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Abstract

For years, research has indicated that some countries have higher levels of resident satisfaction than others. Presently, researchers are studying the causes of this disparity in nationwide happiness. To investigate factors influencing the happiness of nations, we gathered data from the 2020 Gallup World Poll. Through the use of model selection criteria and the creation of a multiple linear regression model, we found that economic, social, and cultural predictors all appear to have a significant impact on measures of national happiness. This may have implications for global efforts to improve the quality of life of struggling nations.

Introduction

Typically, happiness is perceived as an individual feeling of satisfaction, not a national trend. However, a great deal of psychological research has been conducted on nationwide happiness, or how satisfied residents of a particular country feel with their lives. While past research has cited GDP and other wealth indicators as the primary predictors of world happiness, recent research has indicated that social indicators may be equally as important (Oishi & Schimmack, 2010; Diener & Tay, 2015). Other recent studies suggest that culture alone may have an impact on happiness. Hadju & Hadju found that immigrants from countries with high satisfaction levels are more satisfied in their new countries than immigrants from countries with low satisfaction levels, despite controlling for economic and socio-demographic factors (2016).

The goal of this study is to produce a model that identifies factors associated with happiness in countries around the world. Based on the literature, we expect that the best model of world happiness will contain a variety of economic, social, and cultural predictors. While we hope our model reflects the complex and subjective nature of happiness described in Hadju & Hadju's (2016) and Joshanloo & Weijers' (2014) research, we recognize that happiness is difficult to quantify. Nevertheless, we aim to identify factors that reliably predict a country's happiness, regardless of where it falls on the globe.

Methods

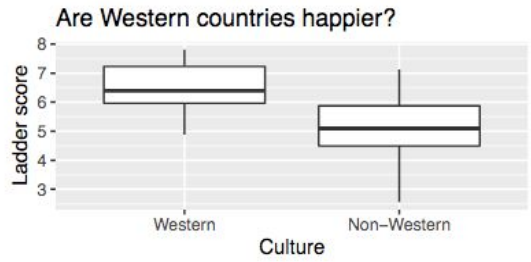
Our dataset contains data from 153 countries obtained from the February 28th, 2020 release of the Gallup World Poll. National happiness was measured using a "ladder score," which is each country's average response to a question asking citizens to rank their life on a scale from 1-10, 0 being their worst possible life and 10 being their best. Potential predictors in our dataset included both economic (logged GDP) and social (social support) variables as well as variables measuring health (life expectancy), satisfaction with the government (perceived corruption), individual autonomy (freedom to make life choices), and generosity. Many of these predictors were quantified by the average national responses to yes/no questions, where 0 represented a response of "no" and 1 represented a response of "yes." Our dataset also has a regional variable which we used to create a cultural variable indicating whether a country is part of the Western world. We classified European countries, the United States, Canada, Australia, and New Zealand as a part of "Western" culture. All other countries were labeled as "Non-Western" cultures.

We began our exploratory data analysis by calculating summary statistics and plotting the distributions of our response variable (ladder score) and explanatory variables. After examining our variables' distributions, we created correlation and scatterplot matrices to evaluate which quantitative variables were most related to happiness. Additionally, we found summary statistics by group (ie. Western/Non-Western) and created coded scatterplots to check for interactions. In creating models, we employed various methods of model selection: cross validation for best subset, stepwise selection, and lasso regression. We also experimented with the inclusion of interaction terms based on our coded scatterplots, performing a nested F-test to see if they improved our model. After deciding upon a final model, we multiplied binary variable values by 10 so that a 1 unit increase of these variables in our model would correspond to a 0.1 increase in the average national response. We also centered our life expectancy variable such that a value of 0 corresponds to a healthy life expectancy of 64.45 years for a given country.

Results

In assessing relationships between ladder score and other variables, we found that almost all of our quantitative variables were fairly correlated with happiness. Logged GDP (0.77), social support (0.76), and life expectancy (0.77) all had strong correlations with ladder score. Freedom to make life choices (0.59) and the perception of corruption (-0.41) in a country were also moderately correlated with ladder score. Interestingly, a country's level of generosity was not correlated with its happiness (0.069). In investigating cultural association with happiness, we found that the 42 Western countries in our sample tended to have higher ladder scores, with a median of 6.39, while the 111 Non-Western countries had a median ladder score of 5.09. Figure 1 illustrates this relationship.

Figure 1



We also suspected that Western culture could influence the relationship between happiness and some of our quantitative variables. When testing for interactions with the Western culture variable, we found ladder score increased more per unit change in logged GDP (Figure 2) or social support (Figure 3) for Western countries than for their non-Western counterparts, indicating potential interactions.

