic_database/ameco_en.htm.

Table 1. Correlation coefficients

	Life satisfaction	Unemployment	Inflation	Growth
Unemployment	-0.138			
Inflation	-0.187	0.021		
Growth	0.155	-0.150	-0.358	
Interest rate	-0.174	0.247	0.842	-0.341

C. Estimation

There are several methods for estimating equations (1) and (2). Given that the life satisfaction data are ordinal variables, an ordered discrete choice model is appropriate. I therefore use the ordered probit maximum likelihood model to estimate the coefficients from equations (1) and (2). Since this model treats true life satisfaction as a latent variable, the numerical values of the coefficients so obtained have no meaningful interpretation. In spite of that, the *ratio* of any two coefficients (e.g. unemployment and inflation) has an unambiguous meaning: It represents the utility-constant trade-off a representative individual would be willing to make between these variables (marginal rate of substitution).

Previous literature on macroeconomics and life satisfaction has used several estimation strategies. While Di Tella et al. (2003) apply an ordered probit maximum likelihood estimator to the original data, Di Tella et al. (2001) run second-stage OLS regressions in which the dependent variable is the regression-corrected life-satisfaction level from a first-stage OLS regression of life satisfaction on individual characteristics. As a robustness check and in order to enhance comparability with some of the previous literature, I will therefore employ OLS in addition to the ordered probit model.[9] Using a one-stage instead of a two-stage OLS approach has no effect on estimated coefficients (Greene 2003).[10] A further robustness check will involve country-specific time trends (a time trend whose coefficient is permitted to vary by country).

[9] Some literature has suggested that treating life satisfaction data as cardinal variables and using least squares has no large effect on estimated rates of substitution (Ferrer-i-Carbonel and Frijters 2004).

[10] In contrast to Di Tella et al. (2003), Di Tella et al. (2001) use moving averages for unemployment and inflation. I abstain from using moving averages, since doing so would further reduce the time frame (see subsection II.B concerning data availability for Germany).

III. Results

A. Estimation results

Table 2 shows the key estimation results for equation (1). The estimations control for socio-economic characteristics of the survey respondents, especially income and individual employment status. As Table A1 in the Appendix shows, the individual socio-economic characteristics affect life satisfaction in the way familiar from the literature (see Frey and Stutzer 2002). Income, higher education, and marriage are positively associated with life satisfaction. Females report higher life satisfaction than males, whereas age takes the usual u-shaped profile. Household size, the number of children, being divorced, separated or widowed, the size of the town, and being unemployed are negatively associated with life satisfaction. The coefficient estimates for the socio-economic characteristics are remarkably robust to the treatment of the macroeconomic variables.

The fact that a respondent is unemployed affects life satisfaction more strongly than any other of the individual circumstances. However, over and above *individual* unemployment, the relationships formulated in subsection II.A hypothesize that life satisfaction is in addition related to the *general* unemployment level (being an indicator of unemployment *risk*). Furthermore, the hypothesis is that other macroeconomic indicators affect life satisfaction as well.

In checking these assertions, I proceed in several steps. In a first step I omit the growth rate and long-term interest rate from the regressions, thus obtaining a model comparable to that of Di Tella et al. (2001). In regression (1), which is the counterpart to column (1) in Table 1 of Di Tella et al. (2001), unemployment and inflation get significant negative coefficients. The unemployment coefficient is larger than the inflation coefficient. This is consistent with their result; yet they obtain a larger proportion of the two coefficients (the unemployment coefficient is 2.3 times as large as the inflation coefficient).

In regression (2), I augment the model by including the growth rate. This yields a significant positive coefficient on growth and significant negative coefficients on unemployment and inflation. The latter two coefficients are practically equal. They are smaller in magnitude than in regression (1) but considerably larger than the coefficient on growth.[11]

[11] The larger coefficient size in regression (1) is related to the negative correlation with growth (Table 1); unemployment and inflation act as proxies for *low* growth.

Regression (3) extends regression (1) by including the long-term interest rate (while omitting the growth rate). This leaves the unemployment coefficient from regression (1) unaffected, but implies that the inflation coefficient becomes insignificant. The interest rate has a significant negative coefficient, whose magnitude is even somewhat larger than that of unemployment.

