The privatization of bankruptcy: evidence from financial distress in the shipping industry

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January 25, 2016

Abstract

Current bankruptcy legislation in many countries tends to follow the US model of Chapter 11, whereby the courts have the authority to stay the contractual rights of the secured creditors. The alternative approach of *freedom of contracting* whereby the privately negotiated debt contract defines a contingency that the courts strictly implement in the event of financial distress, is largely ignored. We study the resolution of financial distress in shipping, where the ex-territorial nature of assets have distanced the industry from on-shore bankruptcy legislation. We have four main findings. First, we demonstrate how contracts and other private institutions have adapted to the industry's special circumstances so as to deliver effective resolution of financial distress. Second, we use vessel arrest as a proxy for the economic cost of financial distress. We show that the level of arrests are low and mostly originating in companies that are going bust. Third, we estimate the expected economic life of vessels (conditional on age) in financial distress, and show that it is significantly shorter than the rest of the vessel population, reflecting under-maintenance of the vessel prior to arrest. This provides a signifcant test for Myers (1977) under-investment hypothesis. Finally, our estimates of the under-maintenance effect, suggest that fire sale discounts reported in the literature using standard methods may be seriously overstated. In summary, the shipping industry provides a rare opportunity to study the evolution of legal institutions in an environment of conflicting jurisdictions, one that may be described as being generated by a Hayekian spontaneous order.

"*There is only one law in shipping: there is no law in shipping*".

Sami Ofer (shipping magnate)

1 Introduction

The last thirty years have witnessed a significant expansion of judicial activism in corporate bankruptcy. Many countries have reformed their bankruptcy laws using Chapter 11 of the US Bankruptcy Code as a model, whereby the courts are given the authority to protect companies from creditors in order to assist their recovery. In particular, creditors can exercise their security interests only to the extent that these rights are not stayed by the court. No doubt, there are important cross-country differences in the discretion given to the courts, as well as to their willingness to exercise it (see Davydenko and Franks (2008) and Djankov et al (2008)). Even in the United States, the activist trend has not been entirely consistent: see Baird and Rasmussen (2002) and Ayotte and Morrison (2009). And yet, it is fair to say that the old English principle of *freedom of contracting* is all but forgotten. Namely, the idea that privately (re)negotiated debt contracts should be strictly enforced and serve as contingency plans in the eventuality of default is no longer a serious policy option. Jensen's (1997) call for the privatization of bankruptcy law is viewed as a somewhat esoteric idea.

It seems that these developments have been driven by a strong conviction that in the absence of vigorous court involvement, freedom of contracting is destined to be plagued by coordination failures. According to Jackson (1986), bankruptcy, by its very nature, raises a common pool problem. Hence, debtors and creditors are unable to renegotiate existing contracts in order to resolve Myers' (1977) debt overhang problem, to their mutual benefit. As a result, viable projects are discontinued, assets liquidated unnecessarily, and a company's value diminished by creditors runs, similar to Diamond-Dybvig (1984) bank runs. It follows that the common pool problem is, essentially, a failure of the contracting parties, to allocate property rights on the pool of the company's asset among the stakeholders, so that they have the incentive to take value-enhancing actions. Moreover, these problems are exacerbated by insufficient market liquidity, so that forced sales of assets are not fairly priced. Shleifer and Vishny (1992) argue that part of the solution is in bankruptcy law: "assets in liquidation fetch prices below value in best use ...[Hence,] automatic auctions ... , without the possibility of Chapter 11 protection, is not theoretically sound." Pulvino (1998) provides empirical estimates of a fire sale discount of up to 30% of the value of second hand aircraft.

Remarkably little is known about the actual operation of freedom of contracting regimes, partly because law reforms have pushed them close to extinction. In this paper, we study the resolution of financial distress in shipping, where the ex-territorial nature of assets has loosened (although not completely eliminated) the grip of national bankruptcy laws. While enabling freedom of contracting, the ex territoriality of assets also creates a major challenge: how to establish the rule of law, so that contracts, and property rights in general, are strictly enforced. Operating across many jurisdictions, much of the time on the high seas, sometimes in ports notorious for corruption and lawlessness, proponents of legal activism might expect to find an industry plagued by coordination failures. We find surprisingly little evidence to this effect.

We have four main findings. First, in spite of the potentially chaotic environment in which the industry operates, rule of law has been established: it is largely private, decentralized, highly differentiated, competitive and adaptable. Property rights (and, thus, security interests) are registered with the flag that each vessel flies. So called *flags of convenience* are semi-private and revenue oriented. Competition weeds out corrupt and disorderly flags because creditors would refuse credit to vessels flying such flags. Upon default, a secured creditor has the right to repossess the vessel by arresting it in port. Though many ports are corrupt and inefficient, there are a sufficient number that are not. Ports, like flags, compete on the quality of service. Most importantly, contracts and institutions have adapted so as to deliver an efficient repossession process. For example, crews, who physically control the vessel, are made senior to the mortgage, to discourage the crew from abandoning the vessel when their wages are unpaid, thereby aligning their interests with the creditor rather than the distressed owner. In addition, operators are organized as holding companies, with each vessel owned separately by a different subsidiary. The creditor can thus take a security interest in the equity of the subsidiary as well as on the physical vessel. Such a contract, referred to as a 'double mortgage', allows the creditor to repossess and sell a vessel when it is on the high seas, without bearing the costs of arresting it in a port. We illustrate the functioning of the system with a description of the Eastwind case, a large operator of ships that went into bankruptcy in 2009.

