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Olaf J. de Groot • Anja Shortland

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Jolly Rogers and Dodgy Rulers

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Gov-arrrgh-nance
Jolly Rogers and Dodgy Rulers[*]

Olaf J. de Groot[†]
DIW Berlin

Anja Shortland[‡]
Brunel University and DIW Berlin

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Abstract

In this paper, we argue that the effect of governance on the emergence of crimes of different levels of sophistication is highly non-linear. State failure, anarchy and a lack of infrastructure are not conducive to establishing any business, including illicit enterprises. At the bottom of the spectrum, therefore, both legal business and criminal gangs benefit from improved governance. With further improvements in governance criminal activities decline. We find strong and consistent support for this hypothesis using the International Maritime Bureau's dataset on piracy. Piracy is reported by ship-owners, giving a unique insight into crime in badly governed countries which were systematically excluded from previous analyses. We show that profitable forms of piracy flourish where on the one hand there is stability and infrastructure, but on the other hand the state does not have the capacity to intervene and/or bureaucrats can be bribed to turn a blind eye. For minor acts of theft from ships the pattern is quadratic: piracy first rises and then falls as governance improves.

[†] German Institute for Economic Research (DIW Berlin), Mohrenstrasse 58, 10117 Berlin. Email: odegroot@diw.de.
[‡] Corresponding Author: Department of Economics, Brunel University, Uxbridge UK UB8 3PH and German Institute for Economic Research (DIW Berlin), Mohrenstrasse 58, 10117 Berlin. E-mail Anja.Shortland@brunel.ac.uk

Introduction

The literature studying the effect of governance on illegal activity shows that as the quality of governance increases the importance of the informal sector shrinks and the intensity and seriousness of crime is reduced (e.g. Friedman *et al.,* 2000; Johnson *et al.,* 1998; Loayza, 1996). The common starting point in this literature is to assume that there is a government (which can be more or less corrupt or effective at catching criminals) and a legal sector where profitable business activity may be conducted. Entrepreneurs choose which sector to operate in depending on (expected) sanctions and rewards. However, these assumptions are not universally applicable. Firstly, some governments do not control (all of) their territory. This may be because of complete state failure or because they have abdicated governance to separatist groups, which may tolerate or even support organised crime. Secondly, economic opportunities may be altogether limited by the lack of enforceable contracts, secure property rights and/or a lack of infrastructure for getting goods to markets. Criminal gangs need infrastructure and markets, both to create opportunities for stealing and to turn their loot into cash. By combining operations in the shadow and legal economies, criminals can further increase the profitability of their operations.

We therefore hypothesise that at the bottom of the governance spectrum, illegal activity would benefit from improvements in governance, which aid the functioning of markets. There should be a "sweet spot" on the governance spectrum where markets function well enough to enable lucrative criminal activity, while law enforcement is still too weak and/or officials too corrupt to provide an effective threat of sanctions. Once governance improves beyond this point we expect to observe the established result that crime is decreasing in governance.

Countries at the bottom of the governance scale have so far been systematically excluded from the empirical literature on governance, because these countries do not report reliable data on illegal activity. In this paper we look at the relationship between the incidence of piracy and the quality of governance. The International Maritime Bureau's piracy dataset used here does not rely on local data collection, but on ship-owners' reports of various types of maritime crime. It therefore presents us with a unique opportunity to study what happens in the informal sector when there is complete or near state failure.

At the same time the problem of piracy itself is of increasing political and academic interest. The recent explosion of piracy off the coast of Somalia and the spiralling cost of providing maritime security (privately or through naval intervention) mean that we need to

evaluate different strategies to combat piracy.[1] Most commentators agree that piracy is a problem which is best resolved on land: Percy and Shortland (2010) argue, for example, that naval intervention can reduce the problem at best and at worst simply shift it elsewhere. According to Treves (2009), there is little appetite for repeated incursions into sovereign states' territories to pursue pirates into their lairs, even where UN Security Council resolutions explicitly authorise this[2]. Increasing the ability and willingness of a government to intervene to stop piracy is therefore widely accepted as the key to resolving a country's piracy problems (see Boots, 2009; Kraska and Wilson, 2008 or Menkhaus, 2009).

Therefore answering the question of under what conditions piracy emerges and establishes itself as a business model is paramount for designing a successful response to maritime insecurity. Echoing the literature on crime and governance, much of the current debate links piracy to state failure[3]. There is an explicit or implicit assumption that we can reduce piracy by stabilising conflict regions and strengthening state structures[4]. However, as shown by Coggins (2010b), most "failed states" do not produce (significant amounts of) piracy[5]. Instead, piracy is endemic in countries with weak (but not hopeless) governance such as Nigeria, India, Indonesia, Thailand and Bangladesh. Diagram 1 illustrates this point.

Piracy is therefore well suited to illustrate and examine the hypothesised non-linear relationship between governance and illegal activity. As governance improves from the lowest levels, pirates find it easier to run their businesses. As markets develop, more foreign ships arrive to trade in a country's harbours. Pirates need to worry less about their booty being contested on land and can use existing infrastructure and markets to unload and sell their loot. Piracy will therefore rise both in terms of the number of attacks and in their ambition. The "sweet spot" for pirates on the governance spectrum occurs where (possibly informal) governance structures ensure contract security and physical infrastructure while government officials turn a blind eye. Only once governance improves beyond the "optimal" piracy point,

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[1] See for example Boots (2009), Kraska (2008 and 2009), Kraska and Wilson (2008, 2009a and 2009b), Menkhaus (2009)

[2] Sending the naval gunboats into pirate havens was the way piracy has traditionally been resolved.

[3] For a typical example see "Anarchy on land means piracy at sea"
  http://www.nytimes.com/2009/04/12/opinion/12kaplan.html

[4] House of Lords, European Union Committee: Combating Somali Piracy
 http://www.publications.parliament.uk/pa/ld200910/ldselect/ldeucom/103/103.pdf,
State Department Briefing on U.S. Efforts on Anti-Piracy
http://www.america.gov/st/texttrans-
english/2010/February/20100218165748eaifas0.4240795.html#ixzz0ywcvKVXv

[5] The exception to this rule would appear to be Somalia, which has failed in the sense that the government in Mogadishu does not control the (somewhat artificial) state of Somalia. However, Coggins (2010a) shows that piracy emanates from areas within Somalia which are relatively stable.

are improvements in governance reflected in a reduction in (the profitability of) piracy (diagram 2).

We disaggregate the dataset on piracy compiled by the International Maritime Bureau (IMB) into various types of piracy (minor and major theft, hostage-taking, hijack and ransom, "phantom ships"). We show that the most lucrative forms of piracy are associated not with pervasive state failure and anarchy, but with a combination of relatively effective governments and pervasive corruption. A further opportunity for piracy to develop is the phenomenon of "pockets of lawlessness" where a government has lost control over part of its territory to groups tolerant of piracy that are able to provide relatively stable business conditions[6]. For minor acts of piracy we show that the probability of piracy being reported from a location, as well as its intensity and persistence follow a quadratic pattern. We also show that the previously established highly significant negative linear relationship between governance and crime is present in the IMB dataset – once we exclude the least well governed countries from the sample.

The paper is structured as follows. In the next section we review the relevant literature and formulate our research hypotheses. In section 3 we introduce our data and discuss our modelling strategy. In section 4 we discuss our results, section 5 concludes.

2 Literature Review and Hypotheses

2.1 Literature Review

2.1.1 Crime, the (shadow) economy and governance

Since Becker's seminal (1968) paper on the economics of crime, crime and illegal sector activity have come to be perceived as a maximisation problem. Agents make a rational choice of whether to commit crimes depending on the rewards of crime as compared to various alternative activities, the probability of being detected and punished (and to a lesser extent) the severity of the threatened punishment. People commit crimes, if the expected pay-off from engaging in criminal activity exceeds that from legitimate market activities. The relationship between criminal activity and income (inequality), unemployment, education, socioeconomic background, arrest probability and various forms of punishment has been explored extensively using household and regional panels in a number of developed countries and emerging markets. Buonanno (2003) provides a useful overview of the literature.

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[6] This argument can be made for example for Puntland in Somalia and the delta region in Nigeria

The literature on the effects of governance on legal and illegal activities tests some of the insights from the literature on the economics of crime at the macro-economic level. Given the importance of the probability of punishment in deciding whether or not to engage in criminal activity, improvements in a country's governance should help to suppress illegal activity. Indeed, the empirical studies discussed here demonstrate a clear negative, linear relationship between various aspects of illegal activity and the quality of governance. Azfar and Gurgur (2005) show that the incidence of different types of crime is associated with higher levels of corruption and lower levels of government effectiveness. Fisman and Wei (2007) and Berger and Nitsch (2008) present evidence from trade statistics that a higher level of corruption is associated with increased smuggling activities. Loayza (1996) shows that the informal sector grows with lower levels of governance (and an increasing bureaucratic burden). According to his theoretical model, this effect is related to the increased costs of accessing the formal sector, as well as the costs of remaining in the formal sector. In another theoretical contribution, Azuma and Grossman (2008) find that under fairly general conditions, it can often be optimal to belong to the informal sector when a government is not found to be benevolent. Friedman *et al*. (2000) show empirically that business can be driven underground by pervasive bureaucracy and corruption. Kaufman (2004) uses a business survey to show that issues like corruption serve as a strong impediment to doing business, particularly in non-OECD countries.

Complementing this research there are a number of studies which demonstrate that legal economic activities are positively affected by improvements in governance. Chang *et al.* (2009) argue that improvements in governance are necessary for a country to be able to obtain the benefits of trade liberalisation. After all, only when the internal and external obstacles are removed, can businesses successfully expand. Weill (2009) finds that corruption in most cases reduces bank lending, thereby further affecting growth possibilities of legitimate organisations. This finding echoes the results by Levine (1999), who looks at the relationship between the quality of financial institutions and long-run economic growth, and Djankov *et al*. (2007), who use a cross-country analysis to show that legal protection of creditors increases total lending.

