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Predicting Political Revolution

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PREDICTING POLITICAL REVOLUTION

by

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This thesis, submitted by Douglass Hart in partial fulfillment of the requirements for the Degree of Master of Applied Economics from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done, and is hereby approved.

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Douglass Hart
10 April 2013

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ABSTRACT

My thesis study examines the economic and sociological factors associated with political revolutions in order to create a predictive model. I do this by using statistical methods with nation level panel data collected from public domain sources. I anticipate being able to create a predictive model that provides a probability forecast of a country undergoing political revolution within a two year time-frame.

CHAPTER I

INTRODUCTION

Political revolution is an event wherein a nation's people rise up and attempt to overthrow the ruling power and replace the current governing power with another. The occurrence of revolutions dates back almost as far as organized government does, and with over two hundred different national governments in power today, it is unavoidable that this phenomenon will continue to take place around the globe.

These events can have far reaching effects in varying degrees around the world; a revolution affects not only the revolting nation but also its neighboring states and trading partners. Neighboring countries may feel the effects, or even be drawn into the middle, of violent civil wars as revolutionaries seek refuge across national borders or attempt to move weapons and recruit soldiers into their own state. Attempts could be made to loot resources across national borders in order to finance expensive guerrilla wars. A nation that trades with a revolting country can be affected by a revolt in a number of adverse ways. A nation that exports goods to a revolting country may find that the new government after a revolt does not honor the contracts made by the pre-revolutionary authorities and will no longer pay for the traded goods. In the case of a nation that imports from a revolting nation, disruptions in production in the revolting

nation due to the revolt, or revolutionary forces taking control of a nation's ports in order to gain a foothold on the current regime, would cause a revolting nation to cease the export of goods that a trading partner may rely on. These goods can include exports such as foodstuffs or intermediary goods in a foreign countries' manufacturing process. A disruption of this type in the supply chain would force businesses to form rushed contracts with new suppliers and completely rebuild supply chains or fail to meet contracts with end users which could have devastating results with other trading partners.

Not only are imported and exported goods at risk, but also capital and financial assets. Foreign direct investment can be seized entirely under volatile conditions. This means that businesses that set up plants in foreign countries could lose millions in capital and suffer severely reduced production capacity. Just as with payment for goods, a new regime may choose not to recognize the national debt accrued by the previous regime, leaving holders of government issued bonds with nothing. Stock prices of companies that operate within the revolting nation could plummet as upheaval disrupts manufacturing and other business processes vital to publicly traded firms.

A change in the ruling power of a nation can have big implications politically as well as economically. Regime changes due to coup d'états and guerrilla uprisings can bring quick and unexpected ends to political alliances. A former allied state could even turn into a potentially hostile power, drastically changing the political landscape of an

entire region. In the interconnected global economy that we live in today a revolt in a single nation can have effects on the entire world to varying degrees.

A better study of the causes and correlates of revolutions will help us predict the onset of these chaotic and often times violent events, providing the opportunity to take action in a number of ways. With proper warning of the oncoming of a revolt a trading nation could take efforts to minimize the impact of a potential disruption in trade flows; alternate trade routes or supply chains could be sought out before they are immediately needed. Investors would be made aware of this unique risk in making investment decisions. Proper warning of revolts would benefit policy makers as well. The efforts of more powerful nations or even the U.N. could include an attempt to prevent a revolution from occurring in allied nations by addressing signs of political fractionalization with negotiation, or attempting to affect the outcome of a civil war. Fair warning of these events would allow foreign policy makers and investors alike a myriad of options in the face of an upcoming crisis event beyond simply reacting after the fact.

The objective of this paper is to develop a model to predict the likelihood of a nation undergoing a political revolution using both social and economic factors. This paper will not to explain all of the direct causes of a revolution, as these can be widespread and difficult to isolate. Rather, the purpose of this study is to utilize current theory pertaining to the wider causes of revolution and build upon it in order to be able to predict their occurrence in a more broad sense than would be possible if based on

specific causes in a case by case fashion. This is accomplished by using econometric techniques on data compiled from previously gathered sources. From these sources variables are used first based on previous studies, and then new variables are tested, mostly economic, in an attempt to locate new potential indicators, and incorporate them into a model that would be able to predict the onset of revolts and similar events.

In the construction of any economic model it helps to examine prior evidence or literature on the subject in order to build a preliminary framework for the model. I look at literature focusing on the causes of revolts, civil wars, and state collapses as the onset of all of these events are of interest in this study, with an emphasis on the first two. Several papers whose subject is the onsets of civil wars are Collier and Hoeffler (2002) and Collier and Hoeffler (2004). These papers focus on a rebel forces ability to obtain the natural resources necessary to finance a revolutionary movement through the practice of looting. Around the same time another paper was published by Fearon and Laitin (2003), which looked not at a rebelling force's ability to utilize natural resource allocations for financial reasons, but their ability to take advantage of non-material resources. This was done by weighing a national government's ability to finance the creation and maintenance of an army with the ability of rebel forces to take advantage of such factors as geographic terrain, population sizes, and political instability. In the same vain as these studies is an econometric study done by Smith (2004), which studies a nation's abundance of oil resources and the utilization of these resources to create wealth as a determinant of a political regime's survival. This study concludes that the

presence of oil wealth correlates with higher longevity in political regimes, which supports the argument made by Fearon and Laitin (2003) that a state's ability to finance a strong military is a factor that weighs in on the onset of civil wars.

The second theoretical point of view that is the focus in many of the studies previously done on the topic of revolution is that of political structures, which is mentioned by Fearon and Laitin (2003) when they propose that political instability is one of the resources that insurgents can take advantage of in the ignition of civil wars. This line of inquiry is further pursued by Bates (2008) and Goldstone (1991). The underlying assertion made in these texts is that many nations may have potential anti-state factions with varying degrees of resources, and the assumption is made that any state that is politically stable and united will be able to defeat an unequally funded rebel movement. Therefore this would imply that the best way to predict the occurrence of political revolution would be to look for cases wherein there is political fractionalization already present. In line with this theory is an econometric study by Goldstone et al. (2010), which primarily uses five categorical measures of political polity as independent variables for forecasting adverse political events, ranging from revolts to ethnic wars. This study is particularly noteworthy in that the goal of their research falls in line with the goal of this study, that being to develop an empirical model for forecasting the probability of an adverse event occurring. The primary difference between the study done by Goldstone et al. (2010) and this one is that the events in question are more

narrowly defined in my study to those that specifically relate to the usurping of a governing body.