Second, we take vessel arrests as a proxy for coordination failures. In a Coasian world (with financial frictions), companies that run out of capital lose their assets to better capitalized ones, but this transfer of ownership should not disrupt the assets from operating and generating cash. Anecdotal evidence indicates that practitioners understand this implication of the Coase Theorem and act accordingly: upon default, and under threat of arrest, vessels are sold 'voluntarily' and creditors are repaid. As a result, the amount of capacity under arrest as a proportion of total industry capacity is only 0.4% in recessions, and is close to zero in normal times. Even more significantly, we find that most of the arrests are caused by debtors who are in virtual liquidation. At the same time, we find that debtors who have gone through serious financial distress, characterized by very significant downsizing (sometimes by more than 50%) but remain operating, have largely avoided vessel arrests. It seems that the main economic cost of financial distress originates with dysfunctional debtors rather than with poorly coordinated creditors. This undermines an important criticism that is often levelled against a freedom of contracting regime although one has to be careful about generalizing from shipping to other industries.[1]

Third, we estimate vessel's hazard rates, namely the probability of being 'broken up' (the counterpart of "death" in the demographic use of the term) conditional on age and other vessel characteristics. We find that vessels under arrested and auctioned tend to have a higher hazard rate compared to other shipping transactions. This finding is consistent with Myers (1977) under investment hypothesis, for which evidence is scarce, applied to investment in maintenance. Evidence from a hand collecgted UK sample of arrested and auctioned ships also confirms this under-maintenance effect. While the Myers (1977) debt over hang problem is very prominent in the literature empirical evidence is much more scarce.

Lastly, we quantify the effect of the higher hazard rate on vessels value, and use it to demonstrate a statistical bias in the measurement of the fire-sale discount. We start by applying Pulvino's methodology to our data, which yields similar results: conditional on financial distress, a vessel is priced about 30% below a market benchmark. We call it the raw discount, which we then decompose into a quality component (due to the higher hazard rate and the implied shorter expected economic life) and the remainder which may be assigned to liquidity (the difficulty of finding a buyer on short notice). The results suggest that about half of the raw discount is due to low quality i.e. under investment. Moreover, we show that a liquidity discount affects only the lower end of the value distribution: there is no evidence that high-value vessels, arrested in ports with a high standard of enforcement are sold below the market benchmark.

Our paper is related to a large literature on the economic analysis of bankruptcy law. In particular, it relates to a new set of results that have demonstrated the unintended consequences of law reform: Vig (2013) for India, Rodano et. al (2015) for Italy, and Lilenfeld-Toal et al. (2012).Our paper is also related to a large legal literature on both the feasibility and the desirability of competition among legal systems: LoPucki and Kalin (2001), Kahan and Kamar (2002) and Bebchuk and Cohen (2003) and Romano (2005). We see this debate in the more general context of 'spontaneous' generation of law and institutions through the decentralized interaction of traders within competitive markets: see Hayek, (1979), Bernstein, (1992) and Greif et. al, (1994).

[1] It should be noted that we are focusing here on the ex-post coordination failures that are often cited as market failures that justify statutory bankruptcy codes. It, however, may still be the case that firms change their behavior ex-ante and this may generate inefficiencies. For example, the shipping industry might respond ex-ante to (sub-optimal) low levels of leverage or concentrated creditors. While the shipping industry is highly levered, we are aware that ex-post coordination failures may generate ex-ante inefficiencies. We are therefore very cautious about not making any welfare claims, but just want to highlight that at least some of the justiication used for Chapter 11 don't seem to be borne out by our data.

Lastly, our fire-sale results are related to Campbell, Giglio and Pathak (2011), Coval and Stafford (2007), Stromberg (2000), and Eckbo and Thorburn (2008). Shleifer and Vishny (2011) provide an excellent survey of the fire sale discount literature in both finance and economics.

The rest of the paper is organized as follows. In section 2 we describe our data. In Section 3 we discuss the institutional structure of the industry including how property rights are registered and enforced particularly in the case of an arrest of a ship. Section 4 provides an analysis of the economic costs of the arrest and immobilization of a vessel. Section 5 estimates the fire sale discount for arrested and auctioned vessels and section 6 concludes the paper.

2 Data

Our main data source is Lloyd's List Intelligence (henceforth LLI) originally part of Lloyd's of London, the famous syndicate of insurance underwriters.[2] Lloyd's has been collecting vessels' technical information (type of vessel, size, construction date etc.) and ownership information for more than two hundred years, but the data has existed in electronic form only since the mid 1990s.[3] Our sampling window ends in early 2011. We focus on merchant vessels (bulk, containers, reefers and tankers) excluding passenger ships and highly specialized technical vessels (e.g. oil exploration vessels). We also exclude small vessels below 10 dead-weight tons (DWT). Effectively, this is a survey of the world fleet during the sample period. The data contains information about both active and scrapped vessels. Each vessel is identified by an International Maritime Organization (IMO) number, which is attached to the body of the vessel, and remains intact when the vessel changes owner or name. Another important source is Clarkson Research Services Limited (CRSL), a shipping broker, which supplies price information for secondary market transactions. The CRSL and LLI data sets can be matched through IMO numbers. LLI also has detailed information about vessel arrest: port of the arrest, length of arrest and in many cases a short narrative describing the circumstances of the arrest. We augment this source with records of the Admiralty Marshal, the officer who executes vessel arrests in the UK. These records provide more detailed information about the direct costs of the arrest, e.g. port charges, and about the auction process, including all the bids submitted. Additional data sources are mentioned below.

