Predictors of Well-Being in High Income, Industrialized Countries and Their Related Effects

Christopher Holcomb

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Abstract

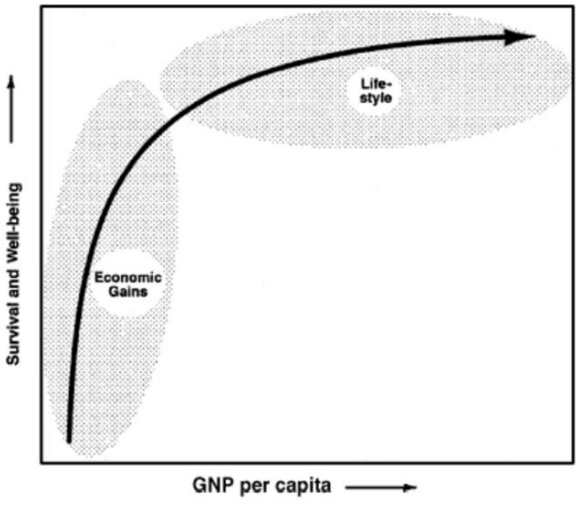
Motivated by both: academic research illuminating the diminishing returns nature of the relationship between income and subjective well-being, and the recent development of composite indices as alternatives to GDP, this paper seeks to analyze empirically the relationship between a variety of macro-level indicators and subjective well-being. As there has been a paucity of research on this subject on just high-income countries, the paper looks at only those countries and finds that the effects of GDP do indeed diminish in comparison to low-income countries. Furthermore, the empirical analysis overall supports the thesis that as GDP rises, the values of countries shift from personal survival and economic opportunity towards larger government, less working hours, and more emphasis on trust in institutions and people.

Introduction

As societies progress, it becomes less necessary for their citizens to be concerned with personal survival; people are given the opportunity to shift their focus from immediate needs to getting the most out of life. In a similar way, as modern societies have developed, their people have become concerned with issues that they never were before. This shift has led to an intriguing dichotomy in the modern world. As many residents of the Global South are still searching for their daily food and shelter, residents of the Global North are starting to take those things for granted. To perhaps overly generalize the situation, while many Southerners remain locked in a struggle for survival, Northerners have stopped concerning themselves with survival and are searching for how to experience life more fully in other ways (see Figure 1).

As a sign of this shift, concerns with environmental protection, inequality, and human well-being have risen rapidly in more industrialized nations in the last 40 years, and especially in the last ten. A key focal point of discussion as a result of this shift has been over whether or not measures of income (or, the means for obtaining survival) can fully explain the improvement of the human condition. More specifically, the discussion often focuses on GDP as an indicator for the quality and well-being of a society. While economists recognize that GDP is not the only descriptor of the state of a society, the indicator is nevertheless heavily relied upon by news outlets, policymakers, and the general population as a composite measure for a nation's health.

Figure 1.



Inglehart, et al. (2008)

In response to this reliance, two developments have occurred which are pertinent to the research at hand. The first development has been a thorough survey of the data surrounding well-being. Through econometric analysis, many researchers have sought previously to determine what factors are most highly predictive of high levels of well-being, both at individual (Easterlin, 2003) and societal levels (Inglehart, et al. 2008). A large percentage of this research has focused on the relationship between income levels and well-

being, with the general results being now widely established. Firstly, a high level of correlation between income and well-being has been proven by almost every study (Stutzer and Frey, 2010). Secondly, the relationship between the two variables seems to be logarithmic in nature (Helliwell, 2002, also, Figure 2.). Well-being increases sharply with small increases in income at lower levels as societies rise out of poverty, but this relationship exhibits diminishing returns. It does not follow that well-being increases in industrialized nations are not still related to rises in income, but the question can be raised as to whether there may be more important factors. See a preliminary comparison of my regressions for below and above $8,500, Table 1, to further illustrate this point. Also interesting to note in this table are the changes in the effects of leisure time, freechoice, post-materialism, and confidence in churches.

Figure 2 Diener and Seligman (2004)

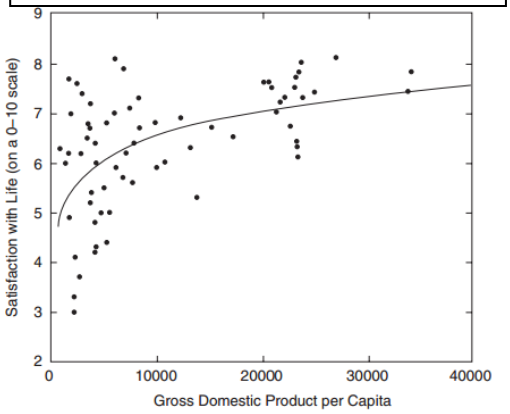


Fig. 2. Satisfaction with life as a function of gross domestic product per capita. Each circle represents the gross domestic product and life satisfaction in a nation. The curve shows a line that describes the relation between income and life satisfaction in these nations.

The second development has been the creation of alternative indicators to GDP for measuring progress (for an overview, consult Bleys, 2012). Some of the most notable of these are the Genuine Progress Indicator, the Human Development Index, the Ecological Footprint, The Happy Planet Index, and the Gross National Happiness measure used by Bhutan. Some of these indices make additions to GDP (GPI, HDI) and some of them scrap it in favor of other objective measures (Ecological Footprint), while others use subjective measures or a mixture of both (HPI, GNH). Many, but not all, of these indices have been created by environmental groups or activists within the Global North seeking to provide a fuller picture of human well-being and illuminate the costs of, in their view, unsustainable growth.

It is out of the development of these alternative indicators and the investigation of income's relationship with well-being that my research arises. While many researchers have sought to ascertain how correlations with well-being differ between high and low income countries with micro indicators (Sarracino, 2013), in my experience none have sought to explore the differences between high income countries with composite national indicators. Since many of the aforementioned indices have been created in an attempt to effect political change in developed

nations, it seems logical that those indices should, rather than attempting to apply a broad formula for societal advancement to all societies at once, be tailored specifically to the situation

Table 1: LGDP Below and Above Cutoff

VARIABLES	(1)Below $8,500 Well-being	(2)Above $8,500 Well-being
state of health (subjective)	0.878***	0.812***
	(0.159)	(0.160)
Post-materialist index 4-item	0.415**	0.288***
	(0.162)	(0.105)
Importance In Life of Leisure Time	-0.0100	0.975***
	(0.142)	(0.288)
most people can be trusted	0.0629	0.263
	(0.481)	(0.277)
Confidence in Churches	0.111	0.241***
	(0.0815)	(0.0894)
WVS Unemployment Rate	-0.852*	-0.325
	(0.438)	(0.579)
Log(GDP)	0.0880*	0.101
	(0.0492)	(0.0731)
how much freedom of choice and control	0.559***	-0.0207
	(0.0902)	(0.0972)
Constant	-0.944	0.170
	(0.598)	(0.789)
Observations	121	80
R-squared	0.706	0.775

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

of the developed world. Furthermore, in fitting with the goals of many of the organizations who have developed these indices, it is important to analyze how each of these key factors influences the environment. It is my intention, therefore, to use econometric techniques to determine which of a broad range of factors are most influential on well-being among high-income, industrialized countries, and then to analyze how these factors affect environmental indicators.

