The Effects of Community and Freedom on Happiness

1 Background & Significance

When it comes to organizing and leading societies with the purpose of maximizing civic happiness, leaders often do not know on what to focus. Every country has unique capabilities, demographics, governments, populations, and varying levels of overall happiness. In Nordic countries for example, high quality social institutions, trust in the government, and strong perceptions of autonomy and freedom are key contributing factors to their high ratings of subjective happiness [2]. Other factors not related to government and public policy, such as prosocial behavior or donating time and money to others, have also been shown to increase ratings of happiness fairly universally [1]. Although it is known that several factors from both public and private aspects of life have impacts on perceptions of happiness, the exact contributions that each factor has, and any potential interactions between factors, are less understood.

Using data from the 2021 World Happiness Report, with 6 different measurements for over 149 countries along with their ladder scores for happiness, this analysis examined how these factors play a role in the happiness of a country. This data is particularly interesting because it was gathered in 2021, when the global COVID-19 pandemic affected most, if not all, countries. The concluding analysis could have significant impacts on decisions about policy-making, specifically what factors a country should focus on improving or supporting in order to generate a greater amount of happiness within its community.

2 Data Collection

The data of the 2021 World Happiness Report (WHR) was aggregated from the 2018–2020 Gallup World Polls of the global analytics and advice firm, Gallup. (Gallup reported that happiness was measured because of its intrinsic importance and its ability to assist policymakers in making constructive decisions [3].) The Gallup World Poll supplied surveys of 1000 people per country in more than 160 countries over a maximum of three years. For countries with more than 80% total telephone coverage, interviews were conducted by random-digit-dialing, while for other developing countries interviews were conducted face-to-face with randomly selected households. Additionally, the Lloyd's Register Foundation provided access to the World Risk Poll, and since the data was based on 2021, it also included data from the ICL-YouGov Behavior Tracker as part of the COVID Data Hub from the Institute of Global Health Innovation.

3 Data Analysis

A linear regression model was employed to determine how strongly several predictors affected the quantitative evaluation of happiness (*Ladder Score*). First, a model was made with the following predictor variables: (*Region*); the logarithm of GDP per Capita (*Log GDP*); perceptions of social support (*Social Support*); healthy life expectancy (*Life Expectancy*); perceived freedom to make life choices (*Freedom*); self-reported generosity (*Generosity*); and perceived

corruption (*Corruption*). Region was a factor with 10 levels: Central and Eastern Europe, Commonwealth of Independent States, East Asia, Latin America and the Caribbean, the Middle East and North Africa, North America and Australia and New Zealand, South Asia, Southeast Asia, Sub-Saharan Africa, and Western Europe. (Some variable names were adjusted from their original terms. See Appendix A for original variable names.)

Once the original model was made ($R_a^2 = 0.7872$), interactions between predictor variables, potential quadratic relationships between predictors, and the response variable, Ladder Score, were tested. It was found that there were interactions between Log GDP and Social Support, Log GDP and Life Expectancy, Log GDP and Freedom, Social Support and Life Expectancy, Social Support and Freedom, Social Support and Corruption, Life Expectancy and Freedom, and Life Expectancy and Corruption. These interactions were determined by predicting Ladder Score from the interaction between two predictors. If the p-value was less than 0.05, the interaction was added to a new, larger model. Quadratic relationships between a predictor and Ladder Score were also tested. Scatter plots of Ladder Score vs each predictor were made, and if the scatter plot had a quadratic shape to it, a model with the predictor squared was created. If that model had a higher R_a^2 value than the original model, then the quadratic term was also added to the larger model. (See Figure C.1.)

Once significant interactions and quadratic predictors were found, a model containing every predictor, every interaction, and (Social Support)^2 was generated. This larger model was then pared down using the Akaike information criterion, AIC. The model with the smallest AIC value used Region, Log GDP, Social Support, Life Expectancy, Freedom, Generosity, Corruption, Social Support $*$ Life Expectancy, Social Support $*$ Freedom, Social Support $*$ Corruption, Life Expectancy $*$ Corruption to predict Ladder Score. This new, smaller model was then tested to see if it fit the conditions for inference.