[2]The intelligence unit is currently owned by Informa, a publisher.

[3]Lloyd's list, an industry news bulletin, exist since 1734 and Lloyd's vessel register exist since 1764.

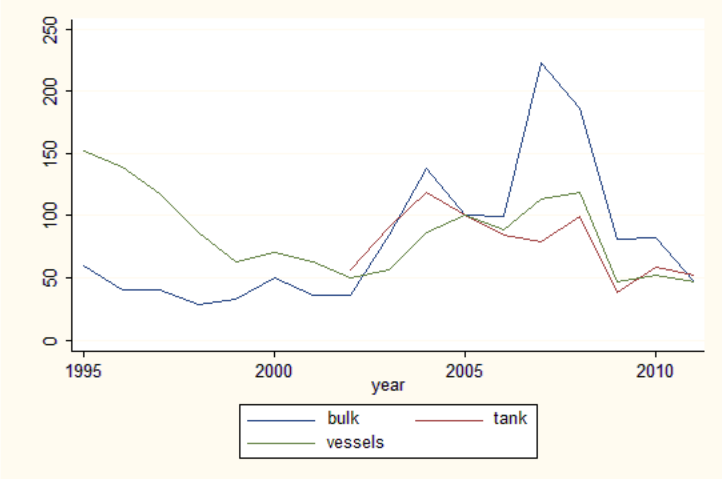
Table 1: The evolution of the fleet over the sample period

year	1995	2000	2005	2010
Number of vessels				
	19,424	21,312	23,840	29,555
Size of vessels (DWT)				
mean	32,027	33,664	37,808	44,460
median	13,466	14,519	18,835	25,160
SD	52,971	53,632	55,282	59,254
Age of vessels (years)				
mean	15.6	16.8	17.4	16.1
median	15.6	16.6	16.6	13.6
SD	9.8	11.0	12.2	13.4

With expanding international trade, the world's merchant fleet has grown steadily over the sample period, from 19,424 vessels in 1995 to 29,555 in 2010, an annualized growth rate of 2.8%; see Table 1. The table also reports the size of vessels (measured in deadweight tons, henceforth DWT) and their age, which are the main explanatory variables in our valuation estimates in Section 5 below. Vessel average size has increased through the sample period, but the fleet has aged slightly, with the average vessel age increasing from 15.6 years to 16.1 years. Since the early 2000s the industry has seen an unprecedented boom, with the Baltic Dry Index (tracking world-wide charter rates in bulk carrying, mainly raw materials like coal or iron ore) increasing more than four times before crashing to half its 2003 level shortly after the 2008 financial crisis. As Figure 1 shows, charter rates in the tanker business[4] have gone through a similar cycle, albeit of a less erratic nature. Figure 1 also plots a price index for vessels as estimated in Section 5.

[4]We use the "Dirty tanker" index for crude oil.

Figure 1: Charter rates and vessel price indexes, $P_{2005} = 100$



3 Institutional structure

As described above, the shipping industry has used the ex-territorial nature of its assets in order to distance itself from on-shore national bankruptcy laws. As a result, financial distress is largely resolved through the enforcement of debt contracts by a nexus of private, decentralized, differentiated and competitive market institutions. To achieve an acceptable standard of enforcement in a potentially chaotic and lawless environment, markets and contracts had to adapt. In this section we provide a detailed description how the idustry has adapted to this harsh environment. It is worth remembering that claims about ill adaptablity played an important role in bringing about legal activism in the US which provided the principal building blocks of Chapter 11 of the US bankruptcy Code. An understanding of the institutional structure is also important in the interpretation of the quantitative results that we derive in subsequent sections.

3.1 Property rights

We begin with the industry's special ownership structure. A shipping operator is typically organized as a holding company with multiple subsidiaries, each one owning a single vessel. The legal separation of vessels within a holding company allows a lender to take collateral not only on the physical vessel but also on the shares of the company owning the particular vessel, referred to as a 'double mortgage'. We describe below how this double mortgage can, in the event of default, allow the lender to repossess a ship on the high seas without taking it into port and thereby incurring significant costs.

The registration of property rights of a vessel is made with a sovereign country and 'flys' the flag of that sovereign. Though registration is a technicality, it is an important one since any mortgage on the vessel is recorded on the same register. It is not unknown for owners or lenders to find that their property rights have been tampered with in low quality flags; as a result, lenders will often stipulate in the loan agreement the country or flag of registration.

So-called flags of convenience register vessels with which they have no other material connection. In many cases, they belong to nations too small to have any significant trading activity and which may be located far away from any maritime route.. For example, the Marshall Islands, has a population of less than 100,000 people and an annual GDP/capita of about $9000. It is located in the Pacific Ocean (slightly north of the equator), away from any major maritime route. Flags of convenience charge an annual lump sum fee, often a significant source of income for such small economies. They also support a significant set of service providers, e.g. a domestic bar association. Effectively, flags of convenience are semi-private revenue driven institutions that operate in a highly competitive environment. In 2010, 49% of vessels and 61% of the DWT capacity in our sample were registered with flags of convenience. For example, the Marshal Island increased its registration from 66 vessels in 1995 to 1,378 vessels in 2010, constituting 5% of the world's vessels and 12% of the DWT capacity, indicating the quality of these vessels.