Overall therefore, there is good evidence that as governance improves the scope for and profitability of legal private sector activity rises, while illegal activities are increasingly

suppressed. However, all these papers (explicitly or implicitly) assume that a functioning state, as well as a formal sector, continues to exist alongside the informal / illegal sector. It is not clear from this literature what the effects on the informal sector of a complete breakdown of state authority would be.

One might reasonably argue that in the case of anarchy or state failure, opportunities for both formal and informal sector businesses are severely limited. Any entrepreneurial activity, whether legal or illegal, which involves the production, storage or sale of goods requires at least some enforcement of property rights and a modicum of contract security and stability[7]. Profitable "organised crime" thrives on existing market structures, as is demonstrated by the case of the Mafia in Italy and the USA. Indeed, sociological research on organised crime has pointed out for a long time that criminal groups often combine their illegal activities with legitimate business ownership, thereby increasing profits from both types of activities (Graebner-Anderson, 1979). We therefore postulate that the scope and ambition of illegal business is increasing as governance improves at least for the lower part of the governance spectrum.

2.1.2 Governance and Data Collection

So far the empirical economic literature has been unable to explore illegal activity in badly governed countries. This is not surprising, given that state failure results in the complete breakdown of data collection[8]. Even when a state has some data collection capacity, there may be severe concerns about data quality: Soares (2004) and Azfar and Gurgur (2005) show that the willingness to report crime is negatively correlated with institutional quality and corruption. Because of this association between state weakness and the absence of (reliable) data, the states at the very bottom of the governance spectrum have been systematically excluded from the governance studies cited above[9].

The measure of crime used in this study is exceptional in that it does not suffer from this dearth of data problem. It is based on the maritime piracy database published annually by the International Maritime Bureau (IMB). This collates the reports of ship-owners who

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[7] Dixit (2004) in his book on "Lawlessness and Economics" points out that under conditions of anarchy it is easier to wait for someone else to produce something and then steal it than to engage in production. Similarly large-scale theft (from outsiders) is only lucrative if the booty is not immediately contested.
[8] For example the IMF's 2009 assessment of Somalia simply stated that the Somali government "has not been able to restore order" and that the "absence of an internationally recognized government and official information about economic and financial developments precludes a full assessment…"
[9] Also see Lemke (2004) on the systematic absence of African countries in the International Relations literature.

experienced (attempted) attacks on their ships with varying degrees of sophistication and economic damage caused. It provides us with a global record of a criminal activity – including countries where the local police are too stretched or too corrupt to collect data. The IMB defines piracy as any "armed maritime crime". This is much more inclusive than that provided by the UNCLOS[10]. For the purpose of this paper, the IMB's broad definition of piracy is very helpful, as most maritime crimes are directed against ships at anchor and against steaming ships in territorial waters.

The IMB database allows us to consider which types of maritime crime are associated with different domestic conditions. The reported incidents range from incidents of small-scale theft of cash or "quantities of rope" and "300 litres of paint", via the hijack-and-ransom of large super-tankers to the complete disappearance of large cargo vessels and their load.[11] We thus have information on a range of criminal activities from small-scale (armed) robbery to organized crime, independent of whether or not a state has control over its territory and is able to collect reliable data. We also include unsuccessful attacks in some model specifications, as not every successful attack is reported and we may get a better picture of the incidence of piracy when we include everything that is reported.[12]

2.1.3 Models of Piracy

Potential explanations for the emergence of piracy abound, though few of these explanations have been tested formally in large-n studies (Murphy, 2007 and Sörenson, 2008). The first common theme in the qualitative analyses is "opportunity" such as a favourable geography, busy harbours and / or proximity to trade routes. Secondly, would-be pirates need access to the "means" of piracy, such as boats, capable sea-men, weapons and men trained in their use. Thirdly, the emergence of piracy might be aided by a "motive" such as poverty, economic crises or enforcement of fishing rights. Finally, the ability and willingness of a government to intervene to stop piracy is a crucial factor in determining the

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[10] The UNCLOS in Article 101 provides the following definition of piracy: http://www.un.org/Depts/los/convention_agreements/texts/unclos/part7.htm
Piracy consists of any of the following acts:
(a) any illegal acts of violence or detention, or any act of depredation, committed for private ends by the crew or the passengers of a private ship or a private aircraft, and directed: (i) *on the high seas*, against another ship or aircraft, or against persons or property on board such ship or aircraft; (ii) against a ship, aircraft, persons or property in a place *outside the jurisdiction of any State.*
[11] The IMB reports also includes both successful and unsuccessful attacks, though the latter may not legally be acts of piracy at all, see: http://online.wsj.com/article/SB10001424052748703988304575413470900570834.html?mod=WSJ_hpp_LEAD NewsCollection
[12] Piracy (however defined) is likely to be underreported. Ship-owners may have an incentive not to report piracy in order not to inform insurers or because the bureaucratic implications of reporting outweigh the potential benefit thereof.

emergence and the amount of piracy in a location[13]. Lack of government intervention might arise from legal and jurisdictional weaknesses, lack of resources to enforce the law, or a country being embroiled in violent conflict.

The precise effect of governance is being debated. Many commentators argue that state breakdown or state weakness creates conditions of anarchy in which (organised) crime can flourish. This appears consistent with piracy emanating from countries such as Somalia, often portrayed as the archetypal "failed state". Proponents of this argument see the solution of the piracy problem in strengthening central government.

On the other hand, according to Coggins (2010b), most failed states do not produce significant amounts of piracy. Sörenson (2008) points out that boarding and hijacking a ship does not present a real problem. The real challenge is to remain in control for a sufficiently long time to extract a profit (through extortion or sale of cargo or hull). This requires access to secure refuges and markets. Indeed, Percy and Shortland (2010) show that the time pattern of piracy in Somalia suggests that piracy was significantly reduced in times of instability, uncertainty and violent conflict. Within Somalia most pirate incidents appear to be emanating from Puntland: an area of the country in which there is informal governance and some degree of stability rather than the anarchy of Southern and Central Somalia (Coggins, 2010a). This would suggest that the effects of governance on piracy are indeed non-linear. Conditions of complete anarchy are bad for pirates. Moderate order may be better than moderate disorder when piracy is an organised business (Percy and Shortland, 2010). Only highly effective governments would be able to stamp out piracy altogether.

2.2 Considerations on Piracy and Quality of Governance

Piracy is at its most lucrative when pirates are able to steal (large) ships with their cargo, unload the cargo and give the ship a new identity to sell it off. This form of piracy, which is associated particularly with the Malacca Straits, needs to be run like a business[14]. Pirates need a reliable network of subcontractors, customers for their booty and sufficient stability to ensure that profits are not eroded by turf wars between rival pirate groups. It also requires a good physical infrastructure for unloading cargo and giving ships a new identity. High-end piracy therefore needs functioning market structures and an administration which

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[13] Murphy (2007) and Sörenson (2008) distinguish between states which are too weak to discourage piracy, those which allow piracy and those which encourage piracy.
[14] Leeson (2007) eloquently makes the point that in the 17th and 18th century pirates had developed clear internal governance structures and were highly organised criminals.

tolerates the use of suitable port facilities by criminal groups while providing security for the pirate operation.[15] This combination is likely to be very rare.

The "Hijack and Ransom" form of piracy carried out in Somalia is rather less profitable, but only requires a very basic physical infrastructure. Hijacked ships are anchored several nautical miles off the coast while ransom negotiations are conducted over the safe return of the crew. In the meantime some or most of the hostages are taken off the ship and looked after in local households to ensure that the international naval forces do not try and liberate the ship and its crew. It is essential to keep the hostages alive and safe from potential attacks by rival groups. Percy and Shortland (2010) show that even this form of piracy needs stability and contract security. In terms of governance it needs a more pervasive form of state failure: pirates are completely open about conducting ransom negotiations from ships anchored for months on end within territorial waters, as state forces are unwilling or unable to intervene.

In the more basic "Kidnapping" form of piracy, the crew is taken off the ship and ransoms are demanded for their safe return (e.g. Nigeria). This form of piracy is less lucrative, as the ship owners have less to lose commercially by dragging out the ransom negotiations to lower the final ransom payment[16]. There are two possible reasons why a piracy business would choose to operate in this way. Either the government is too effective and would interrupt ransom negotiations conducted openly from boats moored in territorial waters. Or, alternatively, if government weakness is pervasive and several criminal gangs operate undisturbed, the ship could be contested by rival gangs, who rather than attacking a ship in the open sea would prefer to steal someone else's hostages. Therefore pirates hide their hostages on land. At the lowest level of governance the only form of piracy which is possible are hit and run acts of theft of ship's stores and cash – something that even a relatively well governed country will find difficult to stamp out entirely[17].

Diagram 2 illustrates the relationship between piracy and governance we have in mind. As the quality of governance improves the scope and ambition of acts of piracy initially increases. Other things equal, better governed territories attract more shipping traffic and increase opportunities for piracy. Infrastructure improves and pirates do not have to worry as much about their profits being contested by rival gangs. From a certain point onwards, other

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[15] This is exactly the set of conditions under which piracy flourished in former times – for example the *Barbary Corsairs* in Morocco under Sultan Moulay Ismael and the Elizabethan "Privateers".

[16] The lost "cost of hire" during ransom negotiations in Somalia often exceeds the cost of the final ransom.

[17] Even countries with excellent governance find it difficult to stamp out violent crime entirely, as the experience of the US anti-drugs campaign shows. Also see Erikson and Parent (2007)

forms of economic activity become more attractive and there is a natural attrition out of piracy and into other forms of business. As the state begins to assert control over its territorial waters – not least because it has increasing interest in safeguarding its imports and exports – this will encourage more pirates to exit the business and go straight. A highly effective a government will see only occasional incidents of the pettiest forms of piracy.