In regression (4), the growth rate and the interest rate are jointly added to the unemployment and inflation rates. The coefficients on unemployment and growth are now similar as in regression (2). The coefficient on the interest rate is similar as in regression (3). All of these coefficients are significant, whereas the coefficient on inflation is insignificant, as in regression (3).[12]

Table 2. Regression results for equation (1), 1992-2002. Dependent variable: *LS*

	Regression (1)	Regression (2)	Regression (3)	Regression (4)
Unemployment rate	-0.053	-0.038	-0.053	-0.043
	(10.60)	(6.33)	(10.60)	(6.14)
Inflation rate	-0.044	-0.037	0.012	0.011
	(8.80)	(7.40)	(1.09)	(1.00)
Growth rate		0.006		0.004
		(3.00)		(2.00)
Long-term interest rate			-0.056	-0.050
			(5.67)	(5.00)
Country dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Individual characteristics	Yes	Yes	Yes	Yes
Pseudo-R^2	0.234	0.235	0.235	0.235

Note: ordered probit, t-statistics in parentheses.

Before discussing these results in more general terms, we turn to the estimation results for equation (2), in which the macroeconomic variables are included as changes instead of levels. Apart from this difference, Table 3 has the same structure as Table 2.[13]

[12] The result that the inflation rate and the long-term interest rate are not simultaneously significant is related to the strong correlation between them (Table 1).

[13] Since results for the socio-demographic characteristics are practically the same as shown in Table A1, they will not be presented in detail.

In regression (1), unemployment and inflation have significant negative coefficients. The inflation coefficient is larger than the unemployment coefficient. This discrepancy is further increased in regression (2), in which growth is added and obtains a significant positive coefficient whose magnitude, however, is considerably smaller than that of the other two coefficients.[14] In regression (3), in which the interest rate is added, the unemployment coefficient from regression (1) is (again) almost unaffected in magnitude and significance, whereas the inflation coefficient becomes insignificant (as in equation 1). The interest rate has a large and significant negative coefficient. The latter result also holds in regression (4), which, in addition has a positive and significant coefficient on growth. Unemployment and inflation have negative coefficients, but only that on unemployment is significant.

Table 3. Regression results for equation (2), 1992-2002. Dependent variable: *LS*

	Regression (1)	Regression (2)	Regression (3)	Regression (4)
Unemployment rate	-0.046	-0.045	-0.045	-0.043
	(2.19)	(2.14)	(2.14)	(2.05)
Inflation rate	-0.068	-0.093	0.001	-0.035
	(3.09)	(3.72)	(0.04)	(1.30)
Growth rate		0.006		0.013
		(2.00)		(4.33)
Long-term interest rate			-0.289	-0.398
			(5.07)	(6.42)
Country dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Individual characteristics	Yes	Yes	Yes	Yes
Pseudo-R^2	0.253	0.254	0.254	0.255

Note: ordered probit, t-statistics in parentheses.

In comparing equations (1) and (2) there are some important differences. In regressions (1) and (2) the coefficient for inflation is bigger than the one for unemployment in equation (2), while the opposite is true for equation (1). The

[14] Di Tella et al. (2003) experiment with the change in GDP per capita and find it significant only when country-specific time trends are included.

coefficient of growth in regression (4) is larger than in regression (2) in the case of equation (2), while the opposite is true for equation (1). The coefficient for the interest rate and its importance in comparison with the other macroeconomic variables is much larger for equation (2) than for equation (1).

B. Some robustness checks

Since the previous literature has used several estimation methods, a first robustness check employs least squares instead of the ordered probit model. Results for the full version of equation (1) are shown in the first column of Table 4. All of the qualitative results described above are preserved: While growth affects life satisfaction positively and significantly, unemployment and the interest rate have a negative impact. The inflation rate is insignificant due to inclusion of the interest rate, as in the ordered probit regression. When the interest rate is omitted (results not shown in the Table), the inflation rate is significantly negative, and the associated coefficient (-0.023) is essentially the same as that of the unemployment rate (-0.024), whereas the coefficient on the growth rate is the same as in the full specification (0.003)[15].

A second robustness check adds a time trend, whose coefficient is allowed to vary by country.[16] When the ordered probit model (being the preferred estimation method) is retained (second column of Table 4), the qualitative results from the main model (as summarized in the preceding paragraph) remain valid, but the precision of the coefficient estimates (t-statistics) is sharply reduced. The time trends are insignificant for most countries.