3.2 Legal diversity

It is not uncommon for a vessel to be registered with one flag, for the ownership of of the subsidiary to be incorporated in another country, and for the holding company to be incorporated in a third country. Sister vessels owned by the same holding company may fly a different flag, and their owner ownership be incorporated elsewhere. More significantly, though the mortgage always submits to the law of the flag, the loan agreement, where most of the contractual substance (e.g. repossession procedure) is specified, will typically submit to another law, often English or American. Even in this event, a loan agreement may submit to English law, but may specify that disputes are to be resolved by Singaporean arbitration. This may be done for reasons of expertise as well as expense. Then there are insurers, customers, bunkers (fuel suppliers), and other suppliers, whose contractual relationships with the operator are affected by their respective locations. Also, in case of collision, salvage or arrest, the law of the port where the vessel is situated takes precedence. One might expect that such legal diversity would increase the incidence of coordination failures. We show, below, how the industry uses the choice of legal regimes, jurisdictions and means of enforcement to its own advantage, in order to resolve potential conflicts and obtain an effective resolution.

3.3 Arrest of vessels

An arrest followed by the repossession and sale of the vessel is the ultimate remedy that a creditor can take in order to obtain payment. Sometimes, the arrest is strategic, so as to improve the creditor's bargaining position or to deter the debtor from taking an action that would affect the creditor's rights on the vessel.We have much anecdotal evidence to indicate that banks avoid arrest whenever possible, so as to avoid direct costs and prevent vessel immobilization and the loss of cash flows from the continuation of the vessel's operations. The first course of action is for the bank to approach the distressed owner and use the threat of arrest in order to obtain payment. Typically, owners comply, and sell the vessel 'voluntarily', sometimes to a buyer found and even funded by the bank.

Table 2: Arrests, by trigger and resolution

		Trigger					
		crew	mortgage	other	unknown	unsecured	total
Resolution	auction	11	131	10	50	32	234
	break-up	11	59	39	38	21	168
	sale	20	123	57	126	42	368
	same owner	35	83	428	402	283	1231
	unknown	1		4	187	2	194
	total	78	396	538	803	380	2,195

During the sample period LLI reports 2,195 arrests. This is a small number relative to the $370,000$ vessel-years that are recorded in Table 1 above, a rate of about 0.6%. LLI narratives[5] reveal a variety of factors that provoke an arrest apart from financial distress: a drunken shipmaster, contraband, violation of international sanctions, fire, collision with another vessel, or disputes with suppliers. It is sometimes difficult to distinguish financial from other factors that might trigger an arrest. For example, a client may have a vessel arrested on the grounds that the owner mishandled a cargo and caused damage. In such an event, it would be easy for a financially sound owner to find a bank that would guarantee payment, conditional on a ruling in favor of the client, and thereby quickly lift the arrest warrant. However, a distressed owner may not be able to obtain such a guarantee, thereby

[5]Based on a system of agents that Lloyd's has in major ports all over the world to report mainly insurance-related events.

prolonging the arrest and exacerbating his own distress.

Table 2 classifies arrests by trigger and resolution. The classification is made on the basis of LLI narratives in conjunction with other information such as a transfer of ownership. We can with confidence identify538 arrests that are not directly related to debt collection, and another 803 arrests as being unlikely, leaving 474 arrests as being definitely related to the failure to repay secured debt, as well as the wages of the crew; of these 474 cases, 30% of the ships are auctioned and the proceeds distributed to the creditors. About 17% of all vessels arrested and auctioned end with the vessel being sold for scrap[6], an indication of the low quality of the vessels under arrest, a matter on which we shall provide much elaboration below.

3.4 Ports of arrest

To initiate an arrest, port authorities need to verify that the creditor has a valid contractual right to seize the vessel, and subsequently execute the sale (if no settlement between debtor and creditor is reached) and distribute the proceeds among the creditors according to their priority. There are some material differences in procedures across ports. For example, some ports, such as Gibraltar,allow a sale by private treaty whereby the creditor identifies a buyer and the sale is executed without a public auction, at a price that the Admiralty Court considers fair on the basis of expert opinion. A sale by private treaty can be resolved in a matter of days. Other ports, such those in the Netherlands, accept only a public auction. There are also important differences in the speed of implementing the procedure, with some ports being more sensitive to the costs imposed by the immobilization of the vessel. Other ports are hopelessly corrupt and inefficient and are to be avoided by creditors at all costs. We are aware of a case where it took the creditor ten years to receive the proceeds arising from an arrest and auction in a particular port in Asia.

Six countries stand out for the effectiveness of their arrest procedure: Gibraltar, Hong Kong, Singapore, South Africa, the Netherlands and the UK. As a result, there are more arrests initiated by secured creditors[7] in these specialized ports, relative to the volume of traffic.[8] While their share in the world's cargo traffic is only 12%, these six ports have a 39% share in the arrest activity; see Table 3 which is based on our sample of 474 arrests identified as 'definitely related to the failure to repay debt'. In contrast, in some of the

[6]Much of vessel breakup, an extremely hazardous business, is done in poor countries like Pakistan or Bangladesh, which may cause owners to abandon a vessel under arrest ending with an extremely long resolution.

[7]The 474 cases identified above.