To test if this linear model fit the conditions for inference, three graphs were made (Figure C.2a, C.2c, C.2e). First, a scatter plot of residuals versus the fitted values for the model was generated (C.2a). This scatter plot showed an approximately random distribution of residuals, though there were some points that fell substantially outside of the other residuals, which could suggest that the model was not the best model to fit the data. After the scatter plot, both a histogram of residuals (C.2c) and a Q-Q plot (C.2e) were constructed to check the normality of the residuals. The histogram was skewed slightly to the left and the Q-Q plot fit adequately in the center of the plot but strayed away significantly on the edges. These graphs led to the conclusion that this model was not appropriate to use for inference.

Consequently, the data points were checked to see if any outliers or influential points were in the model. By checking z-scores for each point, any observation with a z-score that was either greater than 3.0 or less than -3.0 was considered an outlier. This corresponded to two observations, Botswana and Tanzania. Influential data points were tested using Cook's distance, and any point with a distance greater than the 50th percentile was considered influential. Both outliers, Botswana and Tanzania, were found to be influential and were eliminated from the data set. (See Appendix B for more detail on the removal of Botswana and Tanzania.)

Once the two outliers were removed from the model, a new model was created using the process outlined above, which held the same predictors from the previous pared down model to predict Ladder Score. The smaller model was again tested to make sure that it fit the conditions to conduct inference. The same plots (Figure C.2b, C.2d, C.2f) of residuals vs fitted values (C.2b), histogram of residuals (C.2d) and Q-Q plot (C.2f) were generated and compared to those of the previous pared down model. Because the histogram was less skewed and the Q-Q

plot fit better at extreme points, the new model—without Tanzania and Botswana—was used for subsequent analyses. The equation for this model, which most efficiently predicts ladder score and shows how predictors determine happiness and which predictors have interactions with each other, is:

$$\begin{aligned}
&\text{LadderScore} = 11.459 \\
&- 0.155(\text{Region}_{Independent}) - 0.045(\text{Region}_{East\ Asia}) + 0.204(\text{Region}_{Latin\ America}) \\
&- 0.097(\text{Region}_{North\ Africa}) + 0.099(\text{Region}_{North\ America}) - 0.059(\text{Region}_{Western\ Europe}) \\
&+ 0.299(\text{Log GDP}) - 2.986(\text{Social Support}) - 0.367(\text{Life Expectancy}) + 6.668(\text{Freedom}) \\
&+ 0.469(\text{Generosity}) - 2.971(\text{Corruption}) + 0.298(\text{Social Support} * \text{Life Expectancy}) \\
&- 5.065(\text{Social Support} * \text{Freedom}) - 13.114(\text{Social Support} * \text{Corruption}) \\
&+ 0.204(\text{Life Expectancy} * \text{Corruption})
\end{aligned} \tag{1}$$

4 Discussion & Conclusion

The term in Equation 1 with the highest positive impact on Ladder Score was Freedom, which raised the response variable by 6.668 for each 1 point increase in perceived freedom to make life choices. The term with the greatest negative impact on Ladder Score was Social Support $*$ Corruption, which decreased Ladder Score by 13.114 per unit increase. The regression model had different slopes for Social Support given different amounts of Corruption. It was also interesting to note that the model created found a negative relationship between Social Support, Life Expectancy, and Social Support $*$ Freedom on Ladder Score; this relationship appears counter-intuitive since, as these values increase, a country's predicted happiness score decreases. Region had little effect on happiness and no clear correlation between level and happiness.

One problem with this model predicting Ladder Score is the intercept term, whose value of 11.459 exceeds the maximum Ladder Score of 10. The model would predict a Ladder Score of 11.459 for a country in Central or Eastern Europe with predictors all of value 0, which unrealistically exceeds 10. This is not a huge problem because no such country exists, but it is still a shortcoming of the model since the model cannot function under all possible conditions. Finally, for future studies, it may also be beneficial to fit a log-linear model using the data as this model would may discover more relationships between variables without the "bias" of using Ladder Score as the response variable.

Analyzing the effect of various factors on the happiness of a country revealed that happiness depending primarily on freedom and community. Freedom greatly improved happiness, whereas corruption—an abuse of freedom—greatly diminished it. When freedom and corruption were coupled with community (Social Support), the results were potentially detrimental. For a government to understand how to implement measures to protect and promote freedom, they ought to consider analyzing precisely how the interactions between (1) Freedom and Social Support and (2) Corruption and Social Support operate. This would clarify the confusing detriment which the interaction between Freedom and Social Support actualizes. In sum, the conclusion of this analysis reminds governments to erect policies which protect and promote freedom—and perhaps community—for its citizens, if the government seeks its society's happiness.

