An Inquiry into the Happiness of Nations

A Macroeconomic Analysis

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0. Abstract

This paper investigates the concept of national happiness and examines the existing literature on happiness and its causes, before using recently released data from the United Nations to construct a model that explains what makes nations happy, given macro-socioeconomic indicators of the nation.

1. Introduction

A social paradox is that, while most people strive to become happier individuals, nations pursue increase in their gross domestic product without much cognizance to other social indicators within the country. Although happiness is a fundamental human goal and universal aspiration, social, ecological and economic challenges have made the achievement of happiness an unachievable goal for many (Williamson, 2012). Thus, a new branch of economics strives to work with sustainable economic development that maximizes the utility of the people of the nation. Championed by the former King of Bhutan Jigme Singye Wangchuck, the concept of gross national happiness (GNH) and ways to achieve it has been discussed in many seminars and symposiums, most notably in the United Nations General Assembly (United Nations, 2011). In April 2012, the United Nations even published a comprehensive ranking of nations as to how happy they really are (Telegraph, 2012). However, there has been no formal attempt of trying to establish a universal model that can accurately explain happiness in terms of socioeconomic indicators, although individual correlations between happiness and such indicators like GNP per head have been established.

In this light, I believe exploring a model in which happiness is a dependent variable with respect to a multitude of socioeconomic indicators will be a worthwhile addition to the existing literature on happiness.

In this paper, we derive a model that can reasonably forecast happiness of nations, given the key socioeconomic indicators of that nation – GDP per capita, inflation, unemployment and democracy. The paper discovers a logarithmic relationship between happiness and GDP per capita, health and education, linear relationship with inflation and unemployment, and interestingly, a quadratic relationship with democracy. The quadratic relationship is perhaps explained by people's fondness of the stable nature of strong autocracies and strong democracies, with the minimum point of the quadratic equation representing weak autocracies and weak democracies – the middle of the continuum.

The paper then uses the model to estimate happiness (the ratio of model sum of squares to residual sum of squares, being 2.5, corroborates the reliability of the model), and ends by citing scopes of future research in the relevant field.

2. Literature review

2.1. Problems with simple regression models for happiness

Tella, MacCulloch & Oswald (2003) discuss the limitations of a simple regression due to the unit root problem, the influences of politics on macroeconomic indicators like unemployment and inflation (thus making unemployment and inflation endogenous as opposed to exogenous), the fact that happiness is untrended whereas GDP is trended (always increases), the simplicity of unstructured surveys, the way results of a survey can be manipulated using the approach of question, number of choices for answer, and the length of the survey, whether a cross-country and cross-time comparison can be made of happiness indices, and other limitations in brief (2003), and in details in another paper (Tella & MacCulloch, 2006).

The structure of survey questions and its impact on regression findings are perhaps best simplified using Strack, Martin & Schwarz's (1988) study. They asked students the two questions "How happy are you with your life in general?" and "How many dates did you have last month?" in that specified order, to find that the correlation between the answers to these two questions was -0.012 (statistically insignificant from zero). However, when the order of the questions was reversed with another sample of students, the correlation rose to 0.66. This exhibits the ability of the design and structure of the survey to influence reported life satisfaction.

2.2. Individual approach towards happiness

Much literature on happiness, be it in sociology or economics, is focused on individual happiness. Regressions are run with age, gender, marital status, income level and education as typical independent variables. Researches typically show that an individual is happier when they are women, married, young or old (U-shaped age curve), with higher income and with higher education (Blanchflower, 2007). Macroeconomic indicators are seldom used in these regressions (Perovic & Golem, 2010).

2.3. Does the wellbeing of others play into our individual utility functions?

Tella, MacCulloch & Oswald (2003) investigated the correlation between macroeconomic variables and happiness, using the self-reported categorical data of 300,000 individuals across twelve European nations from 1975 to 1992. The authors used an ordered probit model for regression, to address the categorical nature of the data. The authors also used income quartile as an independent variable as opposed to absolute income because of the relativism of happiness (one is only happy if one is richer than one's neighbor). Year dummies are used to control for happiness trends indigenous to cultures and nations; a time dummy controls for events that affect the world economy; personal traits and characteristics were controlled for as well. Happiness was rated using a generic question with four possible choices (extremely happy, happy, not very happy, and unhappy).

The authors found that in Europe, given the same relative position in the income quartile, an absolute increase in GDP by $1,000 (1985 USD), and hence an absolute increase in income,

increase the number of people extremely satisfied with life from 27% to 30%, and reduces the number of people depressed about life from 4.8% to 4.1%. Using time lags of one and two years as means of robustness checks did not uncover any significant differences. However, the time dummy was highly significant, showing that some phenomenon common to all Europe was responsible in decreasing overall happiness. This fall in general happiness may be explained by the adaptation theory, which states that any effects of change in income will fade over time (Perovic & Golem, 2010).

The adaptation theory was expounded by the Nobel-winning economist Daniel Kahneman et. al. (2006); in his paper, he identified the pursuit of higher income as a focusing illusion – the fact that people tend to desire higher incomes because they associate it with happiness, even though higher incomes later do not deliver that happiness. Kahneman et. al. (2006) noted that despite the correlation between life satisfaction and household income, increases in income have mainly had a transitory effect on reported life satisfaction.

The research by Tella et. al. (2003) also showed that during recessions, *all* individuals in the country would have to be paid $200 (1985 USD) on top of compensation for a direct fall in GDP, if they were to maintain the same level of life utility. This extra $200 is a pure psychological cost of recession on all individuals within a country. This suggests a correlation between recession and holistic happiness.

Blanchflower (2007) carried out a similar survey with 25 OECD countries using the macroeconomic indicators GDP per capita, unemployment, interest rates and inflation, using different model specifications. He found that national happiness falls with a rise in interest rate, inflation and unemployment; his study suggests that GDP per capita only factors in with poorer nations.