Related Literature

The aforementioned body of research investigating the relationship between income and well-being was largely motivated by Richard A. Easterlin's study in 1974. This preliminary research was the foundation of what came to be known as the Easterlin Paradox, the idea that

while there is a strong relationship between increased income and higher subjective well-being *within* countries, there is not a relationship between increased income and higher subjective well-being *between* countries (Easterlin, 1974). This conclusion inspired many others to do their own analysis of the question, each falling in his or her place on the spectrum of affirming or denying the paradox.

As more data became available and further studies were done, academic research has reached a consensus on at least some of the related issues. As Stutzer and Frey note, "The relationship between income and subjective well-being, both in simple regressions and when a large number of other factors are controlled for in multiple regressions, proves to be statistically (usually highly) significant." (Stutzer and Frey, 2010) Furthermore, as established by Diener and Inglehart (Diener and Seligman, 2004; Inglehart et al. 2008, respectively), this relationship exhibits diminishing returns. The initial idea that there is no relationship between income and well-being between countries, then, is not true. This relationship has been shown to be logarithmic in nature, and Easterlin maintains that a paradox still exists in the form of a lack of relationship between long-term changes in GDP and increases in subjective well-being (Easterlin 2010).

Because of this diminishing returns phenomenon, several researchers have instead assessed the relationship between the log of income and well-being, as I have done in Table 1. Using this transformation, Wolfers and Stevenson appeared to debunk the Easterlin Paradox in 2008, concluding that there is in fact both a within country and between country relationship between income and happiness over time (Wolfers and Stevenson, 2008). Graham, however, responded to this study with the analysis that the results are largely dependent upon what type of subjective well-being measure is used in your study. While most previous research had relied on questions that instruct respondents to assess their happiness as a whole, the Gallup Poll data that Wolfers and Stevenson used asked respondents to "compare your life with the best possible life," a more relative question that lends itself more easily to connections with income (Graham, 2010).

Easterlin also critiqued the work of Wolfers and Stevenson, asserting that they looked at too short of a time period (Easterlin, 2010). It seems then, that on some of these issues there is at least some amount of scholarly disagreement. My paper thus, does not seek to add its voice to the particular disagreement over time-series interactions, but rather work off of the conclusions

that have already been widely established, namely that while income is related to well-being, this relationship decreases as a country's income rises, giving way to a shifting of values among the population.

If I would like to restrict my analysis to high-income countries, I must first determine a definition for that term. While it seems that no study has sought to assess the macro-level predictors of well-being in just high-income countries, several organizations and studies have undertaken the challenge of defining what a high-income or developed country is. As explained by Nielson, three of the most prominent of these organizations are the IMF, the UNDP, and the World Bank. Each organization uses a different classification system, and some, like the IMF's, seem more arbitrary than others. The three organizations' definitions of "developed countries" are as follows:

UNDP: the top 25% of the Human Development Index (an index of life expectancy, education, and per capita income)

World Bank: classifies "High Income" countries as those with per capita national incomes above US$6,000 in 1987 terms, resulting in a cutoff point of $12,195 in 2009 and including roughly 26% of the world's countries.

IMF: Purely subjective classification of countries as "advanced." This corresponds very closely with a list of OECD countries, missing only Chile, Estonia, Hungary, Mexico, Poland, and Turkey, and adding only Cyprus, Malta, and Singapore.

The way these classifications work out, the IMF lists the smallest number of countries with their "advanced" list, while the UNDP includes all of these with a few extras. The World Bank list is still larger, containing every country from the UNDP list and a few more additions. Several researchers have also made judgments and decisions about how to distinguish high income or developed countries. In 2004, Diener and Seligman theorized, citing other studies, that "There are diminishing returns for increasing wealth above U.S. $10,000 ($12,135.92 in today's dollars); above that level, there are virtually no increases or only small increases in well-being." In other studies, such as Sarracino's, a high-income designation was made by putting a

cut-off point at $10,726 in per capita GDP (in fitting with the World Bank's cutoff point for high-income countries in the year of the study's observations, 2006). My own selection process will be expounded upon below.

Regarding the impact of specific variables, related literature also lends aid. As outlined by Dolan (2008), there seem to be several broad general categories. Dolan's literature review separates well-being influencing variables into the categories of income, personal characteristics, socially developed characteristics, how we spend our time, attitudes and beliefs, relationships, and national socioeconomic indicators. According to Diener (2004), some "Important noneconomic predictors of the average levels of well-being of societies include social capital, democratic governance, and human rights." This conclusion is supported independently by Sarracino (2003) in regard to social capital and Inglehart, et al. (2008) in regard to freedom and democracy. Finally, Helliwell (2008) identified such variables as age, marital status, trust in others, importance of God, education, and income decile as particularly important. As will be shown in the model specification section, these studies provided a good basis of understanding for me to determine which variables to use in my own analysis.

Some of this exploration of variables led to further research on particular metrics within the World Values Survey (WVS). Two of these of note are the post-materialism index and the income variables within the WVS. For the post-materialism index, my main question was how the rating (1=Materialist, 2=Mixed, 3=Postmaterialist) was determined, as the survey question didn't show the questions themselves. The index is calculated based off of a respondents choice of two answers from a list of four:

Which is a more important goal for the country?

a) Maintaining the order of the nation;
b) Giving the people more say in important government decisions
c) Fighting rising prices; or
d) Protecting freedom of speech.

Here, choosing a and c give the result of materialist, where b and d give the result of post-materialist. There has been some amount of controversy in academic literature over whether the index accurately corresponds with a value change. In 2003 however, Hansen and Tol did an analysis of the index with country-level aggregate scores (as I use it) in relation to inflation, unemployment, and crime. While their study concludes that the effectiveness of the metric may

not be as strong Inglehart (its creator) claims, it nonetheless lends enough support to the index to qualify its use as a minor part of my study.

Considerable doubt has also been cast upon the scale of income variable within the World Values survey, as explained by Donnelly and Pol-Eleches (2012). For the objective income measurement, one which puts respondents into deciles based on the income levels in their specific country, it seems that the survey was not administered equally. Some administrators placed respondents into deciles based on the sample itself, some pre-determined deciles, and some subjectively asked respondents to pick their own decile on a scale of one to ten. These differing methods make it difficult to use this variable in a meaningful way without compromising the validity of the results. As a result, in those cases where I use the scale of incomes variable, its results may be at least slightly compromised. At the very least, this variable should be classified as more subjective than purely objective.

