SYRIAN WAR GAMES

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DEDICATION

This thesis is dedicated to you, the reader. I hope that you find this topic as thought-provoking as I have and eagerly search out more information pertaining to it.

ABSTRACT

The Syrian Civil War is one of the world's deadliest ongoing conflicts. Although there are a variety of factors that both led to the war's outbreak and contribute to its continuation, this thesis focuses specifically on the role oil plays in perpetuating the violence. In particular, this thesis relies upon game theory to examine how the Islamic State of Iraq and the Levant's control over Syria's natural oil reserves impacts military strategies for the terrorists, the coalition forces engaged in Syria, and other local fighting groups. Ultimately, this thesis concludes that ISIL's control over Syria's oil limits the coalition's ability to attack the terrorists and encourages other local fighting groups to economically collaborate with ISIL.

TABLE OF CONTENTS

INTRODUCTION

The Syrian Arab Republic is a nation currently embroiled in one of the world's deadliest ongoing conflicts. As the Syrian Center for Policy Research now estimates, approximately 470,000 Syrians have died since the conflict began in 2011 (Boghani 2016). Needless to say, if the international community is to effectively intervene in Syria, it is first necessary to develop an accurate understanding of the multisided war unfolding there. Unfortunately, this is by no means an easy task as the roster of relevant fighting factions, their alliances and nemesis continually fluctuate. Syria's situation is at times so convoluted that Israel's Prime Minister, Benjamin Netanyah, has gone so far as to state that the conflict there more closely resembles the one portrayed in the televised fantasy drama, "Game of Thrones" than a traditional war (Tharoor 2016).

Netanyah's statement is particularly true when it comes to the retailing and acquisition of oil extracted by the Islamic State of Iraq and the Levant (ISIL), a terrorist organization currently in control of a large swath of Syria's territory and a majority of the country's natural oil supply (Solomon, Kwong, and Bernard 2016). Unlike most other terrorist organizations which rely upon donations to fund their activities, ISIL is has achieved financial self-sustainability, primarily through the extraction and sale of oil. This is where the perplexity begins as Syria's embattled government, opposing rebel groups, and the Republic of Turkey all purchase ISIL manufactured oil, thereby financially supporting their direct military competition. Further adding to this conundrum are the displayed priorities of the international coalition of nations who are militarily intervening in Syria. Instead of placing ISIL controlled oil fields literally in the crosshairs of their airstrikes, this joint international

mission has decided not to directly attack these seemingly ideal targets and instead focused their military efforts on other parts of the oil production process. Because of this, ISIL's ability to sell their extracted oil has only been encumbered, not impeded.

LITERATURE REVIEW

Because the Syrian Civil War is a relatively recent violent event, the field of research surrounding it has yet to fully mature. This is not to say that no informative scholarly research has been published on the role oil has played in Syria's conflict. In their 2015 paper, "War and the Oil Price Cycle", published in the Journal of International Affairs, Amy Jeffe and Jareer Elass take a macro view of the subject by analyzing how volatilities in the price of oil has fueled Middle Eastern Conflicts. As such, the authors single out the fact that in this age of modern conflict, oil reserves have become both a "spoil of war" and a strategic objective that must be captured as part of an organization's larger military campaign (Jaffe and Elass 2015).

Researchers have also focused their attention more intently within Syria. The German Institute of Global and Area Studies' Alexander De Juan & Andre´ Bank, in their 2016 article "The Ba'athist Blackout? Selective Goods Provision and Political Violence in the Syrian Civil War", discuss how Syria's ruling Ba'ath political party relies upon its control over governmental goods and services to coerce loyalty from citizens living within the national government's sphere of influence (Juan and Bank 2015). Others have attempted to examine the proper strategy for international intervention in Syria. Kenneth M. Pollack and Barbara F. Walter accurately represent this discussion in there 2015 article in the Washington Quarterly, "Escaping the Civil War Trap in the Middle East", where they argue that continued US intervention in Syria is necessary in order to protect citizens and national resources which will become vital for recovery once the conflict ends (Pollack and Walter, n.d.). Despite this

diversity of published articles pertaining to the Syrian Civil War, there has yet to be any analysis of the role Syria's oil supplies have had in shaping military strategies there.

THESIS OBJECTIVES

Due to this void of published literature, pertaining to oil's impact on military strategies currently being implemented in the Syrian Civil War, this thesis seeks to answer the following question:

> 'When it comes to Syria's natural oil reserves, how do organizational preferences of ISIL, other local fighting groups, and coalition forces influence their willingness to cooperate, in Syria?'

Subsequently, this will be accomplished through the use of game theory, an approach which illustratively represent economic models based on 'player's' preferences. Ultimately, the following analysis will utilize game theory to illuminate how organizational objectives, pertaining to Syrian oil, dictate the strategies currently being implemented by these three differing fighting groups engaged in Syria. Due to the dual nature of this query, the following analysis will be divided into first examining the coalition force's preference not to disable ISIL's ability to manufacture crude oil and, second, analyze why ISIL and its rivals economically cooperate with each other.

CONTRIBUTION TO THE FIELD OF RESEARCH

This thesis will contribute to the field of research in two ways. First, all military forces entangled in Syria's Civil War follow strategies designed to achieve specific outcomes, given the country's present situation. One of the most influential factors shaping these strategies is ISIL's control over the country's oil fields. By using game theory to model this conflict, this thesis will explain how each military group's actions

are intended to reach a desired outcome given ISIL's control over the country's oil supply. In turn, this analysis will also highlight how ISIL responds to each of these strategies. This will provide a complete picture of why these strategies of either cooperation or hindrance are followed by different military groups.

Secondly, once these strategies have been revealed, this thesis will analyze the strategic choices taken by each military group. To achieve this, each strategy will be evaluated to determine if a better outcome is possible given the level of cooperation, or lack thereof, between opposing military groups. If a better outcome is possible, this thesis will briefly discuss what possible steps could be taken to achieve this and the political roadblocks preventing them from occurring.

METHODOLOGY AND RESEARCH

This thesis will analyze three different types of groups which are militarily involved in Syria: ISIL, other local fighting collectives, and coalition forces. As information about the strategies of these groups is at best limited or provided through a third party, and at worst safeguarded from the general public as a matter of security, the following analysis will be reliant on a combination of quantitative and qualitative information. This is done out of necessity as it is currently not possible to assemble an accurate picture the Syrian conflict by simply relying on one method of research. Due to the novelty of the Syrian Civil War, the relevant information will primarily be collected through news reports and government issued documents.

This information will be used to assemble the three components necessary to conduct game theory analysis:

1. The players: actors who either compete or cooperate to achieve a preferred outcome.
2. Set of Strategies: the method by which each player chooses to achieve their preferred outcome given how the opposing player acts.
3. Payoff: the reward the players receive. A player will achieve their preferred outcome if it is the best possible outcome given the opposing player's strategy.

Once all three components have been defined, game theory can commence.

THESIS STRUCTURE

In order to carry out the analysis required to answer the aforementioned research question, this thesis will be divided into two parts. The first of these will provide the necessary background information to effectively study this topic and, the second, will concentrate on illustrating the performed analytical process. Because of this, the first chapter of this thesis will focus on the formation and history of Syria leading up to the outbreak of its civil war in 2011. Here, particular attention will be afforded to the evolution of Syria's government and the series of events that culminated in the epidemic of violence now plaguing the country. This part will end with brief introductions to the three groups militarily engaged in the country.

Following this introduction to the country and its armed groups, chapter two will delve into the oil component of this conflict. To accomplish this, it will initially discuss basic information about Syria's oil reserves and the role it has played in the country before 2011. This chapter will conclude by providing an overview of the process whereby

Syrian oil, now controlled by ISIL, is extracted, transported, and refined all before being sold.

Once this cursory review of relevant background information has ended, the second half of this thesis will begin as the strategies of all three groups are analyzed. This process will start with chapter three which will further define each of the three fighting groups by explaining their current attributes, objectives, and actions. Aided by this information, the actual analytical game theory process will commence in chapter four and consist of two stages. First, coalition forces' plan to root out ISIL by relying upon airstrikes and the terrorist's group's response strategy will be evaluated. Secondly, the economic cooperation between ISIL and opposing fighting groups to facilitate the sale of ISIL oil will be analyzed. Once all of these steps have been accomplished, this thesis will determine how ISIL's control over Syrian oil influences the strategies used by military groups within the country.

CHAPTER 1: HISTORY OF THE SYRIAN CIVIL WAR

The Syrian Arab Republic is a Middle Eastern state bordered by the countries of Iraq, Israel, Jordan, Lebanon, and Turkey as well as by the Mediterranean Sea. Similar to its neighboring countries, Syria did not organically form as differing cultures were not naturally assimilated together overtime to construct a new nation. Instead, following the end of World War I in 1918, statehood was forced upon its inhabitance by western powers. Although many had hoped that these cultural differences would fade with time, the Syrian Civil War, with its multiple sectarian forces, is a stark reminder that these opposing interests still prominently exist, both in Syria and in the region (Spyer 2016).

This chapter seeks to shed light on the formation of Syria and briefly explore how the nation, more specifically its government, evolved to the current one led by President Bashar al-Assad. Following this, the causes of the Syrian Civil War will be discussed, beginning with the environmental and socio-economic crises the country underwent in the lead up to 2011. From there, the analysis will review how the Arab Spring began in Syria and how the government's failed attempts to suppress this movement ultimately set off the national multi-sided war currently decimating the country. Lastly, this chapter will conclude with short introductions to the three key acting organizations that will be further analyzed in Chapter 4.

1.1 HISTORY OF SYRIA

1.1.1 FORMATION OF SYRIA

Formerly part of the Ottoman Empire, the modern day Syrian territory was established following the end of World War I, when, as part of the 1916 Sykes-Picot

Agreement between France and the United Kingdom (UK), France gained control over the region and formed the country ("Britain and France Conclude Sykes-Picot Agreement - May 19, 1916" 2016). This settlement was reached between foreign western powers without any consideration for the welfare of the local populace (Fildis 2016). State lines were arbitrarily drawn and, because of this, local societies with significantly different identities and beliefs were either divided or unnaturally congregated by the new countries. In Syria, this instilled a sense of rebellion amongst its new citizens against the central government (Eytan 2016). Although the Syrian people would rally together to oppose a shared enemy, these truces were not lasting as differing societies struggled against one another for dominance.

In 1925, following half a decade of French control, the Syrian people embarked upon the most prolonged and devastating insurrection in Middle Eastern History, as they struggled to liberate themselves from their foreign rulers (Provence 2009). After 21 years of discontinuous fighting, the Syrian people finally gained full independence from their western overseers in 1946, when the last French troops left the country. Unfortunately, self-governance did not bring peace to Syria as succeeding Syrian governments struggled to maintain order as a series of military coups destabilized the country ("Syria Profile - Timeline" 2016).

1.1.2 RISE OF THE ASSAD GOVERNMENT

Syria's most recent government was established in 1970, when General Hafez al-Assad led the "Correction Movement", a practically bloodless coup which overthrew the previous administration and installed Assad as the country's new leader ("Syria - The Baath Redirections of 1966 and 1970" 2016). As Syria's President, Assad

worked to strengthen his national government and established measures to cripple political opposition. Under his leadership, the country's constitution was amended, granting Assad's Ba'ath political party unprecedented influence over the state and Syrian society. This allowed Ba'athists to dominate all aspects of Syrian affairs from education and trade unions to military matters.

Although Hafez al-Assad promoted the Ba'ath political party, his real focus was on expanding his personal political dominance. During his nearly 30-year rule, Assad continued to further centralize power within his government by granting increasing amounts of authority to himself, his family, his closest advisors, and members of the military. Although Assad presented his rise to power as a return to civility for Syria, his government came to represent corruption, oppression, and self-service ("Profile: Syria's Ruling Baath Party" 2016). These political immoralities increasingly came to define the Ba'ath government following the transfer of national leadership to Assad's son, Bashar al-Assad.

1.1.3 PRESIDENT BASHAR AL-ASSAD

Bashar al-Assad ascended to the position of Syria's president following the death of his father in 2000. In many ways, this transition of authority more closely resembled the coronation of a new monarch, rather than a democratic process. Ten days after Hafez al-Assad had uttered his last breath, Bashar al-Assad became eligible for the presidency, following the Syrian parliament's decision to lower the minimum age requirement from 40 to 34; ran unopposed for office; and won by capturing 97% of the popular vote ("Bashar Al-Assad - President (Non-U.S.)" 2016).

Although Bashar al-Assad easily gained his father's vacated seat, his electoral victory was not applauded by all. As Eyal Zisser expounds in his 2003 Middle East Quarterly article, "Does Bashar al-Assad Rule Syria?":

> *Bashar's rise to power was received with undisguised derision—toward the man himself as well as the Syrian "Socialist Democratic Popular Republic," which Hafiz al-Assad and his son had turned into a monarchy, even a family fiefdom.* (Zisser 2003)

Despite facing mass dissatisfaction, both against the national government and his presidency, Assad was able to govern his country for over a decade until 2011 when Syria erupted into a civil war.

1.2 CAUSES OF THE CIVIL WAR

1.2.1 THE DAMASCUS SPRING

Following Bashar al-Assad's presidential victory in 2000, a massive societal push for democracy took place when the Damascus Spring began. Named after Syria's capital city, the Damascus Spring was a societal movement spearheaded by journalists, scholars, and community leaders who sought to peacefully reform Syria's political system by focusing on two key policy changes. First, since 1963 the country had operated under a 'State of Emergency', the Damascus Spring demanded that this end. As part of this, political prisoners would be released and the national government would be required to not only recognize, but protect its citizens' right to free speech. Secondly, these intellectuals sought to end the Ba'ath party's stranglehold over the country. To do this, they called upon Assad to end the country's one-party electoral system and implement policies designed to foster the development of a multiparty system.

Although Assad's government never formally recognized the Damascus Spring, a series of reforms were announced which did begin to address the social movement's petitions. However, this was a strategic misdirection as these reforms were quickly overwritten as the national government began a campaign of terror against the Damascus Spring's leaders who were arrested, threatened, and publically humiliated. By 2002, the last remanence of the Damascus Spring retired their campaign after Syria's government implemented a sequence of policies designed to further discourage political opposition ("The Damascus Spring" 2016).

Ultimately, Assad emerged victorious from his political confrontation against the Damascus Spring, however, this was one of the first signs that his presidency was not as secure as his supporters might have hoped. More significantly, this event revealed Assad's strategy of noncompliance when it came to addressing societal pressures to alter his government. Although this benefited him in the short term, Assad's unwillingness to carry out meaningful reforms caused his numerous opposition supporters to seek out increasingly severe methods to challenge him (Macfarquhar and Stack 2011).

1.2.2 THE HARSHENING ENVIRONMENT

An unresponsive government was not the only contributing factor that led to the civil war in Syria. In the lead up to the current conflict, a diversity of socio-economic situations and the violent dissatisfaction they produced began to culminate. First and foremost, of these situations, was the widespread draught that lasted from 2006 to 2011. Like most Middle Eastern states, Syria is predominately an arid country

with limited access to fresh water (Stokes 2016). Despite this limitation, agriculture was a cornerstone of the Syrian economy before the drought began. The national government had devoted a great deal of its financial resources towards the cultivation of the local agricultural industry, resulting in Syria transitioning from a net importer to a net exporter of farmed goods. Cotton was a specifically important crop, as a 2007 report released by Middle East Review of International Affairs recounts, 2.7 million farmers', roughly 15% of the Syrian population, depended on it for their livelihoods (Raphaeli 2007).

Because of these circumstances, the country was thrown into a state a chaos when it was struck by a drought in 2006. To label this drought as severe would be to underrepresent it. According to NASA and University of Arizona researchers who have studied historical precipitation trends in the region, this was the worst drought that has afflicted Syria in the last 900 years (Stokes 2016). During this four-year time period, according to the Center for Climate Security, 75% of Syria's crops withered and died before they could be harvested and 85% of all livestock perished because of malnourishment. Due to this biblical scale natural disaster, the United Nations approximates that anywhere from two to three million rural Syrians, out of 10 million, lived in a state of 'extreme poverty' because of the drought (Polk 2013).

1.2.3 THE SOCIO-ECONOMIC COMPONENT

This radically harshening environment and the humanitarian crisis it produced only added to Syria's unemployment concerns. Researchers Nader Kabbani and Noura Kamel of the Dubai School of Government recount in their 2007 article, "Youth Exclusion in Syria: Social, Economic and Institutional Dimensions", that in 2002

Syria's unemployment rate was 26%, which, despite being one of the highest in the world, was on par with the rest of the region. However, Syria was unique in the composition of its unemployed as young adults were disproportionally unable to find work when compared to their elders. Because of this, the ratio of unemployed younger to older unemployed adults was 6 to 1 in Syria, which was the most uneven distribution of joblessness in all of the Middle East. Kabbani and Kamel go on to state that this inequality is indicative of a much larger problem facing Syria, which is a population of youths who feel disconnected from the rest of the nation (Kabbani and Kamel 2007).

Young adults who remain emotionaly un-invested from their community pose a substantial threat to society, as they are more likely to join violent extremist groups. This phenomenon is discussed in Astrid Zweynert 2016 story in Business Insider, "Poverty, despair, hunger for revenge drive young Syrians to extremist groups: research". As Zweynert reports:

> *Young adults] need to earn a basic living, a desire for a sense of purpose and revenge are key factors that push young Syrians into joining extremist groups*

Zweynert explains that this is particularly true for men between the ages of 12 and 24 which is the demographic most likely to take up arms in support of religious extremist groups, such as ISIL. The most effective way to counteract this is to have a growing economy and a responsive government (Zweynert 2016). Sadly, both of these became harder to find as societal desires to alter the status quo in Syria grew increasingly ferocious.

In conclusion, around the beginning of this decade, Syria had become a mixing pot of combustive societal substances. The Assad Family's oppressive government, the worst drought the region has experienced in almost a century, and a massively disenfranchised youth population all coalesced in the country forming a figurative powder keg. All the country needed was a spark to set it all off. This came in 2011 when the Arab Spring swept across the Middle East and into Syria.

1.3 THE CIVIL WAR BEGINS

1.3.1 THE ARAB SPRING AND NEW PROTESTS

The Arab Spring was a transnational, citizen led movement amongst Arab states that sought to bring about a new era of democracy for this part of the world. Beginning in Tunisia, in 2010 when a protestor performed self-immolation in opposition to the country's national government, this movement quickly spread throughout the Middle East to 17 other nations, arriving in Syria on March 19, 2011 when security forces killed five protestors (Blight, Pulham, and Torpey 2011). Following this incident, public opposition against Assad's government continued to mount as, across the country, an increasing number of protestors banded together to demand their government adopt democratic reforms. In response, the national government labeled members of this political movement as "armed criminals" or "terrorists" and used the national security force to terrorize and disrupt their activities. While this tactic had succeeded in 2000, during the Damascus Spring, due to the increasingly severe circumstances in Syria, the opposition movement did not yield from Assad's oppression but instead seized weapons and began violently retaliating ("Arab Uprising: Country by Country" 2016). Unfortunately, Syria's cohesion only began to deteriorate further as time progressed.

Similar to other Arab Spring movements, the Syrian protestors originally called for the government to adopt democratic reforms and expand its recognition of personal liberties, in addition to address the widespread corruption and abuse which had come to define the nation. However, faced with increasing pressure from Assad's regime to discontinue their efforts, the protestors' multiple goals rapidly distilled down to a single point of concentration, dethroning Assad. This new focus invigorated the movement and a series of simultaneous mass protests took place across the country. Unwilling to negotiate, the government doubled down on its physical counter measures by launching formal military operations against the protestors, using thanks and artillery to drive them out of cities. Two months after the Arab Spring began in the country, 1,000 Syrian citizens were reported killed because of this burgeoning conflict (Ghettas 2016).

1.3.2 THE CIVIL WAR BEGINS

One month after the national government attempted to beat the opposition into a bloody surrender, utilizing targeted military campaigns, the move towards armed insurrection in Syria began. It started in Jisr al-Shugur, a city near Syria's border with Turkey, when protestors raided a police station, confiscating weapons which they then used to battle national security forces stationed there (Holliday 2011). This move towards violent opposition rippled across the country as battles broke out between newly armed rebel fighters and national security forces. Although a formal declaration of civil war has yet to be declared, this marks the historical turning point when opposition forces began transitioning from protestors into military collectives.

Forced to choose between either protecting the national government or its citizens, some members of the Syrian military and security forces instead decided that the best course of action was to desert, either seeking safe havens from the violence or joining the opposition. The most significant of these occurred in August, 2011, when a collective of defected officers formed the Free Syrian Army (FSA) and allied themselves with opposition factions by combating Assad's military ("Guide to the Syrian Rebels" 2016). This preceded the formation of several other key rebel groups including the Army of Conquest (AC), an Islamic Extremist group operating in near Lebanon and the Meditation Coast, and Syrian Democratic Forces, a predominately Kurdish freedom fighter collective concentrated in the north-western corner of the country (Lund 2016) (Hubbard 2015).

Adding to the litany of combating forces in Syria is the Islamic State of Iraq and the Levant (ISIL). Although similar to the Army of Conquest in that it is an Islamic extremist group, ISIL is a truly different entity as it is not aligned with AC and seeks differing long-term objectives. Additionally, ISIL controls access to key Syrian oil reserves, as well as a majority of the country, placing it in a unique epicenter of interaction with various other fighting groups (OFGs). Because of this, the forthcoming analysis will view this organization as an independent entity and will not merge it with other rebel groups currently engaged in Syria.

The last combat organization involved in Syria that requires mention are the United States led coalition forces currently attempting to intervene in Syria. In 2013, the US became the first western nation to become indirectly involved in the Syrian Civil War when President Obama agreed to begin providing military aid to rebel groups

("Who Is Supplying Weapons to the Warring Sides in Syria?" 2016). However, following ISIL's military victories, in 2014, Obama announced the USA's intention to begin directly engaging ISIL and other terrorist organizations acting in Syria. As he argued during a public address:

> *ISIL poses a threat to the people of Iraq and Syria, and the broader Middle East -- including American citizens, personnel and facilities. If left unchecked, these terrorists could pose a growing threat beyond that region, including to the United States.* (Obama 2014)

That same year, the US began carrying out airstrikes in Syria, targeting ISIL and other Islamist extremist fighting groups (Saul 2016). More recently, last year, the USA's commitment to supporting rebel fighters and opposing ISIL progressed even further as the USA announced the deployment of US special forces in Syria to support militant Assad opposition groups.

1.4 CHAPTER CONCLUSION

This chapter served two purposes. First, it provided the necessary context to accurately frame the Syrian war for analysis. As it revealed, this civil war is a complex conflict with multiple driving forces and groups of actors either collaborating or competing with one another. Secondly, it introduced the three key actors, rebel forces, ISIL, and coalition forces, whose strategies and objectives will be the subject of the forthcoming analysis. From here, it is possible to begin analyzing the role oil has played both in Syria's development and its Civil War.

CHAPTER 2: SYRIAN OIL AND THE CIVIL WAR

Up till know, the contextual explanation for the Syrian Civil War has concentrated on the history and events that culminated in the outbreak of violence within the country. Although this aspect is vitally important for understanding the current conflict, it remains only one half of the information necessary to perform game theory analysis. Therefore, the missing component will be discussed in this chapter as the subsequent sections explains oil's importance in Syria's Civil War by focusing on how the Islamic State of Iraq and the Levant is capable of producing revenue from its sale. To accomplish this, the following analysis will illustrate the process by which Syrian oil, controlled by this terrorist organization, is extracted, transported, refined, and ultimately sold. However, before this narrative can begin, it is first necessary to understand the role oil has played in Syria before the civil war erupted. The next section will achieve this by providing a rudimentary introduction about the country's oil fields and their importance to the country.

2.1 SYRIA'S OIL RESERVES

According to the United States' Central Intelligence Agency, of the 101 countries with proven crude oil reserves, Syria is ranked 32nd with an estimated 2,500,000,000 barrels of oil which has yet be extracted. Although this supply is quite miniscule as compared to Venezuela or Saudi Arabia, both of whose reserves exceed 200 billion barrels, oil is vitally important for Syria ("The World Factbook" 2016). As the World Bank explained in a 2010 country brief:

> *Syria's [economy] remains dependent on the oil and agriculture sectors, both subject to uncertainties due to changes in oil prices and rain dependency respectively. The oil sector provides approximately 20*

percent of the government's revenues and about 40 percent of its export receipts.

The report continues by addressing oil's importance in Syrian society as the national government's ability to fund public services was directly dependent on oil revenue ("Syria Country Brief" 2010). This became particularly true in the late 2000s as the Syrian drought dried up the country's agricultural sector and the nation became more dependent on oil revenues. Following the civil war's start, Syria's oil reserves further increased in importance as opposing military groups battle one another to possess them.

2.2 THE CURRENT SITUATION IN SYRIA

As of February 29th, 2016, ISIL controls a majority of Syria's oil fields. These were seized as part of the terrorists' objective to establish an Islamic nation by militarily opposing all other claims to the region (Solomon, Kwong, and Bernard 2016). Although infamous for the level of secrecy within which they operate, it is well known that ISIL profits greatly from these oil fields. This was made abundantly apparent following a US Special Forces raid against ISIL in May of 2015. In addition to successfully capturing thousands of documents detailing ISIL's inner workings, US forces also secured financial ledgers which revealed that almost half, nearly $40 million, of the terrorist groups funding comes from its sale of oil (Speckhard 400AD). Although these documents affirm ISIL's motivation for occupying Syria's oil fields, a more thorough understanding of its oil production chain is necessary before this thesis can begin analyzing ISIL and coalition forces' strategies in Syria.

2.2.1 ISIL'S OIL PRODUCTION CHAIN

Following ISIL's capture of an oil field, the organization deploys teams of recruited workers to repairer damaged oil wells and restore their ability to extract crude oil (Van Heuvelen 2015). Once this has been achieved, the oil production process becomes underway as ISIL sells the majority of its extracted crude oil to unaffiliated traders. These merchants transport the unprocessed fossil fuel via trucks to oil markets, most often in ISIL controlled Syrian territory, where it is sold to oil refineries.

Typically, these refineries are of a primitive designed, being constructed by residents rather than by professional corporations. Once a delivery of crude oil is received, these refineries process the fossil fuel to produce petrol and mazout, a form of diesel. Electric grids are exceptionally limited in Syria and, because of this, it is common practice for Syrians to rely upon mazout to power their homes and businesses as it is a cheaper and more reliable fuel than petroleum.

Following the refinement process, the oil is repurchased by merchants who then sell it to consumers through one of three major markets. The first of these are markets controlled by ISIL who, in its attempt to establish a sovereign nation, require merchants to be licensed and pay taxes for the sale of their product. ISIL oil is also delivered to markets outside of the terrorist's territory. Supporters of Assad's regime and rebel forces both purchase ISIL oil to augment their limited supply of petrol and mazout. Lastly, the more daring traders will attempt to smuggle ISIL oil outside of the country. Historically, their intended markets are either in Turkey or Iraq, though reports have indicated that this trend is decreasing as Syria's neighbors bolster their border security (Solomon, Kwong, and Bernard 2016).

2.3 CHAPTER CONCLUSION

Despite not being an original cause of the conflict, Syria's oil reserves play an important role in the civil war's continuation as they provide ISIL with the ability to generate profits. However, this is where this thesis's crux begins. As this chapter demonstrated, ISIL oil is purchased by local military forces who are directly compete against the terrorists for control over Syria. Furthermore, ISIL's finances are heavily dependent on its ability to produce oil. The outside observer is left with two questions:

> 'Why are these opposing forces cooperating and why have coalition forces avoided destroying the ISIL oil wells?'

These two questions form the basis of this thesis's second half, which will begin analyzing the strategies of each military groups in Syria in relation to ISIL's control over the country's oil.

CHAPTER 3: FIGHTING ORGANIZATIONS IN SYRIA

Despite there being a myriad of fighting organizations currently engaged in Syria, this thesis will only focus on three of them: The Islamic State of Iraq and the Levant (ISIL), other foreign fighting groups (OFGs), and the international coalition. ISIL was selected as it controls the most territory in Syria, possesses a majority of the country's oil reserves, and is an international terrorist organization which has helped spur the international community into intervening in Syria. OFGs is a catch all classification for other local combat groups presently involved in Syria who are not members of ISIL, which includes President Assad's military, opposition militants, and Kurdish rebels. Lastly, coalition forces compose the largest and most impactful foreign intervention in Syria, particularly focusing their military efforts on combating ISIL, this group adds a third component to this war.

This chapter marks the beginning of this thesis's analysis. In order to perform game theory, a study requires three elements:

1. Players (the organizations involved in Syria)
2. Strategies (the actions these organizations utilize to achieve their objectives)
3. Rewards (the possible outcomes that may result from the intermingling of two group's strategies)

The first and second elements of game theory will be explored in this chapter. Once this has been accomplished it is possible to progress on to game theory which will analyze how these players utilize their strategies to achieve the desired rewards.

3.1 THE ISLAMIC STATE OF THE LEVANT

The Islamic State of the Levant is a Sunni Muslim terrorist group which arose to prominence following the USA's invasion of Iraq in 2003 (M. A. Weaver 2006). Although this group has been known by numerous names, including but not limited to al-Qaeda in Iraq, the Islamic State, the Islamic State of Iraq and Syria, this thesis chooses to identify it as the Islamic State of the Levant as this is currently the most accurate English translation for the organizations name (Irshaid 2016). As a Sunni terrorist group, ISIL is committed to waging a holy war in order to protect the caliphate, a new nation the organization established in 2004 which is entirely governed by Islamic law (What Is "Islamic State"? n.d.). Currently, the caliphate exists in ISIL captured territory, spanning from the northern part of Iraq to the southern portion of Syria, though the organization has stated its objective of expanding its governance to the surrounding region.

3.1.1 ISIL'S STRATEGY

Currently, ISIL relies on two separate strategies for interacting with the coalition and OFGs. As ISIL possesses no air force, and lacks sufficient artillery to repel coalition airstrikes, ISIL's predominate strategy for mitigating the coalition threat is to adapt their operations. A prime example of this strategy in action is their method for dispensing extracted oil. Before coalition aircraft began targeting transport vehicles, ISIL had oil merchants arrange their vehicles into rows while they waited to purchase oil. However, as this proved tempting targets for the coalition, ISIL now provides merchants with a waiting number and an estimated pick up time so that the vehicles can idle in secluded locations (Solomon, Kwong, and Bernard 2016).

Although ISIL and OFGs are opposing forces, they have developed a symbiotic relationship with one another. OFGs depend on ISIL for oil, as will be discussed later, and ISIL is reliant on the OFGs for weapons and ammunition. Similar to their oil trade, this exchange occurs through intermediary agents who purchase weapons from the OFGs and resell them to ISIL (Solomon 2015). For both OFGs and ISIL, these resources are vital to their causes, making their origins of no concern to the organizations.

3.2 OTHER FIGHTING GROUPS

As it has been stated, there are numerous rebel groups currently embroiled in Syria's multisided civil war. Because of this, fighting groups, other than ISIL, are generally sorted into three major camps: rebels, the regime's army, and Kurdish militias. Without delving too deeply into the specifics of each group, it can be stated that all OFGs either seek to exert their dominance over all of Syria or capture a portion of the country in order to found a new state. The key difference that separates these groups from ISIL is their lack of oil resources, which will be reviewed in the following section (Solomon, Kwong, and Bernard 2016). Because of this, and to facilitate effective game theory analysis, this thesis has consolidated these three organizational types into one classification, OFGs.

3.2.1 OFGS' STRATEGY

Currently, OFGs only inhabit slivers of territory along Syria's western and northern boarders as the remainder of the country is controlled by ISIL. This places OFGs at a distinct disadvantage as it prevents them from directly accessing Syria's natural oil reserves which they require in order to operate their machinery (Solomon, Kwong,

and Bernard 2016). Fortunately for OFGs, ISIL's presence in Syria has motivated other nations, most notably the USA and Russia, to become involved in the war and begin supplying weapons to OFGs (Sly 2016). Because of this, OFGs are able to rely upon intermediary agents to indirectly sell weapons to ISIL and use the revenue generated from this activity to purchase oil derived from ISIL, forming an economic symbiotic relationship where oil is exchanged for weapons, allowing both groups to perpetuate the war.

3.3 COALITION FORCES

Spearheaded by the USA, an international coalition of fifteen nations has steadily increased their involvement in Syria since the outbreak of the civil war in 2011. Originally, these foreign nations confined themselves to only providing supplies to rebel groups (McKelvey 2016). However, in 2014, this shifted drastically when the US announced that it would begin carrying out airstrikes against ISIL. This has become the coalitions' favored strategy for combating ISIL as they have conducted more than 3,000 aerial attacks on ISIL as of December 2015 (M. Weaver and Borger 2015).

3.3.1 THE COALITION'S STRATEGY

By utilizing their air superiority, the coalition is attempting to balance their short term objective of banishing ISIL from the region and their long term goal of assisting in the restoration of Syria. In order to achieve this, the coalition aircraft originally targeted points along the oil production chain that were physically distant from the oil extraction equipment captured by ISIL, such as oil refineries and transport vehicles. However, as ISIL has adapted to these attacks, the coalition forces have been forced

to become more aggressive by attacking targets linked to the oil extraction process (Solomon, Kwong, and Bernard 2016). Although they have yet to outright destroy the oil wells, the coalition is moving progressively closer towards this outcome as they attempt to reach the point where ISIL is no longer capable of adapting to their attacks.

3.4 CHAPTER CONCLUSION

By highlighting each group's goals and strategies, it is possible to begin identifying what conceivable outcomes could emerge when one of these groups begins interacting with another. With the information provided in this chapter, this thesis is now prepared to construct game theory models. This is carried out in the following chapter.

CHAPTER 4: GAME THEORY ANALYSIS

Now that each of the three groups have been introduced, their goals identified, and their actions explained, game theory analysis can now begin. The overarching objective of this thesis is to provide insight into how ISIL's control of Syria's oil fields impact military strategies in Syria. Because of this, this analyses will be divided into two parts. The first will evaluate the coalition forces' aversion to destroying ISIL controlled oil wells, preferring instead to attack other points along the oil product chain. As part of this, this analysis will also explore how ISIL's response to these airstrikes either amplifies or mitigate the coalition attacks. This will be accomplished utilizing a variation the 'safety in numbers' game whereby the two actors engage each other simultaneously and there is no cooperation between them.

The analysis's second part will focus on the economic cooperation between ISIL and other Syrian fighting groups (OFGs) as chapter 3 already touched upon, this includes rebel organizations, Kurdish fighters, and troops loyal to the Assad government. Here, the analysis will determine why these opposing groups assist one another by utilizing a 'sequential game' which occurs non-simultaneously between two actors, allowing each one to respond to the other's strategy. This method allows for 'backwards induction' which will ultimately explain each groups' incentive to cooperate. Both of these analyses will conclude by explaining how, in each situation, both actors have reached Nash Equilibrium and discuss what steps would need to be taken in order to achieve Pareto optimality.

These two applications of game theory will ultimately be this thesis's contribution to the field of research. Here it is important to note that this advancement in knowledge

will not be made through a new quantitative correlation or by revealing societal preferences through qualitative studies. Instead, this thesis will advance the understanding of the Syrian Civil War by relying on game theory to provide a comprehensive picture of how ISIL's control over Syrian oil impacts military strategies in Syria. This will benefit future researchers and policy makers as it demonstrates how military strategies in Syria will adjust as the organization seek the most beneficial outcome they can feasibly achieve.

4.1 COALITION FORCES AND ISIL

The first relationship that this thesis will analyze is the rivalry between ISIL and coalition forces, which will be accomplished by utilizing the 'safety in numbers' game. This is a simulation where two players simultaneously engage each other without first coordinating their strategies. What differentiates this from other basic forms of game theory is that each player has more than two responses to choose from in order to oppose the other player. As the best way to understand game theory is to conduct it, the following section will provide a brief overview of a classic 'safety in numbers' game.

4.1.1 AN EXAMPLE OF THE SAFETY IN NUMBER GAME

Two equally matched opposing armies, red and blue, are preparing to engage each other in combat. As part of this, the commander for each side must decide how many troops to commit to the forthcoming battle. Each commander has 300 troops at his disposal and can deploy them in units of 100. Unfortunately, neither

commander knows how many troops his opponent will deploy. For both sides, the goal is to win the battle. This situation is represented in Table 1.

Table 1: Safety in Numbers Example

Army Blue \ Army Red	0	100	200	300
0	B , B	C , A	C , A	C , A
100	A , C	B , B	C , A	C , A
200	A , C	A , C	B , B	C , A
300	A , C	A , C	A , C	B , B

This table represents the situation faced by the red and blue armies as each side can choose to either deploy 100 troops, 200 troops, 300 troops, or none of its forces to the forthcoming battle. In the table, these figures are represented next to the matrix. Depending on each side's actions, there are three possible outcomes that can be reached: the red army wins, the blue army wins, or the battle ends with a draw. As previously mentioned, the goal of each army is to win the battle. However, it is not possible for both armies to achieve their stated objectives as these goals contradict one another.

Because only one army can win, or else the battle ends in a draw, each side possesses a linear set of preferences when it comes to these outcomes. In the table

“A” represents the most preferred outcome as it signals that the army achieved its stated objective of winning the battle, “B” indicates that the outcome could either be improved or worsen for that army, and “C” denotes the least preferred outcome for that army. With these two features in mind: it is possible to read the table as follows:

C, A: The red army wins.

A, C: The blue army wins.

B, B: The battle ends in a draw.

With this information, it is possible to determine that each commander will deploy all 300 soldiers under his command. This deduction is reached quite simply. If neither side commits troops to the battle, then the contest will end in a draw (B, B). However, if the red commander, for instance, recognizes this he will command 100 of his red troops into combat to oppose the nonexistent blue army and win the battle (C, A). If, on the other hand, the blue commander predicts that the red army will deploy 100 troops, he will intern unleash 200 of his soldiers, securing a blue victory (A, C). The blue commander will not command less than 200 troops onto the battle field as any fewer would result in a less then preferable outcome. This process continually repeats as each commander increasingly commits more of his troops to the fight until both sides have spent all 300 of their forces and the battle ends in a draw (B, B). Knowing this, it is now possible to determine when Nash Equilibrium occurs between the two armies and if both sides are making Pareto optimal decisions.

4.1.2 NASH EQUILIBRIUM AND PARETO OPTIMALITY

Nash equilibrium is a term specific to game theory that was developed by famed mathematician, Jon Nash. Simply put, Nash Equilibrium is the outcome where

neither player has any incentive to change their strategy ("Nash Equilibrium Definition" 2007). In Table 1's example, the Nash equilibrium is where both the red and blue armies have committed all 300 of their troops to battle, resulting in a draw (B, B). Here, it is important to note that this is the exact same outcome as if both armies had each deployed no troops. However, both sides are incentivized to win and will deploy troops in order to do so. Therefore, Table 1's Nash equilibrium is the outcome where neither army is capable of further increasing their number of committed troops and are incapable of decreasing their deployed troops as it will result in an unfavorable outcome for them.

Pareto optimality, on the other hand, is the status where limited resources are being utilized in the most efficient manner possible ("Pareto Efficiency Definition | Investopedia" 2016). Because of this, a Pareto optimal outcome may not be the most favorable outcome for one side, but is the best possible result given both players' preferences. For the battle between the red and blue armies, the Nash equilibrium is not a Pareto optimal outcome. As has already been discussed, the battle will end in a draw. However, this outcome will come at the cost of 600 troops, which are limited resources for both armies. Therefore, knowing that the battle will ultimately end in a draw, the Pareto optimal outcome would be for both commanders not to deploy any troops. This will still produce the same outcome as the Nash equilibrium's but at no cost to either side. Both red and blue troops will literally live to fight another day while still providing their commanders with the same results as if they had all gone into battle. Unfortunately, this outcome can only be achieved if the red and blue commanders set aside their differences and cooperate with one another.

4.1.3 ISIL V. COALITION FORCES

As has been reflected upon throughout the course of this thesis, ISIL and coalition forces are diametrically opposed to one another. This said, they are united in their adoration of Syria's oil reserves as they both seek to control them through differing means. ISIL's strategy is dependent on dominating the geographic region in which a majority of the oil fields are located, while the coalition relies upon its aerial superiority to bomb strategic points along ISIL's oil production chain in an endeavor to drive ISIL from the region. Unsurprisingly, as Chapter 3 discussed, ISIL has not acquiesced to the coalition's demands, instead choosing to adapt their oil vending process and their inner workings to account for the airstrikes. To this, coalition forces responded by caring out increasingly aggressive attacks, though they are still mindful not to damage the oil wells. This situation is represented in Table 2.

Table 2: ISIL and Coalition Game

ISIL \ Coalition Forces	Stop Attacks	Continue Attacks	Increase Attacks	Destroy Wells
Stop Production	B , B	D , A	E , C	F , F
Continue Production	A , D	C , C	D , B	F , F
Adapt Systems	C , E	B , D	C , C	F , F
Abandon Territory	F , A	F , A	F , A	F , F

Similar to Table 1 with its red and blue armies, Table 2 represents the actions, outcomes, and preferences for ISIL and coalition forces. This table's first feature,

which is important to note, is that both ISIL and coalition forces have 4 actions to choose between. However, unlike the previous example, these choices are not reflections of one another. This is due to the fact that there is an uneven distribution of resources between these two military groups. Coalition forces rely upon their superior airpower and, as of yet, have not attempted to hold territory in Syria. Because of this, their actions are centered around aggression towards the terrorist group. ISIL, on the other hand, lacks an air force and sufficient artillery to repel coalition airstrikes. Because of this, their actions are focused on adapting to coalition aggressions.

With this plethora of actions comes a diversity of possible outcomes. Once again, it is important to note that Table 2 significantly digresses from the traditional safety in numbers game as it expresses that there are ten possible outcomes for ISIL and coalition forces to achieve. To evaluate these outcomes, it is necessary to understand that both ISIL and the coalition each have an ascending order of preferences. These preferences are represented in Table 2 with “F”, the least preferable, and continues backwards through the alphabet to “A” being the most preferred.

As with Table 1, there is currently no scenario in which both ISIL and the coalition each reach their most preferred outcome. In fact, because these two sides are polar opposites of each other, as one side draws closer to its preferred outcome, the other automatically moves further away from its own. An example of this is when ISIL is continuing to produce crude oil and coalition forces are continuing their attacks resulting in a stalemate (C, C). However, when the coalition decides to increase

their attacks they progress towards their objective while, at the same time, ISIL moves further away from their goals (D, B). This makes practical sense, as Chapter 3 discussed, when the coalition increases their attacks they do so by expanding the number of acceptable airstrike targets. Therefore, they are making it increasingly difficult for ISIL to control their territory, moving the coalition closer to a Syria free from the terrorist group while ISIL takes a step back from its objective of expanding the Caliphate.

The most striking aspects of this table are the matrix's rightmost column, bottom row, and the top left cell. The rightmost column signifies the outcome if coalition forces were to destroy ISIL controlled oil refineries (F, F). This is currently the most unfavorable outcome for both sides as ISIL would lose almost half of its capacity to generate revenues while the coalition would severely cripple any post war reconstruction efforts. The most favorable outcome for the coalition and the least preferred for ISIL is represented in the bottom row (F, A), which denotes the resulting preferences if ISIL were to surrender its territory. This would unquestionably be a significant victory for coalition forces and a major loss for ISIL.

The last significant aspect of Table 2 is the top left cell that signifies the resulting situation if ISIL and coalition forces began peace negotiations which would require the terrorists to halt their illegal oil productions and, in return, the airstrikes would cease (B, B). This draw is preferable to other ones that occur in the game (C, C) because it would halt the violence whereas the other stalemates would continue it even though neither side is achieving any significant progress. However, as Table 2 illustrates, neither side is willing to accept this as they both have actions that would

lead to preferable outcomes. If ISIL continues oil production, the terrorists will generate income to fuel their violent opposition against western influence. Similarly, coalition forces would prefer a military victory over peace talks with ISIL as negotiations would impart ISIL with state legitimacy, an outcome that the coalition seeks to avoid.

4.1.4 NASH EQUILIBRIUM FOR ISIL V. COALITION FORCES

Despite this ensemble of outcomes and preferences, it is nevertheless still possible to determine the Nash equilibrium for ISIL and coalition forces. In this instance, Nash equilibrium occurs when coalition forces "increase aggression" and ISIL chooses to "adapt systems" of operation, resulting in a draw (C, C). This assertion is reached based on the fact that this is the only outcome where neither side would willingly change strategies, as it would require them both to accept less favorable outcomes. Coalition forces would refuse to revert back to their previous level of aggression as it would now be less effective as ISIL had improved their systems of operation. Additionally, the coalition has so far rejected to carry out direct attacks on oil extraction equipment, signaling that this too is a less preferable choice.

On the other side of the battlefield, ISIL's leadership would rebuff any suggestion of returning to previous systems of management and oil production. This option is rejected as it would make the terrorists unnecessarily vulnerable to coalition attacks and places unnecessary strain on their limited resources. Additionally, abandoning their captured territory is by no means an option for these terrorists. ISIL was founded with the expressed objective of establishing the Caliphate as soon as possible. Because of this, any loss of territory is seen as deviating from their stated

objective and not acceptable. Therefore, based on these preferences, it is possible to determine that the Nash equilibrium lies between increased aggression from the coalition and ISIL adapting their systems in order to continue prospering while under attack.

4.1.5 PARETO OPTIMALITY FOR ISIL V. COALITION FORCES

Similar to Table 1, it is possible to identify the Pareto optimal outcome for ISIL and the coalition. As with the hypothetical red and blue armies, the terrorists and coalition forces are currently not achieving the Pareto optimal outcome (B, B). This is the greatest optimal outcome, that is also achievable, as both sides will reach their most preferred outcome at the least cost to their opponent. However, in order to reach this state, both sides would have to cooperate with one another as they are equally incentivized to achieve more preferable outcomes which come at the other's cost.

4.1.6 POLICY OPTIONS FOR ISIL V. COALITION

This analysis benefits policy makers and military commanders as it identifies that so long as ISIL is able to adapt to the coalition's increased aggression, the battle to control Syria's oil reserves will remain in a stalemate. Therefore, three policy options exist. First, the coalition leaders could continually intensify the pressure they are exerting on ISIL until the terrorists can no longer adapt to it and are forced to fold. This dire situation would change the game for ISIL as the terrorists would shift their priorities from controlling Syria's oil fields to preserving their organization even at the cost of territory.

Secondly, ISIL and coalition leaders could reach a peaceful end to the violence, resulting in both sides achieving the Pareto optimal outcome. However, this will require cooperation between the two groups. Seeing as they are motivated by opposing objectives, this is an unlikely outcome.

Third and finally, the terrorist's continued aggression towards their enemies may coarse the coalition into destroying oil extraction equipment currently under the control of ISIL. As Table 2 demonstrated, this is presently not a preferred outcome for coalition forces. Nevertheless, the situation in Syria may deteriorate to such a point that it is costlier for the coalition not to destroy the extraction equipment than tolerate ISIL's continued oil operations. This would result in a reordering of coalition preferences.

4.2 ISIL AND OTHER FIGHTING GROUPS

The second relationship that merits analysis is the cooperation between ISIL and other fighting groups (OFGs) in Syria. However, a traditional game, such as the ones utilized in 4.1, is not applicable in this case as these two groups communicate with one another and act in turns, rather than simultaneously. Because of this, the following analysis will utilize a 'sequential game' which is capable of reflecting both non-simultaneous action and cooperation.

Additionally, a sequential game's outcomes cannot be analyzed in the traditional sense where a researcher progresses forward through a series of possible players' actions until reaching the final Nash equilibrium. Instead, in a sequential game, a researcher relies upon 'backwards induction' in which subgames are analyzed. A

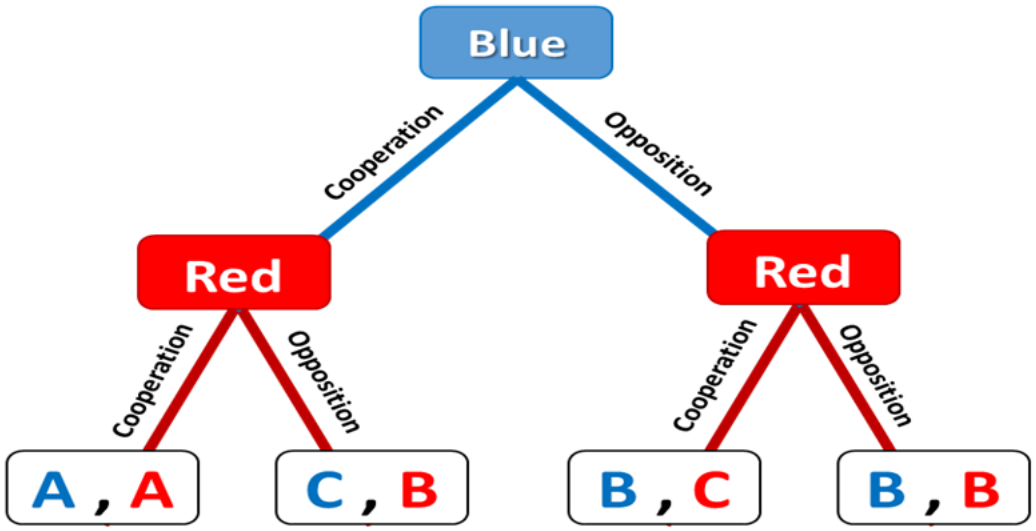
subgame is a phase, during sequential games, when only one player can act by selecting a single action to perform from multiple options. Backwards induction is performed by taking a sequential game's last subgames and, relying upon understood player preferences, determining which actions the player will choose to perform in order to achieve their most preferred outcome.

This process is repeated with the preceding subgames which involve the other player who is aware of his opponent's choices. This process is continually replicated until the research reaches the original subgame in which player one chooses to either cooperate or oppose player two. The key to this analysis, as compared to the study of traditional game theory, is that the examination moves backwards and that each player is aware of the other player's actions. Ultimately, this process allows the research to determine which of the multiple sequential game outcomes is the Nash equilibrium. These concepts will be further explained by the following section's example.

4.2.1 A SEQUENTIAL GAME EXAMPLE

Two investors, red and blue, are considering backing a crowdfunded project which, if fully funded, will double both investors' initial buy-ins. However, if the project is not fully funded then all investment will be lost and no compensation will be returned to investors. Additionally, red and blue are the last two investors who can support this project. Therefore, both red and blue must fund the project in order for either of them to profit from it. This scenario is presented in Table 3.

Table 3: Sequential Game Example



Once again, Table 3 represents the interactions between two players. Although, in this instance, each player is limited in their actions as they can only choose to either cooperate with or oppose the other player. With its two players, each of whom must choose between two actions: there are 4 possible outcomes to this game:

A, A: Both red and blue decide to cooperate and receive double their investments

C, B: Blue cooperates and loses all money as red saves money by not investing

B, C: Red cooperates and loses all money as blue saves money by not investing

B, B: No money is earned or lost as neither red nor blue oppose by not investing

Table 3 illustrates all possible series of choices that lead to these four outcomes. This is represented as a pyramid of choices where one player acts first and then the second responds. In this example, blue is the first to act by deciding whether to cooperate, invest in the project, or oppose, withhold the investment. After this decision has transpired, it is red's turn. Knowing blue's choice, red can choose to either cooperate, i.e. fund the project, or oppose it by not investing. This results in the 4 outcomes, forming the base of the pyramid. As with the games found in 4.1, each player's outcome preferences are signified by a letter, "A" being the most favorable and "C" the least preferred.

Although it is abundantly apparent that cooperation is the best strategy for both red and blue, as it will generate the largest reward, this does not guarantee that these two investors will both choose this course of action. To determine this, one must conduct backwards induction. This analysis is performed by first studying the two subgames red performs. The first of these occurs if blue decides to cooperate. If this is the circumstance, red will also cooperate as this will generate the most preferred outcome (A) as compared to the outcome if red chooses to oppose (B). Similarly, if blue decides to oppose, red will also choose to oppose, as this action will produce the most personally favorable outcome (B).

Now that the two outcomes of red's subgames have been determined, it is possible to begin analyzing blue's subgame decision. Here, blue has two choices, cooperate or oppose. Fortunately for blue, it is apparent that red will mimic blue's actions.

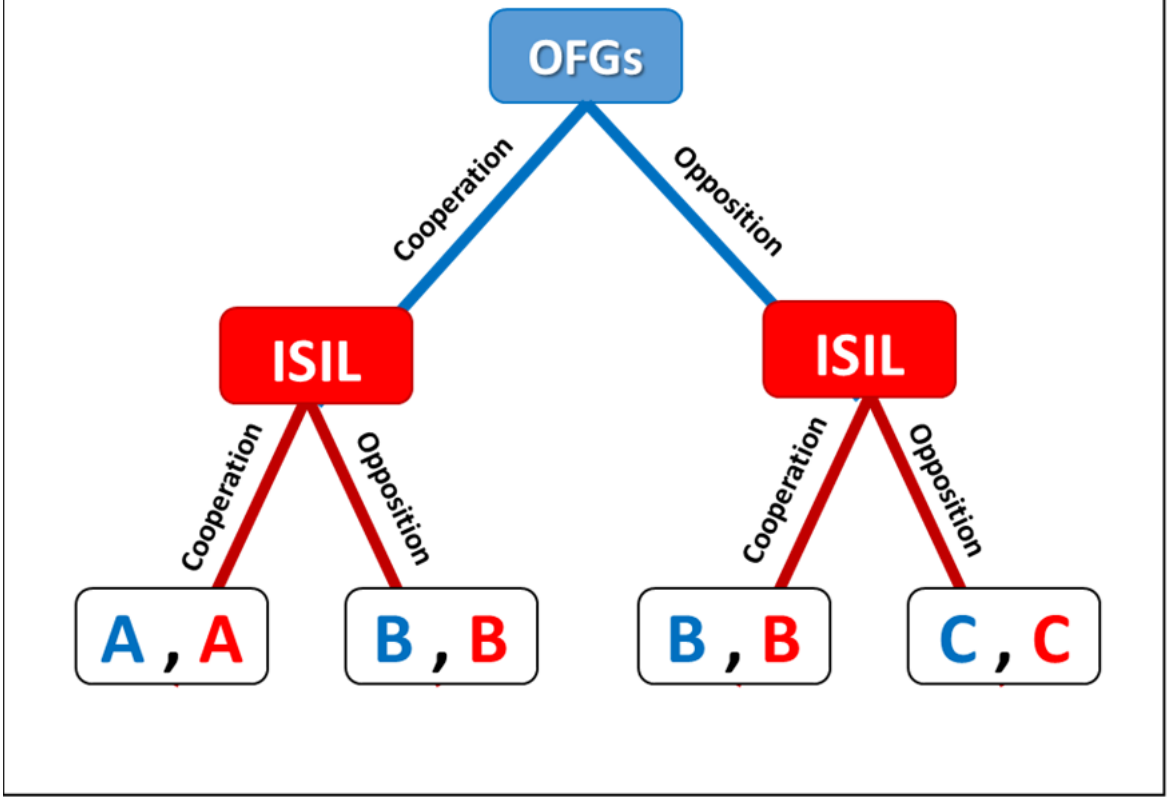
Therefore, red only has two possible outcomes (A, A) or (B, B). Because blue is a rational individual, the investor will choose to cooperate meaning that both blue and red will invest resulting in Table 3's Nash equilibrium being (A, A).

4.2.2 COLLABORATION BETWEEN ISIL AND OFGS

As Chapter 3 made light of, ISIL and OFGs are currently engaging in a perpetuating vicious circle which promotes violence. ISIL extracts oil from its captured territory and then sells it to merchants who, in turn, vend it to OFGs. Consequently, these military groups which struggle against the terrorists for control of Syria sell weapons and ammunition which were donated to them from coalition forces, to ISIL. Both the oil and weapons are then used to wage bloody battles, as the two sides endeavor to assert their dominance over the country. Thus forms a continuous circle of immoral violence powered by the exchange of oil and weapons.

Despite the fact that the cooperative relationship between ISIL and OFGs is nonlinear, it is a far simpler matter to illustratively capture this collaboration between enemies as a traditional sequential game. Although this is a less accurate depiction than a circular model, which embodies this relationship's perpetuating nature, a linear sequential game is both simpler to construct and easier to interpret, so long as the viewer remembers that the partnership between ISIL and OFG is continually reaffirmed with each transaction. This is exemplified in Table 4. Because this is a continuous relationship, either ISIL or OFGs could be illustrated as making the first decisions as whether to cooperate or oppose. However, Table 4 is designed to represent OFGs as making the first decision, in order to better facilitate the development of policies that will improve Syria's situation.

Table 4: ISIL and OFGs Sequential Game



In Table 4, cooperation signifies a player's willingness to purchase another player's good. In this case, the OFGs cooperates with ISIL by acquisitioning oil produced by the terrorist organization. Similarly, ISIL cooperates with OFGs when they purchase weapons from their military opponents. Following this logic, the opposition action illustrated in this table denotes an organization's refusal to buy the good provided by their economic counterpart.

Parallel to the hypothetical example provided in Table 3, Table 4 includes two players, ISIL and OFGs, each of whom makes one choice to either collude with or oppose the other organization. Similarly, this produces four outcomes with differing levels of appeal to the two organizations.

A, A: OFGs gain oil and ISIL attains weapons

C, C: OFGs do not gain oil and ISIL does not attain weapons

B, B: One side gains the resource it requires and the other side profits. However, this is not preferable as this is a one-sided economic exchange and therefore cannot be continued in the long-term as one side will deplete its financial resources.

As always, these organizational preferences are represented by the letters “A” through “C”, revealing that joint cooperation currently produces the most favorable outcome.

Just as in Table 3, this ongoing sequential game between ISIL and OFGs can be evaluated through backwards induction. If OFGs cooperate and purchase ISIL oil, ISIL is in turn motivated to also cooperate by purchasing weapons from OFGs. This desire for armaments, which was explored in Chapter 3, carries over to the other side of Table 4’s. If OFGs decide not to purchase ISIL oil, the terrorists will still be motivated to cooperate and attain OFG’s weapons. Therefore, OFGs must choose between cooperating and attaining this subgame’s Nash equilibrium (A, A) or selecting to oppose ISIL by not buying their oil which will lead both to a non-preferred outcome (B, B). Unsurprisingly, OFGs are currently choosing to cooperate with ISIL.

4.2.3 POLICY OPTION FOR COOPERATION BETWEEN ISIL AND OFGS

This sequential game analysis benefits policy makers and military leaders as it shows the chain of decisions that led to the establishment of the current economic partnership between ISIL and OFGs. This knowledge would prove valuable if, for instance, the coalition desired to expand its opposition to ISIL by economically

combating the terrorists. To do this, however, the coalition would first need to understand ISIL's relationship with OFGs and the vital decisions which perpetuate their circle of trade, both of which are provided in Table 4. As this table demonstrates, for continued cooperation to occur between ISIL and OFGs, both parties must be adequately incentivized. Therefore, it is possible that significant international pressure directed at OFGs could radically redefine this cooperation, even conceivably ending it. In order to achieve this, coalition forces would need to incentivize OFGs to a greater extent than these fighters already are to collaborate with ISIL. This would change the sequential game as the Nash equilibrium would move from both sides cooperating to ISIL cooperating while OFGs oppose them.

Unfortunately, Table 4's sequential game analysis does not indicate the form or the extent to which this international pressure would need to occur in order to produce the desired termination of ISIL and OFGs' partnership. However, what this analysis lacks in specificity it makes up for with assurance as it reinforces the argument that ISIL and OFGs' partnership is one of convenience. Therefore, one possible policy solution would be to have the coalition provide OFGs with free oil. Because of this, OFGs would no longer be incentivized to purchase ISIL oil and the terrorists would lose a significant portion of their budget for the procurement of armaments. With this, the circle of oil, weapons, and violence would conceivably end, simply by providing OFGs with the proper incentive to change their strategy.

4.3 CHAPTER CONCLUSION

This chapter sought to fulfil this thesis's pledge of advancing the scholarly understanding of how ISIL's control of Syria's oil fields impacts military strategies.

To achieve this, two relationships were identified. The first being the uncooperative battle between ISIL and coalition forces and the second pertaining to ISIL's economic partnership with OFGs. This first relationship was analyzed through the safety in numbers game, which identified that currently both ISIL and the coalition have reached a Nash equilibrium. However, this state is neither optimal, nor does it successfully advance the causes of either group. Therefore, policy changes must be implemented in order to escape this quagmire. However, this is difficult as ISIL's control of Syria's oil fields currently limits the range of options available to coalition forces.

The second set of analysis focused on the relationship between ISIL and OFGs. It revealed that ISIL's oil reserves strongly incentivized OFGs to not only economically engage with them but to form a trade circle in which weapons and oil are indirectly exchanged for one another. Similar to the first batch of research, this analysis indicated that this economic partnership is breakable but, once again, this would prove to be a difficult feat as ISIL's oil resources provide a powerful incentive for its opponents to cooperate with them.

THESIS CONCLUSION

The Syrian Civil war is a tangled web of death and misery which is asphyxiating the Syrian people. Already, its death count is more than double the total sum of casualties caused by the conflicts Afghanistan, Iraq, and Pakistan (Crawford 2016). Even more horrifying, the Syrian Center for Policy Research approximates that one in ten combatants and civilians in Syria have either been wounded or killed because of the violence (Boghani 2016). This intensity and ferocity of violence has forced millions to flee the country and either search out refuge in neighboring states or attempt the perilous trek to Europe.

Clearly military assistance must be provided, if not to stem the violence, then as a response to the mounting humanitarian crisis that this civil war is producing. Unfortunately, such action by the international community must be performed with the utmost care in order not to endanger the country's eventual recovery from this conflict. This thesis sought to assist this endeavor by employing game theory to illustrate how ISIL's control over a majority of Syria's oil fields has impacted strategies for the terrorists, other fighting groups, and the coalition forces in Syria.

In order to successfully achieve this contribution, this thesis first analyzed the coalition's airstrike strategy, which avoids directly targeting ISIL's oil extraction equipment, and ISIL's tactic of adapting to these attacks rather than abandoning their territory. Here, a version of the 'safety in numbers' game was utilized as it demonstrates how these two sides, which neither communicate nor cooperate with one another, are both capable of reaching the Nash equilibrium. The resulting analysis revealed that both the terrorists and coalition forces are constrained by

ISIL's control over Syria's oil. Because of this, their strategies are currently counteracting one another, meaning that neither ISIL nor the coalition will be capable of progressing past this stalemate until one or both groups adjust their preferences.

This thesis's second round of analysis focused on the economic cooperation which is currently taking place between ISIL and OFGs. As part of this, a sequential game was constructed to explore the series of decisions which occur in order to facilitate the continued exchange of ISIL's oil for OFGs' armaments. From this examination, and Chapter 3's review of the motivations that drives these two groups, it was possible to deduce that this arrangement was based on necessity rather than comradery as OFGs require ISIL's oil to function. Therefore, as this examination concludes, it is possible to disrupt this partnership if one of these groups is provided with sufficient incentives.

In summation, this thesis sought to answer the question, 'how does ISIL's control of Syria's oil fields impact military strategies in Syria?' To contribute to this field of research, this thesis relied upon two forms of game theory to analyze two separate relationships currently taking place in Syria. As with all academic studies of military and terrorist actions, this thesis was based upon current understandings of the conflict in Syria. However, as with all violent events, the Syrian Civil War continues to evolve as time progresses. Therefore, this thesis strives to form a solid base of knowledge from which future studies of this multisided civil war can begin. In particular, future research should strive to expand this game theory by reformatting it to reflect the ever changing situation in Syria as military strategies continually react to one another. Hopefully this will help launch further research and policy

recommendations that will, one day, assist in bringing about an end to this terrible conflict.

BIBLIOGRAPHY

"Arab Uprising: Country by Country." 2016. *BBC News*. Accessed May 18. http://www.bbc.co.uk/news/world-12482309.

"Bashar Al-Assad - President (Non-U.S.)." 2016. *Biography*. Accessed May 16. http://www.biography.com/people/bashar-al-assad-20878575.

Blight, Garry, Sheila Pulham, and Paul Torpey. 2011. "Arab Spring: An Interactive Timeline of Middle East Protests." *The Guardian*. March 22. http://www.theguardian.com/world/interactive/2011/mar/22/middle-east-protest-interactive-timeline.

Boghani, Priyanka. 2016. "A Staggering New Death Toll for Syria's War -- 470,000." *FRONTLINE*. Accessed June 2. http://www.pbs.org/wgbh/frontline/article/a-staggering-new-death-toll-for-syrias-war-470000/.

"Britain and France Conclude Sykes-Picot Agreement - May 19, 1916." 2016. *HISTORY.com*. Accessed May 13. http://www.history.com/this-day-in-history/britain-and-france-conclude-sykes-picot-agreement.

Crawford, Neta. 2016. "Civilians Killed & Wounded | Costs of War." Accessed June 2. http://watson.brown.edu/costsofwar/costs/human/civilians.

Eytan, Freddy. 2016. "The Failures of the International Community in the Middle East since the Sykes-Picot Agreement, 1916-2016." *Jerusalem Center For Public Affairs*. Accessed May 15. http://jcpa.org/the-failures-in-the-middle-east-since-the-sykes-picot-agreement/.

Fildis, Ayse. 2016. "The Troubles in Syria: Spawned by French Divide and Rule | Middle East Policy Council." Accessed May 13. http://www.mepc.org/journal/middle-east-policy-archives/troubles-syria-spawned-french-divide-and-rule.

Ghettas, Kim. 2016. "US Policy on Syria 'Depends on Success in Libya.'" *BBC News*. Accessed May 18. http://www.bbc.com/news/world-middle-east-13529923.

"Guide to the Syrian Rebels." 2016. *BBC News*. Accessed May 18. http://www.bbc.com/news/world-middle-east-24403003.

Holliday, Joseph. 2011. "The Struggle for Syira in 2011: AnOperational and Regional Analysis." *THe Institute for the Study of War*, Middle East Security Report, 2 (December). http://www.understandingwar.org/sites/default/files/Struggle_For_Syria.pdf.

Hubbard, Ben. 2015. "A Look at the Army of Conquest, a Prominent Rebel Alliance in Syria." *The New York Times,* October 1. http://www.nytimes.com/2015/10/02/world/middleeast/syria-russia-airstrikes-rebels-army-conquest-jaish-al-fatah.html.

Irshaid, Faisal. 2016. "Isis, Isil, IS or Daesh? One Group, Many Names." *BBC News*. Accessed June 5. http://www.bbc.com/news/world-middle-east-27994277.

Jaffe, Amy Myers, and Jareer Elass. 2015. "War and the Oil Price Cycle." *Journal of International Affairs* 69 (1): 121–37.

Juan, Alexander De, and André Bank. 2015. "The Ba'athist Blackout? Selective Goods Provision and Political Violence in the Syrian Civil War." *Journal of Peace Research* 52 (1): 91–104. doi:10.1177/0022343314559437.

Kabbani, Nader, and Noura Kamel. 2007. "Youth Exclusion in Syria: Social, Economic, and Institutional Dimensions." *The Middle East Youth Initiative,* no. 4(September).

Lund, Aron. 2016. "Origins of the Syrian Democratic Forces: A Primer | Syria Deeply." Accessed May 18. https://www.newsdeeply.com/syria/articles/2016/01/22/origins-of-the-syrian-democratic-forces-a-primer/.

Macfarquhar, Neil, and Liam Stack. 2011. “In Syria, Thousands Protest, Facing Violence, Residents Say.” *The New York Times*, April 1. http://www.nytimes.com/2011/04/02/world/middleeast/02syria.html.
McKelvey, Tara. 2016. “Arming Syrian Rebels: Where the US Went Wrong.” *BBC News*. Accessed June 5. http://www.bbc.com/news/magazine-33997408.
“Nash Equilibrium Definition.” 2007. *Investopedia*. June 18. http://www.investopedia.com/terms/n/nash-equilibrium.asp.
Obama. 2014. “President Obama: ‘We Will Degrade and Ultimately Destroy ISIL.’” *Whitehouse.gov*. September 10. https://www.whitehouse.gov/blog/2014/09/10/president-obama-we-will-degrade-and-ultimately-destroy-isil.
“Pareto Efficiency Definition | Investopedia.” 2016. Accessed May 31. http://www.investopedia.com/terms/p/pareto-efficiency.asp.
Polk, William R. 2013. “Understanding Syria: From Pre-Civil War to Post-Assad.” *The Atlantic*, December 10. http://www.theatlantic.com/international/archive/2013/12/understanding-syria-from-pre-civil-war-to-post-assad/281989/.
Pollack, Kenneth M., and Barbara F. Walter. n.d. “Escapting the Civil War Trap in the Middle East.” *The Washington Quarterly* 38 (2): 29–46.
“Profile: Syria’s Ruling Baath Party.” 2016. *BBC News*. Accessed May 14. http://www.bbc.com/news/world-middle-east-18582755.
Provence, Michael. 2009. *The Great Syrian Revolt and the Rise of Arab Nationalism*. University of Texas Press.
Raphaeli, Nimrod. 2007. “Syria’s Fragile Economy.” *Middle East Review of International Affairs* 11 (2): 24–51.
Saul, Heather. 2016. “Syria Air Strikes: US Launches Attack on Isis as Jihadist Group Warns of Retribution | Live | News | The Independent.” Accessed May 19. http://www.independent.co.uk/news/world/live/syria-air-strikes-us-launches-attack-on-isis-live-9750101.html.
Sly, Liz. 2016. “Did U.S. Weapons Supplied to Syrian Rebels Draw Russia into the Conflict?” *Washington Post*. Accessed June 5. https://www.washingtonpost.com/world/did-us-weapons-supplied-to-syrian-rebels-draw-russia-into-the-conflict/2015/10/11/268ce566-6dfc-11e5-91eb-27ad15c2b723_story.html.
Solomon, Erika. 2015. “Isis: The Munitions Trail.” *Financial Times*, November 30. http://www.ft.com/intl/cms/s/2/baad34e4-973c-11e5-9228-87e603d47bdc.html#axzz47d0gRJ4k.
Solomon, Erika, Robin Kwong, and Steven Bernard. 2016. “Syria Oil Map: The Journey of a Barrel of Isis Oil.” *Isis Syria Oil Map*. Accessed May 25. http://ig.ft.com/sites/2015/isis-oil/.
Speckhard, Anne. 400AD. “ISIS’s Revenues Include Sales of Oil to the Al-Assad Regime.” *The Huffington Post*. 57:00. http://www.huffingtonpost.com/anne-speckhard/isiss-revenues-include-sa_b_9789954.html.
Spyer, Jonathan. 2016. “Do ‘Syria,’ ‘Iraq’ and ‘Lebanon’ Still Exist?” *The Tower*. Accessed May 15. http://www.thetower.org/article/do-syria-iraq-and-lebanon-still-exist/.
Stokes, Elaisha. 2016. “The Drought That Preceded Syria’s Civil War Was Likely the Worst in 900 Years.” *VICE News*. Accessed May 17. https://news.vice.com/article/the-drought-that-preceded-syrias-civil-war-was-likely-the-worst-in-900-years.
“Syria - The Baath Redirections of 1966 and 1970.” 2016. *Library of Congress*. Accessed May 14. http://countrystudies.us/syria/17.htm.

"Syria Country Brief." 2010. *World Bank*, September.
"Syria Profile - Timeline." 2016. *BBC News*. Accessed May 14. http://www.bbc.com/news/world-middle-east-14703995.
Tharoor, Ishaan. 2016. "If 'Game of Thrones' Were in the Middle East." *Washington Post*. Accessed May 19. https://www.washingtonpost.com/news/worldviews/wp/2015/04/09/if-game-of-thrones-was-in-the-middle-east/.
"The Damascus Spring." 2016. *Carnegie Endowment for International Peace*. Accessed May 16. http://carnegieendowment.org/syriaincrisis/?fa=48516.
"The World Factbook." 2016. Accessed May 13. https://www.cia.gov/library/publications/the-world-factbook/geos/sy.html.
Van Heuvelen, Ben. 2015. "Armed with Intel, U.S. Strikes Curtail IS Oil Sector." *Iraq Oil Report*. December 28. http://www.iraqoilreport.com/news/armed-intel-u-s-strikes-curtail-oil-sector-17473/.
Weaver, Mary Anne. 2006. "The Short, Violent Life of Abu Musab Al-Zarqawi." *The Atlantic*, August. http://www.theatlantic.com/magazine/archive/2006/07/the-short-violent-life-of-abu-musab-al-zarqawi/304983/.
Weaver, Matthew, and Julian Borger. 2015. "Syria Airstrikes: Everything You Need to Know." *The Guardian*. December 1. http://www.theguardian.com/politics/2015/dec/01/syria-airstrikes-everything-you-need-to-know.
"Who Is Supplying Weapons to the Warring Sides in Syria?" 2016. *BBC News*. Accessed May 19. http://www.bbc.com/news/world-middle-east-22906965.
Zisser, Eyal. 2003. "Does Bashar Al-Assad Rule Syria?" *Middle East Quarterly*, January. http://www.meforum.org/517/does-bashar-al-assad-rule-syria.
Zweynert, Astrid. 2016. "Poverty, Despair, Hunger for Revenge Drive Young Syrians to Extremist Groups: Research." *Business Insider*. May 4. http://www.businessinsider.com/r-poverty-despair-hunger-for-revenge-drive-young-syrians-to-extremist-groups-research-2016-5.