The papers suggest that exogenous macroeconomic indicators in turn affect individual utility functions, and hence personal happiness and wellbeing is contingent upon the wellbeing of the economy as a whole.

2.4. The sub-sample of transition economies

Accepting Tella et. al.'s (2003) initial proposition about the correlation between happiness and macroeconomic variables, Perovic & Golem (2010) researched the sub-sample of transition economies; more specifically, they wanted to observe any correlation between reduction in government spending idiosyncratic to these nations and their national happiness.

In their study, Perovic & Golem (2010) find that inflation and unemployment have inverted U-curves against happiness. This means that, initial and nominal levels of inflation and unemployment makes people happier, but after a threshold level, makes them unhappier. One line of reasoning is that, nominal levels of inflation and unemployment shows that the nation is not producing on the production possibility frontier, but rather within it, providing incentives for

the country to increase production that would otherwise be nonexistent in a non-inflationary economy, generating employment through more investments.

GDP per capita and government spending have positive effects on happiness, meeting a priori expectations. This is in line with the liberal view of governments being benevolent actors and that state intervention is beneficial. The paper suggests that the steady decline in government spending across all transitional economies made people less happy. Thus, the paper suggests that, at least for transitional economies, bigger governments mean happier people.

2.5. Sen's equity adjusted approach

Sen & Anand (1997) postulates that mean macroeconomic figures should not be accepted at face value, but be adjusted downwards for inequality within the nation. Thus, if M is a macroeconomic measure, and μ is the mean of that measure, then M should not equal to μ, but rather M = μ(1-I), where I is the percentage inequality, as measured by the Gini coefficient. So, if Bangladesh achieves a 60% literacy rate, but with an inequality of 20%, then a literacy rate of [0.60 (1-0.20) =] 48% is a more accurate measurement of the literacy rate in Bangladesh.

Using this approach and Ingelhart et. al.'s 2004 survey data on reported happiness, Borooah (2006) finds that reported happiness falls faster in nations that have greater inequality. Happiness fell dramatically in transitional economies when the Sen approach was used, because of the vast inequality that plagued the nations after the fall of the Soviet Union. However, Borooah (2006) also found that nations that reported lower levels of happiness were also the ones with most inequality. Therefore, Borooah's equity adjustment may have been a double-count, because inequality may already have been factored into the reported happiness of individuals.

2.6. A priori knowledge

The independent variables to be tested in the analysis are:

1. GDP per capita
2. Inflation
3. Unemployment
4. Life expectancy
5. Literacy
6. Democracy
7. Corruption perception index

GDP per capita, according to Blanchflower (2007), only affected the happiness of poorer nations, suggesting that the effect of per capita income on happiness diminishes as income rises. Mathematically, this implies that with respect to per capita GDP, happiness increases at a decreasing rate. However, over time, a rise in income tends to have very little effect on an individual as well as a national level; the happiness index for the world has been stagnant despite an overall increase in world incomes (Parker, 2010). This is attributed to expectations – as

income rises, so does expectations, and therefore, perceived happiness does not rise. Similar observations were made, and similar conclusions were drawn by other researches (Kahneman et. al. [2006] & Tella et. al. [2003]).

Inflation has a great negative psychological effect on the perceived happiness of individuals (Parker, 2010). When 12 European countries were surveyed for the period 1975-91, it was found that a 5% increase in inflation shifts 5% of the total population to a lower satisfaction level (Frey & Stutzer, 2002). However, Perovic & Golem (2010) found an inverted U relation, indicating that people are happier as inflation increases initially, but sadder as inflation increases beyond a certain threshold level. One explanation for this phenomenon is that, nominal levels of inflation and unemployment shows that the nation is not producing on the production possibility frontier, but rather within it, providing opportunity for the country to increase production that would otherwise be nonexistent in a non-inflationary economy, thereby exhibiting possibilities of generating further employment through more investments.

Unemployment affects people in multiple ways. Personal unemployment not only causes a fall in income levels, it leads to a loss in social status and self-esteem. Unemployed people are more prone to divorces and separations, and suffer from depression more often than the employed (Frey & Stutzer, 2002). One can propose that it is because of the unhappiness that individuals face unemployment; happier people fit into their workplace better, and hence are more employable. This problem of reverse causation has been addressed extensively through research and rejected; the causation runs from unemployment to happiness (Frey & Stutzer, 2002). On aggregate, even when one is employed, high unemployment rates surrounding the person can result in lower happiness levels. Tell et. al.'s (2003) study finds that unemployment rates negatively affect happiness, even on persons that are employed. Reasons for this might involve psychological effects, lack of job security or fear of social tension (Frey & Stutzer, 2002). Frey & Stutzer (2002) also found in twelve European countries, that a 1% rise in unemployment must be offset by a 1.7% fall in inflation – that the effect of unemployment is much greater on happiness than that of inflation.

Education seems to have both direct and indirect effects on happiness. The indirect effect is through income – education increases the income level of individuals, ultimately making them happier (Cuñado & Gracia, 2012). Even after controlling for income and labor status, studies in Spain found that education has a self-confidence or self-estimation effect on happiness (Cuñado & Gracia, 2012). The other direct effect is through enhanced social networks and exposure to the outside world. By increasing involvement of the individual with the real world, education may allow people to be happier (Chen, 2012). It is assumed that, as education levels increase, its effect on happiness diminishes – education level affects happiness only when the initial educational endowment is low.

