AN ECONOMIC ANALYSIS OF SOMALI PIRACY DETERRENCE STRATEGIES WITHIN THE CONTEXT OF THE ECONOMIC THEORY OF CRIME AND PUNISHMENT

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ABSTRACT

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From 2006 to 2010, the number of reported piracy incidents perpetrated by Somali pirates, has increased from 19 to 212 per year, an alarming trend for the international shipping industry. This paper examines the increasing number of pirate attacks within the context of the theory developed in, *Crime and Punishment: An Economic Approach* (Becker, 1968). This paper demonstrates the supply of pirates is a function of probability of punishment, severity of penalty, as well as institutional factors.

This research entails a theoretical discussion, and an analysis of the available data on Somali piracy. The theoretical discussion combines theory with current studies on piracy. The data analysis examines the effect of deterrence strategies on the success of pirate attacks.

The data for the statistical analysis is primarily taken from The International Maritime Bureau annual piracy reports from 2006-2010. One hundred attacks will be randomly selected from the total (600), and additional data collected from other published reports

The synthesis of Becker's model and a statistical analysis of Somali piracy deterrence efforts offers a unique approach to studying the current dilemma. This research includes a theoretical discussion and an empirical model that should provide some insight into which current strategies are effective against the increasing pirate threat.

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CHAPTER ONE

INTRODUCTION

Naval exploration and trade parallels the development of the modern world. However, the criminal act of piracy also permeates the pages of naval history on which the foundation of the modern world is predicated. History is filled with tales of woe, suffering and economic entrapment at the hands of pirates. Yet, the naval powers of the world have traditionally been able to vanquish the threats posed by pirates.

Piracy falls within the bounds of criminal activity; however, it proposes a unique problem to governing forces. While the vast majority of crime falls within a clear jurisdiction, piracy can occur in international waters which complicates the issue of authority and punishment. Furthermore, crime, including piracy, disrupts the public order which is the foundation for economic growth within a society. In today's international community, piracy threatens free trade in particular by endangering ships traveling through the Gulf of Aden, Red Sea, Indian Ocean, and adjacent waters. Piracy is an issue that must be addressed in order to promote global economic growth and security.

One of the most infamous groups of pirates in naval history, the Barbary Pirates, instilled fear into commercial vessels sailing through the sea-lanes of the Atlantic and Mediterranean. Following the Algiers-Portugal Peace Treaty of 1793, Portuguese naval patrols ceased operations near the Strait of Gibraltar. Algiers, a benefactor of European tributes for the past century[1], then

[1] Barbary Pirates, since the 17th century, had been capturing commercial vessels in the Mediterranean. They would seize cargo and enslave sailors. As protection, European nations paid tributes to Algiers to prevent the interception of their ships. The U.S. did not pay tribute to Algiers, for economic and doctrinal reasons (January 2009).

had access to the most utilized sea-lanes in the world, the Atlantic Ocean (January 2009). Utilizing brutal tactics, the Barbary Pirates targeted U.S. vessels, capturing eleven commercial ships and enslaving approximately one hundred sailors. The solution of the U.S. in the late eighteenth century was to declare war on Algiers and the four other Barbary States, which included Tunis, Tripoli, Morocco, and Algiers. The Barbary War officially escalated in 1803 with the capture of the USS *Philadelphia.* In response, President Jefferson sent a special coalition under the command of First Lieutenant Presley O'Bannon (USMC). With of force of seven Marines and a group of Mamelukes, Lt. O'Bannon marched across North Africa and recaptured the USS *Philadelphia* at Derne. Named the "Hero of Derne" Lt. O'Bannon's triumph was indicative of the United States' victory over the Barbary States (January 2009). Although the United States was able to use unrestricted military force in order to eradicate the pirates of Northern Africa, the contextual environment that allows pirates to operate freely in the twenty first century does not lend itself to such a straight-forward solution.

In the contemporary naval community, pirate attacks are still a real threat to economic security and freedom of the seas. On February 22, 2011, Somali pirates killed four American hostages that had been hijacked while yachting through the pirate-infested waters of the Arabian Sea. This act of brutality, theorized to be a reaction to the 2009 killing of three pirates by U.S. Navy SEALs during the rescue of American Richard Phillips, Captain of the MV Maersk Alabama, elucidates the current dangers of sailing through the Red Sea and Gulf of Aden. The risk of traversing through one of the most commercially utilized sea-lanes in the world extends to all naval vessels, predominantly commercial, due to the escalation of piracy in the Gulf of Aden and surrounding waters in the last fifteen years. While the death of civilians strikes an alarming chord in the international community, it is uncommon for seafarers to be killed during pirate

attacks. However, the economic toll taken on the global community as a consequence of unfettered pirate attacks on commercial vessels has become a cancer for the globalized economy. In the midst of U.S. economic sanctions imposed on Iran by President Obama; a trade embargo imposed by the European Union; Iran's threats of closing the Strait of Hormuz to foreign trade; and "an economic war," as coined by the economic minister of Iran, Shamseddin Hosseini, a transcendent threat continues to operate without impunity.

According to correspondent, C.J. Chivers in a *New York Times* article on 06 January 2012, during the first few days of 2012, a United States rescue carrier task force intercepted 13 Iranian hostages from Somali pirates. The Sunshine cargo ship, traveling from France to Iran, came under attack from six pirates armed with automatic rifles and rocket propelled grenades (RPGs). The startled crew of the Sunshine armed their distress signal which was answered by the John C. Stennis, a U.S. aircraft carrier. Luckily, the Stennis was only separated from the vulnerable Sunshine by a few miles. Upon arrival, the pirates had abandoned their attempts at overtaking the ship as well as their weapons. Immediately detained by the U.S. Navy, the pirates were subsequently released due to a lack of evidence after photographs and fingerprints were taken from of pirates. However, during the time of the pirates' detainment, the Navy used surveillance from a helicopter as well as radar to track the location of the pirates' mother ship. U.S. Naval personnel tracked the pirates back to a fishing vessel, Al Mulahi, which was flying Iranian flags. Having already received military threats from Iranian military officials, the Navy had to utilize extreme precaution in further investigation of the potential pirates. During a suspicious radio interchange, an Iranian captive professed their situation in Urdu, a language foreign to his Somali captors. With permission from the Pakistani commander of Combined Task Force 151, a navy team entered to Al Muhali to find the six Somalis, as well as nine

additional pirates. Control of the ship was turned over to the U.S. Navy without resistance and the thirteen Iranian captives were liberated.

The Al Muhali incident illustrates a number of problems the international authorities are having with deterring the actions of Somali pirates. First, in this case by good fortune, the Stennis task force was in the vicinity of the distressed Sunshine. In most cases, however, the vast expanse of sea in which the Somali pirates operate in prevents deterrence forces from quickly reacting to distress signals. Second, the U.S. Navy was forced to release the potential pirates because the pirates tossed their weapons into the sea, there was insufficient evidence to detain the pirates. In many cases this lack of evidence leads to the release of many pirates who are able to go scott-free. Third, while the evidence was lost, the pirate boarding party admitted to being equipped with six AK-47s and an RPG with ten rockets, a devastating force for an unarmed commercial ship to encounter. With greater success, Somali pirates are using the revenue to increase the depth of their armory and bolster their military force. Lastly, the labor supply for pirates in Somalia is abundant due to the political and socioeconomic conditions of the failed state, and the subsequent reduction in employment. For example, an offending pirate, Mr. Mahmoud, admitted he was aware of the consequences but he justified his offenses on his first pirate excursion by lamenting, "In Somalia we have no jobs. That's the reason to go to sea. Our country has a civil war, and I don't have skills."

The International Maritime Bureau reported that, during the first nine months of 2011, Somali pirates had increased the number of their operations from 126 through September in 2010 to 199 through September of 2011. The attacks perpetrated by Somali pirates accounted for 56% of all piracy incidents in 2011 (ICC 2011). These record-breaking figures are the continuation of a pattern that has been occurring over the past decade. As a result of the growing number of

incidents, the estimated cost of piracy to the international economy is approximately 3.238-11.544 billion dollars a year (Bowden 2011). The estimated cost of piracy is a combination of several factors. Table 1 provides the upper bound and lower bound estimates for the total costs of piracy in 2010.

Table 1: Estimate Annual Costs of Somali Piracy

Sources: (Bowden 2011) and (Voytenko 2011)

Estimated Costs (Millions USD)	Ransom Costs	Coalition Forces	Prosecution Costs	Insurance Premiums	Commercial Vessel Security Equipment	Cost to Local Economies	Re-Routing	Anti-Piracy Organiztions
Upper Bound	238	2,000	31	3,200	2,500	1,250	2,300	25
Lower Bound	94	1,000	30	460	363	1,000	267	24

The large range is due to variability in piracy data reported, limitations due to estimated costs, and inflated reported costs due to possible political biases. The upper bound estimates are reported by the Chatham House organization, Oceans Beyond Piracy (Bowden 2011). The upper bound estimates are criticized by Voytenko for overinflating estimated costs in order to exaggerate the problem. In Voytenko, 2011, more conservative estimates are provided. Due to the lack of undisputable reported evidence, it is assumed that the actual economic cost falls within the range from 3.238 to 11.544 billion USD in 2010. This figure represents a legitimate impediment to the international economy. Furthermore, not included within the economic costs is the suffering endured by the hostages that are taken into captivity by the Somali pirates. Piracy is a serious threat to all seafarers traveling through the chokepoints adjacent to the Somali Coast.

The world's shipping industry constitutes ninety percent of all international commerce and estimated 8% of the world's international trade travels through the Suez Canal (The Economist 2011) which connects directly to the pirate-infested waters which include The Gulf of Aden; The Red Sea; The Gulf of Guinea; The Strait of Malacca; The Indian subcontinent, particularly between India and Sri Lanka; and Central and South America (Bendall 2010).

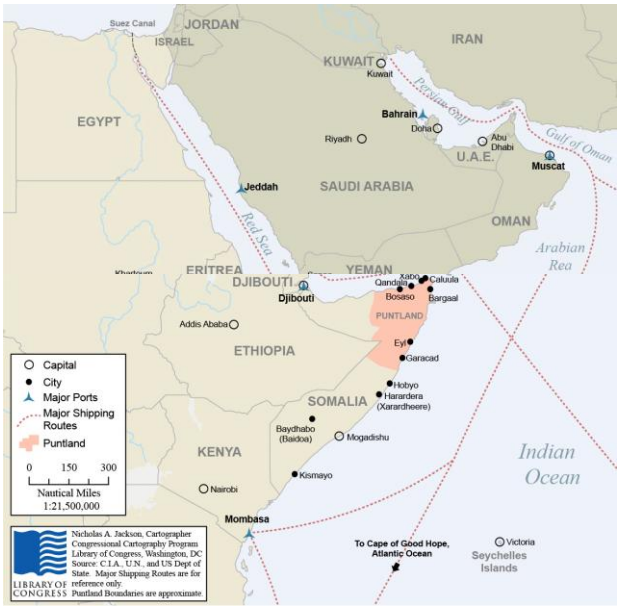

Figure 1: Major Shipping Lanes (IMB 2010)

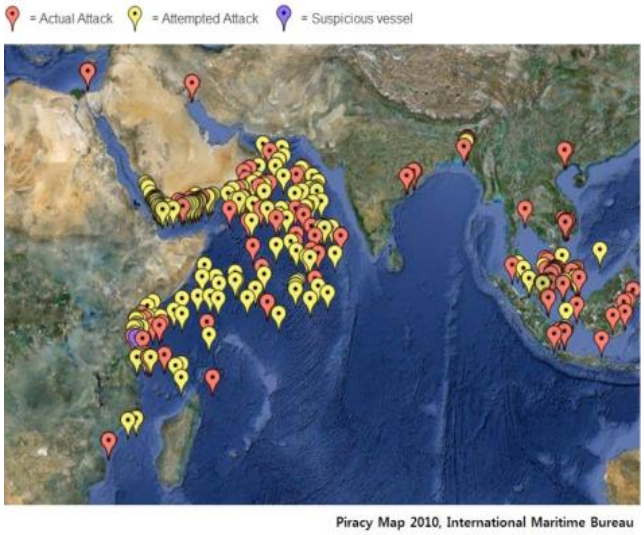

Figure 2: 2010 Pirate Attacks (IMB 2010)

As seen above in Figs. 1 and 2, the pirate attacks, occur not only in a large expanse of ocean, but are concentrated in several chokepoints on the major shipping lanes. Due to the heavy sea-lane traffic and vulnerability of commercial vessels in several key locations, Somali pirates are afforded the ability to exploit the nautical danger zones and target indefensible vessels. Furthermore, in order to circumvent these vital sea-lanes and change shipping routes would force shipping companies to incur higher operating costs.

The piracy problem is not limited to the vast expanse of ocean covered by the Somali Pirates. The essence of the problem lies within the inability of international enforcement

agencies to deter the Somali population from engaging in acts of piracy. This inability to prosecute is ultimately derived from the lack of institutional structure in the failed state of Somalia. Therefore, one aim of this study is to examine different deterrence and punitive strategies, within the context of Becker's *Crime and Punishment: An Economic Approach* (1968).

The economic theory suggests boundaries on the capabilities of enforcement agencies by noting the scarcity of resources that can be devoted to the capture and prosecution of criminals and thus determines the optimal value of resources to devote to anti-criminal activity. This study will analyze how a variety of anti-piracy strategies utilize resources and, by using an analytical cost benefit analysis, determine their economic desirability.

The rest of the research will be organized as follows: Chapter II reviews the institutional background of Somalia, including the root causes of the piracy dilemma. The discussion of the development of the piracy phenomenon in Somalia and countermeasures includes the failed state, fishing piracy, current anti-piracy measures undertaken by international militaries, and the best management strategies of commercial vessels. Chapter III discusses the economics of piracy and the application of Gary Becker's economic theory of crime, with subsequent economic extension to piracy. The discussion of Becker's theory includes a discussion of optimality conditions and behavioral responses to the variables presented in the theoretical model. Chapter IV describes the variables of the model, in the context of Becker's theory, and presents the results of the statistical analysis; Chapter V gives the conclusion and suggests areas that deserve further study in the field of piracy and its economic causes and consequences.

CHAPTER II

INSTITUTIONAL BACKGROUND AND CURRENT DETERRENCE STRATEGIES

The Somali piracy trend, currently taking place off of the coast of the Horn of Africa, is a result of several institutional failures by the Somali government. Somalia has ranked number one in the Foreign Policy's Failed States Index from 2008-2011. The central government has little control over its population, and the factionalized country is oppressed by poverty and an ongoing civil war. Since creation of the Somali independent state in 1960, fractionalization and territory disputes with neighboring countries have created an internal turmoil that has destroyed the Somali state. Somalia's history of militant dictatorships, civil war, fractionalization, and the absence of a central governing body has led to an anarchical state that has bred a budding pirate population. Without the threat of a Somali police force, the Somali pirates have been able to carry out attacks on commercial vessels with little fear of authorities and in some cases with impunity.

Given the geographic chokepoint created by the Horn of Africa and Somalia's proximity to the Gulf of Aden combined with the lack of Somalia's policing of pirate activity, the number of pirate attacks has increased dramatically over the past ten years. The burden of piracy defense has fallen on the international community as well as the owners of the commercial vessels that are constantly at risk when traveling through the Red Sea and adjoining sea-lanes. With ransom costs ranging from 3-5 million dollars combined with insurance costs and opportunity costs rising in reaction to the increasing transportation costs, an increasing importance has been placed on finding ways to circumnavigate or eradicate the piracy problem. Although, in recent years coalition navies and maritime anti-piracy agencies have had success in deterring pirates through

developing anti-piracy activities, the question still remains as to what strategies are most effective and who is responsible for financing these anti-piracy activities. Furthermore, while demand for short term solutions requires complex and often difficult international cooperation, establishing a long term solution necessitates fixing the Somali failed state and establishing an effective central government.

