

Our International Image

Is there a relationship between U.S. Approval Rating in countries abroad, and how predominantly Muslim or developed those countries are?

Ryan Boone, Kanya Manoj, Jacob Zionce
12/8/2011

Introduction

Given ongoing concerns over Islamophobia at home and perceived anti-Americanism amongst Muslim populations abroad, an analysis of the relationship, if any, between the proportion of a population that identify as Muslim and that population's perception of U.S. actions would prove a timely contribution to current debates.¹ The central research question of this study examines whether or not there is a correlation between the percent of Muslims in a country and U.S. approval rating in that country. The null hypothesis states that U.S. approval ratings and Muslim proportion should be independent, while the alternative hypothesis states that a relationship exists. The project goes on to utilize multivariate analysis to form a more representative model that distinguishes between developed and developing countries based on several indicators provided by the United Nations Development Programme. The hypothesis testing here determines whether or not the resulting model is significant. This will allow more precise analysis in trends that differ between advanced Muslim countries like the UAE and developing Muslim countries like Afghanistan, thus pinpointing areas of interest. This is an observational study intended for exploratory use; causality cannot be inferred from this study's results. Future areas of research and analysis can be identified, however.

Data Collection

The data set was determined by data availability because collection, for this study, was not feasible. After eliminating cases for which full variable data was not present, the set was left with only

¹ Mujahid, Abdul Malik. "Islamophobia Statistics USA." *Islamic Information & Products - SoundVision.com Home!* 08 Sept. 2011. Web. 17 Nov. 2011. <<http://www.soundvision.com/info/islamophobia/usastatistics.asp>>.

123 countries to serve as test cases. Since this includes every case that meets the criteria, the resulting data set is treated as a population rather than a sample. Additionally, any sample that could have been generated would have been either too small to guarantee normality or too large to guarantee independence. The generalizability that could have come from sampling is not as important a factor in studies relating to the international system given the low number and interdependent nature of countries.

Countries are not perfect statistical cases. The data represents the current knowledge of conditions in the countries represented, yet these statistics cannot always keep abreast of current events or adequately capture the historical context on which perceptions often rest. As examples, Libya is represented here despite undergoing a revolution within the past year and Sub-Saharan Africa consistently returns high rates of U.S. approval while Middle Eastern countries do not. Furthermore, the study will be heavily hampered by non-response bias; many countries were either not polled or statistics could not be gathered, possibly due to repression, danger, or a lack of concern. China, the world's most populous country, is missing. A failure to conform to measures of statistical soundness does not preclude interesting findings, however.

U.S. global approval ratings, the response variable, were taken from a 2011 Gallup poll.² The data for this variable was continuous and numeric. The primary explanatory variable in this study is the proportion of a population that is Muslim, as supplied in 2009 by the Pew Research Center.³ This variable was numeric and continuous, although limited to a range between zero and one. The first research question's parameter of interest is the R^2 statistic, which indicates both the strength of the relationship and how well variances in approval rating can be explained by changes in the proportion of Muslims in a country.

² "Global Views of U.S. Leadership." *Gallup.com*. Gallup, 18 Mar. 2011. Web. 17 Nov. 2011. <<http://www.gallup.com/poll/142631/Worldwide-Leadership-Approval.aspx>>.

³ *Mapping the Global Muslim Population*. Rep. Pew Research Center, Oct. 2009. Web. 15 Nov. 2011. <<http://pewforum.org/newassets/images/reports/Muslimpopulation/Muslimpopulation.pdf>>.

In support of the secondary research question, development statistics were drawn from the 2011 UNDP Report.⁴ Human Development Index, Gross National Income per Capita, Life Expectancy, and Gender Inequality were all based on 2011 data in the report. Infant Mortality (per 1,000) was drawn from 2009 data. The Human Development Index was included because it is traditionally considered a quintessential measure of “development.” The index is determined based on GNI, Life Expectancy, and the number of years of schooling. The study opted to include GNI separately because economic strength is considered a different measure of development, and the wealth of a country affects many facets of life in that society. Life Expectancy and Infant Mortality are two, distinct measures of health and are heavily affected by the availability of services and the presence of conflict. Variables based on UNDP values were all continuous and numeric, although several were limited to between zero and one. Gender Inequality, in particular, exhibited a special analysis given that a higher score reflected a lower level of development. A final explanatory variable utilized in the multivariate analysis was whether the country’s legal system had been influenced by religion, as presented on the CIA World Factbook’s site.⁵ This was another way of categorically measuring the constraints of religion on a society. The variable had two levels: yes and no. There are differences in the extent of religious influence that are not representable by this variable, however. The parameter of interest here is the p-value that determines the significance of the multivariate model in predicting U.S. approval rating. The adjusted R² value will indicate what the portion of the variance in U.S. approval ratings can be explained by the variables, as well as the strength of the relationships between variables.