It is suggested that health is highly correlated to income levels beyond disability (Smith, Langa, Kabeto, & Ubel, 2005)– once people are not disabled, their income seems to ensure health. A

study on 700 native Dutch citizens shows that healthier individuals (measured by body mass index) results in happier individuals (Cornelisse-Vermaat, Antonides, van Ophem, & van den Brink, 2006), indicating that there should be a positive relationship between life expectancy and happiness.

It is believed that there are institutional effects on happiness. The type of political system influences the happiness of individuals. It is expected of people living in democratic societies to be happier than their counterparts under undemocratic regimes, because politicians in their country submit to their will, and not the other way around (Frey & Stutzer, 2002). Participatory political systems tend to cater to people's wants and needs, thereby making them happier. Veenhoven's (2000, as cited in Frey & Stutzer, [2002]) research found that political, economic and personal freedoms are strongly correlated with happiness. Analyses on sub-samples show significance of economic freedom in poorer nations but strong correlation between political freedom and happiness in richer nations.

Corruption and lack of law and order make people worse off because it inhibits the daily passage of life of individuals. A violation of the established social order upsets people, and therefore it should be accepted that corruption makes people unhappy. Corruption is seen to cause negative effect on subjective well beings beyond its economic consequence (Heukamp & Ariño, 2011).

3. Data

Data was initially collected for over 150 countries in the world from various sources. In order to maintain the integrity of the regression analysis, it was decided that the same countries would be used for all analyses. As a result, we were left with 147 countries and territories (Appendix A) to work with.

The data for unemployment was available for 133 countries and territories (Appendix A). However, because all the missing 14 countries were African, and dropping them all from the overall regression might constitute a sample bias, data for all 147 countries was used in all analyses save unemployment, where the 133 country-data were used.

The combined regression analysis had to use 133 countries and territories because that was the maximum number of countries available across all variables. Possibility of a sample bias is mitigated because there are multiple independent variables for the same dependent variable, which increases the robustness of the analysis.

Data and their sources at listed below:

Sl.	Variable	Period	Source
1.	Happiness	2005-2011	Helliwell, Layard & Sachs, 2012
2.	GDP per capita	2007-2010	World Bank, 2012
3.	Inflation	2007-2010	World Bank, 2012

4.	Unemployment	Single period, latest data	CIA, 2012
5.	Literacy	2002	Caramani, 2008
6.	Life expectancy	2010	World Bank, 2012
7.	Democracy	2010, 2011	Economist Intelligence Unit, 2011
8.	Corruption	2011	The Guardian, 2011

Table 1: Variables used for regression, with sources

4. Results and findings

4.1. GDP per capita
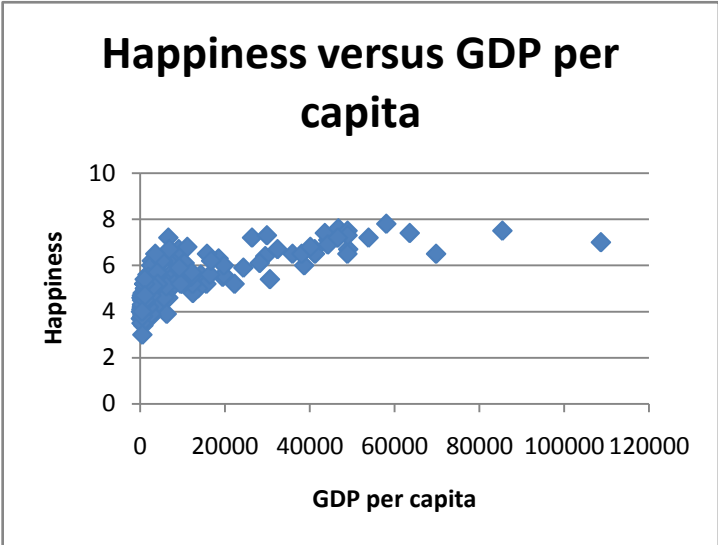
Figure 1: Scatter diagram with happiness and GDP per capita

The graph insinuates a logarithmic relationship between happiness and GDP per capita. A regression analysis of the natural logarithm of GDP as the independent variable against the happiness score indicates a strong correlation between happiness and GDP; the regression coefficient is 0.57 with a 0.0% chance of being significantly different, and the adjusted R squared value is 0.69.

Thus, an increase of income by a dollar would increase the happiness index by 0.57 times the natural logarithm of the ratios of the incomes (Appendix B). For very small changes, therefore, the ratio is one, and the natural logarithm is zero – for small changes in income, happiness increasing only if the income was low to begin with. This confirms our a priori knowledge that, as income increases, happiness increases at a decreasing rate.

Happiness = 0.6091 + 0.5659 x ln (GDP per capita)

(2.27) (18.10)

Parentheses include t-values. Adjusted R-squared = 0.6911

4.2. Inflation

Happiness versus inflation

Figure 2: Scatter diagram with happiness and inflation

As expected, the graph insinuates a negative relationship between inflation and happiness – the coefficient of the inflation variable is negative. Results show that for a 1% increase in inflation rates, the happiness index would slip by 0.08. The adjusted R squared value is only 0.12. Because inflation rate in Zimbabwe, 24,411%, is a clear outlier among the other 147 data figures for inflation, Zimbabwe was excluded from this study. The reason for the non-fitting nature of the curve might be a specification error; because inflation is measured in different ways in different countries, the measurement discrepancy may also have contributed to the lack of fit.

Happiness =   5.9259   -   0.0844 x inflation
                              (40.43)   (-4.56)

Parentheses include t-values. Adjusted R-squared = 0.1192

4.3. Unemployment rate

Happiness versus unemployment

Figure 3: Scatter diagram with happiness and unemployment

Unemployment seems to be negatively correlated with happiness, confirming our a priori knowledge. The P-value of the coefficient is 0.0%, although the graph is not a good fit – the adjusted R value is only 0.13. One reason for this might be the nature in which unemployment is defined – its definition is nebulous and each government defines it in a manner it deems appropriate. Each nation has different definitions and methods of measuring unemployment, making its cross-country analysis difficult. Since unemployment figures are prone to manipulation for political motives, its accuracy is often apocryphal; the trend, however, can be relied upon.

