

CEDI

Working Paper No. 11-02

Combating “Maritime Terrorism” of the Coast of Somalia

Anja Shortland and Marc Vothknecht

February 2011

CEDI DISCUSSION PAPER SERIES

**Centre for Economic
Development & Institutions
Brunel University
West London
<http://cedi.org.uk>**

Combating “Maritime Terrorism” off the Coast of Somalia

Anja Shortland[∞]

Brunel University, Uxbridge UK UB8 3PH,
German Institute for Economic Research (DIW Berlin), Mohrenstr. 58, 10117 Berlin, Germany
e-mail: Anja.Shortland@brunel.ac.uk

Marc Vothknecht

German Institute for Economic Research (DIW Berlin), Mohrenstr. 58, 10117 Berlin, Germany
e-mail: mvothknecht@diw.de

Abstract

This paper evaluates the effectiveness of the international naval mission in the Gulf of Aden from 2008-2010, both in terms of its counter-piracy and its counter-terrorism objectives. We draw on arguments developed in the literature of terrorism and law and economics, detailed statistical analyses and a large number of in depth interviews. Counter-piracy operations are a qualified success: their main effects are the stabilisation of attacks at a high level and the substitution between the relatively well protected transit corridor in the Gulf of Aden and the open sea. However, the counter-piracy measures appear to deter pirates from forming alliances with Islamist movements and may therefore make a major contribution to international security.

Keywords: Piracy, Somalia, counter-terrorism, law and economics

[∞] Corresponding Author: Anja Shortland, Tel: 0044 1895 267091 (no fax)

1. Introduction

Piracy off the coast of Somalia has raised the cost of transporting goods through the Gulf of Aden considerably¹. It is perceived as a potential threat to world trade, given the importance of the Gulf of Aden route for oil and general cargo shipments to Europe.² Of even greater concern is its potential impact on international security and regional stability. It is feared that Somali piracy might supply weapons to or become a source of finance for (regional or international) terrorist organisations such as *Al Shabab* and *Al Qaeda* and fund Islamist insurgencies across Africa. As a worst-case scenario, sea-borne terrorists could use boats laden with explosives or volatile cargo to devastating effect in crowded shipping lanes and harbours or create major hazards by sinking large ships in narrow shipping lanes (Alexander and Richardson, 2009; Menkhaus, 2009; Murphy, 2007; Stephenson, 2010).

We have therefore seen an unprecedented degree of co-operation of the world's naval forces with the aim of countering piracy in the Gulf of Aden (Kraska, 2009; Kraska and Wilson, 2009). The US, NATO, the EU are leading co-ordinated counter-piracy programmes centred on the traditional naval tactic of concentrating ships in a narrow and therefore relatively well protected transit corridor. Several other national fleets provide additional services for vessels carrying their national flags or otherwise requesting urgent assistance. Many shipping companies have over time improved their practices and have invested in self-defence measures, raising the stakes for pirates. In April 2010 the US also started to tackle the piracy problem at its root, by making it more difficult to pay ransom to a number of named "pirate kings".³ Despite this, at the end of December 2010 the International Maritime Bureau had published 218 reports of incidents involving Somali pirates for the year, compared to 216 the year before and 111 in 2008. At best, therefore, the naval operation appears to have stabilised the piracy problem at a high level.

In contrast to the existing literature which in the main discusses the effectiveness of these counter-piracy efforts qualitatively,⁴ we quantitatively examine the period of high intensity counter-piracy operations since 2008.⁵ After a brief discussion of piracy and counter-piracy efforts off the coast of Somalia we develop a number of testable hypotheses based on the arguments provided by the literature examining hostage-taking in the context of terrorism. We investigate which of the counter-piracy measures employed by the international community have had significant (deterrent) effects on pirates by raising the risks of disruption, detection and punishment.

We statistically examine the pattern of attacks off the coast of Somalia from January 2008 to June 2010. We interpret the results drawing on information collected in a large number of in-depth

¹ US Department of Transportation, *Economic Impact of Piracy in the Gulf of Aden on Global Trade*, Dec. 2008, at http://www.marad.dot.gov/documents/HOA_Economic%20Impact%20of%20Piracy.pdf

² United States National Security Council (2008): *Countering Piracy Off the Horn of Africa: Partnership & Action Plan* at http://www.marad.dot.gov/documents/Countering_Piracy_Off_The_Horn_of_Africa_-_Partnership_Action_Plan.pdf

³ Ince & Co, *Piracy - US Presidential Order on payment of ransoms and recent developments*, Articlesbase.com, Sep. 14, 2010, at <http://www.articlesbase.com/law-articles/piracy-us-presidential-order-on-payment-of-ransoms-and-recent-developments-3264291.html>

⁴ See for example Gathii (2010), Roach (2010) and Treves (2009) approaching the issue from a legal point of view and the qualitative discussions in Menkhaus (2009), Murphy (2010) and Stephenson (2010).

⁵ Percy and Shortland (2010) evaluate monthly statistics from January 2000 - June 2009.

interviews conducted with those involved in the naval counter-piracy missions, lawyers, risk analysts and captains. We show that the transit corridor in the Gulf of Aden had the expected and desired effect of aiding the naval forces to come to the rescue of ships under attack. The number of successful attacks in this region has been reduced. However, there we observe clear geographical substitution effect in response to the naval measures. Attacks and successful hijackings have risen in the open sea stretching as far South as the Maldives and the Mozambique Channel and as far East as the coast of India.⁶ Moreover, the transit corridor had no (statistically significant) effect on the number of attempts made by pirates in the Gulf of Aden. This suggests that many pirates are not deterred from trying their luck right under the noses of the international naval forces. Although pirates avoid high risk activities, the “catch and release” policy dictated by international human rights laws is clearly not an effective deterrent. Improvements in private sector defensive measures (and the more “robust” policies of the Indian, Chinese and Russian naval forces in 2010) have improved the effectiveness of the transit corridor only marginally, probably because pirates have also improved their tactics and equipment.

Overall, our results suggest that the threat of trial in Kenya may be diverting experienced pirates, who are likely to face prosecution and imprisonment if caught. New entrants continue to prefer the easier conditions for piracy in the Gulf of Aden, despite the risks of disruption.

We cannot statistically identify an effect of the new US ransom policy so far. Qualitative analysis shows that a unilateral policy initiative of this type is unlikely to succeed, because successful acts of piracy generally affect a large number of international stakeholders and the ability of US insurers to contribute to the final settlement is (so far) irrelevant to the ransoming process. As long as ransoms can be negotiated from somewhere and are ultimately paid by someone, pirates (and their victims) do not change their behaviour, leaving the business intact.

Overall, the results presented here provide a useful check of the effectiveness of traditional defensive measures in the face of a non-traditional threat. Many Somalis are not deterred by encountering naval forces operating at the highest international human rights standards. To the extent that there is deterrence, the well protected targets are easily substituted, either by preying on the badly prepared and unprotected or by avoiding the protected region altogether. Somali piracy therefore demonstrates the vital importance of private sector willingness to cooperate with the military to deny attackers an easy prey. The results also demonstrate the fundamental problem of unilateral policies on ransom payments.

On the other hand, it can be argued that the threat of escalating military violence and the demonstration of superior fire-power has crucially contributed to piracy remaining a business rather than becoming allied to violent insurgent movements. Pirates only demand ransoms and never make political demands. Pirates are extremely careful about managing their “business only” image and resist contacts with Islamist movements. We therefore propose that while the success of the counter-piracy operations is strictly limited, this may be more than outweighed by their (unsung) success as a counter-terrorism measure.

⁶ See Carolyn Bandel and Kevin Crowley, *Somali Pirate Attacks Sink Premiums as Insurers Leap Aboard*, Bloomberg.com, Aug. 3, 2010, at <http://www.bloomberg.com/news/2010-08-02/somali-piracy-attacks-surge-premiums-sink-as-more-insurers-leap-aboard.html>; and Nick Childs, *Navies struggle with 'swarming' pirates*, BBC.co.uk, April 1, 2010, at <http://news.bbc.co.uk/1/hi/8598726.stm>

The paper is structured as follows. Section 2 sets the scene by providing an overview of Somali piracy and counter-piracy measures. Section 3 reviews the literature on counter-terrorism policies and the economics of criminal behaviour and adopts a model of terrorist hostage-taking to model Somali piracy. We formulate our research hypotheses in section 4. Section 5 introduces the data and the statistical model. The results are presented in section 6. Section 7 concludes with a discussion of the results and policy implications.

2. Somali Piracy and Counter-Piracy

2.1. Background of Somali Piracy

Piracy in Somalia dates back many years. According to Murphy (2010), dhows and fishing vessels were occasionally attacked off the coast of Somalia even during the 1950s. The roots of the current problem, however, lie in the collapse of the Somali state in 1991 when struggles between clans for political influence and supremacy erupted into a full blown civil war. International interventions to place and support a central government in Mogadishu proved futile (Menkhaus, 2007).⁷ Even in 2010 the prospects for a united well-governed Somalia are remote.⁸ Instead the country can be roughly divided into three parts: the relatively stable Somaliland in the North, the anarchic Southern Somalia and the informally governed Puntland region in the middle (Coggins, 2010). The transitional federal government in Mogadishu is an irrelevance for most of the country and its influence is disputed even within the city's boundaries by Islamist militias, despite military support from the African Union. In Somaliland and Puntland governance is provided by clan structures. In Southern Somalia (and occasionally in the Southern part of Puntland) governance is contested between local warlords and Islamist forces.

Piracy has established itself as a major business in the Puntland region of Somalia. State failure had resulted in a power vacuum on the high seas, leaving the international fishing fleets free to exploit Somalia's rich fishing grounds and for ships to dump toxic cargo in the region.⁹ Exasperated Somali fishermen initially attacked foreign trawlers to extract "fines" at knifepoint. This developed into extortion and hostage-taking. Eventually local militias began to enter into the piracy business and began to target ships entirely unconnected to the initial grievance in the busy shipping lanes of the Gulf of Aden (Menkhaus, 2009). Even the ships of the World Food Programme delivering much needed aid to impoverished and displaced people in Somalia have been attacked.¹⁰

Pirates take advantage of the easy availability of weapons and men trained in their use, as well as the abdicated governance in Puntland. Local elites share in the proceeds of piracy and therefore leave pirates to negotiate ransoms in peace from ships openly moored a few nautical miles off the coast for periods of several months (Menkhaus, 2009). Local communities are employed in the

⁷ See also Jeffrey Gettleman, *In Somalia, Those Who Feed Off Anarchy Fuel It*, *Nytimes.com*, April 25, 2007, at <http://www.nytimes.com/2007/04/25/world/africa/25somalia.html>

⁸ See Le Sage (2010) for a recent evaluation of the political situation in Somalia.

⁹ Ishaan Tharoor, *How Somalia's Fishermen Became Pirates*, *Time.com*, April 18, 2009, at "[How Somalia's Fishermen Became Pirates](#)"

¹⁰ Diane Penn, *Pirates could affect food delivery to Somalia – WFP*, *United Nations Radio*, April 15, 2009, at <http://www.unmultimedia.org/radio/english/detail/72967.html>

guarding and feeding of hostages, the negotiation of ransoms and benefit from the secondary effects of pirates spending their ransoms on locally produced goods and services (as well as beautiful brides). Successful pirates are a role model to underemployed men in the region and profits are re-invested into an ever expanding piracy business.¹¹ Diagram 1 shows the evolution of piracy off the coast of Somalia since 2000.

[insert Diagram 1 about here]

2.2. The Practice of Somali Piracy

The basic style of Somali pirate attacks has been constant over time, though equipment and weapons have been upgraded over time and tactics have been developed to strike ever further away from the Somali coast.¹² Pirates attack their prey from small, open, highly powered fishing boats, known as skiffs. One or two skiffs will generally provide fire cover for the “attack skiff(s)”, which catch up with the target and enter the ship using ladders. Once on board, pirates take the crew hostage and command them to steer the ship towards the Puntland coast.