References

[1] Lara B. Aknin, Ashley V. Whillans, Michael I. Norton, and Elizabeth W. Dunn. Happiness and prosocial behavior: An evaluation of the evidence. *World happiness report*, 2019, 2019.

[2] Frank Martela, Bent Greve, Bo Rothstein, and Juho Saari. The nordic exceptionalism: What explains why the nordic countries are constantly among the happiest in the world. *World happiness report*, 2020:129–146, 2020.

[3] Jeffrey Sachs. Sustainable development solutions network (sdsn) tracks the world's happiness. Last accessed 22 April 2022.

Appendix A Variable Creation

The WHR variables included in this analysis were as follows: Country Name, Global Region (one of 10 arbitrary regions on the globe), Logged GDP (per capita), Social Support (having people to count on in times of trouble), Healthy Life Expectancy from Birth, Perception of Freedom (based on a question about self-satisfaction or perception of freedom to make life choices), Generosity (proportion of citizens who frequently donate to charities), Perceptions of Corruption (based on an average of binary responses of whether or not people believe their government/businesses are corrupted), and the Happiness score. The Happiness score is based on a country's average of an individual's ranking on a ladder describing the conditions of their current life (0 being the worst possible life, and 10 being the best possible life) for both today and in 5 years.

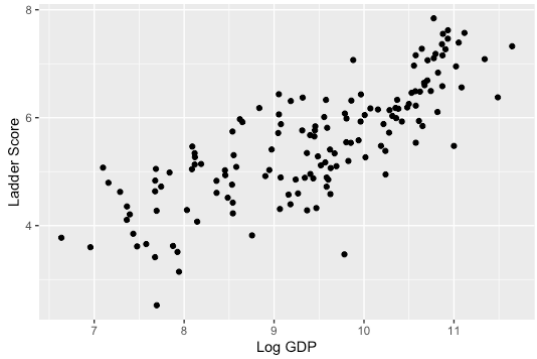
The dataset also included a dystopia metric (accumulation of global minimums per variable) and explanatory variables describing the proportion of each variable's influence on a country's happiness score. These variables were not included in the analysis. No variables had to be cleaned or recorded since the WHR did so already.

Appendix B Outliers

Concerning outliers (both in Sub-Saharan Africa), Botswana's Log GDP (9.782) is much higher than the Log GDP of countries with a similar Ladder Score (c. 3.5). In other words, Botswana is unusually "unhappy" for its Log GDP. Tanzania's Corruption (0.577) is low compared to countries who share a similar Ladder Score (c. 3.6). However, Rwanda has a similar Ladder Score but even lower Corruption (0.167) and was not considered an outlier. Hence, the reasons why Tanzania is an outlier may differ from the explanation given above.

Appendix C Figures

(a) Ladder Score vs Log GDP



(b) Ladder Score vs Social Support

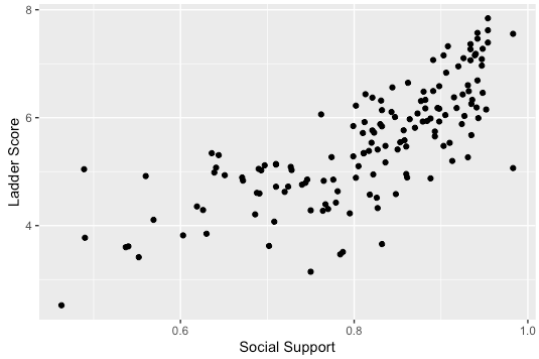
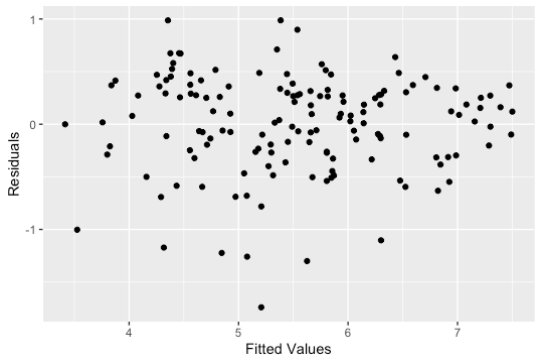
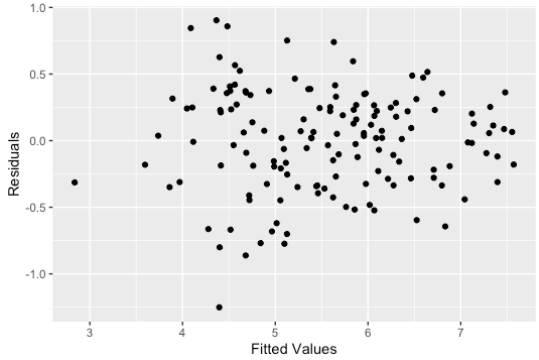