The same conclusions are obtained when the model with country-specific time trends is estimated using least squares (third column of Table 4).

Overall, the substantive results from subsection III.A are robust to variations in the estimation method and to the inclusion of time trends. However, the model with time trends appears overparameterized and to involve considerable collinearity.

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[15] These results can be taken to mean that about 2.5 percent of the population are lifted up one life satisfaction category (on a four point scale) when either the unemployment rate or the inflation rate decreases by one percentage point. A one-percent increase in the growth rate has such an effect for only 0.3 percent of the population. Note that the coefficients in the ordered probit model do not lend themselves to such an interpretation, since the model treats life satisfaction as a latent variable with unbounded domain.

[16] This procedure follows some of the previous literature (Di Tella et al. 2003).

Table 4. Some robustness checks for equation (1), 1992-2002. Dependent variable: *LS*

	Least squares	Ordered probit with time trend	Least squares with time trend
Unemployment rate	-0.026	-0.072	-0.045
	(6.90)	(2.57)	(2.71)
Inflation rate	0.010	0.067	0.038
	(1.54)	(1.14)	(1.06)
Growth rate	0.003	0.014	0.008
	(2.74)	(2.00)	(1.84)
Long-term interest rate	-0.034	-0.029	-0.020
	(5.74)	(1.45)	(1.65)
Time-DK		-0.039	-0.024
		(0.95)	(0.98)
Time-DE		0.013	0.007
		(0.62)	(0.57)
Time-FR		0.037	0.022
		(2.47)	(2.56)
Time-GB		-0.094	-0.052
		(3.13)	(2.92)
Time-GR		0.125	0.073
		(0.83)	(0.82)
Time-IR		-0.073	-0.044
		(2.52)	(2.57)
Time-IT		0.031	0.018
		(0.60)	(0.59)
Time-LU		0.018	0.012
		(0.86)	(0.96)
Time-NL		-0.008	-0.002
		(0.44)	(0.19)
Time-PT		0.113	0.058
		(1.28)	(1.10)
Time-SP		0.057	0.034
		(1.16)	(1.18)
Country dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Individual characteristics	Yes	Yes	Yes
Adj. R^2/Pseudo-R^2	0.227	0.236	0.227

Note: t-statistics in parentheses.

C. Discussion

Several general and robust findings emerge from the estimation results presented above.

(a) In addition to unemployment and inflation, the growth rate belongs in a macroeconomic life satisfaction regression. Quantitatively, the influence of growth is small relative to other macroeconomic factors. These findings hold irrespective of whether the macroeconomic variables are included as levels or as changes (regressions 2 and 4 in both Table 2 and Table 3).

(b) The long-term interest rate is a significant covariate of life satisfaction, but its inclusion implies that the inflation rate becomes insignificant. Quantitatively, the influence of the interest rate is large relative to other macroeconomic factors. Again, these findings hold irrespective of whether the macroeconomic variables are included as levels or as changes (regressions 3 and 4 in both Table 2 and Table 3).

(c) If the interest rate is included in current percentages its coefficient is about the same magnitude as the coefficient for unemployment, but when it is included in changes it is of a much larger magnitude.[17]

(d) If growth is included, but not the interest rate, inflation is practically as important for life satisfaction as is unemployment when levels are considered (regression 2 in Table 2), and more important than unemployment when changes are considered (regression 2 in Table 3).

IV. Conclusions

Previous literature has investigated how subjective well-being is related to unemployment and inflation. Motivated by the "Barro Misery Index", this paper has reconsidered the relationship between macroeconomics and subjective well-being by including the growth rate and the long-term interest rate as additional variables in a life satisfaction regression. The paper found that a macroeconomic life satisfaction equation should include the growth rate, the unemployment rate, and either the inflation rate or the long-term interest rate.

Interpretation of these findings in terms of the traditional misery index as well as the "Barro Misery Index" may start from the idea that both attempt to merge the

[17] This may reflect that changes in the interest rate have an important impact on the costs of credit decisions that had been made in the past.

employment dimension with the stability dimension of macroeconomic performance. The BMI modifies the traditional misery index by (i) adding growth and (ii) capturing stability not just by the inflation rate but, in addition, by the long-term interest rate. The BMI accommodates the circumstance that there is usually a growth-and-employment target and a stability target to macroeconomic policy.