On arrival part of the crew is removed from the ship (most often this includes the captain) to discourage rebellion among the hostages and potential rescue attempts by the international naval forces. The owner of the ship is contacted and an exorbitant ransom demand is made, which is then bartered down over the following months until agreement is reached.¹³ Somali pirates appear to operate with a strict code of conduct, which compels them to keep their hostages alive and in reasonable condition. In the absence of an infrastructure which would allow them to steal and market cargo from the ships, the crew are the “goods” in the Somali piracy business and Western nationals fetch a high price. However, occasionally rough treatment occurs when ransom negotiations are stalled.¹⁴ When the ransom is delivered (by speedboat initially and more recently by air-drop) the ship and crew are released, often to be escorted away by the naval forces. This prevents opportunistic rival pirates from taking advantage of slow ships run by traumatised crews in the direct vicinity of the coast.

A variant of this pattern occurs where fishing vessels (or dive-boats) are hijacked for the purpose of using the vessel as a “mothership”. Here the crew is often simply locked away while the pirates use the hijacked vessel to move around shipping lanes unrecognised by the naval forces or to cover long journeys through the Indian Ocean. They only launch the attack skiffs when a suitable opportunity presents itself. The “motherships” are mostly simply abandoned, when they are no longer needed, or when their stores and fuel run out, or when naval forces become suspicious of them.¹⁵

¹¹ See Jeffrey Gettleman, *The Pirates Are Winning!*, The New York Review of Books, Oct. 14, 2010, at <http://www.nybooks.com/articles/archives/2010/oct/14/pirates-are-winning/?pagination=false>; and Jamal Osma, ‘*We are hungry. There is no government, no economy, so it is a good way to earn money*’, The Times, Dec. 12, 2008, at <http://www.timesonline.co.uk/tol/news/world/africa/article5327626.ece>

¹² Interview with Captain Farrington.

¹³ Interview with Stephen Askins.

¹⁴ See Shortland and Percy (2010)

¹⁵ See BBC News, *Somali pirates free hijacked Pakistani 'mother ship'*, Jan. 5, 2010, at <http://news.bbc.co.uk/1/hi/world/africa/8441855.stm>; EU NAVFOR, *EU NAVFOR Rescues Iranian Crew Left*

2.3. Naval Counter-piracy Measures

Western Navies forming the Combined Task Force 150 have been monitoring suspect shipping off the Somali Coast and the Gulf of Aden from their base in Djibouti since May 2002.¹⁶ Their main task was to support US operations in Iraq and the Combined Task Force 150 (CTF 150) did not initially have a specific counter-piracy mission.¹⁷ Warships only intervened occasionally to provide assistance to attacked ships in their vicinity. Somali piracy was not considered to be a significant problem beyond the shipping community. This perception began to change with pirate attacks on UN aid ships bound for Somalia in 2006 and 2007 and a drastic increase in hijackings in 2008. This led to the implementation of the Marine Security Patrol Area in August 2008 by the CTF 150, diverting shipping traffic in the Gulf of Aden into a corridor closely following the Yemeni Coast (Diagram 2).

International public opinion hardened after the hijacking of the MV Faina in September 2008. There were serious concerns that the Ukrainian freighter's cargo of tanks, heavy weapons and ammunition could fall into the hands of Somali Islamist forces, some of which were linked to Al Qaeda. US warships escorted the Faina and prevented the unloading of the cargo. The idea of taking the "War on Terror" to Somalia and combating "maritime terrorism" using naval forces was born.

The hijacking of the MV Faina was therefore followed by the adoption of four United Nations Security Council Resolutions in October 2008, giving a legal basis for extensive naval counter-piracy operations off the Horn of Africa.¹⁸ The UN resolutions allow the naval forces to capture pirates in Somalia's territorial waters rather than being limited to pursuing piracy on the "high seas" (Roach, 2010). Nato's Operation "Allied Provider" was the first task force to be formally deployed in October 2008 to patrol the waters around Somalia.¹⁹ This was quickly followed by the establishment of the first ever European Union joint naval operation, EU Atalanta in December 2008. Its mandate is to contribute to the protection of humanitarian aid vessels, aiding vulnerable shipping and to "help deter, prevent and repress acts of piracy and armed robbery"²⁰ In January 2009 the Combined Task Force 151 was established to conduct counter-piracy operations with a mandate to "actively deter, disrupt and suppress piracy in order to protect global maritime security."²¹ Over time, naval forces from other countries such as India, China and Russia have also built up a presence in the Gulf of

To Die By Somali Pirates, March 22, 2010, at <http://www.eunavfor.eu/2010/03/eu-navfor-rescues-iranian-crew-left-to-die-by-somali-pirates/>; and EU NAVFOR, *Iranian Dhow Released By Pirates*, March 18, 2010, at <http://www.eunavfor.eu/2010/03/iranian-dhow-released-by-pirates/>

¹⁶ See Combined Maritime Forces webpage on Combined Task Force 150, at <http://www.cusnc.navy.mil/cmef/150/index.html>

¹⁷ Operation Iraqi Freedom, Operation Enduring Freedom

¹⁸ SC Res. 1814, 1816, 1838 and 1846. See Roach (2010) and Treves (2010).

¹⁹ See NATO webpage on Counter-piracy operations, updated April 2, 2009, at <http://www.nato.int/issues/allied-provider/index.html#Provider>

²⁰ See EUNAVFOR webpage on the European Union Naval Operation Against Piracy, at <http://www.eunavfor.eu/about-us/mission/>. During 2010 a new mandate was added, i.e. "monitor fishing activities off the coast of Somalia"

²¹ See Combined Maritime Forces webpage on Combined Task Force 151, at <http://www.cusnc.navy.mil/cmef/151/index.html>

Aden, loosely co-operating with the Western alliances. More than 30 states are now represented in the Gulf of Aden (Roach, 2010).

The corner-stone of naval counter-piracy measures off the coast of Somalia is the Internationally Recommended Transit Corridor IRTC, implemented in February 2009 (see Diagramm 2). Despite the unprecedented degree of international naval co-operation, the density of war-ships is not high enough to offer escorted convoy services through the high risk region. Instead the navies operate a system of “area protection”, spacing the available equipment along the corridor, so as to be in the best possible position to come to the aid of attacked vessels. The corridor thereby enables naval forces to perform well on the main target on which their work is evaluated: the number of disrupted pirate attacks. However, it relies crucially on the active involvement of the private sector: captains need to delay pirates from boarding until the armed forces arrive. If pirates have successfully boarded before the naval forces arrive and have at least one crew member under their control, in general no rescue attempt will be made.²²

[insert Diagram 2 about here]

The second aspect of the naval counter-piracy mission has been the arrest and trial of (suspected) pirates. However, this has been fraught with implementation difficulties. It is notoriously difficult to prove in court that someone is in fact a pirate. In August 2010 it was still disputed whether someone can be punished for attempted piracy – and if so how attempted piracy should be defined.²³ The crews of suspicious skiffs which are arrested by the naval forces therefore know that it is unlikely that they will be detained if they have jettisoned their equipment of weapons and mobile phones (which may link them to previous incidents). Suspected pirates who claim to have been “fishing” or “trading” or even “trafficking humans” are therefore let go with enough food and fuel to get them back home. The naval forces investigation of “suspicious vessels” and chasing pirates after aborted attacks is therefore commonly referred to as “catch and release”.²⁴

Basically it is only possible to convict pirates who have been caught with weapons on board a hijacked ship – i.e. those arrested in rescue missions. This in turn generates another problem: for a Somali man the prospect of spending a few years in a Western prison followed by political asylum in

²² The exceptions to this rule have been a number of rescues of hijacked yachts which present a very high risk of fatalities among the hostages.

²³ See Keith Johnson, *Who's a Pirate? In Court, A Duel Over Definitions* Wall Street Journal 20 August 2010; http://online.wsj.com/article/SB10001424052748703988304575413470900570834.html?mod=WSJ_hpp_LEADNewsCollection

²⁴ See Roach (2010); Jon Ungoed-Thomas and Marie Woolf, *Navy releases Somali pirates caught red-handed*, The Sunday Times, Nov. 29, 2009, at <http://www.timesonline.co.uk/tol/news/world/africa/article6936318.ece>; and Nick Britten, *Navy regularly releases Somali pirates, even when caught in the act*, Telegraph.co.uk, Nov. 29, 2009, at <http://www.telegraph.co.uk/news/worldnews/piracy/6684210/Navy-regularly-releases-Somali-pirates-even-when-caught-in-the-act.html>.

The Combined Maritime Forces reported on 23 October 2009 that 611 pirates were encountered between 22 August 2008 and 23 October 2009. Of these 358 were immediately released. Consolidated statistics report 1437 pirates encountered by naval forces and released without charge. Source: Bruxelles 2, *Bilan des opérations anti-piraterie*, at <http://www.bruxelles2.eu/bilan-des-operations-anti-piraterie-eunavfor-atalanta-ctf-otan-russie-exclusif>

a Western country may in fact not be a deterrent at all, but the ultimate prize.²⁵ To get around this problem a deal was struck with Kenya to bring pirates to trial there. On the positive side, pirates apparently found the prospect of Kenyan prison unattractive.²⁶ This is not surprising given the conditions in Kenyan prisons described by Gathii (2010). Kenya's justice system is slow and inefficient, trials are delayed by a massive backlog of cases and there were concerns about the maltreatment of prisoners. On the other hand the trials in Kenya are not particularly successful. Ship-owners resent the time and effort involved in having their crews testify and trials collapse for lack of witnesses.²⁷ The Combined Maritime Forces reported on 23 October 2009 that 24 out of 59 trials since August 2008 had resulted in the release of the pirates. Moreover, the Kenyan authorities are not always willing to take additional pirates, leaving naval captains holding their detainees on board for extended periods.²⁸ If this occurs, the chances of a successful trial become even more remote given legal rules about the length of time people can be held without charge or access to legal advice. Often the best option becomes to simply release the suspects.

It is therefore questionable to what extent the naval forces manage to generate a significant deterrent effect, being bound by international human rights legislation and domestic legal rules. In the context of violent and lawless Somalia these sanctions may be perceived to be toothless.²⁹ On the other hand, pirates may respond to changes in the risk of disruption, because the loss of pirate equipment itself may be a significant deterrent. They may also respond to changes in the willingness of their targets to invest in on-board defence systems.

2.4. Private Counter-piracy Measures

The ransom is only a (small) part of the cost of having a ship hijacked. The sum of the loss of earnings during months of negotiations, the cost of delivering the ransom, the problem of distressed cargo (because it deteriorates or because delivery contracts are breached), the damage to the ship during the take-over and during the occupation by Somali pirates / armed guards and the medical and mental health costs for the released crews are generally a multiple of the ransom paid to the pirates.³⁰ However, for a ship-owner these risks are insurable. Every ship-owner has to separately insure hull, cargo and crew and a "war" premium is payable on routes through high risk areas. Insurers (eventually) compensate ship-owners for their losses, once the contributions of the individual insurers are agreed. Alternatively, ship-owners can take out special "hijack and ransom insurance", which immediately covers the costs associated with a hijack as well as protecting a ship-owner's no claims bonus vis-à-vis his other insurers.³¹

²⁵ Interview with risk consultant.

²⁶ Interviews with naval officers.

²⁷ Keith Johnson, *Who's a Pirate? In Court, A Duel Over Definitions*, The Wall Street Journal, Aug. 20, 2010, at http://online.wsj.com/article/SB10001424052748703988304575413470900570834.html?mod=WSJ_hpp_LEADNewsCollection

²⁸ In October 2010 Kenya ended its commitment to host pirate trials altogether. BBC news *Kenya ends co-operation in hosting Somali piracy trials* 1 October 2010 <http://www.bbc.co.uk/news/world-africa-11454762>

²⁹ An assertion made by Roach (2010).

³⁰ The ballpark figure is that on average the ransom is only 20% of the costs generated by a hijack (Van der Meijden, 2008).

³¹ Interview with Stephen Askins.