Figure 2

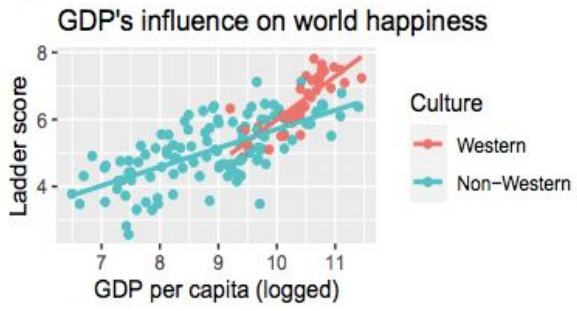
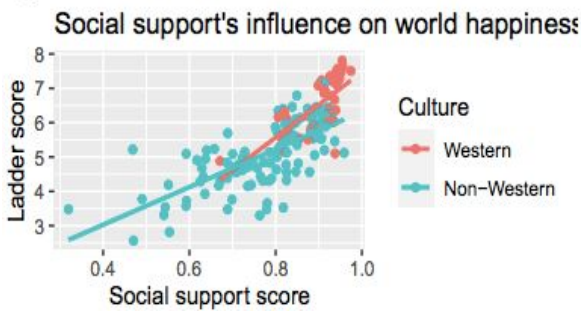


Figure 3



Through our data analysis and employment of model selection methods, we found that a country's happiness score is influenced the most by its logged GDP, social support, life expectancy, freedom to make choices, perceived corruption, and cultural region (Western or Non-Western). In addition, the nested F-test used to compare a model containing these six predictors to a model containing the six predictors and an interaction term between logged GDP and our Western indicator variable suggested that adding the interaction term significantly improved the performance of our model ($F = 5.45$, $p = 0.0210$) at the 0.05 level. We chose this seven-variable model as our final model (see Table 1).

Two particularly influential predictors, according to our model, are social support and free choice. A 0.1 increase in the average national response to a question regarding one's level of social support is expected to increase national ladder score by 0.25 units (95% CI: 0.13, 0.38) after controlling for logged GDP, life expectancy, free choice, perceived corruption, and the Western culture indicator variable. Similarly, a country's happiness score is predicted to increase by 0.21 points per 0.1 unit increase in its freedom of choice score, when all other variables are held constant (95% CI: 0.11, 0.28). Both these

relationships are significant at the 0.001 alpha level. The cultural region of a country also appears to affect its happiness score. We found the effect of GDP on a country's happiness score is more extreme for Western countries. For non-Western countries, doubling GDP corresponds to a 0.0976 point increase in the mean happiness score after controlling for social support, life expectancy, free choice, and perceptions of corruption. However, in Western countries, doubling GDP is associated with a 0.45 point increase in the mean happiness score, when holding all other predictors constant.

Table 1

predictor	coefficient	t value	p value
Intercept	0.50	0.632	0.52800
Logged GDP	0.14	1.770	0.07900
Social support	0.25	0.064	0.00010
Life expectancy	0.03	2.527	0.01300
Free choice	0.21	4.441	0.00002
Perceived corruption	-0.17	-0.487	0.62700
Western	-4.82	-2.147	0.03300
Logged GDP:Western	0.51	2.334	0.02100

Discussion

Our analysis confirms our prediction that economic, social, and cultural factors all influence the happiness of a given country. Our final model includes all three of these types of predictors, aligning with the literature suggesting that both social and economic indicators are important in predicting world happiness (Diener & Tay, 2015; Oishi & Schimmack, 2010). Our model also supports Hadju and Hadju's research on culture's influence on happiness (2016). We found that in Western countries, mean happiness scores were significantly more affected by doubling GDP than in non-Western countries. This suggests that economic success is more important to happiness in the often economically oriented Western cultures than in their non-Western counterparts.