Moreover, data for quite a few nations were missing, mostly developing nations that did not have a strong national statistics department, perhaps constituting a selection bias.

Happiness =   5.8939   -   0.0294 x inflation
                           (50.34)   (-4.59)

Parentheses include t-values. Adjusted R-squared = 0.1320
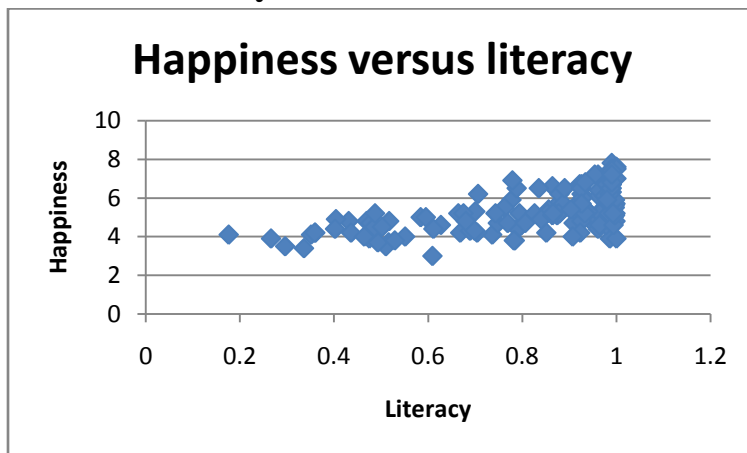
4.4. Literacy rate

Figure 4: Scatter diagram with happiness and literacy rate

The graph indicates an increasing relationship between happiness and literacy rates. Based on our previous knowledge, we specify a logarithmic relationship between literacy rates and happiness. The regression analysis shows that, although the graph is not the best fit (adjusted R value being 0.33), the specified model holds; the coefficient of correlation is 1.94 with a 0.0% chance of being significantly different from it.

One reason for the adjusted R value being small is the nebulous nature of defining and measuring literacy rate – just like unemployment, each nation can arbitrarily choose a definition and method of measuring literacy rate, making cross-country comparison difficult.

Happiness =   5.8450   +   1.9364 x ln (literacy)
                           (64.40)   (8.63)

Parentheses include t-values. Adjusted R-squared = 0.3347
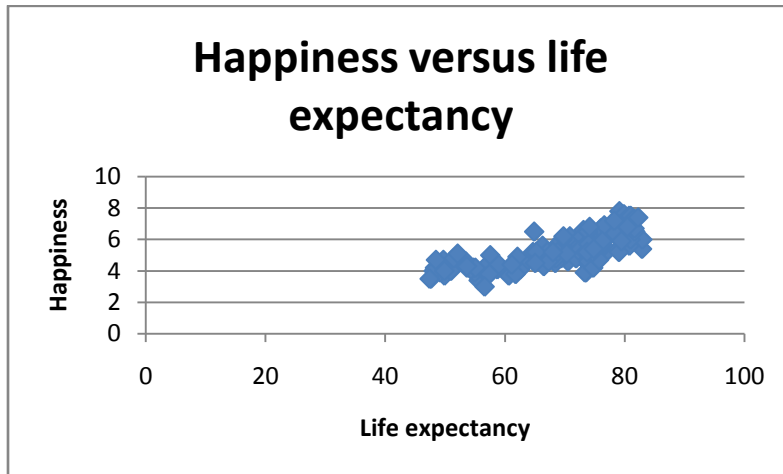
4.5. Life expectancy

Figure 5: Scatter diagram with happiness and life expectancy

The graph indicates an increasing relationship between happiness and life expectancy. The regression analysis based on a logarithmic model shows that the model is statistically significant – the coefficient of regression is 5.21 with 0.0% chance of being significantly different from it. The graph has an adjusted R value of 0.53, showing it is a decent fit. This result confirms our a priori knowledge that life expectancy only increases happiness for initial values of life expectancy.

Happiness =   -16.6949   +   5.2110 x ln (life expectancy)
                                      (-9.82)   (12.99)

Parentheses include t-values. Adjusted R-squared = 0.5347
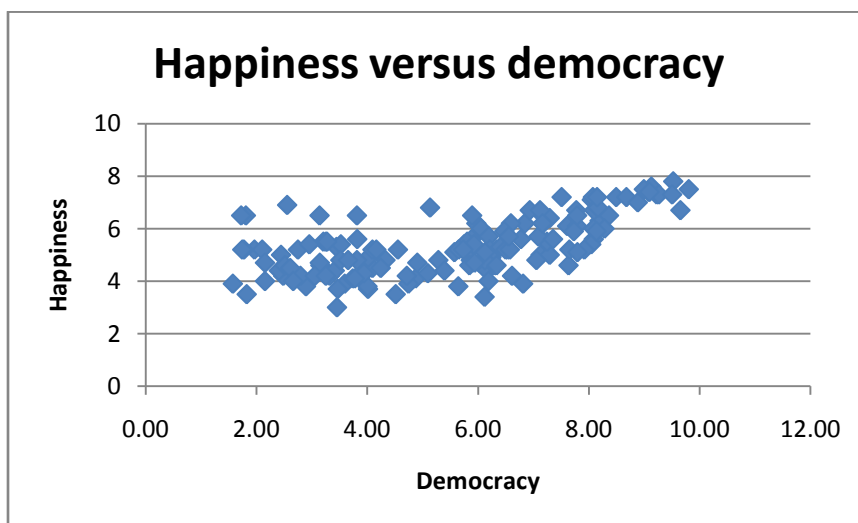
4.6. Democracy

Figure 6: Scatter diagram with happiness and democracy

The graph insinuates a quadratic relationship between happiness and democracy. By forming a quadratic equation with the regression analysis results stated below, we find its turning point at democracy = 3.87 and happiness = 4.66. Intuitively, this means that for democracies rated below 3.87, people are actually happier as the society becomes undemocratic. Perhaps the spiritual satisfaction of living in a theological or monarchical state (ranking poorly in democracy) results in this seeming paradox. Such states like Saudi Arabia, Iran, Qatar, United Arab Emirates, Myanmar, Turkmenistan, Uzbekistan, Bahrain, China, Cuba and Kuwait all rank below the 3.87 mark.