For a ship-owner the question therefore arises to what extent he should compel the crew to take active or passive counter-piracy measures, or gamble that his ship will not be one of the tiny minority which is successfully attacked - and relying on insurance if it happens.³² Driving a zigzag course at high speed and displays of crew alertness are often sufficient to shake off pirate attacks.³³ Beyond this, private counter-piracy measures put a huge burden on the crew.³⁴ For a crew including nationals from a rich country it is arguably preferable to go through the ransoming process, rather than offering resistance.³⁵ Injuries and deaths tend to occur only where crews resist boarding or attempt to regain control of ships. In the case of a successful hijack, Somali pirates treat crews which offered resistance considerably more harshly than those capitulating immediately – “pour encourager les autres”.³⁶

Merchant shipping is traditionally not armed, nor are sailors generally trained to handle weapons. Captains would have to declare (and sometimes unload) weapons caches at every port of call (which can severely delay departures) and would have to comply with the gun laws of the flag state at all times. In addition, Somali and Yemeni traders and fishermen carry out legitimate business in the Gulf of Aden. Shooting at a “suspicious” skiff could invite lengthy litigation requiring crews to prove they acted in self-defence. A small minority of ship-owners have begun to employ armed security guards. However, this is only an option if the cargo is not flammable. Most concerned ship-owners prefer to invest in passive safety features (such as barbed wire, recordings of barking dogs,³⁷ bright lights, dummies dressed as armed guards or releasing slippery substances on the hull) to hold off pirates for a few minutes while awaiting naval rescue or to divert pirates to less well protected ships.

The latest development in private counter-piracy measures are so-called “panic rooms” or “citadels”. These provide a safe place for the crew to await rescue by international naval forces, who are thereby reassured that everyone visible on deck is in fact a pirate. A number of rescues of this type have successfully taken place in recent months. However, using a panic room is only an option if the naval forces are in the direct vicinity of the ship, as they are not impossible to find and enter.³⁸

Ship-owners and captains therefore have a variety of options regarding whether and how to defend their ships. Ship owners responses range from those choosing to take their chances, entering the

³² With 20 successful attacks in the Gulf of Aden in 2009 compared to 17,000 ships transiting through the Suez Canal (a good proxy for international shipping traffic in the GoA though it does not include regional trade), the probability of being successfully attacked is under 0.12%.

³³ EUNAVFOR, *Three vessels saved from pirating thanks to Best Management Practices*, Oct. 14, 2010, at <http://www.eunavfor.eu/2010/10/three-vessels-saved-from-pirating-thanks-to-best-management-practices/>

³⁴ Interview with risk consultant.

³⁵ Crews from India / China / Thailand are often assaulted, especially if they were fishing illegally.

³⁶ Crews are aware of the risk of defending the ship and many captains choose to de-escalate the situation by submitting quickly once passive defences have failed. Interview with tanker captain / marine superintendent.

³⁷ Though highly effective as a defence, dogs would have to be killed before entering the next harbour because of quarantine regulations. Interview with captain.

³⁸ See Johannes Ritter, *Schutz vor Piraterie: Die Piraten rüsten auf*, FAZ.net, Oct. 9, 2010, at <http://www.faz.net/s/RubFC06D389EE76479E9E76425072B196C3/Doc~ED288F086F18A42A5A5BE1558A3AC870C~ATpl~Ecommon~Scontent.html>; and Ince & Co, *Piracy - US Presidential Order on payment of ransoms and recent developments*, Articlesbase.com, Sep. 14, 2010, at <http://www.articlesbase.com/law-articles/piracy-us-presidential-order-on-payment-of-ransoms-and-recent-developments-3264291.html>

transit corridor at the wrong time and at the wrong speed and thereby not being under naval protection at all, to those who have a full and effective range of defensive measures in place. In early 2010 naval commanders estimated that about 20 per cent of the ships transiting the GoA did not use the transit corridor as recommended.³⁹ Naval commanders also point out that none of the ships using the corridor correctly were successfully attacked.⁴⁰

Over time there has been an increasing realisation that the private sector has to work with the naval forces to make the naval counter-piracy measures effective. Because of having to cover such a large area with limited equipment the naval forces rely on the private sector to delay boarding by 20 minutes – the time it takes for help to arrive. The proportion of captains ignoring advice on best practice may be decreasing. We will therefore test whether the naval measures become more effective over time, or whether the improvements in counter-piracy practices are offset by similar innovation among pirates.

3. Policing versus Counter-terrorism Activities and a Theoretical Model of Hostage Taking

3.1. Effectiveness of Counter-terrorism Policies

There is a growing empirical literature on the effectiveness of counter-terrorism policies, most of which is sceptical about the ability of the security forces to deter terrorists from attacking.⁴¹ Enders and Sandler (1993) were the first to point out that the main effect of counter-terrorism measures is to raise the marginal cost of carrying out specific types of attacks (or attacks in specific locations), leading to a substitution effect. They show that when investment in anti-terrorism measures makes certain activities less likely to succeed (e.g. sky-jacking), terrorist groups respond by undertaking other types of activities instead (e.g. kidnapping).⁴²

Recent contributions to this literature show that if anything only well targeted security policies can reduce the number of subsequent terrorist attacks and even then probably only in the short term. Jaeger and Pasermann (2008) analysed high frequency time series data of the Israel / Palestine conflict, showing that Israeli security force interventions did not systematically reduce subsequent Palestinian attacks. Benmelech et al. (2010) show that only highly targeted operations (in this case the demolition of the houses of suicide terrorists and terror operatives) have the desired effect of reducing subsequent attacks. However, this effect is geographically limited and short-lived. Gil-Alana and Barros (2010) show that ETA was able to recover from the arrests of its leaders and other retaliatory security policies: only political initiatives ultimately reduced violence. Rosendorff and Sandler (2004) urge for even greater caution in the use of violence against terror: proactive security policies may increase grievances and consequently terrorist recruitment. For example Fielding and Shortland (2010) show that in Egypt hard crackdowns on dissidents set off cycles of violence – i.e. terrorist activity increased rather than being reduced in the aftermath of large-scale arrests.

³⁹ This was independently confirmed by a security specialist using data from satellite images (information obtained under Chatham house rules).

⁴⁰ Interview with Captain Farrington.

⁴¹ See Enders and Sandler (2006) for a relatively recent review.

⁴² Also see Sandler and Enders (2004).

Although conceived as an anti-terror campaign, the international naval mission in the Gulf of Aden has (therefore?) not risked escalating violence in the region by taking a heavy-handed approach. As discussed above, the mission is characterised by extremely careful targeting of highly suspicious crews in the Gulf of Aden and the treatment of suspects has (mostly) complied with international human rights legislation. In the subsequent analysis we therefore investigate to what extent this cautious policy provides an effective deterrent to the pirates of Somalia.

3.2. Hostage-taking Model and Deterrence

In the economics of law the criminal is modelled as a rational individual, who makes a choice of whether or not to commit a crime based on the expected pay-offs from criminal activity (Becker 1968). This is particularly relevant to crimes that are undertaken with deliberate intent and are carefully planned and executed: the aim of criminal law is to deter crime in the first place, rather than to compensate the victim. Although pirates are often portrayed by the news media as drug-crazed, trigger-happy risk-seekers, we will show that the rational actor model can be applied to pirates, just as Sandler et al. (1983) convincingly argued in the case of terrorists.

Piracy is essentially a hostage-taking operation. Such operations have recently been modelled theoretically by Gaibulloev and Sandler (2009) in the context of terrorism. We adapt their model of the “logistical stage” of hostage-taking events to model the behaviour of pirate crews, who also choose to allocate their resources to maximise the probability of a successful hijack.⁴³ For a given pirate crew, the probability P of a successful attack on a potential target i is given by

$$P_i = P_i(r_i + v_i + e_i), \quad (1)$$

where r_i denotes the pirate’s resources used for the attack (number and experience of attackers, number and quality of skiffs and weapons), v_i represents the vulnerability of target i (technical characteristics of the vessel, fortification, presence or absence of naval forces), and e_i describes external circumstances that may affect the success of the attack (particularly weather conditions determining wind speed, wave height and visibility). Pirates are assumed to allocate their total resources R (with $R = \sum r_i$) over the N potential target vessels in a way that maximizes their utility U^P :

$$U^P(r_i) = \sum_{i=1}^n P_i(r_i + v_i + e_i)Y_i + [1 - P_i(r_i + v_i + e_i)]f_i(r_i + v_i + e_i)F_i + [1 - P_i(r_i + v_i + e_i)][1 - f_i(r_i + v_i + e_i)]C_i \quad (2)$$

Pirates are successful in capturing target i with probability P_i and Y_i denotes the expected pay-off. f_i is the probability of being caught and prosecuted due to the attack on target i , and F_i represents the cost of arrest (i.e. $F_i < 0$). The third possibility is failure without arrest, which occurs with probability $(1-P_i)(1-f_i)$. However, because of the light-touch “catch and release” policy applied to interrupted attacks (and for simplicity) we assume a zero payoff for C_i in the analysis below. According to the first-order condition, the pirates would then equate

⁴³ We thank our anonymous referee for suggesting and developing this model.

$$\frac{dP_i}{dr_i} [Y_i - f_i F_i] = \frac{df_i}{dr_i} P_i F_i \quad (3)$$

across each potential target vessel. The likelihood of a successful attack increases with both the pirate's resources and the vulnerability of the target. In particular, successful hijackings in the past allow pirates to raise R through investment in additional skiffs and upgraded armament; ship-owners may reduce the vulnerability of their vessels through private protection and fortification measures. The success probability is assumed to rise with r_i at a diminishing rate and to rise with v_i at an increasing rate, i.e.

$$\frac{dP_i}{dr_i} > 0, \frac{dP_i}{dr_i^2} < 0, \frac{dP_i}{dv_i} > 0, \frac{dP_i}{dv_i^2} > 0,$$

The presence of the international naval forces and private anti piracy measures limit the likelihood of a successful attack and increase the pirate's risk of being caught. As the probability of being caught f_i increases (and as the threatened punishment F_i becomes more severe) one might expect a decrease in the number of attacks. This is often referred to as the "deterrent effect" of criminal law. Empirical evidence shows that criminals, in general, are sensitive to both an increase in detection rates and to increases in the severity of the threatened punishment (see e.g. Levitt (2004) on crime rates in the US). However, the issue of deterrence is potentially more complex than this. Criminals not only have the choice between committing and not committing a crime, but they can also substitute between criminal activities, based on differences in detection probabilities or the severity of punishment (Enders and Sandler, 1993; Robinson and Daley, 2003). We therefore need to explore evidence of reduced activity and of substitution as a response to changes in the operating environment for criminals. In the context of Somali piracy the obvious substitution would be from the area with a high risk of detection (the Gulf of Aden) to the open seas where naval forces are severely stretched.

In general, for effective deterrence the following criteria must be satisfied (Robinson and Daley, 2003):

- 1) Offenders must be aware of the rules.
- 2) The cost of violations must be perceived to be higher than their perceived benefit.
- 3) Criminals must be willing to change their behaviour in the light of this knowledge.

We argue that conditions 1) and 3) are fulfilled in Somalia. Firstly, Somali pirates seem to be communicating with each other by mobile and satellite phones.⁴⁴ They also have a clear understanding of the rules of the game. When arrested they are aware of whether the circumstances of their arrest merit "catch and release" or detention. They are also aware of the unattractive conditions in Kenyan prisons.⁴⁵

⁴⁴ Matching up the numbers on confiscated phones from different arrests show that pirates from different crews are in contact with each other. Interviews with naval intelligence officers.

⁴⁵ For example when pirates are aware that there is not enough evidence to convict them, they do not believe that they will be taken to Kenya if this is threatened. Interviews with naval officers.