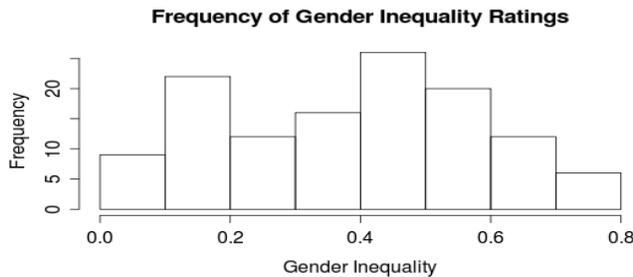
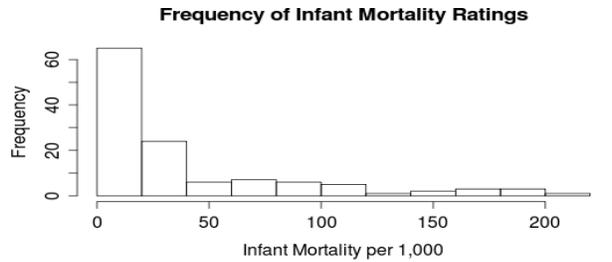
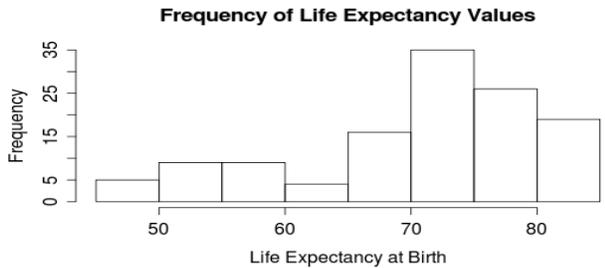
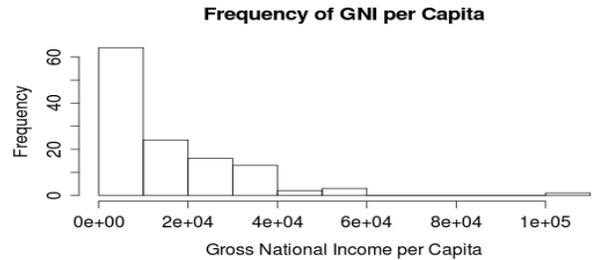
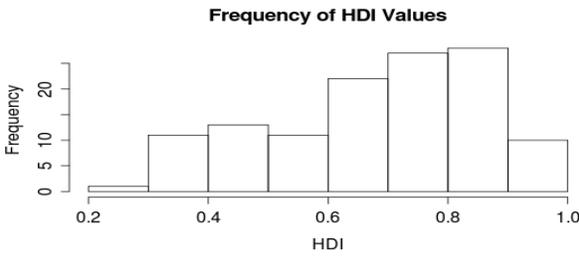
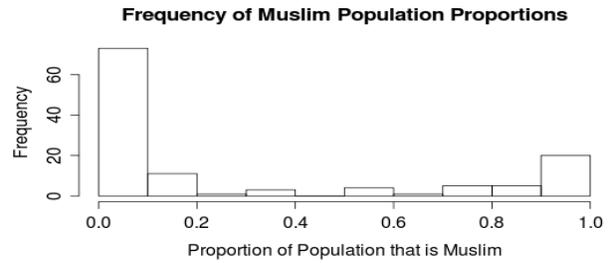
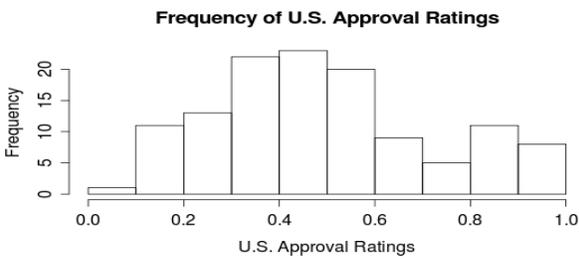
Exploratory Data Analysis

After collecting data, summary statistics and data visualization were collected. As demonstrated by both the data table and the histograms, few variables approached any semblance

⁴ *Human Development Report 2011*. Rep. United Nations Development Programme, 2011. Web. 10 Nov. 2011. <http://hdr.undp.org/en/media/HDR_2011_EN_Complete.pdf>.