Figure C.1: A comparison of quadratic and linear predictors.
Scatter plots of Ladder Score vs each predictor were generated to examine potential quadratic relationships between predictor variables and Ladder Score. Most plots looked fairly linear (e.g. (a)) while the plot of Ladder Score vs Social Support (b) showed a quadratic shape to the data. Scatter plots with quadratic shape to them had the squared predictor added to the model as long as the adjusted R^2 increased upon inclusion of it in the model.

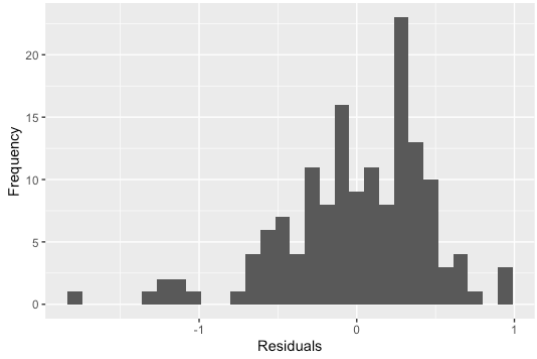
(a) Residuals vs Fitted Values



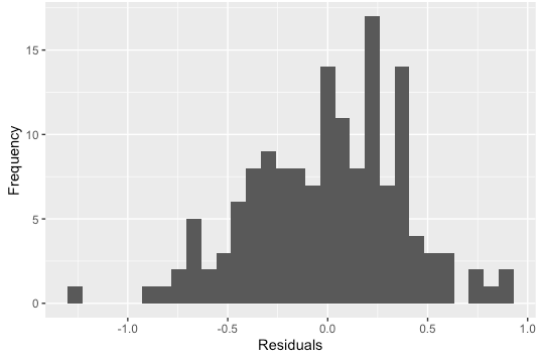
(b) Residuals vs Fitted Values (No Outliers)



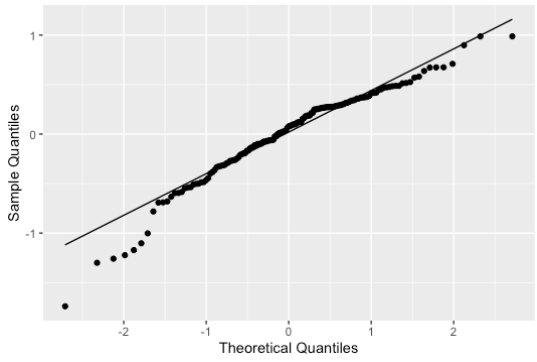
(c) Histogram of Residuals



(d) Histogram of Residuals (No Outliers)



(e) Normal Q-Q Plot



(f) Normal Q-Q Plot (No Outliers)

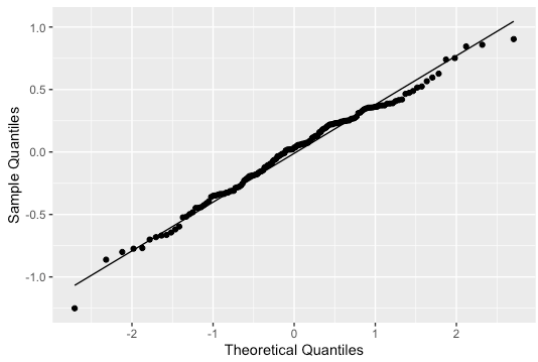


Figure C.2: A Comparison of Residual Graphs from Model with Outliers vs Model without Outliers.

These six graphs represent plots of residuals checking to make sure they are randomly distributed with an expected value of zero and that they are normally distributed. Graphs a, c, and e are from the model including influential outliers Tanzania and Botswana. Graphs b, d, and f were generated from the model without outliers. The plot of residuals look fairly similar between the two models, though the old model had more extreme points (e). The histogram of the original model was left-skewed, and the new histogram was more centered about 0 and less skewed. The original Q-Q plot fit fairly well for central points, but not very well for extreme points, while the new Q-Q plot fit fairly well for almost all points. Because of the differences between these graphs, the new model, without outliers, was used in this analysis.