Secondly, Somali piracy is no longer an opportunistic crime, but crews either set off with fishing equipment or the weapons and fast motors required for piracy.⁴⁶ We can therefore assume that those engaged in piracy have made a conscious decision to do so. There is also clear evidence that pirates engage in risk management. Somali piracy is exceptionally non-violent, indicating that Somali pirates are not suicidal maniacs or extreme risk seekers. There appears to be an unwritten rule that weaponry is used to establish who has the superior firepower rather than to contest possession. As discussed before, crews tend to submit to pirates once passive defence measures have failed, minimising the chance of injury on both sides. Similarly, pirates abandon attacks when they discover an armed defence team on board or when a naval patrol arrives in the vicinity. In the case of MV Lugela in September 2010 pirates were unable to find the crew in the “safe room” and abandoned the ship before the arrival of the naval team coming to liberate the ship.⁴⁷ Also, activities which present a high risk of failure are generally avoided. Ships clearly under naval escort are not touched and the few examples of naval supply ships being attacked appear to have been genuine mistakes. It should be noted in this context that the probability of a pirate being killed are extremely low. According to consolidated statistics just 54 pirates lost their lives in encounters with the military since April 2008 (this includes the 10 missing pirates “released” by the Russian navy after the freeing of the *Moscow University*⁴⁸).⁴⁹

In the analysis below, we test the response of pirates to the changes in navigational risks associated with weather patterns. We see that pirates reduce activity when the risk of being capsized in high waves is high. In the case of monsoonal winds all three conditions for effective deterrence are thereby fulfilled. Thus we can be reasonably confident that pirate behaviour is informed by cost-benefit analyses. Therefore, if pirates do not respond to a change in the probability of detection and punishment due to the naval measures by reducing activities or changing tactics, we interpret this as evidence that either the threatened punishment is not an effective deterrent or the detection probability is still too low to change behaviour.

4. Research Hypotheses

In this section, we develop the testable hypotheses regarding the effect of changes in resources, vulnerability, external circumstances and expected pay-offs based on the theoretical model above.⁵⁰

4.1. Piracy increases with additional resources (r_i)

⁴⁶ Arrested pirates who have dumped their weapons never have more than a few fishing hooks on board, evidently used for catching fish for personal consumption. Those pretending to be traders do not have goods on board. Interviews with naval officers.

⁴⁷ AFP, *Same teams, new tricks as Somali piracy season kicks off*, MSN News, Sep. 28, 2010, at <http://news.ph.msn.com/business/article.aspx?cp-documentid=4363679>

⁴⁸ David Cairns, *Russian navy ‘sent Somali pirates to their death’*, The First Post, May 12, 2010, at www.thefirstpost.co.uk/63244,news-comment,news-politics,russian-navy-sent-somali-pirates-to-their-death-from-the-moscow-university

⁴⁹ Bruxelles 2, *Bilan des opérations anti-piraterie*, at <http://www.bruxelles2.eu/bilan-des-operations-anti-piraterie-eunavfor-atalanta-ctf-otan-russie-exclusif>

⁵⁰ We do not have any data to model changes in the cost of arrest (F_i) over time and assume it is constant.

Poor young men trained in using firearms are plentiful in Somalia. Weapons, GPS equipment and mobile telephony are easily available and not terribly expensive. However, pirates will fail in their objective if they cannot catch up with their prey. This requires each pirate skiff to be powered by two 100 bhp outboard motors, each costing in the region of US\$6-10,000. For a team of at least two (but up to four) skiffs this investment is not easily raised in Somalia – despite reports of stock markets allowing villagers to buy shares in pirate missions.⁵¹ We will therefore test the hypothesis that successful hijackings in the past provide the funds for equipping new pirate crews.⁵²

Most of the ransom money is distributed in the community to pay for services rendered (including “protection”) and among the financial backers of the pirate crew. Members of successful pirate crews are said to be paid a fixed fee in the region of US\$10 -15,000 per successful hijack.⁵³ An additional premium of US\$5-10,000 is paid to the pirate who gets on board first to incentivise pirates to take on this most dangerous aspect of the hijack.⁵⁴ Pirates who have been successful in the past are therefore able to fund further raids, often employing new entrants. Previous investors might also re-invest part of their profits. Ideally the proxy would be based on the amount of ransom monies received, but the ransom paid is treated as a commercial secret in a large minority of cases. For this reason we use the number of ships captured or released by Somali pirates following successful ransom negotiations in the previous months as our proxy.

4.2. Piracy decreases with improved naval and private sector defences (f_i , v_i)

In terms of changing vulnerability of targets, the main change during the period was the institution of the IRTC, and possibly the introduction of the Maritime Security Patrol Area previous to that. Both increased the risk of being chased off a target and having to jettison arms and technological equipment to qualify for “catch and release”. Moreover, it raised the risk for pirates of being arrested and tried or even killed. We therefore create dummy variables for these naval initiatives.

Unfortunately, we cannot construct a proxy for changes in private sector adoption of “best practices” and additional defensive measures during the period. We only have information about those ships which reported pirate attacks and only a subset of those involves reports of the successful use of defensive measures.⁵⁵ However, there is a sense of an increase in private sector awareness over time that the naval measures require private sector co-operation to become effective. Therefore we test whether there was an increase in the effectiveness of the IRTC over time as the private sector improved its defence. Finally, we use a count of the number of disrupted

⁵¹ Mohamed Ahmed, *Somali sea gangs lure investors at pirate lair*, Reuters.com, Dec. 1, 2009, at [http://www.reuters.com/article/idUSTRE5B01Z920091201?feedType=RSS&feedName=businessNews&utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%253A+reuters%252FbusinessNews+\(News+%252F+US+%252F+Business+News\)](http://www.reuters.com/article/idUSTRE5B01Z920091201?feedType=RSS&feedName=businessNews&utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%253A+reuters%252FbusinessNews+(News+%252F+US+%252F+Business+News))

⁵² It is impossible to get reliable estimates of remittances by the Somali Diaspora through the notoriously opaque *hawala* remittance system and explore its potential role in the funding of pirate activity.

⁵³ Gilpin (2009). Others claim that the pirate team gets a proportion of the final ransom to split amongst them, see for example Mary Harper, *Chasing the Somali piracy money trail*, BBC News, May 24, 2009, at <http://news.bbc.co.uk/2/hi/africa/8061535.stm>

⁵⁴ Interview with risk analyst.

⁵⁵ For example Mike Pflanz, *Somali pirates attack US-flagged Maersk Alabama a second time*, Telegraph.co.uk, Nov. 18, 2009, at <http://www.telegraph.co.uk/news/worldnews/piracy/6598482/Somali-pirates-attack-US-flagged-Maersk-Alabama-a-second-time.html>

attempts and successful rescues in the preceding period to capture changes in the effectiveness of the combined private and naval defence capabilities.

4.3. Piracy is increased when weather conditions are favourable (e_i)

The main risk for pirates is navigating a small skiff in the high seas with limited food, fuel and equipment.⁵⁶ We therefore test whether pirates respond to changes in the risks associated with navigation. There are two monsoon seasons in Somalia, the Northeast monsoon from December to March and the Southwest monsoon from June to August.⁵⁷ During these periods, high winds interact with the current in the Gulf of Aden and the coastal current of Somalia's Eastern coastline to create high waves of a short wavelength, which can be extremely dangerous for small skiffs. We test whether pirates display an aversion to committing acts of piracy in bad weather. Moreover, we test whether full moon nights are particularly attractive for Somali pirates.

4.4. Piracy is reduced when pay-offs are less certain (Y_i)

We do not know the exact amount of ransoms paid, as discussed above. What we do know is that ransoms have been increasing over time.⁵⁸ However, the costs of piracy are also likely to have risen. Attack crews have become larger and pirates have to guard ships and hostages over longer periods as negotiations are dragging on for longer. We cannot therefore model (net) pay-offs from piracy empirically. In any case, it is clear that the gains from successful piracy far exceed potential earnings on land. Interviews with Somalis (ex-) pirates who are often completely open about their line of business certainly suggest that piracy is the most attractive business in town.⁵⁹ Comparing the payment of a successful pirate to Somalia's GDP per capita of 277US\$, this is no surprise.⁶⁰ We therefore do not model net pay-offs.

We do, however examine the (combined) effect of two main changes in the business environment of Somali pirates between January 2008 and June 2010. Unfortunately these occurred around the same time making it impossible to disentangle their effects statistically. Firstly, in April 2010 the Al Shabab militia invaded the Southern part of Puntland and ousted pirates from their stronghold of Gharaardeere on 25 April 2010.⁶¹ While it appears that pirates were able to take the boats which were in the process of being ransomed further North, the instability could negatively affect the number of pirate attacks thereafter. Pirates often have a background in local militias and may be

⁵⁶ Especially in the Indian Ocean pirates often appear to be on "one-way" missions. If they cannot hijack a ship for the way back, they simply perish. Interviews with naval officers.

⁵⁷ Naval Research Laboratory, *Arabian Sea/Gulf of Aden Winds - SW Monsoon Introduction Tutorial*, last updated Dec 9, 2002, at http://www.nrlmry.navy.mil/sat_training/world_wind_regimes/GulfOfAden/SW_Monsoon/index.html

⁵⁸ Interview with hostage negotiator, information released by pirates through the East African Seafarers' Association and published in Lloyds List.

⁵⁹ BBC News, *'It's a pirate's life for me'*, April 22, 2009, at <http://news.bbc.co.uk/1/hi/8010061.stm>

⁶⁰ CIA World factbook: US\$ GDP estimate 2009 / population (estimate). At PPP *per capita* GDP is estimated to be US\$600.

⁶¹ Mustafa Haji Abdinur, *Somali Islamists vow to end piracy, pirates flee with ships*, AFP, May 2, 2010, at <http://www.google.com/hostednews/afp/article/ALEqM5j0OwOfeiTzFFb3Vb2e8dxal5qHA>

recalled from the sea to participate in armed conflict on land. Also, armed conflict increases the chances of pirate booty being contested on land, making it less attractive to undertake piracy.⁶²

Secondly, on 13 April 2010 a UN sanctions list and a US presidential order were published, banning payments to a list of individuals threatening to “undermine stability and security in Somalia”, including Al Shabab members and two known “pirate kings”. The order threatens prison sentences and heavy fines to those who knowingly pay ransoms which may end up in the pockets of these individuals. As it is completely opaque who receives money from piracy, the insurance industry needs to tread very carefully, lengthening and potentially scuppering ransom negotiations.⁶³ Indeed ransom negotiations in 2010 have been dragging on much longer than was previously the case.⁶⁴ It is therefore possible that pirates may be reacting to the policy measure by reducing attacks, as they are tied up in guarding their previous prey for longer.

5. Econometric Approach and Data

5.1. Econometric Model of Piracy Attacks

Summarising the considerations and hypotheses outlined above we will test the following logit models of the probability of pirates mounting an attack on a given day between January 2008 and June 2010. The dependent variable is whether or not an attack took place (in a particular location) on a particular day or not.⁶⁵

$$\Pi_{\text{attack}} = \alpha + \beta_1 (\text{resources}) + \beta_2 (\text{naval and private defence measures}) + \beta_3 (\text{weather}) + \gamma (\text{pay-off uncertainty}) + \varepsilon_t \quad (4)$$

$$\Pi_{\text{success}} = \alpha + \beta_1 (\text{resources}) + \beta_2 (\text{naval and private defence measures}) + \delta (\text{weather}) + \varepsilon_t \quad (5)$$

$$\Pi_{\text{success}} = \alpha + \beta_1 (\text{weather}) + \beta_2 (\text{naval and private defence measures}) + \varepsilon_t \quad \text{if attack occurs} \quad (6)$$

We use the total of all attacks originating from Somalia as well as splitting the sample into attacks in the Gulf of Aden and those in the Somali basin. This way we can test whether the naval measures in the Gulf of Aden are effective overall, or whether their effectiveness is geographically limited.

5.2. Data

We use daily information on piracy activity off the Somali coast from January 2008 to June 2010 in order to test our hypotheses empirically. Data on incidents of piracy are drawn from the reports from the International Maritime Bureau (annual reports 2008 and 2009 and 2nd quarter 2010). The IMB provides narratives on all incidents of piracy reported by captains and ship-owners, which allows us to distinguish between successful raids and unsuccessful attempts. We define a successful

⁶² Percy and Shortland (2010)

⁶³ Ince & Co, *Piracy - US Presidential Order on payment of ransoms and recent developments*, Articlesbase.com, Sep. 14, 2010, at <http://www.articlesbase.com/law-articles/piracy-us-presidential-order-on-payment-of-ransoms-and-recent-developments-3264291.html>

⁶⁴ Interview with Steven Askins.