⁵ "CIA - The World Factbook." *World Factbook*. Central Intelligence Agency. Web. 07 Dec. 2011. <<https://www.cia.gov/library/publications/the-world-factbook/docs/notesanddefs.html>>.

Variable	Mean	Std. Dev.	Max	Min	Median	IQR
U.S. Approval Rating	0.4999	0.2260	0.9500	0.0900	0.4700	0.2800
Proportion of Muslims	0.2807	0.3858	0.9970	0.0010	0.0430	0.5935
HDI	0.6834	0.1762	0.9430	0.2950	0.7180	0.2635
GNI	14261.0	16005.1	107721.0	265.0	8666.0	21020.0
Life Expectancy	70.7800	9.6230	83.4000	47.8000	73.9000	10.8000
Infant Mortality	39.1800	49.6133	209.0000	2.0000	18.0000	43.5000
Gender Inequality	0.3841	0.1943	0.7690	0.0490	0.4160	0.3315
UNDP Dev. Cat.	Highest	High	Medium	Low		
	0.3252	0.2276	0.2195	0.2276		
Religious Law	Yes	No				
	0.2276	0.7724				



of normality. The Muslim Proportion variable shows bimodality; very few countries have a moderate number of Muslims. Gender Inequality was also bimodal, although not nearly to the same degree. GNI and Infant Mortality both exhibited strong right skew. HDI and Life Expectancy both exhibited strong left skew. Religious Law was not evenly distributed, with over three quarters of the data in the “No” category. Of all the variables, U.S. approval rating was the most evenly distributed. Median and IQR statistics are better measures of the variables in this study than Mean and Standard Deviation given the behavior they exhibit.