2.1 The History of the Failed Somali State

The inability of the Transitional Federal Government (TGF) to exert any control over the separate clan regions in Somalia has led to indisputable poverty and deprived living conditions for almost the entire Somali population. In the 2011 Human Development Index (HDI) Report, Somalia was not able to be ranked due to lack of data. However, it appeared under the section labeled "Other Countries or Territories." The scarce data that is available gives insight into the abject conditions in which the Somali people live. Life expectancy in Somalia is 51.2 years, which is 7.5 years less than the average for low HDI nations and 18.6 years lower than the world average. More indicative of the quality of life endured by those in Somalia is the inequality adjusted life expectancy which is .260 in Somalia versus the world average of .637[2].

The quality of life is not the only indicator that the institutional mechanisms, which generally support the people of a nation, have failed. The expected years of schooling for Somali children is 2.4 years and the literacy rate is 37.8%. In addition, 56.5 % of females and 84.7% of

[2] Inequality adjusted life expectancy is calculated with consideration to the life expectancy index, education index, and the income index.

males are active members of the labor force[3]. Yet, 65.6% of the population is considered to be living in severely impoverished conditions. Added to the reality of working conditions and wage pittances desperately desired by the population, the median age in the country is 17.5 years with a dependency ratio of 91.2%[4]. With the majority of the population unable to provide for themselves and relying solely on the miniscule wages of a teenage working force crime seems like an inevitable reality. Furthermore, 37.9% of the population lives in an urban environment, and it is from these impoverished regions where the recruitment of pirates is flourishing (HDI 2011). In order to understand Somalia's qualification as a failed state, it is necessary to understand how the development of the country led to its current deprived state of existence.

Somalia, also commonly referred to as The Horn of Africa, harbors a population of approximately 9.9 million people. The mostly nomadic and pastoral population has cultural identity derived from both Cushitic and Arab descent. While the Cushitic people have archaeological ties to The Horn of Africa from around 100 CE, the first traces of development are believed to be from Arab-Koreishite colonists from Yemen in the seventh century CE. The modern era for Somalia did not begin until the 19th century when European powers utilized the nation's crucial trading location for harbor amenities. The largest power within the Somali border was the British East India Company who gained control over the northern portion of Somalia in 1886 in exchange for protection guarantees. The British sovereignty was challenged by a rebellious faction, under the command of Mohamed Abdullah in the early 1920s. Despite his defeat, at the hands of the British, Mohamed Abdullah was deemed a national hero by the Somali people (U.S. Department of State 2011).

[3] Labor Force Participation rate is the sum of all working age individuals actively searching for work or working in the labor force divided by the total number of individuals in the nation of working age.
[4] The dependency ratio is calculated by dividing the total number of people ages (0-14) and (65+) from the population of people ages (15-64).

During the eleven years from 1897-1908, Italian government assumed direct control over the southeast territory of the fledgling nation. The Italian government's colonial territory continued to expand westward and north until, in 1940 with the onset of World War II, the Italians and British engaged in unrestricted warfare. In 1941, British operations focused on overtaking the Italian East African Empire which again brought the majority of Somalia under British control. Under British control, the transition towards autonomy began. In 1948, Italy relinquished all claims on territory in Somalia, and on June 26, 1960 British Somalia gained independence[5]. Initial democratic attempts at constitutional governance failed in 1969 when a coup placed Major General Mohamed Said Barre the Somali president. Under Barre, the government took the form of a twenty member Supreme Revolutionary Council (SRC). The SRC attempted to govern using the Soviet model, and in doing so they centralized control over information, used the military to redistribute fertile farmlands, as well as engaging in a reign of terror over the Somali population (CIA Factbook 2011).

As the military led government became increasingly radical, Somali relations deteriorated with their neighbors. In the 1970s, the Western Somali Liberation Front (WSLF) began to attack the eastern region of Ethiopia using guerilla tactics. From 1975-1977, Somalia invaded Ethiopia twice. This spawned the Ogaden War (1977-1978) that resulted in the defeat of Somlia due to the aid afforded to Ethiopia from Cuba. Following the defeat, Somalia renounced its ties with the Soviet Union. In doing so, they gained the international support from the United States (1982-1988). Despite U.S. aid, the situation in Somalia continued to deteriorate. Barre's regime became increasingly violent in suppressing opposition movements. This led to the Somali Civil War. Several different movements formed in opposition to the military dictatorship including

[5] On July 1, 1960, Italian Somaliland joined the recently independent nation to form the Republic of Somalia.

the Somali Salvation Democratic Front (SSDF), the Somali National Movement (SNM), the United Somali Congress (USC), and the Somali Patriotic Movement (SPM) (U.S. Department of State 2011).

The Somali economy was in complete turmoil. The national treasury was depleted due to military efforts to protect the established government. The population of the war-torn country began to claim refugee status and flee to bordering Ethiopia, Djibouti, and Kenya. In 1991, the central government was driven out of power by USC and SNM forces took control of Mogadishu, the last stronghold of the Barre government. The U.S. and the U.N. provided aid for the distraught Somali populations in several humanitarian operations; however, by 1994 all U.S. forces were withdrawn from Somalia.

Table 2: Major Government Changes in Somali History (U.S. State Department 2012)

Date	Controlling Government	Cause for Change
600-1600	Arab Sultanate	Koreishite immigrants from Yemen
1600-1800	Sultan of Oman and Zanzibar	Took control of coastal towns
1840-1885	United Kingdom	East India Company gains unrestricted harbor facilities
1886-1920	United Kingdom	U.K. gains control over Northern Somalia through treaties with ruling chiefs
1885-1940	Italy	Italy gains commercial advantages (1885); In 1908 Italian Somliland is established and colonial status is granted; In 1936 Italy annexes Ethiopia
1941-1960	United Kingdom-Military administration	Britain defeats Italian forces in eastern Africa during the onset of WWII
1960-1969	Somali Republic	Somali Republic is formed through the UN General Assembly (1959); Italy relinquishes control over Somaliland
1969-1991	Gen. Said Barre; SRC	Military coup overthrows constitutional democracy and Gen. Said Barre assumes position as President
1991-Present	TFG	Absence of effective government; failed state

The collapse of the central government created a void of central authority within Somalia. Despite 14 reconciliation conferences and a mandate by the Organization of African Unity and the Intergovernmental Authority on Development (IGAD), no true central government was established until 2000. The Transitional Federal Government (TFG) was established in 2000 but has had little support in unifying the alienated factions.

The current state of Somalia is that of complete chaos. The TGF is unable to exert any control over the various factions that are contesting for autonomy or control. Furthermore, the terrorist organization, al-Shabaab, controls the south central region of Somalia. In the spring of 2011, Somalia experienced the worst drought in last half of a century leaving an already desperate population in complete destitution. Substantial crop failure and increased food prices have led the U.N. to declare a state of famine in Somalia. Measures have been undertaken by international humanitarian agencies in order to help the estimated 4 million starving and 750,000 dying Somalis; however, many of these ships face the risk of being attacked by pirates (CIA Factbook 2011).

The war-torn population has had to develop ways in which to survive during the current crises. With few jobs available many Somalis have migrated to bordering countries; however, a rising portion of the population has entered into the criminal labor market. Many of these criminals have joined the ranks of the pirates.

2.2 Fishing Piracy

The two fundamental causes of the current piracy problem in the waters off of the Somali Coast are both derivatives of the failed Somali state. However, while the failure Somali

institutional framework and tribal rifts are resultant of the internal struggles of the war-torn state, another international crisis exists. Since the dissolution of General Said Barre's military dictatorship in 1991, Somalia's coast has been invaded by illegal foreign fishing. Illegal, Unreported, and Unregulated (IUU) fishing is an epidemic that affects all of the world's seas. In 2006, the High Seas Task Force reported that IUU practices are valued at approximately 4 to 9 billion USD per year. Of the total amount of revenue from IUU vessels, only 1.25 billion dollars were reported to have been taken from international waters. Therefore, the majority of the focus of IUU fishing is localized to Exclusive Economic Zones (EEZ) and sovereign waters. Furthermore, nations that have weak enforcement, generally as a result of poor institutional infrastructure, are frequently exploited by IUU vessels (HSTF 2006). After the Somali droughts of 1974 and 1986 caused thousands of Somali farmers to migrate to the coast in order to pursue lives in fishing communities. The arrival and prominence of the fishing pirates after 1991 threatened the livelihood of the Somali fishermen and caused significant damage to the ecosystem as a result of illegal fishing processes and the illegal dumping of hazardous waste (Waldo 2009). As a result of the competition between the incumbent fishermen and the foreign intruders[6], an evolution of weapon systems occurred, and the pirates of today are the resultant legacy of these early Somali fishermen. This section discusses how the illegal foreign fishing pirates exploitative practices played an often overlooked role in the development of the current piracy epidemic.

After the collapse of the military regime of Said Barre in 1991, both Somalia's Navy and Coastguard were disbanded. This resulted in the coastal waters of Somalia to be unregulated and

[6] Waldo (2009) distinguishes between two different kinds of pirates: fishing pirates and shipping pirates. Fishing piracy refers to the actions perpetrated by the IUU vessels. Shipping piracy refers to the hijackings and attacks on merchant vessels traveling through the waters near Somalia.

primed for exploitation by foreign interest. In 1991 the UN, Russia, and Spain carried out surveys that revealed the seas East of Somalia could potentially yield over 200,000 tons of fish per year for industrial fishing. While the industrial fishers could gather significantly large catches, estimated to catch approximately $450 million worth of fish from Somali sovereign waters, they are harmful to the indigenous ecosystem; and more significant, the foreign industrial fishing market poses direct competition to the local artisanal fishers[7]. In search of the profitable fish species[8] that reside off the Somali coast, the illegal foreign fishing vessels engaged in illegal fishing strategies. These methods included the utilization of enormous drift nets as well as explosives, which are both illegal and harmful to the ecosystem.

Immediately the relationship between the fishing pirates, as deemed by (Waldo 2009), and the Somali fishermen became volatile and combative. The incumbent fishing community was interested in sustaining their right to fish the waters of their homeland in order to provide their families with the primary dietary source of protein for their families. Meanwhile, the presence of the Somali fishermen meant competition for the fishing pirates, and due to the contrasting missions, the relationship between the two groups turned hostile. Early in 1992, shortly after the arrival of the illegal foreign fishermen, there are reports of attacks on Somali vessels which include pouring boiling water on the decks of Somali ships, cutting fishing nets, and ramming opponent ships. In anecdotally documented cases, these attacks led to the destruction of Somali ships and the deaths of crewmembers. In reaction to the threatening invaders, Somali fishermen began to arm themselves with simple weapons. However, the

[7] Artisanal fishing is considered small scale fishing which depends on traditional methods and basic technology, and usually indicates a low socioeconomic level. These methods and tools include hooks, nets, harpoons, as well as other methods. Artisanal fishers are able to catch fish close to shore due to the simple technology. Most incumbent Somali fishing villages have traditionally relied on artisanal fishing. (World Fisheries Trust 2008)

[8] Somali local valuable fish and crustacean species include tuna, shark, pelagic fish, lobster, and deep-sea water shrimp (HSTF, 2006)

foreign fishing vessels had more capital and were able to afford more sophisticated weapon systems as well as larger and faster ships. This left the Somali fishermen vulnerable to attack from the foreign vessels.

Over time, the local fishermen accumulated more sophisticated weapons until they posed a threatening force. This cyclical trend evolved from its inception in 1991, with the arrival of the IUUs, into the piracy epidemic that now plagues all ships traveling through the waters of the Red Sea, Aden Ocean, Somali Coast, and Arabian Sea (Waldo 2009). While the ultimate goal of the vast majority of Somali pirates are financial gains, there are still some shipping pirates that consider themselves the last line of defense for local Somali fishermen that have been exploited by foreign invaders for over two decades. In a 20 September 2008 *New York Times* satellite phone interview with Jeffrey Gettleman and a pirate hijacker, Sugule Ali, that had just taken control of the Ukrainian freighter, *Faina*, Sugule Ali claimed that the reasoning behind their piracy was, "to stop illegal fishing and dumping in our waters." He continued to assert that, "We don't consider ourselves sea bandits. We consider sea bandits those who illegally fish in our seas and dump waste in our seas and carry weapons in our seas. We are simply patrolling our seas. Think of us like a coast guard." The testimonial from the pirate reveals that the animosity between the Somalis and IUUs is still prevalent in the minds of the affected Somalis. Despite Sugule Ali's self appointment as a crusader against foreign fishermen, he and his team of pirates were asking for $20 million in cash. Once concerned with protecting their rights to fish the sovereign waters of Somalia in order to provide for their family, the former fishermen have now armed themselves with RPGs and semi-automatic weapons. The Somali pirates transformed themselves from victims into the notorious pirates of the modern day world.

Despite the detrimental damage caused by IUUs to the coastal population of Somalia, as well as the oceanic ecosystem, there has been little international attention paid to the fishing piracy. In 2008, the UN Security Council passed two resolutions (Resolution 1816 and Resolution 1834) which pertain to the Somali piracy situation. Somali officials unsuccessfully petitioned these resolutions to address extortion and exploitation of the Somali coast by IUUs. The absence of IUU recognition in the UN resolutions is indicative of the international treatment of the fishing piracy. The UN Security council Resolution 1816 (2008) "condemns and deplores all acts of piracy and armed robbery." The resolution galvanizes, "States interested in the use of commercial maritime routes off the coast of Somalia, to increase and coordinate their efforts to deter acts of piracy and armed robbery at sea in coordination with the TFG." The document considers the Somalia Transitional Federal Government's inability to sufficiently police and prosecute pirates. However, absent from the document is any mention of the exploitation of the TFG's inept maritime authority by foreign vessels. To the same regard, Resolution 1838 fails in the same regard as Resolution 1816 to acknowledge the illegal fishing and hazardous waste dumping in Somali waters.

The long run solution to combating Somali piracy must include a concerted effort to prosecute IUUs. In addition to developing a Somali central government and building self-sustaining infrastructure, the international community must recognize and act in response to the illegal fishing trend. Preventing foreign commercial fishermen from continuing their exploitation of the Somali coast may allow a reemergence of Somali fishermen to provide comfortably for their families. There is no evidence suggesting that irreparable damage has been done to the Somali coast; however, many Somalis that are reliant upon fishing as a means for income are still being ignored and dejected. If the IUU trend continues, more Somali fishermen

may turn to piracy as a means for survival. In a country where agriculture and fishing are the two largest sources of income, a combination of drought and IUUs have devastated an already war torn nation. Fishing and agriculture account for approximately 40% of GDP and 71% of the labor force (CIA Factbook 2011). Therefore, it can be understood that failures in either the agriculture or fishing sectors has detrimental effects on the population of Somalia. In order to prevent the continuation of the illegal fishing piracy, the Somali government must establish a capable coast guard. The re-establishment of a Somali military force will be able to deter both fishing piracy and commercial shipping piracy. This will necessitate international funding and training; however, a sovereign Somali police force could save the international community money in the long run in realized decreases in commercial shipping through Somali waters.

Illegal fishing should be understood as both a root cause for Somali piracy as well as an avenue of approach to decrease Somali piracy, in the long run, by providing additional legal forms of employment. In terms of Becker's theory, illegal fishing decreases the expected revenue of legal employment. Somali fishermen are impeded in their attempts at providing food for their families; thus, they may seek other employment if they unable to make a living through legal means. In a country with a very low education threshold, job opportunities are limited. The availability of jobs affects the institutional variable in Becker's theory. If there are fewer jobs available, the number of offenses will increase in reaction to the limitations on the legal labor market.

Initial steps have been taken by the international community in combating IUUs. The operational plan for EU NAVFOR ATALANTA contains a mandate to monitor illegal fishing off the coast of Somalia. This means that in addition to the EU's effort to safeguard WFP ships, they also plan to investigate suspicious fishing vessels from foreign nations. Although the EU

warships are being multi-purposed and not dedicated solely to monitoring fishing, it is a positive step for Somali fishermen. Furthermore, the Somalia Joint Strategy 2008-2013 notes the destructive effects of IUUs and pledges to allocate resources towards the protection and regulation of fishing in Somali waters. The EU recognition is the first endorsement of solving the problem.