2.3 Testable Hypotheses

The IMB piracy dataset provides a near unique opportunity to examine in a panel setting whether the relationship between state weakness and (organised) crime is non-linear. Because of the differences in the skills and infrastructure needed to carry out different types of piracy, one would expect that different factors would drive the incidence of the various types of piracy. The lucrative forms of piracy need stability and infrastructure in combination with elites tolerant of piracy or a corrupt bureaucracy. This combination is likely to be relatively rare.

H1: The dataset on maritime crime compiled by the IMB is dominated by (small scale) theft. The right conditions for ambitious acts of piracy emerge only rarely.

Piracy which takes the form of armed robbery resulting in minor thefts can occur even under conditions of very weak governance as the pirate groups can be small and do not necessarily have to sell their booty (cash, stores). However, opportunities for such thefts will be few and far between in failed states, as trade volumes collapse and commercial ships avoid harbours and coastlines whenever possible. As governance improves, trade increases and with it opportunity for theft from ships. Eventually the opportunity effect begins to be outweighed by improvements in law enforcement, but petty maritime crime can occur even under conditions of relatively good governance.

H2: The relationship between low level acts of piracy and governance is quadratic, first rising and then falling as governance is improved.

If control over a territory is violently contested, piracy which requires time for completing ransom negotiations or infrastructure to unload cargo and give a ship a new identity is not an option.

H3: Profitable forms of piracy are not associated with anarchy or high level violent conflict.

Top-end piracy (where large amounts of cargo or entire ships are stolen and sold on) needs functioning market structures. It will emerge in conditions where the government selectively provides security, a good infrastructure and market access to criminal groups.

H4: Top-end piracy benefits from a combination of high government effectiveness and bureaucratic corruption.

Conditions conducive to "high-end" piracy may also be found in what Rabasa *et al* (2007) term "ungoverned territories"[18]. Such regions may be quite stable once the government has ceded authority to local actors who are able to produce informal governance structures[19]. If the elites in power are accepting of (and/or participating in the profits from) piracy, these regions are likely to be highly conducive to developing lucrative forms piracy.

H5: Ambitious forms of piracy emerge in countries where there are geographic regions which are not controlled by central government and where governance is not violently contested.

Different forms of piracy exist alongside each other. At the micro level petty piracy may play a role as a training ground for larger and more ambitious forms of piracy. This relates to acquiring skills with weapons and on how to get on board a ship with a high freeboard. Countries with a history of (petty) violent maritime crime would be better able to take advantage of temporary reductions in government effectiveness to become more ambitious in their operations[20].

H6: Different types of piracy co-exist. The existence of petty maritime crime has a positive effect on the probability of a country developing more profitable forms of piracy.

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[18] Rabasa *et al* (2007) look at the related issue of optimal havens for international terrorist activity. They identify regions where the central government's authority is directly challenged (referred to as "contested territories"), regions where the government is unable to exercise its authority ("incomplete governance") and regions where the government has actively withdrawn and ceded authority to local actors ("abdicated governance").

[19] For example Somaliland and Puntland in Somalia.

[20] For example piracy in the Malacca Straits became considerably more frequent ambitious after the Asian crisis and the conflict in Aceh.

Occasional, "opportunistic" maritime crime can occur anywhere at any time. However, pirate gangs are more likely to establish themselves permanently and organise a higher number of attacks in countries with weak governance. Looking at the IMB data we see that a number of countries turn up regularly as piracy-prone locations. This is not a surprise: if conditions for piracy are good in one year chances are that they will continue to be favourable: the geographic indicators are constant over time and improvements in governance tend not to happen overnight. On several occasions we observe piracy starting slowly and increasing in intensity over time and eventually tailing off – probably as additional resources are invested to tackle the problem[21]. Conversely, there are some countries where there are occasional attacks on boats, but no piracy industry establishes itself as a consequence[22]. We hypothesise that in "failed states" opportunities arise rarely and in well governed countries detection of repeat offenders is likely.

H7: Persistence and intensity of piracy initially increases as governance improves and then begins to fall.

Finally, we would expect to find the same result as the established literature on crime and governance if we restrict our sample to those countries which have been used in previous analyses.

H8: The relationship between maritime crime and governance is negative, statistically significant and linear when the countries at the bottom end of the governance are excluded from the empirical analysis.

3 Model and Data

3.1 Models of Piracy

We constructed a panel dataset containing all pirate attacks and their correlates from 1997 to 2009 for all countries with a coastline. For the operationalization of our models to test hypotheses H2-H8, we use the data on different types of piracy events separately, as we believe that different local conditions influence the type of piracy conducted in a location.

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[21] Indonesia, South China Sea, India, Sri Lanka, Brazil, Philippines and Vietnam.
[22] E.g. Eritrea, Equatorial Guinea, Nicaragua, Mauritania, Mozambique, Sierra Leone, Taiwan, Honduras, Costa Rica, Mexico, Oman, Albania, Bulgaria, France, Greece, Netherlands, Portugal, Italy, Malta or Turkey.

3.1.1. Probability of Observing Piracy

Firstly we look at the probability of certain types of pirate activity being reported from a location. For this we construct a dummy variable that indicates whether or not a particular form of piracy takes place in a country during a particular year. This takes care of a number of issues. Firstly, the distribution of piracy events is dominated by country-years without any piracy events. Especially high-end piracy is rare - though where it occurs, we often see a large number of events. When the conditions are right a single country can produce a high number of attacks. Therefore the variable distribution is not in the classic shape of (even zero-inflated) count data. Secondly, piracy has a risk of being underreported. Shipping companies sometimes prefer not to report a pirate attack, because it is thought to reflect badly on them (Murphy 2007). Additionally, reporting incidents of successful boarding can lead to lengthy forensic investigations confining ships to harbor (Chalk 2009). Finally, ship-owners may not want to alert insurance companies to an emerging piracy hotspot (which could be justify a hike in insurance cost) and instead cover minor expenses arising from pirate attacks themselves[23]. However, if piracy occurs in any significant quantity, there is likely to be at least one ship-owner who will report it[24].

Combining all factors in a logit model results in a regression that looks as follows:

$$\Pr\left(piracy_{it} = 1 \right) = \frac{e^{\eta_{it}}}{1 + e^{\eta_{it}}}$$

where

$$\eta_{it} = \beta_0 + \beta X_{it} + \upsilon_i + w_t + \varepsilon_{it}$$

in which $piracy_{it}$ is a dummy variable that takes value 1 if an act of piracy takes place in country i during year t and X_{it} is the set of variables that we use to explain the occurrence of piracy, which are discussed below. υ_i and w_t are the random effects associated with group and time features and have an expected value of 0. Finally, ε_{it} is the residual error term.

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[23] See for example (http://www.usatoday.com/news/world/2010-07-03-nigeria-privacy_N.htm)

[24] In all regressions we tried a variable measuring the geographical distance of the capital of the country from which the attack is reported to Kuala Lumpur, where the dataset is compiled. It is excluded from the reported results if it was not significant.

3.1.2. Intensity of Piracy

Despite our reservations about whether intensity is accurately reported (as discussed above) we also investigate the factors determining the intensity of piracy. Although the intensity variables are counts of different types of incidents occurring each year, they do not follow the traditional distribution associated with count data, e.g. the Poisson distribution or a variant thereof. Firstly, the dataset is dominated by zero observations – i.e. about half of the countries do not ever report any maritime crime and many more only see piracy occasionally. Secondly, when the conditions are very favourable for carrying out acts of maritime crime, a large number of acts are reported. Examples are Nigeria in 2007 with 42 incidents, Bangladesh in 2006 with 46 incidents, Indonesia in 2005 with 79 incidents (plus 12 in the Malacca Straits) and Somalia in 2009 with 211 incidents (including Gulf of Aden and the Red Sea) (IMB, 2009). To avoid the few locations with large observations dominating the results, we use a log transform of the intensity variable ($\ln(1+ piracy_{it})$) and used a panel Tobit regression[25]. This assumes that there is a linear relationship between the independent variables in X_{it} and an unobserved (latent) variable y^*_{it}. We only observe y^*_{it} (in this case $\ln(1+ piracy_{it})$) if y^*_{it} is positive, otherwise we observe a zero.

$$y_{it} = \begin{cases} y^*_{it} \; if \; y^*_{it} > 0 \\ 0 \; if \; y^*_{it} = 0 \end{cases}$$

$$where \; y^*_{it} = \beta_0 + \beta X_{it} + \upsilon_i + w_t + \varepsilon_{it}$$

We were only able to get stable coefficients for small-scale maritime crime[26]. Below we report the results for two samples: the complete sample (i.e. all countries with coastlines, where non-zero observations make up about 20% of total observations) and a sample of all countries in which at least one act of piracy was reported during the period (here non-zero observations make up just under 40% of total observations).

3.1.3 Persistence of Piracy

Whether or not piracy manages to thrive over time is likely to be dependent on the institutional environment: where governance is highly effective we would expect piracy to be tackled quickly. In anarchic states opportunities for piracy arise infrequently and the booty

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[25] An ordered random effects logit or probit for zero, occasional, low intensity and high intensity piracy would be a good alternative, but has not been coded for panels in Stata 11.
[26] Top-end piracy is extremely rare and the results are obviously dominated by Somalia and Indonesia.

could be contested or difficult to sell, lowering the gains from piracy. Countries which function relatively well but have corrupt bureaucrats would be most likely to produce persistent piracy. We therefore estimate a series of dynamic models with a lagged dependent variable, as well as interaction terms between the lagged (dummy) variable with quality of governance.

3.1.4 Sample Selection

We suspect that the non-linear interactions between governance and piracy are applicable to a much wider range of criminal activities. However, the pattern will only be seen when countries at the bottom end of the governance spectrum are included in the sample. As we cannot restore these missing observations to the previous studies, we re-run some of models excluding the very badly governed countries instead. We show that beyond a certain cut-off our result breaks down and the established result of the governance literature is convincingly resurrected.