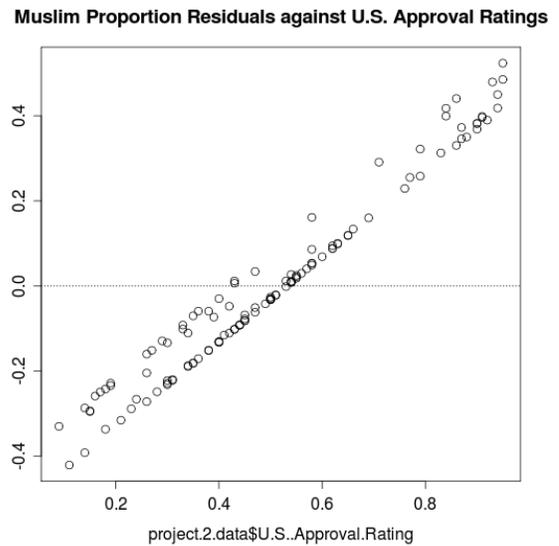
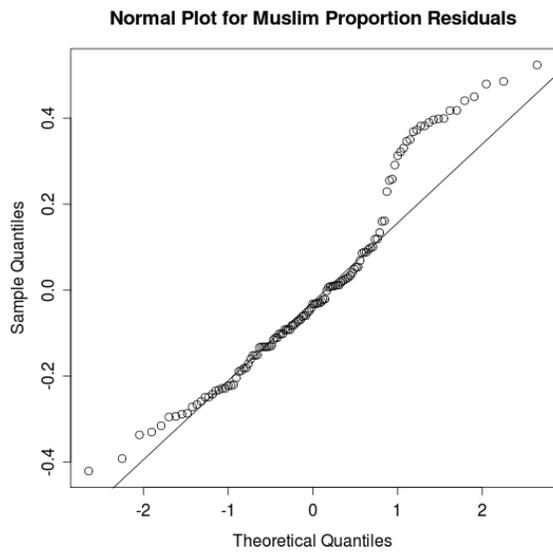
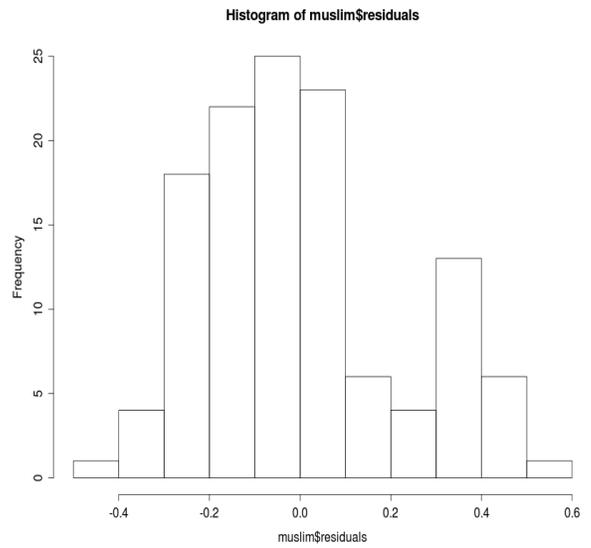
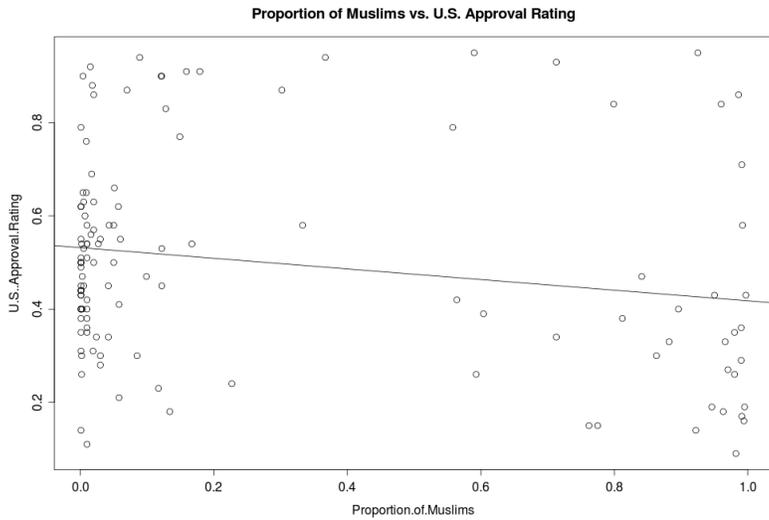
Methodology

Two different techniques are being used in this project. First, a simple linear regression is used to determine if there is a relationship between U.S. approval rating and the proportion of Muslims in a country. Second, a multiple linear regression tests all of the explanatory variables against the response variable to answer the second research question. Since the explanatory variables are not completely independent of each other, conducting a simple linear regression to determine how the primary explanatory variable relates to U.S. approval rating in isolation was necessary to provide context for the multivariate model.

Using statistical software, the conditions necessary for simple and multivariate linear regressions were checked. A step function was implemented during multivariate regression to eliminate variables that decrease the adjusted R^2 value of the model. These variables were found to be both insignificant and fail to contribute meaningfully to the final model.

Single Linear Regression Results

Upon checking model diagnostics for single linear regression, the scatterplot of U.S. approval rating against Muslim proportion did not indicate a linear correlation. Also, the residual histogram and normal probability plot revealed that the data did not fit normal conditions and



exhibited bimodality. Plotting the residuals against U.S. approval rating also showed the variance of the residuals is inconstant. The failures of the conditions likely stem from the trend that most countries have either large or limited Muslim populations, with few cases in between. This compounds the other problems facing statistical analysis of the international system.

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.53195	0.02486	21.399	<2e-16 ***
Proportion.of.Muslims	-0.11410	0.05224	-2.184	0.0309 *

Residual standard error: 0.2226 on 121 degrees of freedom
 Multiple R-squared: 0.03794, Adjusted R-squared: 0.02999
 F-statistic: 4.771 on 1 and 121 DF, p-value: 0.03087