Another article, Gariorowski (1995), analyzes specific occurrences of revolutions in third world countries, and proposes that economic shocks, either via abnormally high inflation rates or recession, can be a significant factor in the process leading to a revolution. It is this idea, that adverse economic conditions can help to bring on a revolt, that I look to incorporate into the more current theory involving political structures. Specifically I look to expand upon the theory revolving around political instability as a cause of revolution by proposing that political instability can be fostered or magnified by adverse economic conditions, and that therefore economic stagnation and decline can be a precursor to political revolution in such instances wherein there is already some level of instability present. If there is some amount of fractionalization present within a political system in addition to the other factors needed, as proposed by Fearon and Laitin (2003), then the addition of political pressure and disagreement brought on in a state of economic decline can magnify the inherent weaknesses in a political system. A period of economic hardship could also be viewed as a sign of weakness to potential rebel forces and thus signal an opportunity to attempt a forced change in power, and limit a regime's ability to fund a strong military counter effort.

In order to test this theory I first establish that economic variables are significant in the prediction of revolution within the presence of other socioeconomic factors which have been shown to correlate with revolution onset by past studies. I then establish that

a lack of economic growth is significant within this framework, and then that these variables retain their significance in the presence of the measures of political instability used by Goldstone et al. (2010). Upon finding these results to be significant I then adapt the model to take the form of a forward looking model in order to predict the probability of the onset of revolution with a two year lead time. I do this by using a two-period lead of the original dependent variable of political upheaval as my new dependent variable. I find that my two-year lead model not only correctly predicts the incidence of revolution with over 75% accuracy within sample, but that the model retains its predictive capacity when used out of sample. Finally I develop a categorical indicator of a nation's level of risk of revolt given the probability of revolt predicted by the model.

CHAPTER II

DATA

For the creation and testing of this model I use yearly data from 1960 to 2000 from over two hundred different nations. This provides a window of over eight thousand potential observations to work with. I am interested in studying the occurrence of several distinct yet similar events which include all out revolt by a populace, the onset of a guerrilla war whose aim is to overthrow the current regime, state collapse, and the incidence of military coup d'états. Therefore, I group together the events of most relevance to create my dependent variable. As such the dependent variable can be defined in a number of different ways depending on which of these events I choose for my definition of revolt to encapsulate. Rather than arbitrarily picking a selection of these factors and ignoring how my model performs on any other definition I test several iterations of my dependent variable in order to ascertain whether or not my model is robust to the decision of how narrowly the term revolt is defined. I also do not simply use all of these terms as I am concerned that the causes that bring about events such as military coups and state collapse may be different than those that bring about revolts or guerrilla wars. The dependent variable in my study is a binary variable that takes a one value in country-years wherein the events of interest

occur. The narrowest definition that I test takes on a one only in the case of an attempted revolt. The second form of dependent variable takes on a one value in country-years wherein there is either a revolt attempt, the start of a guerrilla war, or a state collapse. The third and broadest form of dependent variable takes on a one value in country-years wherein there is any one of a revolt attempt, guerrilla war onset, state collapse, or coup. Lastly, once I am satisfied with the specification of my model I also create a forward looking form of my dependent variable in order to forecast into the future. In doing this I take the dependent variable as defined by the incidence of revolt attempt, guerrilla war outbreak, or state collapse and create a variable that is a two period lead of this. The new dependent variable takes on a one value in country years wherein there will be an incidence of one of the previously listed events two years later.

Next I turn to the independent variables to be included in my model. In building the framework for my model I look to the Goldstone et al. (2010) and the Fearon and Laitin (2003) models to use as a base. Specifically I first attempt to model conditions that would indicate that a rebel force could attain enough of an advantage to attempt to overthrow a state. To this end I include from the Fearon and Laitin (2003) model a measure of population. Rather than use population size as done by Goldstone et al. (2010), I use the percentage of a population that is located in urban areas as suggested by Fearon and Laitin (2002). I have not included a dummy for mountainous regions as per Fearon and Laitin (2003) for two reasons; Goldstone et al. (2010) found this variable to be insignificant, and also because of a lack of sufficient data. I include a variable

measuring oil rents as a percentage of a nation's GDP as per Smith, (2004) and in order to have a measure of a nation's abundance of resources. I also test data pertaining to mineral resource rents, coal rents, and total rents from natural resources. This is done in order to control for a state's ability to finance a military large enough to deter a guerilla effort. Goldstone et al. (2010), in addition to focusing on political structures, found that the infant mortality rate to be very significant, and because of this I include a measure of the infant mortality rate in my model as well, as both Goldstone et al. (2010) and this study have the same goal of forecasting events associated with regime changes. I have also recreated the Goldstone et al. (2010) five measurements of polity, ranging from fully democratic to fully autocratic. I choose to use these variables rather than some of the other more traditional variables measuring political polity found in the Polity IV dataset because Goldstone et al. (2010) reported that their five variables achieved a much better fit for the data and outperformed the other variables in predicting accurate outcomes. I test variables measuring a nation's ethnic and religious diversification, as well as several measures of income inequality, as these have been used in both Goldstone et al. (2010) and Fearon and Laitin (2003). I use several variables in order to measure a nation's economic performance and growth. The first of these is a nation's trade level, measured as a percentage of GDP. The second variable is the growth rate of a nation's gross domestic product. This is the economic variable of most interest as GDP is a good indicator of the size of an economy and the change in this size from one year to the next tells us what the economy is doing. Thirdly I also test data pertaining to

educational attainment. My goal with this is to account for the amount of human capital in a nation to and use this measurement as a proxy for research and development. This is an indicator of technological growth that I use as another measure of a nation's growth in addition to GDP according to endogenous growth theory as outlined by Romer (2006). I choose to use a proxy here not because of exogeneity issues but because of a lack of viable data on more common measures of research and development growth. I also test a dummy variable for previous cases of instability in recent years, which takes into account revolt attempts, active guerrilla wars, state collapses or coups within any of the five years prior to the measurement year. This is not motivated by previous literature so much as it is a measure taken to account for any trend that may occur of periods of instability. As the ultimate goal of this study is the production of a forecast model, the inclusion of a variable to account for trend is an appropriate measure.