Data

The bulk of my data comes from the World Values Survey and the European Values Study. The World Values Survey has been conducted in 87 different countries in five waves from 1981 to 2008. The European Values Study (EVS) has been conducted in 47 European countries and regions (some of which overlap with the WVS) in four waves from 1981 to 2008. These surveys, though conducted separately, utilize the same core group of questions, allowing them to be combined into a single file with 100 countries (averaging 2.93 surveys per country). The questions range from personal characteristics to political, religious, and societal value questions, to measures of happiness and life satisfaction.

While the results of many of these questions will be pertinent for the purposes of this study, the happiness and life satisfaction measures are the key variables upon which the study will be based. These results come from two WVS/EVS questions: "All things considered, how satisfied are you with your life as a whole these days [on a scale of one to ten where 1=dissatisfied and 10=satisfied]?" and "Taking all things together, would you say you are: 1-Very Happy, 2-Quite Happy, 3-Not very happy, 4-Not at all happy?" Since these two questions have reverse polarity, I have combined them using the following formula:

$$Equation\ 1:\ \frac{((-3 * happiness + 13) + lifesatisfaction))}{2} = wellbeing$$

This allows me to put happiness also on a scale from 1-10, and then take the average for each person to form a combined well-being measure. A similar composite measure was used by Inglehart et al. in their 2008 study (though their formula [in my view incorrectly] used a multiplier of 2.5) and serves to at least partially account for Graham's critique that relationships between well-being and various predictors are largely dependent on the type of well-being question that is asked (ranging from simple measures of happiness to questions that force respondents to view their life in comparison to the best possible life, see Graham 2010).

There are some other key variables contained in the World Values Survey/European Values Study. They are subjective variables as follows:

Confidence in Churches: 1-A Great Deal, 2-Quite a Lot, 3-Not Very Much, 4-None at All
Freedom of Choice and Control: 1-10 scale where 1=None At All and 10=A Great Deal
Government Should Reduce Environmental Pollution: 1-Strongly Agree, 2-Agree, 3-Disagree, 4-Strongly Disagree
Importance of God: 1-10 scale where 1=Not at all
Importance in Life of Leisure Time: 1-Very, 2-Rather, 3-Not Very, 4-Not at All
Income Inequality: 1-10 scale where 1=Incomes should be more equal
Income Scale: As explained above, putting respondents into income deciles from 1-10.
Joining in Boycotts: 1-Have Done, 2-Might Do, 3-Would Never Do
Level of Trust: 1-Most people can be trusted, 2-You can't be too careful
Post Materialism Index: As explained above: 1-Materialist, 2-Mixed, 3-Postmaterialist
Respect and Love Parents: One should respect and love their parents: 1-Always, 2-Only if it's Earned, 3-Neither
Social Class: 1-Upper Class, 2-Upper Middle Class, 3-Lower Middle Class, 4-Working Class, 5-Lower Class
Subjective State of Health: 1-Very Good, 2-Good, 3-Fair, 4-Poor, 5-Very Poor
World VS Unemployment Rate: The percent of respondents in the workforce who listed their employment status as "Unemployed"
Would Give Part of Income for Environment: 1-Strongly Agree, 2-Agree, 3-Disagree, 4-Strongly Disagree

*The above scales are as each variable was given in the survey. Since I am using aggregated data, however, I have made several scaling adjustments for the purpose of coefficients and comparison. Firstly, for all variables with reversed scales, like Leisure Importance and Subjective Health, I have reversed the results so that the coefficients will intuitively make sense. Secondly, I have repositioned each variable so that its lowest value is zero, and have placed all but trust and the social class variables on a scale from 0-4 so that their effects can be more accurately compared. The social class variables are now from 0-9, and trust is from 0-1.

In addition to the wealth of data available from the WVS and EVS surveys, I have compiled data on a number of variables from a several other sources. The chief of these sources is the World Bank. From this source, I have obtained data on GDP per capita (in current $US), co2 emissions, life expectancy, per capita health expenditure, death rate, the gini coefficient, unemployment rate, literacy rate, and biodiversity rating (though some of these variables are missing a large percentage of values). From the Polity IV Project (ratings of polity used in a variety of well-being studies), I have obtained measures of democracy, autocracy, a combined democracy/autocracy measure, and a variety of other variables relating to the effectiveness, openness, and stability of world governments. From the Global Footprint Network, I have received data on each country's ecological footprints, carbon footprints, and biocapacities, measures of the country's total and per capita influence on the environment. Finally, I have obtained annual working hours data from the OECD, which contains data on most OECD countries from 1981 on, and data on the Russian Federation from 1992 on.

The most important variables from these other data sets are as follows:

Autocracy Rating: Polity IV Project's rating of each country for its level of autocracy.
Biocapacity Per Capita: The Global Footprint Network's measure of each country's capacity of ecosystems to produce useful biological materials or absorb waste. Given in global hectares per capita.
Carbon Dioxide Emissions: World Bank data on CO2 emissions per year for each country
Carbon Footprint (and per capita): The Global Footprint Network's measurement of the amount of productive land and sea area required to sequester carbon dioxide emissions for each country (in global hectares and global hectares per capita, where one global hectare is a common

unit that encompasses the average productivity of all biologically productive land and sea area in the world in a given year).

Democracy Rating: Polity IV Project's rating of each country for its level of democracy.

Ecological Footprint (and per capita): The Global Footprint Network's measurement of the number of global hectares that are required to sustain a country's total waste or per capita waste.

GDP Per Capita: Taken from the World Bank, data on per cap. GDP for all countries in current US dollars

Health Expenditure and log(Health Expenditure): Taken from the World Bank, measures of how much per year each country spends on healthcare.

Log of per capita GDP: The log of the above GDP variable, taken to analyze the diminishing returns nature of GDP

OECD: A dummy variable for whether or not a country is in the OECD

Polity2: A combined Democracy and Autocracy rating that gives a composite measure of a country's governmental freedom

Working Hours: Working hours per year for all OECD countries and Russia

Unemployment Rate: World Bank unemployment rate for each country.

Taking these data sets, I first merged all the variables into one large file. This file contains: every individual observation from the WVS and EVS studies for about a quarter of the questions contained in the original surveys (I cut out quite a few that were not pertinent to my study.), all of the variables from the World Bank, the OECD data, the Global Footprint Network data, and the Polity IV data. All told, it contains 298 variables with 431,251 observations. Each national variable that I imported, however, is repeated for each individual observation within every country-year classification. Because of this, the OLS model for macro variables cannot be effectively run on this data set; there are too many repeated observations. This data file is nonetheless extremely useful for the comparison of variables at the individual level.