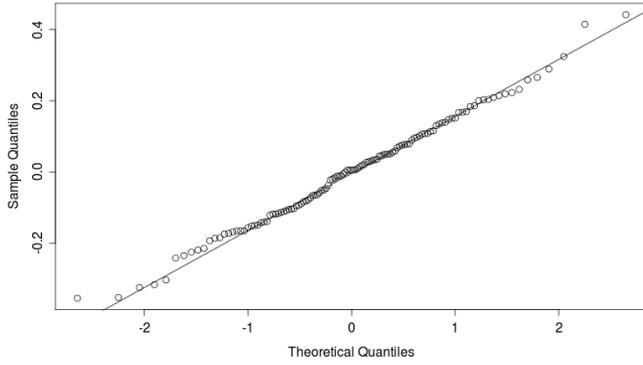
The results of the simple linear regression showed that the relationship between the proportion of Muslims and U.S. approval rating is significant with a

p-value of 0.0309, indicating only a 3.09% chance of seeing these results if no relationship existed between the proportion of Muslims and U.S. approval rating. The Adjusted R² for the simple linear regression is .02999, which agrees with the weak correlation of the scatterplot. Thus, despite its significance, the explanatory variable only accounts for 2.999% of the variance in U.S. approval rating.

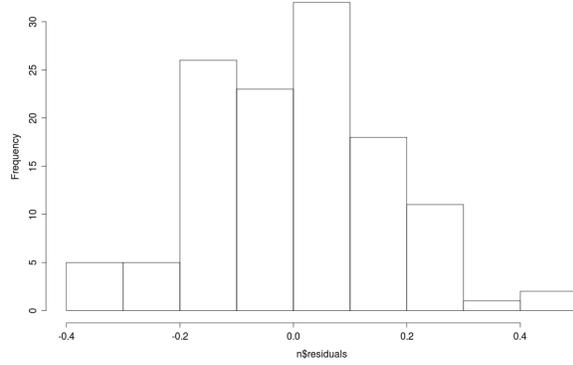
Multiple Linear Regression Results

Some of the diagnostics run on the data indicated problems with statistical soundness. The proportion of Muslims and life expectancy variables demonstrated inconstant variance, which likely explains the fan-shaped distribution of the final model's residuals as shown by the fitted values vs. residuals and fitted values vs. absolute values of residuals plots. The relationships between the UNDP's HDI, GNI, and Life Expectancy data violated the expectation of independence between explanatory variables, but each variable also demonstrated different behavior that supported the decision to include them separately. Between exogenous variables that affect countries beyond the scope of this study, independence determined by the order of data collection cannot be determined. It can be reasonably expected that the results collected in one country are independent of the results collected in another country, whatever other factors may exist. Therefore, although the nature of the data does not lend itself to independent residuals, the data collected still maintain a degree of independence. As shown by the normal probability plot and residuals histogram, the multivariate model had nearly normal residuals, and unless already specified, the variables satisfied conditions for statistical inference.

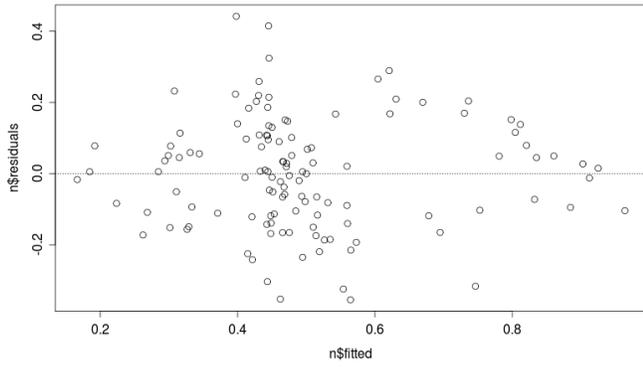
Normal Plot for Multivariate Model Residuals