In building my model I obtain econometric data from several different sources. The first is a webpage titled "The Logic of Political Survival Data Source" which provides supplementary data to a book of the same title written by the authors of the site. This dataset is a compilation of data from several other sources, including Polity IV from the Center for International Development and Conflict Management, Banks' Cross National Time Series Data Archive, the World Bank, COW, or Correlates of War, as well as several articles. I also collect additional data from the World Bank Database and integrate this into the other dataset. The finalized dataset consists of panel data which spans over two

hundred nations which make up the panel groups. Because the World Bank Database only has data going back as far as 1960, the working sample is limited to data pertaining to between 1960 and 2000, and is organized annually. One drawback of using a previously compiled dataset is that it does not allow me to easily update the data within this dataset, as this would involve tracking down all of the original sources and counting on all of them to have been updated, because of this limitation I am restricted to using data prior to 2001.

CHAPTER III

METHODOLOGY

Throughout this paper and unless otherwise stated I choose to use the definition of my dependent variable that indicates the onset of a revolt attempt, the start of a guerrilla war aimed at the overthrow of the current political state, or a collapse of central authority. I choose to use this grouping of events on which to focus as opposed to the other possible combinations because these events will in most cases have a similar effect upon the nation itself and other nations with ties to it, whether those ties be political or economic. I do not include the onset of coups as the factors that cause this event may be different from the causes of the other events in question, and also because the effects of a coup can be widely different. If those who perform a coup have enough power and influence within the country and military, which is a factor that may be associated with coup attempts, they may be able to affect a successful enough change in authority so as to avoid many of the adverse effects that would ensue after the events that I do focus on. Upon building and testing my model I find that such variables as urban population percentage, infant mortality rates, and previous instability to be significant. I initially find oil rents to be somewhat significant, but find that this variable is not robust to the inclusion of other factors in my model such as education

and previous instability and therefore drop it from my working model. I also find trade as a percentage of GDP and GDP growth to be very statistically significant. Upon verifying that GDP growth is significant I then create two new variables to more specifically measure this relationship. The first is a dummy variable that takes on a value of one in country years where GDP growth is negative, marking an economic contraction from the previous year. I then create an interaction term between the GDP growth dummy and GDP growth. This conditional GPD growth variable measures GDP growth only in instances when it is negative. The purpose of these new measurements is to isolate specifically instances of economic decline and determine their magnitude. Of these variables I choose to use the conditional GDP growth variable in my working model over either GDP growth on its own or a combination of GDP growth and the negative growth dummy. I do this as both the Akaike information criterion and Bayesian information criterion report this as being the best specified form of the model.

Next I test the inclusion of my female education variable. In order to measure education levels I use the percentage of pupils enrolled in secondary education who are female. I use this variable because it is more widely available than tertiary education variables and proves to be a better model fit by the Akaike and Bayesian information criterions than measures of tertiary education enrollment. However, there is a concern that this variable measures not only education but civil liberties as some regions allow more freedoms to women than others and this could affect this statistic. Therefore I introduce a civil liberties index as a variable to control for this effect. I find the

percentage of secondary students who are female to be statistically significant as well as the civil liberties index. The inclusion of the civil liberties index does not affect the significance or reported sign of my education variable, though it does decrease the size of its reported marginal effect. The inclusion of this variable does significantly decrease the statistical relevance of the percentage of the population living in urban areas and this variable is therefore dropped from my working model at this point. I also test measurements of ethnic and religious fractionalization. I do not find either of these variables to be statistically significant, a result that mirrors that of both Goldstone et al. (2010), and Fearon and Laitin (2003). Lastly I test the addition of the five categories of political polity used by Goldstone et al. (2010).

Upon reaching a conclusion as to my model parameters I then run tests in order to ascertain that the model is statistically sound and properly specified. The first test that I conduct is for heteroskedasticity, as the presence of this would violate one of the core assumptions made in order to use the statistical techniques that I employ. Using a Breusch Pagan test I find that heteroskedasticity is present within my model. This result is not surprising as I would expect some variance to be present in the error term due to the data having come from over two hundred different nations. In addition to this I also test to see if there is heteroskedasticity present within the observations of a given nation to ascertain whether or not this variance is only caused by the use of multiple nations within the dataset. I do this by conducting the Breusch Pagan test again while limiting my observations to that of a single nation. Upon having conducted this test on

three different nations I find heteroskedasticity present within two of the three at the ten percent significance level. I therefore conclude that heteroskedasticity is present within the observation groups of my panel data as well as within the overall data and correct for this within my model by using heteroskedasticity robust estimation procedures.

This study uses panel data, which would normally require the presence of a group effect parameter to be included within the model in order to distinguish inherent differences from one nation to another. However, because of the nature of my dependent variable; that being that it is a binary variable that does not necessarily occur in one of the recorded observations within each group, a group effect would not be relevant in the way that it would if I were forecasting a dependent variable that takes on a range of values. Therefore I conclude that to include a group effect would not be appropriate for this model and I do not include one in my finished model. In addition to this I later find that the inclusion of a group variable does not increase the predictive power of my model when forecasting into the future.

The next test that I run is for unit root problems within my data as these can be an issue when working with data that contains a time component. My unit root test comes back negative which affirms that my model estimation is not biased by serial correlation problems.

Another measure that I take is to test for the presence of endogeniety within my independent variables. There is some concern that the variable measuring trade may be correlated with the amount of natural resources such as mineral deposits found within a nation and that this could also be correlated with civil war incidences, as put forth by Collier and Hoeffler (2004). To this end I test for the inclusion of not only mineral resource rents, but coal rents specifically and total natural resource rents and find that none have a statistically significant impact a nation's chance of revolt. Therefore I have no reason to suspect that any of my variables suffer from this problem, but I feel the need to further investigate the possibility in order to maintain confidence in the proper specification of my model. In order to ascertain that there is no such bias I estimate my model, taking into account the results of the specification tests that I have already run, and save the residuals. I then run a regression with the saved residuals as the dependent variable and using the same independent variables as before. I do this in order to find if there is a significant correlation between the error term and any of my independent terms, the presence of which would imply endogeniety of the correlated independent term within my model. The results of this regression confirm that I do not have an issue of endogeniety with any of my right-hand side variables, and I am therefore confident in the exogenous variable specification of my model.

Having run tests to ensure that my process does not contain any obvious signs of bias due to the estimation procedures used, I use the two period lead form of my dependent variable in order to forecast into the future. One significant change that I

make in order to estimate this model is to the past instability dummy. I modify this variable to measure if there is instability present in the current or past two country years rather than the past five country years used in the present period version of the model. The logistic regression equation that is used to model the probability of revolt is as follows:

$$\hat{p} = \frac{\exp(b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_0)}{1 + \exp(b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_0)}$$

In demonstrating the form that the models' equation takes I have used six independent variables as this is the number of independent variables in the final form of my model, though all models within this text use this form.