2.3 Development of Somali Piracy in the Last Five Years

The International Maritime Bureau (IMB) maintains a database of information on pirate attacks throughout the world. The number of pirate attacks attributed to Somali pirates constitutes the largest percentage of pirate attacks, 49.2% of all attacks in 2010. In addition, the pirate actions attributed to Somali pirates has been growing at an alarming rate. Before Somali piracy became an international issue, piracy still plagued shipping. Prior to the rapid growth of Somali piracy, The Malacca Strait experienced significant threats from pirates. The Malacca Strait is a vital shipping lane in between Indonesia and the Malaysian peninsula. The Malacca Strait experienced a significant decline in piracy as a result of naval military patrols from Malyasian, Indonesian, and Singaporean navies. The number of pirate attacks decreased from 215 in 2000 to 94 in 2005 (IMB 2005, 5). During this same time, the Indian Ocean experienced a similar pattern of quick increase and sharp decline in the number of pirate attacks. While the number of pirate attacks is on the decline in the Malacca Strait, the number of attacks is dramatically increasing in Somalia. Table 1 uses data from the 2010 IMB piracy report which illustrates the rapid development of Somali pirate activity from 2006-2010.

Table 3: Number and percentage of Somali Pirate Attacks (IMB 2006-2010)

	2006	2007	2008	2009	2010
Gulf of Aden	10	13	92	117	53
Arabian Sea	2	4	0	1	2
Oman	0	0	1	0	0
Red Sea	0	0	0	15	25
Somalia	10	31	19	80	139
World Total	239	263	293	410	445
Somali attacks as a percentage of the world total	9.2	18.3	38.2	52.0	49.2

Several patterns can be observed within the data. First, there is a clear increasing pattern of the number of Somali pirate attacks, and from 2007-2008 there is a dramatic increase in the number of attacks. The increasing pattern seems to be isolated within the Somali region. During the five year span, the number of Somali incidents as a percentage of the number of attacks in the world increases parallel to the number of Somali pirate attacks. This suggests that piracy in the rest of the world has remained constant while there has been a shock to the number of Somali pirates during the last five years.

Secondly, the attacks are not spread out evenly over the entire pirate area of operations nor are they completely consistent over time. This can be the result of two different factors. As the scope of pirates operations increases and they become more profitable, the pirate equipment also becomes more sophisticated. This spread of pirate activity to other, further, seas suggests the use of mother ships and more technologically advanced vessels. Also, the staggering concentrations of pirate attacks over time may suggest the effectiveness of deterrence strategies. For example, there may have been an anti-piracy strategy adopted by international military

forces or private vessels in the Gulf of Aden which could explain the transference of activity to the coast of Somalia and the Red Sea.

Lastly, the consistency of the number of pirate attacks in the rest of the world, while Somali piracy has spiked upwards, may suggest success of pirate deterrence or control strategies in the rest of the world. If these actions have had success in limiting the growth of pirates, it may be possible to mimic the strategies adopted by these enforcement agencies and apply them to the Somali crisis.

The increase in the number of piracy operations as well as the sophistication and the range of the Somali pirates has added to the economic costs incurred by the international shipping community. As the pirates increase the number of successful attacks, their profits swell. A portion of those profits are directly invested in more technologically advanced weapons. Now armed with semi-automatic weapons, rocket-propelled grenades (RPGs), and more powerful ships used as mother-ships, the Somali pirates pose a significant mortal danger to all seafaring vessels in the region. Although current trends suggest the aim of the pirates is primarily financial, the threat of deadly force still exists. Without an effective police force and due to the absence of proper prosecution capabilities, the Somali pirates are able to flourish with little risk of being punished. Without punishment, there is no disincentive to join the labor supply of the pirate market.

2.4 The consequences of piracy to the Somali economy

As demonstrated by the previous section, Somali piracy is a fast growing occupation for the disenfranchised youths of Somalia. In Chapter III, an in depth discussion of the Becker's economic theory reveals that criminals, like pirates, operate with the expectation of a monetary

return to crime greater than that which they could alternatively earn in a legal labor market. Estimates claim that Somali pirates generated approximately $70 million in revenue from ransom payments in 2009. Compared to Somalia's revenue from gross cattle exports ($40 million) and the government budget for Puntland ($17.6 million), piracy offers a very lucrative venture for a desperate population (Shortland 2012). The large amounts of money paid to Somali pirates for the safe return of crews and vessels impose large economic repercussions to the shipping industry. In addition, the increased costs of security, insurance, and damage done to ships create an international impediment to globalization. According to Becker's theory, the revenue gain from a criminal act offsets the fiscal loss of the victimized person or organization; however, crime generally caries high externalities that cause net losses to society. Therefore, while the net social loss accrued as a result of piracy is clearly recognized in ransom payments, hostage suffrage, and other negative externalities, the flow of ransom money must also be analyzed to determine the social gain by pirates in order to properly determine net social loss.

While measuring social losses from piracy is relatively simple, tracking the flow of money following a ransom payment is a much more complicated and speculatory process. Due to the political instability of Somalia, measuring economic development in known pirate towns is a difficult endeavor. Therefore, alternative means for determining economic development must be relied upon.

Shortland (2012) relies upon satellite imagery of night-time light emissions and high resolution satellite images in order to indicate locations of unequal economic growth. The measurement of night-time light emissions indicates increased usage of electricity; light emissions are generally a reliable marker of economic growth. Since 2007, she claims that there has been a general decrease in light emissions, excluding Bosasso and Garowe which have pirate

affiliations. From the high resolution images, Shortland was able to recognize possibly telling changes in Hobyo, a coastal Somali town, and Garowe, the capital of Puntland. Hobyo, starting in 2005, started to show signs of development of high-end communications equipment and fortified structures. Garowe, which is known to have strong pirate ties, has doubled in size during the time period 2002-2009. This economic growth has had an alarming rate of increases in luxury goods, such as new cars and expensive houses (Shortland 2012). These changes are inconsistent with the general Somali population who lives on the fringe of absolute poverty.

There is a large concern that ransom from piracy is being laundered into other countries for other illegal activity, such as terrorism, the evidence provided by satellite imagery demonstrates that at least some portion of the revenue is staying within the borders of Somalia. However, the money is not being used to stimulate Somali economic growth; rather, ransom money funds increased weaponry and technology for pirates as well as providing luxuries to the beneficiaries of piracy. Beneficiaries most likely include clan hierarchies and active pirate members. This has created the unfortunate situation in which the pirates benefit tremendously from ransom payments while the poor public suffers by an increased wage gap and increasing food prices (Shortland 2012). Therefore, the net social loss extends further than the international commercial shipping industry. The devastated Somali population is also suffering from the economic exploits of the organized pirate industry.

2.5 Current Deterrence and Anti-Piracy Strategies

Anti-piracy strategies range from military intervention to re-routing naval routes around Arica, in order to avoid the risk of pirates in the Red Sea and Gulf of Aden. The official U.S.

National Maritime Security Strategy, regarding Somali pirates, put in place in 2005 states, "safety and economic security of the United States depends upon the secure use of the world's oceans." The statement asserted that the international threat to maritime security posed by pirates will not be tolerated by the United States. The Bush Administration certified the Policy for the Repression of Piracy and other Criminal Acts of Violence at Sea in 2007, which declared that the United States would, "continue to lead and support international efforts to repress piracy and other acts of violence against maritime navigation." In 2008, the U.S. developed a plan developed to combat piracy threats around the Horn of Africa. "The Countering Piracy off the Horn of Africa: Partnership and Action Plan" (henceforth the Action Plan) outlined the U.S. policy for dealing with Piracy in three parts. One, prevent attacks by making the sea-lanes less vulnerable to piracy. Two, in accordance with international maritime laws, disrupt all pirate activity. Three, prosecute all parties guilty of violations of international maritime laws. This strategic goals established by the 2007 and 2008 called for large-scale military intervention on the part of the U.S. Navy and Marine Corps. However, allocation of military resources, in 2007 and 2008, was difficult due to the two-war front maintained by the United States during this time.

In 2009, the Obama Administration revoked the strategic military interventionist approach and replaced it with a nation-building strategy. The Obama Administration focused on building the TFG into a formidable government capable of asserting control over the Somali nation. This support plan included direct financial aid as well as the implementation of security advisors in Puntland and Somaliland with the directive of persuading officials to police piracy. In addition to military action, the 2008 Action Plan proposed direct support and establishment of a trust fund that supports the prosecution of pirates. The judicial support of Kenya was

welcomed by the Obama Administration; however, in 2010, the effectiveness of the injection of U.S. finance into the Kenyan judicial infrastructure was uncertain (Congressional Research Service 2011).

2.5.A. Military Deterrence

In a study conducted by Oceans Beyond Piracy in 2010, reported that approximately two billion dollars per year is spent by militaries around the world to combat piracy (Oceans Beyond Piracy 2010). The primary method of military and naval deterrence has taken the form of security patrols and acting in the capacity as a reaction force. The U.S. Navy, operating under strategies developed in the 2008 Action Plan, is part of an international coalition against piracy around the Horn of Africa. The United States is currently engaged in Operation Ocean Shield and Combined Task Force 151. In addition to the two military operations conducted by the United States, the European Union (EU) established operation EU NAVFOR ATALANTA. The operational plan sets forth three goals for the pirate-infested region. One, protect ships carry cargo from the World Food Program (WFP) that are supplying the decimated populations of Eastern Africa. Two, offer safe passage to vulnerable commercial vessels traversing through the dangerous waters. Three, terminate all pirate activities taking place off of the coast of Somalia (Percy and Shortland 2009). The policies asserted by the EU legislation are very much parallel to those issued in the U.S. 2008 Action Plan.

However, all of the navies operating in the Red Sea, Gulf of Aden, and Arabian Ocean face the same problems in completing the goals outlined in the two documents. First, due to the expansion and increased sophistication of pirate operations and technology, the pirate scope of operations has increased to include a vast expansion of ocean. Also, pirates have learned to

hijack vessels and return to within 200 miles of the Somali coast, which protects them under Somali sovereignty which is unable to provide proper security of its shores. In order for international protection forces to stop these attacks, they have to be on the scene almost immediately; otherwise the timeframe for action expires, leaving military forces impotent. Secondly, naval militaries are reluctant to act due to the risk incurred by the hostages. In 2010, there were a total of 1,180 hostages taken by pirates, 86% of which were taken by Somali pirates (IMB 2010). Of those 1,180 hostages, only eight were killed in 2010. This is strong evidence that suggests that the pirates are solely interested in financial gains. However, if a doctrine of direct military engagement with pirates was adopted, it can be inferred that the number of hostages killed would increase dramatically. In order to protect hostages, international navies focus on the deterrence and preventions of piracy (Percy and Shortland 2009).

The three major operations launched in reaction to the Piracy threat are EU NAVFOR ATALANTA, Operation Ocean Shield, and CTF 151. The first, Operation ATALANTA, began in December 2008 and has expanded operations until December 2012. The mission objectives for the EU operation include protecting WFP vessels, deterring Somali piracy, protecting commercial vessels, and monitoring fishing activities off of the coast of Somalia.

The operation is a cooperative effort made by all EU countries and additional countries, including Norway, Croatia, Ukraine, and Montenegro. The participating nations provide naval vessels, patrol aircraft, vessel protection detachment (VPD) teams, in addition to financial contributions. The Operational Commander is Rear Admiral Duncan L. Potts (UK), supported by the Deputy Operation Commander Rear Admiral Rainer Endres (Germany), and Force Commander Rear Admiral Jorge Manso (Spain). The 8.4 million Euros and 8.05 million Euros that financed the operation in 2010 and 2011 respectively were split up among EU countries

based on GDP. The headquarters of the operation is based in Northwood, United Kingdom. The combined forces amount to 1,500 military personnel and a range of five to ten surface warfare vessels in the area of operations (AO)[9] dedicated to the deterrence of pirate activities in Somali waters. The military strategy used by the EU naval forces is dynamic and is based around the changing tactics adopted by the pirates (EU NAVFOR Somalia 2011).

Since the inception of the operation in 2008, the EU claims that they have had a 100% success rate in protecting WFP vessels[10] as well as the detainment of 111 suspected pirates, of which 56 have been convicted at the time of the publication of the paper. In addition to the naval campaign against pirates, the EU operation allocates funds to the training of a Somali security force. In May 2010, training began in Uganda. Furthermore, the EU has supported the African Union's military mission to Somalia (AMISOM) with approximately 9,000 military personnel in Africa as well as 258 million Euros in monetary support to the African Peace Facility. The EU has also supported the long run effort to build Somali infrastructure by committing large amounts of funds to governance and security (52 million), education (36 million), and economic growth (48 million) (EU NAVFOR Somalia 2011).

In addition to the EU NAVFOR coalition warships operating in the Gulf of Aden and Indian Ocean, Combined Task Force 151 (CTF 151) has been actively conducting pirate deterrent operations since January 8, 2009. One of three task forces under the command of the Combined Maritime Forces (CMF), CTF 151 is charged with the mission of deterring pirate attacks through patrols, search and seizure missions, and quick response capabilities. CTF 151 was initialized in order to allow CTF 150 to focus on its primary goals of general terror

[9] The AO for EU NAVFOR ATALANTA is 2 million square nautical miles.
[10] WFP vessels have amounted to the delivery of 674,000 tons of food to Somalia.

deterrence, which entails prevention of drug and weapon smuggling into Iraq and Afghanistan. CTF 151 is tasked with patrolling 1.1 million square miles of ocean. Under the command of Vice Admiral Mark Fox (USN), commander of US Fifth Fleet, CTF 151 includes 25 nations providing ships, assets, and personnel. Currently commanded by CDRE Abdul Aleem (Pakistan), the command is rotated every 4-6 months. Since the start of operations in 2009, CTF 151 has maintained a naval force of approximately 30-40 naval vessels (CMF 2009). While the EU NAVFOR coalition ships provide the majority of the escorts for WFP ships, CTF 151 carries predominantly is charged with search and seizure missions as well as daily patrols.

CTF 151 has been successful in protecting commercial vessel crews while simultaneously apprehending pirates. The coalition forces use visit, board, search, and seizure (VBSS) teams to investigate suspected ships and detain any potential pirates. While reporters and policy makers have suggested destroying pirate motherships, the United States operates within the bounds of the 1982 Law of the Sea Convention. This allows coalition forces to board and retake pirate operated ships; however, blowing up a targeted ship is considered illegal. While the weaponry maintained by coalition warships cannot even be compared to the equipment used by pirates. For example, the CTF 151 Flagship, USS Halsey (DDG 97), can travel at speeds up to approximately 25 knots and has a crew of 320 US sailors. In addition, the guided missile destroyer carriers (2) MK-41 VLS, (1) 20mm CIWS, (2) MK-32 triple torpedo tubes, (2) MK 38 MOD 2 25mm machine gun systems (Doehring 2010). The combat arms aboard the USS Halsey are designed to destroy large naval vessels and land targets thousands of miles away. The skiffs operated by 3-7 pirates, 20-60 feet long, could hardly scratch the paint on such a formidable force. However, military anti-pirate measures are conducted with a fine comb rather than a big stick.

As discussed in Chapter I, the VBSS teams use precision and finesse in order to protect hostages and apprehend pirates. Similar to the Al Mulahi incident, a 09 September 2010 *New York Times* report by Gettleman and Schmitt described how a maritime raid force (MRF) from the 15th Marine Expeditionary Unit (MEU) conducted a boarding operation and retook control of the MV Magellan Star in 2010. With the support of the Turkish frigate TCG Gökçeada and US ships, USS Dubuque and USS Princeton, the 24 US marines forced the nine pirates into submission and safely reclaimed the ship and crew. The Magellan Star incident demonstrates despite the overwhelming force advantage claimed by the coalition forces, pirate operations are still carried out very carefully. This increases cost, but protects the safety and welfare of the crew and military members.