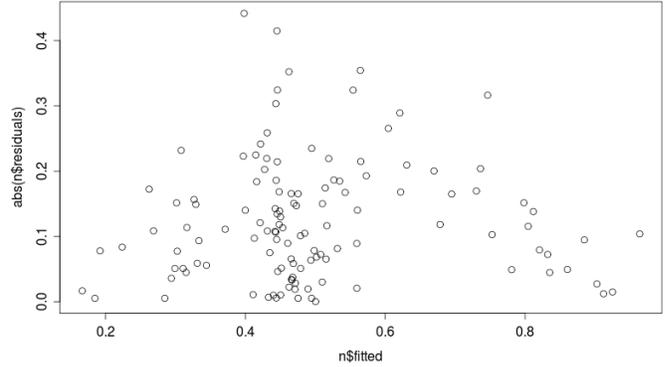
Histogram of n\$residuals



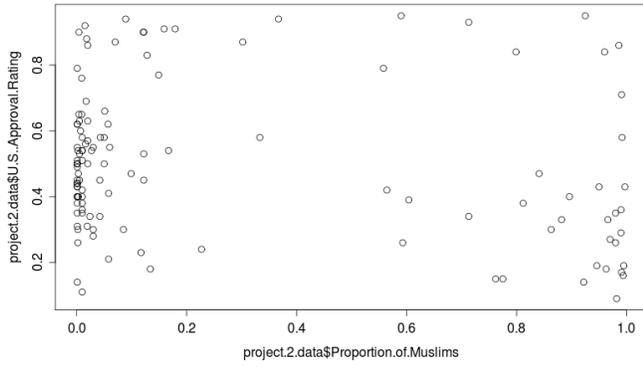
Fitted Values Against Residuals



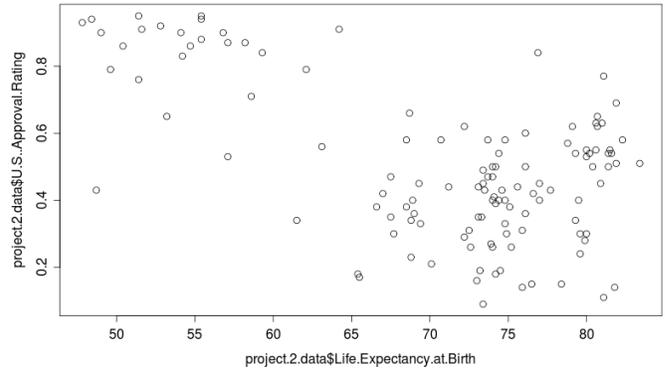
Fitted Values Against Absolute Value of Residuals



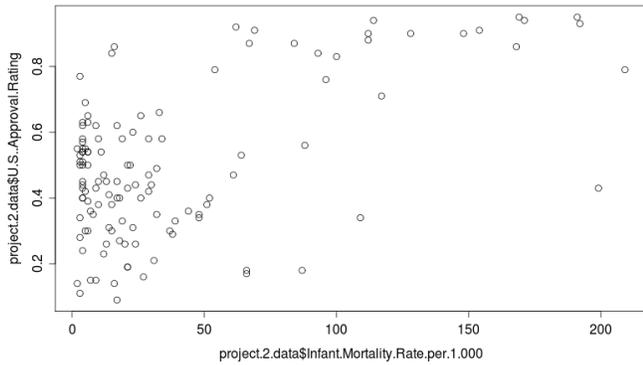
Proportion of Muslims vs. U.S. Approval Ratings



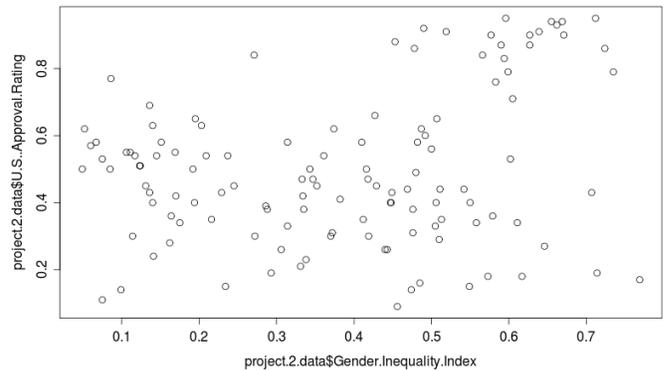
Life Expectancy vs. U.S. Approval Ratings



