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Abstract

This paper focuses on the impact of maritime piracy on international trade. Piracy increases the cost of international maritime transport through an increase in insecurity regarding goods deliveries. Bilateral trade flows between the main European and Asian countries over the 1999 to 2008 period are used to estimate an augmented gravity model that includes various measures of piracy acts. We found robust evidence indicating that maritime piracy reduces the volume of trade; the effect of ten additional vessels hijacked being associated to an 11% decrease in exports. Using these results, the international cost of piracy in terms of trade destruction is estimated to be 28 billion dollars. Finally, we compare the cost of low intensity conflict like Somalia, to the cost of a full scale conflict (Afghanistan) and to the cost of an autarkic state (North Korea) for the international community in the year 2008.The results indicate that the cost of war more than doubles the cost of low intensity conflict.

Keywords: Piracy, International trade, Gravity equation, cost of conflict, security

JEL Classification: F10, F51

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1. INTRODUCTION

International maritime piracy is a growing phenomenon, particularly in its disruption of the main trade route linking Europe and Asia. According to the International Chamber of Commerce (ICC), in 2009 Somali pirates hijacked 47 vessels, took 867 crewmembers hostage and carried out no less than 217 violent attacks on ships. All this took place after the United Nation Security Council (UNSC) passed a resolution authorizing the deployment of a sizeable naval force in the region to protect ships and their crews. From the economic point of view, piracy affects international trade through an increase in insecurity related to the prompt delivery of the goods transported.

Recent research has dealt with various sources of insecurity (corruption, piracy, terrorism) by modelling the long-term effect insecurity has on trade (Anderson 2008; Anderson and Bandiera 2006; Anderson and Marcouiller 2002, 2005). Anderson and Marcouiller (2002) have made the point that inadequate institutions constrain trade far more than tariffs do. Empirical analysis in this area has focused on the impact of violent acts such as terrorism, civil wars and external conflicts on trade (Nitsch and Schumacher, 2004; Blomberg and Hess, 2004; Mirza and Verdier, 2008 and De Sousa, Mirza and Verdier, 2009). In this paper, however, we focus on the impact of maritime piracy on trade, which has not yet been studied, at least to our knowledge. The main advantage in doing this is that it allows us to cover a gap in the literature by addressing violent acts in third-party countries' waters, as Mirza and Verdier (2008) suggested.

Piracy increases the cost of international maritime transport since higher premiums must be paid to crews sailing through dangerous waters, and the cost of insuring the goods shipped also increases. Alternatively traders can adopt longer and costlier trade routes

or change to alternative means of transport (products with a high value/weight ratio could switch to air-freight). The longer route around the Cap of Good Hope is an option considered by maritime companies, but it was not used before 2008, and only very scarcely since (Bendall, 2010).

Data scarcity may partly explain why we have been unable to locate any studies estimating the effects of piracy on trade. For the purposes of this paper, however, we have used new data on piracy attacks supplied by the International Piracy Center (IPC) and empirical research that increasingly introduces accurate measures of insecurity into gravity equations (e. g. Marcouiller, 2000; Anderson and Marcouiller, 2002; Nitsch and Schumacher, 2004; Blomberg and Hess, 2004; Mirza and Verdier, 2008; Wilmsmeier and Martínez-Zarzoso, 2010).

Our aim is twofold: On the one hand we estimate the impact of maritime piracy on maritime trade between Europe and Asia using data on incidents of piracy between 1999 and 2008. In doing so, we account for omitted variable biases and control appropriately for potential endogeneity between acts of piracy and trade. We also investigate whether there has been any substitution effect between transport modes as a consequence of escalating maritime piracy. On the other hand, we estimate the cost of maritime piracy and compare it to the cost of a full scale conflict (Afghanistan) and to the cost of an autarkic state (North Korea) for the international community in the year 2008.

According to our findings, the effect of ten additional vessels hijacked is associated to an 11% decrease in exports and the international trade-related-cost of piracy is estimated to be around 28 billion dollars. The results indicate that the estimated cost of war almost doubles the cost of low intensity conflict.

The paper is structured as follows: In section 2 we review the related literature on insecurity and international trade; in section 3 we present the data used and some descriptive statistics; in section 4 we outline our model, empirical estimation and our main results; in section 5 we discuss the cost of modern maritime piracy for the international community and in section 6 we present our conclusions and ideas for further research.

2. INSECURITY AND TRADE

It is a widely accepted assumption that insecurity decreases trade opportunities. As noticed by Anderson (2008) most of us lived in a more or less 'predatory world', which makes it surprising that few papers have tried to determine to which extent trade is lowered by insecurity.

Anderson and Marcouiller (2005), Anderson and Bandiera (2006) and Anderson (2008) have modelled theoretically the conditions under which endogenous transactions costs, due to criminal activities like piracy, will destroy trade. Anderson and Marcouiller (2005) show how difficult it is for countries to abandon autarky and open up to trade when no institutions are available to protect transactions. Anderson and Bandiera (2006) developed a simple model for contract enforcement carried out by an exogenous agent, such as the mafia or private police forces. Anderson (2008) applies the same conceptual framework to show how merchants can organize through guilds or granted monopolies to protect their transactions.

Marcouiller (2000) and Anderson and Marcouiller (2002), have used the gravity model of trade to research empirically the extent to which insecurity deters trade. We have chosen to follow the same strategy in this paper. Anderson and Marcouiller (2002) used institutional measures to determine the degree of security enjoyed by a particular country. They differentiate between transparency (measures declared to be taken to fight insecurity) and enforceability (the measures, among the former, which are actually carried out). They found that the more transparency the highest the trade volume. In an unpublished paper based on an earlier version of Anderson and Marcouiller (2002), Marcouiller (2000) investigates whether insecurity problems affect all type of goods in the same fashion. Using Rauch's classification (1999) that splits goods into

homogenous, price-referenced goods and differentiated goods, the author finds that insecurity affects trade whatever the type of good. When differentiating between contract insecurity and the prevalence of crime and theft, however, trade in homogeneous goods appears to be more vulnerable to crime and theft, whereas trade in differentiated goods is more sensitive to contract insecurity. Marcouiller (2000) defines piracy and hijacking as stealing merchandise in order to sell it illegally. But this kind of criminal activity, in spite of being frequent in many ports, is only weakly related to the type of piracy we are concerned with in this paper, which mainly involves the hijacking of a ship and its crew. The chief economic motive behind these hijackings is to obtain a substantial ransom for the crew, the ship and its cargo, not to sell the looted goods. The variables used by Marcouiller (2000) and Anderson and Marcouiller (2002) measure merchandise security at the start and end points of the journey. They do not deal with security failures during the course of the journey, such as those involving acts of piracy. This paper addresses this particular issue by using data on maritime piracy.

Refining the analysis initiated by Anderson and Marcouiller (2002), Nitsch and Schumacher (2004) and Blomberg and Hess (2004), distinguish several types of violent acts: terrorism, civil wars, external conflicts, riots and uprisings. They find each of these to have a significant negative impact on bilateral trade. Nitsch and Schumacher (2004) find bilateral trade to drop by 4% if a country experiences a 100% rise in terrorist activity, while Bloomberg and Hess (2004) find that a single terrorist attack leads to a 7.6% decline in that country's bilateral trade. Both studies conclude that external and internal armed conflicts have a greater impact on trade than terrorism does. Mirza and Verdier (2008) and De Sousa, Mirza and Verdier (2009) focus exclusively on terrorist activities. The first of these studies highlights the specificities of terrorism and their relevance for the strategy used to estimate its effect on bilateral trade. Terrorist acts are

directional since they are perpetrated against the interests of a targeted nation by individuals of a perpetrator nation on the soil of the targeted nation, the perpetrator nation, or a third country. Hence terrorist acts have an impact on the bilateral trade relations between the targeted nation and the perpetrator nation, as well as between the neighbouring countries of the perpetrator nation and the targeted nation. Terrorist attacks also have a direct impact on the GDP of the targeted nation, and measures undertaken to fight terrorism impact bilateral trade. Moreover, the incidence of terrorist activity depends on the security measures undertaken to prevent it and on the extent to which modern economies are made vulnerable by their openness. To assess the impact of terrorism on bilateral trade, the global effect of trading with a terrorist country must be differentiated from the effect of bilateral terrorism on trade. Consequently, the endogeneity problems resulting from the effects of terrorism on GDP, and of security measures on terrorism must be taken into account. Mirza and Verdier (2008) single out the case of the impact of terrorism on imports to the United States (US) from countries in which terrorism against the US originates. In order to circumvent the problem created by the impact of security measures on bilateral trade, they use terrorist incidents targeting the US located in a third-party country (neither the US nor the perpetrator's country). They found that a 1% increase in terrorism reduces US imports from the perpetrator's country by around 0.01 %.

Modern maritime piracy differs from terrorism in several respects. Attacks occur on route instead of being directed against a particular country. According to Mejia and al (2009) pirates do not choose their targets according to the origin of the ships. They do, however, try to avoid ships sailing under the flag of a country with a naval force in the area (Kiourktsoglou and Coutroubis, 2010). Piracy may have a significant impact on GDP of the trading countries through a drop in trade, but its impact through asset

destruction or enhanced security measures is minimal. Conversely, the latter do have an impact on the amount and nature of piracy.

3. DATA AND VARIABLES

3.1. A Geography of Maritime Trade and Piracy

Our source of data on piracy incidents is the International Maritime Bureau (IMB) Live Piracy Report. It provides data on all Piracy and Armed Robbery incidents reported to the IMB Piracy Reporting Centre. The IMB is a specialized division of the International Chamber Of Commerce (ICC) established in 1981 to act as a focal point in the fight against all types of maritime crime and malpractice. Piracy suppression is one of the IMB's main areas of expertise, the alarming rise in incidents having led to the creation of the Kuala Lumpur-based IMB Piracy Reporting Centre in 1992. It maintains a round-the-clock watch over the world's shipping lanes, reporting pirate attacks to local law enforcement agencies and issuing warnings about piracy hotspots to shippers.

Figure 1 shows the main maritime routes in 2002. Most of the traffic connects the most economically powerful regions: North America-Europe, North America-Asia, and Europe-Asia. Routes linking Europe and Asia have the particularity of using specially narrow passages: the Straits of Gibraltar, the Suez Canal, the Strait of Bab el Mandab between Yemen and Djibouti and the Straits of Malacca between Sumatra and Malaysia. These passages suffer congestion problems and the countries flanking them are often politically unstable.

Figure 1. Map of Maritime Shipping Routes in 2002

In recent years, incidents of piracy acts have occurred in the vicinities of the Malacca and Bad el Mandab Straits, as well as in the Gulf of Aden along the shores of Somalia (See Figure 2). Somalia continues to endure a protracted civil war and is one of the most politically unstable countries in the world; the region of the Malacca Straits contains many small islands where the Indonesian government has no real control and which can be easily used by pirates as safe-havens. Merchandise being transported between Europe and Asia is, therefore, frequently endangered by piracy, be it in the Gulf of Aden or in Indonesian waters.

Figure 2. Map of the Locations of Piracy Acts in 2008

In order to examine the extent of the problem posed by piracy to shipping between Europe and Asia, and to determine differences in levels of danger by region, we have divided the oceans between the two continents into five regions: the European Seas (ES) from the coastal areas of Iceland and Norway in the North to the waters of the Canary Islands in the South, in addition to the Mediterranean and Black Seas; the Red Sea and Gulf of Aden (RSGA) which includes a vast area of the Indian Ocean along the shores of Oman, Somalia and Tanzania; the Indian Sub-Continental Seas (ISBS) along the shore of Pakistan, India, Bangladesh, Ceylon and the Maldives; the South-East-Asian Seas (SEAS) comprising the waters of Indonesia and the Philippines, as well as those of Malaysia, Vietnam, Thailand, Myanmar and Cambodia; and lastly the East-Asian Seas (SEC) which encompasses the Yellow Sea between China and Korea, the East and South China Seas, and the Japanese coasts .

Figure 3. Maritime Regions

A ship heading from a port in northern Europe to China must cross all five maritime regions; four if it stops its journey in Singapore and three if it unloads its shipment in Mumbai. We have been able to count the number of incidents of piracy occurring annually in each of the five regions between 1997 and 2008, as well as the number of incidents on three different routes linking Europe and Asia over a 12-year period (see Table A.1 and Graph A.1 in the Appendix).

We differentiate between three kinds of incident according to the extent to which the ship's journey is disrupted: Attempted acts of piracy, boardings and hijackings. An attempted piracy act occurs when pirates board a ship and abandon it empty-handed after being discovered, or in instances in which a ship is fired upon without being stopped. Instances of boardings entail actual boarding of a ship by pirates and theft (generally the personal belongings of the crew and/or goods carried for crew maintenance and en-route ship repairs). These incidents may involve violence against the crew. The last type of piracy act, hijacking, consists in the seizure of the ship and its crew, the immobilization of the ship in a coastal area under the control of the pirates and a ransom being demanded in exchange for the crew members, the ship and its cargo. It is most obviously hijackings that are the most disruptive for maritime trade. Table 1 shows the quantitative evolution of piracy incidents over time. It is worth noting the sharp increase in hijackings in 2008 in comparison to previous years.

Table 1. Number of piracy acts by type on the Europe-East Asia Route

3.2. Variables

In this section we set out the variables used in our empirical work, focusing on our target variable: piracy incidents. Sources and variable definitions are listed in Table A.2. Four of these variables concern piracy incidents: *t_tot* represents all piracy incidents (attempted boardings and successful ones) on a particular route, *t_attempt* is for all failed boarding attempts, *t_boarded* we use for incidents in which a ship has been boarded but not hijacked, and finally *t_hijack* stands for hijacked ships. We expect the *t_tot* to correlate negatively with bilateral maritime trade. Moreover, we expect that the more disruptive acts of piracy (hijackings) to have a greater negative impact on bilateral maritime trade.

Our other variables are classical variables for gravity equations: distance ($Dist_{ij}$), is expected to be negatively related to bilateral maritime trade, colonial links ($Colony_{ij}$) and common official language (*Comlang_off)* are expected to be positively related to bilateral maritime trade. The GDPs per capita and populations of the importer and exporter (Yh_i, Yh_j and Pop_i, Pop_j respectively) are used as control variables as suggested in the gravity model literature. We expected GDPs per capita to be positively related to bilateral maritime trade and populations to be negatively related to maritime trade. A summary of the statistics used is presented in Table 2.

Table 2. Statistical Summary

4. EMPIRICAL APPLICATION

4.1. Model Specification

The gravity model of trade is currently the most widely accepted framework for modeling bilateral trade flows (Anderson, 1979; Bergstrand, 1985; Anderson and van Wincoop, 2003; Helpman, Melitz, and Rubinstein, 2008). In it, bilateral trade levels are

usually related to the nominal incomes and populations of the countries involved, to the distance between economic centres of both, and to a number of trade impediments and facilitation variables. Dummy variables, such as former colonies, common language, or a common border, are generally used as proxies for these factors. The gravity model has been widely used to investigate the role played by specific policy or geographical variables in bilateral trade flows. In this case we use incidents of piracy on a given route to augment the traditional model, adding alternatively number of attempts, boarded ships, hijacks or total number of incidents to the trade hindering variables. Introducing time variation the augmented gravity model is specified as

$$X_{ijt} = \alpha_0 \; YH_{it}^{\alpha_1} YH_{jt}^{\alpha_2} Pop_{it}^{\alpha_3} Pop_{jt}^{\alpha_4} Dist_{ij}^{\alpha_5} Piracy_{ijt}^{\alpha_6} F_{ij}^{\alpha_7} \; u_{ijt} \quad (1),$$

where X_{ijt} are the exports from country i to country j in period t in current US$; YH_i (YH_j) indicates the GDP per capita of the exporter (importer), Pop_i (Pop_j) expresses exporter (importer) populations, $Dist_{ij}$ is geographical distances between countries i and j, and F_{ij} represents other factors hindering or facilitating trade (e.g., common language, a colonial relationship, or being landlocked). $Piracy_{ijt}$ is the number of piracy incidents on the trade route linking the two countries i and j.

Lags are included in the model along with piracy variables, as incidents of piracy will affect decisions for shipping in the following years. In this manner we hope to avoid inverse causality issues, as incidents of piracy may be expected to be higher in crowded sea lanes, where traffic is dense and the possibilities for attacking vessels are greater.

The model is generally estimated in log-linear form. Using logarithms for Equation 1, the gravity model is specified as follows.

$$LX_{ijt} = \gamma_0 + \phi_t + \delta_{ij} + \alpha_1 LYH_{it} + \alpha_2 LYH_{jt} + \alpha_3 LPop_{it} + \alpha_4 LPop_{jt} + \alpha_5 LDist_{ij} + \alpha_6 Piracy_{ijt} + \alpha_7 F_{ij} + \eta_{ijt} \quad (2),$$

where L expresses variables in natural logs, the other explanatory variables having been described above.

ϕ_t are specific time effects that control for omitted variables common to all trade flows but which vary over time, they could be a proxy for the business cycle. δ_{ij} are trading-partner fixed effects that proxy for multilateral resistance factors. When these effects are specified as fixed effects, the influence of the variables that are time invariant cannot be directly estimated. This is the case for distance; common language, colonial links and landlocked countries- therefore, its effect is subsumed into the country dummies. Since the variable of interest is piracy incidents, and variability is mainly over time, in some estimations we replace the time dummies by a trend.

Considering that it may take some time before insecurity fully affects trade, we include the second lag for the different types of piracy incidents in our model.

Continuing with our analysis we consider a modification to include the value of air trade as an additional regressor. This second specification which accounts for air trade in a panel data framework is given by

$$LX_{ijt} = \gamma_0 + \phi_t + \delta_{ij} + \alpha_1 LYH_{it} + \alpha_2 LYH_{jt} + \alpha_3 LPop_{it} + \alpha_4 LPop_{jt} + \alpha_5 LDist_{ij} + \alpha_6 Piracy_{ijt} + \alpha_7 F_{ij} + \alpha_8 LXair + \eta_{ijt} \quad (3),$$

where $LXair_{ij}$ is the value in US$ of air trade between i and j in year t, and ε_{ijt} expresses the error term that is assumed to be well behaved. The other variables are the same as in Equation 2, above.

Finally, we estimate Model 3 for each specific route, to investigate whether the number of incidents has a different impact on each route.

4.2. Main results

Models 1 and 2 are estimated for annual exports from 27 European Union (EU) countries to 20 Asian countries and Australia (Table A.3) for a 12 year period (1997-2008). Table 3 shows the results obtained when equation 2 is estimated for all trade routes with hijacks as the target variable. Preliminary results indicate that the only variable that is statistically significant is the number of hijacks, whereas the number of attempts, number of boarded vessels and total number of incidents are not statistically significant for all specifications. We were not able to control for time effects common to all trade flows in the results for all trade routes (Table 3) because they are collinear with the number of incidents, which main source of variability is over time.

After trying different specifications, it was the second lag of the number of hijacks that was found to be most relevant, further lags not being statistically significant. The model was first estimated using simple OLS for the pooled data (Baseline) and using random (M1) and fixed effects (M2) for each specific trading pair. As possible refinements we also estimated a fixed effect model corrected for autocorrelation (M3), another fixed effect model with standard errors corrected also for spatial cross-correlations (M4) and two dynamic models estimated using the generalized method of moments (GMM): one estimated with the variables in levels (M5) and a second model with the variables in first differences (M6). A Hausman test indicates that the country-pair effects are correlated with the error term and therefore only the fixed effects specification is consistent.

In all models, the coefficient estimated for the number of hijacks is negative and statistically significant at standard levels. As expected, an increase in number of attacks hinders exports. Since the results in models 5 and 6 indicate that the coefficient on lagged exports is not statistically significant, our preferred results are those of Model 5, with dyadic fixed effects and controlling for autocorrelation and spatial correlation in

the residuals. According to the results obtained in Table 3, the effect of one additional vessel hijacked is associated with a decrease in exports of about 1.1% (M4). We also tried with export volumes instead of export value, obtaining results similar in magnitude and significance.

Table 3. Baseline results for all trade routes

In Table 4, we present the results obtained by estimating Equation 3, which includes the value of air freight as additional regressor. The estimated coefficient for lxva is not statistically significant in the models specified with fixed effects, only in the OLS baseline model and in M1, estimated with random effects, is the coefficient negative and statistically significant. The coefficient of our target variable, namely piracy, remains unchanged.

Table 4. Break-down of results by specific Trade route (Equation 3)

Table 5 present the results for each maritime route, we can observe that impact is greatest on the route linking Europe to the Sub-Continent, which only includes vessels hijacked in regions ES, RGSA and ISCS.

Table 5. Results by maritime route

The greater effect of piracy on the Indo-European trade route is hardly surprising when the geographical position of the Indian Sub-continent and the recent history of piracy events in the region are considered. Because of its geographic position, it is almost impossible for ships reaching or leaving India to change maritime routes to avoid entirely the part of the Indian Ocean threatened by Somali pirates. This has become all the more true as in 2008 and 2009 Somali Pirates broadened the reach of their operations to encompass much of the Indian Ocean, practically reaching the Maldives Islands (Report of the House of Lords p.11). According to the IMB, 2009 saw an

important shift in the location of attacks by Somali pirates. While in 2008 attacks were mainly in the Gulf of Aden, in 2009 they were concentrated along the Somali sea-board.

Figure 4. The Operating area of the Somali Pirates: The Suez Canal and Cape Maritime Routes

5. DISCUSSION: THE COST OF A FAILED STATE

In this section the estimates obtained in Section 4 are used to simulate the costs of piracy for the international community and to compare the case of Somalia with that of two other countries, Afghanistan and North Korea, which also generate costs, albeit differently, for the international community.

Some authors argue that Somalia could be better off without a centralized government than with its former one (Leeson, 2007; Powell et al, 2008). In what follows, we try to shed some light on the question of whether the international community could have an interest in maintaining a stateless Somalia. We compare the cost for the international community of Somalia as a failed state with a strategic geographic position, with the cost of an antagonist state (Afghanistan) and the cost of an autarkic state (North Korea).

Total trade between Asia and Europe in our sample for the year 2008 was US$ 642 billion[1], and the decrease in international trade between Europe and Asia due to maritime Piracy was around 28 billion US$ 2008[2].We also know that the Somali Pirates accounted for 91% of all ship and crew hijackings in 2008 (42 out of 46 vessels

[1] *Total trade between Europe and Asia* $= \sum_{ij}^{nm}(X_{ij} + M_{ij})$ *, n denotes the number of exporting countries, m the number of importing countries.*

[2] *The average increase in t_hijacks over the period 1999 to 2008 is 3.88, this increase has reduced exports on average by:*

$\%\nabla\hat{X} = 100 * \left[\exp\left(\hat{\alpha}_6 \Delta T_{Hijack}\right) - 1\right]$ *=100**$[\exp(0.011 * 3.88) - 1]$ *=4.36%*

Cost= 0.0436 642594927127= 28017138823.*

hijacked), so we can estimate the cost of Somali Maritime Piracy at 25.49 billion dollars. As we don't take into consideration all the trade transiting the Gulf of Aden, our estimation understates the cost of Somali piracy on the Euro-Asian route. To complete the picture of the cost of Somali Piracy for the International Community, we should also include the cost of maintaining the warships of the International coalition and the increased insurance costs for goods passing through the Gulf of Aden. The cost of the EU-led operation Atalanta has been estimated at 12.4 million dollars for its first year alone (according to the European Committee of the House of Lords). This operation represented the main military presence in the region with nine navy ships in 2008. Unfortunately, we obtained limited data on insurance premiums charged to shipping companies. Consequently, our conservative estimate of the cost of piracy in the Gulf of Aden is 25.5 billion dollars. If we add to this figure the cost of the African Union peace keeping force maintained in Mogadishu (AMISOM) (816.6 billion dollars[3]) in order to guaranty the distribution of humanitarian aid and the cost of this humanitarian aid (501.3 billion dollars[4]), the estimated cost of the Somalia conflict for the international community in 2008 is 26.8 billion dollars.

To compare this figure with the costs to the international community originated in Afghanistan and North Korea, we take into account the same elements: military and humanitarian expenditures, as well as trade destruction caused by these countries. The most difficult task was to gather reliable and up to date data. Our sources are the Office for the Coordination of Humanitarian Affairs (OCHA) and United Nations High Commissioner for Refugees (UNHCR) for costing humanitarian interventions; estimates

[3] *Source: African Union Website, http://www.africa-union.org/root/au/auc/departments/psc/amisom/amisom_Financial.htm.*

[4] *Source: Office for the Coordination of Humanitarian Affairs (OCHA) and United Nations High Commissioner for Refugees (UNHCR).*

from the National Priorities Project for the annual cost of the Afghanistan war; the 2007 United States Congress Report for an evaluation of the annual cost of protecting the northern border of South Korea. The cost of the war in Afghanistan is proxied by the cost born by the USA. Although we are aware these data are far from complete, our goal is to use the available figures for comparison (Table A.5).

Figure 5 compares calculated costs for Somalia, Afghanistan and North Korea. It shows that the military cost of the U.S. deployment in Afghanistan for the year 2008 (43.4 billion dollar) is far more important that the cost of the mobilization of 20,000 U.S. soldiers in South Korea along the North Korean border (7.5 billion dollars) and overshadows completely the cost of the AMISOM and the Atalanta Operations combined (0.82 billion dollars). Costs of humanitarian operations in Somalia and Afghanistan are similar (US$ 0.476 billion and US$ 0.572 billion, respectively) if we do not consider the flow of refugees due to the two conflicts. Once the cost of refugees is integrated[5], the Afghanistan conflict is more expensive in terms of humanitarian operations than the Somalia conflict (US$ 0.699 billion and US$ 0.503 billion, respectively). The cost of humanitarian operations in Somalia represents more than ten times the cost of humanitarian operations in North Korea. We do not consider North Korea to be a source of trade destruction. Although this country surely does not trade at its full potential, it does not hinder trade between other countries. We have already mentioned that Somali Pirates deter US$ 25.5 billion worth of trade flows. However we have not found data on trade destruction originating in Afghanistan over the past ten years.

[5] See figures in Table A.5 from the United Nations High Commissioner for Refugees.

Figure 5. Cost Comparison (to the International Community) of different kinds of States (2008)

From of our back of the envelope calculation, it is clear that the international community can co-exist with a quasi-autarkic State since no threat by the latter has materialized. The war in Afghanistan is obviously more costly for the International community than the situation in Somalia and North Korea. We had in fact expected a larger difference between the cost of the Afghan war and that brought about by Somali maritime piracy. It would undoubtedly be greater if estimates of the long-term impact of the 9/11 terrorist attack on international trade were included, particularly the effects of tighter security regulations adopted by many countries after 2001. Mirza and Verdier (2008) provided a partial answer to this question for US trade by estimating the impact of terrorist acts. They did this by linking the drop in business visas issued to enter the US and their consequences for US imports. A negative and significant impact is observed five years after the terrorist attack. We tend to think that the negative effect of the 9/11 terrorist attacks is not limited to trade with the USA, but also extended to many other countries that adopted tighter controls at their borders. It may even be possible that countries that have raised security, trade more between themselves and the new measures of control have only a transitory effect. Furthermore, these additional controls might have led to a reduction in insurance costs for trade between the countries adopting them, but further research is definitely needed to shed more light on these issues.

6. Conclusions

We have applied a gravity model to annual exports from 27 EU countries to 21 destinations. The effects of piracy incidents were captured by the number of attempts,

the number of boarded vessels and the number of hijacked vessels in the three maritime routes considered. Two main conclusions emerged. First, not all acts of violence against ships hinder international maritime trade, only the most harmful (hijackings) of these lower the amount of trade between nations. Second, as most of the incidents of piracy involving hijacking are attributed to Somali pirates, it seems reasonable to say that, were piracy to disappear in the Gulf of Aden (RSGA region), there would be a slight drop in the cost of maritime trade between Asia and Europe. Third, air freight does not appear to be a substitute for maritime trade; this result is preliminary, as estimates for different type of goods need to be calculated.

Interestingly, it appears to be the case, that rather than eradicating piracy, the International Community has decided to contain it. According to the Commander in chief of the joint European Naval Task Force, the naval forces are in a position to deter, rather than fully eradicate, piracy, due to the vast expanse of ocean in which the pirates operate, as it is impossible to intercept systematically all attempts of piracy. An alternative solution would be to send ground forces onto the Somali shore. This option has been ruled out because of the human and economic cost it would entail, as demonstrated 18 years ago with the US lead operation “Restore Hope”. Yet another solution would be to revive an active gunboat policy on the Somali ports such as Eyl and Garacad, which are known to be used by pirates. Although this may seem less expensive and more feasible, with modern war faring techniques, it would be to ignore a key fact in the current Somali political situation: pirates are one of the few organized forces capable of opposing the Islamist militia that rules a vast part of the country. Weakening the pirates and the two proto-states largely living off the spoils of piracy, could lead to a power vacuum in the regions where the Islamist militias are less active. A strong Islamist State could be a haven for global terrorist activities and, as recent

history has shown, the economic costs brought about by large scale attacks on western soil, through the economic disruption and retaliations they induce, could be extremely costly.

An alternative manageable solution for the International community may be to provide strong backing for one of the new Somali proto-states, and start a program for recycling pirates as pirate-fighting coast guards. This solution would have the advantage of being relatively cheap and creating an area of stability in a strategic region for International trade.

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References

Anderson, James E., 2008. Commercial Policy in a Predatory World. Working Paper 703. Boston College, Boston.

Anderson, James E., Bandiera, Oriana, 2006. Traders, Cops, and Robbers. Journal of International Economics 70, 197-215.

Anderson, James E., Marcouiller, Douglas, 2002. Insecurity and the pattern of trade: an empirical investigation. Review of Economics and Statistics 84, 345-52.

Anderson, James E., Marcouiller, Douglas, 2005. Anarchy and Autarky: Endogenous Predation as a Barrier to Trade. International Economic Review 46, 189-214.

Anderson, J.E. and Van Wincoop, E., 2003. Gravity with Gravitas: A Solution to the Border Puzzle. American Economic Review 93, 170-192.

Bendall, Helene B., 2010. Cost of Piracy: A Comparative Voyage Approach. Maritime Economics and Logistics 12, 178-195.

Blomberg, Stephen, B., Hess, Gregory, 2004. How Much Does Violence Tax Trade? Working Paper No. 1222. CESIfo, Munich.

Fratianni, Michele, Kang, Heejoon, 2006. International Terrorism, International Trade and Borders. Working Paper. Indiana University, Indianapolis.

International Maritime Bureau, 2009. Piracy and Armed Robbery Against Ships Report. International Chamber of Commerce, London.

Kiourktsoglou, Georges, Coutroubis Alec, D., 2010. Somali Piracy vs Flag of Attacked Vessel. Working Paper. University of Greenwich, London.

Leeson, Peter T., 2007. Better off stateless: Somalia before and after Government Collapse. Journal of Comparative Economics, 35(4), 689-710.

Marcouiller, Douglas, 2000. Hijacking, Hold-Up, and International Trade. Working Paper No. 477. Boston College, Boston.

Mejia, Maximo, Cariou, Pierre, Wolff, Francois-Charles, 2009. Is Maritime Piracy Random? Applied Economics Letters, 16, 891-895.

Mirza, Daniel, Verdier, Thierry, 2008. International Trade, Security and Transnational Terrorism: Theory and a Survey of Empirics. Journal of Comparative Economics, 36, 179-194.

Nitsch, Volker, Schumacher, Dieter, 2004. Terrorism and International Trade: An Empirical Investigation. European Journal of Political Economy, 20, 423-433.

De Sousa, Jose, Mirza, Daniel, Verdier Thierry, 2009. Trade and the Spillovers of Transnational Terrorism. Swiss Journal of Economics and Statistics, 145, 453-461.

Powell, Benjamin, Stringham Edward, 2009. Public Choice and the Economic Analysis of Anarchy: A Survey. Public Choice, 140, 503-538.

Rauch, James E. 1999. Networks Versus Markets in International Trade. Journal of International Economics 48, 7-35.

UNHCR, 2008. Global Report.

Wilmsmeier, Gordon, Martínez-Zarzoso, Inmaculada, 2010. Determinants of Maritime Transport Costs: A Panel Data Analysis. Transportation Planning and Technology 33, 117-136.

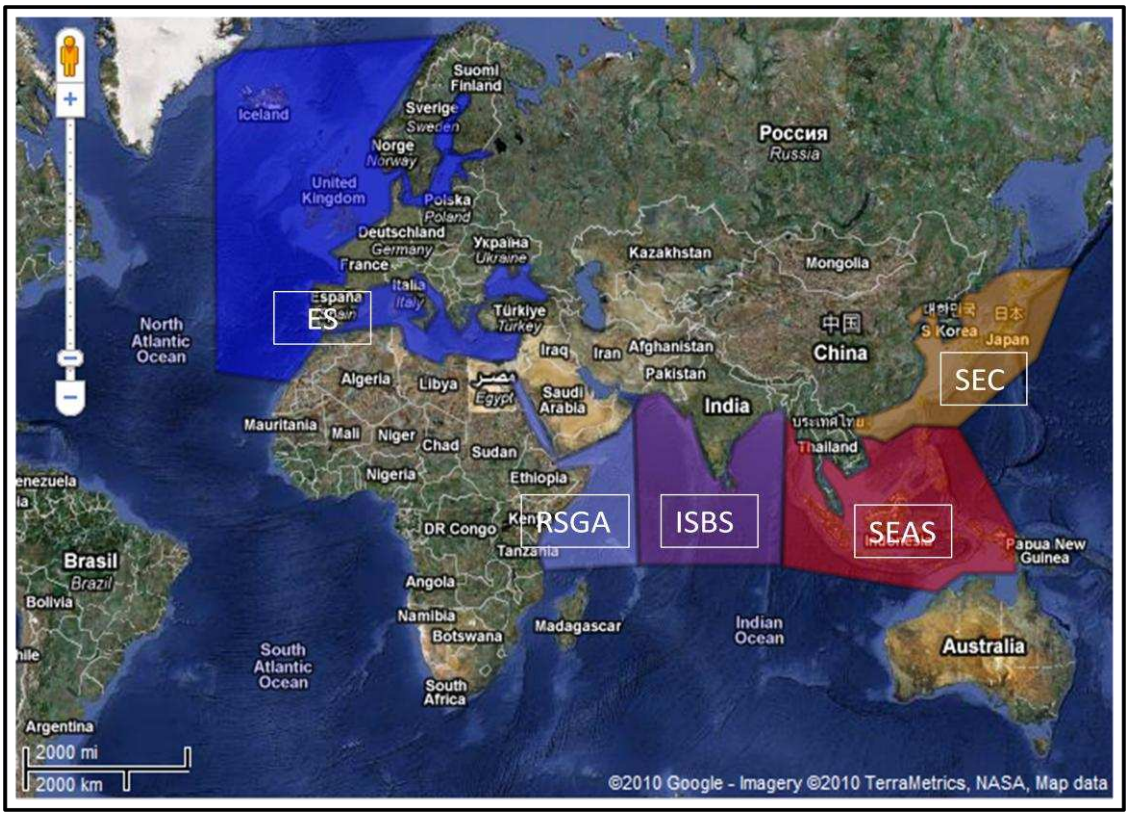
Figure 1. Maritime Shipping Routes in 2002

Source: http://people.hofstra.edu/geotrans/. Rodrigue, Jean-Paul. Department of Global Studies and Geography, Hofstra University, New York.

Figure 2. Location of piracy acts in 2008

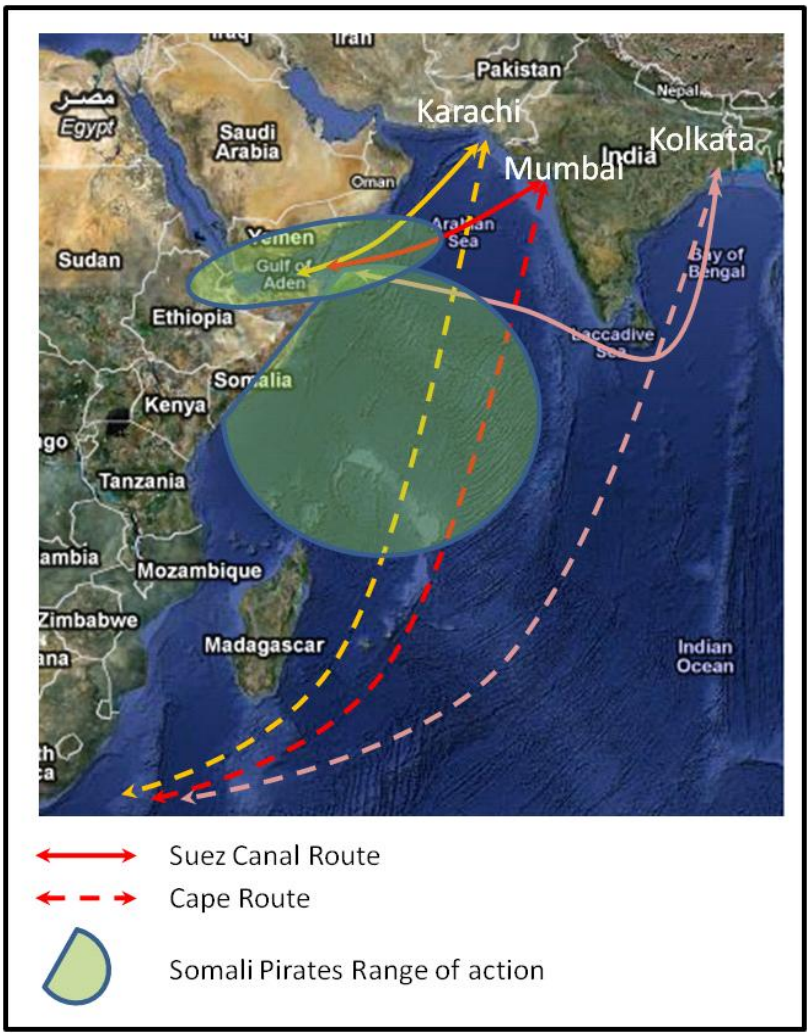
Source: IMB Piracy Reporting Center, International Maritime Bureau, ICC Commercial Crime Services, London, UK. http://www.icc-ccs.org

Figure 3. Maritime regions



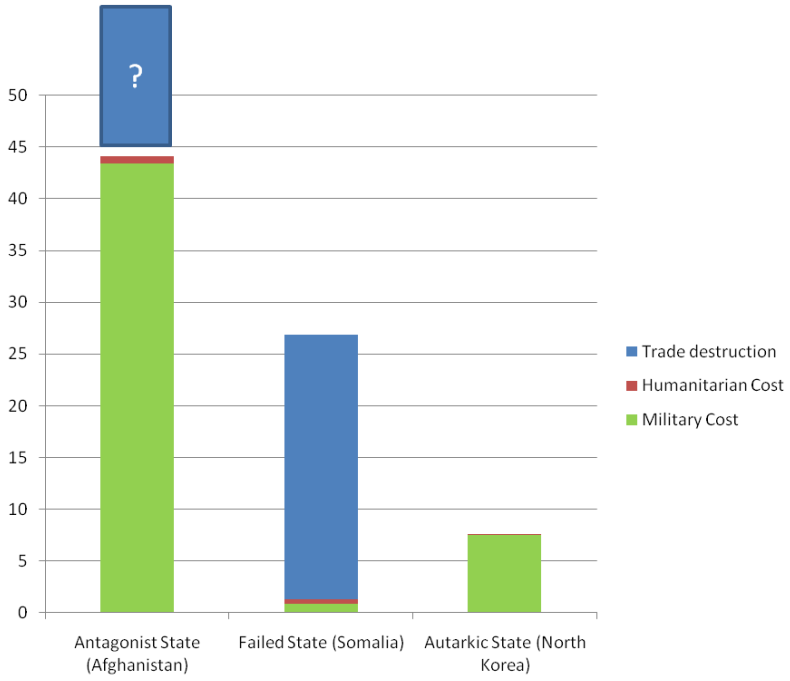
Source: Self-created using data from IMB Piracy Reporting Center, International Maritime Bureau, ICC Commercial Crime Services, London, UK. http://www.icc-ccs.org

Figure 4. Range of Action of the Somali Pirates. Suez Canal and Cape Maritime Routes



Source: Self-created using data from IMB Piracy Reporting Center, International Maritime Bureau, ICC Commercial Crime Services, London, UK. http://www.icc-ccs.org

Figure 5. Comparison of the Cost for the International Community of different types of States in 2008



Source: Authors' own calculations based on the sources listed in Table A.4; figures are in billions US $.

Table 1. Acts of piracy on the Europe- South East Asia Route by type

Year	Type of incidents			
	boarded	hijacked	attempt	Total
1997	100	15	23	138
1998	90	14	31	135
1999	169	12	46	227
2000	235	6	130	371
2001	145	18	75	238
2002	152	26	60	238
2003	180	17	88	285
2004	134	9	63	206
2005	111	23	59	193
2006	104	13	50	167
2007	98	13	56	167
2008	81	46	80	207
2009	153	49	84	406

Source: Authors' own calculations using data from the IMB Piracy Reporting Center, the International Maritime Bureau, and the ICC Commercial Crime Services, London, UK. http://www.icc-ccs.org

Table 2. Statistical Summary

Variable	Obs	Mean	Std. Dev.	Min	Max
LX	4755	16.22	3.17	3.74	23.91
LXAair	5171	15.15	3.68	0.69	22.88
LYHi	5628	9.71	0.90	7.35	11.62
LYHj	5130	7.64	1.65	5.35	10.77
LPOPi	5670	15.88	1.43	12.87	18.23
LPOPj	5400	17.55	1.79	13.21	21.01
LDist	5670	9.03	0.25	8.20	9.81
T_HIJACK	5670	15.66667	11.76795	1	46
T_BOARDED	5670	113.8111	57.0805	34	246
T_ATTEMPT	5670	58.73704	28.63038	12	137
T_TOT	5670	188.2148	83.50224	48	391

Note: L represents natural logarithms, X and LXair the value of maritime and air trade respectively; YHi and YHj express per capita gross domestic product (GDP) of exporter and importer countries; Popi and Popj are the respective populations; Dist is distance between countries; T_HIJACK, T_BOARDED and T_ATTEMPT is the total number of ships hijacked, boarded and suffering attempts of piracy.

Table 3. Baseline results for all trade routes

	OLS	RE	FE	FE,AR(1)	FE, Spatial C.	GMM,FE	GMM,FD
	Baseline	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**
	b/t	b/t	b/t	b/t	b/t	b/t	b/t
LYHi	1.125***	0.813***	0.627***	0.389***	0.627***	0.415***	0.356
	55.039	19.826	4.611	2.67	4.183	2.7	1.641
LYHj	1.281***	0.614***	0.863***	0.531***	0.863***	0.416***	0.226
	37.406	13.025	8.541	3.818	11.703	2.8	0.84
LPOPi	0.896***	0.859***	-2.081**	0.232	-2.081*	0.04	0.235
	50.227	21.736	-2.408	0.989	-1.828	0.045	0.124
LPOPj	1.156***	1.127***	-4.388***	0.157	-4.388***	-3.065***	-6.015**
	64.268	23.874	-4.532	0.631	-5.355	-2.881	-2.346
LDist	-0.351***	0.994***					
	-3.231	3.476					
L2.T_HIJACK	-0.012***	-0.014***	-0.011***	-0.007***	-0.011***	-0.005**	-0.004**
	-3.37	-5.363	-4.09	-3.041	-5.736	-2.244	-2.135
COMLANG_OFF	0.492***	0.864**					
	3.884	2.345					
COLONY	0.510***	0.697					
	5.052	1.586					
L.LX						0.197	-0.046
						1.409	-0.463
CONSTANT	-36.196***	-38.355***	110.107***	1.614***			*0.066*
	-33.681	-13.667	5.801	3.623			1.265
R^2 WITHIN		0.739	0.152			0.145	0.023
R2	0.777		0.231	0.312			
Nobs	3494	3494	3494	3003	3494	2802	2377
LL	-6344.085		-3978.446	-3113.288		-2596.522	-2837.674
RMSE	1.489	0.847	0.816	0.683		0.664	0.798
Hansen test						2.288	1.455
Probab.						0.130	0.228
AIC	12708.170	.	7968.891	6238.576	.	5205.044	5689.348
BIC	12769.76	.	8005.844	6274.62	.	5240.672	5729.763

Source: Self-created

Note: t-statistics are calculated using robust standard errors. L is for natural logarithms, X and LXair are the value of maritime and air trade; and YHi and YHj are per capita gross domestic product (GDP) of exporter and importer countries respectively; Popi and Popj are country populations; Dist is distance between countries; T_HIJACK, the total number of ships hijacked. COMLANG_OFF and COLONIAL are dummy variables that take the value of one when the countries have a common official language and when they had a colonial relationship in the past, respectively; L2. is the appropriate variable in year t-2 (second lag) and L. is for year t-1 (first lag). FD indicates that the model has been estimated with the respective variable in first differences.

Table 4. Break-down by specific Trade route (Equation 3)

	OLS	RE	FE	FE,AR(1)	FE, Spatial C.	GMM,FE	GMM,FD
	Baseline	**m1**	**m2**	**m3**	**m4**	**m5**	**m6**
	b/t	b/t	b/t	b/t	b/t	b/t	b/t
LYHi	1.122***	0.818***	0.636***	0.563***	0.636***	0.463***	0.36
	52.786	19.465	4.6	4.014	3.431	2.983	1.588
LYHj	1.279***	0.629***	0.845***	0.303**	0.845***	0.401***	0.217
	37.092	12.947	8.086	2.22	10.33	2.652	0.808
LPOPi	0.865***	0.862***	-2.137**	0.536***	-2.137**	-0.172	0.099
	44.836	20.239	-2.385	2.856	-2.087	-0.184	0.05
LPOPj	1.189***	1.150***	-4.279***	-0.096	-4.279***	-2.958**	-5.194*
	64.764	23.651	-4.185	-0.471	-4.414	-2.551	-1.912
LDist	-0.398***	1.032***					
	-3.437	3.47					
L2.T_HIJACK	-0.012***	-0.013***	-0.010***	-0.005**	-0.010***	-0.005**	-0.005**
	-3.359	-5.028	-3.651	-2.44	-6.719	-2.32	-2.233
COMLANG_OFF	0.499***	0.783**					
	3.808	2.088					
COLONY	0.363***	0.572					
	3.482	1.28					
LXAir	-0.024***	-0.043***	0	-0.006	0.000	0.000	0.005
	-2.983	-3.445	0.031	-0.325	0.04	-0.016	0.312
L.LX						0.192	-0.024
						1.405	-0.217
CONSTANT	-35.284***	-38.628***	109.616***	1.306***		0.063	
	-30.989	-13.118	5.593	4.13		1.145	
R^2 WITHIN			0.152			0.145	0.023
R^2	0.777	0.739	0.231	0.312			
Nobs	3298	3298	3298	2818	3298	2658	2215
LL	-5925.716		-3685.382	-2826.735		-2408.501	-2614.256
RMSE	1.461	0.829	0.801	0.661		0.652	0.788
Hansen test						2.322	1.963
Probab.						0.128	0.161
AIC	11871.43	.	7384.764	5667.471	.	4831.003	5244.511
BIC	11932.44	.	7427.472	5709.077	.	4872.2	5290.136

Note: t-statistics were calculated using robust standard errors. L indicates natural logarithms, X and LXair express the value of maritime and air trade; and YHi and YHj are for per capita gross domestic product (GDP) of the exporter and importer countries; Popi and Popj express country populations; Dist is distance between countries; T_HIJACK is the total number of ships hijacked. COMLANG_OFF and COLONIAL are dummy variables that take the value of one when the countries have a common official language and when they had a colonial relationship in the past, respectively; L2. expresses the respective variable in year t-2 (second lag) and L. the variable in year t-1 (first lag). FD means that the model has been estimated with the respective variable in first differences.

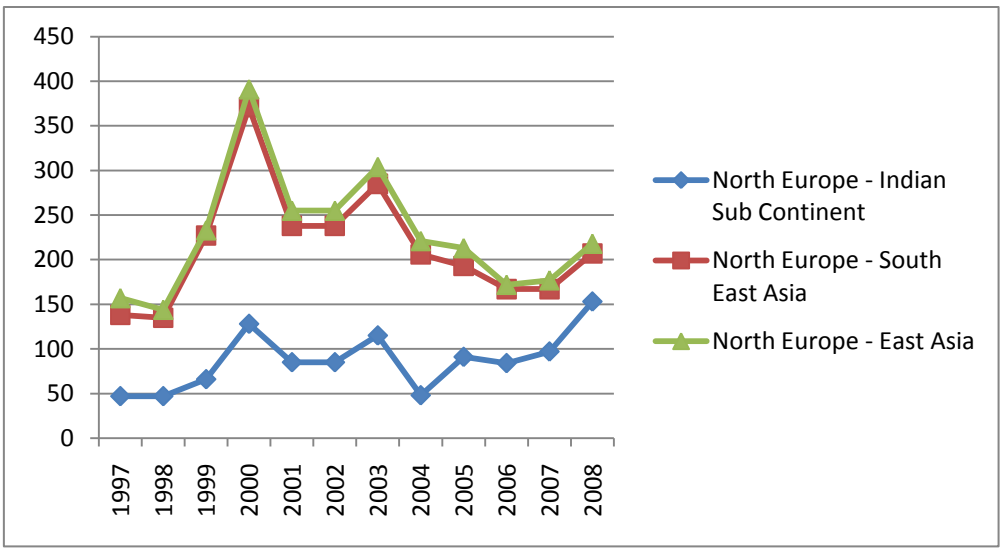
Table 5. Results by maritime route

FE with ar(1) and spatial correlations	Europe - Indian Sub Continent m2 b/t	Europe - South East Asia m3 b/t	Europe - East Asia m1 b/t
LYHi	0.584***	0.423**	1.095***
	3.322	2.246	4.198
LYHj	1.544***	0.344**	0.827***
	10.21	2.172	8.209
LPOPi	-6.333***	2.982***	-12.538**
	-8.853	4.027	-2.556
LPOPj	-3.980**	-6.689***	-0.091
	-2.198	-5.982	-0.085
L2.T_HIJACK	-0.014***	-0.008***	-0.006**
	-10.177	-5.085	-2.244
LXAir	0.005	-0.007	0.001
	0.219	-0.422	0.061
CONSTANT	174.326***	64.604***	230.347**
	8.569	3.356	2.314
R2_WITHIN	0.182	0.115	0.239
Nobs	1116	1427	755

Note: t-statistics are reported, calculated using robust standard errors. L expresses natural logarithms, X and LXair represents the value of maritime and air trade respectively; and YHi and YHj are for per capita gross domestic product (GDP) of the exporter and the importer country respectively; Popi and Popj express the respective populations; Dist is distance between countries; T_HIJACK, is the total number of ships hijacked. COMLANG_OFF and COLONIAL are dummy variables that take the value of one when the countries have a common official language and when they had a colonial relationship in the past, respectively; L2. means it is the variable in year t-2 (second lag).

APPENDIX 1

Graph A1. Total number of incidents on the three maritime routes.



Source: IMB Piracy Reporting Center, International Maritime Bureau, ICC Commercial Crime Services, London, UK. http://www.icc-ccs.org

APPENDIX 2

Table A1. Maritime Region Navigated according to each trade route.

Maritime Route	**Maritime regions navigated**				
	European Seas (ES)	**Red Sea/ Gulf of Aden (RGSA)**	**Indian Sub Continental Seas (ISCS)**	**South East Asian Seas (SEAS)**	**East Asian Seas (SEC)**
Europe - Indian Sub Continent	X	X	X		
Europe - South East Asia	X	X	X	X	
Europe - East Asia	X	X	X	X	X

Source: Authors' own elaboration.

APPENDIX 3

Table A.2 Sources and variables

Dependent Variables	Description	Source
X_{ij} : Maritime Exports from i to j	Nominal X	Eurostat

Independent Variables	Description	Source
Y_i : Exporter's income	Exporter's GDP, PPP (current $)	WDI
Y_j : Importer's income	Importer's GDP, PPP (current $)	WDI
t_boarded	number of ships boarded by pirates on a particular route	IMB
t_hijack	number of ships hijacked by pirates on a particular route	IMB
t_attempt	number of attempted piracy acts on a particular route	IMB
t_tot	number of piracy acts on a particular route	IMB
$Dist_{ij}$: Distance	Distances between country capitals of trading partners (km)	CEPII
Comlang_off	Dummy variable = 1 if the trading partners share the same official language	CEPII
$Colony_{ij}$:	Dummy variable = 1 if the trading partners had colonial links in the past, 0 otherwise	CEPII

Note: WDI denotes the World Bank Indicators, IBM denotes the International Maritime Bureau and CEPII the *Centre d'Etudes Prospectives et d'Informations Internationales.*

APPENDIX 4

Table A3. List of exporter and importer countries

European Countries	Asian Countries and Australia
AUSTRIA	AUSTRALIA
BELGIUM (and LUXBG -> 1998)	BANGLADESH
BULGARIA	BHUTAN
CYPRUS	CAMBODIA (ex KAMPUCHEA)
CZECH REPUBLIC (CS->1992)	CHINA (PEOPLE'S REPUBLIC OF)
DENMARK	HONG KONG
ESTONIA	INDIA
FINLAND	INDONESIA (ID+TP from 77,excl. TP -> 2001)
FRANCE	JAPAN
GERMANY (incl DD from 1991)	KOREA, REPUBLIC OF (SOUTH KOREA)
GREECE	LAO PEOPLE'S DEMOCRATIC REPUBLIC (LAOS)
HUNGARY	MALAYSIA
IRELAND	MYANMAR (BURMA)
ITALY	NEPAL
LATVIA	PAKISTAN
LITHUANIA	PHILIPPINES
LUXEMBOURG	SINGAPORE
MALTA	SRI LANKA (ex CEYLAN)
NETHERLANDS	TAIWAN
POLAND	THAILAND
PORTUGAL	VIETNAM (excl. NORTH -> 1976)
ROMANIA	
SLOVAKIA	
SLOVENIA	
SPAIN	
SWEDEN	
UNITED KINGDOM	

APPENDIX 5

Table A.4 Sources and variables used in section 5

Variables description	Country	Source	cost in million US dollars
Cost of humanitarian Intervention			
	Afghanistan	*Office for the Coordination of Humanitarian Affairs (OCHA)*	*572*
	Afghanistan	*United Nations High Commissioner for Refugees*	*127.5**
	North Korea	*Office for the Coordination of Humanitarian Affairs (OCHA)*	*48*
	North Korea	*Office for the Coordination of Humanitarian Affairs (OCHA)*	*0**
	Somalia	*Office for the Coordination of Humanitarian Affairs (OCHA)*	*476*
	Somalia	*United Nations High Commissioner for Refugees*	*25.3**
Cost of military intervention			
	Afghanistan	*Costofwar.com*	*43400*
	North Korea	*United State congress report (2007)*	*7500*
	Somalia	*African Union website and House of Lord European Committee*	*816.6*
	Somalia	*European Committee of the House of Lords (Atalanta)*	*12.4*
Trade destruction			
	Afghanistan	*?*	*?*
	North Korea	*Authors estimate*	*0*
	Somalia	*Authors estimate*	*25495*

*This figures result from a calculation of the authors made from Data of the UNHCR Global Report 2008. Number of refugees assisted by the UNHCR for Somalia, Afghanistan and North Korea (459253, 1718155 and 0 respectively), cost of UNHCR operation by region (US$ 259.7 billion for East and Horn of Africa and US$ 221.8 billion for Asia respectively) and the number of refugees and internally displaced persons by region (2.9 million in Asia and 4.7 million in East and Horn of Africa) can be found in the report. We have calculated the cost per persons assisted by UNHCR and multiplied by the number of refugees for the concern regions.