CHAPTER IV

ANALYSIS OF RESULTS

Modeling In-Period

Table 1 displays the results of my pre-polity variables model using the definition of my dependent variable that encapsulates revolt attempts, guerrilla war onsets, and state collapses.

The first thing to note from the table is that all of the variables are significant statistically at the one percent level. In interpreting what these parameters tell us I look to the marginal effects rather than the coefficients themselves due to this being estimated as a logistic model; as such the actual coefficients do not have a useful interpretation. Trade as a percentage of GDP has an average marginal effect of -0.0009, which tells us that a one percent increase in trade of GDP will cause the likelihood of revolution to decrease by 0.09% on average. This tells us that although this variable is very significant, its actual effect on the probable outcome is relatively small in most cases. With a slightly higher marginal effect of 0.0013 the infant mortality rate is only slightly more influential; in most cases the average effect is a 0.13% increase in the probability of revolt due to an increase in the infant mortality rate. As a result of the coefficient of conditional GPD growth being negative, in order to interpret its effect we

must bear in mind that the value for the actual variable will always be either zero or negative due to the way that this variable is calculated. This means that in calculating a fitted value, we would be multiplying two negatives together to get a positive value. What this tells us is that a higher absolute value of conditional GDP growth is associated with a higher probability of a revolt occurrence. The average marginal effect for this variable is -0.0117. For each additional one percent that GDP growth is negative in a given year, a country is 1.17% more likely to undergo a revolt on average. This is the largest marginal effect reported on a non-binary or non-ordinal variable, making this the third most influential variable in my model.

Table 1

Logistic Regression on Occurences of Revolution, Guerrilla War Onset or State Collapse

Independent Variable	Coefficient	P-Value	Marginal Effect
Trade As Percentage of GDP	-0.0085	0.006	-0.0009
Infant Mortality Rate	0.0120	0.001	0.0013
Conditional GDP Growth	-0.1111	0.000	-0.0117
%Female secondary Education	0.0575	0.000	0.0060
Civil Liberties Index	0.2340	0.000	0.0246
Instability	2.2250	0.000	0.2336
Constant	-6.6233	0.000	
Observations: 1014	Correctly Classified: 76.63% With .213 Cutoff		

With an average marginal effect of 0.0060, the average change due to the percentage of females in secondary education is 0.6%. As this coefficient is positive, a nation will have a higher probability of revolting the higher its percentage of women in secondary education, which is not an expected outcome. This tells us that the more of a

nation's women are educated the more likely it is to revolt, which is contrary to what I expected to be the case. One theory that might explain this finding is that less educated populations are easier to control, or that nations with less education have more central control and are therefore less susceptible to revolutionary behavior. Another possible explanation for this could be that any substantial change in a nation's growth potential due to increased research and development would already be controlled for by controlling for the change in a nation's GDP. I test for this by estimating my model with the exclusion of both the conditional GDP growth and trade variables, but in doing so find that the sign of my education variable does not change. The other conclusion that I find from this result is that this is likely not the ideal variable to use as a measure of human capital, which is the motivation for its inclusion within the model. Despite the fact that my education variable does not seem to adequately measure the factor that I intend to use it to, I choose to leave this variable in my final model. I do this because this factor, while not fulfilling its intended purpose in regards to testing theory, still adds predictive power to my model and in doing so still supports the primary purpose of this study which is to accurately predict the onset of revolutions and similar events. The marginal effect of the civil liberties index is 0.0246, which tells us that for every one point higher on the index, a nation is an average of 2.46% more likely to revolt. The civil liberties index is set on a scale of one to seven so the largest effect that this variable will have is around an additional 17.22% chance of a nation revolting. This is in line with my

expectations as a nation with the highest amount of freedom in its civil liberties scores a one in the index, with nations who grant the least civil liberties scoring a seven.

The last variable in this iteration of my model, the indicator of past instability with regards to internal conflict within a nation, has a marginal effect of 0.2336. Since this is a binary variable this means that countries that have undergone a revolt, guerrilla, coup d'état, or state collapse within the previous five years are 23.36% more likely to undergo one of these events again in the current year than it otherwise would.

This model correctly classifies the onset of these events with an accuracy of 76.63% in sample. In establishing the amount of observations that have been correctly classified for the purpose of benchmarking model measurement for comparison to other iterations of this model, or to other studies, I have chosen to set the cutoff rate for whether the estimated probability signifies the prediction of a revolt or not as the point at which the percentage of correctly classified incidences of revolts equals the percentage of correctly classified incidence of non-revolts. The default cutoff rate is at 0.5 at which the model accuracy is reported as 85.01%, but though this is the point halfway between zero and one, this value is no less arbitrarily set than any other cutoff rate that one could select; this point has nothing to do with how the predicted values are actually distributed or more specifically, how the predicted values of the observations which actually take on a one value are distributed. The method that I use does take this into account in choosing the point that simultaneously maximizes the correct prediction of both revolutionary events and non-revolutionary events. In

addition to doing this to avoid choosing an arbitrary point at which to set the cutoff rate, I use this method in adoption of the method that Goldstone et al. (2010) implemented in choosing their prediction cutoff point, which will allow for a further point of comparison between the results of that study and this one. This means that the cutoff point for each iteration of my model may be different, and as such I display the cutoff point for each model iteration at the bottom of the corresponding table throughout this paper.

Next I test for the inclusion of the categorical measures of regime polity put forth by Goldstone et al. (2010), which consist of five dummy variables measuring countries over a spectrum ranging from fully democratic to fully autocratic. They are: fully democratic regimes, partially democratic regimes, partially democratic regimes with factionalism present, partially autocratic regimes, and fully autocratic regimes. Ruling political regimes are assigned to these five categories depending on a combination of two factors: competitiveness of political participation, and openness of executive recruitment (Goldstone et al., 2010). A detailed explanation of how nations are scored on the democratic to autocratic scale and assigned to the five categories using these variables can be found in Gladstone et al. (2010), but is beyond the scope of this study. Table 2 displays the results of this logistic regression, wherein the variable for fully democratic has been omitted to avoid over specification.

Table 2			
Logistic Regression on Occurences of Revolt, Guerrilla War Onset or State Collapse With The Addition of Polity Dumies			
Independent Variable	Coefficient	P-Value	Marginal Effect
Trade As Percentage of GDP	-0.0089	0.006	-0.0009
Infant Mortality Rate	0.0137	0.000	0.0014
Conditional GDP Growth	-0.0991	0.000	-0.0102
% Female Secondary Education	0.0555	0.000	0.0057
Civil Liberties Index	0.3029	0.012	0.0311
Instability	2.1033	0.000	0.2161
Partial Democracy	0.3997	0.399	0.0411
Factionalism	0.9856	0.008	0.1013
Partial Autocracy	0.1462	0.704	0.0150
Full Autocracy	-0.1421	0.766	-0.0146
Constant	-7.0059	0.000	
Observations: 1014	Correctly Classified: 76.43% With .2 Cutoff		

Upon including these variables I find that the only one that is statistically significant is partial democracy with the presence of factionalism. This is a very different result from that reported by Goldstone et al. (2010), who found that not only were these variables highly significant, that they retained their significance with the inclusion of a wide range of other variable. There are several possible explanations for this drastic difference in findings. This discrepancy could be due to the fact that the dependent variable in my study is much less broad in the nature of the events it attempts to predict than that used by Goldstone et al. (2010). However, as their study tested the use of their model with various forms of dependent variable, one of which only took into

account adverse regime changes, the reason for this is more likely due to the use of a case-control method employed by Goldstone et al. (2010) due to the low number of incidences of their dependent variable. I have not chosen to adopt this method because within my sample, a much greater percentage of my observations contain events of interest, even with the exclusion of coups.

The largest change from Table 1 in the reported marginal effects of the original variables is a decrease of 0.0175 in the instability dummy, which equates to a 1.75% lower chance of a country revolting if prior instability is present than reported before. The next largest change is an increase of 0.0065 in the civil liberties index, which means an average additional 0.65% increase in a countries probability of revolt due to this variable. Using hypothesis tests conducted using the standard errors reported by both regressions, the marginal effects reported by the two regressions are not statistically significantly different from each other. This indicates that the inclusion of the Goldstone et al. (2010) measures of political structure do not significantly affect the estimates of the other variables within my model. The largest marginal effect reported of the four categorical polity measurements is that of factionalism; which is also the only one to gain any statistical significance. At 0.1013 this means that a nation found in this classification is 10.13% more likely to undergo a revolutionary event.

Since not only are the majority of these dummies not significant statistically, but also their inclusion does not increase the ability of my model to predict accurate outcomes, I choose only to include the factionalism dummy moving forward.

I next run the model on two alternate specifications of my dependent variable to see how well the model holds up to changes in how narrowly the concept of revolution is defined. Table 3 displays a comparison of the regression results using the three different versions of my dependent variable moving from most to least restrictively defined from left to right. The standard definition that I use in estimating my model results up to this point and throughout the rest of this paper is the center of the three sets of estimates.

Table 3

Logistic Regression Results on Three Versions of Dependent Variable

Most Restricted Form Measures Revolt Attempts
Standard Definition Measures Revolt Attempts, Onset of Guerrilla Uprisings And State Collapse
Least Restricted Form Measures Revolt Attempts, Onset of Guerrilla Uprisings, State Collapse, And Coups

	Dependent Variable					
Independent Variable	Most Restricted		Standard Definition		Least Restricted	
	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value
Trade As Percentage of GDP	-0.0082	0.012	-0.0090	0.004	-0.0080	0.008
Infant Mortality Rate	0.0111	0.002	0.0126	0.000	0.0136	0.000
Conditional GDP Growth	-0.0971	0.000	-0.0999	0.000	-0.1049	0.000
%Female Secondary Education	0.0456	0.003	0.0538	0.000	0.0604	0.000
Civil Liberies Index	0.3131	0.000	0.2388	0.000	0.2448	0.000
Instability	2.2518	0.000	2.1156	0.000	2.0381	0.000
Factionalism	1.0396	0.000	0.8706	0.001	0.9160	0.000
Constant	-6.7928	0.000	-6.5222	0.000	-6.8631	0.000
Observations	1014		1014		1014	
Correctly Classified	77.22%		75.94%		75.94%	
Classification Cutoff	0.175		0.19		0.188	

All Regressions Ran Using Heteroskedasticity Robust Standard Errors

As I move from my standard dependent variable classification to only studying the incidences of revolt attempts, I find that the statistical significance of trade, infant

mortality, and female education decreases. When moving from my standard definition to the least restricted definition which also takes into account incidences of coups, trade as a percentage of GDP becomes less significant. The factionalism dummy becomes slightly more significant with the inclusion of coup d'états in the dependent variable. No trend is forthcoming as the definition of my dependent variable becomes increasingly less restricted. The reported p-values of conditional GPD growth, the civil liberties index and the previous instability dummy do not decrease from 0.000 with the variation of the dependent variable specification.

The other relevant factor to examine when testing the effects of specification of the dependent variable of my model is predictive capacity. I find that moving from the standard specification to the least restricted form of my dependent variable does not change the accuracy of my model. The restriction of my dependent variable to only the incidence of revolt attempts increases the prediction capacity of my model by 1.28%. The conclusion of this test is that my model performs either as well as or better when using alternate forms of my dependent variable, which for practical purposes means that the independent variable selection does not need to be altered when using the model to predict a different combination of revolution type events. I do not report the marginal effects as they are not needed to ascertain whether or not the model estimates have changed significantly, which is the purpose of testing the alternate specifications of the dependent variable.

Modeling Future Events

While I have established that my model is both significant statistically and practically in terms of predicting events given information from the year in which they occur, this is not necessarily a useful result in and of itself. Correctly predicting the occurrence of an event such as a revolution or civil war with less than twelve months to take action based on this knowledge may not be ideal to policy makers or others that could be affected by these events as a larger timeframe may be necessary in order to properly plan and execute contingency plans. The more time policy makers are given to react before the predicted event may occur, the more options are available to them. To this end I now take my model from an in-year predictive model to a forward looking model to predict the occurrence of revolutionary behavior two years into the future.

There are several potential methods of doing this, but for simplicity and ease of use, I use the method implemented by Goldstone et al. (2010). This method makes the dependent variable a two period lead of my original dependent variable, meaning that the new dependent variable takes on a one value in a country-year two years prior to the actual occurrence of a revolutionary incident. In executing this method I also make a change to my instability variable, which takes a one value if there are revolutionary incidences recorded in any of the previous five country years. I adapt this variable to take on a one value if there is an incidence within the measurement year or the three years previous to this. In doing this I make an effort to use the model to predict if a country would revolt in this intermediate year and then incorporate this value into the

instability dummy. The results of this inclusion however are not useful in increasing predictability. Having tested this inclusion using several cutoff rates for the determination of a revolt occurring, including 0.108, 0.2, 0.346, 0.4, and 0.5, I find that this inclusion decreases model forecasting accuracy by roughly one percent in the best of these cases. This value is therefore not incorporated into the instability dummy.

The alternative approach would be a more mainstream method of forecasting future events. This approach would involve the use of a vector auto-regression model in order to predict all of the variables within a model into the future in order to come up with predicted values of the dependent variable. There are several complications when using this method to address this particular issue however; the primary one being the use of panel data. The vector auto-regression model is not designed to take into account data from different groups, only a single group over a period of time. This means that in implementing this method I would have to run a separate regression on each of the nations within my study in order to predict the future values of my independent variables, and then aggregate these predicted results into panel format. This would also require the use of an entirely different model in order to best forecast these independent variables. Another possible complication of using a VAR model is the fact that the dependent variable is binary. A VAR may not be ideal for the prediction of or inclusion of a binary dependent variable; especially within nations where these events are relatively rare which could be an issue as each nation must be predicted separately. Once the forecasting and aggregation of the independent variables for the primary

model are complete, the in-period model as specified prior to this point would then be used in order to make predictions of the future values. As with most forward predicting models, a problem that could arise due to this method is the compounding of errors. Not only must the error within the original model be accounted for but also the error in the forecasting of the independent variables. So for simplicity of implementation I use the more straightforward method.

Table 4			
Logistic Regression on Occurences of Revolt, Guerrilla War Onset or State Collapse With Two Year Lead			
Independent Variable	Coefficient	P-Value	Marginal Effect
Trade As percentage of GDP	-0.0068	0.013	-0.0007
Infant Mortality Rate	0.0088	0.010	0.0010
Conditional GDP Growth	-0.0492	0.017	-0.0055
%Female secondary Education	0.0470	0.001	0.0052
Civil Liberties Index	0.1721	0.002	0.0191
Instability	1.9613	0.000	0.2177
Constant	-5.4953	0.000	
Observations: 1014	Correctly classified: 75.25% With .22 Cutoff		

Table 4 displays the results of the model estimated to predict the two periods into the future onset of a revolutionary occurrence. In the forward predicting form of my model I have excluded the Goldstone et al. (2010) variable measuring democracy in the presence of factionalism. I do this for the practicality of the model's implementation rather than for a lack of statistical significance or model predictability. While the model's predictability falls by 0.19% with this exclusion, I find that when attempting to

predict out of sample, the number of nations that can be predicted using the model increases drastically when information on this variable is not required. I therefore believe that this is a practical trade off to make, however the results of the two year lead model estimated using the factionalism dummy are reported in Appendix A.

In comparison to the in-year model as reported in Table 1 the statistical significance of all of the right hand side variables with the exception of the instability dummy have fallen. This is not surprising as I would expect that in a two year timeframe variables such as GDP growth, trade, and the infant mortality rate would fluctuate, and they would therefore lose some significance due to this fluctuation. I would expect that in most cases the values of the civil liberties index would not change drastically in the absence of a revolutionary event, so the fall in significance in this factor is not as expected as the others.

The non-dummy variable with the most change in its reported marginal effect from the model as reported in Table 1 is conditional GDP growth with a decrease in magnitude of 0.0062 from -0.0117 to -0.0055. This means that not only is this variable is less statistically significant when forecasting future values, it has a smaller impact on the outcome of the prediction. This is a trend that is followed by all of the variables, with the exception of the instability dummy, which while having a smaller marginal effect, still retains its level of statistical significance.

When used to forecast future events, the non-binary or ordinal variable with the largest average marginal effect is conditional GDP growth, which is 0.0055. This means an increase in the magnitude of Conditional GDP growth is an increase in the chance of revolt by 0.55%. The education variable has the next biggest average marginal effect at 0.0052, which means that a change in this variable causes a change in the chance of revolt by just over half of one percent. At -0.0007 and 0.0010, the marginal effects of trade as a percentage of GDP and the infant mortality rate are relatively small. The civil liberty index has an average marginal effect of 0.0191 meaning that when a country moves up on this index by one point it gains 1.91% in its revolt likelihood. The marginal effect of the instability dummy is 0.2177, meaning that a country that has undergone an incident of political instability in the current year or the past three years is 21.77% more likely to revolt in two years' time than those who have remained stable in recent years.

The most important observation regarding this iteration of the model is that the percentage of cases of revolutionary activity that are correctly classified does not significantly change from that of the in-year form of the model when predicting the onset of revolt attempts, guerrilla war beginnings and state collapses. The finding that the model does not lose significant predictive power when used to forecast future events is extremely important and means that this model can have practical applications for political policymakers and the private sector alike. It should be noted though that in comparison to the reported results of Goldstone et al. (2010), the other study that attempts to predict the occurrence of similar events, this model does not achieve the

same success; the aforementioned study reported a success rate of over eighty percent when forecasting events with a two year lead time. This means that for forecasting a broader scope of instability events the Goldstone model may be ideal for practical purposes.

The last thing that I do in order to establish the significance and practicality of my results is to collect data on a year outside of the range of my dataset in order to test the model's accuracy when forecasting in a year outside of the sample range; the inability to accomplish this would drastically decrease the practical value of this model. For this year, I choose 2011, which means that the majority of the data I gather in order to test my model is from 2009. As discussed earlier it is for this reason that I have excluded factionalism from my model. I find that the Polity IV dataset has information on substantially less nations than either Freedom House or the World Bank databases from which I gather the data on the rest of my independent variables. When testing on the 146 nations on which sufficient information is found, this model predicts 137 of these correctly when using the 0.22 cutoff rate, used for benchmarking purposes, which translates to over 93% accuracy when predicting in the year 2011 for those nations for which there is sufficient information available to predict.

Having established that my model has the capability to be useful to policy makers on a practical level, some note should be made to end users as to how best utilize this model in order to yield the most useful results. This model has been found to predict the incidence of revolutionary behavior with an accuracy of over 75%, however

as there are over 200 different sovereign nations in the world today this still leaves an error window of about 46 misclassified countries per year on average when used to predict a clear yes or no outcome. What this means for the actual implementation of this model is that one should not simply treat its predictions as fact and proceed to distance oneself from those nations predicted to fall. A nation that would not revolt on its own may be pushed to doing so if its trading partners and political allies where to cut ties as a result of policy aimed to minimize collateral damage. This would make the outcome of this model in some cases a self-fulfilling prophecy. For distribution and reference purposes I set the percentage of type one and type two prediction errors as equivalent for this model for the cutoff rate throughout this paper, but because less nations tend to revolt than not, this means that most of the prediction errors are those that predict a revolt where there will not be one, which emphasizes that to make the mistake discussed above would be to risk the onset of many more revolts than are necessary. To this end it is recommended that this model should be used rather as a way of flagging nations that are at a higher risk of internal political upheaval and should be investigated further on a case by case basis. Once this has been done, then preemptive action could be taken to minimize adverse spillover effects from a revolution or similar event that threatens the existence of the current political system.

To this end it may be more practical to break down the fitted values of this model into categorical levels of risk, ranging from high to low risk of revolutionary incidence. In doing this I organize my 1014 fitted predictions into quintiles, the

breakdown of which can be seen on Table 5. When examining the 1014 data points used in the estimation of my model I find that my dependent variable takes on a value of one in 16.96% of these observations and therefore find it appropriate to label the highest twenty percent of the predicted values as high risk.

Table 5	
Risk Level Classifications	
Risk Categorie	Description
Low Risk	From 0 up to 0.0356
Medium Low Risk	From 0.0356 up to 0.0559
Medium Risk	From 0.0559 up to 0.1081
Medium High Risk	From 0.1081 up to 0.3463
High Risk	From 0.3463 up to 1

I then assign my fitted values for 2011 into these five categories and examine the results. Within the 146 countries for which predictions are made, twenty one are in the low risk group, fifty five in the medium low risk group, fifty five in the medium risk group, ten in medium high risk range, and five classified as high risk. None of the five countries classified as being at high risk actually underwent revolts that year, which further illustrates the usefulness of breaking the predictions down into risk categories rather than cut and dry predictions. I have included six of these predictions in table 6, but the entire list of predicted values and risk levels for 2011, including the six found here, can be found within Appendix B.

The first of these six, Hungary, is a typical case for a low risk level. Despite having a lower than average number for its conditional GDP growth in 2009, which is -6.8, it has a very low infant mortality rate, a high trade value, no previous instability, and scores a one on the civil liberties index. Yemen is an interesting case in that it is one of four nation that revolted in 2011 that were predicted not to, the others being Tunisia, Syria and Egypt. My model classifies Yemen as having a medium low risk level which is the lowest risk classification of the four nations. In looking at the data from 2009, Yemen has no prior instability, no negative GDP growth, and scores a three on the civil liberties index. Yemen and all three of the other non-predicted revolts of 2011 were involved in the "Arab Spring" uprising movement of late 2010 and 2011.

Table 6

Select 2011 Nations With Predicted Risk Levels

Country	Predicted Probability	Risk Level	Revolt
Hungary	0.0271	Low	No
Yemen, Rep.	0.0424	Medium Low	Yes
United States	0.0494	Medium Low	No
Syrian Arab Republic	0.0803	Medium	Yes
Cote d'Ivoire	0.3413	Medium High	Yes
Bangladesh	0.4088	High	No

The United States also scores within the medium low range of risk for revolt, likely due to negative GDP growth in 2009 due to the recession that began in 2008. In addition to this the United States reportedly has a low rate of trade in comparison to overall GDP in that year. The Syrian Arab Republic, or Syria, scored within the medium

range of revolt risk. Another of the countries associated with the Arab Spring Syria like Yemen had no negative GPD growth in 2009 as well as no record of recent instability, it did however have a higher score of 6 on the civil liberties index, and a higher value for the percentage of secondary education that is female than Yemen. Cote d'Ivoire, formerly the Ivory Coast, scores in the medium high risk range and is interesting in that it actually did undergo a civil war in 2011. With a relatively high score of five on the civil liberties index, a high infant mortality rate, and a recent history of instability this result is not surprising. Bangladesh is one of the five nations which scored in the high risk level of which none actually underwent revolts. Bangladesh had positive GDP but a history of instability, a high civil liberties index score, and above average values for their infant mortality rate and female education both of which are associated with higher probability of revolt.

CHAPTER V

CONCLUSION

This study has established several significant findings regarding political revolution. In this paper it is shown using empirical evidence that adverse economic conditions can be an indicator of political instability in a nation, and it is also shown that this result is robust to the inclusion of variables that have been used to study instability in the past. In addition a predictive model has been created that predicts not only revolution but revolutionary guerrilla war and state collapse with a two year lead time with over 75% accuracy when maximizing both the correct prediction of occurrences and non-occurrences of revolutionary episodes. It also shows that this model can be a good starting point in looking for possible episodes of instability by highlighting high risk areas that subsequent efforts can focus upon via the creation of a range of categorical risk levels.

One drawback of this study is that many of the independent variables that I would have liked to test were not documented well enough in many nations to glean significant results from them. I would have liked to include variables that took into account numerous aspects of the ease of doing business within a country, but information on these variables was extremely scarce and too recent to be encapsulated

within the scope of my dataset. A related shortcoming of this study was the inability to find an effective measure of technological growth, normally measured by either the amount of R&D development or human capital in a nation. Another drawback is the need to collect current data in order to make predictions using this model; in collecting data to generate predictions for the year 2011, I am unable to run the model on over fifty nations due to a lack of sufficient data, which limits the practical use of the model to nations for which sufficient data can be found.

In continuing forward in the further study of revolutions and other events that disrupt the power structure of a nation there are several possibilities for areas for further research. A study involving more influence-able variables such as the ease of doing business or number of large or small businesses might yield practical results from a policy standpoint. A more in depth analysis of the effects of education and the acquisition of human capital as a measure of a nations capacity for economic growth through increased research and development may also be a fruitful endeavor once the appropriate data is more widely available.

With the information that this model provides both policymakers and investors alike from nations around the world can be better informed of the risk of political upheaval that may present itself in the countries around them or even within their own borders. Armed with this information they can then focus their intelligence efforts to further define potential risks and take steps to protect themselves from the chaos that a revolution can bring to the entire world.

APPENDICES

Appendix A

Table 7			
Logistic Regression on Occurences of Revolt, Guerrilla War Onset or State Collapse With Two Year Lead And Inclusion of Factionalism Variable			
Independent Variable	Coefficient	P-Value	Marginal Effect
Trade As percentage of GDP	-0.0070	0.010	-0.0008
Infant Mortality Rate	0.0093	0.007	0.0005
Conditional GDP Growth	-0.0402	0.065	-0.0058
%Female secondary Education	0.0445	0.002	0.0052
Civil Liberties Index	0.1743	0.003	0.0172
Instability	1.8718	0.000	-0.0011
Factionalism	0.6391	0.023	0.2146
Constant	-5.4197	0.000	
Observations: 1014	Correctly classified: 75.44% With .2 Cutoff		

Appendix B

Table 8

Complete List of Predicted Risk Levels For Year 2011

Country Name	fitted	Risk Level	Country Name	fitted	Risk Level
Afghanistan	0.0463	Medium Low	Lebanon	0.0650	Medium
Albania	0.0440	Medium Low	Lesotho	0.0607	Medium
Algeria	0.0861	Medium	Liberia	0.0556	Medium Low
Angola	0.0983	Medium	Lithuania	0.0512	Medium Low
Antigua and Barbuda	0.0606	Medium	Macedonia, FYR	0.0400	Medium Low
Argentina	0.0588	Medium	Madagascar	0.0694	Medium
Armenia	0.1128	Medium High	Malawi	0.0741	Medium
Australia	0.0375	Medium Low	Malaysia	0.0331	Low
Austria	0.0327	Low	Maldives	0.0397	Medium Low
Azerbaijan	0.0724	Medium	Malta	0.0195	Low
Bahamas, The	0.0391	Medium Low	Mauritania	0.3507	High
Bahrain	0.0462	Medium Low	Mauritius	0.0357	Medium Low
Bangladesh	0.4088	High	Mexico	0.0717	Medium
Barbados	0.0321	Low	Moldova	0.0604	Medium
Belarus	0.0543	Medium Low	Mongolia	0.0422	Medium Low
Belgium	0.0240	Low	Montenegro	0.0506	Medium Low
Belize	0.0567	Medium	Morocco	0.0555	Medium Low
Bhutan	0.0671	Medium	Mozambique	0.0668	Medium
Bolivia	0.0591	Medium	Namibia	0.0454	Medium Low
Bosnia and Herzegovina	0.0494	Medium Low	Nepal	0.3489	High
Botswana	0.0584	Medium	Netherlands	0.0263	Low
Brazil	0.0614	Medium	New Zealand	0.0360	Medium Low
Brunei Darussalam	0.0517	Medium Low	Norway	0.0372	Medium Low
Bulgaria	0.0449	Medium Low	Oman	0.0503	Medium Low
Burundi	0.1068	Medium	Pakistan	0.0915	Medium
Cambodia	0.0561	Medium	Panama	0.0278	Low
Cameroon	0.1328	Medium High	Paraguay	0.0507	Medium Low
Cape Verde	0.0360	Medium Low	Peru	0.0548	Medium Low
Central African Republic	0.1016	Medium	Philippines	0.0554	Medium Low
Chad	0.2802	Medium High	Poland	0.0352	Low
Chile	0.0364	Medium Low	Portugal	0.0422	Medium Low
China	0.0810	Medium	Qatar	0.0583	Medium
Colombia	0.0769	Medium	Romania	0.0630	Medium
Congo, Dem. Rep.	0.3735	High	Russian Federation	0.1086	Medium High
Congo, Rep.	0.0558	Medium Low	Rwanda	0.1018	Medium
Costa Rica	0.0319	Low	Samoa	0.0506	Medium Low
Cote d'Ivoire	0.3413	Medium High	Sao Tome and Principe	0.0709	Medium
Croatia	0.0544	Medium Low	Saudi Arabia	0.0592	Medium

Table 8 Cont.					
Complete List of Predicted Risk Levels For Year 2011					
Country Name	fitted	Risk Level	Country Name	fitted	Risk Level
Cuba	0.0980	Medium	Senegal	0.0531	Medium Low
Cyprus	0.0330	Low	Serbia	0.0449	Medium Low
Czech Republic	0.0315	Low	Seychelles	0.0174	Low
Denmark	0.0383	Medium Low	Singapore	0.0053	Low
Dominica	0.0306	Low	Slovak Republic	0.0270	Low
Dominican Republic	0.0546	Medium Low	Slovenia	0.0387	Medium Low
Egypt, Arab Rep.	0.0737	Medium	South Africa	0.0654	Medium
El Salvador	0.0575	Medium	Spain	0.0437	Medium Low
Eritrea	0.0954	Medium	Sri Lanka	0.0681	Medium
Estonia	0.0489	Medium Low	St. Kitts and Nevis	0.0467	Medium Low
Ethiopia	0.0855	Medium	St. Lucia	0.0294	Low
Fiji	0.2794	Medium High	St. Vincent, Grenadines	0.0372	Medium Low
Finland	0.0503	Medium Low	Sudan	0.1369	Medium High
France	0.0434	Medium Low	Swaziland	0.0741	Medium
Gambia, The	0.0813	Medium	Sweden	0.0362	Medium Low
Georgia	0.0637	Medium	Switzerland	0.0324	Low
Germany	0.0378	Medium Low	Syrian Arab Republic	0.0803	Medium
Ghana	0.0477	Medium Low	Tajikistan	0.0818	Medium
Grenada	0.0560	Medium	Tanzania	0.0557	Medium Low
Guatemala	0.0603	Medium	Thailand	0.2665	Medium High
Guinea	0.3515	High	Togo	0.0495	Medium Low
Hungary	0.0271	Low	Trinidad and Tobago	0.0495	Medium Low
Iceland	0.2233	Medium High	Tunisia	0.0658	Medium
Indonesia	0.0646	Medium	Turkey	0.0642	Medium
Ireland	0.0230	Low	Uganda	0.0550	Medium Low
Israel	0.0391	Medium Low	Ukraine	0.1062	Medium
Italy	0.0653	Medium	United Arab Emirates	0.0204	Low
Japan	0.0635	Medium	United Kingdom	0.0404	Medium Low
Kazakhstan	0.0699	Medium	United States	0.0494	Medium Low
Kenya	0.0621	Medium	Uruguay	0.1125	Medium High
Korea, Rep.	0.0282	Low	Vanuatu	0.0504	Medium Low
Kuwait	0.0619	Medium	Venezuela, RB	0.0996	Medium
Kyrgyz Republic	0.0433	Medium Low	Vietnam	0.0502	Medium Low
Lao PDR	0.0739	Medium	Yemen, Rep.	0.0424	Medium Low
Latvia	0.0737	Medium	Zambia	0.1080	Medium

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