Another reason for the quadratic relationship may be people's predilection for stability, a standard feature of authoritarian regimes. Democracies, especially weak ones, are often marked with instability, political unrests, public protests, and the likes, thereby making people unhappy. Stability is manifest in strong authoritarian regimes and strong democracies, with those in the middle (semi-authoritarian/semi-democratic regimes) being the most fragile (Hadenius & Teorell, 2006), which could explain the quadratic relationship between happiness and democracy.

Happiness =   6.0421   -   0.7145 x democracy +0.0922 x democracy squared
                (15.54)   (-4.70)   (6.83)

Parentheses include t-values. Adjusted R-squared = 0.5230

4.7.   Perceived corruption
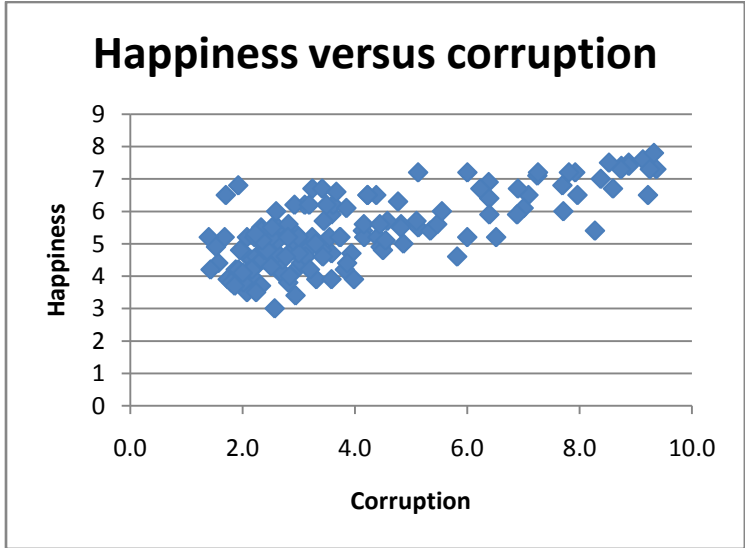
Figure 7: Scatter diagram with happiness and perceived corruption

Corruption seems to negatively hamper happiness – the graph shows that the lesser the perceived level of corruption in the country, the happier the people are (corruption is quantified using the corruption perception index, where 1.0 is the most corrupt and 10.0 is the least corrupt). The coefficient of correlation is 0.37 with a 0.0% confidence – the adjusted R squared is 0.54,

showing a good fit. Thus, for a one point drop on the corruption scale, people of a country will be likely to report a 0.37 point drop in their life satisfaction.

Happiness = 3.8893 + 0.3653 x corruption
(29.98)   (13.00)

Parentheses include t-values. Adjusted R-squared = 0.5350

5. Combined model

The combined analysis uses the natural logarithm of GDP per capita, inflation, democracy (and democracy squared) and unemployment. Studies (Smith, Langa, Kabeto, & Ubel, 2005) show that health is highly correlated to income beyond the point of physical disability. Similarly, research (Cuñado & Gracia, 2012) also establishes a strong relationship between education and income, in the sense that a good education results in a higher income. Hence, we would run into a problem of multicollinearity if we included income, education and health within the same analysis. Thus, education and health have been dropped.

Lastly, the democracy statistic as published by the Economics Intelligence Unit (2011) used corruption as a question within their broader survey in evaluating the level of democracy within a nation. As a result, using both the variables would cause the same problem of multicollinearity, and so corruption was dropped.

Dependent variable: Happiness		**Observations**	133
		Adjusted R-squared	0.7070
		Prob > F	0.0000
Variable	**Coefficient**	**Coefficient under single var regression**	
Ln(GDP per capita)	0.4328 (8.50)	0.5659 (18.10)	
Democracy	-0.4522 (-3.54)	-0.7145 (-4.70)	
Democracy squared	0.0491 (4.13)	0.0922 (6.83)	
Inflation	0.0175 (1.32)*	-0.0844 (-4.56)	
Unemployment	-0.0066 (-1.60)*	-0.0294 (-4.59)	
Constant	2.4864 (3.96)		

*Parentheses include p-values. * denotes statistical insignificance*

Table 2: Regression results with all variables

The results from the multivariate regression analysis corroborate our findings using individual variables. More income makes people happier; unemployment upsets people, whereas democracy remains ambiguous. However, given the capricious nature of defining and measuring inflation and unemployment, and their poor fits during the single variable regression, their coefficients are statistically insignificant – their p-values are 18.9% and 11.1% respectively. However, the probability that all coefficients are zero at once is 0.00%, and the adjusted R-squared value is 0.7070, showing the findings are significant on the whole.

Although this study shows that inflation is positively related to happiness, the regression coefficient for inflation is statistically insignificant. This can be attributed to the capricious

nature of measuring inflation across nations, a problem that has made unemployment's effect on happiness statistically insignificant as well.