Against this background, the results of the paper suggest that people care about growth and employment on the one hand and stability on the other. Stability may alternatively be captured by the inflation rate or the long-term interest rate. Measured in whichever of these ways, stability does not seem to be less important to European citizens than growth and employment.

If stability is captured in terms of the inflation rate, our findings suggest that similar weights may be appropriate for inflation and unemployment. The traditional misery index – which attaches equal weights to unemployment and inflation – may be *incomplete* as a macroeconomic social welfare function, since it fails to capture growth as one determinant of well-being. It may be right, however, in capturing peoples' unemployment-stability trade-off.

Appendix

Table A1. Complete regression results for equation 1, 1992-2002.
Dependent variable: *LS*

	Regression (1)	Regression (2)	Regression (3)	Regression (4)
Unemployment rate	-0.053	-0.038	-0.053	-0.043
	(10.60)	(6.33)	(10.60)	(6.14)
Inflation rate	-0.044	-0.037	0.012	0.011
	(8.80)	(7.40)	(1.09)	(1.00)
Growth rate		0.006		0.004
		(3.00)		(2.00)
Long-term interest rate			-0.056	-0.050
			(5.67)	(5.00)
Household income	0.061	0.061	0.061	0.060
	(30.50)	(30.50)	(30.50)	(30.00)
Household size	-0.026	-0.025	-0.025	-0.025
	(5.20)	(5.00)	(5.00)	(5.00)
Age	-0.032	-0.032	-0.032	-0.032
	(16.00)	(16.00)	(16.00)	(16.00)
Age**2	0.000	0.000	0.000	0.000
	(16.54)	(16.54)	(16.54)	(16.54)
Male: Reference group				
Female	0.055	0.055	0.055	0.055
	(5.00)	(5.00)	(5.00)	(5.00)
Education 15 years: Reference group				
Education > 15 years	0.074	0.074	0.075	0.075
	(5.28)	(5.28)	(5.36)	(5.36)
Education > 19 years	0.168	0.169	0.169	0.170
	(10.50)	(10.56)	(10.56)	(10.63)
Still in education	0.042	0.046	0.045	0.047
	(0.93)	(1.02)	(1.00)	(1.04)
No children: Reference group				
1 child	-0.026	-0.026	-0.025	-0.026
	(1.63)	(1.63)	(1.56)	(1.56)
2 children	-0.009	-0.009	-0.009	-0.009
	(0.47)	(0.47)	(0.47)	(0.47)
3 children	0.021	0.020	0.021	0.020
	(0.68)	(0.68)	(0.68)	(0.68)

Table A1. (continued): Complete regression results for equation (1), 1992-2002. Dependent variable: *LS*

	Regression (1)	Regression (2)	Regression (3)	Regression (4)
4 children and more	-0.143	-0.146	-0.144	-0.145
	(2.75)	(2.81)	(2.77)	(2.79)
Single: Reference group				
Married	0.125	0.125	0.127	0.127
	(7.35)	(7.35)	(7.47)	(7.47)
Living together	0.018	0.019	0.021	0.021
	(0.69)	(0.73)	(0.81)	(0.81)
Divorced	-0.255	-0.256	-0.256	-0.256
	(8.23)	(8.26)	(8.26)	(8.26)
Separated	-0.324	-0.325	-0.324	-0.325
	(7.36)	(7.39)	(7.36)	(7.39)
Widowed	-0.143	-0.145	-0.144	-0.145
	(5.50)	(5.58)	(5.54)	(5.58)
Employed: Reference group				
Unemployed	-0.448	-0.449	-0.449	-0.450
	(19.48)	(19.52)	(19.52)	(19.56)
Retired	0.035	0.035	0.034	0.034
	(1.84)	(1.84)	(1.79)	(1.79)
Housewife	0.045	0.044	0.044	0.044
	(2.65)	(2.59)	(2.59)	(2.59)
Other occupation	0.240	0.238	0.238	0.238
	(5.45)	(5.41)	(5.41)	(5.41)
Rural: Reference group				
Small town	-0.071	-0.071	-0.071	-0.071
	(5.92)	(5.92)	(5.92)	(5.92)
Big town	-0.149	-0.148	-0.148	-0.148
	(11.46)	(11.38)	(11.38)	(11.38)
Country dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Pseudo-R^2	0.234	0.235	0.235	0.235

Note: ordered probit, t-statistics in parentheses.

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