Infant Mortality vs. U.S. Approval Ratings



Gender Inequality Index vs. U.S. Approval Ratings

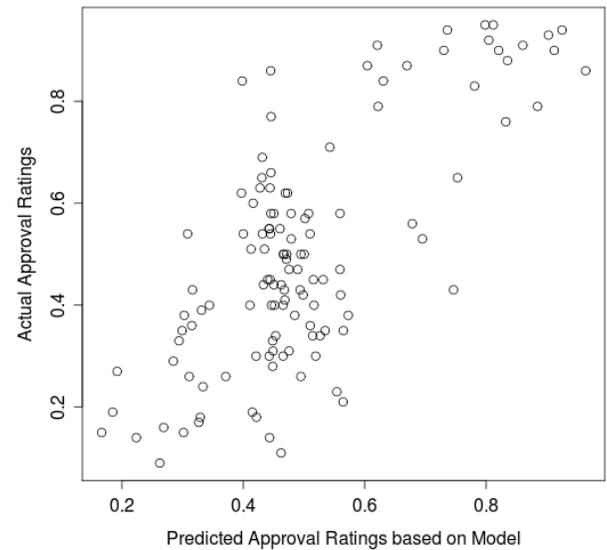


Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	1.6829241	0.3105554	5.419	3.26e-07	***
Proportion.of.Muslims	-0.0919921	0.0506464	-1.816	0.071875	.
Life.Expectancy.at.Birth	-0.0147646	0.0037585	-3.928	0.000145	***
Infant.Mortality.Rate.per.1.000	0.0011361	0.0006248	1.818	0.071565	.
Gender.Inequality.Index	-0.3427903	0.1307873	-2.621	0.009932	**
Religious.LawYes	-0.1094882	0.0463412	-2.363	0.019795	*

Residual standard error: 0.1587 on 117 degrees of freedom
Multiple R-squared: 0.5271, Adjusted R-squared: 0.5068
F-statistic: 26.08 on 5 and 117 DF, p-value: < 2.2e-16

Predicted Approval Ratings against Actual Ratings



The step function determined that life expectancy, gender inequality, infant mortality rate, the proportion of Muslims, and religious law should all be included in the final model. HDI and GNI were eliminated.

The multiple linear regression results show that the proportion of Muslims statistic had a p-value of .071875 as part of the multivariate model, and is therefore not significant 95% confidence level. With a p-value of .071565, infant mortality was also not significant. The variable with the lowest p-value was life expectancy, with a p-value of .000145. The adjusted R^2 of the model was .5068, indicating that the model accounts for 50.68% of the variance in U.S. approval rating. The p-value of the entire model was less than 2.2×10^{-16} , guaranteeing a nearly impossible chance that these results would occur if the explanatory variables are independent of U.S. approval rating.

Conclusion

For the first research question, the proportion of Muslims in a country was deemed statistically significant in relation to U.S. approval rating during simple linear regression. At a 95% confidence level, the null hypothesis is rejected. For the second research question, the model proved to be a significant predictor of U.S. approval rating, thereby rejecting the second null hypothesis. While the model overall was significant, the HDI and GNI variables, the two development indicators traditionally utilized, were removed during the step function. In addition, the proportion of Muslims in a country and infant mortality rates were found insignificant despite inclusion in the model, while the influence

of religion on law, life expectancy, and gender inequality were found to be significant. This study shows that traditional indicators of societal and economic development may not strongly relate to how the U.S. is viewed. Though the nature of the data prevented statistical compliance, the results found were the best achievable with the tools available. The multivariate model indicates that countries with religious influences on law, higher Muslim proportions of population, better health, and higher gender inequality tend to hold worse views of the U.S. International aid, the geography of military intervention, access to information, and cultural differences are but a few of many possible explanations for this.

This conclusion helps identify disparities in public opinion of the U.S. around the world while raising more questions. Given the model, researchers can predict approval ratings for countries for which data was not available. They can also contrast public opinion with government cooperation in the countries the U.S. deals with. As countries become increasingly democratic, it will be interesting to see whether negative opinions translate into anti-U.S. policies. Now that the Arab Spring revolutions have begun to institutionalize themselves through recent elections, the increasing prominence of Islamist parties in Middle East governments will likely challenge existing relationships.

Future research would benefit from an increased number of cases, though this necessitates changes in data collection on the part of international organizations. The implementation of more advanced techniques appropriate for the peculiarities of the international system would also help isolate the variables from factors unaccounted for. Additionally, bringing extra variables into the model could increase accuracy. Education and access to technology are possible additions because global access to information is increasing at an astonishing rate. Repeating the study over time could also track changes in public opinion in relation to historical events, and could help pin down eras or actions that experienced large shifts in U.S. global approval. Better understanding of how U.S. policies are viewed internationally can only increase the ability of the U.S. to respond effectively in an increasingly interdependent and globalized world.