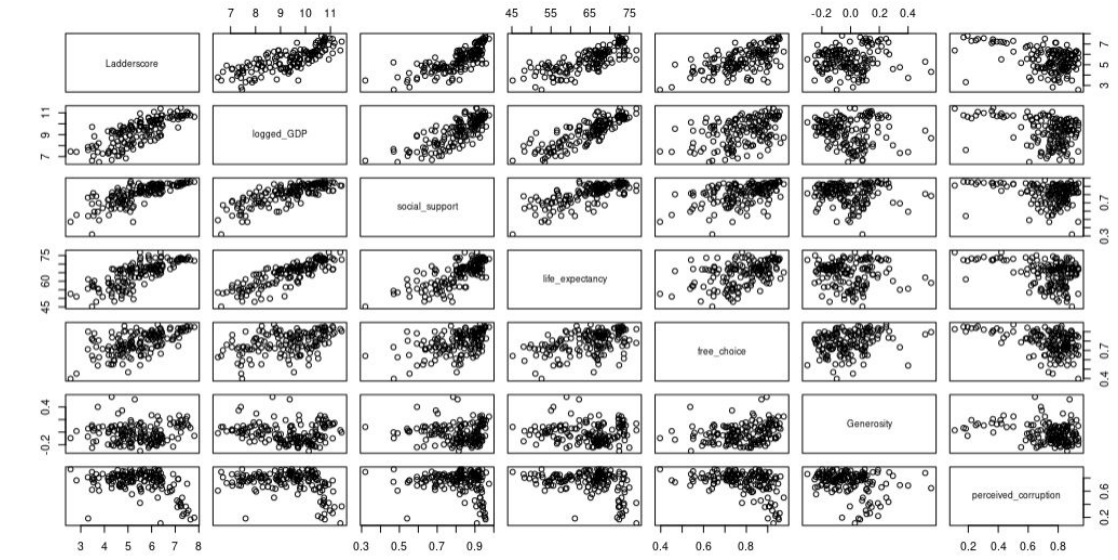
Furthermore, the results of our study have implications for global efforts to raise the quality of life in countries around the world. Our model illustrates that national happiness is affected by many facets of life, so these facets should be taken into account. To address quality of life issues in struggling countries, world leaders could not only work to raise GDPs but also to provide the means for residents to be socially supported and enact their freedom to make choices, for example.

Despite the notable implications of our model, it has limitations. First, as the observational units in our dataset were countries, our model should not be used to predict the happiness scores of individuals. Additionally, our data was collected as a part of an observational study, thus we cannot claim the multiple predictors in our model cause changes in the levels of happiness of nations. While they may be associated with an increase or decrease in happiness, there are many potential confounding variables not included in our study. Future studies may consider incorporating a greater wealth of predictors. Finally, a major limitation of our study is the general subjectivity of "happiness." The definition of happiness in our study is how close residents of a given country feel they are to achieving their best possible life. While this generally serves as an adequate measure, certain cultures may feel content with what they have, even if things could be improved, or disagree upon what amounts to a happy life. As described in Joshanloo & Weijers' research, some cultures even have an aversion to happiness (2014), so happiness would not indicate a "good life" in this case. Future researchers may want to consider cultural complexities in the measurement of nationwide happiness and investigate ways to best assess happiness cross-culturally.

Appendix

A. Pairs and Correlations

```
##                     Ladderscore logged_GDP social_support life_expectancy
## Ladderscore          1.00000000  0.7753744      0.76500076       0.77031629
## logged_GDP           0.77537440  1.0000000      0.78181358       0.84846862
## social_support       0.76500076  0.7818136      1.00000000       0.74274409
## life_expectancy      0.77031629  0.8484686      0.74274409       1.00000000
## free_choice          0.59059678  0.4190186      0.47886318       0.44884619
## Generosity           0.06904313 -0.1183994     -0.05678035      -0.07185211
## perceived_corruption -0.41830509 -0.3347291     -0.21052960      -0.35384121
##                     free_choice  Generosity perceived_corruption
## Ladderscore           0.5905968  0.06904313           -0.4183051
## logged_GDP            0.4190186 -0.11839937           -0.3347291
## social_support        0.4788632 -0.05678035           -0.2105296
## life_expectancy       0.4488462 -0.07185211           -0.3538412
## free_choice           1.0000000  0.25372112           -0.4201445
## Generosity            0.2537211  1.00000000           -0.2784802
## perceived_corruption -0.4201445 -0.27848023            1.0000000
```



B. Summary Statistics (Western Indicator Variable)

western_indicator	min	Q1	median	Q3	max	mean	sd	n	missing
1 Western	4.8827	5.9626	6.39415	7.229775	7.8087	6.514348	0.7871528	42	0
2 Non-Western	2.5669	4.4924	5.09480	5.871600	7.1286	5.079307	0.9529510	111	0