According to our analysis, inflation has a greater impact on happiness than unemployment, contrary to what Frey & Stutzer (2002) found in the case of Europe. We see that a 1% increase in unemployment can be offset by a 0.35% decrease in inflation (Appendix B). A possible reason for this could be that in a world setting, where income is very low, a slight fall in general price level greatly boosts the consumption bundle for individuals. Compared to the European case, the social stigma and personal loss from unemployment outweighs the price effect. Since most countries have low incomes to begin with, perhaps a job loss has no significant effect on happiness; they would rather be more excited at the prospect of cheaper goods.

So, to calculate the happiness index of a nation, we can use the following formula:

Happiness = 2.4864 + 0.4328 x ln(GDP per capita) – 0.4522 x democracy + 0.0491 x democracy squared + 0.0175 x inflation – 0.0066 x unemployment (equation 1)

Comparison with the coefficients found from the single variable regression analysis shows that single variable regressions overestimate the effects of macroeconomic indicators on individual happiness. A multivariate regression controls for the other variables. So, for a one percent rise in unemployment, happiness index can be expected to drop by 0.0066 points, and not 0.0294 points, when we control for income, democracy and inflation.

5.1. Forecasting ability of the model

Country	Hap	Exp Hap	Error	Error squared	Country	Hap	Exp Hap	Error	Error squared
Afghanistan	4.2	4.167722	0.032278	0.001042	Kyrgyzstan	4.8	4.529286	0.270714	0.073286
Albania	5.2	5.044657	0.155343	0.024131	Laos	5.2	4.780159	0.419841	0.176266
Algeria	5.3	5.153713	0.146287	0.0214	Latvia	4.8	5.839369	-1.03937	1.080288
Angola	4.2	5.199269	-0.99927	0.998539	Libya	5.2	5.588436	-0.38844	0.150883
Argentina	6.2	5.678691	0.521309	0.271763	Lithuania	5.5	5.845275	-0.34528	0.119215
Armenia	4.5	5.015071	-0.51507	0.265298	Luxembourg	7	7.359195	-0.3592	0.129021
Australia	7.3	7.150923	0.149077	0.022224	Macedonia	4.4	5.041541	-0.64154	0.411575
Austria	7.2	6.842966	0.357034	0.127473	Malaysia	5.7	5.456313	0.243687	0.059383
Azerbaijan	4.6	5.425523	-0.82552	0.681488	Mali	4	4.184773	-0.18477	0.034141
Bahrain	5.5	5.766881	-0.26688	0.071225	Malta	6	6.387224	-0.38722	0.149942
Bangladesh	4.8	4.379744	0.420256	0.176615	Mauritius	5.4	5.9141	-0.5141	0.264299
Belarus	5.5	5.446763	0.053237	0.002834	Mexico	6.7	5.702994	0.997006	0.994021
Belgium	7.1	6.644941	0.455059	0.207079	Moldova	5.2	4.860503	0.339497	0.115258
Benin	3.4	4.479153	-1.07915	1.164571	Mongolia	4.6	5.012904	-0.4129	0.17049
Bolivia	5.6	4.837409	0.762591	0.581545	Montenegro	5.2	5.37296	-0.17296	0.029915
Bosnia	4.8	4.866199	-0.0662	0.004382	Morocco	4.8	4.871002	-0.071	0.005041
Botswana	4.6	5.805011	-1.20501	1.452052	Mozambique	4.7	4.06801	0.63199	0.399411