3.1.5 Explanatory Variables

The main variables of interest in X_{it} are three aspects of governance. Firstly, the quality of various aspects of governance as measured by the indicators constructed by Kaufmann *et al.* (2009) for the World Bank[27]. Secondly, the intensity of violent conflict in a country and whether or not a country is considered a "failed state". Thirdly we consider drugs exports of a country as an indicator of the possible existence of "ungoverned territories" where organised crime has replaced the government as the main provider of public goods and security and perhaps already has maritime experience through the export of drugs[28].

We then include a number of control variables to capture opportunities for pirate activity. As our dataset is dominated by attacks on stationary ships we include the number of deep water ports as a proxy for a country's maritime tradition and its participation in world trade. Secondly, we construct a proxy for the number of ships in the anchorages outside these ports. Finally we include a dummy for countries which are exporting oil, as this would generate shipping traffic pretty much regardless of the dangers associated with its territorial waters[29].

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[27] The reported results are based on data from 1997 (or 1998) to 2008
[28] Data on homicide rates are not widely enough reported (especially at the bottom of the governance spectrum) to be usable as a proxy for violent crime within a country.
[29] This was not significant and is not included in the results reported below.

For attacks on moving ships we were unable to access data on the intensity of shipping traffic on the various trade routes. Instead we use a dummy for countries bordering the areas commonly described as "choke points" or "strategic passages" for shipping traffic[30]: As regards capturing the effect of poverty as a "motive" for piracy we use the indicator of poverty which is most widely available regardless of the level of governance (GDP *per capita*)[31].

3.2 Estimation method

We use random effects in our estimation, because of the characteristics of the data. In several countries piracy is endemic, while others never report piracy at all. Employing fixed effects reduces the sample by about two-thirds, with most of the interesting observations dropping out. Additionally, fixed effects are unlikely to be informative because the levels of governance do not change much over the thirteen-year period of data. Of all our observations, government effectiveness and control for corruption change by more than one standard deviation in only eight and ten countries respectively[32]. Of this total of sixteen countries, only eight would still be included in our regressions, after dropping all countries where there is no variation in the occurrence of piracy.

All reported results were calculated in Stata 11. Slight differences in the estimation results can occur depending on the version of Stata used, the starting estimates and number of quadrature points used by the programme[33]. Using the "quadchk" routine we find that in the regressions there may be relative differences in the estimated coefficients of up to 1%. To make the reported results replicable we increased the quadrature points to 24 in all specifications.

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[30] See for example Kaluza *et al* (2010) and Rodrigue (2004). These passages are particularly relevant for shipments of oil.

[31] As GDP *per capita* is highly correlated with quality of governance indicators, multicollinearity may occur. Where we found GDP per capita to be significant, we report the results both with and without this variable to show that the statistical relationship for the governance variables is not spurious.

[32] Government Effectiveness worsened in Cote d'Ivoire, North Korea, the Comoros, Mauritania and Eritrea. It improved in St. Vincent and the Grenadines, Malta and Dominica. Control on Corruption worsened in Guinea, Cote d'Ivoire, North Korea, Gambia and Trinidad & Tobago, while it improved in the Bahamas, Georgia, United Arab Emirates, Liberia and Qatar.

[33] The main result on the effect of governance on piracy is robust to the version of Stata and the number of quadrature points used.

3.3 Data

The dependent variable in this analysis is based on the maritime piracy database published annually by the International Maritime Bureau (from 1997 to 2009). The IMB provides narratives on all incidents of piracy reported (voluntarily) by captains and ship-owners as well as annual counts of incidents of piracy for each country. However, the IMB's reporting choices at the aggregate level are not optimal for our analysis.

Firstly, the IMB distinguish between "successful" and "unsuccessful" attacks, where successful attacks include incidents where pirates managed to get on board a ship. A significant percentage of this group, however, includes cases in which nobody is hurt and during which nothing is stolen. In an economic sense, such cases would not be classified as "successful". Secondly, the aggregation of "successful" attacks into "boarded", "detained" and "hijacked" does not do justice to the wealth of data available in the individual narratives. Finally, the IMB is not entirely consistent in its decisions regarding aggregation[34].

We have therefore analysed each individual narrative in the IMB Annual Piracy Reports between 1997 and 2009 and recoded them as follows. Within the "successful" category, we divide the individual observations between petty theft, major theft, hijacking for ransom, stealing a small or a big vessel (with cargo), taking people hostage and "other"[35]. Within each category, we also know how many attacks were successful in an economic sense and how many were not.

The "unsuccessful" IMB category consists of piracy attempts that failed entirely, coded by the IMB as "fired upon" and "attempted". As it is unobservable what the intent was of the would-be attackers, we divide this category between stationary and non-stationary attacks. This acknowledges the fact that an attack on a moving vessel is more ambitious and associated with a higher level of sophistication than an attack on a stationary one. The non-stationary failed attempts of piracy are the only category that have increased strongly over time, increasing from 7 per cent of all attacks in 1997 (55 per cent of failed attacks) to 45 per cent of all attacks in 2009 (91 per cent of failed attacks). Table 1 contains a summary of all the piracy events, distributed over all the different categories[36].

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[34] Some attacks on fishing fleets are reported as separate attacks on each ship, while others are reported as a single incident. Our database records the number of ships successfully attacked. This is irrelevant in the estimations which consider a dummy variable of whether or not piracy takes place, but it could matter in the regressions of the intensity of piracy.

[35] The "other" category mostly consists of harassment by officials and what appear to be mutinies. We do not make use of this category at all here.

[36] A number of the observations in the IMB database take place either in international waters or in straits bordered by two or several different countries. We deal with this as follows: Events in the Gulf of Aden (270 cases of any kind of piracy, whether successful or failed), the Red Sea (42 cases), the Arabian Sea (10 cases), the

Diagram 3 shows how successful attacks are distributed over the different types of piracy. We have clear support for our hypothesis H1: most of the reported acts of successful piracy as reported by the IMB are of the small scale theft type, which can occur under any form of governance. Its share of all piracy events varies between 72 (in 2008) and 93 per cent (2000). High-end piracy is relatively rare and as expected the rarest form of piracy is the major theft type, which needs the combination of good infrastructure and pervasive corruption.

The exogenous variable of interest is governance. For this, we use the Kaufmann *et al*. (2009) variables related to corruption and government effectiveness[37]. While the "rule of law" index[38] captures the phenomenon we seek to cover most closely, it is partially based on country expert's opinions of the pervasiveness of crime. The occurrence of piracy may influence expert opinions on the overall quality of law and we have therefore not used this variable. Kaufmann *et al*. (2009) report estimates for these variables for each country from 1996 to 2008[39]. While they specifically point out that the values of these variables are normalized annually and are thus not originally intended to be used as panel data, Kaufmann (2004) shows that it is actually feasible to do so. In addition to the level of governance, we also include a dummy indicating whether a country in a particular year is considered to suffer from state failure. We define state failure using the Polity IV dataset (Marshall et al., 2010), which gives an error value of -77 for country-years where the situation is so chaotic that it is impossible to judge institutional quality.

Indian Ocean (4 cases) and the Gulf of Oman (1 case) are commonly accepted to have been carried out by Somali pirates. Similarly events in the Malacca (220 cases) and Singapore Straits (78 cases) are attributed to Indonesia. 2 events in 2003 in the Caribbean Sea are most likely to have originated in Trinidad and Tobago and 1 event in 2004 in the Pacific Ocean is most likely to have been carried out by Colombian pirates. We have not been able to come up with a clear attribution of piracy events in the South China Sea and have therefore not allocated these events to any country. However, the littoral states (China, Philippines, Vietnam, Malaysia, Indonesia) all feature as originators of piracy in various years in the database regardless. Therefore only the intensity variable is affected by this omission.

[37] *Control of Corruption (CC)* – measuring the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests"
Government Effectiveness (GE) – measuring the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies

[38] *Rule of Law (RL)* – measuring the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence

[39] For the years 1997 and 1999, Kaufmann et al. unfortunately do not report any data. In order to be able to use these years nonetheless, we chose to interpolate the missing years from the reported data. Knowing that the quality of governance does not change very quickly and recognizing that we are mostly interested in major differences in the quality of governance, we believe this is safe.

The second governance-related variable is the occurrence of conflict. This may indicate that the governance score reported by Kaufmann is not uniformly applicable across the country, because some regions are not governed by the central authority. For this, we use the MEPV dataset (Marshall and Cole, 2010), which reports on political violence in all countries in the world. This database is particularly useful for our purpose, because it reports the magnitude of societal impact of civil or ethnic violence in each year varying from 1 (sporadic political violence) to 10 (extermination and annihilation) [40]. We look at the effect of different levels of conflict; the idea being that intense contest over territory is not helpful for pirates, while abdicated governance and low level violence may well aid piracy[41].

Thirdly, we look at the effect of the presence of organized crime on piracy. For this, we use the annual International Narcotics Control Strategy Report (1997 to 2010), in which the American government discusses the international drug trade. Conveniently, each year the report identifies a list of countries that significantly contribute to the production or distribution of non-synthetic prohibited drugs. We create a dummy variable of whether or not a country is included on this list in a specific year[42].

To capture opportunity and "maritime tradition" we use the number of deep ports per country, defined as ports large enough for ships that adhere to the new Panamax standard (World Shipping Register, 2010)[43]. Secondly, we include is a dummy of whether or not a country borders one of the following choke points: the Suez Canal and Bab-el-Mandeb, the Panama Canal, the Malacca Straits, the Strait of Hormuz and the Bosphorus (Rodrigue, 2004)[44]. Each of these passages can only circumvented at great economic cost, whereas otherwise it is generally possible to give the coastline of a failed state a wide berth. The presence of a choke point therefore increases the opportunity for piracy[45].