Following this merging process, I wanted to condense the file into a data set with just a single observation of each variable for every country-year occurrence. To accomplish this, I took the mean of every variable by country-year and placed those results in a separate data file. This development allows me to analyze the average for each question of all survey responses within a country in a certain year. Thus, for a certain country and year, say, Australia in 1981 to

provide an example, I can see the average well-being response, the average freedom of choice rating, and the average confidence in the church rating in addition to the national measures of GDP and working hours. This data file allows for the macro-level comparisons and models that I want to run for the purposes of this study.

Taking this data set, I then had to make the decision of just how I defined a "high income" country. As shown by Nielson, determining this separation point is less than straightforward, with even the world's leading development organizations disagreeing over exactly how to classify countries. Based on the standards of both the World Bank and Diener, a good starting point seems to be around $12,000 per capita (Diener's cutoff point was $10,000, but after inflation, it works out to be around $12,000). Using this as a starting point, I set out to try to find an exact point, with the following criteria in mind: 1. If I erred in any direction from that $12,000 starting point, it should be to the lower side. The theory is that the higher income goes, the less it affects well-being, so picking an arbitrarily high cut-off point could bias my results. Additionally, erring on the lower side would give me more data points, and therefore, a stronger model. 2. I would prefer to find a natural break in the data, a gap within which I could place my cutoff point. By finding this, my point would not arbitrarily separate observations with minimal differences in GDP.

Figure 3.

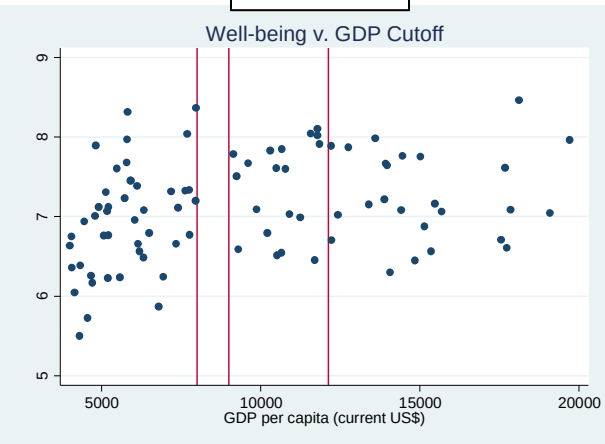
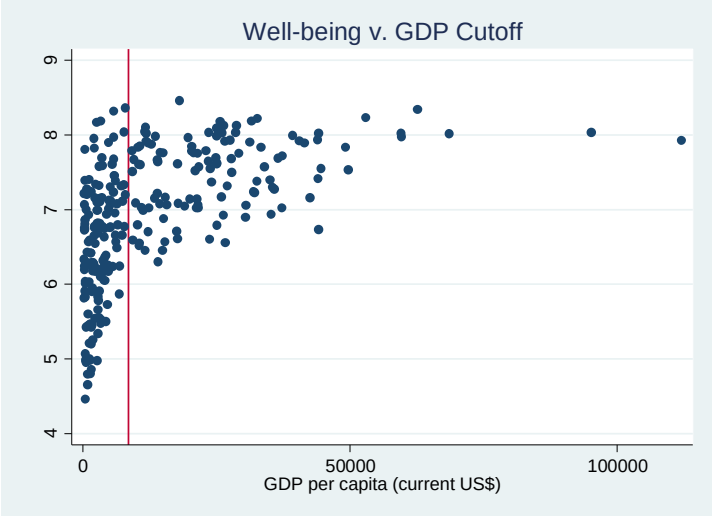


Figure 3 is what I found. It is a subset of the dataset where $4,000<GDP<$20,000. The furthest right line marks $12,135, the cutoff point suggested by Diener's post-inflation numbers. As can be seen, this point would be right in the middle of a large cluster of data points. Moving lower down the scale, however, I found that there was a $1,169 gap from $7,973 to $9,142 where no observations were present. This meant that I could place the cutoff point in the middle of that gap, say, at $8,500, and meet both of my aforementioned criteria. The full picture of the data with this cutoff point marked is shown in Figure 4. Again, I should acknowledge that there is no single way to make a distinction between low and high-income

countries, but it seems that in view of Figures three and four, the cutoff point I have chosen is at least as suitable, if not more suitable, than any.

Figure 4.



I should acknowledge one more distinction about the data before I move on to the model specification process. Partially because of data availability and partially because of the motivation of my research, many of the models that I run contain only OECD countries. For these models, the list of included countries looks very similar to the list in the "advanced" country listing of the International Monetary Fund. This is primarily because of the fact that my working hour data, one of the key variables in this research, comes from the OECD. I found that the OECD had the most complete and reliable selection of working hour data for this high-income subset of countries. The ILO also publishes working hour data, but these data are less complete and often measured differently between countries. Furthermore, part of the motivation of my research is to respond to political movements in the Global North, so restricting my analysis at least partially to those countries that are more widely recognized as the Global North (and not just by their incomes) seems to make sense.

Model Specification

Because my data set started with over 200 variables, I had to sift through a variety of possibilities for inclusion in the model to determine some final results. Since some of my variables were missing a large number of observations, I had to restrict my original variable list to those that contained values for the vast majority of observations. Based partially on the results of previous research determining which variables have the most effect, and partially on my available variables, I started off with eleven broad general categories. These were: Education, Employment, Environment, Health, Home and Family, Income, Inequality and Social Class, Politics, Religion, Safety and Trust, and Values. For each of these categories, I selected 4-10 variables that I thought might be pertinent to well-being and analyzed their scatterplots,

correlations, and regression significance with well-being. Through this process, I was able to narrow down the list of variables to 24 final options. This list contained: zero variables for Education (perhaps because my literacy rate variable had an insufficient number of observations), three variables for Employment, two variables for Environment, two variables for Health, three variables for Home and Family, one variable for Income, one variable for Inequality and Social Class, five variables for Politics and Governance, three variables for Religion, one variable for Safety and Trust, one variable for Values, and two general descriptive variables (birthyear and sex).

This list gives me a solid basis from which to look further into relationships, correlations, and determining those variables that are most predictive of well-being. After this point, I used several different types of model selection to maximize both the fit of my model and the number of observations included, while keeping the number of variables low. Key considerations were both Mallows's Cp and the R-Squared value as well as issues of collinearity. To examine the results of this model selection leading to the final base model, see Figure 5. in the Appendix. The final model was as follows:

$$Wellbeing = \beta_0 + \beta_1 * PostMaterialism + \beta_2 * SubjectiveHealth + \beta_3 * Churchconfidence + \beta_4 * LeisureImportance + \beta_5 * Trust + \varepsilon$$

The diagnostics for this model are also shown in the Appendix as Figures 6-9.