⁶⁵ Very rarely more than one attack takes place on a specific day. Sometimes the attacks are clearly linked - see discussion of “swarming” below. The results are robust to estimating an ordered logit instead.

attack as one in which the pirates took control of the ship and sailed it to Somalia to begin ransom negotiations.⁶⁶

5.2.1. Descriptive Statistics

Diagram 3 describes the evolution of piracy off the Somali coast since January 2008. Distinguishing between attacks in the Gulf of Aden and attacks in the Somali Basin, we see a clear seasonal pattern with relatively low levels of piracy during the monsoon months. By far most of the incidents of piracy in 2008 were reported from the Gulf of Aden, where 90 out of 114 (reported) attacks took place. A total of 41 of these attempts were successful, with no obvious regional differences in the effectiveness of attacks.

[insert Diagram 3 about here]

With the implementation of the IRTC in early 2009, the picture gradually changes. While the number of piracy attacks in the Gulf of Aden peaked in the first half of 2009, the subsequent decrease in attacks after the Southwest monsoon period suggests that the anti-piracy naval forces in the Gulf of Aden may have become more effective over time. In particular, the share of successful attacks in the Gulf dropped significantly from 31 per cent before February 2009 to 16 per cent thereafter.

At the same time, we observe a substantial increase in the number of piracy attacks in the Somali Basin, with almost 45 per cent of all incidents between July 2009 and June 2010 reported from this area (as compared to a share of only 21 per cent in 2008). Further, the probability of an attack being successful in this region seems to remain remarkably stable over time, with around 40 per cent of all attempts in the Somalia Basin resulting in a successful hijacking. The subsequent analyses intend to reveal the underlying causes of these trends.

5.2.2. Explanatory Variables

We firstly test a series of weather variables. We use dummy variables for the Northeast and Southwest monsoon months of December – March and June-August. However, these are a rough estimate for the actual monsoon period we also interacted a measure of the maximum wave-height observed in the Gulf of Aden and off the coast of Somalia with the combined monsoon dummies, to capture the rough waves associated with the monsoons more accurately.⁶⁷ We also include a dummy of the month after each monsoon season to capture potentially increased pirate activity after the monsoon season ends.⁶⁸ Finally, we include a full moon dummy for 5 days centered on each full moon, as well as generating a variable for clear full moons from an interaction of the full

⁶⁶ The IMB defines a getting on board a ship as a pirate success, even if the ship is subsequently abandoned or rescued.

⁶⁷ While the variable is highly significant, the ICOADS wave data are not available for 2010, meaning we lose 6 months of observations in these regressions.

⁶⁸ Mike Pflanz, *Somali pirate attacks 'set to increase' as monsoon eases*, Telegraph.co.uk, July 27, 2009, at <http://www.telegraph.co.uk/news/worldnews/africaandindianocean/somalia/5918908/Somali-pirate-attacks-set-to-increase-as-monsoon-eases.html>

moon dummy with rainfall in Hargeisa thereby eliminating full moons with cloud cover.⁶⁹ Full moon nights are said to be particularly conducive for successful piracy operations.⁷⁰

To capture increased risks of disruption we firstly use dummy variables corresponding to the Maritime Security Patrol Area (MSPA) from 23 August 2008 to 31 January 2009 and the IRTC from 1 February 2009. To check whether the IRTC became more successful over time as the private sector improved its performance regarding taking active anti-piracy measures, we split the transit corridor into its 2009 and 2010 effects. We also experimented with a count variable starting from the implementation of the transit corridor and the natural log of this count variable. Finally, we use a count of the number of successfully disrupted pirate attacks in the previous 3, 5 and 30 days as a proxy for any increases in the effectiveness of the international naval forces in chasing pirates off their prey. To capture increases in the perceived risk of arrest and trial (which are associated with successful rescues), we created a count of the number of successful rescues in the previous 30 days.

We captured increased uncertainty arising from the presence of Al Shabab in Puntland and the UN and US ransom initiative with a dummy variable taking the value 1 from 13 April 2010. News from Somalia is not reliable or frequent enough to come up with a more precise measure of the occupation of Puntland territory by Al Shabab unfortunately. We captured variations in the resources available for Somali piracy by including a count of successful attacks in the previous six months and the number of ships which were successfully ransomed in the previous three months. This captures the influx of new resources to equip new pirate crews. All explanatory variables are summarised in Table 1.

[insert Table 1 about here]

6. Results

The results clearly show that pirates are sensitive to and avoid the risks arising from difficult conditions for navigating skiffs in rough seas. However, the naval counter-piracy measures have not deterred Somali pirates overall, but have led to strategic substitution between targets.

6.1. Incidents of Piracy and Pirate Successes in the Gulf of Aden

All models of the incidents of piracy in Table 2 suggest that pirates are risk averse, with pirates being considerably less active during both monsoon seasons.⁷¹ Similarly, they exploit conditions which give them an additional small advantage – such as full moon nights. Table 2a shows that at the margin the likelihood of pirate attacks is reduced by around 15 per cent in the South-West Monsoon season

⁶⁹ Source: Somalia Water and Land Information Management (SWALIM), at www.faoswalim.org/ unfortunately there are no data on coastal cloud cover.

⁷⁰ Eoin O’Cinneide, *Pirate moon party*, TradeWinds.no, Sep. 30, 2009, at <http://www.tradewinds.no/andalso/article545237.ece> This is most likely to be relevant for raids in the Gulf of Aden.

⁷¹ The seasonal indicators are only rough approximations for the actual monsoon timing. Pirates can go out during the monsoon period when wind-speeds are low. In addition pirates move from the central Gulf of Aden to the Red Sea.

and around 10 per cent during the North-East Monsoon season. Full moon nights raise the probability of an attack by around 6 per cent.

[insert Tables 2 and 2a about here]

However, the naval counter-piracy measures have not had the desired deterrent effect. On the contrary, Model (1) suggests that the incidence of piracy in the Gulf of Aden has increased during the naval counter-piracy measures. Particularly the implementation of the Marine Patrol Area appears to be associated with a substantial rise in piracy. The much improved IRTC is still associated with a considerable increase in pirate attacks, though by 2010 the association appears to be less pronounced. There are two possible reasons why a transit corridor may not work as expected. Firstly, the threat of losing weapons and phones (but not the skiff and motors) and the remote threat of a successful conviction may simply not be great enough to deter pirates from attacking right under the noses of the world's naval forces. Secondly, the transit corridor makes it easier for pirates to choose a prey. Although ships travel fairly predictable routes to minimise distance and conserve fuel, shipping traffic before the implementation of the transit corridor was not nearly as concentrated as it is now. Piracy therefore involved lengthy periods of waiting until a suitable target appeared in the direct vicinity of the pirates. A transit corridor takes the guesswork out of finding a ship.⁷² Used in combination with the AIS system, pirates may even be able to identify preferred targets in advance.⁷³

However, model (2) shows that the positive association between the transit corridors and incidence of piracy disappears once we control for additional resources becoming available for piracy as pirates who have been successful in the past reinvest their profits in the piracy business. The naval counter-piracy efforts have therefore not been counter-productive, but they have failed to deter (an increasing number of) pirate crews from trying their luck in the Gulf of Aden. Model 3 therefore excludes them from the list of explanatory variables.

Model (4) suggests a slightly different interpretation of the effects of the transit corridor. In this model there is the same positive effect from resources from past piracy and a small positive effect from the number of pirate attacks disrupted in the previous 30 days. This suggests that pirates are, if anything, more likely to attack again after being chased off a target previously. There is no statistical effect from the count of rescues in the previous 30 days (omitted from the reported results), indicating that pirates do not fear increased arrest probabilities. This result seriously calls into question the effectiveness of naval measures as a deterrent.

This does not mean that naval measures are ineffective altogether, however. Models (5) and (6) explore the effectiveness of the transit corridor in terms of changing the likelihood that pirate attacks will be successful. Although no effect can be discerned for the MSPA, the transit corridor enters the model with a highly significant negative coefficient: the number of successful pirate attacks in the Gulf of Aden has been reduced by around 4 per cent at the margin. The probability that once an attack was initiated it would be successful was reduced by around 20 per cent at the

⁷² Percy and Shortland (2010)

⁷³ The fact that the Maersk Alabama was attacked again a few months after being ransomed suggests that this may be going on: Mike Pflanz, *Somali pirates attack US-flagged Maersk Alabama a second time*, Telegraph.co.uk, Nov. 18, 2009, at <http://www.telegraph.co.uk/news/worldnews/piracy/6598482/Somali-pirates-attack-US-flagged-Maersk-Alabama-a-second-time.html>

margin. Interestingly, there is no discernable effect from the improvements in the private sector's increasing adoption of "best practice" in 2010. Any positive effects seem to have been outweighed by similar innovations and improvements in the business practices of pirates.

Firstly, pirates seem to have changed their tactics regarding selecting prey. Initially pirates' preferred targets were "beautiful, well maintained ships" as an indication of well-endowed ship owners able to afford high ransoms.⁷⁴ Recently, it is the badly prepared, slow and inattentive, which have become the targets of pirates (Murphy, 2010). Secondly, Coutroubis and Kiourktsoglou (2010) show that Somali pirates are selective in their target choice, avoiding ships carrying flags associated with the countries present in the international naval forces in the region.⁷⁵ Thirdly, pirates seem to be attacking in larger groups than previously with swarms of pirates flooding an area, so that the naval forces are stretched and cannot engage all of them.⁷⁶

6.2. Total Incidents of Somali Piracy

Table 3 summarises the results of the overall incidents of Somali piracy and Table 3a the associated marginal effects. Again all models confirm that pirates avoid high risk activity during the monsoon season, especially the South-West monsoon.⁷⁷ Overall, the transit corridor is associated with an increase in the number of incidents of piracy of 10 per cent at the margin, even when we control for the increasing resources available for piracy and the number of recently disrupted attacks which cause pirates to simply try again.

[insert Tables 3 and 3a about here]

Model (8) suggests that the positive and borderline significant positive effect of the transit corridor in model (7) is driven by a significantly positive effect in 2009, which disappeared in 2010, suggesting that the policy is no longer counter-productive. This could arise because of better private tactics combined with the effect of the new rules regarding ransom payments and the upheaval in Galmuduq province from April 2010. Once we control for the greater uncertainty over pirate payoffs (Y_i), we do get a negative effect for the time after 13 April 2010, though this is not statistically significant (model (9)).

When it comes to modelling pirate success, overall we do not see an overall reduction in the number of successful pirate attacks due to the operation of the IRTC. If anything, the increase in disrupted attacks due to the operation of the corridor raises the probability of a subsequent success, perhaps indicating that pirates are learning from past mistakes (models (10) and (11)). The abandoned maritime patrol area was associated with an increase in successful attacks (model (12)) – perhaps because it combined the advantages for pirates of highly concentrated shipping with a low

⁷⁴ Interviews with naval officers and risk consultant.

⁷⁵ This includes not just the national flags, but also flags of convenience used by Western ship-owners to circumvent domestic taxes and restrictions.

⁷⁶ Nick Childs, *Navies struggle with 'swarming' pirates*, BBC.co.uk, Apr. 1, 2010, at <http://news.bbc.co.uk/1/hi/8598726.stm>

⁷⁷ Model 12 suggest that high Monsoonal waves (data not available for 2010) are a statistically significant deterrent.

probability of encountering naval patrols.⁷⁸ The probability of successful attacks is significantly reduced in rough winds and increased in the post-monsoon period with its increased pirate activity.