Brazil	6.6	5.726019	0.873981	0.763843	Myanmar	5.2	5.249458	-0.04946	0.002446
Bulgaria	3.9	5.517309	-1.61731	2.615688	Namibia	4.9	5.002036	-0.10204	0.010411
Burkina Faso	3.9	3.733907	0.166093	0.027587	Nepal	4.5	3.951403	0.548597	0.300959
Cambodia	4.1	4.436555	-0.33656	0.113269	Netherlands	7.5	7.062449	0.437551	0.191451
Cameroon	4.4	4.42238	-0.02238	0.000501	New Zealand	7.3	6.975864	0.324136	0.105064
Canada	7.4	7.030977	0.369023	0.136178	Nicaragua	5.2	4.653989	0.546011	0.298128
Central African Rep	3.5	4.481889	-0.98189	0.964106	Nigeria	4.8	4.611147	0.188853	0.035665
Chile	6.1	5.876553	0.223447	0.049929	Norway	7.5	7.703108	-0.20311	0.041253
China	4.7	5.105175	-0.40518	0.164167	Pakistan	5.2	4.62032	0.57968	0.336029
Colombia	6.2	5.368471	0.831529	0.69144	Panama	6.7	5.631941	1.068059	1.14075
Comoros	3.7	4.267007	-0.56701	0.321497	Paraguay	5.3	5.048958	0.251042	0.063022
Costa Rica	7.2	5.959918	1.240082	1.537803	Peru	5.2	5.2644	-0.0644	0.004147
Croatia	5.6	5.754171	-0.15417	0.023769	Philippines	4.8	4.861982	-0.06198	0.003842
Cuba	5.4	5.255913	0.144087	0.020761	Poland	5.7	5.795092	-0.09509	0.009042
Cyprus	6.4	6.246152	0.153848	0.023669	Portugal	5.2	6.259949	-1.05995	1.123492
Czech Rep	6.3	6.323765	-0.02377	0.000565	Qatar	6.5	6.469589	0.030411	0.000925
Denmark	7.8	7.377265	0.422735	0.178705	Romania	5.2	5.599783	-0.39978	0.159826
Djibouti	5	4.42412	0.57588	0.331638	Russia	5.2	5.582292	-0.38229	0.146147
Dom Rep	5.1	5.255951	-0.15595	0.024321	Rwanda	4.2	4.166689	0.033311	0.00111
Ecuador	5.4	5.123075	0.276925	0.076687	Saudi Arabia	6.5	6.047072	0.452928	0.205144
Egypt	4.8	4.978467	-0.17847	0.03185	Senegal	4.4	4.222688	0.177312	0.03144
El Salvador	5.9	5.147739	0.752261	0.565897	Serbia	4.6	5.319067	-0.71907	0.517057
Estonia	5.2	6.086679	-0.88668	0.7862	Singapore	6.5	6.13051	0.36949	0.136523
Finland	7.6	7.086976	0.513024	0.263194	Slovakia	5.6	5.972285	-0.37229	0.138596
France	6.7	6.50027	0.19973	0.039892	Slovenia	5.9	6.270786	-0.37079	0.137482
Georgia	3.9	4.860049	-0.96005	0.921694	South Africa	5.1	5.685834	-0.58583	0.343201
Germany	6.5	6.724897	-0.2249	0.050579	Spain	6.7	6.430017	0.269983	0.072891
Ghana	4.7	4.783071	-0.08307	0.006901	Sri Lanka	4.2	5.113008	-0.91301	0.833584
Greece	6.1	6.320721	-0.22072	0.048718	Sudan	4.4	4.872558	-0.47256	0.223311
Guatemala	6.2	5.040595	1.159405	1.34422	Sweden	7.3	7.273138	0.026862	0.000722
Guyana	6	4.99432	1.00568	1.011392	Switzerland	7.4	7.213702	0.186298	0.034707
Haiti	3.8	4.129575	-0.32958	0.10862	Syria	4.7	5.17928	-0.47928	0.229709
Honduras	5.5	4.873387	0.626613	0.392644	Tajikistan	4.6	4.697893	-0.09789	0.009583
Hong Kong	5.4	6.018264	-0.61826	0.38225	Tanzania	3.8	4.261476	-0.46148	0.21296
Hungary	5	5.906727	-0.90673	0.822154	Thailand	5.7	5.262367	0.437633	0.191523
Iceland	6.7	7.474706	-0.77471	0.600169	Trinidad and Tobago	6.2	6.095981	0.104019	0.01082
India	5	4.95238	0.04762	0.002268	Tunisia	5.2	5.010561	0.189439	0.035887
Indonesia	5.2	5.050288	0.149712	0.022414	Turkey	5.2	5.558114	-0.35811	0.128246
Iran	5.2	5.60897	-0.40897	0.167256	Turkmenistan	6.5	5.17198	1.32802	1.763637
Iraq	4.9	4.780189	0.119811	0.014355	Ukraine	5.1	5.271924	-0.17192	0.029558

Ireland	7.2	6.896317	0.303683	0.092223	UAE	6.9	6.282563	0.617437	0.381228
Israel	7.2	6.277274	0.922726	0.851423	UK	6.8	6.649871	0.150129	0.022539
Italy	6.5	6.460448	0.039552	0.001564	United States	7.2	6.689845	0.510155	0.260258
Jamaica	6.2	5.606083	0.593917	0.352737	Uruguay	5.9	6.100725	-0.20072	0.040291
Japan	6	6.577459	-0.57746	0.333459	Uzbekistan	5.2	5.136625	0.063375	0.004016
Jordan	5.6	5.087843	0.512157	0.262305	Venezuela	6.8	5.908275	0.891725	0.795173
Kazakhstan	5.5	5.566569	-0.06657	0.004431	Vietnam	5.4	4.78954	0.61046	0.372661
Kenya	4.2	4.275128	-0.07513	0.005644	Yemen	4.5	4.645761	-0.14576	0.021246
Korea, Rep of	5.6	6.354641	-0.75464	0.569483	Zambia	4.7	4.66806	0.03194	0.00102
Kuwait	6.5	6.2401	0.2599	0.067548	**Total**	**733.8**	**733.5073**	**0.292661**	**39.78369**

where Hap = reported happiness, Exp Hap = happiness as predicted by the model

Table 3: Reported happiness, happiness as predicted by the model, and the error terms

The table above exhibits the forecasting ability of the model. Using the equation 1 derived from the regression analysis, we see that the model can forecast happiness of a nation with reasonable accuracy, given the values of independent variables. The ANOVA table for the combined model is shown below:

Source	Sum of squares	df	Mean sum of squares	$F_{(5, 127)} = 64.69$
Model	101.326536	5	20.2653072	Prob > F = 0.0000
Residual	39.7836897	127	0.313257399	
Total	141.110226	132	1.06901686	

Table 4: ANOVA table for combined model

It shows that the ratio of model sum of squares to residual sum of squares is much greater than one (101.33/39.78 = 2.55), reiterating the predictive power of the model. The probability that the mean sums of squares are statistically insignificant is 0.00%, again confirming that the model can reasonably forecast happiness of nations using macroeconomic variables.

6. Limitations

The principle limitation of this research is the paucity of sufficient data to carry out a time series and panel analysis. As a result, it is impossible to prove that our observations are in statistical control over time. This is important to establish the long run integrity of the findings of the regression analysis. Systematically available data for happiness across different time periods would help us in discounting trends or special causes that may have affected values of all dependent and independent variables, through use of control charts, time-series sequence plots, or runs counts (Tamura, 2012).

Future additions to the field of happiness economics would perhaps involve extending this static analysis across time, in order to ensure even greater robustness of the model derived.

7. Conclusion

This paper did a worldwide investigation on the macroeconomic reasons of happiness. In doing so, most findings were consistent with a priori knowledge regarding happiness, extrapolated from much smaller samples. This paper confirms the logarithmic relation between income and happiness; it also corroborates negative relations between inflation and unemployment, and happiness.