The final variable that is a good indicator of opportunity is related to the observation that much of maritime crime takes place in anchorages. Here ships often only have a skeleton crew on board, making it easier for criminals to come on board undetected and overwhelm the

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[40] Within the time period that we are looking at, the maximum level of conflict intensity is 7.

[41] Both because abdicated governance can result in pirate havens and conflict means easy access to weapons.

[42] We only include countries producing non-synthetic drugs. We also considered the possibility of using the presence or size of counternarcotics aid provided by the US government as an indicator for drug production, but as counter-narcotics aid is used as a political tool, there is a very strong correlation between distance from the US and the likelihood of receiving such aid. For the other drugs variable, this correlation is much less strong.

[43] Benítez (2009) defines the New Panamax standard as a draft of maximum 15.2 meters. This is the size with which ships will be able to use the Panama Canal after the expansion of the Panama Canal is completed in 2014.

[44] Somalia is judged to benefit from the Bab-el-Mandeb choke point despite not technically bordering it.

[45] Another opportunity-related variable we tried was a dummy variable indicating whether a country is an oil exporter as this would generate shipping traffic regardless of local conditions. However, this was not significant in any regressions specification and is omitted from the reported results.

sailors [46]. Unfortunately, it has not been possible for us to gather information about the use of anchorages over time, so instead we construct an instrument that should capture how busy anchorages are. Anchorages are generally associated with ports, giving ships a cheap place to wait until cargo becomes available or a new charter is agreed. Ships are more likely to use anchorages when supply of shipping services outstrips demand and not all ships can be operated profitably. Our proxy for the number of ships in anchorages in a given country year is therefore constructed as follows: First, we use the number of deep ports per country. Second, we employ the annual midpoint of the Baltic Dry Index (Baltic Exchange, 2010). This index measures the cost of shipping and it is particularly interesting for us, as it gives information about the equilibrium between supply and demand for shipping services. The index responds both to changes in the global economy when this affects trade, but also to the supply of ships. Both of these may affect the number of ships laid-up at anchorage. Finally, we expect that ship owners are sensitive to the fees levied by port authorities for being allowed to anchor a ship for some time. Prime example is Chittagong, which is considered to be among the cheapest ports in terms of anchorage fees and is thus a prime destination for it. However, as we have no information about these fees, we believe that GDP per capita (from Heston et al. 2009) is a reasonable indicator for the order of magnitude of these fees. In order to construct our anchorage instrument, we combine these elements as follows:

$$anchorage_{i,t} = BDI_t * ports_i / GDP_{i,t}$$

Table 2 contains a summary of the descriptive statistics of all the variables we use in the analysis. We also assign a category to each of the control variables, to see whether this variable relates to a *motive* to commit acts of piracy, the *means* to be able to commit or whether it affects the *opportunity* to do so. Most of the reported acts of (high end) piracy arise from a small number of locations (Bangladesh / Somalia / Indonesia). The dummy variables therefore show that the right conditions for piracy arise very rarely, while the intensity variables show that if conditions are good a lot of piracy operations may be conducted. The anchorage variable in itself does not have any meaning as this is the value of the instrument we construct. Table 3 summarizes all the sources employed in this paper.

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[46] The "anchor watch" for a large cargo ship may only be three to five people

4. Results

4.1 Small-scale Maritime Crime

We split up the sample broadly into petty maritime crime on the one hand and lucrative forms of piracy on the other. Table 2 reports the results for small scale maritime crime. The three dependent variables are dummies of whether the following types of attack occurred at least once during the year 1) successful small scale theft, 2) successful and unsuccessful small scale theft and 3) all attacks on stationary ships, regardless of whether or not they were successful. We observe the expected quadratic effect in governance quality: initially, as governance improves, so does the probability of armed theft from ships. However, as governance improves beyond this optimal point, the likelihood of petty maritime crime decreases. It does not greatly matter whether we use government effectiveness or control of corruption as our proxy for the quality of governance, but government effectiveness is more consistently highly significant[47]. We therefore have strong evidence in favour of hypothesis H2.

In addition we have two other factors which increase the probability of maritime crime: 1) the existence of low level civil conflict, which undermines the quality of governance at least locally and raises the amount of weapons in a country, and 2) an acknowledged problem with drug production and distribution, which means that (armed) criminal gangs are already organised in the country. However, the drug dummy is not robustly significant across regression specifications. The small-scale piracy dummy also appears to be linked to poverty, in that the lnGDP *per capita* variable is highly significant (in addition to the governance variables). Foreign ships are a tempting target in poor countries. The final factor of relevance is the opportunity arising from ships berthed in harbours. Interestingly here we have another quadratic effect: deep sea ports create opportunities, but countries with a strong maritime tradition (and hence several deep sea ports) appear to invest in effective deterrents against piracy[48]. The optimal arrangement for pirates appears to be if all of a country's shipping traffic is concentrated in a few and hence congested ports with busy anchorages.

4.2 High-end Piracy

For the more lucrative forms of piracy we look at the different types of attacks separately. The results are presented in tables 3 and 4. The most ambitious type of piracy is the theft of entire ships and / or major amounts of cargo. This is the turning point on the curve pictured in figure 1 and while the quadratic effect in governance is preserved in the

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[47] The Rule of Law indicator provides the best fit, but as piracy itself may feed into expert evaluation of how effective the government's control of crime is we have not reported it here.
[48] When we control for GDP per capita this effect disappears, however.

coefficients, it is (as would be expected) no longer significant. Instead we observe a very interesting interaction between two aspects of quality of governance (models 4 and 5). Piracy increases in government effectiveness which measures (among other things) the quality of public goods provision. This would include infrastructure, such as the port and dock facilities pirates need to unload the cargo and give a ship a new identity. On the other hand there is a strong negative effect on piracy as the government increases its control of corruption. Therefore we have very good evidence in favour of H4. As expected, the econometrically preferred regression equation does not include state failure as an explanatory variable, confirming hypothesis H3[49]. Finally we have evidence for Hypothesis H6 in that the existence of petty forms of maritime crime increases the likelihood of more ambitious forms of piracy occurring. Among the control variables we find evidence for the importance of opportunities for piracy again: here they are the choke points where shipping is concentrated and ships slow down for easy target selection and anchorages where ships lie idle and are not well guarded. Log of GDP *per capita* (as an indicator of poverty as a motive) is not significant alongside the governance variables (which maintain significance in specifications which include GDP per capita). We interpret this as an indicator that high-end piracy is organised crime and not driven by extreme poverty.

Model 6b shows similar results for the governance effects are obtained for the hostage taking form of piracy (on either side of the maximum point in figure 1): Both corruption and a reasonable level of government effectiveness are helpful for this form of piracy. Pirates need stability to keep their hostages safe from other groups while negotiating ransoms – if this security can be provided by corrupt government officials so much the better. However, model 6a indicates that this result is not completely robust: when we control for geographical distance from Kuala Lumpur the government effectiveness variable loses significance and distance from Kuala Lumpur takes on significance instead. Ship-owners outside Asia (where relations with the IMB reporting centre might be particularly good) might not report missing crew if the problem is quickly and cheaply resolved by paying a ransom. Therefore this governance result should be interpreted with caution here. However, hide-outs in areas neither well controlled nor actively contested by government as indicated by the (robust) significance of the low level ethnic conflict dummy. Busy anchorages provide opportunities for this form

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[49] Statefailure is at the border of significance if Somalia is included in the sample but not at all significant if Somalia is excluded. Please see discussion below.

of piracy. Again there is no evidence for a "poverty motive" from the GDP *per capita* variable.

The main governance variable determining the probability of hijacking of ships and their ransom without theft of cargo is low level violent conflict. This indicates the importance of the existence of "ungoverned territories" for anchoring ships while ransoms are being negotiated. While there appear to be benefits from corruption in specifications (7 and 8), these disappear if we control both for Somalia as a special case and for the existence of petty forms of piracy which are in themselves linked to institutional weakness (model 9). Again we have evidence that this type of piracy develops from petty forms of piracy when the conditions are right. This fits in well with explanations of Somali piracy which focus on Somali fishermen initially stealing from ships illegally fishing or dumping toxic waste in Somali waters and eventually moving on to extortion and large-scale hijack and ransom. There are no GDP per capita effects indicating that these pirates are not the opportunistic poor but relatively well resourced.

11 of the 45 positive observations of this variable are generated by Somalia and the Somalia dummy is highly significant[50]. However, the state failure variable was not significant in this model regardless of whether we controlled for Somalia. We therefore argue that the "anarchy" or "failed state" explanation of Somali piracy is not helpful. Somalia has only "failed" in the narrow sense in that the international community's preferred form of Somalia as a unitary state governed from Mogadishu is not viable. However, Somaliland is reasonably well governed (Walls, 2009) and Puntland provides sufficient stability at least for reasonably lucrative piracy. In fact, the Puntland set-up where pirates conduct their business while local elites (openly or secretly) participate in the gains most closely resembles the conditions of the historical swashbuckling accounts of piracy – except that (fortunately) 17th century style port facilities are not conducive to stealing cargo and giving ships a new identity for resale, hence the focus on ransoms.

4.3 Intensity of Piracy

Table 7 summarises the results on the intensity of (small-scale) maritime crime. We get a robust result that at the bottom end of the governance spectrum criminals benefit from improvements in security, stability and public services and reductions in predatory (corrupt)

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[50] For 2004 we have one successful hostage taking, one theft and several unsuccessful attempts on steaming ships – i.e. no successful hijack and ransom observation.

state behaviour. As governance improves further, the incidents of theft from ships begin to fall. This main result does not greatly depend on the sample or the definition of governance (we see very little difference between the a) and b) versions of the models). Once again we confirm the importance of opportunity (ports and busy anchorages give easy access to targets) and poverty as a motive for stealing from ships (the number of incidents is reduced as GDP per capita increases). The intensity regressions therefore confirm the results from the probability regressions.