Working off of this model, I ran several regressions, progressively adding in log(GDP), Unemployment Rate, Income Equality, and Working Hours for the sake of comparison. The results of this progression are shown in Table 2.

Because many subjective and value-based variables seemed to be the most closely related to well-being, I wanted to analyze the effect that general optimism or positivity might have on answering both these subjective questions and the questions of well-being. To that end, I attempted to create a new variable that could act as a proxy for optimism. I did this by taking the financial satisfaction data with the two different measures of social class discussed above. This resulted in three different variables:

$$Finsat = FinancialSatisfaction - Income\ Scale$$

$$Finsat2 = FinancialSatisfaction - \frac{IncomeScale + SocialClass}{2}$$

$$Finsat3 = FinancialSatisfaction - SocialClass$$

This was relatively straightforward, because I had transformed each variable to have the same scale (which required multiplying and transforming social class to take it from 5-1 to 0-9). Theoretically, these variables should measure how unrealistically satisfied one is with life, as a large number would indicate large financial satisfaction with a low social class. The correlations for these variables can be seen in the Appendix, Figure 10. Once I had these new variables, I wanted to run some models with subjective health as the dependent variable. For these models, I included some standard measures of national health, like death rate, life expectancy, and log(GDP), as well as some unrelated subjective variables that had proven to be strongly predictive of well-being, like trust and confidence in churches. I used log(GDP) instead of health expenditure because the two are highly correlated and I had less observations with values for health expenditure. Taking this set of variables, I added each financial optimism measure in one by one. The results of these models are in Table 3.

As this result indicated that subjective health may be biased and not a true measure of health, I wanted to shift the focus of my research away from subjective variables. I then pursued a model selection process restricting my explanatory variables to only ones from outside of the WVS/EVS dataset. The results of this model selection process are in Figure 11 of the Appendix. Due to collinearity issues, I had to replace life expectancy with the Unemployment Rate, resulting in the following model, the results of which can be seen in Table 4. Also of note here, is that the inflation rate was insignificant for well-being:

$$WB = \alpha_0 + \alpha_1 Deathrt + \alpha_2 EFPp.c. + \alpha_3 WorkHours + \alpha_4 CO_2 + \alpha_5 Log(GDP) + \alpha_6 BioCapP.C. + \alpha_7 Polity + \alpha_8 Unemployment + \varepsilon$$

The diagnostics for this model can be seen in Figures 12-14. These results led to a few other tests to isolate the relationship between working hours and GDP. Firstly, I used the non-WVS variable model shown above to analyze the relationships between variables in four different settings:

First: A model with all of the variables from table 4 except Working Hours, analyzed on countries with GDP values below the $8,500 cutoff point.

Second: The same model, analyzed above the $8,500 cutoff point.

Third: The same model at the same GDP range, but restricted to only those countries for which I had working hours data.

Fourth: The same restrictions as iteration three, but this time adding in the variable for working hours.

These results are shown in Table 5. As these results further indicated that the effect of GDP on well-being disappears when working hours are taken into account, I wanted to do some basic analysis of the relationship between these two variables. To explore this relationship, I ran some iterations starting out with just log (GDP), then adding working hours, and finally adding the Unemployment rate. I also looked at an added variable plot for log (GDP) for this last model. These can be seen with Table 6.

Before moving on to exploring environmental factors, I wanted to analyze some other effects. The first relationship that I wanted to look at was that of life expectancy, age, and well-being. I looked at the possibility of instrumenting life expectancy with age, but it appeared that, though age was not correlated with well-being and was correlated with life expectancy, life expectancy did not have a strong enough relationship with well-being for a model of this nature to be useful.

Secondly, I analyzed the effects of social class. Since I only had a small number of observations in my subdivided data set, I decided to just split the dataset at the median, running regressions below and above that mean with the model:

$$Wellbeing = \theta_0 + \theta_1 Postmaterialism + \theta_2 Log(GDP) + \theta_3 Trust + \theta_4 Unemployment + \theta_5 IncomeEquality + \varepsilon$$

These results are shown in Table 7.

Finally, I wished to compare those factors that contribute to well-being with their environmental consequences. My first step in this process was to take a combination of the model used in Table 2 with the model for Table 4. Using Ecological Footprint Per Capita as the dependent variable, I ran an OLS on this model, with the results shown in Table 8.

As these results were not very useful, I wanted to break down the analysis a bit further. There are two variables in the World Values Survey that show different characteristics of environmental concern. The first tells whether a respondent would give part of their own income for the environment; the second asks whether the government should reduce environmental pollution. Using these two variables, I analyzed which of a collection of variables impacted them most, and put the results side by side. This is shown in Table 9.

Results

*****For all results, data is restricted to countries with GDP>$8,500 unless otherwise indicated.

Table 2: Final Model Iterations

VARIABLES	(1) wbobs	(2) Wbobs	(3) wbobs	(4) wbobs
state of health (subjective)	0.996***	0.796***	0.770***	0.870***
	(0.143)	(0.152)	(0.158)	(0.163)
Post-Materialst Index 4-Item	0.280***	0.274***	0.287***	0.148
	(0.0912)	(0.0970)	(0.101)	(0.101)
Importance In Life of Leisure Time	1.132***	0.955***	0.921***	0.814**
	(0.212)	(0.221)	(0.216)	(0.314)
Confidence in Churches	0.184***	0.230***	0.221***	0.195***
	(0.0654)	(0.0692)	(0.0684)	(0.0614)
most people can be trusted	0.413*	0.314	0.217	0.164
	(0.233)	(0.242)	(0.257)	(0.336)
Log(GDP)		0.109	0.133*	-0.00179
		(0.0735)	(0.0729)	(0.0916)
Income Equality			-0.112	-0.0218
			(0.0900)	(0.101)
WVS Unemployment Rate			-0.168	-1.385**
			(0.568)	(0.597)
Working Hours Per Year				-0.000602**
				(0.000249)
Constant	0.0753	0.0502	0.257	2.958*
	(0.562)	(0.805)	(0.810)	(1.626)
Observations	101	80	80	64
R-squared	0.802	0.774	0.781	0.830

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As can be seen from these results, the addition of these extra variables (with the exception of working hours) does not greatly improve the results. Furthermore, the variables of subjective health, importance of leisure time, and confidence in churches remain both positive and strongly significant for all four iterations. Log(GDP), however, was not highly significant. It retained some significance for the model that also included income inequality and unemployment rate, but as soon as the working hours information was added, its coefficient actually went from positive to negative while becoming insignificant.