The paper notes that the statistical significance of the regression coefficient of GDP per capita, education and health mostly stem from the fact that the world has very low initial endowment of these variables. As world income, education levels, and healthcare coverage increases, the effects of the stated macroeconomic variables on happiness will greatly diminish.

The paper also tried establishing an empirical relationship between happiness and democracy across the world, and found, interestingly, that there exists a quadratic relationship between the two variables. Lower level of democracy increases happiness – this can be characterized by the spiritual effect or the stability of a theological state or a monarchy, all of which would rank low on the democracy scale. Higher level of democracy predictably increases happiness due to self-actualization and manifestation of individual will throughout the state.

Colloquially referred to as "grass is always greener on the other side", variables like household income, education and health, three seemingly important contributors to happiness, only affects happiness at initial levels, and then their increase exhibits diminishing marginal increments in happiness. Variables like perceived corruption or inflation, on the other hand, that tend to be discussed more often and whose effects are felt more tangibly in everyday life, tend to have linear relationships with happiness. This exemplifies the relative nature of happiness.

8. Acknowledgements

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10. Appendices

10.1. Appendix A

Countries and territories (147) used in regression analysis for GDP per capita, inflation, corruption, democracy, life expectancy and literacy:

1. Afghanistan	29. Colombia	57. Hong Kong
2. Albania	30. Comoros	58. Hungary
3. Algeria	31. Congo, DR	59. Iceland
4. Angola	32. Congo, Rep of	60. India
5. Argentina	33. Costa Rica	61. Indonesia
6. Armenia	34. Croatia	62. Iran
7. Australia	35. Cuba	63. Iraq
8. Austria	36. Cyprus	64. Ireland
9. Azerbaijan	37. Czech Republic	65. Israel
10. Bahrain	38. Denmark	66. Italy
11. Bangladesh	39. Djibouti	67. Ivory Coast
12. Belarus	40. Dominican Republic	68. Jamaica
13. Belgium		69. Japan
14. Benin	41. Ecuador	70. Jordan
15. Bolivia	42. Egypt	71. Kazakhstan
16. Bosnia	43. El Salvador	72. Kenya
17. Botswana	44. Estonia	73. Korea, Rep of
18. Brazil	45. Ethiopia	74. Kuwait
19. Bulgaria	46. Finland	75. Kyrgyzstan
20. Burkina Faso	47. France	76. Laos
21. Burundi	48. Georgia	77. Latvia
22. Cambodia	49. Germany	78. Lebanon
23. Cameroon	50. Ghana	79. Libya
24. Canada	51. Greece	80. Lithuania
25. Central African Republic	52. Guatemala	81. Luxembourg
	53. Guinea	82. Macedonia
26. Chad	54. Guyana	83. Madagascar
27. Chile	55. Haiti	84. Malawi
28. China	56. Honduras	85. Malaysia

86.	Mali	108.	Philippines	130.	Tanzania
87.	Malta	109.	Poland	131.	Thailand
88.	Mauritius	110.	Portugal	132.	Togo
89.	Mexico	111.	Qatar	133.	Trinidad and
90.	Moldova	112.	Romania		Tobago
91.	Mongolia	113.	Russia	134.	Tunisia
92.	Montenegro	114.	Rwanda	135.	Turkey
93.	Morocco	115.	Saudi Arabia	136.	Turkmenistan
94.	Mozambique	116.	Senegal	137.	Uganda
95.	Myanmar	117.	Serbia	138.	Ukraine
96.	Namibia	118.	Sierra Leone	139.	United Arab
97.	Nepal	119.	Singapore		Emirates
98.	Netherlands	120.	Slovakia	140.	United Kingdom
99.	New Zealand	121.	Slovenia	141.	United States
100.	Nicaragua	122.	South Africa	142.	Uruguay
101.	Niger	123.	Spain	143.	Uzbekistan
102.	Nigeria	124.	Sri Lanka	144.	Venezuela
103.	Norway	125.	Sudan	145.	Vietnam
104.	Pakistan	126.	Sweden	146.	Yemen
105.	Panama	127.	Switzerland	147.	Zambia
106.	Paraguay	128.	Syria		
107.	Peru	129.	Tajikistan		

Countries and territories missing (14) from the regression analysis for unemployment:

1. Burundi
2. Chad
3. Congo, DR
4. Congo, Rep of
5. Ethiopia
6. Guinea
7. Ivory Coast
8. Lebanon
9. Madagascar
10. Malawi
11. Niger
12. Sierra Leone
13. Togo
14. Uganda

10.2. Appendix B

Effect of increase in GDP per capita on happiness index

If GDP per capita increases by x, then

Change in happiness index $= 0.57 \text{ x } \ln(GDP\ per\ capita + x) - 0.57 \text{ x } \ln(GDP\ per\ capita)$

$$= 0.57\ [\ \ln(GDP\ per\ capita + x) - \ln(GDP\ per\ capita)]$$

$$= 0.57 \text{ x } \ln\left(\frac{GDP\ per\ capita + x}{GDP\ per\ capita}\right)$$

Hence, as x → 0,

$$\lim_{x \to 0} 0.57 \text{ x } \ln(\frac{GDP \text{ } per \text{ } capita + x}{GDP \text{ } per \text{ } capita})$$

$$= 0.57 \text{ x } \ln(\frac{GDP \text{ } per \text{ } capita}{GDP \text{ } per \text{ } capita})$$

$$= 0.57 \text{ x } \ln 1$$

$$= 0$$

<u>Tradeoff between unemployment and inflation</u>

Using the single variable correlations, if unemployment increases by 1%, happiness decreases by 0.0294 points. Ceteris paribus, the effect of inflation must be equal and opposite to keep happiness at its initial level. This is possible iff

0.0844 x inflation = 0.0294 x unemployment

or, inflation = 0.0294 x 1/0.0844

or, inflation = 0.3483 %