4.4 Dynamics of Piracy

Table 8 includes a lagged dependent variable into both the small-scale and large-scale piracy logit regressions to investigate the persistence of piracy. In all models either the lagged dependent variable, or in the case of model 15 a related lagged piracy variable are highly significant. In model 13a we additionally see that the persistence of small-scale piracy depends on the institutional quality in the country. The interaction terms between lagged low level piracy and the governance variables are highly significant. Persistence becomes more likely with increasing governance initially and then decreases with better governance – i.e. we see occasional opportunistic piracy in high and very low governance countries and regular piracy in the middle. This clearly confirms hypothesis H7.The raw governance variables are no longer significant in this model (13b).

For attacks on moving ships (model 14) we also see persistence over time (as well as a positive effect from current or lagged low level piracy). Successful major theft (model 15) seems to be more strongly associated with low level piracy in the past (the "school of piracy" explanation) than with its own lagged value. In both cases the result for the raw institutional data remains intact and the interaction terms are not significant. Possibly, top end piracy is too rare for these interactions to become statistically significant. The message remains therefore that the combination of effective public provision alongside deep corruption furthers top end piracy - with additional benefits from learning about boarding ships for the purpose of theft and having handled significant booty in the past[51].

4.5 Sample Selection

The strength of our previous results initially improves when we exclude observations from the very bottom of the governance spectrum. This is because we are discarding an

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[51] The improved log-likelihood indicates that this regression specification is in fact econometrically preferred to equation 5.

obvious outlier - Somalia - which produces persistent and intense piracy despite its low governance score. As expected, table 9 shows that once we increase the government effectiveness threshold for excluding countries above -0.7 our result breaks down and the quadratic term is no longer significant[52]. Instead the previous result of a negative, linear relationship is once again highly significant, confirming hypothesis H8. We therefore conclude that one should be extremely careful about generalising the effects of governance obtained in the medium to high governance range to countries at the bottom of the governance spectrum.

4.6 Summary and Interpretation

The results show a clear non-linear relationship between governance and the probability, intensity and persistence of (maritime) crime. Looking at the coefficients, the models predict that optimal conditions for petty maritime criminals exist in countries where the government effectiveness score is in the region between -0.9 and -0.5 and the corruption score between -1.3 and -0.9. Countries like Bangladesh, Cambodia and Cameroon are exactly in this range, while countries such as the Democratic Republic of Congo, Haiti, North Korea and Sierra Leone are "too dysfunctional" for a thriving piracy business – at the moment! Institution-building measures in Indonesia are reflected in the considerable improvements in Indonesia's governance scores, moving pirates from being right in the "sweet spot" up until 2003 to well beyond it by 2008.

5 Conclusions

The evidence presented in this paper strongly suggests that the effect of governance on criminal activity is non-linear: criminals and especially organised crime benefit from functioning market and state structures at least to some extent. This is because criminal and legal business activities are similar in the way they are conducted and legal business ventures are often an integral part of successful organised crime. The result is highly intuitive and perfectly in line with sociological research on criminal organisations. The piracy dataset compiled by the IMB collects its data from the victims of various forms of maritime crime rather than from governments and police authorities and provides a unique picture of crime in countries which are too dysfunctional to provide sufficient data to be included in previous studies of the economics of crime.

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[52] At this point we are excluding a number of countries from the regression which are generally missing from econometric analyses, such as Angola, Cambodia, the Congo, Eritrea, Iran, Iraq, Liberia, Myanmar, Sierra Leone, Somalia, Sudan, Vietnam and Yemen.

Specifically, we were able to show that even low level maritime crime benefits from improvements in governance for some parts of the governance spectrum as opportunities for theft and enjoying the fruits of crime improve. In weakly governed countries, piracy can become endemic, while in ungoverned, failed states and well governed countries piracy occurs only very occasionally. Overall a quadratic specification fits the relationship between governance and petty maritime crime best.

For piracy businesses at the top of the spectrum (and by extension other forms of lucrative organised crime) we showed that optimal conditions arise when corrupt elites or bureaucracies are able to provide selective access to excellent physical infrastructures and thriving markets in return for bribes. Given that the various aspects of institutional quality tend to be highly correlated, such conditions arise only rarely. They can occur when a sudden deterioration in economic performance or political stability undermines discipline and commitment in the civil service, as was demonstrated in Indonesia after the Asian crisis.

Lastly, we were able to provide evidence that the Kaufmann governance indicators, which provide a broad picture of institutional quality at the national level, may not adequately capture "pockets of lawlessness" within countries. When criminal or insurgent / dissident groups control coastal areas we may well see them developing a piracy branch to increase the profitability of their operations.

We cannot be sure that our results on the effect of governance on maritime crime can be generalised to other forms of crime. However, the current problems of rich European countries with organised criminal gangs from Eastern Europe and Asia suggests that well developed markets and infrastructures are more attractive to these criminals than the conditions in their poor and unstable home countries. The Italian Mafia thrives in an environment where government effectiveness and corruption exist alongside one another: precisely the conditions our models suggest helps sophisticated organised criminal gangs. What our result does show clearly, is that the established result of a negative, linear relationship obtained by analysing (mostly or exclusively) reasonably well governed countries does not necessarily apply to countries at the bottom of the governance spectrum. Criminality might increase as markets create new opportunities and can become endemic unless bureaucrats are incentivised to tackle rather than tolerate or protect criminal organisations. This insight needs to be factored into policy advice to countries emerging from state failure.

Regarding policy advice for combating piracy, the result that the effect of governance is non-linear is critical. For land-based approaches to resolving piracy to become effective

governance structures need to be strengthened beyond the point where the improvements provide a net gain to pirates. The focus of such approaches needs to be on eliminating corruption and targeting (political and criminal) groups tolerant of piracy which control coastal territories. Our explanation for the successful reduction in pirate activity in the Malacca Straits is that the conditions for pirates were optimal in the turmoil after the Asian crisis and during the conflict in Aceh. Therefore a subsequent improvement of institutional quality had the desired effect of moving pirates "down the curve" in figure 1 to the right of its turning point. However, the continued existence of petty maritime crime in the region suggests that pirates are to some extent biding their time: top-end piracy can re-emerge as soon as the political or economic situation in Indonesia deteriorates and bureaucrats once again look for bribes to supplement incomes. For piracy in Nigeria the results suggest that if the "*Mend*" group succeeds in creating an autonomous region which is no longer contested by the Nigerian government piracy will increase and more lucrative forms of piracy will be developed.

The Somalia problem has very deep roots. More violent contest over who provides governance in Puntland would probably reduce piracy in the region. A peaceful settlement, however, where Puntland is given greater independence (with resulting improvements in political stability and physical infrastructure) could move pirates even further into their "sweet spot". If Puntland's elites could be convinced by the international community to become less tolerant of openly conducted hijack and ransom piracy, the most likely initial outcome would be a change in pirates' tactics to hostage-taking and jettisoning the ships.

Finally, piracy is likely to remain a problem in the long term, as countries where opportunities for piracy exist emerge from state failure and start to develop markets and infrastructure. Such improvements combined with corruption or semi-autonomous regions could lead to the development of pirate activity until institutional quality becomes sufficiently high for governments to be able to intervene effectively.