6.3. Incidents of Piracy in the Open Seas

The previous results regarding the aversion of pirates to high waves are confirmed, except that it is mainly the South-West monsoon which interacts with the coastal current to create the conditions which deter pirates (Table 4). We no longer have a statistically significant deterrent effect of the North-East Monsoon, probably because risk averse “open sea” pirates are replaced by pirates substituting from the Gulf of Aden to the open seas.⁷⁹ The importance of past resources in feeding into subsequent attacks is also confirmed.⁸⁰ Given that the overall number of incidents and successful incidents has not decreased, despite the reduced number of attacks and successes in the Gulf of Aden, it comes as no surprise that the models looking at piracy in the Somali Basin show a clear substitution effect. Successes and attacks have risen by around 10 per cent and 5 per cent respectively in response to the implementation of the transit corridor (Table 4a) – even when we control for the increase in overall piracy resources due to ransom payments. This result is clearly in line with the classic result of Enders and Sandler (1993).

[insert Tables 4 and 4a about here]

Given the much greater navigational difficulties and risks associated with piracy in the open seas, we conjecture that this substitution has occurred in response to the increased risk of detention and trial. We may be observing that pirates avoid the Gulf of Aden once there is sufficient evidence for a successful conviction e.g. from forensic examination of previously hijacked boats.⁸¹ This interpretation is also in line with information gleaned from interviews with naval officers and commanders who claim that the “quality of pirates” in the Gulf of Aden has declined.⁸² This would leave the least experienced and least capable pirates operating in the Gulf of Aden, where finding prey is easiest and the probability of disruption is highest. Given that their first arrest for attempted piracy is unlikely to result in a prosecution, the risk of disruption is irrelevant to these pirates. The observed reduction in successful attacks in the Gulf of Aden could therefore be due to a combination of the decline in the quality of pirates and the success of the navies in preventing attempted attacks.

6.4. The US Ransom Initiative

The dummy variable indicating the two challenges to the piracy business stemming from the US ban on ransoms to specific named pirates and the incursion of Al-Shabab militias into the “pirate town”

⁷⁸ Naval commanders also surmised that the proximity to the Yemeni coast allowed look-outs to be stationed and that the “dog-leg” in the corridor slowed shipping down unnecessarily. Interview with Captain Farrington.

⁷⁹ Naval officers observed pirates moving their skiffs out of the Gulf of Aden into the open seas for the 2009 North-East Monsoon. Interview with Captain Farrington and other naval officers.

⁸⁰ There is no additional explanatory power in splitting resources into those derived from successes in the Gulf of Aden and Somalia, indicating that it makes sense to model Somali piracy as a single business, in which pirates choose their attack location.

⁸¹ Pirates arrested in the Gulf of Aden have also been successfully linked to previous hijackings by examining their GPS equipment, proving that the equipment was used at the time and position of a previous incident. Interview with naval intelligence officer.

⁸² Interview with Captain Farrington and others.

of Gharardeere did not have any statistically significant effects on subsequent pirate activity. While it is possible that the negative effects already present in the data will strengthen in the longer run,⁸³ it is also possible that pirates can simply move their operations further North and carry on negotiating ransoms as usual in the confidence that they will be paid.

The reason for the latter is that the global adoption of the US ransom initiative has been resisted by most of the key players in the insurance business, specifically in the City of London. A policy of never negotiating with hostage takers is sub-optimal in most cases and therefore unlikely to succeed (Lapan and Sandler 1988, Sandler et al., 1983). This is particularly so in the case of Somali piracy where the final ransom money is generally a small fraction of the total value of the ship and it is in everybody's interest to pay it to avoid a total loss.⁸⁴ A unilateral no-negotiation policy, however, is ineffective in the complicated world of global shipping. Most ships represent a wide mixture of international interests. For example, the flag state of the ship might be a "flag of convenience". The ship owner, the charterer, the crew and the owners of the cargo may all belong to different nations. Their respective insurers may be incorporated in different nations yet again. The ransoms are therefore paid and the insurers apportion the individual contributions amongst themselves.⁸⁵ The ability or inability of an American insurer to contribute to the final settlement (which may occur many months after the ransom is paid) is therefore irrelevant to pirates - at least for the time being.

6.5. Are Somali Pirates Ideologically Close to Violent Islamist Movements?

The final issue we want to address is the question of the link between pirates and violent Islamist movements in Somalia. The first point to make in this respect is that officially the Islamist movements have at all times been highly opposed to piracy considering it in breach of *Sharia* law.⁸⁶ This has been backed up by public actions against pirates whenever Islamists gained control of pirate areas in Puntland – which for example resulted in the complete cessation of piracy from June to November 2006 when the UIC was in control of large parts of Puntland and Southern Somalia.⁸⁷ However, some argue persuasively that the main reason for the clashes between pirates and Islamists are economic, as pirates disrupt trade, which is "taxed" by the Islamists.⁸⁸ Nonetheless, accusations of (financial) links between pirates and Islamist militias abound (Stephenson, 2010). Islamists are reported to tap into the cash flows generated by piracy and were extremely interested in the cargo of the MV Faina.⁸⁹

⁸³ We have only 79 observations with this dummy equal to 1.

⁸⁴ For example the ransom for the *Sirius Star* was US\$3mn, when the cargo alone was worth 100mn.

⁸⁵ Interview with Stephen Askins.

⁸⁶ BBC News, *Somali Islamist insurgents seize pirate haven*, May 2, 2010, at <http://news.bbc.co.uk/1/hi/world/africa/8657060.stm>

⁸⁷ See Colin Freeman, *Pirates fear the lash of sharia law*, Telegraph.co.uk, Oct 15, 2006, at <http://www.telegraph.co.uk/news/worldnews/1531507/Pirates-fear-the-lash-of-sharia-law.html>; and Spiegel Online, *Pirates Sunk by Somali Islamists*, Aug. 23, 2006, at <http://www.spiegel.de/international/0,1518,433233,00.html>

⁸⁸ Nick Wadhams, *Somali Pirates vs. Islamists: A Dispute Over Business*, Time.com, May 7, 2010, at <http://www.time.com/time/printout/0,8816,1987855,00.html>

⁸⁹ See Dana Hughes, *Somalia's Pirates and Islamists Clash and Cooperate*, abcnews.go.com, April 28, 2010, at <http://abcnews.go.com/International/somalia-pirates-islamic-fighters-works->

However, financial and operational links between pirates and Islamists have not been proven. Speaking against a *jihadist* connection are two observations: Firstly, pirates regularly attack Muslim-owned and operated ships (including Egyptian, Tunisian and Saudi-owned vessels). Secondly, pirates demands are always financial, they do not have the political elements so strongly associated with terrorist hostage taking (e.g. the reading of propaganda statements or release of political prisoners, see Gaibullov and Sandler 2009). To explore the potential of ideological links to Islamism, we added two extra dummy variables into our regressions for Ramadan and for all Islamic holidays. Given the Islamists' fundamental objection to piracy under *sharia* law one would expect that if there was an ideological link between pirates and Islamists, they would choose to avoid piracy activity which is explicitly designated as sinful at this time.

If anything, pirate activity appears to be higher during Ramadan and other holy days in the Islamic calendar than at other times of the year. Partially this might be due to the fact that Ramadan in 2008 and 2009 occurred towards the end of the monsoon season. Alternative explanations could be the need to fund additional expenditure during the feast days or that pirates expect (Muslim) crews to be less alert during Ramadan, making success more likely.⁹⁰ We included the Postmonsoon and Ramadan dummies as alternative explanatory variables and have reported the dummy which had the best fit. Overall we do not find any evidence of an ideological closeness of pirates with fundamentalist Islamic groups.

Piracy therefore appears to be first and foremost a business which does not operate under *sharia* principles. Nonetheless, naval intelligence telephone intercepts show that Islamists are keen to form operational and financial links with pirates. However, the pirates fiercely resist contacts with Islamist organisations, fearing that any evidence of co-operation would lead to an escalation in the intensity and the severity of counter-piracy efforts.⁹¹ Military interventions against Somali "terrorists" take a very different form from the current light-touch naval intervention.⁹² This clear distinction may have prevented (or at least postponed) the formation of a very undesirable alliance.

7. Discussion of Results and Conclusions

The results clearly show that Somali pirates are keenly aware of the risks involved in piracy and manage these risks through the timing of their raids, by strategic substitution between targets and geographical locations and by carefully managing their image and alliances. The naval measures have not managed to eliminate piracy in the region. Although the naval forces stress their successes in intercepting pirate attacks and the occasional rescue of hijacked ships, these measures have at best stabilised piracy at a high (if tolerable) level.

[times/story?id=10500912&page=1](http://www.nybooks.com/articles/archives/2010/oct/14/pirates-are-winning/?pagination=false); Jeffrey Gettleman, *The Pirates Are Winning!*, The New York Review of Books, Oct. 14, 2010, at <http://www.nybooks.com/articles/archives/2010/oct/14/pirates-are-winning/?pagination=false>; and Rob Crilly, *Islamists plunder weapons from hijacked ship in Somalia*, The Times, Sep. 29, 2008, at <http://www.timesonline.co.uk/tol/news/world/africa/article4842684.ece>

⁹⁰ For example many ships are operated by Indonesian crew.

⁹¹ Information obtained under Chatham House Rules.

⁹² BBC News US Somali airstrikes ,kill many'; January 2007 <http://news.bbc.co.uk/1/hi/world/africa/6243459.stm>

The “catch and release” policy does not appear to deter pirates from operating in the Gulf of Aden – pirate attacks have not been reduced due to the implementation of the IRTC or the improvement of private sector defences. However, some deterrence has occurred, because we see increased activity in the open seas off the coast of Somalia. The clear substitution effect in combination with interview evidence suggests that it is the experienced pirates who are deterred from operating in the Gulf of Aden because of the prospect of trial and prison. Pirates without a “criminal record” can use the Gulf of Aden to hone their skills in the confidence that any encounters with the international naval forces are likely to be relatively benign. Once there is sufficient evidence to convict them, pirates prefer to hunt in the open seas. Here emergency assistance cannot possibly be reliably provided by the current naval contingent, which is barely adequate for the effective protection of the IRTC.

Overall one might conclude that the employment of naval forces in the Gulf of Aden has not achieved its declared aim of deterring or eliminating piracy in the region. However, this would mean ignoring that quite possibly the mission has been a highly effective counter-terrorism operation. The statistical analysis presented above suggests that pirates avoid high risk activities and are highly strategic. Ransom moneys would be an excellent way of swelling the war chest of Islamist movements and beyond this piracy could be strategically employed to directly obtain banned goods and weapons for *ihadists*. Therefore, presumably ways could be found of circumventing the current blanket ban on piracy by the fundamentalists’ interpretation of *sharia*. However, no alliances between pirates and violent Islamist movements have been proven. Instead, pirates are aware of the dangers of being seen to cooperate with the Islamist militias and resist contacts. Quite possibly pirates are betting on being “tolerated” by the international community as long as they are seen as a potential counterweight to Al-Shabab in Somalia. The UN and US ban on money transfers to Al-Shabab are likely to enforce such considerations.

To the extent that reducing piracy is the aim of the current naval deployment, there are three policy implications from this research. Firstly, the deterrent effect of operations in the Gulf of Aden could be strengthened. “Catch and release” is not a deterrent, whereas detention and trial of pirates appears to be something that Somali pirates would rather avoid. The international community therefore needs to resolve the issue of the legal status of attempted piracy and ensure that arrested pirates can be handed over for prosecution and get legal assistance quickly to comply with international legal and human rights standards. This might be accomplished by establishing trial facilities in “floating courts” in the Gulf of Aden – a policy that has been mooted on several occasions. The policy is attractive as it would provide a deterrent to pirates in the Gulf of Aden without escalating violence.

Secondly, Somali piracy is constrained by a lack of resources for equipping pirate crews: when funds become available many young men come forward to try their luck in the piracy business. It is always individually rational for ship-owners to pay a ransom that is still a fraction of the total value of ship, cargo and crew. However, each ransom payment confers a negative externality on the rest of the shipping community. Given that the Somali pirates have had several hundred hostages under their control at all times, it is politically impossible to stop ransom payments altogether. Increasing the difficulty with which ransoms can be paid and continuing to drive them as low as possible, makes a valuable contribution to stemming the influx of new pirates.