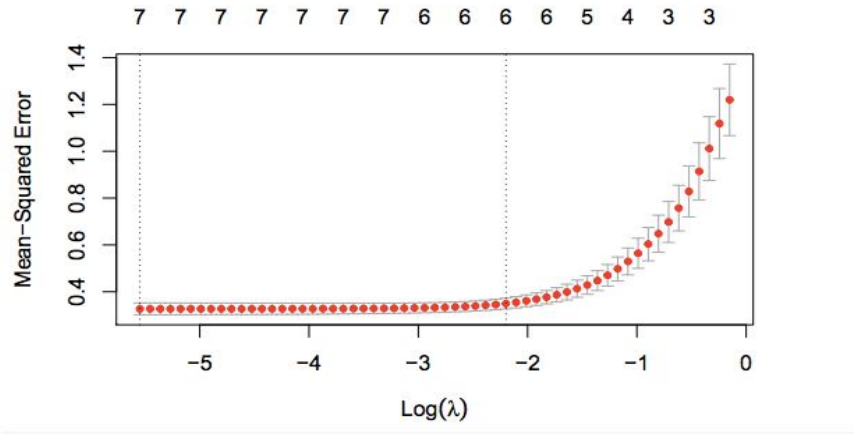
C. Model Selection Methods

a. Stepwise Selection with AIC Criteria

```
Step:  AIC=-174.87
Ladderscore ~ logged_GDP + free_choice + social_support + Western +
    life_expectancy + perceived_corruption

                      Df Sum of Sq    RSS     AIC
<none>                              44.521 -174.87
+ Generosity           1    0.2434 44.278 -173.71
- perceived_corruption 1    1.2045 45.726 -172.79
- logged_GDP           1    1.3552 45.876 -172.29
- life_expectancy      1    1.4022 45.923 -172.13
- Western              1    3.2849 47.806 -165.98
- social_support       1    5.3052 49.826 -159.65
- free_choice          1    5.9663 50.488 -157.63

Call:
lm(formula = Ladderscore ~ logged_GDP + free_choice + social_support +
    Western + life_expectancy + perceived_corruption, data = Worldhappinessfinal)

Coefficients:
         (Intercept)           logged_GDP          free_choice       social_support
            -1.33171              0.16838              2.08383              2.67546
             Western      life_expectancy perceived_corruption
             0.41089              0.02738             -0.59183
```

Through stepwise selection, we found that the best model according to AIC criteria was a model that used 6 of our 7 potential predictors (logged GDP, social support, perceptions of corruption, healthy life expectancy, freedom to make life choices, and our indicator variable for Western culture). The only variable not selected by this methodology was generosity. The image above demonstrates the final step of this method which produced the 6-variable model.

b. Selection through Lasso Regression



Selection through lasso regression confirmed our beliefs that a model using 6 of 7 the variables in our dataset would best predict national happiness, as seen in the graph above. Again, the generosity variable was eliminated.

D. Testing Inclusion of Interaction Term in Final Model

```
## Analysis of Variance Table
##
## Model 1: Ladderscore ~ logged_GDP + free_choice + social_support + Western +
##     life_expectancy + perceived_corruption
## Model 2: Ladderscore ~ logged_GDP + social_support + life_expectancy +
##     free_choice + perceived_corruption + Western + logged_GDP:Western
##   Res.Df    RSS Df Sum of Sq      F  Pr(>F)
## 1    146 44.521
## 2    145 42.910  1    1.6118 5.4464 0.02098 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

We have significant evidence at the 0.05 level (F = 5.45, p = 0.02) that including an interaction term between logged GDP and Western improves our model.

E. Final Model

a. Mutations

```
Worldhappinessfinal <- Worldhappinessfinal %>%
  mutate(social_support10 = social_support*10,
         perceived_corruption10 = perceived_corruption*10,
         free_choice10 = free_choice * 10,
         life_expectancy_c = life_expectancy - mean_life)

model_final <- lm(Ladderscore ~ perceived_corruption10 + social_support10 + free_choice10 + life_expectancy_c
+ logged_GDP + Western + Western:logged_GDP, data = Worldhappinessfinal)
summary(model_final)
```

We realized that due to various quantitative variables having a range of just 0-1, the effect of a 0.1 unit change would be more interpretable than the effect of a 1 unit change. So, we updated our final model to include mutated versions of the perceived corruption, social support, and free choice variables. We also centered our life expectancy variable, such that a value of 0 corresponds to a healthy life expectancy of 64.45 years for a given country, as no country will have a life expectancy of 0.

b. Confidence Interval for Final Model

```
                             2.5 %      97.5 %
(Intercept)           -1.057709921  2.05159973
perceived_corruption10 -0.084991883  0.05139005
social_support10        0.127270371  0.37829923
free_choice10           0.114421253  0.29791117
life_expectancy_c       0.007015223  0.05741179
logged_GDP             -0.016460072  0.29804868
Western                -9.248954059 -0.38261548
logged_GDP:Western      0.077922625  0.94000325
```

References

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Hajdu, G., & Hajdu, T. (2016). The impact of culture on well-being: Evidence from a natural experiment. *Journal of Happiness Studies*, 17(3), 1089-1110. doi:http://dx.doi.org.ezproxy.stolaf.edu/10.1007/s10902-015-9633-9

Joshanloo, M., & Weijers, D. (2014). Aversion to Happiness Across Cultures: A Review of Where and Why People are Averse to Happiness. *Journal of Happiness Studies,* 15(3), 717–735. https://doi.org/10.1007/s10902-013-9489-9

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