Table 3: Predictors of Subjective Health

VARIABLES	(1) Subhealth	(2) subhealth	(3) subhealth
confidence: churches	0.342***	0.330***	0.325***
	(0.0597)	(0.0658)	(0.0700)
Death rate, crude (per 1,000 people)	-0.00677	-0.0166	-0.0193
	(0.0125)	(0.0146)	(0.0151)
Life expectancy at birth, total (years)	0.00292	0.00296	0.00319
	(0.0140)	(0.0161)	(0.0177)
Log(GDP)	0.0448	0.00580	0.0246
	(0.0576)	(0.0701)	(0.0772)
most people can be trusted	0.620***	0.656***	0.664***
	(0.132)	(0.159)	(0.178)
Finsat	-0.0139		
	(0.0181)		
finsat2		-0.0355	
		(0.0321)	
finsat3			0.0129
			(0.0322)
Constant	1.591*	2.089**	1.840*
	(0.881)	(1.002)	(1.068)
Observations	68	52	53
R-squared	0.547	0.549	0.560

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

These models exhibit the clear flaws inherent in using the World Value Survey's subjective variables to predict well-being. Here, no matter which optimism measure was used, the only variables that were influential in predicting subjective health were confidence in churches and whether or not respondents in a country thought that most people could be trusted. Also intriguing from these results was the conclusion that none of my proxies for optimism had any significant effect on a nation's average subjective health score. Perhaps this is because of the issues that I explained earlier with the "objectivity" of the income scale variable, but the same held true for variable 3, which only used the subjective social class measure.

Table 4: Non-WVS variables

VARIABLES	(1) wbobs
Death rate, crude (per 1,000 people)	-0.0546**
	(0.0246)
Ecological Footprint p.c.	0.178***
	(0.0408)
Working Hours Per Year	-0.000802***
	(0.000243)
CO2 emissions (metric tons per capita)	-0.0288**
	(0.0138)
Log(GDP)	0.0569
	(0.0731)
Biocapacity p.c.	0.0213***
	(0.00643)
Polity IV Combined Index	0.121
	(0.0864)
Unemployment, % of Total Labor Force	-0.0198**
	(0.00964)
Constant	6.952***
	(1.693)
Observations	86
R-squared	0.611

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In this model, with both log(GDP) and working hours included, lgdp was not significant. The strongest variables were death rate, ecological footprint, working hours, CO2 emissions, biocapacity, and unemployment rate. All of the coefficients seem to make sense, although it is intriguing to note that while C02 has a negative effect on well-being, ecological footprint's effect is positive. Since CO2 emissions are included in the footprint calculation's, this result implies that to improve well-being, a country should increase consumption without increasing emissions. Part of the relationship between the variables could be seen by removing CO2 from the model. When this was done, the coefficient for ecological footprint, while still strongly positive, dropped to .122.

Table 5: Non WVS Predictors at Different Cutoffs

VARIABLES	Below $8,500 wbobs	Above $8,500 wbobs	Above + #Hours wbobs	Above + #Hours wbobs
Death rate, crude (per 1,000 people)	-0.152***	-0.0559**	-0.0310	-0.0546**
	(0.0201)	(0.0241)	(0.0296)	(0.0246)
Environmental Footprint p.c.	-0.0970	0.231***	0.226***	0.178***
	(0.0808)	(0.0320)	(0.0355)	(0.0408)
CO2 emissions (metric tons per capita)	-0.00234	-0.0303**	-0.0429***	-0.0288**
	(0.0251)	(0.0123)	(0.0124)	(0.0138)
Log(GDP)	0.259**	0.259***	0.205**	0.0569
	(0.107)	(0.0799)	(0.0791)	(0.0731)
Biocapacity p.c.	0.0198	0.0171**	0.0226***	0.0213***
	(0.0210)	(0.00761)	(0.00715)	(0.00643)
Polity IV Combined Index	0.0622***	0.0431	0.167*	0.121
	(0.0234)	(0.0449)	(0.100)	(0.0864)
Unemployment, % of Total Labor Force	-0.0170**	-0.0101	-0.0138	-0.0198**
	(0.00850)	(0.00993)	(0.00960)	(0.00964)
Working Hours Per Year				-0.000802***
				(0.000243)
Constant	5.848***	3.980***	3.233**	6.952***
	(0.785)	(0.990)	(1.491)	(1.693)
Observations	101	98	86	86
R-squared	0.554	0.552	0.553	0.611

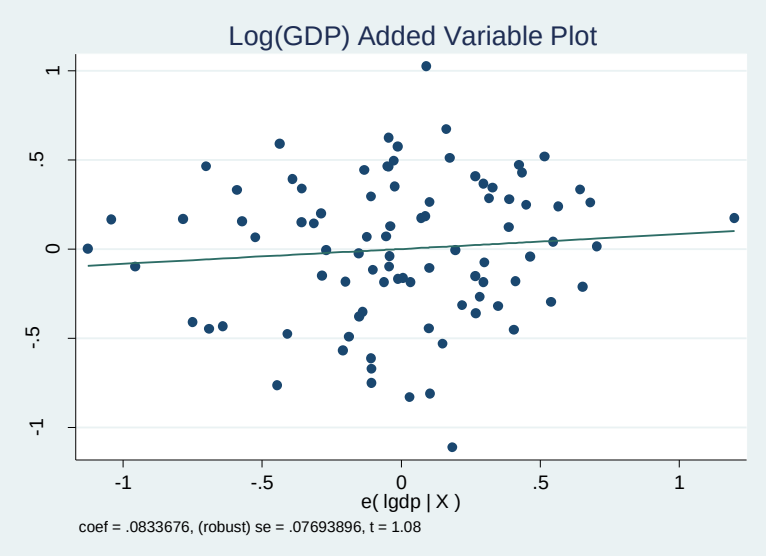
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

There are several factors at work in these four iterations. Firstly, we can again note the large differences between important factors at different levels of GDP. This evidence confirms the validity of my decision to focus specifically on high-income countries. In conflict with my earlier results, however, this model does not show any noticeable difference in the effect of log(GDP) in high income versus low income countries. While both polity levels and unemployment rate become strongly less important, GDP's importance does not decrease. Once again, however, when working hours is included in the model the effect of log(GDP) is greatly diminished. Because the two variables seemed to be affecting each other greatly, I wanted to explore the relationship further.

Table 6: Relationship Between LGDP and Other Variables

VARIABLES	(1) wbobs	(2) wbobs	(3) wbobs
Log(GDP)	0.304***	0.136*	0.0834
	(0.0780)	(0.0753)	(0.0769)
Working Hours Per Year		-0.00101***	-0.00106***
		(0.000238)	(0.000229)
Unemployment, % of Total Labor Force			-0.0306***
			(0.0110)
Constant	4.436***	7.896***	8.706***
	(0.797)	(0.991)	(0.985)
Observations	116	91	89
R-squared	0.104	0.256	0.311

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1



Judging by these models, it seems that largely, the positive gains from increasing GDP among high income countries are mainly due to its correspondence with decreasing working hours. I was unable to analyze the relationship between these two variables at lower income levels due to scarcity of data, but this is an intriguing result because prior academic research has been somewhat mixed on the topic (Dolan, 2008.) My results are probably different for two reasons: 1. I look at working hours on a national scale, instead of comparing part time vs. full time for individuals; 2. I only look at high income countries, who have already reaped the benefits of higher productivity gained from industrialization. Perhaps this is an area for further exploration in future research.