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Diagram 1: Distribution of Intensity of (all acts of) Piracy
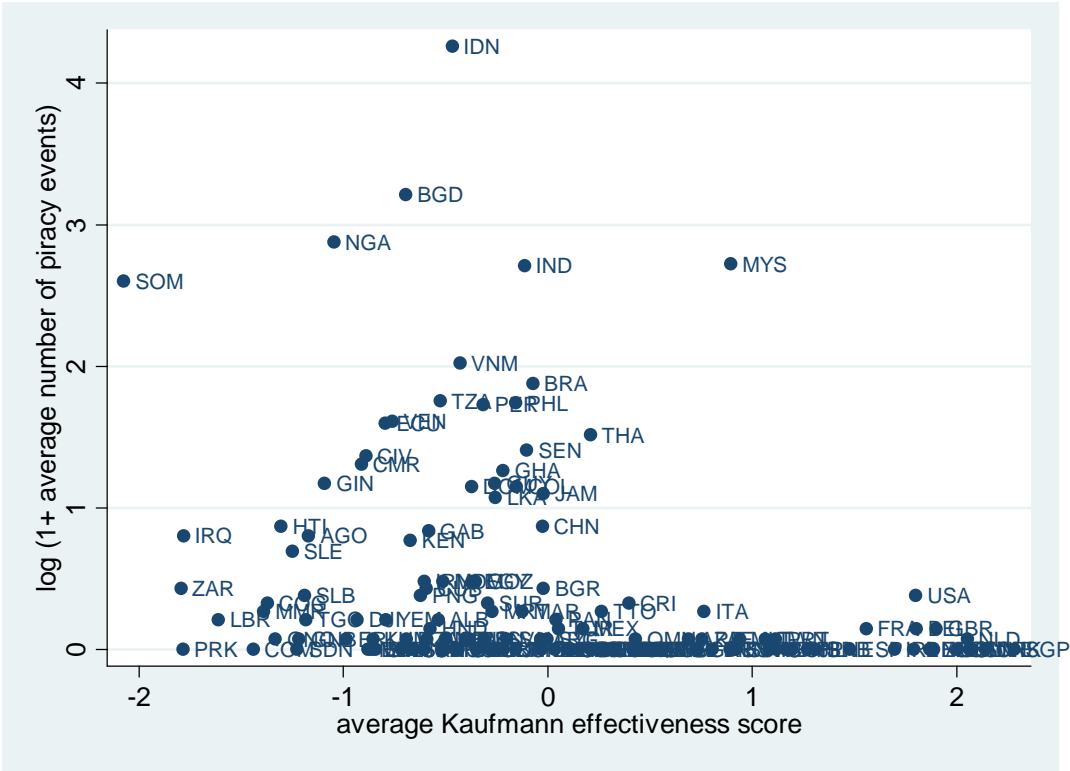
Diagram 2: *Hypothesised Relationship between Piracy and Governance*
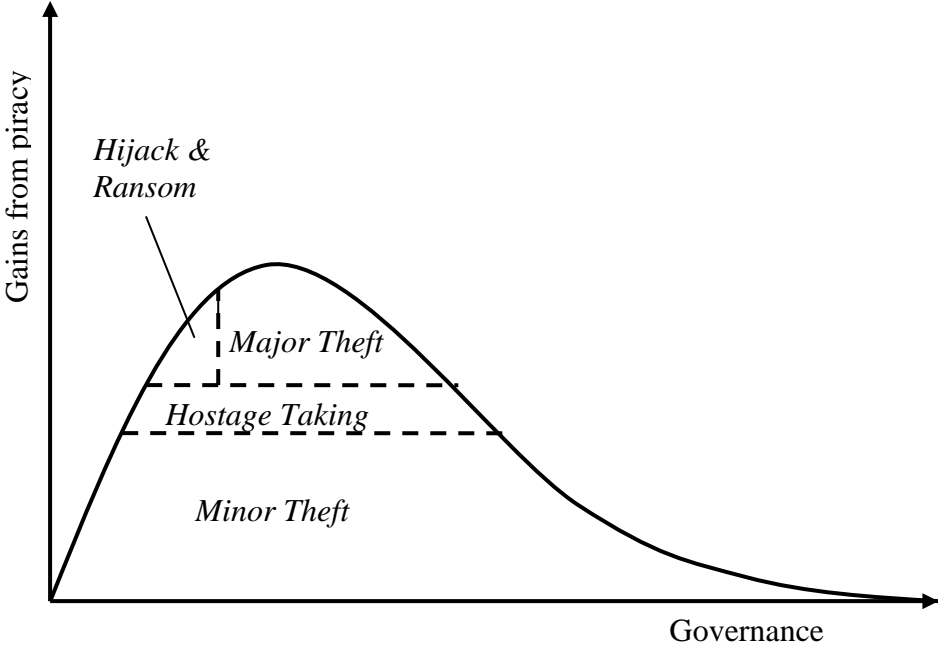
Diagram 3: *Different types of economically successful piracy*
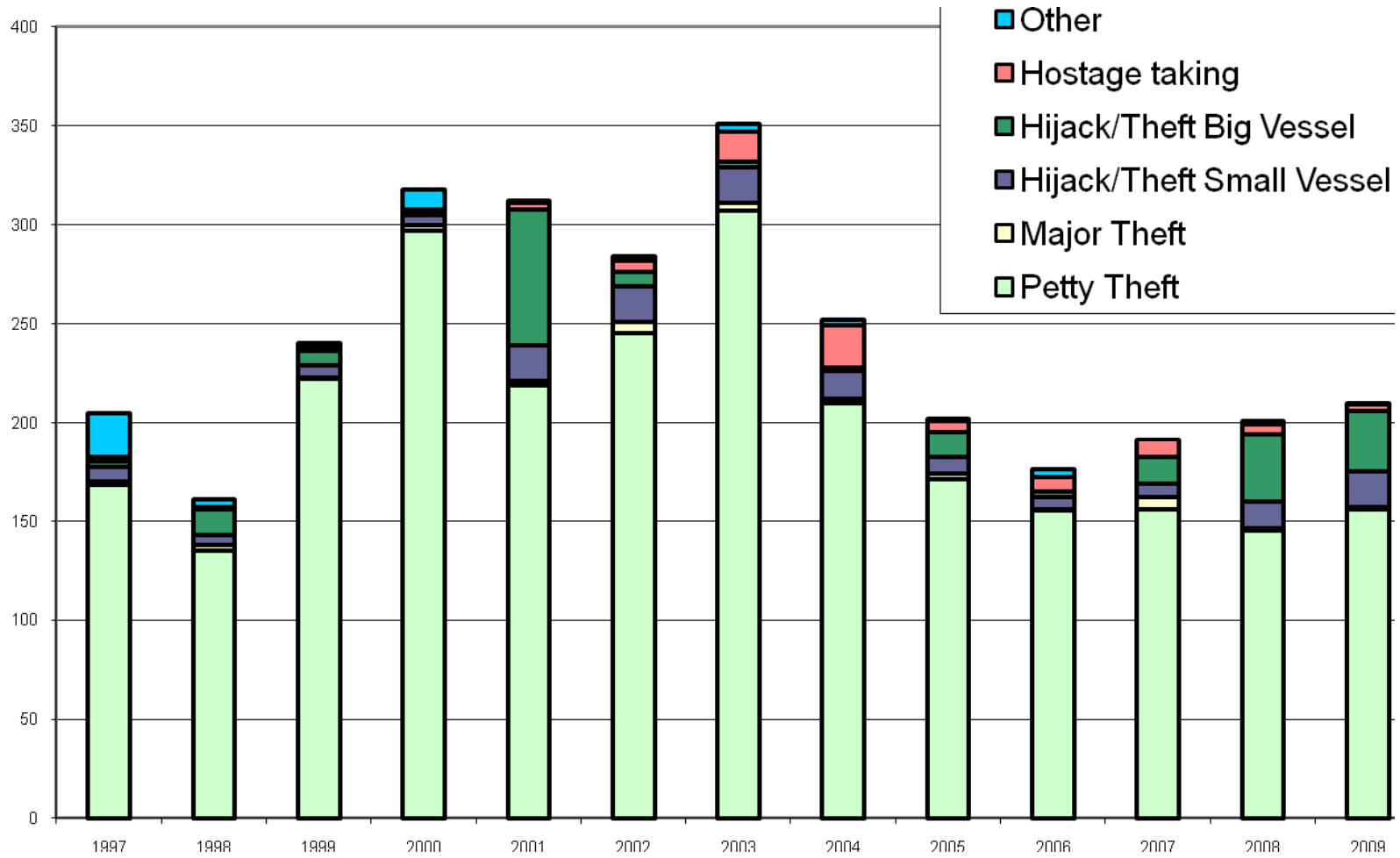
Table 1. Summary statistics for all piracy events

	Successful piracy						Unsuccessful	
	Petty Theft	Major Theft	H&R/theft SV	H&R/theft BV	Hostage	Other	Stationary	Non-stationary
1997	168	2	7	3	2	23	13	16
1998	135	3	5	13	1	4	8	28
1999	222	1	6	7	2	2	16	45
2000	297	3	5	1	2	10	44	109
2001	219	2	18	69	3	1	31	69
2002	245	6	18	7	6	2	42	44
2003	307	4	18	3	15	4	25	89
2004	210	2	14	2	21	3	32	61
2005	171	3	8	13	6	1	14	63
2006	155	1	6	3	7	4	23	40
2007	156	6	7	13	9	0	94	26
2008	145	1	14	34	5	2	11	82
2009	156	1	18	31	3	1	19	186

Table 2 Descriptive Statistics of all variables used

Variable	Control type	N	Mean	St.Dev.	Minimum	Maximum
Dummy variables						
Successful minor theft		1976	0.177	0.381	0	1
Minor theft		1976	0.199	0.400	0	1
Minor theft + attacks on stationary ships		1976	0.209	0.406	0	1
Big ships and major theft		1976	0.020	0.141	0	1
Big and small ships and major theft		1976	0.031	0.173	0	1
Hostage-taking		1976	0.008	0.087	0	1
Hijack and Ransom		1976	0.023	0.149	0	1
Intensity variables						
Successful minor theft		1976	1.282	6.334	0	124
Minor theft + Attack on stationary ships		1976	1.469	7.251	0	140
Controls						
ln(gdp per capita)	motive	1787	8.920	1.144	5.733	11.388
State failure	means	1976	0.016	0.126	0	1
Civil (2)	means	1972	0.010	0.100	0	1
Low conflict	means + motive	1976	0.081	0.273	0	1
Deep ports	opportunity	1976	1.822	3.477	0	28
Anchorage	opportunity	1787	0.670	1.883	0	24.154
Choke	opportunity	1976	0.085	0.279	0	1
Drug exports	means	1976	0.124	0.330	0	1
Corruption (WB cce+4)	opportunity/means	1728	4.022	1.000	1.984	6.625
Government effectiveness (WB gee+4)	means	1756	4.023	0.996	1.489	6.531
ln(Kuala Lumpur)	report bias	1963	9.053	0.659	5.759	9.861

Table 3 Data Definitions and Sources

Variable	Source	Definition
Dummy variables		
Successful minor theft	International Maritime Bureau Annual Report	Actual theft of small amount of goods, defined (approximately) as the amount the pirate(s) are able to carry by themselves
Minor theft	International Maritime Bureau Annual Report	Actual and attempted theft of small amount of goods
Minor theft + Attack on stationary ships	International Maritime Bureau Annual Report	Actual and attempted theft of small amount of goods + attacks on ships that are stationary (berthed or anchored)
Big ships and major theft	International Maritime Bureau Annual Report	Theft of large ships (trawler or greater) + theft of large amount of goods
Big and small ships and major theft	International Maritime Bureau Annual Report	Theft of large ships + theft of small ships + theft of large amount of goods
Hostage-taking	International Maritime Bureau Annual Report	Piracy cases where individuals are held for ransom, but the ship is not
Hijack and Ransom	International Maritime Bureau Annual Report	Piracy cases where both ship and crew are held for ransom
Intensity variables		
Successful minor theft	International Maritime Bureau Annual Report	Number of cases of actual theft of small goods
Minor theft + Attack on stationary ships	International Maritime Bureau Annual Report	Number of cases of actual theft of small goods + attacks on ships that are stationary
Controls		
ln(gdp per capita)	Penn World Tables	log of GDP per capita (in 2006$)
State failure	Polity IV Project	Dummy variable that takes value 1 if Polity IV reports -77
Civil (2)	Major Episodes of Political Violence	Country-years where a civil conflict of intensity 2 takes place
Low conflict	Major Episodes of Political Violence	Low level civil or ethnic conflict dummy: 0< MEPV score<4
Deep ports	World Shipping Register	Number of ports with a draft equal to the New Panamax standard (15.2 meters)
Anchorage	Baltic Dry Index, World Shipping Register and Penn World Table	Indicator for anchorage, as defined in the text
Choke	Kaluza *et al* (2010) and Rodrigue (2004)	Choke points for tanker and container traffic
Drug exports	International Narcotics Control Strategy Report	Dummy for countries mentioned as significant non-synthetic drug producers
Corruption (WB cce+4)	Kaufmann et al. (2010)	Extent to which power is exercised for private gain
Government effectiveness (gee+4)	Kaufmann et al. (2010)	Quality of civil service
ln(Kuala Lumpur)	self-collected	log of the distance between a country's capital and Kuala Lumpur