Thirdly, the naval forces might consider routinely replacing the high-powered outboard motors of released pirate crews with motors suitable for fishing. Given that the 100 bhp motors are crucial to the success of pirates and are probably the largest contributor to the fixed cost of a pirate venture, such policy might enhance the effectiveness of “catch and release” in reducing pirate resources and raise its effectiveness as a deterrent.

Acknowledgements

We would like to thank Stephen Askins of Ince & Co, Roland Vogler-Wander of the German Marine and Captain Farrington of the Royal Navy, as well as a number of anonymous interviewees for providing important information about Somali piracy and the naval mission. We thank two anonymous referees, Tilman Brueck, Olaf de Groot and seminar participants at the Brunel Centre for Intelligence and Security Studies and at the IFSH in Hamburg for helpful comments on an earlier draft of this paper.

References

- Alexander, Y., Richardson T., 2009. *Terror on the High Seas: From Piracy to Strategic Challenge*. Praeger Security International.
- Becker, G.S., 1968. Crime and Punishment: An Economic Approach. *Journal of Political Economy* 76 (2), 169-217.
- Benmelech, E., Berrebi, C., Klor, E., 2010. Counter-Suicide-Terrorism: Evidence from House Demolitions. Working paper accessed at http://www.economics.harvard.edu/faculty/benmelech/files/HD_october_18_with_tables.pdf.
- Coggins, B., 2010. Nothing Fails Like Success: Anarchy, Piracy and State-building in Somalia. International Relations Working Group Paper. Dartmouth College.
- Cooter, R., Ulen, T., 2008. *Law and Economics*, fifth ed., Pearson International.
- Coutroubis, A., Kiourktsoglou, G., 2010. Somali piracy vs. flag of attacked vessel, mimeo.
- Enders, W., Sandler, T., 1993. The Effectiveness of Antiterrorism Policies: A Vector-Autoregression-Intervention Analysis. *American Political Science Review* 87 (4), 829-44.
- Enders, W., Sandler, T., 2006. *The Political Economy of Terrorism*, Cambridge University Press, New York.
- Fielding, D., Shortland, A., 2010. 'An Eye for an Eye, a Tooth for a Tooth' - Violence and Counter-insurgency in Egypt. *Journal of Peace Research* 47 (4), 433-47.
- Gathii, J., 2010. Kenya's Piracy Prosecutions, *American Journal of International Law* 104 (3), 416-35.
- Gaibullov, K., Sandler, T., 2009. Hostage Taking: Determinants of Terrorist Logistical and Negotiation Success. *Journal of Peace Research* 46 (6), 739-56.
- Gil-Alana, L., Barros, C., 2010. Note on the Effectiveness of National Anti-Terrorist Policies: Evidence from ETA. *Conflict Management and Peace Science* 27, 28-46.
- Gilpin, R., 2009. Counting the Costs of Somali Piracy. Working Paper, United States Institute of Peace.
- Jaeger, D., Paserman, D., 2008. The Cycle of Violence? An Empirical Analysis of Fatalities in the Palestinian-Israeli Conflict. *American Economic Review* 98 (4), 1591-604.
- Kraska, J., 2009. Coalition Strategy and the Pirates of the Gulf of Aden and the Red Sea. *Comparative Strategy* 28 (3), 197-216.
- Kraska, J., Wilson, B., 2009. Repressing Piracy in the 21st Century: An International Maritime Threat Response Plan. *Journal of Maritime Law and Commerce* 40 (1), 43-58.
- Lapan, H.E., Sandler, T., 1988. To Bargain or not to Bargain: That is the Question. *American Economic Review* 78, 16-21.

- Le Sage, A., 2010. Somalia's Endless Transition: Breaking the Deadlock. Strategic Forum 257, Institute for National Strategic Studies, National Defense University.
- Levitt, S.D., 2004. Understanding Why Crime Fell in the 1990s: Four Factors that Explain the Decline and Six that Do Not. *Journal of Economic Perspectives* 18 (1), 163-90.
- Menkhaus, K., 2007. The Crisis in Somalia: Tragedy in Five Acts. *African Affairs* 106, 204, 357-90.
- Menkhaus, K., 2009. Dangerous Waters. *Survival* 51 (1), 21-25.
- Murphy, M., 2007. Contemporary Piracy and Maritime Terrorism: The Threat to International Security. IS Adelphi Paper 388.
- Murphy, M. 2010. Somalia: the New Barbary? Piracy and Islam in the Horn of Africa, Columbia University Press.
- Percy, S., Shortland A., 2010. The Business of Piracy in Somalia. DIW Discussion Paper 1033.
- Roach, A., 2010. Countering Piracy off Somalia: International Law and International Institutions. *American Journal of International Law* 104 (3), 397-415.
- Robinson P., Darley, J., 2003. The Role of Deterrence in the Formulation of Criminal Law Rules: At Its Worst When Doing Its Best. *Georgetown Law Journal*, 949-1002.
- Rodrigue, J.-P., 2004. Straits, Passages and Chokepoints: A Maritime Geostrategy of Petroleum Distribution. *Les Cahiers de Geographie du Quebec* 48 (135), 357-74.
- Rosendorff, B.P., Sandler, T., 2004. Too Much of a Good Thing? The Proactive Response Dilemma. *Journal of Conflict Resolution* 48 (5), 657-71.
- Sandler, T., Enders, W., 2004. An Economic Perspective on Transnational Terrorism. *European Journal of Political Economy* 20 (2), 301-16.
- Sandler, T., Tschirhart, J., Cauley, J., 1983. A Theoretical Analysis of Transnational Terrorism. *American Political Science Review* 77 (1), 36-54.
- Stephenson, J., 2010. Jihad and Piracy in Somalia. *Survival* 52 (1), 36.
- Treves, T., 2009. Piracy, Law of the Sea, and Use of Force: Developments off the Coast of Somalia. *The European Journal of International Law* 20 (2), 399-414.
- Van der Meijden, L., 2008. The Influence of Modern Piracy on Maritime Commercial Transport. Thesis Submitted for Partial Fulfilment of the Requirements for the MSc Degree in Urban, Port and Transport Economics, Erasmus University.

Diagram 1: Somali Piracy – Attempts and Successful Attacks (1/2000-6/2010)

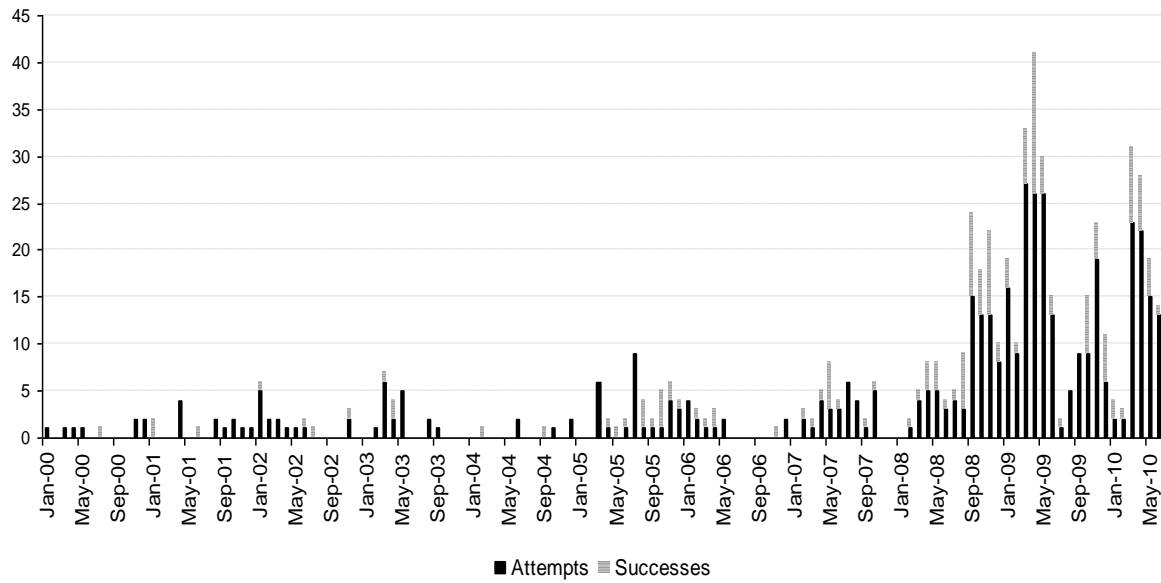


Diagram 2: The Two Transit Corridors

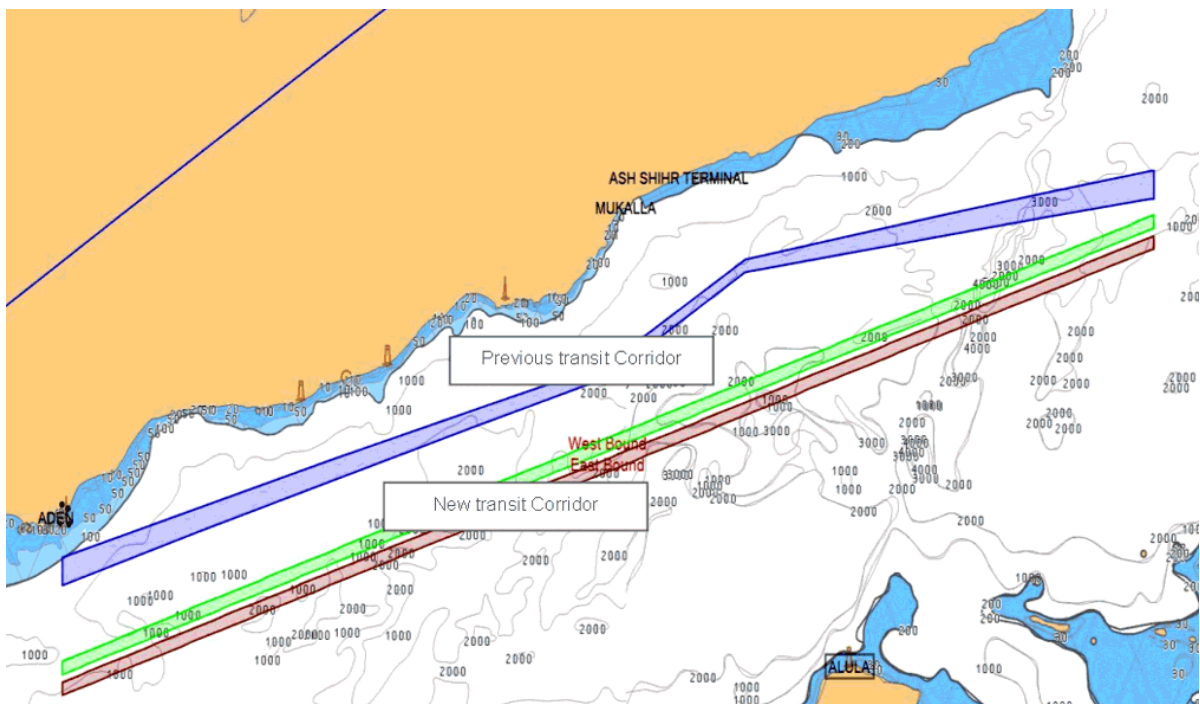


Diagram 3: Somali Piracy – Attempts and Successful Attacks by Region (1/2008-6/2010)