Table 7: Effects of High and Low Social Class

VARIABLES	(1) wbobs	(2) wbobs
Post-Materialst Index 4-Item	0.807***	-0.237
	(0.182)	(0.322)
Log(GDP)	0.0143	0.312**
	(0.143)	(0.137)
most people can be trusted	0.277	0.772**
	(0.407)	(0.345)
WVS Unemployment Rate	0.808	1.238
	(1.072)	(1.652)
Income Equality	-0.462***	-0.126
	(0.165)	(0.168)
Constant	6.474***	4.867***
	(1.468)	(1.580)
Observations	36	33
R-squared	0.455	0.224

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Once again, these results are to be taken with caution, as there is considerable doubt as to the objectivity of the income scale variable that I used to divide my sample. Additionally, the number of observations in these models is small. There are, however, some interesting phenomena. The strongest factors between high and low social classes here were the level of post-materialism and the importance of income equality. Both of these variables have large impacts at the lower stages of social class, while they have negligible impacts in the higher half of social class. Their coefficients make sense too, as a greater degree of post-materialism and a weaker desire for income equality leads to higher well-being results among lower classes. Conversely, factors like income and trust are more important to those in higher social classes.

Table 8: Predictors of Environmental Footprint

VARIABLES	(1) efpc
Inflation	-0.0439
	(0.0832)
Log(GDP)	0.977
	(1.066)
Death rate, crude (per 1,000 people)	0.0353
	(0.127)
Working Hours Per Year	-0.000552
	(0.000900)
state of health (subjective)	2.207
	(1.460)
most people can be trusted	-0.422
	(1.993)
Confidence in Churches	0.824*
	(0.441)
Importance In Life of Leisure Time	-1.421
	(1.650)
WVS Unemployment Rate	-5.091*
	(2.744)
Post-Materialst Index 4-Item	0.214
	(0.544)
Constant	-7.233
	(9.832)
Observations	63
R-squared	0.331

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

These results are only intriguing inasmuch as they lead to the conclusion that those variables that influence well-being are really not all that predictive of a country's environmental footprint. The confidence in churches variable continues to intrigue me, as it maintains significance in a variety of models. A correlation matrix for this variable is as follows, and shows that church confidence relates to importance of god, an indicator of religiosity:

	church~2	godimp2	wbobs	trust	subhea~h	efpc
churchconf2	1.0000					
godimp2	0.7876	1.0000				
wbobs	0.1449	0.0750	1.0000			
trust	-0.1976	-0.4574	0.5192	1.0000		
subhealth	0.1742	0.0982	0.8180	0.4907	1.0000	
efpc	0.0546	-0.0728	0.3051	0.1921	0.2666	1.0000

Table 9: Factors Influencing Environmental Concern

VARIABLES	(1) incenv2	(2) govpol2
Post-Materialst Index 4-Item	0.0709	-0.0671
	(0.113)	(0.182)
important in life: leisure time	1.503***	-0.775*
	(0.358)	(0.430)
most people can be trusted	0.350	-1.949***
	(0.309)	(0.484)
confidence: churches	0.145	0.282*
	(0.105)	(0.163)
Log(GDP)	-0.441***	0.267**
	(0.0814)	(0.125)
Inflation	0.0251**	0.0110
	(0.0108)	(0.0126)
Polity IV Combined Index	0.0110	0.262
	(0.0830)	(0.190)
Biocapacity p.c.	-0.0152*	0.0248*
	(0.00863)	(0.0135)
Death rate, crude (per 1,000 people)	-0.0459**	-0.0148
	(0.0190)	(0.0404)
WVS Unemployment Rate	-0.464	1.296
	(0.831)	(1.147)
how much freedom of choice and control	-0.0880	-0.179*
	(0.0855)	(0.103)
Ecological Footprint p.c.	0.0652**	-0.0705***
	(0.0317)	(0.0230)
Constant	3.439***	0.899
	(1.083)	(1.546)
Observations	72	52
R-squared	0.514	0.720

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

These models show striking differences between the types of people who support these two values. Not a single variable that maintains significance in both models keeps the same sign. For example, an increase in the importance of leisure time simultaneously leads to an increase in desire to spend personal money on the environment and a decrease in the desired role of the government in stopping pollution. Conversely, the relationship with GDP is strong in the opposite way. As GDP rises, people become more interested in letting the government spend money on pollution, and less interested in spending it themselves. It seems that the dynamics at

work here have slightly less to do about actual environmental concerns as they do about respondents' views on the role of government. One peculiar variable in these models is the level of trust in others. It seems to have no relation with the level of personal income spending on the environment, but a larger degree of *distrust* leads to a greater desire for the government to alleviate the pollution itself. These results similarly held when I considered the combined sample of both high and low income countries.

Conclusion

As a whole, my results seem to be supportive of Inglehart's hypothesis of the transition of values from survival to self-expression as GDP rises. My results have shown that there is indeed a difference in what values are important between high and low income countries. Where respondents in lower income countries valued freedom of choice, unemployment rates, and higher incomes, respondents of higher income countries cared more about environmental factors, and values, with those countries whose respondents had greater confidence in churches and placed a greater emphasis on leisure time having the highest levels of well-being. Additionally, in every model, subjective health was far and away the best predictor of well-being. Obviously the health of individuals is important, but whether the aggregate version of this variable can be seen as an unbiased estimator of a nation's health is highly debatable.

In shifting away from these more subjective variables towards more objective composite measured, I discovered I few things with more possible policy implications. Firstly, among high income countries, the academic literature's conclusion of GDP as a sure-fire predictor of well-being becomes much less robust. The significance of log(GDP) was highly dependent upon what other variables were included in the model and the subset of countries that were studied. Additionally, it seems much more important that the increase in GDP has led to a decrease in working hours than that a country's income has risen. It may be that as a country is developing economically, it is beneficial for them to increase working hours and overall productivity, but for industrialized nations, the emphasis is more properly placed on leisure time and a *decrease* in working hours.