Table 4: Small-scale Maritime Crime

Model	1a	1b	2a	2b	3a	3b
Dependent:	Successful minor theft	Successful minor theft	Successful / unsuccessful minor theft	Successful / unsuccessful minor theft	Attacks on stationary ships	Attacks on stationary ships
Constant	-6.914*	0.070	-6.376**	2.025	-6.494**	2.062
	(3.602)	(4.188)	(2.822)	(3.577)	(2.834)	(3.598)
Corruption Control	3.126*	3.223*				
	(1.869)	(1.906)				
(Corruption Control)^2	-0.602**	-0.541**				
	(0.243)	(0.247)				
Govt effectiveness			2.855*	2.917**	2.972**	3.114**
			(1.467)	(1.487)	(1.475)	(1.502)
Gov-eff-sq			-0.549***	-0.460**	-0.567***	-0.483**
			(0.193)	(0.194)	(0.195)	(0.196)
LnGDP Per capita		-0.975***		-1.168***		-1.215***
		(0.319)		(0.335)		(0.336)
Civil Conflict (2)	2.302**	2.108**	3.181**	2.780**	3.126**	2.726**
	(1.079)	(1.041)	(1.406)	(1.294)	(1.406)	(1.293)
Drug exports	1.057*	0.952	0.867	0.728	1.242**	1.070*
	(0.566)	(0.599)	(0.606)	(0.630)	(0.620)	(0.641)
Deep Ports	0.757***	0.961***	0.790***	1.005***	0.799***	1.041***
	(0.227)	(0.309)	(0.259)	(0.311)	(0.272)	(0.316)
Deep-ports-sq	-0.031*	-0.044	-0.035	-0.049*	-0.036	-0.053*
	(0.019)	(0.029)	(0.023)	(0.029)	(0.024)	(0.029)
Log-likelihood	-469.672	-458.891	-509.542	-495.069	-517.462	-499.992
N	1728	1694	1756	1722	1756	1722

Table 5 Top end Piracy

Model	4	5
Dependent:	big vessel and major cargo theft	vessel and major cargo theft
Constant	-2.214*	-3.846***
	(1.227)	(1.064)
Corruption Control	-2.396***	-1.906***
	(0.765)	(0.586)
Govt effectiveness	1.491**	1.550***
	(0.625)	(0.586)
Choke Point	1.879***	2.125***
	(0.459)	(0.476)
Anchorage	0.164***	0.171***
	(0.048)	(0.052)
Petty Piracy	1.606***	1.413***
	(0.469)	(0.437)
Log-likelihood	-127.480	-174.875
N	1694	1694

Table 6 Hostages and Hijack and Ransom

Model	6a	6b	7	8	9
Dependent:	Hostage-taking	Hostage-taking	Hijack and ransom (big or small)	Hijack and ransom (big or small)	Hijack and ransom (big or small)
Constant	19.249**	-4.490	-3.299**	-2.978*	-4.508***
	(8.981)	(3.721)	(1.399)	(1.556)	(1.435)
Corruption	-7.593**	-6.451***	-0.647*	-0.895**	-0.360
	(3.110)	(2.275)	(0.364)	(0.400)	(0.358)
Govt effectiveness	3.696	5.182***			
	(2.390)	(1.988)			
Ethnic Conf (1)	1.999**	2.442**			
	(0.941)	(0.942			
Low Conflict			2.049***	1.523***	1.874***
			(0.524)	(0.537)	(0.520)
Somalia dummy			5.604***		7.320***
			(1.934)		(1.781)
Choke Point			1.858***	2.673***	
			0.700	(0.686)	
Anchorage	0.341***	0.322***			
	(0.092)	(0.098)			
Petty Piracy				1.387***	1.522***
				(0.509)	(0.513)
ln(Kuala)	-1.738**				
	(0.789)				
Log-likelihood	-28.008	-37.602	-117.029	-117.658	-115.939
N	1682	1694	1728	1728	1728

Table 7 Regression results for the intensity of piracy

	10a	10b	11a	11b	12a	12b
	Countries with at least one act of piracy				All countries	
Dependent:	Successful / unsuccessful minor theft	Successful / unsuccessful minor theft	Attacks on stationary ships	Attacks on stationary ships	Successful / unsuccessful minor theft	Attacks on stationary ships
Constant	-1.306	-1.156	-1.228	-0.971	0.728	0.850
	(1.910)	(1.746)	(1.922)	(1.735)	(2.110)	(1.907)
Corruption Control	1.951**		1.919**		1.581*	
	(0.864)		(0.881)		(0.912)	
(Corruption Control)^2	-0.319***		-0.317***		-0.287**	
	(0.115)		(0.117)		(0.121)	
Govt effectiveness		1.972***		1.887**		1.674**
		(0.746)		(0.742)		(0.762)
Gov-eff-Sq		-0.290***		-0.279***		-0.264***
		(0.099)		(0.099)		(0.101)
Deep Ports	0.200***	0.180***	0.185***	0.162***	0.179***	0.167***
	(0.054)	(0.055)	(0.055)	(0.055)	(0.050)	(0.050)
lnGDP per capita	-0.241*	-0.307**	-0.233*	-0.304**	-0.474***	-0.569***
	(0.140)	(0.153)	(0.138)	(0.152)	(0.157)	(0.170)
Anchorage			0.047*	0.054**	0.064**	0.069***
			(0.025)	(0.024)	(0.025)	(0.025)
Log-likelihood	-808.372	-812.912	-833.956	-839.204	-885.037	-892.453
N	966	972	966	972	1694	1722

Table 8: Piracy Dynamics

	13a	13b		14	15
Dependent:	Successful / attempted minor theft	Successful / attempted minor theft	*Dependent:*	Attacks on moving ships	Vessel and major cargo theft
Constant	7.461***	7.461***	*Constant*	-5.757***	-6.41***
	(1.864)	(1.864)		(0.449)	(0.562)
Lag s/a minor theft	11.88***	11.995***	*Lag att. minor theft*	1.956***	2.264***
	(3.48)	(30.635)		(0.437)	(0.539)
Govt effectiveness		-0.317	*Lag attacks on moving*	1.134**	
		(1.498)		(0.517)	
(Govt effectiveness)^2		-0.071	*Corruption Control*	-2.227***	-2.298***
		(0.187)		(0.737)	(0.858)
Interaction laggedminor effectiveness*	5.44***	5.593***	*Govt effectiveness*	1.614***	1.4**
	(1.572)	(1.651)		(0.62)	(0.673)
*Interaction laggedminor * effectiveness^2*	-0.649***	-0.651***	*Anchorage*	0.138***	0.169***
	(0.21)	(0.219)		(0.058)	(0.051)
Deep Ports	0.201***	0.234***	*Choke*	1.96***	1.89***
	(0.067)	(0.07)		(0.445)	(0.471)
Drug dummy	1.788***	1.683			
	(0.558)	(0.553)			
Civil conflict (level2)	2.468*	2.418			
	(1.413)	(1.403)			
Ln GDP per capita	-1.244***	-0.765***			
	(0.210)	(282)			
Log-likelihood	-454.471	-451.135	*Log-likelihood*	-140.666	-110.449
N	1583	1583	*N*	1576	1576

Table 9: Sample Selection Example

	16a	16b	16c
Dependent variable	Attacks on stationary ships (minor theft type)		
Sample	Excluding government effectivess score <-0.7	Excluding government effectivess score <-0.6	Excluding government effectivess score <-0.6
Constant	-8.955	1.653	4.517***
	(8.859)	(9.332)	(1.732)
Govt effectiveness	9.263**	4.58	-2.092***
	(4.152)	(4.306)	(0.428)
Gov-eff-Sq	-1.12**	-0.618	
	(0.467)	(0.477)	
Drugs	1.296**	1.704**	1.899***
	(0.619)	(0.704)	(0.697)
Deep Ports	1.06***	1.090***	0.841***
	(0.312)	(0.31)	(0.298)
Deep Ports-Sq	-0.511*	-0.053**	-0.0439
	(0.29)	(0.028)	(0.027)
Log-likelihood	-341.267	-322.304	-330.962
N	1350	1273	1273

Countries missing from both restricted samples: Albania, Angola, Bangladesh, Bosnia and Herzegovina, Cambodia, Cameroon, Comoros, Congo, Dem. Rep., Congo, Rep. Cote d'Ivoire, Cuba, Djibouti, Dominica, Dominican Republic, Ecuador, Equatorial Guinea, Eritrea, Fiji, Gabon, The Gambia, , Guinea, Guinea-Bissau, Haiti, Honduras, Indonesia, Iran, Islamic Rep., Iraq, Kenya, Korea, Dem. Rep., Liberia, Liberia, Libya, Marshall Islands, Mauritania, Myanmar, Nicaragua, Nigeria, Pakistan, Palau, Papua New Guinea, Sao Tome and Principe, Serbia, Sierra Leone, Solomon Islands, Somalia, Sudan, Suriname, Syrian Arab Republic, Tanzania, Togo, Ukraine, Vanuatu, Venezuela, Yemen
Additional countries missing from second sample: Algeria, Bulgaria, Georgia, Guatemala, Kiribati, Lebanon, Madagascar, Micronesia, Peru, Romania, Tonga, Vietnam