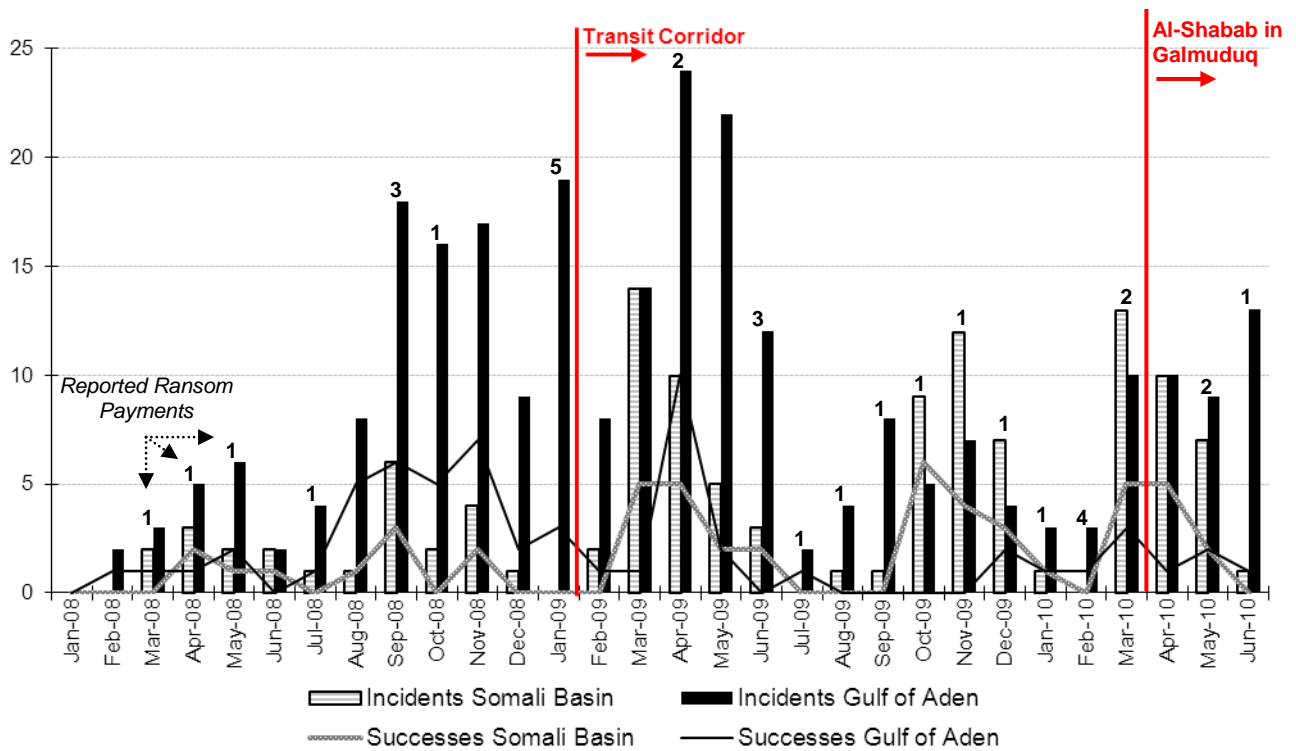


Table 1: Variable Definitions and Sources

Variable	Definition	Source
Incident	Dummy: at least one incident of piracy reported in the region	International Maritime Bureau Piracy Reports
Success	Dummy: at least one incident which result in a successful hijacking and no subsequent rescue attempt is made	International Maritime Bureau Piracy Reports
Ransom payment	Number of reported ransom payments in the past 90/180 days	International Maritime Bureau own calculations
Past success	Number of successful attacks in the past 180 days	International Maritime Bureau own calculations
Recent disruption	Dummy: Disruption occurred in the past 30/90 days	International Maritime Bureau own calculations
IRTC (Internationally Recommended Transit Corridor)	Dummy from February 2009	EU NavFor
Southwest monsoon	June - August	
Northeast monsoon	January - March	
Post-monsoon	April and September	
(Clear) full moon	Full moon nights with no rainfall in Hargeisa	Somalia Water and Land Information Management (SWALIM)
Ramadan	Dates of Ramadan	
US Ransom Rule	Dummy from April 13, 2010: US ransom initiative and Al-Shabaab presence in Gharadeere	
MSPA (Marine Security Patrol Area)	Dummy from August 23, 2008 to January 31, 2009	
Holydays	Holy days in the Islamic calendar	
Wave height * Monsoon	Maximum weight height off the Somali coast interacted with the combined monsoon dummies	International Comprehensive Ocean-Atmosphere Data Set (ICOADS)

Table 2: Logit Regressions on Piracy in the Gulf of Aden

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
	Incident of Piracy				Successful Attack	
					<i>Full Sample</i>	<i>Given Attack</i>
Southwest monsoon	-0.79*** (0.25)	-0.89*** (0.25)	-1.00*** (0.23)	-0.78*** (0.23)	-1.08** (0.46)	
Northeast monsoon	-0.63*** (0.20)	-0.60*** (0.20)	-0.57*** (0.20)	-0.56*** (0.21)	-0.49 (0.34)	
MSPA	1.13*** (0.29)	0.50 (0.41)				
IRTC 2009	1.01*** (0.26)	0.45 (0.36)				-1.12*** (0.37)
IRTC corridor 2010	0.83*** (0.29)	0.30 (0.38)				-0.95** (0.44)
IRTC					-0.78*** (0.30)	
Number of Successful Attacks in the past 180 days		0.03** (0.01)	0.04*** (0.01)			0.03** (0.01)
Clear Full moon			0.39* (0.22)	0.40* (0.22)		
Full moon					0.57* (0.33)	
Number of Reported Ransom Payments in the past 90 days				0.12** (0.05)		
Disruptions in the past 90 days				0.12*** (0.04)		
Ramadan			0.55* (0.30)			
Constant	-1.74*** (0.25)	-1.90*** (0.26)	-1.93*** (0.24)	-1.77*** (0.24)	-2.87*** (0.39)	-0.35 (0.23)
Observations	912	912	912	882	912	197
Pseudo R-squared	0.05	0.06	0.06	0.05	0.05	0.05

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2a: Marginal Effects – Piracy in the Gulf of Aden

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
	Incident of Piracy				Successful Attack	
					<i>Full Sample</i>	<i>Given Attack</i>
Southwest monsoon	-0.13*** (0.04)	-0.14*** (0.04)	-0.16*** (0.04)	-0.13*** (0.04)	-0.06** (0.03)	
Northeast monsoon	-0.10*** (0.04)	-0.10*** (0.03)	-0.09*** (0.03)	-0.09*** (0.03)	-0.03 (0.02)	
MSPA	0.18*** (0.05)	0.08 (0.06)				
IRTC 2009	0.16*** (0.04)	0.07 (0.06)				-0.21*** (0.06)
IRTC corridor 2010	0.13*** (0.05)	0.05 (0.06)				-0.18** (0.08)
IRTC					-0.04*** (0.02)	
Number of Successful Attacks in the past 180 days		0.00** (0.00)	0.01*** (0.00)			0.00** (0.00)
Clear Full moon			0.06* (0.03)	0.06* (0.04)		
Full moon					0.03* (0.02)	
Number of Reported Ransom Payments in the past 90 days				0.02** (0.01)		
Disruptions in the past 90 days				0.02*** (0.01)		
Ramadan			0.09* (0.05)			

Table 3: Logit Regressions on Piracy off Somalia (both Gulf of Aden and Somali Basin)

Dependent Variable:	(7)	(8)	(9)	(10)	(11)	(12)
	Incident of Piracy			Successful Attack		
Southwest monsoon	-1.14*** (0.23)	-1.27*** (0.24)	-1.27*** (0.24)	-0.78** (0.36)	-0.79** (0.36)	
Northeast monsoon	-0.51*** (0.19)	-0.53*** (0.19)	-0.66*** (0.21)			
IRTC	0.39* (0.20)		0.49** (0.21)	-0.12 (0.23)		0.53 (0.33)
IRTC 2009		0.50** (0.21)				
IRTC 2010		0.14 (0.26)				
Disruptions in the past 90 days	0.13*** (0.04)	0.11*** (0.04)	0.11*** (0.04)	0.13*** (0.05)	0.13** (0.05)	
Number of Reported Ransom Payments in the past 90 days	0.14** (0.06)	0.16** (0.06)	0.15** (0.06)			
Ramadan	0.51* (0.29)	0.51* (0.29)	0.49* (0.29)			
US Ransom Rule			-0.48 (0.30)			
Post monsoon				0.65** (0.27)	0.65** (0.27)	0.88*** (0.29)
Wave height * Monsoon						-0.20** (0.09)
MSPA						0.72* (0.37)
Constant	-1.56*** (0.22)	-1.54*** (0.22)	-1.48*** (0.22)	-2.43*** (0.22)	-2.48*** (0.19)	-2.53*** (0.33)
Observations	882	882	882	882	882	731
Pseudo R-squared	0.08	0.08	0.08	0.05	0.05	0.07

Logit Regressions. Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3a: Marginal Effects – Piracy off Somalia (both Gulf of Aden and Somali Basin)

Dependent Variable:	(7)	(8)	(9)	(10)	(11)	(12)
	Incident of Piracy			Successful Attack		
Southwest monsoon	-0.22*** (0.04)	-0.24*** (0.04)	-0.24*** (0.04)	-0.07** (0.03)	-0.07** (0.03)	
Northeast monsoon	-0.10*** (0.04)	-0.10*** (0.04)	-0.13*** (0.04)			
IRTC	0.08* (0.04)		0.09** (0.04)	-0.01 (0.02)		0.05 (0.03)
IRTC 2009		0.10** (0.04)				
IRTC 2010		0.03 (0.05)				
Disruptions in the past 90 days	0.03*** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.01*** (0.00)	0.01** (0.00)	
Number of Reported Ransom Payments in the past 90 days	0.03** (0.01)	0.03** (0.01)	0.03** (0.01)			
Ramadan	0.10* (0.06)	0.10* (0.06)	0.09* (0.06)			
US Ransom Rule			-0.09 (0.06)			
Post monsoon				0.06** (0.02)	0.06** (0.02)	0.08*** (0.03)
Wave height * Monsoon						-0.02** (0.01)
MSPA						0.06* (0.03)

Table 4: Logit Regressions on Incidents of Piracy in the Somali Basin

Dependent Variable:	(13)	(14)	(15)	(16)	(17)
	Incidents of Piracy			Successful Attack	
Southwest monsoon	-1.29*** (0.37)	-1.35*** (0.37)	-1.44*** (0.38)	-0.94* (0.55)	-0.87 (0.56)
Post-monsoon	0.73*** (0.24)	0.74*** (0.24)	0.66*** (0.24)	1.15*** (0.33)	1.12*** (0.34)
Number of Reported Ransom Payments in the past 90 days	0.16** (0.07)	0.16** (0.07)	0.18** (0.07)	0.06 (0.11)	0.06 (0.11)
IRTC	0.91*** (0.30)	1.03** (0.41)	0.97*** (0.30)	1.02* (0.60)	0.90* (0.47)
MSPA		0.06 (0.44)		0.05 (0.66)	
US Ransom Rule		-0.46 (0.34)		-0.96 (0.63)	
Holydays			0.65* (0.36)		0.19 (0.58)
Constant	-3.11*** (0.28)	-3.12*** (0.35)	-3.24*** (0.30)	-3.97*** (0.51)	-3.98*** (0.44)
Observations	912	912	912	912	912
Pseudo R-squared	0.10	0.11	0.11	0.09	0.08

Logit Regressions. Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4a: Marginal Effects – Incidents of Piracy in the Somali Basin

Dependent Variable:	(13)	(14)	(15)	(16)	(17)
	Incidents of Piracy			Successful Attack	
Southwest monsoon	-0.13*** (0.04)	-0.14*** (0.04)	-0.15*** (0.04)	-0.04* (0.03)	-0.04 (0.03)
Post-monsoon	0.08*** (0.02)	0.08*** (0.02)	0.07*** (0.02)	0.05*** (0.02)	0.05*** (0.02)
Number of Reported Ransom Payments in the past 90 days	0.02** (0.01)	0.02** (0.01)	0.02** (0.01)	0.00 (0.01)	0.00 (0.01)
IRTC	0.09*** (0.03)	0.11** (0.04)	0.10*** (0.03)	0.05* (0.03)	0.04* (0.02)
MSPA		0.01 (0.05)		0.00 (0.03)	
US Ransom Rule		-0.05 (0.04)		-0.04 (0.03)	
Holydays			0.07* (0.04)		0.01 (0.03)