CTF 151 and EU NAVFOR ATLANTA have had numerous successes similar to the Magellan Star incident. Over 750 pirates have been prosecuted in over 11 separate countries (Oceans Beyond Piracy 2010); however, not all pirates are convicted, and in addition to those prosecuted, even more are released after their initial capture. The legal systems of the prosecuting nations are overwhelmed and cannot support the high demand for conviction of Somali pirates. An estimated $31 million is spent each year in prosecution costs of pirates, an amount that many small nations cannot afford. Due to the circumstances, many pirates are captured more than once only to be freed. This has caused a great deal of frustration for the crews of the coalition forces. As sailors note, when a skiff is spotted with ladders it is almost a guarantee that they are actively conducting pirate operations. However, despite this incriminating evidence, the current political climate prevents definitive action to be taken in many cases. The impediment imposed upon military forces prevents them from fully performing to the fullest of their capabilities which grants pirates nautical impunity. An increased focus on

conviction and detainment, as well as loosening engagement restrictions, would improve the effectiveness of military deterrence.

Despite the effectiveness of military intervention, the premier form of pirate deterrence is the use of best management practices (BMP). Implementation of BMP has the greatest rate of success against effectively combating pirates. Both EU NAVFOR ATALANTA and CTF 151 advocate the use of the strategies outlined in the publication of BMP. The first commanding Admiral of the CMF, Vice Admiral Bill Gortney (U.S.), warned commercial vessels captains, "The most effective measures we've seen to defeat piracy are non-kinetic and defensive in nature." He continues to acknowledge the issues that need to be on land, "But the problem of piracy is and continues to be a problem that begins ashore and requires an international solution" (CMF 2009). VADM Gortney's statement after the creation of CTF 151 highlights the need to complement military efforts with concerted nation-building activities.

2.5.B. Best Management Practices

In a joint effort to educate commercial vessel captains in combating piracy, The U.S. Navy Maritime Liason Office (MARLO), Maritime Security Centre Horn of Africa (MSCHOA), NATO Shipping Centre (NSC), and Operation Ocean Shield have released the fourth version of *Best Management Practices for Protection against Somalia Based Piracy*. The guide notes that majority of successful pirate hijackings are due to the vessel's failure to adhere to the strategies outlined in the training book. The BMP guide has three absolute requirements: register with MSCHOA, report to the United Kingdom Maritime Trade Operations office (UKMTO)[11], and

[11] The UKMTO is located in Dubai (BMP 4, 2011).

use ship protection measures in case of an attack. Registration with MSCHOA is completed by completing a form that allows anti-piracy organizations to cooperate with coalition forces and track commercial vessels traveling through dangerous waters. The second step, requests ships travelling through the waters bounded by the Suez Canal to the north and the grid position 10 degrees south and 78 degrees east. In order to report, ships are asked to send a daily email to the UKMTO in order to update the ships position. The latest reported position is used by military forces to search for a ship if a distress signal is sent (BMP 4 2011). The last crucial step to the successful implementation of BMP is the effective usage of ship protection measurements (SPMs).

The first suggestion is that ships travel through high risk waters via the Internationally Recommended Transit Corridor (IRTC). This majority of coalition forces are concentrated along this route. The BPM distinguishes between two types of activities, deterrent and preventative. Deterrent activities include maintaining a constant and alert watch. Alert watches require additional personnel on each watch, rotating often to preserve alertness. Binoculars, night vision goggles, and proper use of radar maximize the effectiveness of watches. In many cases, pirates will choose not to attack a ship that seems to be well prepared to combat a boarding. In order for crews to be properly prepared, ship emergency drills should be practiced prior to entering risky waters. Second, physical preparations of the ship can mitigate damage and even prevent a hijack. These preparations include chain link fences to lessen RPG damage, place barbed wire around perimeter of ship, fortify vulnerable surfaces of ship, and provide crew with helmets and Kevlar (BMP 4 2011).

Preventative measures conducted by crews include any activity that attempts to repel a pirate attack. Use of fire hoses and ballast pumps to flood the deck causing water to run off the

sides makes it difficult for pirates to board. Second, alarms and highlighting pirates with lighting will aid coalition forces help deter the pirates. Use of citadels and safe rooms are effective if pirates are denied use of critical tools and ship driving capabilities. Use of armed and unarmed security contractors provides experience to the crew which can help fight off pirate attacks. Lastly, BMP requires that attacked ships report the attack in order to help anti-piracy organizations to alert military forces and warn other commercial vessels (BMP 4 2011).

Unfortunately, navies find severe difficulty in determining the proper execution of the detainment of pirates. Navies cannot arrest and detain suspected pirates without cause for suspicion. Given this restriction, it is often necessary to catch pirates in the act of a violation of international maritime laws. Therefore, it is rare and difficult for navies to execute the aforementioned goals established by the U.S. and the EU. Furthermore, if international enforcement navies are successful in obtaining guilty parties, current policy is to hand judicial responsibility to Kenya. However, Kenya is currently unequipped to handle such a large number of cases and pirates are often released without punishment.

2.5.C. Difficulties of Prosecution

While the coalition forces patrolling the Gulf of Aden and Indian Ocean have had some success in detaining pirates, there are significant roadblocks preventing prosecution of pirates. There are four crucial impediments in the prosecution of pirates (Percy and Shortland 2011, 9-10). One, piracy recruitment occurs on land where it is uncontrolled, therefore, the detainment of one group of pirates is easily replaced by another set of pirate recruits. The labor supply for pirates is vast due to the chaotic, jobless, and uncontrolled environment of Somalia. Secondly, the prospect of detention does not create a deterrent effect for pirates because western jails offer

more security than Somalia. Prisons have consistent meals, beds, and sanitary conditions. These may be incentives for pirates to be caught. Thirdly, African legal systems are not fully capable of adjudicating pirates. Pirates cannot be tried in Somalia due to lack of unbiased courts, and trials of pirates in Kenya ended in 2010. Lastly, it is extremely difficult to provide sufficient evidence against pirates unless they are caught in the middle of an attack (Percy and Shortland 2011). There are many cases in which pirates are detained only to be released back into Somalia due to the inability of the international community to prosecute them.

In a 2012 New York Times article by C.J. Chivers on 06 March 2012, he reports that 15 accused pirates were transferred to Seychelles to await trial. After a detainment period of two months on board three U.S. warships, the pirates face charges of twenty years or more. Seychelles has become a large adjudication resource for the trials of pirates. Convicted pirates are sent to a U.N. financed prison that has been established in Somaliland, Somalia. The journey of the suspected pirates provides a testament to the difficulty of prosecuting those suspected of piracy. Furthermore, the implicit costs associated with the detainment and conviction of pirates are extremely high for the U.S. military, Seychelles, and the U.N. The establishment of the U.N. prison and efforts by Seychelles represent some steps taken by the international community to enforce punishment of piracy. However, this process will need to be brought to the source of pirates on land in order to experience success.

Chapter II has outlined the root causes of Somali piracy and discussed the different methods which are currently being used to combat it. The deterrence methods, conducted by both the international coalition forces and private shipping companies, are the police force preventing Somali pirates from completely stopping the commercial shipping through the Gulf of Aden, Red Sea, and Indian Ocean. In Chapter III, the Somali pirate situation is put into the

context of Gary Becker's Economic Theory of Crime and Punishment. By putting the piracy situation into terms defined by Becker's theory, it will allow for an evaluation of the effective deterrence methods currently being used and how a long term solution is the only way to stabilize the area and put an end to pirates operating with impunity.

CHAPTER III

APPLICATION OF THE ECONOMIC THEORY OF CRIME AND PUNISHMENT

It is a commonly held misconception that the Somali pirate community is comprised of lawless and unorganized outlaws. Reports of hijackings and attacks on merchant ships rarely give an insight into the thought processes of the assailants. These reports often assert that pirates, like most criminals, do not engage in a rational decision making process. Contrary to these beliefs, Becker's *Crime and Punishment: An Economic Approach* (1968), suggests that criminals in fact undergo a series of rational decisions, a process that can be applied to the Somali pirate community.

Starting with Adam Smith in the eighteenth century, economists and philosophers demonstrated interest in the relation between crime and economics. Smith related the need for protection from crime with the accumulation of wealth and Jeremy Bentham, a utilitarian philosopher, was concerned with the reaction of criminals to legal policies (Ehrlich 1997, 43).

This field of economic study postulates that criminal activity is predicated upon a rational decision-making process that dictates whether a criminal will choose to commit a crime or abstain. The fundamental question of the theory is what is the optimal amount of crime in a given society? The optimal amount of crime is dependent upon the difference between the amount of resources allocated to preventing and prosecuting illegal activities versus the net damage to society as a result of the crime. The addition of the economic perspective to the study of criminology presents a new mechanism with which criminal activity can be studied. Furthermore, the application of this theoretical disposition to the study of pirate deterrence can

help illuminate some previously aspects of pirate decision-making which could provide knowledge to the arsenal of policy makers.

3.1: Basic Components

Utopias envision realms of perfect order and prosperity. Although the prospect of a crime-free society seems desirable on the surface, Becker's theory supplies an explanation that describes why a world without crime would actually be dystopian, more similar to George Orwell's, *Nineteen Eighty-Four*. In order for a society to exist without any criminal activity, complete allocation of resources would have to be devoted to police activity[12]. Becker notes that while it may be possible to eradicate major felonies, such as murder, assault, and armed robberies, which account for a smaller percentage of criminal activity, it is not possible to rid society of all crime. The costs associated with dissolving all crime, which includes white collar crimes, the marginal cost of policing and prosecuting each individual crime would far outweigh the net damage done to the society as a consequence of the crime committed. Therefore, unless a society is willing to forgo all personal liberty and abandon all lose all benefits from social programs in return for complete lawfulness, the utopia paradigm is impossible. What Becker's theory provides is a mechanism with which to determine the appropriate amount of crime that a society allows, given a government's resources and institutional strength[13].

Becker's model establishes the follwoing five categories which are fundamental in deriving an optimality condition (Becker 1968, 172).

[12] This is one way to reach utopian society. Optimistic approaches to reaching utopia require all persons to subscribe to the same values. This situation is equally unable to be controlled completely by governing policy.
[13] The amount of resources needed for policing a society is dependent upon the degree to which a society "buys in" to the legal system in place.

1. The number of crimes and cost of offenses
2. The number of crimes processed and adjudicated
3. Government expenditures on maintaining a police force, prisons, and judicial systems
4. Number of convictions and the cost of judicial processing as well as imprisonment and other punishments
5. private expenditure on protection

These categories are used to determine different the effects of consequences on several factors such as net societal damages, the cost of apprehension and conviction, criminal labor market, assignment of punishments, and optimality conditions.

3.1.A. Net Damages to Society

The net damage to society is defined by Becker as the net harm to society as a result of the crime subtracted by the net gain that the criminal receives from an illegal action, as explained by the equation $D(O) = H(O) - G(O)$. Where damage done by a crime is $D(O)$, harm to society is defined as $H(O)$ and the gain by the criminal is $G(O)$. Both damage to a society and gain to the criminal are functions of the total number of offenses (O). Net harm to society can include, but is not limited to, physical and psychological damage to the victim, damage to property, and fiscal or property loss of the victim. In many cases of petty crimes, the net damage to society is going to be the emotional distress of the victim. For example, if a thief steals a man's wallet on a busy street, the economic net gain for society is zero. However, the victim still suffers due to the distress caused by being without his driver's license, credit cards, and any other property kept is his wallet, in addition to the sense of injustice. Therefore, the net loss to society is the distress caused to the victim as well as the lingering injustice. In Becker's model, larger magnitudes of

net loss to society warrant larger amounts resources policing and prosecution. This means that, at the margin, more serious crimes, such as murder or armed robbery, garner more attention and resources expended by police forces. In the case of piracy, societal net loss extends to increased opportunity costs, increased security costs, damage to commercial vessels, in addition to the ransom and crew suffrage (Becker 1968, 173).

3.1.B. Cost of Apprehension and Conviction

The cost of catching and prosecuting criminals entails more resources than wages for police, court personnel, and prison employees. Police and court "activity," as defined by Becker, includes inputs of labor, supplies, and capital. Becker provides the production function for the level of technology and proficiency of the judicial system, which is defined as $A= h (p, O, a)$. In this case, activity equals the net harm per offense (h), which is a function of probability of conviction (p), total number of offenses (O), and the number of arrests and determinants of activity (a). In the case of piracy, increases in activity would include increased military technology, reporting centers, alarm systems, safe rooms/citadels, other defense systems on board commercial vessels, as well as increases to the capability of judicial and punitive measures enforced by Somali and international courts. Increases in the level of A (activity) would increase the overall cost. Simultaneously, an increase in activity would also increase the total number of offenses that lead to convictions (pO). Transitively, an increase in the probability of conviction (p) would increase the overall cost of apprehending criminals, as demonstrated by the function $C= C(p, O, a)$ (Becker 1968, 175).

3.1.C. Criminal Labor Market

Similar to the "legal" labor market, the supply of criminals is determined by a model of cost-benefit rationality. However, the costs associated with the criminal labor market are risks associated with crime, which include risks of detection, prosecution, and punishment. While workers in the "legal" labor market concern themselves with a balance between labor and leisure, determined by wages per hour of labor, criminals decide whether the monetary benefits of a specific crime outweigh the cost of punishment. Several factors affect the decision-making process of a criminal. These risks include, the probability of being caught per offense (*p*), severity of punishment per offense (*f*), and an institutional variable per offense (*u*). The institutional variable is dependent on the current state of the social atmosphere. Considered in the institutional variable are availability of social programs/welfare programs, level of education, and availability of legal employment. The consideration of these variables comprises the function for total number of offenses:

$$O = O(p, f, u)$$

The variables for probability of conviction, as discussed in the previous section, is dependent on activity or allocation of resources to police measures; the severity of punishment is established by law within each jurisdiction of the respective governing body; and the institutional variable is a constant that depends on alternative revenue earning options, average education levels, and social infrastructure, including social programs. The only variables that policy-makers are able to directly influence are *p* and *f*. However, the institutional variable can be affected by improvements in the state of infrastructure in both the private and public sector. Changes in the

institutional variable cannot be changed in the short run.[14] Therefore, in the case of piracy, the only tools available to international powers, in the short run, are to choose the appropriate levels of allocation to military efforts, vessel protection levels, and determining levels of punishment for each act of piracy in order to convict and prosecute criminals. Becker also establishes that, at the margin, increasing *p* or *f* would decrease the utility of the criminal and subsequently reducing the number of crimes. He accomplishes this by first representing the number of crimes as occurring in a specific time period where $O_f = O_f (p_f, f_f, u_f)$. ($O_f$) is the number of offenses that occur in time period (*f*). Therefore:

$$O_{pf} = (\delta O_f / \delta p_f) < 0 \qquad \text{or} \qquad O_{ff} = (\delta O_f / \delta f_f) < 0$$

These equations demonstrate that an increase in *p* or *f* would decrease the total number of crimes during period (*f*), at the margin (Becker 1968, 177-180).

Just like in the "legal" labor market, individuals value wages and labor differently, criminals are sensitive to these variables in different degrees. For example, a criminal with a preference for risk would increase the number of crimes if resources were allocated so that probability of being caught increased proportionate to a decrease in the severity of punishment. Therefore, the elasticities of a criminal in the illegal labor market are determined by their preference for increased probability of capture of increased severity of punishment. As discussed previously in this paper, the inability of African and international judicial systems to effectively prosecute Somali pirates suggests that pirates have preference for risk. A further discussion of the consequences of the failure of the prosecution variable in the Somali pirate context can be found in chapter three.