Furthermore, the relationship between well-being, environmental footprint, and carbon dioxide emissions seems to imply that while an increase in environmental impact leads to increased well-being, a decrease in CO2 while holding this factor constant will also positively affect well-being. This leads to the conclusion that furthered consumption without increased

emissions would result in higher levels of well-being. Perhaps this could be further explored in future studies by breaking GDP down further to consider consumption, net exports, etc. Finally, my results indicated that countries with lower unemployment rates had higher levels of well-being, as well as those with higher amounts of natural resources per person (biocapacity).

Lastly, in regards to the role of the government in responding to environmental problems, it seemed that values continued to change with GDP rise even within the high income country subset. Those nations with higher GDPs tended to focus more squarely on government prevention as opposed to personal sacrifice for the environment.

Putting this all together, we have a more cohesive picture of what this value transition potentially looks like. Whether this transition is chronological has not been proven in this study, but nonetheless there is plenty of evidence to conclude that values are indeed different across countries. It seems that as GDP rises, emphasis for better well-being shifts from economic factors closer towards values that reflect ease and comfort. At this high income level, respondents improve their aggregate well-being level more by emphasizing leisure, decreasing working hours, and having a larger degree of trust in others. On top of this, it seems that residents of high income nations value the role of the government more strongly.

For the environmentalists, the verdict is as of yet unclear. While they may gather important information about the nature of environmental concern from my last model, the model with Environmental Footprint as the dependent variable was of little use. Perhaps the largest conclusion one could glean would be one of relief; it seems that, while an increasing environmental footprint is related to well-being, those factors that most motivate an increase in well-being do not necessarily cause environmental footprints to rise.

Moving forward, it would be very helpful to examine the relationship of consumption with each of these factors even further. It seems an important factor in both the increase of environmental impact and the potential increase of well-being. Beyond this, it would be helpful to get higher quality social class data in order to confirm my results in that area. Finally, it should be explored whether a better proxy for optimism could be found, and how much that proxy may influence subjective well-being.

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Appendix

Model 1 Diagnostics:

Figure 5: Model Selection Results

R-squared	Mallows C	SEE	MSE	models with 4 predictors
0.7366	4.84	4.8197	0.0817	subhealth posmat4 leiimp churchconf
0.7342	5.38	4.8640	0.0824	subhealth leiimp churchconf trust
0.7322	5.83	4.9010	0.0831	subhealth leiimp trust godimp
R-squared	Mallows C	SEE	MSE	models with 5 predictors
0.7535	3.08	4.5118	0.0778	subhealth posmat4 leiimp churchconf trust
0.7485	4.17	4.6015	0.0793	subhealth posmat4 leiimp trust godimp
0.7463	4.67	4.6422	0.0800	subhealth posmat4 leiimp churchconf lgdp
0.7424	5.55	4.7144	0.0813	subhealth posmat4 inceq leiimp churchconf
0.7401	6.05	4.7554	0.0820	subhealth posmat4 leiimp churchconf godimp
0.7390	6.30	4.7754	0.0823	subhealth posmat4 leiimp churchconf conemp

Figure 6: Variance Inflation Factor

Variable	VIF	1/VIF
subhealth	1.99	0.503551
leiimp	1.80	0.554502
posmat4	1.64	0.608725
trust	1.53	0.654063
churchconf	1.20	0.832709
Mean VIF	1.63	

Figure 7.

Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	17.59	20	0.6143
Skewness	8.61	5	0.1257
Kurtosis	0.89	1	0.3463
Total	27.09	26	0.4047

Figure 8.

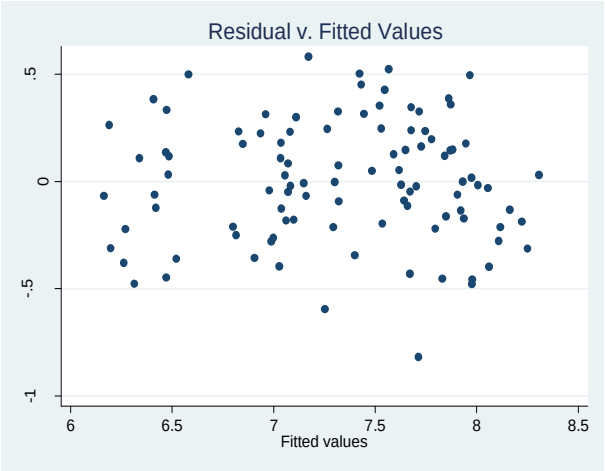

Figure 9.

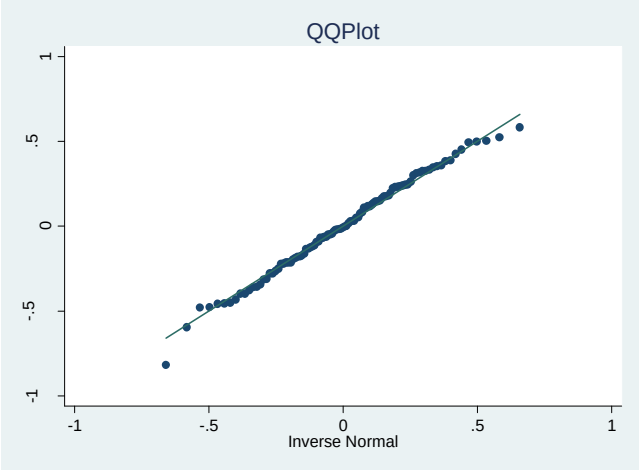

Figure 10: Correlations of Financial Optimism Variables.

	wbobs	subhea~h	fsat2	finsat	finsat2	finsat3
wbobs	1.0000					
subhealth	0.7890	1.0000				
fsat2	0.8557	0.6357	1.0000			
finsat	0.3547	0.1972	0.4622	1.0000		
finsat2	0.5409	0.3057	0.6827	0.8960	1.0000	
finsat3	0.5979	0.3427	0.7328	0.3696	0.7439	1.0000

Non-WVS Model:

Figure 11: Model Selection

Optimal Models Highlighted:

# Preds	R2ADJ	C	AIC	AICC	BIC
7	.5943967	13.75803	48.11559	291.7351	67.6568
8	.626337	8.250881	42.03265	286.2252	64.01651
9	.6275998	9.009773	42.61906	287.455	67.04557
10	.6226172	11	44.60783	290.1607	71.477

Selected Predictors
8 : deathrt efpc nhours lifeexp co2 lgdp bcpercap polity2

Figure 12: Variance Inflation

Variable	VIF	1/VIF
efpc	2.43	0.410699
co2	2.28	0.439333
nhours	1.91	0.522814
lgdp	1.75	0.572358
bcpercap	1.34	0.747453
polity2	1.26	0.793936
unemploy	1.23	0.812333
deathrt	1.20	0.833861
Mean VIF	1.67	

Figure 13:

Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	52.05	44	0.1891
Skewness	15.96	8	0.0429
Kurtosis	0.01	1	0.9130
Total	68.03	53	0.0801

Figure 14: