Economic Resiliency and the Measurement of the Risk of Social Conflict

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George R. Koo

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Abstract

This thesis studies the general economic factors underlying social conflict by reviewing longitudinal data from 2002 until 2012. The study covers more than 200 countries, taking data from the World Bank, International Monetary Fund, United Nations, U.S. Central Intelligence Agency, and the University of Heidelberg.

For decades, economists and social scientists have used various economic factors as one method of explaining phenomena of interest. This thesis correlates a set of economic variables consistent with economic resiliency and uses them in a longitudinal study of intrastate social conflicts. Credit rating agencies such as Moody's and Standard & Poor's have long considered a country's level of economic resiliency to be a key factor in their evaluation of a country's sovereign bonds. In other research studies, economic factors in various combinations are used to explain the nature of social conflict in many discrete cases and specific countries. By reviewing this data, this thesis provides an empirical explanation of the nature of conflict by examining common economic factors that appeared consistently over the study period. The results of this analysis are used to predict the incidence of intrastate social conflict.

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Chapter I

Introduction

Throughout history, people have used public gatherings as one way to call attention to common issues or disputes against a political authority. Such actions are often the beginnings of social conflict. When protests grow in size and intensity, conflict begins and, quite often, violence erupts.

Social conflict can be both constructive and destructive. Sometimes it can be constructive when the outcome produces a meeting of the minds. It can be destructive if unrest escalates into a conflict that involves violence and chaos. The causes for conflict are many and varied. Whether rooted in political, economic, or social issues, these catalysts often generate environmental conditions that spark social conflict. This thesis will explore the nature of intrastate social conflict that is rooted primarily in economic causes. This thesis will also identify and explain the economic indicators that may be associated with the resulting civil unrest. In this thesis, I use the term "social conflict" in the qualitative sense. When measuring conflict, I use "conflict" as a quantitative tool that varies by intensity from low levels to high levels of conflict.

In the field of international political economy, researchers find that the study of economics often affects how nations interact politically with other nations. I believe a long-term study of the interactions between economics and domestic social conflict would be even more revealing. Both areas of study are already subjects of general interest and research. It is becoming increasingly clear that in order to understand international

relations, researchers must have a firm understanding of economics and its impact on the social infrastructure and political institutions of a specific state.[1] As these political institutions influence the economic conditions of every country, a study of how such institutions control national conditions could ultimately affect the stability of a controlling government.[2]

Studies have found that social conflict tends to be less in countries with stable economies, while such conflict may be higher in countries with unstable economies.[3] Eruptions of intrastate unrest can be a catalyst for radical, often violent change. If the issues are not resolved and economic crises occur, the end result is often a change in the local political regime.[4] In the words of Hernando de Soto, a famous Peruvian economist: "And in the past, when their [the underclass'] rising expectations were not met, that mass of angry poor brought apparently solid elites to their knees. . . ."[5]

This thesis focuses primarily on identifying the economic variables associated with social conflict and then explores how the possible independent variables can be used to explain specific levels of social conflict. Additionally, this thesis will define certain

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[1] Jeffry A. Frieden, David A. Lake, and J. Lawrence Broz, *International Political Economy: Perspectives on Global Power and Wealth,* 5th ed. (New York: Norton, 2010).

[2] Frieden, Lake, and Broz, *International Political Economy,* 246–247, 333–336.

[3] See, for example, Ha-Joon Chang, *23 Things They Don't Tell You about Capitalism* (New York: Bloomsbury Press, 2010); Frieden, Lake, and Broz, *International Political Economy*; Thomas Oatley, *International Political Economy,* 5th ed. (Glenview, IL: Pearson Education, 2012).

[4] Oatley, *International Political Economy*.

[5] Hernando de Soto, *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else* (New York: Basic Books, 2000), 212.

models that can be used as predictive tools for the incidence of conflict and levels of social conflict.

For the dependent variable, I use an index on conflict intensity as a categorical measurement of social conflict to operationalize the notion of social conflict while excluding interstate conflicts.[6] The thesis scope explores only economic factors; it does not explore social, political, and religious explanations for conflict and unrest.

I begin by providing an overview of the literature, focusing on interactions between economics and social conflict. Many researchers agree that there are associations between the two factors. I argue, based on more than a decade of data from over 170 countries, that the interactions between societal and economic factors generally precede social conflict. While the interactive effects of some economic factors and social conflict can be measured, there is less agreement on the specific causes of conflict and the direction of a "cause-and-effect" relationship. Moreover, many scholars make a distinction, based on international and domestic perspectives, between political and economic factors and their interactions, with societal impacts often classified together with economic factors.

This thesis is not an exhaustive review of current literature on the dynamics between economics and social conflict. Rather, it presents a limited, yet reasonable cross-section of some of the more prominent scholarly reports that address social conflict in the context of potential economic factors. Currently, there is a vast amount of literature on the topic of social conflict or civil unrest as a general category of research. There are

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[6] Heidelberg Institute for International Conflict Research, University of Heidelberg website. "Datasets," *Conflict Barometer, 2002–2012*. Available from: <http://www.hiik.de/en/konfliktbarometer/index.html>. (Accessed December 13, 2014 and January 24, 2015.)

many different viewpoints and theories on possible underlying causes of social conflict, such as religious fervor, ethnic violence, and military action. In fact, I hope that this thesis will serve as a catalyst for using econometric techniques to conduct further research and quantitative testing of economic theories as they apply to social conflict. To that end, I present selected empirical economic data that support associations between economic conditions and social conflict.

Research Problem

In the thesis, I describe important economic factors that are consistently identified in the current body of research as variables that could lead to social conflict in a country. Quantitative methods that utilize these variables are found in many studies and in a variety of differing contexts. While it is premature to draw any assumptions of causation, these economic factors cannot be ignored when studying the underlying causes of social conflict.

Many economic indicators can act as explanatory variables, but in the spirit of brevity, I focus on a select group of economic factors associated with a country's economic strengths and weaknesses. Thus, measurements of economic strength are classified as variables for "economic resiliency," while measurements of economic weaknesses are categorized as variables of "economic vulnerability." For example, "economic resiliency"[7] is a broad term used by economists to characterize the ability of a

[7] Stephane Hallegatte, "Economic Resilience: Definition and Measurement," World Bank Policy Research Working Paper No. 6852, 2014. Available from: <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2432352>. (Accessed February 28, 2015.) See also: "Moody's Sovereign Methodology 2013," Moody's Investors Service, September 12, 2013. Available from: https://www.moodys.com/research/Moodys-publishes-sovereign-rating-methodology--PR_282238>. (Accessed March 10, 2015.)

country to respond to crises (production shocks, environmental losses, social upheavals, destruction of property, etc.) and then reconstruct and recover. On the other hand, "economic vulnerability" factors are those elements that can create burdens for particular country, and "externalities" that can have a negative impact on the country's economy. Economic vulnerability factors, such as governmental debt levels, inflation, and interest rates, are also considered in my analysis.

Some economists developed models to rate the resiliency of nations and their vulnerabilities to such externalities. I consider some of the variables of economic resiliency as potential predictors of social conflict, and I classify countries (as a unit of analysis) by their varying levels of economic resiliency in order to associate them with and explain social conflict. I examine the economic resiliency and the vulnerability factors of countries over a study period from 2002 until 2012. Both economic resiliency and vulnerability have been well documented by national credit rating organizations, such as Standard and Poor's and Moody's, that utilize economic factors in their continual assessments of a country's credit risk and credit worthiness. However, their work does not necessarily cover social conflict. The rating agencies concentrate their efforts on evaluating a country's ability to pay interest and principal on sovereign bonds and other securities. Moreover, their analyses to determine credit ratings (from the highest rating, "AAA," to the lowest rating, "D") are based on an evaluation of a country's resiliency when responding to economic shocks and crises.[8]

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[8] "Moody's Sovereign Methodology 2013"; Standard & Poors, "S & P's Sovereign Government Rating Methodology" (Standard & Poors, June 30, 2011); Laura Jaramillo, and Catalina Michelle Tejada, "Sovereign Credit Ratings and Spreads in Emerging Markets: Does Investment Grade Matter?" (International Monetary Fund, March 2011), 3–5.

I have selected certain economic variables that are important in a general evaluation of economic resiliency as it relates to social conflict. Several models are presented to measure the degree of association that these variables could have on a level of social conflict. Then I attempt to predict the risk of future conflict.

Research Questions

In this thesis, I hypothesize possible explanations to the following research questions:

1. What important components of economic resiliency could possibly be associated with social conflict?
2. What is the risk (or probability) that social conflict can occur given the combined effects of economic components in a given country?
3. Can these economic components serve as indicators to predict the risk of social conflict?
4. If such economic components could be used to predict social conflict, what are the potential mitigants that could be considered to reduce conflict?

While there are many economic variables, some are not readily measurable or data is missing or incomplete. In my research and analysis, no single variable had a particularly strong impact on social conflict. Interestingly, I discovered that when the data about several economic factors were grouped to form an index, there was a tendency toward interactive impact. When the combined interaction of these variables reached a certain threshold level, the data appeared to indicate an increased tendency and incidence of social conflict.

Economists and researchers have previously combined many different variables in an effort to explain conflict in specific cases and situations. The ordinary least squares (OLS) regression method was used in almost all such cases, but usually in a cross-sectional context often involving a single time period for one country or small cluster of countries. My goal is to extend some of the work done by other researchers and to consider their work as possible explanations of social conflict.

My research involves a multi-country approach over an extended period of time using econometric techniques to control the effects of the economic variables. I also explore different combinations and mathematical transformations of variables that might strengthen or weaken an economic activity and then apply those variables in tests to determine if they might be a promising economic tool for predicting social conflict.

Research Methodology

In approaching the subject of social conflict, I take the position that liberalism and neoliberalism can provide rational explanations for social unrest. Liberalism espouses the belief that democratic governments tend to have less conflict due to economic interdependencies and free trade.[9] With liberalism, the audience costs associated with conflict—both interstate and intrastate—can be detrimental to a country's economy, and such costs will enter into decisions made by national leaders when weighing the benefits of economic growth versus the potential heavy cost of conflict.[10] Neoliberalism extends

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[9] Bruce Russett, "Liberalism," in *International Relations Theories: Discipline and Diversity,* ed. Timothy Dunne, Mijla Kurki, and Steve Smith, 94–113, 3rd ed. (Oxford, UK: Oxford University Press, 2013).

[10] Russett, "Liberalism," 104; also James D. Fearon, "Domestic Political Audiences and the Escalation of International Disputes," *American Political Science Review* 88, no. 3 (1994): 577–592.

these ideas to include a global market economy while emphasizing less government regulation over free markets.[11] In testing these theories, I adopt a positivist approach in which scientific testing of measurable data is used to support my theory that economic variables can have an influence on social conflict.[12]

In the past, researchers have used different measures to identify various types of social conflict. However, the research was usually limited to case studies involving religious, moral, social, or ethical issues in specific countries or regions. My intent is to take a broad view of the world and attempt to establish links between economic factors and social conflict using variables normally associated with macroeconomics. By using data from a variety of countries over a span of time, such information could be useful in identifying causes of unrest.

My research hypothesis begins by considering which explanatory economic variables are associated with the dependent variable "conflict," which I have selected to measure social conflict. I will measure the incidence of conflict with an operationalized variable I call "Conflict Outcome," and the intensity of such conflict using a categorical variable called the "Conflict Barometer" (explained in detail in Chapter II). The explanatory variables are limited to those typically consistent with economic resiliency and measured by a range of macroeconomic and microeconomic factors, such as a country's economic and fiscal strength, and other related factors.

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[11] Keith L. Shimko, *International Relations: Perspectives, Controversies and Readings*, 4th ed. (Boston, MA: Wadsworth, Cengage Learning, 2010), 167–168.

[12] Milja Kurki and Colin Wright, "International Relations and Social Science," in *International Relations Theories: Discipline and Diversity*, eds. Timothy Dunne, Milja Kurki, and Steven Smith, 3rd ed. (Oxford, UK: Oxford University Press, 2013), 18.

After dealing with the data problems, I determined the specific economic factors by a correlation analysis that assesses the degree of association among the variables. The variables with strong degrees of association were selected and compared against each other to reduce the level of serial correlation among the variables, which would render certain econometrics techniques inapplicable. The variables that were selected were also consistent with my hypothesis. Although there were other variables that would have offered additional support, they were eliminated because of data sufficiency and reliability problems and statistical concerns. (Such other variables include: unemployment, trade exports and imports, domestic credit, money supply, local exchange rates, government expenditures, poverty levels, literacy rates, infant mortality, etc.)

I organized my economic variables by two general categories: economic resiliency and economic vulnerability. Economic resiliency refers to the internal country characteristics that contribute to foundational factors of each country.[13] Economic vulnerability refers to externalities that a country could face that could affect its economy.[14]

My empirical analysis involves the use of econometric techniques to establish a relationship between economics and unrest. The specific techniques are specialized regressions and cross-tabulation tables with appropriate tests to address the strength of the relationship and validity of the model to support my hypothesis. Each variable undergoes mathematical transformations to conform its time-series datasets for ease of

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[13] Hallegatte, "Economic Resilience"; L. Briguglio, G. Cordina, N. Farrugia, and S. Vella, "Economic Vulnerability and Resilience: Concepts and Measurements," *Oxford Development Studies* 37, no. 3 (September 2009): 229–248.

[14] Briguglio, et al., "Economic Vulnerability and Resilience."

analysis and interpretation. The specialized regressions are panel-data versions of the logit and probit models (and their categorical counterparts, ordinal logit and ordinal probit).[15]

In general, my analytical procedures involved isolating each of the explanatory factors and mathematically transforming some of them (using natural logarithms) to account for numerical scaling and percentage changes in the metric, rather than changes in the absolute levels. Although doing so introduces statistical variations due to estimation errors, I used certain econometric techniques to minimize residual estimation errors to within tolerable levels.

In my research, I conducted statistical tests to determine the degree of relationships between two or more variables, as well as to test for their statistical significance. Statistical significance is important because any results achieved are not necessarily the result of random error, and any inferences about the relationship can be deemed noteworthy. Other econometric and statistical techniques are used to determine the direction and nature of the relationship of the economic variables and conflict intensity and the validity of the specialized regression models.

Finally, I discuss the predictive power of each model with a comparison to actual outcomes during the study period.

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[15] For further information, see: James H. Stock, and Mark W. Watson, *Introduction to Econometrics*, 2nd ed. (Reading, MA: Addison Wesley, 2007), 383–420; Jeffrey M. Wooldridge, *Introductory Econometrics*, 3rd ed. (Mason, OH: Thomson South-Western, 2006), 583–631.

Research Modeling Limitations

One limitation in my research is the completeness, reliability, and quality of economic variables supplied by the various countries in my study. Some countries are able to supply high-quality information about their economies, while some countries cannot or will not. Therefore, this thesis includes information only from those countries that have acceptable data for analysis during the study period from 2002 until 2012. For countries where such information is not available, perhaps my thesis will stimulus further research when quality data becomes available, thus enabling future scholars to explore the economic conditions that may give rise to social conflict and to use the models I present to analyze those relationships.

While the models presented in this thesis are analytically interesting, the predictions made by them should be considered "in sample" analyses, and any future predictions would demand additional research and analysis to make these models robust in predictive quality.

I hope my research will illustrate and highlight the combinations of economic factors that may be used to measure and potentially forecast the conditions that foster social conflict, and that my findings will provide another method for developing appropriate economic policies that could reduce the intensity of future unrest and conflict.

Chapter II

Factors of Social Conflict

Author Keith L. Shimko writes:

> Why is conflict inevitable? Social conflict has both rational and irrational bases. Group or collective egoism is one of the irrational sources of conflict. When people and groups believe that they are not merely different, but also better than others, this is a recipe for conflict. . . . Conflict also results from the impossibility of creating a social, *economic*, and political order that benefits all equally. . . . Those who would benefit from changing the status quo will always come in conflict with those who benefit from the existing order. This is the essence of social, *economic*, and political conflict.[16] [emphasis added]

Since the beginning of recorded history, social conflicts have arisen over the control and allocation of resources, and the wealth and power associated with the possession of resources. A lack of resources or the deprivation of resources and wealth sets the stage for poverty, an economic condition. Author Robert Gilpin notes: "In a world of scarce resources and conflict over those resources, human beings confront one another ultimately as members of groups, not as isolated individuals."[17]

Social conflict ranges from minor disputes, to wars, even to terrorism. The economic factors most often recognized by social scientists are, as Robert Hinde writes: "Overpopulation, poverty, and political dislocation are no doubt important background

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[16] Shimko, *International Relations*, 37.

[17] Robert Gilpin, *The Political Economy of International Change* (New York: Columbia University Press, 1986), 305.

factors in the genesis of terrorism," and he warns that "as disparities in wealth and opportunity on our planet widen, the problem is certain to get worse."[18]

In order to understand social conflict, it is important to understand its provenance. Since the beginning of civilization, people have gathered into groups to foster change, express a view, or fight a war. Looking back, economic conditions were often identified as potential catalysts for those events. In his Pulitzer Prize winning book, *Guns, Germs and Steel*, Jared Diamond discusses many examples of how, for many centuries, human societies around the world have engaged in conflict over control of resources (an economic wealth component) to the detriment of human lives and cultures.[19] He notes in another of his books, *Collapse*:

> When people are desperate, undernourished, and without hope, they blame their governments, which they see as responsible for or unable to solve their problems. They try to emigrate at any cost. They fight each other over land [an economic resource]. They kill each other. They start civil wars. They figure that they have nothing to lose, so they become terrorists, or they support or tolerate terrorism.[20]

Before identifying specific economic factors associated with social conflict, it is important to define the concept.[21] For purposes of this thesis, I define "social conflict" as the extent to which states or countries are engaged in internal conflict in response to a lack of economic resiliency and/or exposure to economic vulnerabilities. Social conflict

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[18] Robert Hinde, "Root Causes of Terrorism," *Pugwash Online* 30 (2002). Available from: <http://www.pugwash.org/september11/hinde.htm>.

[19] Jared Diamond, *Guns, Germs, and Steel: The Fates of Human Societies* (New York: Norton, 1999), 265–321.

[20] Jared Diamond, *Collapse: How Societies Choose to Fail or Succeed* (New York: Penguin, 2005), 516.

[21] I use the term "social conflict" as a preferred term throughout the text. However, I occasionally use the terms "civil unrest" or "social unrest," both of which also mean social conflict.

is a complex phenomenon with many dimensions, and it involves numerous actors that have the ability to create and control conflict. On one hand, it could involve a group demonstrating about or peacefully advocating an overlooked issue; or that single group could erupt into a cohesive, political group vying for control of a state. Ultimately, the motivations for social conflict are as complex as the study of human nature and behavior.

Moreover, the methods of protest can affect the level of unrest. At a lower level of social conflict, actors may peacefully protest an issue by rallying publicly and voicing their opinion, hoping this will prompt some action. Subsequently, these actors disperse and go home. Another level of social conflict involves varying levels of violence, and soon the issue becomes more important than life itself. With increasing technology and the use of the Internet and media, actors engaged in social conflict have an international platform for expressing their grievances. Economist Hernando de Soto notes: "But as information and communications continue to improve and the poor become better informed of what they do not have, bitterness over the legal apartheid is bound to grow."[22] The stakes are perceived to be so high that the actors will risk life and limb to support them.

Although the manifestation of social conflict is difficult to generalize across all countries, its source can be classified into at least two categories: political and economic. As stated earlier, many of the political reasons for social conflict are difficult to measure quantitatively given current problems that make it difficult to obtain consistent and reliable data. However, economic data continues to be collected and can be used to measure conflict and unrest.

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[22] de Soto, *The Mystery of Capital*, 213.

From an economic perspective, social interventions defined by trade and resource allocations have been in existence throughout history. The methods of accumulating resources and securing economic power have created social classes of people that appear to remain consistent over time and countries, that is, the rich and the poor. Manifestations of unrest can be found throughout history, typically rooted in the behavior of one group of people (the poor) in response to the control of resources and wealth by another group (the rich). Many countries enduring social conflict appear to have a small group of leaders and elites who control an inordinate amount of public resources, which ultimately deprives the general population of needed economic endowments. In many studies undertaken by economists and researchers, "[d]eteriorating economic conditions [have] sparked protest and political instability,"[23] and this economic disparity often becomes the source of social conflict. As authors Daron Acemoglu and James A. Robinson note in their book, *Why Nations Fail*:

> Conflict over scarce resources, income, and power, translates into conflict over the rules of the game, the economic institutions, which will determine the economic activities and who will benefit from them. . . . Who the winners of this conflict are has fundamental implications for a nation's economic trajectory.[24]

I use several economic variables to support the disparity that may explain such social conflict.

Social conflict includes several aspects that can be qualified by level of conflict intensity. To operationalize the concept, I identified various intensity levels so that the

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[23] Oatley, *International Political Economy*, 331.

[24] Daron Acemoglu, and James Robinson, *Why Nations Fail: The Origins of Power, Prosperity, and Poverty* (New York: Crown Business, 2013), 86.

associations with factors of unrest will be representative and testable for each level of social conflict. I identified three major levels of social conflict that appear most often and typically vary by degree of intensity depending upon the literature. They are:

1. *Dispute or peaceful protest*: including civil disobedience, civil resistance, and non-violent direct action.

   This type of protest is characterized as civil action in the form of peaceful group gatherings assembled publicly to voice their views and beliefs on an issue or grievance. Often such protests provide a public forum for groups to be heard, and their goal is to prompt a political authority or entity to address or resolve the issue. Each type of peaceful protest has been the subject of research in the past, and it is likely that other researchers will continue to study them in the future.

2. *Violent protest*: including violent direct action, and terrorism.

   Sometimes peaceful protests do not result in action by the authority. Protesters may become discouraged and agitated, and some members resort to violence in order to gain attention. Violent direct actions occur when frustrated and angry groups resort to the use of force to rebel against, or attack a government or enterprise entity. When this occurs, injuries and deaths may result.

   An extreme form of violent direct action is terrorism in which radicalized groups use deadly force on people and property. At this point, terrorism becomes an unacceptable crime rather than a civil action. Such violent direct action can take different forms, some of which have been the subject of continual research.

3. *Armed struggle*: including armed insurrection, armed conflict, and civil war.

   Social conflict sometimes erupts into armed struggle in which groups form militias and take violent military action against a political authority or entity. Weapons are deployed against an adversary and its constituency in an attempt to bring about change by force. Such struggles often become military operations that lead to widespread devastation, destruction of property, and countless casualties.

Measuring Social Conflict

In my research, I measured the scope of social conflict in terms of the degree of conflict intensity. I limited my discussion of social conflict to that associated with economic conditions on an intrastate level. Interstate conflicts involving external warfare (between country dyads) are specifically excluded. As mentioned in Chapter I, I have not considered conflict associated with religious and ideological views, social causes, and moral issues. Using the degree of conflict intensity, I examined specific economic issues that are most associated with social conflict.

Conflict Barometer

One instrument for measuring social conflict is the Conflict Barometer, developed in 1992 by researchers at the University of Heidelberg. [25] The Conflict Barometer is an index comprised of specific factors that contribute to social conflict. These factors are: the specific actors, the number of casualties, the number of personnel deployed to control the conflict, the use of weapons, and the degree of destruction (to property, infrastructure

[25] Heidelberg Institute, *Conflict Barometer.*

and the economy). In general, the barometer first classifies the factors by levels of violence (binary: non-violent or violent) and the level of intensity, with specific ranked scores to quantify the consequences of conflict. Each factor provides an ordinal scale that is indexed by quantiles to assume the final scales from "1" to "4". I used the Conflict Barometer to measure social conflict—the dependent variable. According to Heidelberg Institute, a conflict is defined as:

> A positional difference between at least two assertive and directly involved actors regarding values relevant to a society (the conflict items) which is carried out using observable and interrelated conflict measures that lie outside established regulatory procedures and threaten core state functions, the international order, or hold the prospect of doing so.[26]

The Conflict Barometer displays "conflict intensity" levels in rank order using the following conflict index levels:

1. Dispute: general political conflicts, civil disobedience, or non-violent direct action.
2. Non-Violent Crises: an escalation of unrest involving public demonstrations and displays of confrontation with the country's political authority.
3. Violent Crises: an escalation to the use of force with the consequence of destruction of property, human casualties, etc.
4. Limited Wars: further escalation to armed confrontations among actors with marked increases in loss of life, destruction of property and heightened risk of civil war.
5. War: Military confrontations with massive human casualties, extensive destruction of property, and political and social turmoil.

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[26] Heidelberg Institute, *Conflict Barometer.*

I chose the Conflict Barometer for the ready availability of its annual time-series datasets and the high level of research data that provided not only measurable ordinal rankings of the data organized by country but also each country's individual Conflict Barometer levels and in-depth discussions of research findings. The Heidelberg Institute assesses the degrees of conflict intensity for over 200 countries and the Institute has followed the progress of country conflict since 1997.

Economic Resiliency

Broadly speaking, economic resiliency measures the "shock-absorbing" capability of a country—its ability to weather, or at least dampen, certain financial shocks that could adversely affect the macroeconomic and microeconomic conditions of a country. Such resiliency enables a country to "bounce back" or recover quickly, thereby forestalling the possibility of citizen revolts against the government. In other words, if the economy recovers quickly, government leaders can quell possible social conflicts, implement financial and economic incentives, and minimize protests. Ranking a country by its level of economic resilience and subsequent impact on conflict makes it possible to identify countries that display a propensity for conflict.

An earlier work on economic resiliency was written by researchers at the University of Malta[27] who operationalized the concept by using a set of economic variables to explain why some countries recovered from economic shocks and some did not. Their work was largely cross-sectional (i.e., single-year studies of a select group of countries), and it did not relate resiliency to social conflict. Based on their earlier work, I

[27] Briguglio, et al., "Economic Vulnerability."

extended the analysis by including more countries and using sets of time-series data that cover more than a decade and focus on social conflict.

Study Parameters

I embarked on a longitudinal study from 2002 to 2012, in which I decomposed economic resiliency into several key macroeconomic variables to explain conflict over a longer period. Within this study timeframe, I used datasets from 214 countries with hundreds of variables for each country, compiled by the International Monetary Fund, the United Nations, the U.S. Central Intelligence Agency, and the World Bank.[28] Not every country reported reliable data consistently and completely. However, for my study period, the data is reasonably consistent, and I analyzed only cases with complete data; I did not consider countries with incomplete data.

I ranked the results on a scale to determine the level of risk exhibited by each country. Then I followed the development of social conflict over time to determine if my hypothesis held. By classifying countries based on their risk of social conflict, I could measure the likelihood of conflict and identify what steps a government could consider to reduce conflict. This enabled me to develop my hypothesis further and proactively develop possible risk mitigants.

I took a quantitative approach to my research, using econometrics and statistics to draw inferences regarding data on social conflict, economic resiliency, and vulnerability.

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[28] World Bank, *Data*, 2015. Available from: <http://data.worldbank.org/>. (Accessed January 24, 2015.); U.S. Central Intelligence Agency, *The World Factbook*, January 2015. Available from: <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2092rank.htm>. (Accessed January 24, 2015.)

I also present additional quantitative data on other variables in an attempt to answer the research questions posed in Chapter I.

All of the data are organized by country. I recoded the data to isolate the type of conflict, whether internal or external. My focus was on internal intrastate conflicts because I believe they are more likely to give rise to conflicts stemming from economic conditions as compared to external conflicts between countries that may not necessarily be rooted in economic conditions.

I characterized internal conflicts as any events of social conflict that were largely contained within the borders of any given nation. Such events included civil disobedience, all forms of direct action, and riots that were limited to one state. The Conflict Intensity level generally distinguished the degrees of conflict, ranging from peaceful protests to violent armed conflicts.

External conflicts were characterized as conflicts involving another nation outside of a specific country's borders. Such conflicts ranged from border disputes over resources (e.g., oil, gas, or water) to violent armed wars with a neighboring country or a distant adversary. Here the Conflict Intensity level was added and calculated to rank the level of conflict—from peaceful negotiations over an issue to violent military operations. However, to focus the analysis on intrastate conflicts, I combined external conflicts with the highest conflict intensity category of armed conflict, given that external conflicts tend to be armed conflicts that will likely involve internal social conflict (i.e., anti-war protests).

Indicators of Economic Resiliency and Vulnerability

With regard to the economic variables, I used the following key economic indicators:

- Macroeconomic stability:
  - Gross Domestic Product per capita[29]

    Gross Domestic Product per capita (GDP per capita at constant 2005 U.S. dollars) is a perennial measure of economic wealth used by many economists. While it is a popular metric, it tends to simplify the relationship between a country's wealth and its population base. If a country's GDP is completely controlled by the government and its elites (e.g., North Korea), the GDP per capita is not a representative measure of economic prosperity since the metric is simply the nation's GDP divided by its population base. A substantial portion of the GDP is "owned" or "controlled" by a limited segment of the population. Income disparities that exist in any one country are not recognized (the GINI coefficient would have been a useful metric, but due to data limitations it was not available for most countries for the study period). Despite the limitations of GDP per capita noted above, it did provide a consistent measure due to its availability.
  - Population Size (and a variant: Labor Force Size)[30]

    The size of a state's population and labor force is an important variable of the economic health of a country. While the population base is its primary assets, it also represents the level of its consumer and production base. Of particular

[29] World Bank, *Data*.

[30] World Bank, *Data*; U.S. CIA, *World Factbook*.

importance is the labor force, which represents that part of the country's production base that could bring about economic growth and sustainability. Typically, the labor force consists of people between the ages of 15 and 64 who are ready, willing, and able to work.

- Inflation[31]

  Inflation is an estimate of the annual percentage increase in the prices of a selected basket of consumer goods. Inflation affects the supply of and demand for consumer goods. While it is not always a representative measure, it does reflect the general trend in the cost of goods and can become a vulnerability for a country when it is not controlled by government policies.

- Microeconomic market efficiency:
  - Trade and Exports[32]

    Trade is the combined total of exports (what a country sells) and imports (what a country buys). Exports tend to enrich countries and provide a foundation for economic growth and wealth. However, when the country's elites control most of the exports and the trickle-down effect tends to be limited.

  - Government Obligations (Government Debts and Claims)[33]

    Government Obligations (or Government Claims) measures the level of the central government's debts and other obligations. It is a measure of economic vulnerability since an indebted government with overextended financial

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[31] World Bank, *Data*; U.S. CIA, *World Factbook.*

[32] World Bank, *Data*.

[33] World Bank, *Data*.

obligations will have limited capacity to recover from economic shocks to its system.

- Interest Rates[34]

  Interest rates represent the cost of capital for a country. When interest rates are adjusted for inflation, the rates become measures monetary policy effectiveness. Foreign investors typically view interest rate levels as a metric in the investing attractiveness of a country. In addition, low interest rates tend to encourage economic growth, while high interest rates tend to retard economic activity.

- Social development [35]

  Social development is characterized and measured by infant mortality rates, literacy rates, education and training metrics, number of primary and secondary schools, universities, health and welfare expenditures, etc. In general, the higher the level of any of the above measurements, the higher the level of social development.

- Life Expectancy[36]

  Life expectancy statistics are compiled by the World Bank and the United Nations based on models that project the life expectancy of a child born in a certain country in a specific year. The measure implies the level of social development of the healthcare infrastructure of a given country.

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[34] World Bank, *Data*.

[35] World Bank, *Data*.

[36] World Bank, *Data*.

I used each of these indicators of economic resiliency in combination with other variables to measure economic resiliency, such as growth, prosperity, and national vulnerabilities.

The above variables are a few of many economic variables collected from various sources used to explain unrest. Most likely, there are more variables to be considered that future researchers can isolate and be compliant to the statistical internal and external validity tests. Every attempt was made to review the data carefully for completeness and reliability, but I cannot be certain given the current state of the reporting process that countries are expected to comply. The economic variables selected for my final modeling efforts, which used the Stata statistical software system,[37] are acceptable from a statistical point of view and an analysis of the findings is available for independent reproduction. In spite of the rigorous amount of statistical testing, I make no claims that there is a true cause-and-effect relationship between economic factors and unrest. I only provide evidence of association that correlates economic variables to conflict that provide plausible explanations for social conflict.

[37] *Stata Longitudinal-Data/Panel-Data Reference Manual: Release 11* (Stata Press, 2009). Also available from: <http://dl.acm.org/citation.cfm?id=1717235>. (Accessed March 14, 2015.)

Chapter III

Literature Review: Schools of Thought

In the literature on the subject of social conflict, researchers tend to fall into three main schools of thought, each sharing a common set of factors but with differing views on these factors or with new explanatory variables added. I classified these schools of thought as "approaches," and identified each one as follows:

- *Classical Approach*: involves certain economic variables that appear consistently in research reports over the past 40 years.
- *Exo-Classical Approach*: includes many Classical approach variables, but also introduces new exogenous variables that could be associated with social conflict.
- *Endo-Classical Approach*: includes many Classical approach variables, but also introduces new endogenous variables that could be associated with social conflict.
- *Novel Approach*: borrows very few, if any, variables from the Classical approach, but instead presents new and interesting variables that may be associated with social conflict.

The first three approaches are similar in their fundamental construct but differ in the nature of their added factors (i.e., exogenous versus endogenous). The Novel approach has few or no Classical variables. Instead, it uses new instrument variables that are statistically significant in the context of the study.

In the majority of the literature, the studies were limited to cross-sectional studies on a country or a cluster of selected countries and these studies did not discuss the ability

of their quantitative models to provide any predictive capacity. However, their collective work provided the connection between economic theory and the potential for social conflict.

The Classical Approach

More than 40 years ago, a report entitled, "An Economic Indicator of Socio-Political Unrest,"[38] outlined several key economic factors underlying political unrest. These factors were not related to social or political grievances (such as voter rights, ethnic conflicts, or moral issues). While I did not perform a comprehensive search of every early study on this topic, the above report was the earliest I could find that identified measurable economic factors. For purposes of this thesis, I have labeled them as "Classical" factors that can be applied to a state entity:

1. Income or Earnings: the individual income of each employed person
2. Unemployment Rate: percent of unemployed persons willing and able to work
3. Income Inequality: disparity between highest and lowest incomes
4. GDP Per Capita Income: income based on Gross Domestic (national) Product per person
5. Inflation: national rate of inflation on consumer goods
6. Trade: levels of exports and imports

These Classical factors were variables of interest in at least 30 research reports that cited these economic variables as having the potential to affect social conflict. The

[38] J. W. Zartman, J. A. Paul, and J. P. Entellis, "An Economic Indicator of Socio-Political Unrest," *International Journal of Middle East Studies* 2, no. 4 (October 1971): 293–310.

above factors have been most often, and these factors have withstood numerous scientific tests of validity conducted by researchers. Each factor was highly robust and exhibited persistent tendencies toward statistical significance in a wide range of studies in many regions of the world. Additionally, in many cases, conflicts with economic roots were not limited to a particular country. Throughout history, countries diverted attention from domestic economic problems in order to wage war with another country in an effort to control resources and for economic gain.[39]

Many research reports currently list at least two of the Classical factors as explanatory variables in different measures of social conflict (such as number of riots, number of deaths, etc.), and it appears that these factors helped form numerous generalized economic theories regarding social conflict. For example, Angrist (1995), Caruso and Schneider (2011), Duncan (2008), Hamilton (2005), Kehrberg (2007), Krueger and Mleckova (2003), Oyefusi (2010), Pastor (1995), Posner (2003), Smith (2009), and many other researchers cited at least three of these Classical factors in their research work products. Classical researchers tended to apply these factors in their national, regional, and local conflict studies. While their statistical regression models might differ (e.g., OLS versus logit), researchers generally used the Classical factors with different coefficients that often resulted in statistical significance.

The body of research that takes the Classical approach reveals that few studies used all six factors consistently. It appears that one shortcoming in the research was that the data needed in order to apply the factors was limited. For example, some researchers

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[39] James D. Fearon, "Rationalist Explanations for War," *International Organization* 9, no. 3 (Summer 1995): 379–414.

said individual income data were not available from the sample subjects of their studies. This meant the same factors could not be applied consistently across different countries due to unavailable or poor-quality data. Moreover, many countries may not have consistent measurements for economic parameters such as rate of inflation and unemployment. Thus, comparability and availability were concerns.

Many researchers of the Classical approach added other variables such as age, education, and marital status to function as controlling variables in their studies. For example, Krueger and Mleckova,[40] Kehrberg,[41] Oyefusi,[42] and Smith[43] introduced the variables "educational opportunities" and "educational enrollments" as control and/or explanatory variables relative to the incidence of riots, terrorism, and civil wars. It is interesting to note that when controlling for these variables, their models produced some highly plausible and interesting results.

The Exo-Classical Approach

Beginning in the 1990s, many researchers began to use statistical techniques and added new variables to increase the explanatory power of their models in their quest for a better understanding of civil conflicts. These new additions are called exogenous variables, and they include food demand, private investment levels, labor management

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[40] A. Krueger, and J. Mleckova, "Education, Poverty and Terrorism: Is There a Causal Connection?" *Journal of Economic Perspectives* 17, no. 4, (Fall 2003): 119–144.

[41] J. Kehrberg, "Public Opinion on Immigration in Western Europe: Economics, Tolerance, and Exposure," *Comparative European Politics* 5 (2007): 264–281.

[42] A. Oyefusi, "Oil, Youths, and Civil Unrest in Nigeria's Delta: The Role of Schooling, Educational Attainments, Earnings, and Unemployment," *Conflict Management and Peace Science* 27 (2010): 326–346.

[43] A. Smith, *Education and Civil Unrest* (Prairie View, TX: Prairie View A&M University, 2011).

levels, ethnicity, interest rates, and oil prices. I have named this school of thought the "Exo-Classical Approach" because the exogenous factors have increased the explanatory power of their models.

The introduction of these variables appeared to bring greater explanatory depth to the reasons for civil strife. For example, Caruso and Schneider presented a case where high long-term interest rates tended to discourage investments, which later affected future economic growth. They went on to associate interest rates to increases in terrorist activities.[44] In two other studies, Oyefusi[45] and Hamilton[46] proposed that oil price shocks tend to affect workers' wages in oil-exporting countries. Oil prices, as an exogenous factor, destabilized worker incomes and led to income inequality (a Classical factor), which later led to riots and violent protests.

The Endo-Classical Approach

Other researchers adopted the Classical approach but employed endogenous variables as possible explanations for incidents of social conflict, which I call the "Endo-Classical Approach." Examples of endogenous variables are: foreign exchange rates, and conditionality. Typically, endogenous variables create a "looping" effect that could affect future values of the same variable as it changes over time. For example, Dornbusch found that foreign exchange rates affect future rates of inflation and unemployment. He found

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[44] R. Caruso, and F. Schneider, "The Socio-Economic Determinants of Terrorism and Political Violence in Western Europe (1994–2007)," *European Journal of Political Economy* 27 (2011): 544.

[45] A. Oyefusi, "Oil, Youths, and Civil Unrest," 326–330.

[46] James D. Hamilton, "Oil and the Macroeconomy," *New Palgrave Dictionary of Economics* (London: Palgrave Macmillan). Also available from: <http://www.Dictionaryofeconomics.Com/dictionary>. (Accessed March 10, 2015.)

that when the rate of inflation changed, the rates of foreign exchange also changed in response to the change in inflation. Moreover, when the foreign exchange rate changed, it put additional pressure on the inflation rate to change again, thereby producing a feedback loop in which each factor continually affected the other. This looping effect led to monetary instability, as food prices spiraled out of control, hurting the poor and destabilizing their incomes, which in turn gave rise to social instability.[47] Endo-Classical researchers tend to use endogenous variables to demonstrate reasons why social strife may be attributable to questionable government policies that initiate an uncontrolled looping effect.

One other endogenous factor present in several literature sources was "conditionality," caused specifically as the result of International Monetary Fund (IMF) creditor-imposed conditions. For many developing countries, credit is an expensive resource. As an international lending institution to sovereign states, the IMF imposes many conditions as part of its lending policies. Among them are restrictive austerity measures that "choked off" economic growth and investment in many developing countries over the last two decades. Chossudovsky,[48] Testas,[49] and Woodroffe and Ellis-Jones[50] give numerous examples where the IMF's conditions had negative consequences

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[47] R. Dornbusch, "Equilibrium and Disequilibrium Exchange Rates," MIT Working Paper No. 309, Cambridge, MA, September 1982.

[48] M. Chossudovsky, "Economic Reforms and Social Unrest in Developing Countries," *Economic and Political Weekly* 32, no. 29 (July 19–25, 1997): 1786–1788.

[49] A. Testas, "The Economic Causes of Algeria's Political Violence," *Terrorism and Political Violence* 13, no. 3 (September 2010): 127–144.

[50] Jessica Woodroffe, and Mark Ellis-Jones, *States of Unrest: Resistance to IMF Policies in Poor Countries* (London: World Development Movement, 2000).

on debtor nations, which subsequently fostered increased political violence and economic hardship. Moreover, due to a lack of IMF oversight, some funds were diverted by certain regimes and used to finance military conflict and corrupt practices.

The literature review revealed numerous instances of surging religious fundamentalism as a cause of increased rebellion against IMF-financed regimes. The emergence of radical religious groups was highly correlated to high levels of unrest and terrorism.[51]

It was interesting to note that, after identifying these endogenous variables, I realized that in today's world, states often face endogenous factors that influence the future values of these variables. With the identification of endogenous factors, perhaps the models utilized in the Endo-Classical approach can reveal some real-world policy implications and insight that could prevent uncontrolled looping.

Although there is a clear need for policy reform (i.e., the IMF and its relations with sovereign debtor states), there is presently no economic leadership to foster the needed reforms. For example, Bremmer and Roubini found that the so-called "G-20 countries" have agreed to changes, but many other countries are afraid to enact such changes for political reasons—one being social conflict that could spiral out of control.[52]

The Novel Approach

All the Classical (including Classical, Exo-Classical, and Endo-Classical) researchers share many of the same factors in their respective approaches. However, in

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[51] Woodroffe and Ellis-Jones.

[52] Ian Bremmer, and Nouriel Roubini, "A G-Zero World," *Foreign Affairs* 90, no. 2 (March-April, 2011). Also available from: <http://www.worldpolicy.org/sites/default/files/uploaded/image/Bremmer%20and%20Roubini%20-%20G-Zero%20World.pdf>. (Accessed March 10, 2015.)

the Novel approach, researchers consider innovative or novel variables to add to their economic "toolbox." Such factors include happiness, ethical views, and rainfall. Graham outlines a set of factors that influence people's views of happiness, including health condition, marital status, infant mortality, and life expectancy. He also identified variables that classified a country's economics by its degree of happiness (or sadness) to explain its economic growth (or social conflict). While happiness was an interesting way to explaining social conflict, Graham did not provide enough empirical support for the explanatory power of each variable.[53]

Some researchers did not provide sufficient support for their reasoning to warrant inclusion of their novel variables. For instance, factors that support happiness may be control variables since levels of happiness are asymmetrical at different levels of income. That is, an extra dollar for a family earning ten dollars per day may not bring the same level of joy as for another family earning only one dollar a day.

Another interesting report by Miguel, Satyanath, and Sergenti identified rainfall levels as a factor that affected income growth (or lack thereof). After reviewing annual rainfall data, the researchers were able to associate it with outbreaks of civil conflicts that resulted in body counts.[54] This study had significant scientific merit since annual rainfall does affect agricultural levels and the corresponding level of workers' wages, especially in an agrarian economy.

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[53] C. Graham, "Some Insights on Development from *The Economics of Happiness*," *World Bank Research Observer* (Brookings Institution: Economic Studies Programs, April 2005): 201–231.

[54] E. Miguel, S. Satyanath, and E. Sergenti, "Economic Shocks and Civil Conflict: An Instrumental Variables Approach," *Journal of Political Economy* 112, no. 4 (August 2004): 725–753.

A research report by Vitell, Rawwas, and Al-Khatib indicated that ethical beliefs were reinforced among people who had been hardened by daily threats of war and strife. They experienced "ethical numbness," defined as a "lack of consideration for the life of other people." This ethical numbness desensitized people to death and destruction and increased their propensity for terrorism, which in turn gave rise to vicious cycles of ongoing violence.[55]

Knowledge Gaps

Within the schools of thought, I could not find any separate analyses of the various aspects of social conflict. For example, factors that contributed to acts of civil disobedience (e.g., peaceful protests) were not shown to be factors associated with terrorism. Similarly, factors that impelled acts of terrorism were not shown to be the same as for civil war. While my literature review was not exhaustive, the treatment of the dependent variable *social conflict* was largely measured by the number of riots, deaths, and outbreaks. Consequently, future research may wish to consider a study of the economic impact on "peace protests," "violent protests," "armed struggles," and various typologies.

Another knowledge gap was the lack of predictive power of the explanatory variables. In the extant research, I did not see any discussion of the forecasting power of the researchers' models. There was little, if any, follow-up research to support the predictive power of their regression models.

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[55] S. K. Vitell, M. Y. Rawwas, and J. A. Al-Khatib, "Consumer Ethics: The Possible Effects of Terrorism and Civil Unrest on the Ethical Values of Consumers," *Journal of Business Ethics* 13, no. 3 (March 1994): 223–231.

Two groups of researchers did introduce the concepts of economic resilience and vulnerability. They classified many of their economic variables into two categories to segregate the resilient elements from the vulnerability elements of a country. These categories were formed into indices for resiliency and vulnerability to explain how certain countries responded to economic shocks better than other countries. The combination of the resiliency and vulnerability indices equated to an overall risk level for each country.[56]

Another knowledge gap that may exist is in correlating these index values and their combined value to other measures of social conflict. I did not find any attempts to forecast civil strife using these index factors, but I do not mean to imply that they do not exist. I chose, in this thesis, to select key variables that represent the best explanatory strengths of both economic resiliency and vulnerability and then apply them in the context of conflict.

By reviewing the literature on the subject of social conflict and categorizing it into various schools of thought, I could clearly see a gap in the literature on this topic. It is my hope that this thesis will contribute to a growing body of knowledge, and an understanding of social conflict, by considering the use of many economic indicators as a means of analyzing such conflict.

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[56] L. Briguglio, G. Cordina, S. Bugeja, and N. Farrugia, "Conceptualizing and Measuring Economic Resilience." Working Paper, University of Malta, Economics Department, 2006. See also: Briguglio, et al., "Economic Vulnerability and Resilience," 229–248.

Chapter IV

Economic Resiliency and Vulnerability

As noted in Chapter III, researchers at the University of Malta conducted one of the first studies of economic resiliency and vulnerability for a select group of countries.[57] Before embarking on my own analyses, I will discuss the concepts of economic resiliency and economic vulnerability as applied in my study.

Economic Resiliency

I define *economic resiliency* as a state's ability to cope with economic shocks and to recover in a reasonable amount of time. Resiliency is measured in terms of specific economic variables used by analysts at national credit rating organization to rate the credit status of sovereign nations.

In my research, I investigated exogenous economic shocks that tend to magnify the risk of GDP shortfalls for any given country. As an example, Singapore has been exposed to significant levels of external economic shock, but it still recovered rapidly. One reason for this resilience is that the government cultivated specific support factors, such as a well-developed capital market and a trade finance center, which helped the country recover more quickly despite periodic economic setbacks. With such support factors in place, a resilient country like Singapore can recover quite well in a short period of time and be ready to resume its national economic growth.

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[57] Briguglio, et al., "Conceptualizing and Measuring."

In contrast, when countries with low resiliency values encounter exogenous shocks, they may send the country into a recession. The ability to recover is likely to be limited, and the national economy will face significant challenges. If it is unable to recover, or if recovery is slow, the country faces a higher likelihood of social instability.

Economic Vulnerability

Economic vulnerability measures a state's level of exposure to economic shocks. Countries deal continually with economic factors that cause risks and challenges. Some risks can be managed; others cannot. A country's level of exposure depends on many factors: level of debt obligations, the cost of capital (i.e., interest rates), the strength of its banking system, and the number of domestic and foreign private banks. Any significant changes to these factors can instigate risk. When exposure to risk becomes apparent, the risk can be classified, indexed, and adjusted based on the country's size relative to its trading partners.

Exogenous economic shocks tend to magnify the risk of GDP shortfalls for a country. Again in regard to Singapore, that country was exposed to significant external economic shocks, but it recovered quickly because it applied policies that fostered economic resilience and enabled the country to "bounce back" within a short period. In this case, strong resilience was demonstrated because government policies fostered excellent management of the country's economic metrics and increased its ability to forecast future shocks.

In summary, the ability to cope with shocks and subsequently bounce back is one component of a country's resilience index relative to all other countries.[58] Some countries have low resilience, and exogenous shocks can send the country into recession. The ability of its economy to recover is limited as it faces significant challenges. Because of its inability to recover, the economy could face a higher likelihood of social instability.

In my survey of the existing literature on the subject of social conflict, I did not discover any writings that discussed economic resilience factors as explanations for social conflict.

[58] Briguglio, et al., "Conceptualizing and Measuring."

Chapter V

Quantitative Research Variables

My research was derived from data covering an 11-year period (2002 to 2012), and was obtained from the World Bank database and other sources.[59] I selected economic variables from the database, and those became the explanatory independent variables. Data for the dependent variables were obtained from the University of Heidelberg (Germany), and included data adjustments and refinements.[60] My econometric methods made use of specialized regression techniques: logit, ordinal logit, probit, and ordinal probit regressions on the time-series panel data. Chapter VI discusses these methods in detail.

Analysis Variables

As noted in Chapter II, many countries did not report consistent data that adequately measure economic resiliency or vulnerability. Even the World Bank database did not have a complete set of time-series data for the economic variables affecting many of the countries in this study. Consequently, my research study base is based solely on countries that had a complete set of data for the full study period. Of the 214 countries I

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[59] World Bank, *Data.*

[60] Douglas Bond, *Heidelberg Conflict Barometer as Adjusted and Revised* (Weston, MA: Virtual Research Associates, 2014).

expected to include in my study, 172 reported sufficient data that allowed me to include them as complete cases based on the economic variables I used.

The following economic indicators are explanatory variables that contribute to economic resiliency and vulnerability:

Gross Domestic Product (GDP): GDP is a useful measure of economic output for a given state.[61] One derivative of GDP is GDP Per Capita, which measures the average output per resident in a state based on its numeric population base.[62] By taking the natural logarithm of GDP or GDP Per Capita, the value of these variables is transformed and standardized to conform to a tighter range for the study period. This transformed variable also measures the percentage change rather than the absolute change in actual level. This variable contributes to economic resiliency.

Inflation Rate: This variable contributes to economic vulnerability. The annual Consumer Price Index was used to measure a country's inflation rate and to provide an indirect measure of its political institutional credibility and effectiveness.[63] For my analysis, this metric was transformed into natural logs.

Labor Force: This variable represents the segment of the population between the ages of 15 and 65 who are eligible and capable of working and can add productive capacity to the economy.[64] For my analysis, this metric was transformed into

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[61] World Bank, *Data*.

[62] World Bank, *Data*.

[63] U.S. CIA, *World Factbook*.

[64] World Bank, *Data*; U.S. CIA, *World Factbook*.

natural logs. This variable contributes to both economic resiliency and vulnerability.

Lagged Conflict**:** Social conflict is a phenomenon that can be random and persist from year to year. Since public demonstrations and conflicts are not subject to calendar-year restraints, the level of conflict in one year could logically lead to a continuation of conflict at least the same level the following year. Consequently, I included this variable, which mirrors the conflict level from the preceding year. This lagging variable was statistically significant in all of the models.

Life Expectancy: To account for differences in development, I needed an indicator that would cluster countries into groups of common categories. GDP per capita is a traditional measure of economic wealth and development. It is a statistic that is well maintained, and it is the World Bank's primary indicator to classify income. While it would have been convenient to use the World Bank categories of "low," "middle," and "high"-income countries based on GDP per capita,[65] I chose a different direction inasmuch as GDP per capita does not adequately account for social development. I found that Life Expectancy could be substituted as a variable that accounts for social development. This is based on the premise that life expectancy is generally associated with the level of education, literacy, and healthcare systems that provide a country's citizens with basic healthcare needs.[66] Life expectancy data are compiled by several other organizations: the United

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[65] World Bank, *Data*.

[66] Cora Drew, "U.S. Life Expectancy: What Factors Contribute to Low Rates?" (Health Capital Consultants, September 2011).

Nations, the Organization for Economic Cooperation and Development (OECD),[67] and the World Bank. This statistical metric was created to measure the predicted typical mortality of a child born in a particular country in a particular year. This metric requires continuous external review of each of the 214 countries in the World Bank database, so almost 94% of the data for this metric is complete.[68]

Development Index: Using both GDP per capita and Life Expectancy, I created this interactive variable to capture the combined impact of economic and social development for each country by year. Economic development is generally implicit in GDP per capita, and social development is implicit in Life Expectancy. First, I created separate categorical variables for GDP per capita and Life Expectancy, with an ordinal quantile scale from "1" to "5" for both variables. Next, I created a single interactive variable that is the product of the scaled rankings of both GDP per capita and Life Expectancy. In addition, I grouped countries by quintiles, ranking their scaled levels of the interactive economic and social development in 20% increment. Not surprisingly, countries such as the Canada, Japan, the U.K., and the U.S. ranked in the top 20% quintile of the Development Index.

In each of my regression models, the Development Index was used as a category variable to control and isolate the effect of development on social

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[67] OECD, *Health at a Glance 2011* (OECD, 2011), 24. Also available from: <http://www.oecd-ilibrary.org/social-issues-migration-health/health-at-a-glance-2011_health_glance-2011-en>. (Accessed March 6, 2015.)

[68] OECD, *Health at a Glance*.

conflict. Later in this chapter, I discuss my cross-tabulations on conflicts that are not symmetrical at different levels of economic wealth and social development. As an "indicator variable," it helps to explain the intensity of conflict in countries ranging from the lowest 20% in development to the highest 20% in terms of economic wealth and life expectancy. In other words, the quantiles of economic and social development allow for the further study into heterogeneous groups of countries at different levels of development. In my opinion, my approach of ranking countries by quantiles differs from the generally accepted approach of labeling countries as "developed," "emerging," or "developing," where such labels tend to be subjective and may lack analytical support based on data.[69]

Furthermore, the United Nations, World Bank, IMF, and many others have debated for decades on appropriate classifications for countries based on levels of development.[70] In the absence of a common taxonomic approach, GDP per capita continues to be the accepted measurement used by the World Bank.[71] Another indicator considered by the United Nations, World Bank, and the IMF is life expectancy, a strong candidate to supplement GDP per capita.[72] However, no agreement has been reached as of the writing of this thesis. Researchers, too, have identified life expectancy as a useful metric. Peter Marber notes in his book, *From Third World to World Class*:

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[69] World Bank, *Data*.

[70] Lynge Nielsen, "Classifications of Countries Based on Their Level of Development: How It Is Done and How It Could Be Done," *IMF Working Papers* (2011): 3–7.

[71] Worldbank.org website; Nielsen, "Classifications of Countries," 4.

[72] Nielsen, "Classifications of Countries," 7.

> Living standards—measured not only by Net Disposable Income or Gross Domestic Product per capita, but by life expectancy, daily caloric intake, infant mortality, and literacy rate—have improved to levels unprecedented in history.[73]

For example, suppose (based on the data for the length of the study period) Country A ranks in the top 20% in terms of GDP per capita and Life Expectancy. Country A's economic development rank would be "5" and its social development rank would be "5" (based on a scale of "1" to "5"). Both ranks are then multiplied together to obtain an interaction variable. In this case, the product for Country A would be "25" for its "Development Index Value."

All countries in the study period would be aggregated and distributed by quintiles and a new quintile index variable would be created with ordinal rankings from "1" to "5". In the case of Country A, its Development Index would be "5" along with its other cohorts in the top 20% ranking scale. Therefore, all the countries in the top 20% in terms of combined economic and social development rankings are a separate homogenous group; however, that group would be heterogeneous to the next 20% country group immediately below it. This ranking system would enable future study into the differences among the country clusters; it also improves on the arbitrary labeling of country clusters by "Developed" and "Developing." Finally, other variables may be considered as part of this indexing design to enhance the clustering of cohorts into both homogenous and heterogeneous clusters for future analysis.

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[73] Peter Marber, *From Third World to World Class: The Future of Emerging Markets in the Global Economy* (Reading, MA: Basic Books, 1999), 13.

The following variables are the dependent variables for my analysis:

Conflict Barometer: The dependent variable for social conflict was the Conflict Barometer,[74] which uses an intensity range of 1 to 4:

1: minor internal political disputes

2: non-violent crisis

3: violent crisis

4: limited war (civil and interstate).

In certain quantitative models, I retained the ordinal quality of the Conflict Barometer while collapsing the highest ordinal level (5) (for external conflict) into level (4) for convenience of analysis.

Conflict Outcome: For some models, I created a variable called "Conflict Outcome" that is a binary dichotomous variable to represent the presence or absence of conflict. This variable was derived from the Conflict Barometer. In such a case, the above code of "1" was recoded to "0" and all categories greater than 1 were recoded to "1." When this recoding appears, it can be interpreted as a country experiencing social conflict (1) or not (0). In the study, every country had a minimum Conflict Barometer code of at least "1." This coding assumes that virtually all countries have minor political disputes, but none that escalate to violence. Where appropriate, I substituted the dependent variable with this dichotomous measure based on the quantitative method.

[74] Bond, *Heidelberg Conflict Barometer*.

Chapter VI

Cross-Tabulation Analyses

I began my empirical analysis with an examination of the frequency distributions of the countries and the proportion of country clusters that fall into the various Conflict and Development Index categories. The cross-tabulations in Table 6-1 illustrate possible relationships between economic variables (as measured by the Development Index) and social conflict (as measured by the Conflict Barometer and Conflict Outcome).

Table 6-1. Proportions of countries by development index and conflict intensity

	Five Quantiles of the Development Index					
Conflict Barometer	**Bottom 20% 1**	**Bottom 40% 2**	**Mid 20% 3**	**Top 40% 4**	**Top 20% 5**	**Total**
1 - Minor disputes	29.3	37.3	50.2	60.8	68.2	47.0
2 - Non-violent	15.9	22.0	16.0	19.4	20.8	18.6
3 - Violent	34.5	24.0	23.6	14.2	8.9	22.4
4 - Limited war	20.3	16.7	10.2	5.6	2.1	12.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

Pearson chi2(12) = 237.4758 Pr = 0.000

	Five Quantiles of the Development Index					
Conflict Outcome (0/1)	**Bottom 20% 1**	**Bottom 40% 2**	**Mid 20% 3**	**Top 40% 4**	**Top 20% 5**	**Total**
0 - No or low conflict	29.3	37.3	50.2	60.8	68.2	47.0
1 - Conflict	70.7	62.7	49.8	39.2	31.8	53.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

Pearson chi2(12) = 163.1850 Pr = 0.000

Software system: Stata IC version 13.1 by StataCorp, LP

Source: Heidelberg Institute & the World Bank

Tables 6-2 and 6-3 visually summarize the differences between conflict intensity levels and the level of economic and social development.

Table 6-2. Conflict intensity for countries in the lowest 20% and 40% of development.

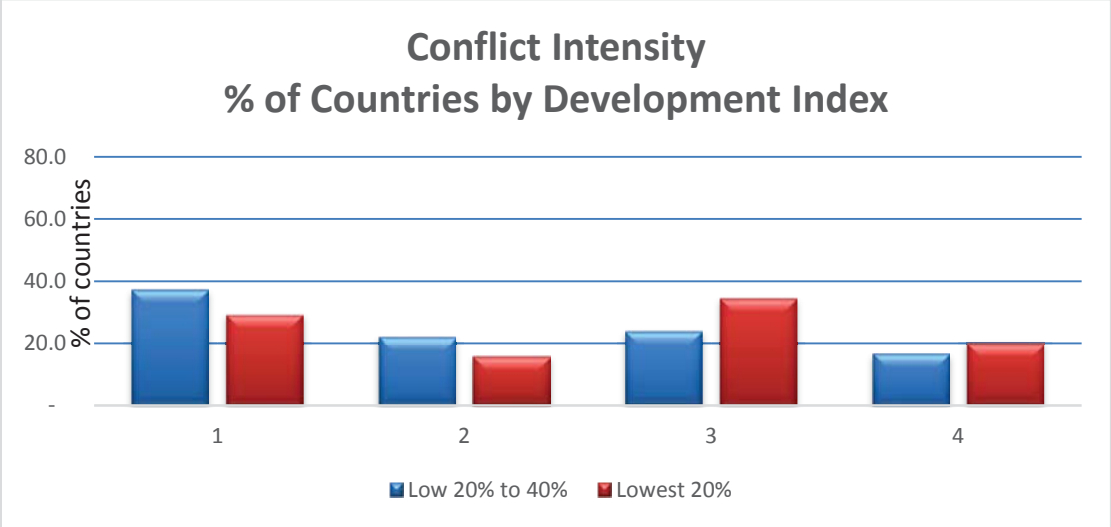


Table 6-2 illustrates that the conflict intensity levels for countries in the lowest 20% and 40% quantile development have noticeably higher levels of violent conflict (3 = violence and 4 = civil war).

Table 6-3. Conflict intensity levels for countries in the highest 60% of development.

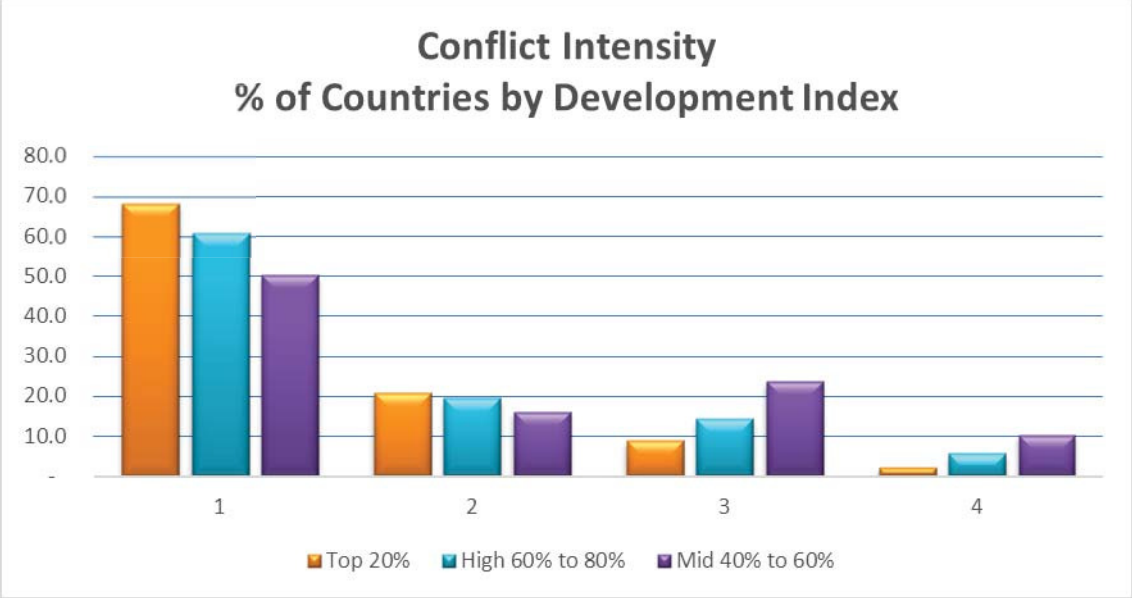


Table 6-3 illustrates that the conflict intensity levels for countries in the highest 60% in quantile development have noticeably lower levels of conflict ("1" = minor disputes and "2" = non-violence).

My observations are as follows:

1. The countries in the highest 20% quintile of economic and social development exhibited the lowest level of conflict as measured by the Conflict Barometer and Conflict Outcome. Approximately 68% of these countries had little or no unrest, while only about 11% experienced unrest that culminated in violence.
2. The countries in the lowest 20% quintile of economic and social development exhibited the highest levels of conflict as measured by the Conflict Barometer and Conflict Outcome. About 29% of these countries had minor disputes, while approximately 71% experienced unrest that culminated in violence.

3. There appears to be a strong inverse association between economic and social development, and conflict.

Since the Development Index is an indicator variable, I consider other economic variables that I hold constant at their means for clarity. My observations, based on Table 6-4, show those countries at the *highest* levels of conflict exhibited:

a. the *lowest* levels of mean economic and social development
b. the *lowest* levels of mean GDP per capita
c. the *highest* levels of mean inflation
d. the *highest* levels of mean size of its labor force
e. *higher* overall mean GDP levels.

Table 6-4. Associations between conflict intensity levels and economic factors.

	Selected Economic Factors and Conflict Intensity				
Conflict Barometer		**Gross Domestic Product ($-billions) ***	**GDP per capita ($) ***	**Inflation Rate (%)**	**Labor Force (size)**
	(Mean)	**(Mean)**	**(Mean)**	**(Mean)**	**(Mean)**
1 – Minor disputes	12.99	122.8	16,947	4.95	4,315,461
2 – Non-violent	10.67	511.7	9,658	5.70	17,962,936
3 – Violent	7.23	297.6	4,694	11.65	27,602,248
4 – Limited war	5.87	279.2	3,211	10.35	37,900,416

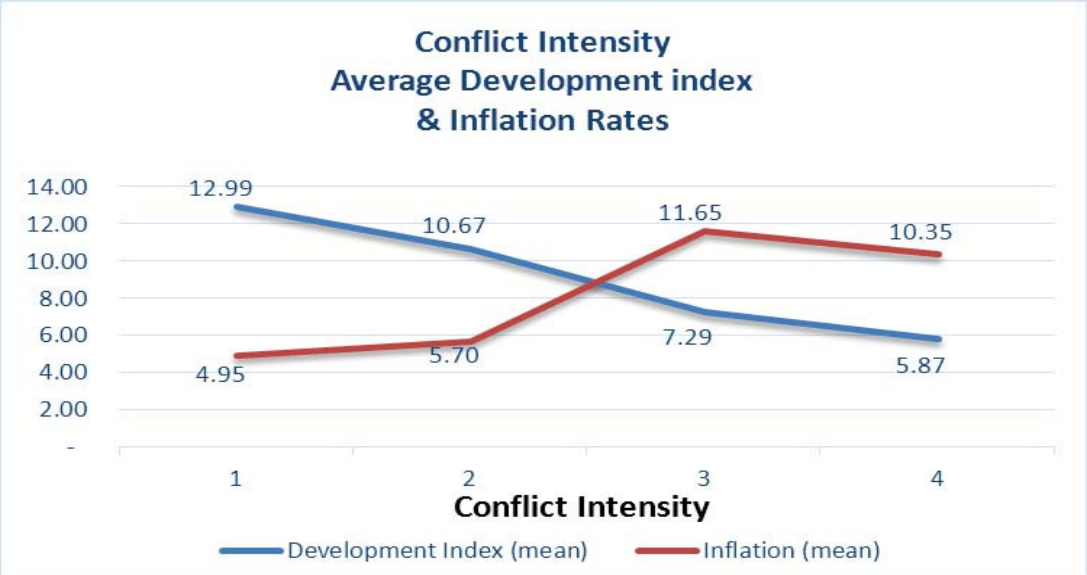
Note:
* = Values in constant 2005 US$

Software system: Stata IC version 13.1 by StataCorp, LP
Source: Heidelberg Institute & the World Bank

The last point suggests that countries with high overall GDP but low GDP per capita may experience some form of income disparities, which may warrant future research study.

Table 6-5 illustrates that countries with the highest development index levels tend to exhibit lower conflict intensity levels than countries with low levels of development. In addition, countries with high rates of inflation tend to exhibit higher levels of conflict than countries with low rates of inflation.

Table 6-5. Conflict intensity compared to development index and inflation rates.



In Table 6-6 below, the countries at the *highest* level of conflict exhibited:

a. the *lowest* levels of mean exports
b. the *highest* levels of mean population sizes
c. the *lowest* levels of mean real interest rates
d. the *lowest* levels of mean life expectancy
e. *high* levels of mean government claims and obligations.

Table 6-6 Associations between conflict levels and resiliency factors.

	Selected Economic Factors and Conflict Intensity				
Conflict Barometer	**Trade Exports (% of GDP)** (Mean)	**Population (size)** (Mean)	**Real Interest Rates (%)** (Mean)	**Life Expectancy (at birth)** (Mean)	**Government Claims & Obligations (% of GDP)** (Mean)
1 - Minor disputes	51.2	6,946,041	6.89	71.7	4.7
2 - Non-violent	42.3	35,431,755	4.68	69.9	9.3
3 - Violent	34.0	54,311,225	9.82	65.9	7.8
4 - Limited war	29.6	90,940,425	5.71	63.5	7.0

Software system: Stata IC version 13.1 by StataCorp, LP
Source: Heidelberg Institute & the World Bank

Based on the cross-tabulations, the trends reveal interesting relationships between conflict and the selected economic variables. To test the variables (at their means) for statistical significance, I use the standard chi-squared tests for means comparisons, which determined that the means of all the above variables to be significantly different from each other, and the above outcomes were not the result of random error.

In sum, countries that exhibit high GDP per capita growth tend to exhibit better levels of social development and also tend to be associated with low levels of social conflict. Countries that are economically vulnerable due to inflation and high levels of government debt tend to exhibit high levels of social conflict.

Chapter VII

Regression Analyses

The regression analyses I undertook are four panel data-level regressions: probit, logit, ordinal probit, and ordinal logit. The choice of these four regression methods was clear given the categorical nature of the dependent variable "conflict." In addition, a binary dependent variable was also used in two of the models to determine the incidence of conflict versus its absence.

I will confine my discussion of results, however, to only the probit and ordinal logit regressions because those models display high levels of statistical significance. I did consider other regression methods, but decided not use them because of various violations in the underlying reasons for their use. The Ordinary Least Squares (OLS) regression, and the Linear Probability Model were not used because the "Zero-Mean Assumption", a major tenet of the Gauss-Markov Theorem,[75] was violated ($E(u \mid x) \neq 0$). This violation means that endogeneity exists among the economic variables because the error terms may be correlated to those explanatory variables, which may cause measurement errors among many variables in the data. Economic variables in a time series tend to be correlated from one period to the next. As such, endogeneity emerges that could threaten the internal validity of the models. The probit and logit regression models, which I have used, are a different class of regression models that can compensate

[75] Stock and Watson, *Introduction to Econometrics*, 166–169; Wooldridge, *Introductory Econometrics*, 45–54.

for endogeneity. Probit and logit regressions relax the Zero-Mean Assumption, whereby efficiency (i.e., small variances are not as important), consistency (i.e., large sample sizes provide for small variances), and the use of the Maximum Likelihood Estimator method compensate for inconsistency and lack of efficiency.[76]

The panel-data, "fixed-effects" regression method was not used because of issues concerning endogeneity, serial correlation, and omitted variable bias. Fixed-effects regressions allow for unobserved influences, such as country characteristics, to be expressed as a constant so that generalizations about the economic variables could be expressed among the countries.[77] Moreover, the fixed-effects regression is not suitable for low, within-country, cluster variations.[78] These problems are common in economic variables given the nature of the time-series panel data, since successive values of the variables are known to be correlated with their previous values.

In general, the "random effects" variable accounts for time-invariant factors that will vary across country groups and may have an impact on conflict. Such random effects variables could be economic integration among countries (such as trading blocks, common currency, etc.). Additional research may be necessary to isolate and define these random effects to determine their ultimate impact on conflict. In any event, the presence of these random effects is consolidated into the constant. Clearly, more research would

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[76] Stock and Watson, *Introduction to Econometrics*, 393–394.

[77] Stock and Watson, *Introduction to Econometrics*, 356–361.

[78] Oscar Torres-Reyna, "Panel Data Analysis." Available from: <http://dss.Princeton.edu/training/ Panel101. pdf>. (Accessed February 15, 2013.)

need to be considered to account for unexplained economic variables and the omitted variable biases they can create for any given model.[79]

While the random effects method assumes no correlation between the explanatory variables and the error term, the country random effects (such as trade integration) could be implied and measured by this variable. Based on my analysis of a statistical measure called "rho", both the probit and logit regression models indicate that there were noticeable levels of the total variation in the models that were explained by the panel-level, random-effects variable implicit in the constant.[80]

The chosen models (probit and logit) are linear-log regressions adjusted for heteroskedastic robust standard errors. These regressions express the dependent variable either as a binary or categorical variable because of a linear process determined by the log transformations of the economic independent variables. The ultimate result is a probability estimate of the incidence of conflict rather than an estimate expressed as a continuous variable. Both models produce coefficients that are not initially insightful without further mathematical adjustments. Thus, the tabular regression estimates are not readily understandable as OLS estimates.

The probit regression assumes the use of the standard normal cumulative probability distribution function, while the logit regression uses the logistic cumulative probability distribution function.[81] The results of each model are probability estimates of

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[79] Wooldridge, *Introductory Econometrics*, 494–498.

[80] *Stata Reference Manual.*

[81] Stock and Watson, *Introduction to Econometrics*, 389.

the occurrence of conflict and conflict intensity. Both models tend to produce similar results.[82]

Moreover, both the probit and logit regressions use the maximum likelihood estimate (MLE) process to calculate its probability estimates,[83] while the OLS method minimizes the sum of the squared errors.[84] The MLE process is computer-intensive and requires large datasets to produce estimators that increase the likelihood of observing conflict, the phenomenon of interest. Since my country clusters contain more than 170 countries with over 1,500 observations, the MLE process implicit in the probit and logit regressions could produce statistically significant results. Given the large sample sizes of the datasets, MLE compensates for dataset issues of inconsistency and efficiency normally present in economic variables.[85]

The random-effects assumptions implicit in the probit and logit regressions allow for statistical inferences that may be useful beyond the study period sample.[86] However, given the statistical limitations in the use of a random-effects model (such as error term correlations), I adjusted the random effects by introducing the Development Index to allow for different "fixed effects" that could be captured by the various constant variable

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[82] Stock and Watson, *Introduction to Econometrics*, 396–397.

[83] Stock and Watson, *Introduction to Econometrics*, 415–418; Wooldridge, *Introductory Econometrics*, 778–779.

[84] Stock and Watson, *Introduction to Econometrics*, 118–123.

[85] Stock and Watson, *Introduction to Econometrics,* 393–394.

[86] Torres-Reyna, "Panel Data Analysis," 26.

levels. This adjustment enabled the ordinal logit model to "simulate" the fixed effects within a random-effects model that would meet the statistical tests for internal validity.[87]

Finally, I did not use Two Stage Least Squares (TSLS) panel regression or Instrument Variable (IV) modeling methods because of the lack of consistent and reliable economic data reported by some countries. While in theory, the use of TSLS and IV econometric techniques may have improved the significance of the regression models I use, and reduce the level of endogeneity and autocorrelation, its uses would be limited to cases and observations of completed cases that had very little missing data.[88] Unfortunately, not all countries reported consistently high levels of quality data. TSLS and IV methods are typically used as simultaneous equations that could improve the probability estimates and forecasting power of the models. These methods could be used by future researchers as the quality and quantity of data from countries improve.

[87] Stock and Watson, *Introduction to Econometrics*, 313–323.

[88] Stock and Watson, *Introduction to Econometrics,* 422–432.

Chapter VIII

Probit Regression Analysis

The probit regression model is a linear-log panel data version that produces linear estimates based on transformed values of the economic variables. The regression coefficients, when multiplied against the economic regressors, are totaled together to produce a z-score that conforms to a probability estimate based on the standard normal cumulative probability function. The probit regression model is designed to produce probability estimates for the incidence of a dependent variable, expressed as a value between "0" and "1," that could be associated with specific independent variables. As previously discussed, the dependent variable is Conflict Outcome. The levels of conflict are more simplified: "0" for the absence of conflict, "1" for the presence of conflict. Any probability estimates have a natural dividing line at the 50% level. Therefore, any probability estimate above 50% indicates the incidence of conflict, while any estimate below 50% indicates the absence of conflict.

The economic variables used in the probit model were: GDP per capita (an economic resiliency factor), inflation (an economic vulnerability factor), size of the labor force (an economic resiliency and vulnerability factor), and the lagged Conflict Barometer. Other variables were also considered but they did not meet the tests of statistical validity, consistency, and efficiency.

Probit Regression Conflict Model

I briefly outline here the theoretical terms of the probit regression conflict model and construct the model using the results of the regression output. In general, a probit regression estimates the probability of a positive outcome (where $y = 1$) for the incidence of conflict. The result of the following expression is a z-score that conforms to a probability value implied by the cumulative normal distribution function:[89]

$$P_{itk} = \Pr(y_{it} = k|k, x_{it}, v_i) = \phi(k_k - x_{it}\beta - v_i) - \phi(k_{k-1} - x_{it}\beta - v_i)$$

$y_{it=\{0,1\}}$ ← Conflict Outcome

where:

k = predicted conflict probabilities $\in (0,1)$
β = economic variable
v = panel data random effects constant
i = each observation
t = time period

The probit regression is finally summarized as:[90]

$Pr\ (z) = \phi$ (z-score) ← Z ~ N (0, 1) Normal Distribution

Table 8-1 below represents output from the probit regression conflict model utilizing economic variables to express a nonlinear model to explain the incidence of conflict. Additionally, the model provides a tool to predict the incidence of conflict by using the "in-sample" data as a foundation for forecasting.

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[89] Stock and Watson, *Introduction to Econometrics*, 389–394.

[90] Stock and Watson, *Introduction to Econometrics*, 391.

Table 8-1. Probit regression model and logit regression model: analysis results.

		(1)	(2)
		Logit Regression - Fixed Effects	Probit Regression - Random Effects
Conflict Outcome (No (0) / Yes (1))	VARIABLES	Conflict Outcome	Conflict Outcome
	GDP per capita (natural log)		-0.163***
			(0.0618)
	Inflation (natural log)	0.408***	0.143**
		(0.158)	(0.0692)
	Labor Force (natural log)		0.297***
			(0.0596)
	Lagged Conflict	1.038***	1.083***
		(0.130)	(0.105)
	Development Index of 2	0.772	
		(0.978)	
	Development Index of 3	1.923	
		(1.275)	
	Development Index of 4	2.078	
		(1.413)	
	Development Index of 5	3.363*	
		(1.892)	
	Constant - Intercept		-5.002***
			(0.896)
	Observations	720	1,588
	Wald Chi-squared	93.76	309.2
	Significance	0.000	0.000
	Number of countries	75	172
	Country Fixed Effects	YES	
	Country Random Effects		YES
	Log likelihood	-251.7	-501.9
	Likelihood Ratio Chi-squared	93.76	309.2

Notes: Standard errors are in parentheses.

***** Statistically significant at the 1%.**

**** Statistically significant at the 5%.**

*** Statistically significant at the 10%.**

The probit regression model that associates certain economic variables with the incidence of conflict is:

Pr(Conflict Outcome = 1 | GDP per capita, Inflation, Labor Force)

= Φ (-5.002 + (– 0.163 x ln(GDP per capita)) + (0.143 x ln(Inflation))

+ (0.297 x ln(Labor Force)) + (1.083 x Conflict Barometer))

In order to derive the probit parameter estimates, the Maximum Likelihood Estimation Function (MLE) is given as:[91]

$$MLE = p_1^{y_1}(1-p_1)^{1-y_1} \times \ldots \times p_n^{y_n}(1-p_n)^{1-y_n}$$

where:

p = probability of an outcome

y_n = actual outcome for each observation

n = each observation of the sample

The MLE is an iterative process of obtaining coefficient parameter estimates based on the actual observations and outcomes that have the highest likelihood of producing the outcome results in the dataset.[92]

Probit Regression Model Interpretations

- For a one-percentage point increase in *GDP per capita*, there was an approximate decrease of -0.0016 (β_1 = -0.163 * 0.01) in the z-score of Conflict Outcomes (holding all the other variables constant). After converting the coefficient into a z- score, a

[91] Stock and Watson, *Introduction to Econometrics*, 398–399.

[92] Stock and Watson, *Introduction to Econometrics*, 398–399, 415–417; also Fred C. Pampel, *Logistic Regression* (New York: Sage, 2000), 64.

probability estimate can be obtained by referring to the cumulative normal distribution table. Thus, for a high value of GDP per capita, the model would produce a high probability estimate that corresponds to a *lower* incidence of conflict for each percentage point increase in GDP per capita.

- For a one-percentage point increase in *inflation*, there was an approximate increase of +0.0014 (β_1 = +0.143 * 0.01) in the z-score of Conflict Outcomes (holding all the other variables constant). After converting the coefficient into a z-score, a probability estimate can be obtained by referring to a cumulative normal distribution table. Thus, for a high value of inflation, the model would produce a high probability estimate that corresponds to the *higher* presence of conflict for each percentage point increase in inflation.
- For a one-percentage point increase in the *labor force*, there was an approximate increase of +0.0030 (β_1 = +0.297 * 0.01) in the z-score of Conflict Outcomes (holding all the other variables constant). After converting the coefficient into a z-score, a probability estimate can be obtained by referring to the cumulative normal distribution table. Thus, for a high value of labor force, the model would produce a high probability estimate that corresponds to the *higher* presence of conflict for each percentage point increase in the labor force.
- For a one unit increase in the *lagging conflict variable*, there was an approximate increase of +1.083 in the Conflict Outcomes (holding all the other variables constant). After converting the coefficient into a z-score, a probability estimate can be obtained by referring to the cumulative normal distribution table. Thus, for a high value in the Conflict Barometer, the model would produce a high probability estimate that

corresponds to the *higher* presence of conflict for each unit increase in the lagging conflict variable.

The Development Index acted as categorical variable to isolate the fixed effects among different countries at different stages of economic and social development. Since the fixed effects (i.e. the Y-intercepts) are not significant, I will summarize the set of Development Indices by saying that for countries at low levels of economic and social development, the probability of conflict would tend to be higher than countries at high levels of development. Furthermore, the probability of conflict tends to decline in a non-linear fashion as development increases over time.

To illustrate the use of the probit regression model, I use the country of Botswana. In 2012, Botswana reported GDP per capita of $6,693.75, an annual inflation rate of 7.54%, with a labor force size of 1,018,258. In 2011, Botswana was relatively peaceful and did not experience any apparent social conflict, so it was assigned a Conflict Barometer rating of "1" (see Table 8.2).

Selected economic variables are transformed into natural logarithms as follows:

- GDP per capita = $6,693.75 The natural log is: ln(6,693.75) = 8.80893
- Inflation = 7.54% The natural log is: ln(7.54) = 2.02026
- Labor Force = 1,029,258 The natural log is: ln(1,018,258) = 13.83336

Table 8-2. Botswana 2012: Conflict Outcome probability estimate.

			Probit Regression: Linear-Logarithmic Model - xtprobit			
Country	**Botswana**		**Regression Estimate: 2012**	**Coefficients (β_n)**	**Regressors (X_n)**	**Parameter Estimates**
Time	**2012**		β_1 (Log of GDP per capita)	-0.16289	8.80893	-1.43490
Probit Probability	**0.17108**		β_2 (Log of Inflation)	0.14288	2.02026	0.28866
Probit Prediction	**0**		β_3 (Log of Labor Force)	0.29745	13.83360	4.11474
GDP per capita	6,693.75		β_4 (Lag of Conflict Barometer)	1.08313	1	1.08313
Log of GDP per capita	8.80893		β_0 (Constant)	-5.00153	1	-5.00153
Inflation	7.54		**Regression Estimate of z-score → ∑ (z-score)**			**-0.94989**
Log of Inflation	2.02026					
Labor Force (Size)	1,018,258		**Probability of Conflict (Yes = 1) - Cumulative Std Normal Distribution**			**0.17108**
Log of Labor Force	13.83360		**Conflict Outcome (prediction) - '0' if <= 0.50, '1' if > 0.50**			**0**
Lag of Conflict Barometer	1					
Conflict Outcome (actual)	**0**					

Using the probit model with data from Botswana, I calculate the z-score:

Pr(Conflict Outcome = 1 | GDP per capita, Inflation, Labor Force, Lag of Conflict Barometer)

= Φ (-5.00153 + (– 0.163 x 8.809)) + (0.143 x 2.020) + (0.297 x 13.834) + (1.083 x 1)

= Φ (-5.00153 + (– 1.4359) + (0.2889) + (4.115) + (1.083)

= Φ (-0.94989) ← This is the z-score value to look up in the cumulative Normal

Distribution tables → Φ (-0.94989) = 17.1%

The probit model calculates a z-score that shows to a 17.1% probability of conflict. Since the probability is less than 50%, the predicted Conflict Outcome implies a binary value of "0" according to the probit model. When compared against the *actual* Conflict Outcome, the incidence of conflict was indeed "0" for Botswana in 2012. Thus,

the probit model correctly predicted the *absence of social conflict* based on the economic factors included in the model.

Probit Regression Results and Selected Country Observations

The total number of countries in my study was 214, covering 11 years of observations and provided 2,354 results. However, the actual number of countries with completed data cases was 172, with 1,588 observations, which implies that each country contributed about 9 years of data. Recall that a value of "0" indicates no incidence of conflict, while a value of "1" indicates the presence of conflict. Using a threshold of 50%, any probabilities over 50% were considered an incidence of conflict. The model incorrectly predicted on 241 occasions out of 1,588, or 15.2% of completed case observations. In other words, the probit regression model predicted Conflict Outcome correctly on 1,347 or 84.8% of the completed case observations.

With regard to the predictive power of the probit regression model, the following results were produced and compared against the actual Conflict Outcomes where the model *did not* make the correct prediction:

- Albania: In 2005, the model predicted a probability estimate of 89.7%, which implied the presence of conflict of "1" when the actual level was "0". During the study period, separatist minority groups in Albania were battling the central government, which caused Albania to oscillate between unrest and peace following the Kosovo Wars of 1999.[93]

[93] Heidelberg Institute, *Conflict Barometer 2005*, 14–18.

- Australia: In 2003, the model predicted a probability estimate of 25.2%, which implied the presence of conflict of "0" when the actual level was "1". During the study period, Australia was involved in several interstate and intrastate conflicts with East Timor and Papua New Guinea over territorial and natural resources disputes, which were not reflected in the data.[94]
- Bahrain: In 2005 and 2006, the model predicted a probability estimate of 39%, which implied the presence of conflict of "0" when the actual level was "1". Sunni-ruled Bahrain was battling separatist Shiite groups that were vying for political and religious control. The ethnic conflict was not captured in the economic data.[95]
- Belize: In 2006, the model predicted a probability estimate of 70.9%, which implied the presence of conflict of "1" when the actual level was "0". Belize had raised taxes dramatically and riots ensued, but the actual Conflict Barometer outcome did not correctly capture this intensity level of unrest.[96]
- Bhutan: In 2009, the model predicted a probability estimate of 48.6%, which implied the presence of conflict of "0" when the actual level was "1". Bhutan had a refugee crisis in which Nepalese who claimed refugee status became involved in a border dispute with Nepal. This ethnic issue was not captured in economic data.[97]

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[94] Heidelberg Institute, *Conflict Barometer 2003*, 29, 33.

[95] Heidelberg Institute, *Conflict Barometer 2005*, 53; Heidelberg Institute, *Conflict Barometer 2006* , 56.

[96] Heidelberg Institute, *Conflict Barometer 2006* , 37.

[97] Heidelberg Institute, *Conflict Barometer 2009*, 55.

- Brunei: In 2009, the model predicted a probability estimate of 22.2%, which implied the presence of conflict of "0" when the actual level was "1". Brunei had interstate territorial disputes with Malaysia, China, and the Philippines over several islands. This political dispute was not captured in the economic data.[98]
- Comoros: In 2009, the model predicted a probability estimate of 85.8%, which implied the presence of conflict of "1" when the actual level was "0". A regional government had a political dispute with the central government. The economic data appeared to suggest vulnerabilities not apparent in the conflict data.[99]
- Cyprus: In 2011, the model predicted a probability estimate of 36.4%, which implied the presence of conflict of "0" when the actual level was "1". The northern region of Cyprus is engaged in a separatist dispute with the central government. This political dispute was not captured in the economic data.[100]

These results were quite compelling and suggest a strong association between the economic profile of a country and the incidence of social conflict in that country. During the 11-year study period, the probit regression model showed impressive results (approximately 84.8% correct predictions) that could not have been accounted for by pure chance. Therefore, in future research, the inclusion of other economic and social variables could enhance the predictive qualities of this model. However, the predictions implied by the probabilities are only guidelines and apply to the data contained within the sample obtained in the 11-year study period. Therefore, no generalizations can be made

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[98] Heidelberg Institute, *Conflict Barometer 2009*, 52.

[99] Heidelberg Institute, *Conflict Barometer 2009*, 25.

[100] Heidelberg Institute, *Conflict Barometer 2011*, 20.

from the above model predictions with regard to any other study period, despite the ability of the probit regression to allow for "out-of-sample" predictions, given the model's random effects attributes.[101]

[101] Torres-Reyna, "Panel Data Analysis," 26.

Chapter IX

Logit Regression Analysis

Similar to the probit regression model, the logit (or logistic) regression model is a linear-log panel data model that produces linear estimates based on transformed values of the economic variables. However, the logit regression produces parameter estimates that are not immediately understandable without further mathematical adjustments.[102] The logit regression produces the natural logarithm exponents that can be used to obtain probability estimates.

These natural logarithms exponents are mathematical transformations of "odds ratio" estimates that can later be used by the logit model to estimate the regression coefficients.[103] The odds ratio is simply the odds of the incidence of conflict divided by the odds of the absence of conflict. Logit regression requires that the odds ratio of an event occurrence be transformed by natural logs.[104] Thus, the logit model produces the log of the odds ratios in its estimation process.[105]

The regression coefficients produced by the logit regression, when multiplied against the economic regressors, are totaled together to produce a value that is the natural

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[102] Stock and Watson, *Introduction to Econometrics*, 394–397; Pollock, *Essentials of Political Analysis*, 212–223.

[103] Stock and Watson, *Introduction to Econometrics*, 395; Philip H. Pollock, *A STATA Companion to Political Analysis*, 2nd ed. (Washington, DC: CQ Press, 2011), 194.

[104] Pampel, *Logistic Regression*, 21.

[105] Pollock, *Essentials of Political Analysis*, 217; Pollock, *STATA Companion*, 194.

logarithm of the odds ratio.[106] Each regressor will have an impact on the log of the odds ratio and expresses those changes as changes in the "logged odds."[107] When the sum of the logged odds are totaled, the result is raised to the power of base "e" (for Euler's number), which is equal to approximately 2.71828. The result will be a value that represents a point on the cumulative logistic distribution function. Each point implies a probability estimate on the occurrence of an event such as conflict.

Given the nonlinear nature of the probability estimates, the logit regression confines the probability estimates to values for the conflict between "0" and "1" based on the association with the specific independent variables. As previously discussed, the dependent variable is Conflict Outcome. The levels of conflict are more simplified: "0" for the absence of conflict, "1" for the presence of conflict. Similar to the probit regression model, any probability estimates have a natural dividing line at the 50% level. Therefore, any probability estimate above 50% indicates the incidence of conflict, while any estimate below 50% indicates the absence of unrest.

The economic variables used in the logit model were inflation (an economic vulnerability factor) and the lagged Conflict Barometer. Other variables were also considered, but did not meet the tests of statistical validity, consistency, and efficiency.

I present the logit regression as an alternate model with similar analytical characteristics to the probit regression model that considers the "fixed effects" unique to each country's development in explaining the association between conflict and economic factors. Unfortunately, the logit regression was not as robust in modeling the Conflict

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[106] Pollock, *Essentials of Political Analysis*, 216–217; Pampel, *Logistic Regression*, 11–17.

[107] Pollock, *Essentials of Political Analysis*, 216.

Outcome as the probit regression. The logit model used 75 countries with 720 completed case observations, while the probit model used 172 countries with 1,588 completed case observations.

While the probability estimates and findings were similar for both models, the probit model's parameter estimates were statistically more significant than those of the logit model (e.g., the probit model's Wald chi-square statistic was higher, at 309.20, versus the logit model's chi-square statistic, at 93.76). The logit regression provided a fixed-effects option that allowed for the modeling of conflict levels that differ based on each country's development level; this option is not available in the probit regression model. Despite this shortcoming, the probit model provided a more robust means to explain the incidence of conflict by covering more countries than did the logit model.

In any case, I will limit my discussion of the logit regression to the model's interpretations of the coefficients and the association to social conflict. I discovered that the strength of the logit regression is not in the forecasting power of dichotomous dependent variables but in predicting categorical variables. I will discuss this further in the next section covering the ordinal logit regression—a variant of the logit model.

Logit Regression Model Interpretations

- For a one-percentage point increase in *inflation*, there was an approximate increase of +0.0041 (β_1 = +0.408 x 0.01) in the logged odds of the Conflict Outcomes (holding all other variables constant). After converting the coefficient to changes in the odds ratio (e.g., $e^{0.0041} = 1.004$), this value presents an increase in the odds of an incidence of conflict. After additional mathematical conversions, the changes in the odds ratio

would conform to the probabilities implied by the cumulative logistic distribution function. Thus, for a high value for inflation, the model produces a high probability estimate that would correspond to the increased presence of conflict for each percentage point increase in inflation.

- For a one-unit increase in the *lagging conflict variable*, there was an approximate increase of 1.038 in logged odds of the Conflict Outcomes (holding all the other variables constant). After converting the coefficient to changes in the odds ratio (e.g., $e^{1.038} = 2.824$), this value presents an increase in the odds of the incidence of conflict. After additional mathematical conversions, the changes in the odds ratio would conform to the probabilities implied by the cumulative logistic distribution function. Thus, for a high value for the lagging conflict variable the model would produce a high probability estimate that would correspond to the increased presence of conflict for each unit increase in the lagging conflict variable.

The Development Index acted as a categorical variable to isolate the effects of different stages of economic and social development. Since the effects are not significant, I can summarize the set of Development Indices by saying that for countries at low levels of economic and social development, the probability of social conflict (after the appropriate mathematical conversions) would tend to be higher than countries at high levels of development. Furthermore, the probability of social conflict tends to decline in a nonlinear fashion as development increases over time.

With only 75 countries out of 214 countries reporting, the explanatory power of the fixed-effects logit regression model is greatly reduced, and the results are deemed inconclusive. In general, a threshold of more than 50% of reporting countries would have

enabled this model to function adequately for predictive analysis. Since the threshold was not reached for the logit model, I will move to the next model.

Chapter X

Ordinal Logit Regression Model

The ordinal logit regression (Ologit) is used to assess the probability or risk of social conflict at different categorical levels of conflict based on economic variables. Like the logit regression discussed in the previous chapter, the Ologit regression is a more sophisticated econometric technique that does not produce immediately understandable results unless further mathematical adjustments are undertaken. However, the Ologit regression produces results that have impressive predictive qualities for different conflict-intensity levels. The basis of this type of regression is the logistic distribution, and the calculated probability estimates are nonlinear in nature. In comparison, the use of the OLS regression is limited to providing linear estimates. Similar to the probit and logit models, the Ologit model provides nonlinear parameter estimates that are suitable for the obtaining probability estimates for categories of conflict levels.

In general, the Ologit regression provides results of the beta coefficients that are natural log exponents. These coefficients are the "logged odds ratios". Once converted (by raising each coefficient as an exponent of base "e"), the odds ratio can be further converted into probability estimates with some additional mathematical adjustments. Probability estimates are calculated at specific "constant cut points" that represent the different conflict (ordinal) levels.

The data regressions shown in Table 10-1 below use the random effects method to consider variations that occur from country to country. These variations are assumed random in nature and are uncorrelated with the economic variables, but they could have an effect on the level of conflict in each country.[108] The economic variables used in the Ologit model are: GDP per capita (an economic resiliency factor), the size of the labor force (an economic resiliency and vulnerability factor), and the lagged Conflict Barometer. Other variables were considered but did not meet the tests of statistical validity, consistency, and efficiency.

While the Ologit regression coefficient estimates are not readily understandable without further mathematical transformations and conversions, observations of the coefficients in Table 10-1 indicate that direction of the economic variable's impact on the conflict variable and the direction is consistent with economic theory. For example, with regard to GDP per capita, increases were associated with *decreases* in social conflict, while an increase in a country's labor force was associated with *increases* in conflict and unrest.

The Ologit regression model is designed to produce probability estimates for the incidence of a dependent variable in specific categories, which can be expressed as a value between "1" and "4" that could be associated with specific independent variables. As previously discussed, the dependent variable is the Conflict Barometer, which varies by intensity level. The Conflict Barometer is in accordance with an ordinal scale between "1" and "5", but the scale has been adjusted and re-scaled from "1" to "4". The Ologit model provides coefficient estimates that would be used to calculate probability estimates

[108] Torres-Reyna, "Panel Data Analysis," 25.

for each of the Conflict Barometer intensity levels. The sum of the probabilities will always equal ONE. The category of the Conflict Barometer with the highest probability estimate will be the predicted level of unrest for a given country at specific points in time during the study period.

Table 10-1. Ordinal logit regression and ordinal probit regression: analysis results.

		(1)	(2)
		Ordinal Logit - Random Effects	**Ordinal Probit – Random Effects**
Conflict Barometer (Intensity: 1 to 4)	**VARIABLES**	**Conflict Barometer**	**Conflict Barometer**
	GDP per capita (natural log)	-0.550***	-0.325***
		(0.176)	(0.102)
	Labor Force (natural log)	0.592***	0.338***
		(0.0938)	(0.0489)
	Lagged Conflict	1.614***	0.842***
		(0.170)	(0.0813)
	Development Index of 2	0.499	0.293*
		(0.311)	(0.176)
	Development Index of 3	0.679*	0.367
		(0.407)	(0.239)
	Development Index of 4	0.488	0.262
		(0.555)	(0.326)
	Development Index of 5	0.260	0.114
		(0.720)	(0.419)
	Constant - Cutpoint 1	7.101***	3.832***
		(1.637)	(0.941)
	Constant - Cutpoint 2	9.302***	5.025***
		(1.635)	(0.936)
	Constant - Cutpoint 3	12.81***	6.949***
		(1.667)	(0.950)
	Observations	1,759	1,759
	Wald Chi-squared	335.96	349.20
	Significance	0.000	0.000
	Number of countries	178	178
	Country Random Effects	YES	YES
	Log likelihood	-1,324.43	-1,342.21
	Likelihood Ratio Chi-squared	336.00	349.20

Notes: Standard errors are in parentheses.

***** Statistically significant at the 1%.**

**** Statistically significant at the 5%.**

*** Statistically significant at the 10%.**

Ordinal Logit Regression Conflict Model

I briefly outline the theoretical terms of the Ologit regression conflict model and construct the Conflict Model with the results of the regression output.

In general, the Ologit regression estimates the probability of a positive outcome in each of the intensity levels for the conflict variable. The result of the following expression is a natural log exponent that when raised to the power of "e," the result is a probability value implied by the cumulative logistic distribution function.

To summarize the ordinal logit function in mathematical terms:[109]

$$P_{itk} = \Pr(y_{it} = k|k, x_{it}, v_i) = \frac{1}{1 + e^{(-k_k + x_{it}\beta + v_i)}} - \frac{1}{1 + e^{(-k_{k-1} + x_{it}\beta + v_i)}}$$

$y_{it=\{1,2,3,4\}}$ ← Conflict Barometer for each intensity level

where:

k = predicted conflict probabilities
β = economic variable
v = panel data random effects constant
i = each observation
t = time period
e = base e

As described above, the Ologit regression is a special case of regular logit regression. The regular logit regression provides probability estimates on a scale between the values of "0" and "1". The Ologit regression provides probability estimates across the ranked values of the Conflict Barometer from "1" to "4". Ologit regression provides probability estimates for each of the four values of conflict intensity. The conflict

[109] Stock and Watson, *Introduction to Econometrics*, 394–395; *Stata Reference Manual*, 268–270.

category with the highest probability estimate is the Ologit regression prediction for a given country at a point in time during the study period. The final probability values are particularly insightful since they provide a risk-level assessment of each probability level. The model's predictive power can be assessed by statistics such as the log-likelihood (significance is achieved at very small values or large negative values) and the Wald chi-squared value (significance is achieved at large values).

Ordinal Logit Regression Model Interpretations

To simplify this discussion, I will articulate the significance of each variable and its consistency with economic theory. My observations for the Ologit regression are as follows:

- For a one-percentage point increase in *GDP per capita*, there was an approximate decrease of -0.0055 (β_1 = -0.550 x 0.01) in logged odds of the Conflict Barometer, while holding all the other variables constant. After converting the coefficient to changes in the odds ratio (e.g., $e^{-0.0055} = 0.9945$), this value represents a decrease in the odds of a higher level of conflict. Therefore, for a high level of GDP per capita, the model would produce a high probability estimate that would correspond to a *low* level of conflict for each percentage point increase in GDP per capita.
- For a one-percentage point increase in *labor force*, there was an approximate increase of +0.0059 (β_1 = +0.592 x 0.01) in logged odds of the Conflict Barometer, while holding all the other variables constant. After converting the coefficient to changes in the odds ratio (e.g., $e^{0.0059} = 1.0059$), this value represents an increase in the odds of a higher level of conflict. Thus, for a high level in the labor force the model would

produce a high probability estimate that would correspond to a *high* level of conflict for each percentage point increase in the labor force.

- For a one-unit increase in the *lagging conflict* variable, there was an approximate increase of +1.614 in the logged odds of the Conflict Barometer while holding all the other variables constant. After converting the coefficient to changes in the odds ratio (e.g., $e^{1.614} = 5.023$), this value represents an increase in the odds of a higher level of conflict. Thus, for a high level in the lagging conflict variable the model would produce a high probability estimate that would correspond to a *high* level of conflict for each unit increase in the lagging conflict variable.

The Development Index acted as categorical variable to isolate the fixed effects among different countries at different stages of economic and social development. Since the fixed effects (i.e., the Y-intercepts) are not significant, I will summarize the set of Development Indices by saying that for countries at low levels of economic and social development, the probability of social conflict would tend to be higher than countries at high levels of development. Furthermore, the probability of social conflict tends to decline in a nonlinear fashion as development increases over time.

To illustrate the use of the Ologit regression model, I analyzed the country of Thailand (see Table 10-2). In 2012, Thailand reported GDP per capita of $3,389.58, with a labor force size of 39,423,475 people. In 2011, Thailand was experiencing continued

Table 10-2. Thailand, 2012: Conflict Barometer probability estimates.

Country	**Thailand**
Time	**2012**
Ordinal Logit Probability of 1	0.00269
Ordinal Logit Probability of 2	0.02110
Ordinal Logit Probability of 3	0.42597
Ordinal Logit Probability of 4	**0.55024**
Ordinal Logit Prediction	**4**
GDP per capita	3,389.58
Log of GDP per capita	8.12846
Labor Force (Size)	1,018,258
Log of Labor Force	17.4899
Development Index (1 to 5)	3
Lag of Conflict Barometer	4
Conflict Barometer (actual)	**4**

Ordinal Logit Regression: Linear-Logarithmic Model - xtologit

Regression Estimate: 2012	**Coefficients (β_n)**	**Regressors (X_n)**	**Parameter Estimates**	**Parameter Estimates**	**Parameter Estimates**	**% Change in Odd Ratios**
β_1 (Log of GDP per capita)	-0.55022	8.12846	-4.47240	-4.47240	-4.47240	-42.3%
β_2 (Log of Labor Force)	0.59206	17.48987	10.35512	10.35512	10.35512	80.8%
β_3 (Lag of Conflict Barometer)	1.61373	4	6.45490	6.45490	6.45490	402.1%
β_4 (Development Index 2)	0.49856	0	0.00000	0.00000	0.00000	64.6%
β_4 (Development Index 3)	0.67893	1	0.67893	0.67893	0.67893	97.2%
β_4 (Development Index 4)	0.48800	0	0.00000	0.00000	0.00000	62.9%
β_4 (Development Index 5)	0.25964	0	0.00000	0.00000	0.00000	29.6%
Regression Estimate: → $\sum (\beta_n X_n)$			**13.01655**	**13.01655**	**13.01655**	**6.94969**
Logistic Distribution - Cut Point 1	7.10135		-7.10135			
Logistic Distribution - Cut Point 2	9.30223			-9.30223		
Logistic Distribution - Cut Point 3	12.81493				-12.81493	
Sum of Regression Estimates [$\sum (\beta_n X_n)$] and Cut Points (-k)			5.91521	3.71432	0.20162	
Exponential Function: $e^{\sum [-k + (\beta n Xn)]}$ =			370.63034	41.03085	1.22339	
Cumulative Logistic Distribution: 1 / (1 + $e^{\sum [-k + (\beta n Xn)]}$) =			0.00269	0.02379	0.44976	1.00000
Probabilities at Logistic Distribution Cut Points:			**0.00269**	**0.02110**	**0.42597**	**0.55024**
Conflict Barometer (Intensity Levels): select the highest probability			**1**	**2**	**3**	**4**

unrest among political parties struggling to implement democratic reforms over the current dictatorship. The assigned Conflict Barometer rating was "4". Additionally, Thailand ranked at the 60th percentile in terms of economic and social development. The results are shown in Table 10-2.

Selected economic variables are transformed into natural logarithms as follows:

- GDP per capita = $3.389.58 The natural log is: ln(3,389.58) = 8.12846
- Labor Force = 39,423,475 The natural log is: ln(39,423,475) = 17.4899

Using the above Ologit Model with the data from Thailand, I calculate the logged odds ratio:[110]

$$P_{itk} = \Pr(y_{it} = k|k, x_{it}, v_i) = \frac{1}{1 + e^{(-k_k + x_{it}\beta + v_i)}} - \frac{1}{1 + e^{(-k_{k-1} + x_{it}\beta + v_i)}}$$

Pr(Conflict = 1 | Cut #1, GDP per capita, Labor Force, Lag of Conflict Barometer, Development Index, constant)

First, the cut points for the Cumulative Logistic Distribution function are derived as follows:

$$\Pr(\ Cut\ point = \boldsymbol{k}) = \frac{1}{1+e^{(-\boldsymbol{k}+(8.12846 \times -0.55022)+(0.59206 \times 17.48987)+(1.61373 \times 4)+(0.67893 \times 1))}}$$

$$\Pr(Cut\ point\ \#1) = \frac{1}{1 + e^{(-\mathbf{7.10135}+13.01655)}} = \frac{1}{1 + e^{(\mathbf{5.91521})}} = \frac{1}{1 + 370.63034} = 0.00269$$

$$\Pr(Cut\ point\ \#2) = \frac{1}{1 + e^{(-\mathbf{9.30223}+13.01655)}} = \frac{1}{1 + e^{(\mathbf{3.71432})}} = \frac{1}{1 + 41.03085} = 0.02379$$

$$\Pr(\text{Cut point } \#3) = \frac{1}{1 + e^{(-\mathbf{12.81493}+13.01655)}} = \frac{1}{1 + e^{(\mathbf{0.20162})}} = \frac{1}{1 + 1.22339} = 0.44976$$

Cumulative Logistic Distribution Function = 1.00000 (the maximum value) and 0 (the minimum value)[111]

[110] Stock and Watson, *Introduction to Econometrics*, 394–395; Stata Press, *Reference Manual*, 268.

[111] Wooldridge, *Introductory Econometrics*, 584.

Now that the cumulative logistic distribution function has identified three cut points based on the model parameters, the difference of each cumulative cut point equals the probability estimate for each Conflict Barometer intensity level:

$$\Pr(Conflict = 1) = 0.00269 - 0 = 0.00269$$

$$\Pr(Conflict = 2) = 0.02379 - \ 0.00269 = 0.02110$$

$$\Pr(Conflict = 3) = 0.44976 - 0.02379 = \ 0.42597$$

$$\Pr(Conflict = 4) = 1.00000 - 0.44976 = 0.55024$$

Therefore, the highest probability estimate would correspond to the predicted Conflict Barometer level. Thus, the highest probability estimate is 0.55024 and this corresponds to the Conflict Barometer intensity level of "4". When the predicted level was compared against the *actual* Conflict Barometer, it was indeed "4" for Thailand in 2012. Thus, the Ologit model correctly predicted the conflict intensity level of social conflict based on the economic factors included in the model.

Ordinal Logit Regression Results and Selected Country Observations

The total number of countries was 214, covering 11 years of observations that provided 2,354 results. However, the actual completed cases that the Ologit regression used were 178 countries with 1,759 observations, which implies that each country contributed about 9.9 years of data. The desired result of the Ologit model is to provide probability estimates for each categorical level of the Conflict Barometer. The model predicted incorrectly on 655 observations out of 1,759, or approximately 37.2% of completed case observations; or, the model predicted the Conflict Barometer correctly on 1,104 or approximately 62.8% of the completed case observations.

The results were interesting and provided impressive insight into the risk of social conflict in each level of unrest. To assess the accuracy of the conflict level, I control the model so only the specific economic variables are allowed to assign prediction levels, which means the variations are based solely on economic and development factors.

With regard to the predictive power of the Ologit regression model, the following results were produced and compared against the actual Conflict Barometer:

- For Benin in 2011, the model predicted a probability estimate of 48.9%, which implied that the predicted conflict level would be "1"; the actual level was indeed "1". Since 2006, with the restoration of democracy and fair elections, Benin has experienced strengthened economic activity and reduced levels of unrest.[112]
- For Afghanistan in 2011, the model predicted a probability estimate of 52.9%, which implied that the predicted conflict level would be "3"; the actual level was "4". The probability estimate for level "4" was 43.4%, so it is safe to assume that this level also had a high likelihood of occurrence. During 2011, Afghanistan was continually involved in many violent intrastate and interstate conflicts among its political and religious groups, with some of these conflicts escalating into civil war.[113]
- For Guinea in 2011, the model predicted a probability estimate of 69.9%, which implied that the predicted conflict level would be "3", and the actual level was indeed "3". In 2011, Guinea struggled with oppositions to its national government that erupted into violence and a failed overthrow of its government.[114]

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[112] Heidelberg Institute, *Conflict Barometer 2009*, 35; Bond, *Heidelberg Conflict Barometer*.

[113] Heidelberg Institute, *Conflict Barometer 2011*, 94–96.

[114] Heidelberg Institute, *Conflict Barometer 2011*, 31.

- For South Africa in 2012, the model predicted a probability estimate of 67.7%, which implied that the predicted conflict level would be "3"; the actual level was indeed "3". During this time, South Africa's ethnic groups continued to clash, eventually erupting into violence that affected the country's economy.[115]
- For Austria in 2012, the model predicted a probability estimate of 88.1%, which implied that the predicted conflict level would be "1" based on the highest probability assigned to that particular level; the actual level was indeed "1". Austria continued its relatively low level of social conflict, while exhibiting the highest levels (top 20%) of economic and social development.[116]

In some cases, the Ologit model had larger prediction errors:

- For Chad in 2011, the model predicted a probability estimate of 65.6%, which implied that the predicted conflict level would be "3" but the actual level was "2". It appeared that the actual level may have been underestimated given continued fighting among rebels vying for control of the country, Chad being on the verge of civil war.[117]
- For Sierra Leone in 2011, the model predicted a probability estimate of 52.3%, which implied that the predicted conflict level would be "1"; the actual level was at "3". The conflict prediction level may have been distorted owing to the level of Sierra Leone's exports. The country is one of the world's top producers of diamonds. With the elites controlling most of the country's resources, its wealth is subject to widespread

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[115] Heidelberg Institute, *Conflict Barometer 2012*, 37.

[116] Bond, *Heidelberg Conflict Barometer*.

[117] Heidelberg Institute, *Conflict Barometer 2011*, 32.

corruption. The country remains among the poorest in the world and ranks among the lowest 20% in economic and social development.[118]

- For Bolivia in 2012, the model predicted a probability estimate of 44.9%, which implied that the predicted conflict level would be "1"; the actual level was "3". While there were instances of civil disobedience and riots in Bolivia, it appeared that most of the riots were from groups vying for national political power and a desire for change, which indicated that the unrest could be more political and ethnic in nature rather than from economic disturbances.[119]
- For Mongolia in 2012, the model predicted a probability estimate of 67.6%, which implied that the predicted conflict level would be "1" based on the highest probability assigned to that particular level; the actual level was "3". It appeared that actual conflict revolved around ethnic violence rather than economic issues.[120]

[118] Heidelberg Institute, *Conflict Barometer 2011*, 33.

[119] Heidelberg Institute, *Conflict Barometer 2012*, 63.

[120] Heidelberg Institute, *Conflict Barometer 2012*, 79.

Chapter XI

Ordinal Probit Regression Model

The ordinal probit regression (Oprobit) model is very similar to the ordinal logit regression (Ologit) model since the probability estimates are reasonably close and it allows for the prediction of categorical dependent variables.[121] Like Ologit regression, the Oprobit regression is designed to provide probability estimates, but those estimates are based on the cumulative standard normal distribution function (like the regular probit model) rather than the cumulative logistic distribution function. In making probability estimates, Oprobit uses standardized z-scores from the cumulative normal distribution function. Using the Conflict Barometer's four intensity levels, Oprobit provides probability estimates for each of the four conflict levels based on z-scores predicted by the use of explanatory economic variables. Since the results are similar to the Ologit model, I will limit my discussion of the Oprobit model to general interpretations of the model coefficients.

Ordinal Probit Model Interpretations

Despite the differences in distribution functions, the ordinal probit model results tend to be very similar to those of the ordinal logit regression, but easier to interpret and understand. Therefore, I will discuss the coefficient only.

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[121] Stata Press, *Reference Manual*, 275–282.

- For a one-percentage point increase in *GDP per capita*, there was an approximate decrease of -0.0033 (β_1 = -0.325 x 0.01) in z-score on the Conflict Barometer (holding all the other variables constant). After converting the coefficient into a z-score, a probability estimate can be obtained by referring to the cumulative normal distribution table. Thus, for a high level of GDP per capita, the model produces a high probability estimate that corresponds to a *low* level of conflict for each percentage point increase in GDP per capita.
- For a one-percentage point increase in *labor force*, there was an approximate increase of +0.0034 (β_1 = +0.338 x 0.01) in z-score on the Conflict Barometer (holding all the other variables constant). After converting the coefficient into a z-score, a probability estimate can be obtained by referring to the normal distribution table. Thus, for a high level of labor force size, the model produces a high probability estimate that corresponds to a *high* level of conflict for each percentage point increase in the labor force.
- For a one-unit increase in the *lagging conflict variable*, there was an approximate increase of 0.842 in z-score of the Conflict Barometer, while holding all the other variables constant. After converting the coefficient into a z-score, a probability estimate can be obtained by referring to the normal distribution table. Thus, for a high level of the lagging conflict variable, the model would produce a high probability estimate that would correspond to a *high* level of conflict for each unit increase in the lagging conflict variable.

The Development Index acted as categorical variable to isolate the fixed effects among different countries at different stages of economic and social development. Since

the fixed effects (i.e., the Y-intercepts) are not significant, I will summarize the set of Development Indices by saying that for countries at low levels of economic and social development, the probability of conflict would tend to be higher than countries at high levels of development. Furthermore, the probability of conflict tends to decline in a non-linear fashion as development increases over time.

Chapter XII

Summary of Findings and Results

The empirical results provided by both the probit and ordinal logit regression models suggest a strong link between economic conditions and social conflict based on data from about 80% of the world's countries (completed cases on 172 of 214 countries, or 80.3%). The results indicate that the variables of economic resiliency and vulnerability could be linked to social conflict. The evidence gathered for my study, which covered an 11-year period, consistently supports the fact that economics is integrated with politics in many of the world's countries, adjusted for levels of economic and social development. Based on my analysis of the data, I can state that social conflict could be associated with the confluence of the following factors: levels of internal wealth (as measured by GDP per capita) of a country's people, life expectancies, the size of its population and labor force, and the influences of inflation. To a lesser degree, conflict could also be associated with interest rates, government obligations, and trade exports (refer back to Table 6-6).

The empirical regression models are useful tools to measure the strength of relationships in factors currently in the economic and social environment. Using the econometric techniques that I present in this thesis is only a first step in identifying reasons why social conflict exists in our world. The power of the specific models presented is in the measurement and predictive power of the model based on the data collected over the 11-year study period. Although I have harnessed only a few significant economic variables in my findings and results, I believe other researchers could build

upon my results and consider other variables to tease out other significant attributes in an effort to refine our understanding of social conflict. There is certainly room for more research to improve the predictive quality of these models.

Finally, each of the models was subjected to a variety of tests to determine statistical validity and the strength of the economic variables. Not all the models exhibited significant impairments that could affect their ability to support the inferences discussed in this thesis. All the results can be independently replicated to support the assertions and inferences contained herein.

Theory Implications

The empirical analyses presented here support my thesis hypothesis: social conflict as measured by the Conflict Barometer may be associated with factors that measure the economic resiliency and the vulnerability of a country. The association appears to be strong enough to provide predictive significance based on my longitudinal study encompassing at least 80% of all countries in this study. This association appears to hold up based on 11 years of data. Therefore, such data could be enormously helpful for generalizing about how economic factors may be catalysts for social conflict. One word of caution: more work that is empirical must be conducted in order to identify any spurious associations created by data collection methods and reporting limitations.

In the following, I reiterate the research questions posed at the beginning of this thesis, and follow with my responses:

Q: What components of economic resiliency and vulnerability might be associated with social conflict?

A: GDP per capita, inflation, labor force size, and life expectancy, among possibly more unobserved variables.

Q: What is the risk (or probability) that social conflict could occur given the combined effects of a country's economic components?

A: See the results of the probit (Chapter VIII) and ordinal logit (Chapter X) specialized regressions.

Q: Can these economic components function as indicators that help predict the risk of social conflict?

A: Yes, see the results of the probit (Chapter VIII) and ordinal logit (Chapter X) specialized regressions.

Q: If such economic components could be used to predict social conflict, what are the potential mitigants that might reduce conflict?

A: By implementing policies that could:

- increase GDP per capita (not just GDP levels alone),
- provide jobs that keep the labor force (between the ages 15 to 65) working,
- pass on the benefits of exports to its citizens,
- increase life expectancy through social services,
- reduce government debt burdens, and
- reduce inflation.

In summary, if a country's economic resiliency factors decline, the risk of social conflict is likely to rise. As a corollary, if a country's vulnerability factors rise, the risk of social conflict also would be likely to rise.

Chapter XIII

Conclusion

The phenomenon of social conflict is a problem for many nations around the world. Some of that conflict may be due to unsatisfactory economic conditions in a country, or it may be due to other unknown variables or combination of variables. This thesis introduces research on the economic factors that could give rise to social conflict. Given that I have explored only a few economic indicators (as potential causal variables), there may be other unobserved variables that could serve as predictive indicators to the phenomenon of social conflict. I believe my research adds to the understanding of human behavior in the context of economic policy development.

I began my analysis by classifying countries according to levels of economic and social development. The datasets originated from the World Bank, the International Monetary Fund, the United Nations and the U.S. Central Intelligence Agency, and the Heidelberg Institute of the University of Heidelberg in Germany. These datasets covered 214 countries over an 11-year study period. Additionally, I create a categorical control variable called the "Development Index," which can be used dynamically for any time period to control for the level of country development. This index is an empirical measure that uses GDP per capita and Life Expectancy as proxies for economic and social development. It is my hope that other researchers will identify other variables that will enable them to forego the practice of labeling countries as "developed", "developing", or "emerging". Through the use of cross-tabulation tables, I identified several levels of

unrest that appear quite consistent across countries at specific levels of the Development Index.

My empirical analysis utilized two econometric methods (using panel data regression techniques) that were useful in identifying the degrees of association, the strength of the selected economic variables, measuring the statistical significance of each variable, and the overall significance of the models. The findings were compelling and enabled me to build a functional expression to summarize the link between economic variables and social conflict. The panel data probit regression model provided probability estimates for the *incidence or absence of conflict* based on economic variables, while the ordinal logit regression model provided probability estimates for a *range of conflict intensity levels*. Therefore, the association between economic variables and social conflict appears to be consistent and strong for at least 80% of the world's countries during the 11-year study period from 2002 to 2012.

After reviewing the model results, I compared the predicted results and probabilities against actual social conflicts. This process enabled me to determine errors in the predictive quality of the models. In the probit model, I discovered that the model predicted conflict outcomes incorrectly in approximately 15.2% of the observations (completed cases on 172 countries; 1,588 observations), or conversely, the predictions were correct for 84.8% of the 1,588 observations. In the ordinal logit model, the model predicted less accurately and forecasted conflict intensity levels incorrectly in approximately 37.2% of the observations (completed cases on 178 countries; 1,759 observations), or conversely, the forecasts were correct for 62.8% of the 1,759 observations.

In summary, my modeled results support the work of many past researchers who have postulated a relationship between economics and social conflict. Based on the evidence I provide, the few economic variables that I analyzed are statistically significant in explaining social conflict, and they support the supposition that economic conditions can give rise to discontentment that may lead to social conflicts. However, economic conditions are heavily influenced and could be created by the political institutions that control the economic resources and the distribution of wealth in any given country. Unfortunately, many political institutions may have considerations that override any concerns for their citizens' wealth and well-being. Those political motivations will continue to be the subject of many other researchers and scholars.

While numerous researchers have focused their cross-sectional economic studies on specific countries and cases, my work is an extension of their work by applying econometric methods in attempt to identify the specific economic variables that were common factors for many countries during the 11-year study period. Although I do not make any claim that economic factors are actual *causes* that *affect* social conflict, the evidence presented in this thesis demonstrates strong associative trends between economics and social conflict. However, more work will be needed to support causality and the directionality of such economic factors on social conflict.

With regard to directionality, Frederic Mishkin, a former Governor of the Federal Reserve Bank, suggests that causality may run from globalization and economic growth to the notion of reduced poverty (an economic condition), while in my opinion and

analysis, high economic growth could in turn lead to reduced conflict.[122] I hope my work will stimulate others to consider longer study periods, apply more robust analytical techniques, and isolate other variables that I have overlooked or omitted for the sake of parsimony.

In closing, while more research will need to be done, based on my research, economics plays an important role in the determination of social conflict and, with the current econometric methods, such the economic conditions can be used to predict and measure the risk of social conflict.

Future Research Possibilities

This thesis analyzed certain variables of an economic nature that might cause social conflict. My objective was to identify a set of tools for explaining and predicting social conflict. Although my empirical results are interesting—even compelling—my study was limited to time-series data from 2002 to 2012 and only to countries that provided complete cases and observations during the study period. Additional research is needed to extend this analysis to include successive years and to identify other economic variables that might further explain how economics can influence a country's level of social conflict and provide predictive mechanisms to identify the risk of conflict.

Empirical data studied in this thesis may not be complete and may be subject to adjustments and reporting errors by the subject countries. In future research requiring similar data, limitations may exist where empirical data is not available from some

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[122] Frederic S. Mishkin, *The Next Great Globalization: How Disadvantaged Nations Can Harness Their Financial Systems to Get Rich* (Princeton, NJ: Princeton University Press, 2008), 6.

countries and sources. The data may also be suspect with regard to its reliability, construction, and validity issues. Further empirical work will be required to test the validity of the external data before it could be used to form new theories to generalize the nature of social conflict.

The econometric methods utilized in this thesis were specialized regressions designed to illustrate the degree of associations among the explanatory variables and the dependent variables applicable to special cases of the construction of the dependent variable. More research could be conducted to consider the use of other advanced techniques in applied econometrics to study the interactions of other economic variables and to account for stochastic trends that typically develop in time-series data in longitudinal studies longer than 20 years.

In the course of my data collection, I encountered a lack of decomposed data for the independent and dependent variables. My use of indices (such as GDP, inflation, etc.) and aggregate metrics produced by other researchers (such as life expectancy) tended to limit the amount of analysis that could be performed on those indices and levels. By examining individual sub-components, one can determine whether the resulting indices could be replicated correctly and whether the construction of the indices might have inherent measurement errors, data biases, and other data validity issues and concerns. The economic variables used in my research explained some of the variations in conflict intensity. Nevertheless, there may be other confounding (or interacting) variables that could influence the dependent variable. Such confounding factors may include (or exclude) other undiscovered economic variables, societal factors, or environmental

factors. More study could be conducted to evaluate additional economic factors that may have an impact on social conflict.

Finally, directionality of association is another important consideration for future research. While this thesis proceeds from the basis that economic conditions could be associated with social conflict, a researcher might also argue that conflict could precede or lay the groundwork for economic conditions. Given the limitations on the statistical tools that could be used to assess the directionality of such factors, it continues to be a research challenge to determine whether certain factors should be dependent variables or the independent variables.

My hope is that my journey provides further knowledge that will stimulate others to consider policy initiatives to predict, control, and possibly reduce social conflict. I also hope that my approach will add to the existing body of knowledge on the use of economic variables to predict conflict, and encourage further exploration into the interactions among such variables to help explain phenomenon of social conflict and its causes. More importantly, I hope that my research will ultimately assist policy makers to determine the economic costs associated with conflict and help save the lives affected by social conflict.

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