[14] In the case of fishing piracy, see Section 2.2, abolishing IUUs from Somali waters would increase the institutional variable in the short run. If EU naval efforts are effective in limiting IUUs, increases in fishing employment would have a short run effect on the institutional variable, thus affecting the pirates' decision making process.

3.1.D. Assignment of Punishment

Becker introduces fines as a cost-saving alternative to imprisonment. However, in the case of piracy, fines are not a possible means of punishment. The point of a fine is to impose a fiscal punishment on a perpetrator, beyond the gains of the illegal exploits, provided they have a means to pay the fine. In the case of Somali pirates, as discussed in chapter II, the Somali pirates have no ability to pay a fine, other than with money supplied by previous ransoms of commercial vessels. Forfeiture of hijacking profits would not be a sufficient to create a deterrent effect. The pirates would only lose what they had just stolen, thus effectively breaking even. Fines are only effective if the fine is larger than the net gain from a crime. Therefore, fines would not deter pirates from committing another crime. With that said, the option of fining pirates is completely impossible. Therefore, those interested in prosecuting pirates must rely on the alternative, and more common forms of punitive action. These most of include forms of restriction, imprisonment, and in extreme cases, capital punishment.

Unfortunately, punishments, other than fines, carry an implicit social cost. Prosecution and imprisonment carry a high social cost because prisoners are no longer part of the laboring and taxpaying community; instead, prisoners become completely reliant on the state for basic living necessities. In addition to the costs of providing the basic needs of prisoners, taxpayers pay the wages of prison guards and employees as well as the costs of maintaining of prisons. Becker understands the social cost of imprisonment to equal $f' = bf$, where (f') equals the social cost and (b) is a coefficient that represents the cost on society determined by the magnitude of the punishment. For example, the cost on a society of sending a criminal to a maximum security prison versus a minimum security prison. (Becker 1968, 180). The coefficient (b) transforms severity of punishment (f) into the social cost of a punishment per criminal (f'). The debate over

international responsibility for the prosecution and imprisonment is a derivation over this high social cost of imprisoning pirates.[15]

3.2 The Model and Optimality Conditions

As stated in the previous section, policy-makers are only given the ability to set the levels of *p* and *f* in order to deter crime and allow the optimal amount of crime to occur. First, in order to determine the amount of crime that maximizes social welfare, Becker established a social welfare function that states:

$$L = D(O) + C(p, O) + bpfO$$

The equation sets social welfare (*L*) equal to damage of offenses (*D*), the amount spent on combating offenses (*C*), and the total social loss from punishments and imprisonments (*bpfO*). From this equation, Becker obtained his first order conditions, which provide an insight into the effects of changing *p* and *f*. The marginal cost of increasing the number of offenses, whether through a reduction in *p* or *f*, is equal to the average revenue of each offense (-*bpf*) multiplied by the elasticity of criminal preference for risk or punishment ($1 - 1/\varepsilon_f$ or $1 - 1/\varepsilon_p$) (Becker 1968, 181-182). The model assumes that, for the perpetrator, there are decreasing marginal returns to each subsequent number of crimes committed. This is due to the increased likelihood of capture and conviction for each number of crimes committed. Also, if there are few criminals in the illegal labor market who cause low levels of net damage to society, there will be limited resources allocated to police efforts. With increases in the level of crime, policy-makers react by allocating more funding to preventing and prosecuting crime. Although it is progressively more

[15] See chapter II

risky for criminals to engage in more and more criminal acts, it is also more costly for governing bodies when there is more crime. There are decreasing marginal revenues for criminals, and increasing marginal costs for governing bodies. For example, if there is only one criminal in the illegal labor market who commits only one crime and quits, the marginal revenue is high because the chances of being caught are significantly lower. There would be little police response and the criminal would have a low probability of conviction. In this situation, the total net loss would be almost zero. Conversely, in a society where crime is rampant and police efforts are extreme, the cost of convicting and prosecuting each individual criminal becomes increasingly more costly. For the criminal, the illegal labor market would yield low revenue streams because the chances of being caught would be much higher due to the increased police efforts. This would net a huge social net loss (Becker 1968, 181).

In order for a policy-making body to reach an optimal level of crime and crime prevention, they must choose the number of offenses where the marginal cost for the government equals the marginal revenue for criminals than seeking legal forms of employment. In order to do this, they have to choose the levels of *p* and *f* that make it more costly for criminals to join the illegal labor market. This is because criminals will continue to join the illegal labor market until it is unprofitable for them. Until the optimal amount of offenses is reached, the police force is a reactive body. This means that, criminals will continue to join the illegal labor market until it is unprofitable; therefore, the police will be forced to increase efforts until the number of police and severity of punishment create a situation in which the probability of facing an adverse prison sentence outweighs the gains of committing the crime. This occurs in the zone of optimal offenses.

Another possible explanation for the decreasing marginal returns to crime is that police initially focus on the most harmful crimes initially. Thus, as crime and deterrence efforts increase, the focus of the policy-makers is to abolish the majority of the most detrimental and despicable crimes, such as murder, rape, massive extortion, and armed robbery. Therefore, police efforts will mostly focus on these criminals, and lower level criminals, predominantly white collar criminals, slip through the cracks. However, as more resources are given to police efforts and punishments become increasingly severe, criminals may opt to engage in smaller scale operations. These are crimes that are harder to convict, demanding high operational budgets, but yield little revenue for the criminal. This also would create a massive net loss. Therefore, a more desirable social policy would be to allow some crimes continue and focus on the more socially harmful crimes. This would also place a society in the socially optimal zone of offenses.

In equilibrium, Becker asserts that criminals are "risk preferrers," at the margin. Under these conditions, if a criminal labor market is at equilibrium, individuals would not enter the illegal labor market because they would be able to make a better salary, adjusted for risk, in legal avenues of employment. Therefore, optimality in Becker's model is the point at which police efforts and punishment strategies create a situation in which legal employment is more profitable than the expected value of crime. In order to so, Becker's model provides policy-makers a guide to allocate crime deterrence resources at optimal levels (Becker 1968, 208-209).

Applying Becker's theory to Somali piracy highlights the fundamental problems within Somalia. Becker's model depends on the presence of a reactionary governing body that has the ability to police, adjudicate, and punish crime within their sovereign territory. This is not the case in Somalia. Therefore, as demonstrated in this chapter, criminals and pirates alike make

rational decisions regarding their crimes. If the risk adjusted revenue from a crime is lower than profits from the legal labor market, individuals will choose not to join the illegal labor market. However, with the current state of Somalia several disruptive factors prevent Somali and international governing bodies from issuing justice, and in turn, deterring piracy. One, there is no consistent legal process that threatens pirates with punishment. Two, due to economic crises, crop failure, civil war, and encroachment of illegal fishermen there are sparse opportunity for Somalis to find work that sufficiently provides for their families. Lastly, an issue of responsibility exists which prevents a single governing body from providing necessary funding for prosecution and punishment. These issues are discussed in length in chapter IV.

3.3 Behavioral Consequences of the Model

Since the formalization of the economic theory of crime and punishment in Becker (1968), a new focus of economic study was introduced. The cascade of economic literature following from Becker's seminal paper introduced new applications of the theory as well as refined factors established in Becker (1968). The range of these studies varied from private protection and self-insurance as in (Ehrlich and Becker 1972) and (Ehrlich 1997) to organized crime versus individual crime as seen in (Chang, Lu, and Chen 2007). Although many papers have been written on the subject of the economic theory of crime and punishment, this section will focus on these subjects due to their direct relationship with several key issues in the context of Somali piracy that were not covered in Becker (1968). For example, private insurance and private protection will help explain the case for use of private ship security teams, anti-piracy measures, and commercial insurance. Also, pirates do not operate as individual perpetrators; rather, they are organized into various groups, operating in tandem with other pirate teams

aboard motherships. Therefore, examining the decision making choices afforded to organized crime will allow policy makers to better combat recruitment.

First, as an alternative to buying market insurance, commercial vessels have two options in order to mitigate expected losses. Self insurance and self protection are both options, examined in (Ehrlich and Becker 1979), that provide an alternative to market insurance that reduce the size of losses and decrease the probability of a loss respectively. Self insurance, in the case of preventing piracy, can be considered any actions which are taken by the individual or the company that owns the vessel that mitigate risk of hijack or damage. Examples of self-insurance on commercial vessels are utilization of BMP, fire prevention equipment and alarm systems, safe rooms/citadels, and alarm systems that notify local military vessels and naval response centers. Self-protection includes security teams and anti-piracy equipment and training. While market insurance costs are equal to periodic payments to a firm, self-insurance and self-protection cost initial capital. Ehrlich and Becker demonstrate that self-insurance focuses and market insurance are substitutes. However, market insurance is more apt to cover rare losses, whereas self-insurance is more capable of mitigating losses from more commonplace damages associated with being the victim of a crime (Ehrlich and Becker 1979, 635-637). While self-protection does not change potential losses from a successful hijacking, it decreases the probability of being hijacked. However, in the case of piracy, this can be a dangerous strategy that could potentially lead to an exchange of deadly fire between pirates and a vulnerable crew. There is no evidence that claims that insured ships take less preventative measures in order to maintain safety. However, it is possible that a captain of an insured ship may advise his crew to take more precaution when under direct attack from pirates due to the comfort of a potentially shorter captivity period or the increased probability of a rescue.

While Becker (1968) only allows for policy makers to reach an optimal amount of offenses by negotiating appropriate levels of police funding and punishment, Ehrlich (1997) adds mitigating variables, such as private protection which is discussed as self insurance in (Ehrlich and Becker, 1979). Ehrlich determines that individuals' levels of private protection spending react to higher rates of crime or increased probability of being a victim. Also introduced in Ehrlich (1997) is the idea that economic growth and capital accumulation by firms and individuals increases the profitability of criminals. This also applies to the piracy victims. As international economic growth continues, cargo becomes more valuable and aggregate tonnage traveling through pirate-infested waters increases. These factors increase the profitability potential for pirates, which may lead to injections of new pirates into the pirate labor market. Finally, Ehrlich differentiates between the two strategies of deterrence, those which rely on negative incentives and positive incentives and which deal with a greater focus of rehabilitation and labor alternative. Ehrlich testifies that both negative and positive incentives are able to deter crime. However, positive incentive programs, such as labor training subsidies, provide a much lessened burden on social welfare. This application of alternatives is briefly seen in Becker (1968) in his institutional variable, but is elaborated upon by Ehrlich (1997). The positive incentive strategy can be an effective deterrent tool for limiting the pirate labor market if alternative labor projects can be developed. While there have not been sufficient efforts to provide alternative employment in Somalia, the converse incentive has been observed. For example, due to the presence of IUUs, as discussed in section 2.2, many Somalis left the fishing labor market and joined illegal pirate gangs. Therefore, if profitable labor can be supplied, it should deter a portion of pirates away from the pirate labor market.

In other studies of piracy, the reasons for piracy are a function of risk, opportunity, resources, and poverty (Percy and Shortland 2009). This is very similar to Becker's reasons for crime. In this case, risk is considered as a combination of enforcement of naval laws by military coalitions and weather conditions (monsoons). Resources refer to the amount of input capital available; there is evidence that the input costs are provided by financiers. Piracy is also a result of poverty which has been demonstrated by Chapter II. Lastly, pirates take advantage of the natural geographical chokepoints adjacent to the Somali coast which are also one of the most frequently traveled by valuable commercial traders (Percy and Shortland 2009). The input factors provided in Percy and Shortland (2009) do not consider punitive risk; however, the decision factors of pirates demonstrate a close similarity to Becker's model of criminal decision-making.

Both Ehrlich and Becker (1979) and Ehrlich (1997) focus on deterrence by governing bodies and individuals. Chang, Lu, and Chen (2005) investigate the benefits of operating within an organized group of criminals. This paper is pertinent to the discussion of piracy because pirates are not individual operators and rely on "mothership" crews and attack commercial vessels in teams of four to seven pirates. In Chang, Lu, and Chen (2005), the number and type of criminals that join a criminal organization are endogenous. Furthermore, the study expresses how joining a criminal organization, or in this case a pirate group, carries an extra benefit. Additional benefits include greater influence, criminal networking, protection from competitors and rivals, improved capital and technology (Abadinsky 1994). These benefits are crucial for Somali pirates in conducting operations.

While many suspect that the pirate gangs have close ties to the Somali terrorist group, Al Shabbab, these reports are unfounded. However, reports have demonstrated that pirates are

being financed by wealthy African businessmen. Feelings of immunity have inspired financiers of piracy, within Somalia, to boast their profits. Saeed Yare, a pirate financier, claims to have accrued 2.4 million USD from ransom payments in a single year (Murphy 2011). This type of financing scheme demonstrates that pirates operate within fairly organized operating groups. Without the presence of an established organization, pirates would not have the ability to purchase semi-automatic weapons and rocket propelled grenades that are used in the majority of hijackings. Furthermore, it is suspect that pirates pay a share of ransom earnings to tribal leaders for protection purposes. The first assertion made in Chang, Lu, and Chen (2005) is that, in a revenue uniform distribution scheme, low skill criminals will choose to operate individually, while those with some skill will join the organized crime market. This suggests that if this proposition is consistent with Somali pirates, many pirates are former fishermen or have an aptitude for using weapons. In order to try and discourage individuals from joining the organized crime labor market, Chang, Lu, and Chen (2005) advocates serving organized criminals with harsher penalties. The study justifies this strategy by noting that harsher penalties increase the entry fee into organized crime and, in some cases dissuades individuals from joining. This treatment of pirates as an organization, as opposed to individual criminals, may provide a unique way in which to prosecute them as a group. If so, harsher penalties may dissuade potential pirates from joining hijackings and opt for other means of revenue. Furthermore, due to the capital and technological necessities associated with piracy, those individuals that are dissuaded from joining, as a result of harsher penalties, will not become pirates because of funding restraints.

In order to impose harsher penalties on pirate organizations, a police effort must first take place within the Somali borders. Therefore, this technique would fall under the long term

solution to ending piracy. Due to the necessity of organization in order to finance and conduct pirate attacks, dismantling pirate gangs would inhibit the effectiveness of all pirates. It is very improbable that pirates would be able to operate in small gangs, 5-6, without the support of financers and a larger organization to protect them and their large influxes of capital. In order to effectively take apart the pirate organizations, part of the rebuilding process of Somali infrastructure must include rooting out and punishing leaders of pirate gangs. This includes financiers and organizational heads. If this is accomplished, it is fathomable that pirates would no longer find safe harbor in Somalia. For this reason, it is argued in Percy and Shortland (2011) that piracy is not able to be controlled by naval mechanisms because it is a land-based problem in a land where anarchy is the presiding political environment. The inability of naval forces is predicated upon the inability of naval forces to persecute the root of piracy. Naval forces and deterrence strategies are only able to increase the risk of capture and decrease expected revenue of pirates. The threat of punitive action is still largely questionable, and more importantly, pirate leader and financiers operate with impunity. Leaders are able to recruit and organize disenfranchised Somali youths within the shield of chaos provided by the unstable nature of Somalia.

There are reports of pirate organizations growing on land, which may account for the increase in pirate attacks in recent years. Pirates have created a community in which members can profit through the purchase of "shares" in a crude pirate stock exchange (Hallwood and Miceli 2011, 5). According to pirate shareholders, the scope of pirate operations has increased to 72 "maritime companies" and shareholders receive returns on their investment (Minney 2010). According to a 22 year old investor, she received a 75,000 USD return in 38 days from an initial investment of a RPG (Minney 2010). Whether there is merit to these claims, it is troubling to

imagine the increases of pirate sophistication of such a large magnitude. The ultimate solution is to engineer a politically feasible way in which to empower a Somali government and create an effective police force. Until then, the international community will continue naval efforts. In defense of the current naval strategy employed by the United States, Secretary of State Hilary Clinton stated, "[you] have to try to put out the fire before rebuilding the house" (Spearin 2010). Given the international circumstances, it does not seem that a full commitment to the long run solution, of rebuilding Somalia, is probable in the near future. Therefore, the statistical model will focus on maximizing the effectiveness of the short run deterrence activities currently in place.

CHAPTER IV

ECONOMETRIC ANALYSIS OF PIRATE DETERRENCE STRATEGIES

Chapters II and III have demonstrated that pirates operate in response to potential gains from ransom payments as well as captured vessels and property. Furthermore, pirates are maritime criminals, and like criminals, they make rational decisions whether to commit an act of piracy based on the likelihood of punishment and the severity of punishment. Pirates are threatened by international coalition forces, which parallel police activities in sovereign states, and individual commercial ships also practice anti-piracy activities. As discussed in Chapter II, the judicial institutions assigned to handle piracy are inconsistent and in many cases ineffective. Therefore, this study will focus on how the deterrent strategies, individual anti-piracy measures undertaken by commercial vessels and military policing, affect the success rates of pirates and their expected revenue. If the analysis finds that the deterrence activities are effectively reducing the success rate of pirates, the supply of pirates may begin to decline in reaction to the decreased expected revenue.

The purpose of analyzing the reported data regarding pirate attacks on vessels traveling through waters adjacent to Somalia is to determine which short run deterrence methods have had the greatest affect on preventing successful hijackings. The deterrence strategies represent the police spending variable in Becker's theory. The solution to combating Somali piracy is broken down into the two policy variables provided by Becker, which include police spending (short run) and the judicial assignment of punishment (long run). The long run method, which is expected to have a greater deterrence effect on pirates, is not covered within the scope of this research. Therefore, the research focuses on the effect of deterrence strategies.

The deterrence strategies work in two capacities that have a deterrent effect on pirates. One, measures taken by commercial or private that decrease the likelihood of a successful hijacking decreases the expected revenue from piracy[16]. Two, military intervention may result in the detention of pirates. Within Becker's model, this is equivalent to probability of arrest. By determining which strategies have the best effect on decreasing the probability of success while simultaneously making it more risky for pirates to operate, policy can be suggested for the optimal allocation of resources. The model will first examine how effective the various strategies are; then, the coefficients will be used in combination with the estimated costs to determine the expenditure necessary for the successful implantation of anti-piracy measures.

In order to evaluate the effectiveness of the various deterrence activities discussed in this paper, I will use two types of econometric regressions, a probit analysis and an ordinary least squares regression. A random sample of 100 pirate attacks was taken from the total number of pirate attacks (502) over the course of 2006-2010. In order to ensure that all five years are represented proportionally, the total number of attacks from each year was divided by 502. A random sample was taken from each year according to the percentage, from each respective year, of the total number of attacks. The number of incidents from each year, in the sample, are as follows: 2010 = 36, 2009 = 35, 2008 = 18, 2007 = 7, and 2006 = 4. Each incident was accessed through IMB Piracy Reports 2006-2010. The reports provided the majority of the data used in the regression. However, for data not reported in IMB 2006-2010[17], research was done into each individual hijacking in order to determine which deterrence activities were utilized, amount of

[16] Pirates have two choices when they face a significant decrease in ability to hijack ships. One, find another means of employment that has a higher risk adjusted expected revenue. Two, find a financier to improve technology. There have been reports of pirate financiers. The long term solution of increasing the effectiveness of a Somali government to police actions within its sovereignty would address this problem (Murphy 2011).

[17] Almost every incident that lacked data concerning deterrence activities utilized were ships that had been successfully hijacked.

ransom paid, and length of captivity. Resources used to find the information were general web searches. Sources of information came from international news agencies, interviews, and various databases/ individual reports.[18] If data was not available for a single incident, that data point was omitted and a random number generator was used to determine the replacement[19]. Deterrence activities and pirate capital are denoted by a binary variable in both regressions. The two analyses will use two different dependent variables, a binary variable for hijack success will be used in the probit analysis and the ransom payment is the dependent variable in the least squares regression.

In this study, the international community is seen as one policy-making agency. Therefore, the total amount of funding allocated towards anti-piracy efforts determines the probability of catching and convicting a pirate. The allocation of anti-piracy funding into the various activities also affects the probability of conviction, depending upon relative cost to effectiveness. Therefore, by recognizing which strategies have the greatest effect on decreasing the percentage of successful hijackings, optimal allocation will increase the probability of conviction of pirates. Given the criminal supply function from Becker's theory, an increase in conviction probability decreases the expected utility of pirates which also decreases the total labor supply of pirates. The two regression equations are as follows:

(1) $HIJACK_i = \beta_0 + \beta_1 EVMNS_i + \beta_2 SECTEAM_i + \beta_3 ANTPMRS_i + \beta_4 SUEZ_i + \beta_5 GRT_i + \beta_6 MONSOON_i + \beta_7 YEAR_i + \beta_8 MONTH_i + \varepsilon_i$

[18] Resources used to determine missing data are not guaranteed to be entirely accurate.
[19] The replacement incident was taken from randomly generated from a sample that was the same as the omitted data point. For instance, if a successful hijack from 2008 was omitted, a replacement was generated from successful attacks in 2008. This method was used in order to maintain the same proportion of successful attacks as the original generated sample.

(2) $RANSOM_i = \beta_0 + \beta_1 ANTPMRS_i + \beta_2 EVMNS_i + \beta_3 CITADEL_i + \beta_4 SECTEAM_i + \beta_5 MILINT_i + \beta_6 HOSTAGES_i + \beta_7 GRT_i + \beta_8 MONSOON_i + \beta_9 PRTBRDVSL_i + \beta_{10} PRTINPT_i + \beta_{11} SUEZ_i + \beta_{12} LGTCAPTV_i + \beta_{13} YEAR_i + \beta_{14} MONTH_i + \varepsilon_i$

4.1: Discussion of the Variables

The LHS variables are a binary variable for successful hijacks (*HIJACK*) and a variable that measures the total revenue earned by pirates for a single pirate attack (*RANSOM*). The Right Hand Side (RHS) variables that measure deterrence strategies are evasive maneuvers (*EVMNS*), military intervention (*MILINT*), ship security team (*SECTEAM*), and anti-piracy measures (*ANTPMRS*), and installation of a safe room/citadel (*CITADEL*). Also, included are variables for the number of hostages taken in a hijacking (*HOSTAGES*) and the length of captivity for the hostages (*LGTCAPTV*).

TABLE 4:

List of Variables	(1)	(2)	(3)	(4)	(5)
Dependent Variable					
HIJACK	X	X			
RANSOM			X	X	X
Independent Variable					
ANTPMRS	X	X	X	X	X
EVMNS	X	X	X	X	X
CITADEL			X	X	X
SECTEAM	X	X	X	X	X
MILINT	X	X	X	X	X
HOSTAGES					X
GRT		X		X	X
MONSOON		X		X	X
PRTINPT		X		X	X
SUEZ		X		X	X
LGTCAPTV					X

The RHS control variables are the total number of ships that travel through the Suez Canal each moth (*SUEZ*), the gross registered tonnage of the ship attacked (*GRT*), an estimated cost for the pirates input (*PRTINPT*), a binary variable for whether the pirates are able to board the vessel

(*PRTBRDVSL*), and a dummy variable for the monsoon season (*MONSOON*). Table 4 includes a list of all the variables, Table 5 contains a brief definition for each variable, and Table 6 presents the descriptive statistics of all the variables.

Table 5: Definitions for all Variables

Dependent Variables:

1. HIJACK: Assigns a one or a zero to each observation depending on whether the attacking pirates were able to gain control of the ship or not respectively.
2. RANSOM: The amount of ransom paid to the pirates for the safe return of the crew and property (vessel, cargo, and personal property).

Independent Variables:

1. ANTPMRS: Any use of the best management practices, as discussed in section 2.5.B. Binary variable; equals one in any attack in which BMPs were utilized by the victim vessel.
2. EVMNS: Binary variable that assigns a one to any incident in which evasive maneuvers were taken by the captain of the vessel being attacked in an attempt to impede a pirate attack.
3. CITADEL: Binary variable that equals one if the attacked vessel has a citadel or saferoom.
4. SECTEAM: Binary variable that equals one if the attacked vessel has a security team aboard.
5. MILINT: Binary variable that equals one if any type of military intervention is employed during a pirate attack. Military intervention is any situation in which coalition forces are present during an attack, are conducting a convoy of commercial ships, or are deployed to stop an active pirate attack.
6. HOSTAGES: Measures the number of hostages that are taken during a pirate attack. Crew members are only considered hostages if the pirates successfully hijack the ship.
7. GRT: Gross registered tonnage. Measures the size of the ship.
8. MONSOON: Binary variable that assigns a one to any incident that occurs during a month that is in the monsoon season. The monsoon lasts from the end of May to the beginning of September.
9. PRTINPT: Measures the approximated amount of input capital that the pirates use in a single attack. Approximated by year, anecdotal evidence of resources (skiff engine, weapons, GPS, etc.).
10. SUEZ: Proxy variable for the number of ships that travel through the Gulf of Aden and Indian Ocean per month. The SUEZ variable measures the number of registered ships that travel through the Suez Canal each month.
11. LGTCAPTV: Meausres the number of months that hostages are held captive after a hijacking.

Table 6: Descriptive Statistics

Variables	Mean	Max/Min	Standard Dev.	Number Obvs.
HIJACK*	.28	1/0	0.45267	100
RANSOM	464,265	5,500,000/0	4948.44	100
ANTPMRS*	.73	1/0	0.44763	100
EVMNS*	.53	1/0	0.5016	100
CITADEL*	.05	1/0	0.27266	100
SECTEAM*	.02	1/0	0.1407	100
MILINT*	.26	1/0	0.4408	100
HOSTAGES	5.11	39/0	9.7689	100
GRT	27960.15	164292/100	34311.95	100
MONSOON*	.18	1/0	0.386	100
PRTINPT	12690	14,000/10,000	1931.63	100
SUEZ	1557.11	1,993/1,313	164.76	100
LGTCAPTV	1.305	13/0	2.935	100
Note: *= Binary Variable				

From Table 6, for each binary variable (indicated by an asterisk), the mean statistic is also the fraction of incidents in which the variable was expressed. For example, 28% of all ships were reported hijacked in the sample. Secondly, the large discrepancy between ships in reported GRT is due to the differences in size between container ships and yachts.

The binary dependent variable is evaluated by a probit analysis. In the probit regression, the dependent variable is a binary variable that designates whether pirates were successful or unsuccessful in an attack on a vessel. The goal is to examine how the anti-piracy efforts have affected the percentage of successful pirate attacks from 2006-2010. The probit analysis provides an insight into the disincentive factors of the successful implementation of deterrence strategies. From the regression significance and magnitudes of coefficients, it can be inferred which strategies have experienced the greatest success. The goal of the analysis is to offer insights into which strategies should receive more attention and resources. If commercial vessels

and international forces are able to decrease the success rate of hijackings, it becomes more costly for Somalis to engage in pirate activities. Therefore, a combination of alternative legal labor opportunities, for Somalis, and decreased success rates of piracy could lead to a decrease in the overall number of pirates.

The dependent variable for the second set of regressions measures the revenue earned by pirates as a result of a successful hijacking of a commercial vessel or yacht, in United States Dollars (USD). The revenue ranges from $1500 (the cost of two stolen zodiac boats) to $5.5 million which was paid for the safe return of the tanker MV Maran Centaurus in 2009. The ransom payments will not be adjusted for inflation due to the short time period that the research covers. The ransom variable is used in order to test the pirates' expected utility gained from a single pirate attack. By testing various deterrence strategies against the expected revenue of pirates, it may be observed that certain strategies are effective in diminishing the gains from piracy. If the gains from piracy are lessened, an increase in the allocation of funds to that strategy could increase the effectiveness in fighting pirates. Also, if the expected returns from piracy are lessened, pirates may no longer find piracy to be the best source of labor, due to the risks.

The variables for the defensive and deterrence strategies are used to analyze the various anti-piracy activities and are a proxy for measuring the probability of conviction of pirates. The evasive maneuvers variable is a dummy variable that measures whether or not the captain of the commercial vessel utilizes evasive maneuvers. The evasive maneuvers variable is calculated as a dummy variable in all regressions because the extra price of conducting evasive maneuvers could not be determined. According the Marine Security International (MSI) services, evasive maneuvers are increases in speed and zig-zag patterns that make it more difficult for pirates to

board the ship. The *EVMNS* variable represents the cheapest strategy. Costs include general anti-piracy training of naval captains. This variable operates as a disincentive for pirates due to the increased difficulty to hijack vessels. Therefore, it requires greater skill as a pirate in order to hijack vessels, and as seen in Chu, Lu, and Chen (2005), pirates will be forced to join pirate organizations. This is due to the need for improved technology and equipment. Also, pirates with some naval competence are required and low skilled pirates will drop out of the criminal labor supply due to the difficulty of hijackings as a result of evasive maneuvers and their likely high rate of failure. This also supports the theory that disenfranchised Somali fishermen, as a result of IUUs, make-up the majority of the pirate labor supply. The coefficient for the evasive maneuvers variable will most likely be negative due to the increased difficulty of hijacking a ship imposed on the pirates. If the coefficient for evasive maneuvers is large, it would suggest that a comprehensive training program for captains traveling through dangerous waters would mitigate the damages experienced due to pirate attacks.

Military intervention includes any situation in which any naval military vessel directly intervenes in an active pirate attack. Military presence is also a result of intervention; however, the military intervention variable only covers incidents where they are present during an attack. The military intervention variable is a dummy variable which assigns a one or zero to each situation depending on whether the military played an active role in an attack or not respectively. The cost of any military action is approximately $83,000, and in order to calculate the cost efficiency, the proxy amount is multiplied by the coefficient. This calculation provides the estimated cost efficiency of military intervention. Intervention can be either the presence of a coalition navy ship or helicopter. Also, military intervention extends to naval convoys and any attempted hijacking with naval military vessels in the general vicinity. In many anecdotal cases,

pirates respond to the arrival of military ships by abandoning weapons or fleeing the scene of the attack. There are also cases in which pirates respond to the arrival of military vessels by shooting upon the naval warships. The intervention of international militaries affects the probability of conviction of pirates. By increasing military spending, pirates are much more likely to be apprehended or even killed in violent exchanges. Increases in apprehension decrease the marginal revenue of each attack. Also, the potential threat of death or injury threatens the utility of pirates by increasing the severity of punishment. The presence of potential fatal responses by military may deter pirates from joining the pirate labor force. The military intervention variable should have a large negative coefficient. However, military expenditures are very expensive; therefore, the variable must have a high coefficient in order to justify the large allocation of funds to military spending.

Another form of potentially dangerous forces faced by pirates are private security teams. The variable assigns a one or a zero to ships attacked that have security teams or do not respectively. The cost efficiency can be calculated by multiplying $55,000 to the coefficient, which represents the cost to hire a private security team for a single convoy (Voytenko 2011). It is cheaper for the international community for each ship to employ private contractors trained in maritime defense; however, it increases the cost for commercial vessels. Furthermore, the presence of an armed security teams increases the likelihood of deadly force being used by pirates. This potentially endangers the crew, which a situation that is preferably avoided. Like the military intervention variable, private security teams impose the potential force and increase the marginal cost for each pirate attack. The cost of private security teams are measured by the wages earned by the private contractors. The coefficient is expected to both be large and negative in both equations. This is due to the belief that the presence of security teams will have

a negative effect on the amount of ransom pirates expect to earn as well as significantly decrease the probability of a successful hijacking. It is unlikely that untrained pirates are able to overtake ships with trained professionals.

Anti-piracy measures include any other activity that does not include any of the previous deterrent strategies, based on (BMP 4 2011). Reports of ships utilizing anti-pirate measures demonstrate that use of rocket flares, lining the ship's perimeter with barbed wire, alert watches, SSAS alarm systems, fire hoses, citadels/safe rooms, and detachment of ladders have all experienced some success in limiting hijackings. The anti-piracy measures variable is a dummy variable that simply determines whether or not a crew used anti-piracy measures when they came under attack from Somali pirates. The cost efficiency multiplier for anti-piracy measures is $54,000 (Bowden 2011). Unlike security teams and military intervention variables, best management practices implementation is a single cost. After the initial capital input, anti-piracy measures cost nothing for every subsequent convoy. Costs associated with anti-piracy measures include training of the crew and any extra equipment costs including barbed wire, flares, as well as any other additional equipment. These costs are much lower than security teams, but not as low as training for evasive maneuvers. Like both of the previous variables, the general anti-piracy measures conducted by the ship's crew are expected to raise the difficulty for pirates attempting a hijacking. This decreases expected revenue and makes it a less profitable venture. The coefficient is expected to have a negative effect on the success of hijackings, but it is not expected to have as great an effect as military intervention or security teams.

The last deterrent strategy is the use of a safe room/ citadel. A citadel is considered to have been used if pirates are able to board the ship, but the crew locks themselves in a safe room. This does not ensure that the pirates are not able to take control of the ship; however, within the

sample, there are no incidents in which the crew reports to have taken control of the ship after taking shelter in a citadel. The *CITADEL* variable is designated by a binary variable. The cost efficiency variable is $450,000 (Break Bulk 2012). The cost represents the installation cost of a bullet proof safe room. The citadels found in the sample are assumed to be bulletproof due to the inability of the hijackers to take control of the ship.

Also being tested in the regressions are two variables that may have an effect on the amount of ransom paid, number of hostages and length of captivity. These two variables provide an additional variable that may help explain variations in ransom payments. These two variables are only used to test the ransom dependent variable because they should have no effect on whether pirates are successful in hijacking a ship. The number of hostages ranges from 2-39, and the length of captivity ranges from 1.5-13 months. Current trends demonstrate that ransom negotiations have become increasingly more complicated. During that same time frame, the amount of ransom payments has increased. Therefore, there may be a correlation between length of captivity and ransom payments that is due to time. Regardless, there is expected to be a positive effect of number of hostages and length of captivity on the amount of ransom paid.

In addition to the RHS variables that measure the effectiveness of the deterrence activities, several control variables are included in the regression to account for variations from month to month and year to year. First, a proxy for the total number of ships in pirate-infested waters, the total number of ships that travel through the Suez Canal, accounts for the volume of commercial ships that travel through the waters that are notorious for pirate attacks. The variable is measured monthly in order to account for changes from month to month. Controlling for the total number of ships prevents the estimated coefficients from being biased. Biases avoided

include interpreting increases in piracy as a result of increases in commercial shipping in through the pirate channels and waters (Suez 2012).

In order to control for variability in the level of pirate technology, the variable *PRTINPT* provides an estimate for the amount of capital put into each attack. The amount of input of a pirate attack starts at 14,000 USD, which is the cost of a pirate skiff, an engine consistent with those used by pirates, and basic semi-automatic weapons (Murphy 2012). 14,000 USD input represents the estimated amount for all attacks in 2010. Each year is decreased by 1,000 USD in order to account for growth of pirate technology. In any case that reports the pirate skiff as too slow to keep up with the ship or having engine problems, an estimated input of 7,500 is assigned which represents inferior technology.

The gross registered tonnage variable is used as a proxy for ship size. It is expected that the *GRT* variable will affect both sets of regressions. First, larger ships are less susceptible to being hijacked by pirates. For example, three out of five yachts were successfully hijacked, whereas one of eight tankers was successfully hijacked. Second, larger ships will require a larger ransom payment to secure their release. It is expected that *GRT* will have a negative effect on the *HJK* variable and a positive effect on the ransom variable.

The regression also controls for seasonal changes. Eastern Africa, including adjacent waters, are subject to violent monsoon seasons. These extreme weather conditions dictate the difficulty of shipping, including increased difficulty for pirates attacking commercial ships. Therefore, by accounting for changes in season, and noting the most probable seasons in which pirates choose to conduct operations, potentially skewed monthly data can be avoided. The monsoon season lasts from the end of May until the beginning of September. The variable

assigns a value of either one or zero for when the attack is during the monsoon season or during the calmer months respectively.

4.2: Regression Results and Analysis

In Table 7, seen below, the probit model expresses the effects of the various deterrent activities on the dependent variable, *HIJACK*. There are only two variables that demonstrate any significance. That is to say, only the coefficients of anti-piracy measures and evasive maneuvers can be considered less than zero with any confidence. Given the significance of the coefficient, it can be said that the two variables have a significant deterrent effect on pirates' ability to hijack a vessel. However, it is difficult to analyze the coefficients in this initial regression due to the binary reports of deterrence efforts. Furthermore, the R-squared for the test is relatively weak, .3207. The controls added in the second regression only increase the R-Squared to .3525. This suggests that there are influential variables not included in the first two regressions. With a small amount of the variability of the dependent variable explained by the independent variables and the lack of significant coefficients, another test needed to be conducted in order to evaluate the activities more in depth. From this initial test, it appears that anti-piracy measures and evasive maneuvers have a complicating effect on pirates' ability to hijack a ship.

In the second regression, the model predicts that there are more successful hijackings with the greater number of ships in the pirate area of operations. Despite the fact that SUEZ is not significant at the .1 level, it predicts that, given the average number of ships per month that pass through the Suez Canal (1,557), the probability of a ship being hijacked is 200%.

TABLE 7: Dependent Variable: Hijack	(1)	(2)
C	.5289	-1.479
	(1.725)	(-.555)
ANTPMRS	-.895	-.911
	(-2.32)**	(-2.23)**
EVMNS	-1.705	-1.77
	(-4.69)***	(-4.43)***
SECTEAM	-.377	-.713
	(-.422)	(-.762)
MILITARY	.593	.575
	(1.52)	(1.403)
PRTINPT		1.71E-05
		(.153)
GRT		-6.7E-06
		(-1.032)
MONSOON		-.789
		(-1.398)
SUEZ		.0013
		(1.075)
McFadden R-squared	.3207	.3525
S.E. of regression	.378	.379
S.D. dependent var	.451	.451
Number of Obs.	100	100

Note: Z-statistics are in parentheses
*-Denotes significance at the 10% level
**- Denotes significance at the 5% level
***-Denotes significance at the 1% level

However, if the two significant deterrence variables are used by the attacked ship, the probability of being hijacked is reduced to -66%. The predicted probabilities of hijack success are greatly reduced when the simplest anti-piracy deterrence strategies are used. This makes a strong case for increased training and preparation of individual ships in order to prevent pirate victimization. It is ultimately the responsibility of ship owning companies to protect their employees and property. Therefore, the implementation of anti-piracy measures and evasive maneuvers significantly reduces the probability of being hijacked by Somali pirates. Although the other

deterrence strategies are not significant in both regressions in Table 7, this is most likely due to the shortcomings of the model to properly predict the actual effect of the deterrence strategies on the success rates of pirates. Furthermore, it is very unlikely that military intervention increases the probability of successful pirate hijackings. Lastly, it is important to note that there are other factors that affect how successful pirates are in attacking ships. The size of the ship and inclement weather conditions also reduce the probability of a successful hijacking, as demonstrated by the *GRT* and *MONSOON* variables.

In Table 8, seen below, the dependent variable is changed to the reported amount of ransom paid to pirates in return for the release of hostages as well as property, including the ship. By using the ransom payments as the dependent variable, the regressions explain how the four deterrence activities affect the expected utility of the pirates from a single attack. Also added to the regressions are two hostage variables that measure the amount of time hostages are held in captivity and how many hostages are taken in a successful hijacking. The addition of these variables is expected to capture the decision making rationale behind ship owning and insurance companies when they are negotiating ransom payments.

Three analyses are reported in Table 8. The first examines how effective the deterrence variables are at decreasing the expected utility of pirates. The second regression adds additional controls. Lastly, the third regression measures the effectiveness of the four deterrence variables while controlling for changes in ransom due to variation in time, hostages, ship size, and length of captivity.

TABLE 8:

Dependent Variable: Ransom	(3)	(4)	(5)
C	1,049,234	-423,736.8	-777,074.4
	(6.46)***	(-.314)	(-.9607)
ANTPMRS	-42,378	-48,605.01	20,436.79
	(-.4802)	(-.547)	(.3805)
EVMNS	-831,589.5	-200,607.9	-136,914
	(-4.26)***	(-4.43)***	(-.1.01)
CITADEL	-366,934.2	-410,637.9	-108,190
	(-.844)	(-.942)	(-.407)
SECTEAM	-902,758.7	-909,781.6	33,454.38
	(-1.342)	(-1.347)	(.0811)
MILINT	-249,073.2	-191,909.8	-64,959
	(-1.076)	(-.804)	(-.45)
HOSTAGES			67,242.53
			(8.32)***
GRT		4.419	5.093
		(1.51)	(2.88)***
MONSOON		-266,147.4	-23,083
		(-1.03)	(-.147)
PRTINPT		74.38	35.89
		(.496)	(1.08)
SUEZ		-310.89	182.05
		(-4968)	(.483)
LGTCAPTV			78,834.5
			(2.988)***
R-squared	.1893	.2289	.728
Adjusted R-squared	.1462	.1518	.694
S.E. of regression	927,450	924,424.5	555,225.6
Number of Obs.	100	100	100

Note: t-Statistics are in parentheses
*-Denotes significance at the 10% level
**- Denotes significance at the 5% level
***-Denotes significance at the 1% level

As seen in regression (3), the deterrence variables are not able to fully predict the size of a ransom payment alone. The R-squared is weak, .1893. In the second test additional control variables are added, including *MONSOON*, *GRT*, *SUEZ*, and *PRTINPT*. From the second regression, the effect of two of four of the deterrence variables is significant. Both best management practices and evasive maneuvers significantly decrease the amount of ransom

expected by pirate hijackers. In the case of evasive maneuvers, the coefficient demonstrates that by executing evasive maneuvers is extremely effective. In any case where a captain uses evasive maneuvers, pirates expected ransom is decreased by $200,609. That is significant when the average ransom payment is around 2 million to 3 million USD. Evasive maneuvers are relatively costless. Therefore, if a captain is trained in proficiently maneuvering his ship, pirates are drastically limited in their ability to board the ship. Although the second regression demonstrates that only evasive maneuvers are significantly effective against pirate attacks, the variability of the dependent variable is still largely unexplained, and the R-squared value is .2289.

The last test introduces length of captivity and number of hostages into the regression. The test reveals that the size of ransom payments is largely determined by factors after the attack. The dependent variable is largely explained by the number of hostages, size of the ship, and the length of captivity. Companies are willing to pay more for the safe return of valuable cargo and large crews, as demonstrated by the significance of the hostage variables. These variables also explain much of the variability of ransom payments. The R-squared value of .728 demonstrates that the amount of ransom payments is mostly determined by the hostage negotiation variables and not by events that occur before the hijacking.

The significance of ship size, hostage size, and length of captivity is due to the relationship between how much shipping companies are willing to pay for the safe return of the crew and the ship. First, large ships are usually carrying more expensive cargo; therefore, the value of the ship to the company is high. Also, fishing vessels and yachts are usually privately owned or owned by small companies. In these cases the demands of pirates may be lessened due to inability to pay by small companies. However, the companies that own large ships are usually

well insured and they have the means to retrieve pirated crews and cargo. Second, large crews are correlated with large ships and are subject to the same explanation. Lastly, over the course of the five year span that this study is based, the complexity of ransom negotiations has increased. This has lead to significantly higher periods of captivity. Also, during the same time period, ransom payments have increased dramatically. The significance of the length of captivity may be capturing the correlation between negotiation complexity and the increase in ransom payments.

The third regression estimates that a ransom payment increases $67,242 with each additional hostage, $78,834 for each additional month the hostages are held captive and $5.09 for each additional GRT. Therefore, the estimated ransom payment for the MV Asian Glory, which was hijacked on 01 January 2010, is 2,382,177 USD. The real reported ransom was 2,400,000 USD. The regression coefficient estimated the ransom of the MV Asian Glory with a .7% error. Therefore, it can be confidently stated that ransom payments are a function of the size of a ship, number of hostages, and length of captivity. These represent decisions on behalf of insurance and ship owning companies. The deterrence activities do not affect ransom payments significantly.

Using regression (3), the estimated effect of the deterrence strategies on the amount of expected revenue can be estimated without the overriding effect of ship size, hostages, and length of captivity. The lack of significance is most likely due to the limitations of the model. However, estimated effect can still be observed from the coefficients. The coefficients estimate the effect of the use of the various deterrent methods. Therefore, in order to determine the cost efficiency of each method, the coefficient must be divided by cost. First, best management practices are estimated to produce a decrease in expected revenue of pirates by -48,605 USD.

The cost efficiency[20] of purchasing basic preventative equipment, is predicted to be as follows: sonic deterrent equipment/ alarm systems (-37.43), barbed wire (-3.899), sandbags (-38.99) (Voytenko 2011). The predicted cost efficiency for each piece of equipment is likely not representative of the effectiveness of each piece of equipment. The anti-piracy measures variable was measured as one, therefore, it does not differentiate the effect of each implementation. Furthermore, the use of suggested BMP equipment is a fixed cost. Therefore, a single purchase has a constant deterrent effect regardless of the number of times a ship travels through pirate waters.

In regression (4), the coefficient of the presence of a citadel/safe room is -410,637 USD. At a 450,000 dollar cost, the expected cost efficiency is 1.05. Citadels are also a fixed cost. The coefficient of the presence of a security team is -909,781 USD. If the cost to hire a security team for a single transit is 55,000 USD, the expected cost efficiency is -16.16. Security teams cost 55,000, on average, per transit. This makes them more costly than other strategies for that reason. Lastly, the coefficient of military intervention is -191,909 USD. The operating cost of a military vessel to aid a distressed commercial vessel is approximately 83,000 USD. Therefore, the estimated cost efficiency is 1.885. Like security teams, military intervention has a cost for each response. However, unlike the other deterrent activities, military intervention places the burden of cost on their respective country, whereas, the cost of the other strategies falls on the company that owns the ship.

From the data, it is clear that an evasive maneuver is the most effective strategy for preventing hijackings with a cost efficiency of -875,503.5. This is because there is no

[20] Cost efficiency is measured by loss in expected pirate revenue (from ransoms paid) per dollar spent on a deterrent activity.

measurable cost associated with conducting evasive maneuvers. Additionally, if cost of evasive maneuvers equals zero, then cost efficiency cannot be computed, and it may be subject to inconsistency. However, some older ships and small ships may still be vulnerable due to slow speeds and increasing pirate technology. In these cases, the utilization of BMP, as suggested in (BMP 4, 2011) will yield the greatest deterrent effect against pirates.

The estimated effects given by the regressions have several limitations. One, the deterrent effect of military presence (not intervention) cannot be measured in the scope of this analysis. Two, the size of the sample may have affected the significance of the coefficients. Three, the sample data was obtained through reports of pirate attacks from a large range of sources. In many cases, information was scarce. This may be due to company's attempting to protect their reputation by limiting the amount of details to reach the public or lack of coverage. Therefore, inaccuracy of data is a possibility. Lastly, omitted from the analysis was the variability in the ability of the pirate hijackers. The study treats the pirates as a single entity. However, in reality it is much more likely that there are different groups of pirates with a large range of financing and expertise. This may have a biasing effect on the reasons for why a ship was hijacked.

CHAPTER V

CONCLUSION

In a 22 February 2012 *New York Times* report by Jeffrey Gettleman, foreign policy leaders from about 40 countries met in the Lancaster Building in London on 16 February 2012. The topic of the meeting was a discussion of the international plan to solving the instability in Somalia, and its starving nation. The meeting is acknowledgement by the foreign community that a long term solution to the major issues facing Somalia is the only last way of combating piracy, among other Somali issues, is the only proper way to ensure that pirates can no longer operate with impunity. The long term solution demands foreign nations to provide funding and supervision for the reestablishment of an effective Somali government as well as opportunities for Somali people to earn their own living.

For nearly 20 years Somalia has been a devastated nation with a void of power. This has had a destructive effect on its citizens, many of whom are living in utter poverty. Another consequence of the crumbling political and social infrastructure of the nation has been the free reign of gangs, including the development of complex pirate organizations. The only solution to this problem is to create a self-governing and policing government. This long term plan will take a large amount of funding, support from leading nations, and time. Meanwhile, what are maritime companies to do about pirates who face little chance of reprimand for their brutal crimes?

This research has provided a comprehensive overview of the development of Somali piracy since 1991 and discussed the consequences of the actions of pirates. The research also demonstrates that the piracy dilemma shares many of the characteristics of other crime and

pirates rationally in response to international policies. The statistical analysis found in Chapter IV estimates that the amount of ransom paid for the release of ships and hostages is a function of the value of the ship hijacked (using GRT as a proxy), number of hostages, and number of months hostages are held captive. However, the statistical analysis also estimates that ship owning companies and ships' captains can prevent a hijacking by employing the preventative measures outlined in "Best Management Practices 4th Edition" (BMP 4 2011). In turn, the more ships are able to deter pirates from hijacking vessels in the Gulf of Aden, Indian Ocean, and Red Sea, the expected return to piracy decreases.

The economic model of crime and punishment developed by Gary Becker, discussed in Chapter III, predicts that if coalition forces and commercial vessels are able to decrease the amount of expected revenue, increase the marginal cost of attacking ships, and increase the risk for pirates to be captured, then the pirate labor supply will decrease and the number of pirate attacks will decrease. From 2009 to 2010, there is only a small increase in the number of pirate attacks, which may suggest some success in combating piracy. However, the real impediment to ending Somali piracy is the chaotic environment of Somalia and the inability to consistently prosecute Somali pirates. The impoverished and uncontrolled atmosphere of Somalia have two large affects on piracy. One, due to scarce legal job opportunities, pirates are replaceable; therefore, captured pirates are easily replaced by pirate leaders operating within the Somali borders. Two, pirates do not face a consistent threat of punishment due lack of resources for prosecution and jailing pirates. Within the Becker model, the legal job scarcity decreases the institutional variable and increases the labor supply for pirates. Also, the inability to threaten piracy with incarceration makes them favor taking the risk of being caught, knowing that they will not be sufficiently punished for their actions. Therefore, the potential revenue of a

successful pirate attack outweighs the risks and punishments, which leads to an increase in the number of pirate attacks and consequently more hijacked vessels. The optimal strategy to counteract the piracy problem is to combine long run and short run efforts.

This research has demonstrated that the actions taken by coalition forces and implementation of best management practices has increased the cost for pirates and decreased their expected revenue. Estimated costs from the statistical analysis also demonstrate that allocating resources to training personnel and providing ships with anti-piracy equipment have a high success rate in deterring pirates. In Table 7, both *ANTPMRS* and *EVMNS* had significant effects at the .05 and .01 levels respectively. Both methods of pirate deterrence, undertaken by the private owners and captains, had a significant negative effect on decreasing the likelihood of pirates successfully hijacking the vessel. In Table 8, the majority of the variability of ransom payments paid was accounted for by *LGTCAPTV*, *GRT*, and *HOSTAGES*. All three of these variables had significant effects at the .01 level. However, when the three hostage variables were omitted, *ANTPMRS* and *EVMNS* were significant in reducing the expected revenue of the pirates. Given that the coefficients on *ANTPMRS* and *EVMNS* were significant and negative in two of the four regressions run, it is very likely that they are effective in preventing pirates from being able to board and hijack ships. It is also of note that in cases in which the pirates were able to board the vessel, the expected revenue increased dramatically. The *PRTBRDVSL* had a significant effect at the .01 level. Although the other tested deterrence methods were not significance in any regression, it is most likely due to the inability of the sample to capture the true effect of the anti-piracy measures on expected revenue and probability of a successful hijacking.

The statistical analysis does not yield a large number of significant results due to three large limitations on the data. First, Somali piracy has experienced rapid expansion in the range

of attacks and number of offenses. Therefore, the research only covers five years of anti-piracy activities, which may not be enough time to fully examine the true effects of the deterrent strategies. Second, the sample data represents only reported data which is scarce and potentially inaccurate. Many insurance companies and companies that own the ships have an interest in preventing the details of a hijacking from being public record. The design of the analysis attempted to mitigate the potential problems caused by inaccurate information, but the lack of reliable reports may have altered the significance and magnitude of the coefficients. Third, one of the two policy variables in Becker's model is degree of punishment; however, due to lack of data and the design of the analysis, the research does not investigate the effects of prosecution on the number of pirate attacks.

The research does not examine how the allocation of funds to improving Somalia's infrastructure, prosecution of suspected pirates, and building of jails affects the prevalence of pirate attacks. These activities would constitute a long run approach to preventing disenfranchised Somalis from joining the ranks of pirates. Would allocation of all funding to improving infrastructure and the effectiveness of the Somali government eradicate piracy in Somalia? In all likelihood, not. While it is necessary that a greater focus must be placed on improving conditions in Somalia as well as establishing some sort of police force that can limit pirate operations on land, naval deterrence must remain a part of the concerted effort to rid piracy in these vital shipping lanes. The analysis provided by this research represents one part of the research needed in order to suggest a policy of resource allocation.

5.1. Future Research

Research in the future should be dedicated to examine the effects of how increasing Somali infrastructure could limit the ability of pirate organizations to operate. In order to do so, research will have to be postponed until full restoration efforts being and data is available. In addition to studying the effects on piracy as a result of increased funding to infrastructure, the changes in the number of pirates prosecuted may have an effect on the number pirate attacks. Although data on the effects of financing Somali development are not available, future research could examine the effects of infrastructure development in comparable unstable countries. If a nation under similar conditions was able to decrease its crime rate due to the development of a government and private sector labor supply, recreating those measures taken could provide a strong model to aid the growth of Somalia, and potentially rid the country of its pirate organizations.

Further research can also be done in order to improve the predictive capability of the model introduced in this study. A larger sample, more reliable reports, and additional control variables may be able to capture more of the variability in the success of pirate attacks. Lastly, a statistical analysis that captures both of the policy variables in Becker's model may be able to provide a policy that advocates an effective allocation of funds to both long run and short run activities.

Piracy developed in Somalia due to the total lack of regulation and lack of available work. Poverty and hunger continues to plague the Somali population, and in reaction to the unfortunate conditions, many young Somalis joined the ranks of pirates. The only lasting solution to ridding the country of pirates is to develop a self-sustaining Somali government

capable of policing its own citizens. Until that goal becomes a reality, shipping companies can provide the means to protect their crews and capital. This study has demonstrated that properly training ships' crews and equipping ships with proper anti-piracy equipment can effectively prevent pirates from being able to hijack private and commercial ships. These methods of preventions have relatively low costs, and by lowering the success rates of pirates, the labor supply of Somali pirates may begin to decrease because of the increases in risk of punishment, associated with military presence and increased Somali infrastructure, and decreases in profitability, as a result of decreases in likelihood of successful hijackings.

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Appendix A: List of Acronyms

ANISOM: African Union's Military Mission to Somalia

BMP: Best Management Practices

CMF: Combined Maritime Forces

CTF 151: Combined Task Force 151

EEZ: Exclusive Economic Zone

EU NAVFOR: European Union Naval Force

HDI: Human Development Index

IGAD: Intergovernmental Authority on Development

IMB: International Maritime Bureau

IRTC: Internationally Recommended Transit Corridor

IUU: Illegal, Unreported, and Unregulated fishing

LHS: Left Hand Side variable

MARLO: Navy Maritime Liaison Office

MEU: Marine Expeditionary Unit

MRF: Maritime Raid Force

MSCHOA: Maritime Security Centre Horn of Africa

NSC: NATO Shipping Center

RHS: Right Hand Side variable

RPG: Rocket-Propelled Grenade

SNM: Somali National Movement

SPM: Somali Patriotic Movement

SRC: Supreme Revolutionary Council

SSDF: Somali Salvation Democratic Front

TFG: Transitional Federal Government

USC: United Somali Congress

UKMTO: United Kingdom Maritime Trade Operations Office

VADM: Vice Admiral

VBSS: Visit, Board, Search, Seizure teams

WSLF: Western Somali Liberation Font

WFP: World Food Program

Appendix B: List of Tables

Table 1: Estimate Annual Cost of Somali Piracy

Estimated Costs (Millions USD)	Ransom Costs	Coalition Forces	Prosecution Costs	Insurance Premiums	Commercial Vessel Security Equipment	Cost to Local Economies	Re-Routing	Anti-Piracy Organiztions
Upper Bound	238	2,000	31	3,200	2,500	1,250	2,300	25
Lower Bound	94	1,000	30	460	363	1,000	267	24

Table 2: Major Governmental Changes in Somali History

Date	Controlling Government	Cause for Change
600-1600	Arab Sultanate	Koreishite immigrants from Yemen
1600-1800	Sultan of Oman and Zanzibar	Took control of coastal towns
1840-1885	United Kingdom	East India Company gains unrestricted harbor facilities
1886-1920	United Kingdom	U.K. gains control over Northern Somalia through treaties with ruling chiefs
1885-1940	Italy	Italy gains commercial advantages (1885); In 1908 Italian Somliland is established and colonial status is granted; In 1936 Italy annexes Ethiopia
1941-1960	United Kingdom-Military administration	Britain defeats Italian forces in eastern Africa during the onset of WWII
1960-1969	Somali Republic	Somali Republic is formed through the UN General Assembly (1959); Italy relinquishes control over Somaliland
1969-1991	Gen. Said Barre; SRC	Military coup overthrows constitutional democracy and Gen. Said Barre assumes position as President
1991-Present	TFG	Absence of effective government; failed state

Table 3: Total Number of Successful and Attempted Somali Pirate Attacks

	2006	**2007**	**2008**	**2009**	**2010**
Gulf of Aden	10	13	92	117	53
Arabian Sea	2	4		1	2
Oman			1		
Red Sea				15	25
Somalia	10	31	19	80	139
World Total	239	263	293	410	445
Somali attacks as a percentage of the world total	9.2	18.2	38.2	52.0	49.2

Table 4: List of Variables

TABLE 4:

List of Variables	(1)	(2)	(3)	(4)	(5)
Dependent Variable					
HIJACK	X	X			
RANSOM			X	X	X
Independent Variable					
ANTPMRS	X	X	X	X	X
EVMNS	X	X	X	X	X
CITADEL			X	X	X
SECTEAM	X	X	X	X	X
MILINT	X	X	X	X	X
HOSTAGES					X
GRT		X		X	X
MONSOON		X		X	X
PRTINPT		X		X	X
SUEZ		X		X	X
LGTCAPTV					X

Table 5: Definitions for all Variables

Dependent Variables:

3. HIJACK: Assigns a one or a zero to each variable depending on whether the attacking pirates were able to gain control of the ship or not respectively.
4. RANSOM: The amount of ransom paid to the pirates for the safe return of the crew and property (vessel, cargo, and personal property).

Independent Variables:

12. ANTPMRS: Any use of the best management practices, as discussed in section 2.5.B. Binary variable; equals one in any attack in which BMPs were utilized by the victim vessel.
13. EVMNS: Binary variable that assigns a one to any incident in which evasive maneuvers were taken by the captain of the vessel being attacked in an attempt to impede a pirate attack.
14. CITADEL: Binary variable that assigns a one ships reported to have a citadel or saferoom.
15. SECTEAM: Binary variable that equals one if the attacked vessel has a security team aboard.
16. MILINT: Binary variable that equals one if any type of military intervention is employed during a pirate attack. Military intervention is any situation in which coalition forces are present during an attack, are conducting a convoy of commercial ships, or are deployed to stop an active pirate attack.
17. HOSTAGES: Measures the number of hostages that are taken during a pirate attack. Crew members are only considered hostages if the pirates successfully hijack the ship.
18. GRT: Gross registered tonnage. Measures the size of the ship.
19. MONSOON: Binary variable that assigns a one to any incident that occurs during a month that is in the monsoon season. The monsoon lasts from the end of May to the beginning of September.
20. PRTBRDVSL: Binary variable that equals one if the attacking pirates are able to board the victim vessel. Pirates may board vessel but still be unsuccessful in hijacking the ship.
21. PRTINPT: Measures the approximated amount of input capital that the pirates use in a single attack. Approximated by year, anecdotal evidence of resources (skiff engine, weapons, GPS, etc.).
22. SUEZ: Proxy variable for the number of ships that travel through the Gulf of Aden and Indian Ocean per month. The SUEZ variable measures the number of registered ships that travel through the Suez Canal each month.
23. LGTCAPTV: Meausres the number of months that hostages are held captive after a hijacking.

Table 6: Descriptive Statistics

Variables	Mean	Max/Min	Standard Dev.	Number Obvs.
HIJACK*	.28	1/0	0.45267	100
RANSOM	464,265	5,500,000/0	4948.44	100
ANTPMRS*	.73	1/0	0.44763	100
EVMNS*	.53	1/0	0.5016	100
CITADEL*	.05	1/0	0.27266	100
SECTEAM*	.02	1/0	0.1407	100
MILINT*	.26	1/0	0.4408	100
HOSTAGES	5.11	39/0	9.7689	100
GRT	27960.15	164292/100	34311.95	100
MONSOON*	.18	1/0	0.386	100
PRTBRDVSL*	.29	1/0	0.4560	100
PRTINPT	12690	14,000/10,000	1931.63	100
SUEZ	1557.11	1,993/1,313	164.76	100
LGTCAPTV	1.305	13/0	2.935	100
Note: *= Binary Variable				

Table 7: Estimates for Probit regressions that use probability of successful pirate hijacking as the dependent variable

TABLE 7: Dependent Variable: Hijack	(1)	(2)
C	.5289	-1.479
	(1.725)	(-.555)
ANTPMRS	-.895	-.911
	(-2.32)**	(-2.23)**
EVMNS	-1.705	-1.77
	(-4.69)***	(-4.43)***
SECTEAM	-.377	-.713
	(-.422)	(-.762)
MILITARY	.593	.575
	(1.52)	(1.403)
PRTINPT		1.71E-05
		(.153)
GRT		-6.7E-06
		(-1.032)
MONSOON		-.789
		(-1.398)
SUEZ		.0013
		(1.075)
McFadden R-squared	.3207	.3525
S.E. of regression	.378	.379
S.D. dependent var	.451	.451
Number of Obs.	100	100

Table 8: Estimates for the least squares regression model that use ransom paid as the dependent variable

TABLE 8:
Dependent Variable:

Ransom	(3)	(4)	(5)
C	1,049,234	-423,736.8	-777,074.4
	(6.46)***	(-.314)	(-.9607)
ANTPMRS	-42,378	-48,605.01	20,436.79
	(-.4802)	(-.547)	(.3805)
EVMNS	-831,589.5	-200,607.9	-136,914
	(-4.26)***	(-4.43)***	(-.1.01)
CITADEL	-366,934.2	-410,637.9	-108,190
	(-.844)	(-.942)	(-.407)
SECTEAM	-902,758.7	-909,781.6	33,454.38
	(-1.342)	(-1.347)	(.0811)
MILINT	-249,073.2	-191,909.8	-64,959
	(-1.076)	(-.804)	(-.45)
HOSTAGES			67,242.53
			(8.32)***
GRT		4.419	5.093
		(1.51)	(2.88)***
MONSOON		-266,147.4	-23,083
		(-1.03)	(-.147)
PRTINPT		74.38	35.89
		(.496)	(1.08)
SUEZ		-310.89	182.05
		(-4968)	(.483)
LGTCAPTV			78,834.5
			(2.988)***
R-squared	.1893	.2289	.728
Adjusted R-squared	.1462	.1518	.694
S.E. of regression	927,450	924,424.5	555,225.6
Number of Obs.	100	100	100