[8]Traffic data are taken from the Institute of Shipping and Economics Logistics (ISL), Bremen, for the years 2005-2008.

world's busiest ports, such as Japan, China or the USA, the arrest volume is small relative to the volume of traffic. The following cross-county regression provides a formal test:

$$N - arrest_i = c + \underset{(2.34)}{0.30} \times volume_i + \underset{(8.46)}{2.97} \times D - specialized_i + \varepsilon_i,$$

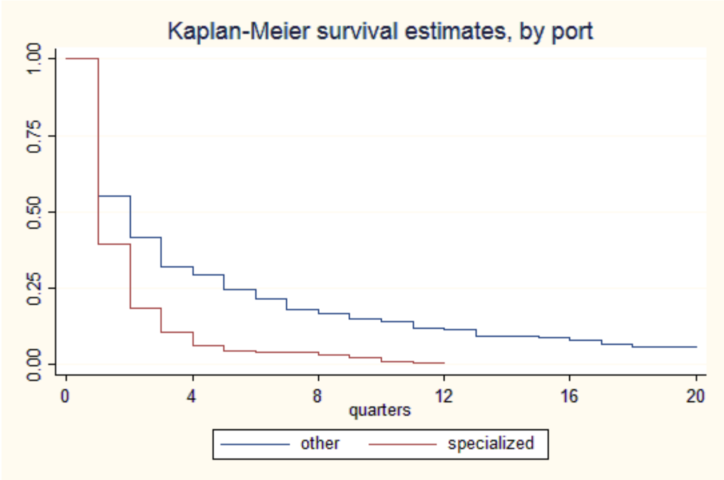
where i is a country index, $N - arrest$ is the number of arrests, $volume$ measures the volume of traffic and $D - specialized$ is a dummy variable for the six ports above. $N = 55$, $R^2 = 0.59$ and t-statistics are in brackets below the estimators.

Table 3: Arrest and traffic activity in some specialized and high volume ports

	N arrests	arrest (%)	traffic (%)
Arrest specialized ports			
Gibraltar	33	7	0
Hong Kong	19	4	1.7
Netherlands	37	7.8	3.5
Singapore	37	7.8	3.3
South Africa	19	4	1.2
UK	42	8.9	2.8
other	287	60.5	87.6
High volume ports			
Australia	9	1.9	5.1
China	5	1.1	15.8
Germany	6	1.3	2.3
Japan	2	0.4	6.6
South Korea	4	0.8	5.8
USA	23	4.9	11.9
other	425	89.7	52.5

Figure 2 plots a Kaplan-Meier (non-parametric) estimate of the duration of arrest, for the six specialized ports and the other remaining ports. A log-rank test is consistent with the hypothesis that the two groups differ significantly, at the 1% level (with chi-squared statistic of 42.92) in the way they function. Clearly, arrest at a specialized port imposes significantly lower deadweight loss. Noticeably, both functions are affected by a long tail; even at a specialized port an arrest can, in some extreme cases, drag on for up to three years. From the LLI narrative the impression is that such prolonged arrests may be a result of technical problems, for example, a shipyard placed a vessel under arrest so as to facilitate repossession in case the owner defaults on the repair bill. In other cases, a bankrupt owner disappeared while abandoning in port a vessel that had reached the end of its economic life rather than bear the cost of sailing it to a yard where it would be broken up and sold for scrap.

Figure 2: Duration of arrest in specialized and other ports



3.5 Contract adaptability

The results of Section 3.4 are consistent with the view that creditors frequently direct vessels to be arrested at an efficient port. Two contractual innovations, crew seniority and the double mortgage play an important role in achieving this result. It is worth noting that the word innovation does not imply a recent introduction of the instrument; the maritime lien was introduced prior to the twentieth century in some ports. Our focus here is not on the history and timing of the innovation but its specialized use in the shipping industry as a means of improving contract enforcement.

Crews have physical control of the vessel. If distressed owners refuse to cooperate with the bank, the collaboration of the crew is paramount. Since default is typically accompanied by wage arrears, the crew may no longer be loyal to the owner. The bank can thus contact the crew and direct them to sail the vessel to an efficient port for arrest and if necesssary sale, promising to pay the wage arrears immediately the vessel is in port; in addition, the lender frequently offers to pay the crew's flight to their home country. Though the arrangement benefits both bank and crew, there is a commitment problem: once in port, the bank can renege on its commitment. The problem is resolved by a maritime lien, a security interest that the crew has on the vessel. Since the maritime lien is senior to the mortgage, a port with a high standard of contract enforcement would prioritize wage arrears to loan repayment. To the best of our knowledge, shipping is the only industry where labour is senior to capital for commercial considerations. It is an interesting twist on theories of control, which predict that the party in control should be junior and hold a residual claim; see Klein, Crawford and Alchian (1978) and Grossman and Hart (1986). When the residual claim is out of the money the senior claimant has to write down some of the debt so as to bring the party in control back into the money to restore value maximizing actions. Such renegotiation may be hard to implement when the physical communication between the senior and the junior claimants is imperfect. The alternative is to grant the crew seniority, at a time when the crew's contribution to the asset value becomes pivotal.

A second contractual innovation is the double mortgage. In this case the bank holds both a mortgage on the vessel and a security interest in the shares of the registered owner. The first security is on the physical asset i.e. the vessel, the second is on the title to the vessel i.e. the shares of the company that owns the vessel. The procedure through which the bank can repossess the shares is specified in the loan agreement. We illustrate how the arrangement works using the case of Eastwind Maritime Inc., a New York based company owning, at the time of the loan agreement, some 90 vessels. The company went into bankruptcy on June 22, 2009. Nordea, a Scandinavian bank with an extensive portfolio of maritime loans, took security interests in 12 Eastwind subsidiaries each of which owned one vessel. To facilitate repossession, the board members of these subsidiaries pledged signed but undated resignation letters. When Eastwind failed to repay interest on their loans, Nordea declared them in default, signed the resignation letters, and appointed new directors, who promptly sold the shares in the twelve subsidiaries to Samama's Draften Shipping, a company controlled by the Ofer family. We are informed the value of the proceeds of sale was more than $50 million dollars. The sale took only a few hours to execute and some of the vessels were on the high seas at the time. Crucially, the creditor did not have to instruct the crews to sail the vessels to a port to have them arrested and sold. The latter procedure would have taken more than one month, and the company's entry into Chapter 7 would likely have forestalled the sale of the ships.

3.6 Conflicts of jurisdictions and coordination failure

The structure of debt in the shipping industry, and the fact that ships sail the high seas both mitigate the effects of judicial activism of on-shore bankruptcy procedures. However, the separation is imperfect, and the friction between the contract and national bankruptcy law may be a source of a coordination failure. The Eastwind case highlights these frictions.

Nordea's repossession of the twelve vessels took place just hours before Eastwind's subsidiaries filed for bankruptcy under Chapter 7 of the US code in the Southern District of New York. Almost certainly, Nordea heard rumors that such filing was imminent.[9] The events that followed make clear how essential for Nordea was the early repossession

[9] That Eastwind was an American company is irrelevant. Any debtor with assets in the US can file for US bankruptcy. In re Theresa McTague, Debtor, 198 B.R. 428. July 15, 1996, a precedent was established to the effect that a US bank account with $194 qualifies.

of the ships. Upon filing for Chapter 7, a trustee was appointed by the court and a stay was imposed on all of Eastwind's assets. The trustee challenged the repossession of the vessels by Nordea and the sale, and claimed that the ships belonged to the bankruptcy estate. The dispute was settled in favor of Nordea although they had to pay $750k to the trustee. In return, the trustee acknowledged the validity of the repossession and accepted that the Eastwind subsidiaries 'lacked appropriate authority' to file for bankruptcy.[10] Had Nordea delayed the sale, the automatic stay would have applied and the bank's collateral would have been weakened. That is clear from another decision in the Eastwind case. Some vessels were insured in the UK and those contracts were written under English law, with clauses stating that the insurance would terminate in the event of the bankruptcy of the insured. The trustee in Chapter 7 litigated against the insurers, arguing that under US law they were obliged to extend the insurance until the bankruptcy procedures were completed. His reasoning was that without insurance the vessels could not leave port and those on the high seas would have had to terminate their voyages.[11] While recognizing that an English court would be likely to rule in favor of the insurer, the US court ruled in favor of the trustee. The judge also dismissed the insurers' claim that 'they did not anticipate such a result' on grounds that with 'more than 30 years experience with US bankruptcy law' they should have been aware of such an event and account for the consequences.[12]

4 The deadweight loss of vessel arrest

In a world that operates according to Coase's Theorem, a company that runs out of capital might be forced to sell assets to a better capitalized one. However, such sales and de-leveraging should be accomplished without any disruption to operating performance. In that respect, any arrest is a coordination failure, since the vessel is immobilised and ceases to earn income. In this section we provide more systematic evidence that rejects Jackson's (1986) common-pool hypothesis. We document the magnitude of vessel arrest and reject the hypothesis of a creditor run for that vast majority of companies going bust. To motivate are quantitative analysis we take a second look at Eastwind's decline and fall.

[10]The court's decision (case No. 09-14014-ALG, US bankruptcy court, Southern District of NY) is limited to confirming the settlement and, thus, has no detail on the substantial arguments for or against the legality of the repossession.

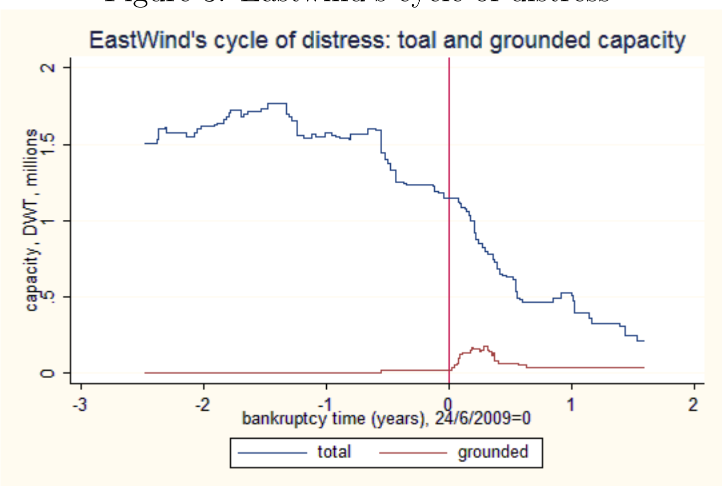
[11]Clearly, the trustee could buy insurance and for it from the revenue he would get from selling the vessels. The real issue here is the seniority of the insurance fee.

[12]Re Probulk Inc., Bankruptcy Court, Southern District of NY, Bankruptcy No. 09–14014–ALG.

4.1 Eastwind's cycle of distress

Our data provide precise dates at which ownership and arrests started and ended allowing us to track Eastwind's cycle of distress at a daily frequency. The top (blue) line in Figure 3 tracks the company's total capacity (in millions of DWTs) while the bottom (red) line tracks capacity that is immobilized due to arrest. The two time series are plotted against "bankruptcy time", with zero being the day of the Chapter 7 filing. Several points deserve special emphasis. Firstly, vessels were arrested during Eastwind's distress and bust episode, although the magnitude of the deadweight loss seems to be quite limited. Secondly, there is clear evidence that a substantial amount of downsizing was achieved without any arrest: Eastwind started divesting capacity a year before it filed for bankruptcy, with very little arrest activity. Over the entire cycle Eastwind divested some 1.5 million DWT, while the capacity under arrest amounted to some 0.2 million DWT-years. Hence, on average, 13% of the downsized capacity was immobilized for one year. Thirdly, all along the path of Eastwind's decline, capacity under arrest was well below total capacity. Even at its peak, a few months after the Chapter 7 filing, the arrested to total capacity ratio was well below 100%. This finding is not consistent with standard theories of creditor's run, whereby creditors driven by a first-mover advantage would grab any asset that is not yet seized by another creditor. It is consistent, however, with the view that once property rights are efficiently allocated by separating assets to different mortgages and properly prioritizing all other creditors, runs do not occur because no creditor can "jump the queue" by grabbing an asset.

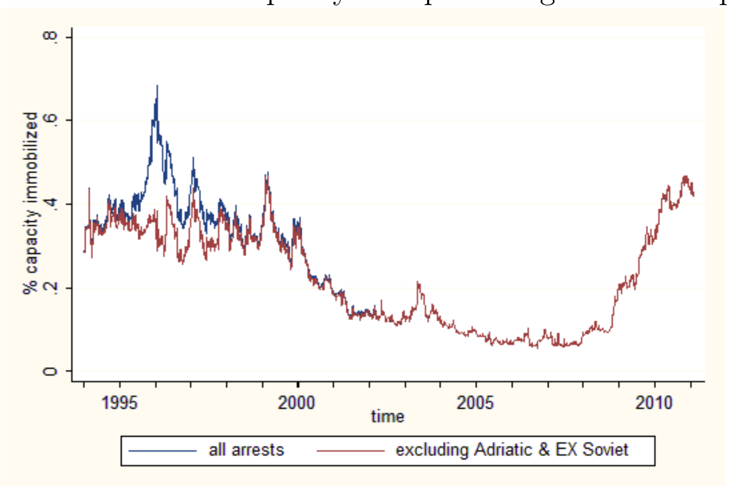
Figure 3: Eastwind's cycle of distress



4.2 Immobilization across the industry

We now turn to generalizing the points made above in the Eastwind case discussed above to the entire industry. On an industry level, the magnitude of vessel arrests are extremely small. Figure 4 plots the amount of immobilized capacity as a percentage of total industry capacity, measured in DWT. We exclude from the measurement non-financial arrests, namely those with an "other" trigger (see Table 2 above). The bottom (red) line also excludes the bankruptcy of Adriatic Tankers, a sizable Greek operator that went bust following a labour conflict, and some ex-soviet companies that went bankrupt old and sub-standard fleets. Even at times of severe slowdown, barely 0.4% of industry capacity is immobilized. Over the entire sample period, the immobilization to capacity ratio is about 0.2% on average; see table 4 below.

Figure 4: Immobilized capacity as a percentage of total capacity



The next step is to link arrests more directly with financial distress. We identify distress outcomes with company downsizing. Company i is classified as distressed, by year y, if it has downsized by 50% (or more) relative to peak capacity during the previous five years:[13]

$$\frac{capacity_{i,y}}{max\left\{capacity_{i,y-5},...capacity_{i,y-1}\right\}}\begin{cases}\leq 0.5: \text{distress year}\\ > 0.5: \text{ non-distress year}\end{cases}. \tag{1}$$

For the same company, a sequence of distressed years are joined up to form a distress episode and the denominator of equation (1) is defined as $peak\_capacity_i$ for company i. In case the denominator of equation (1) varies over the episode, the highest is taken as company peak capacity. The variable $trough\_capacity_i$ is defined similarly, that is,

[13]Missing values are replaced by zeroes.

defined as the lowest capacity over the distress episode.[14]. We classify a company that terminated operations and vanishes from the ownership register as "bust". Notice that bust is a special case of distress. This definition is ambiguous as a company may terminate due to M&A activity or because owners (of small companies) have decided to shut down due to personal circumstances. We thus apply an additional test: a bust company should have a period of 50% downsizing in the years before it goes bust or experience at least one arrest. Notice that our definition of bust ignores, deliberately, the legal mechanism through which the company ceased to exist, whether it was taken to a bankruptcy court or was forced to sell all its vessels "voluntarily".

Our procedure yields 2,990 distress episodes, of which 1,182 constitute a bust. The probability of bust conditional on distress falls to about 25% (155 divided by 581) from 40% (1182 divided by 2990) when calculated on capacity rather than on an episode basis; see Table 4. The difference between the two measures reflects the fact that bust companies have lower capacities. Another interesting observation is that arrested vessels tend to be small, on average, or about half the population average size. We shall return to this point in the fire-sale analysis, below.

The arrest statistics in Table 4 include all arrests in the sample, regardless of the triggers identified in Table 2 above. This is due to the difficulties of always being able to distinguish distress-related arrests from arrests caused by other reasons. It follows that the reported estimates should be taken as an upper bound. For distress episodes, we sum up total capacity and capacity under arrest over the years within each episode and then add up the episodes. For the non-distressed population we just add up capacity years. The probability of arrest in the non-distressed population is extremely small: 0.14% (0.26%) when capacity is measured in tonnage-years (vessel years). Conditional on financial distress, the corresponding probabilities increase ten-fold to 1.88% (2.89%). Conditional on bust, the corresponding probabilities increase even further to 5.17% (8.81%). We sum up total capacity and capacity under arrest over the distress episodes. There are no significant differences in the duration of arrest and the average size of vessels arrested between busts and non busts.

[14] There is a very small number of companies that had two episodes of distress.

Table 4: Capacity under arrest, by outcome

	entire industry			
	vessel years	DWT years, 10^6		
total capacity	384,137	14,300		
arrest under arrest	1,580	30		
N of arrest events	2,105			
prob. arrest (unconditional)	0.41%	0.21%		
average duration of arrest (years)	0.75			
average vessel size	37,226			
average vessel size in arrest (DWT)	18,861			
	no distress		distress	
	vessel years	DWT years,10^6	vessel years	DWT years, 10^6
N of episodes			2,990	
total capacity	362,582	13,700	21,555	581
capacity under arrest	958	19	622	11
N of arrest events	1,254		851	
prob. arrest (conditional)	0.26%	0.14%	2.89%	1.88%
average duration of arrest (years)	0.76		0.73	
average size in arrest (DWT)	19,631		17,513	
	no bust		bust	
	vessel years	DWT years, 10^6	vessel years	DWT years, 10^6
N of episodes	1,808		1,182	
total capacity	16,469	426	5,086	155
capacity under arrest	174	3	448	8
N of arrest events	219		632	
prob. arrest (conditional)	1.06%	0.69%	8.81%	5.17%
average duration of arrest (years)	0.80		0.71	
average size in arrest (DWT)	16,767		17,887	

The next step is to correlate capacity under arrest with the scale of the downsizing, unconditional on whether the distress ended in a bust, or not. In equation (2) we regress the fraction of fleet immobilized on the fraction downsized for a financial-distress episode i. We define $\Delta capacity_i$ as the difference between $peak\_capacity_i$ and $trough\_capacity_i$, while $imob_i$ sums up capacity under arrest over time within an arrest episode i (same definition as in Table 4). Notice that $\Delta capacity$ is measured in DWT while $imob$ is measured in DWT years. We normalize the population by deflating both sides of the equation by $peak\_capacity_i$, so that the main explanatory variable is, actually, the percentage downsizing. $Dbust$ is a dummy variable that receives a value of 1 if the distress window ends in a bust and 0 otherwise. Since, by definition, downsizing in bust is a 100%, γ has the interpretation of a dummy slope.

$$\frac{imob_i}{peak\_capacity_i} = \alpha + \beta \frac{\Delta capacity_i}{peak\_capacity_i} + \gamma Dbust_i \frac{\Delta capacity_i}{peak\_capacity_i} + \varepsilon_i. \quad (2)$$

Results are reported in Table 5 below. The second column reports results for episodes with no arrest events, which happens to be the vast majority of cases and the first column reports for episodes with an arrest event. Note that company disappearances from the ownership register without arrest events were already excluded at an earlier stage.

Table 5: The determinants of arrested capacity

	column 1	column 2
	$imob_i$	$imob_i$
$\Delta capacity_i$	0.01	-0.044
	0.165	(-0.090)
$Dbust_i$	-0.229***	-0.473**
	(-8.051)	(-2.370)
constant	0.028	0.244
	0.578	0.667
R^2	0.03	0.022
N	2,990	520

In the case of distress episodes that did not end in a bust, the $\Delta capacity$ coefficient is not statistically different from zero. That is the case even when we include in the regression only episodes that had at least one arrest events. This finding is consistent with the hypothesis that surviving companies, even when in financial distress, have an incentive to cooperate with their secured creditors. As Table 4 demonstrates, they still suffer from a certain incidence of arrest. But as Table 5 shows, there is no evidence that links this arrest to repossession activity (insignificant $\Delta capacity_i$coefficient). Also, a statistically and economically significant relationship between arrest activity and downsizing exist when the company goes bust. On average, between 23% and 47% of vessels divested are arrested for the duration of one year. This evidence is consistent with the hypothesis that bust companies have a weaker incentive to cooperate with their creditors in minimizing the loss of value in financial distress.

Though the high incidence of arrest is consistent with the dysfunctional-owner hypothesis, it is also consistent with the creditors-run hypothesis. We apply the same test that we have used above to rule out a creditors run in the Easwind case, which is that capacity under arrest is consistently below total capacity all along the cycle of distress. Hence, let $capacity_{d,i}$ ($imob_{d,i}$) be the daily capacity (under arrest) on day d of episode i. Let $daily\_arrest\_rate_{d,i}$ be the ratio of the latter over the former. For each company that went bust we scan the entire episode to identify the maximum daily arrest rate, $max\left\{daily\_arrest\_rate_{d,i}\right\}_d$. Arguably, we are not interested in high arrest rates that took place well down the cycle of distress. We thus truncate the series $\{daily\_arrest\_rate_{d,t}\}$ at the point where $capacity_{d,i}$ fell 25% below $peak\_capacity_i$. The results are reported in Table 6 below. We also report the $mean\left\{daily\_arrest\_rate_{d,t}\right\}$ over a 91 days window around the maximum. Of 1176 bust episodes[15], 870 had no arrests. For another 97 we can reject the hypothesis of a creditors run on grounds that the arrest rate peaked below 100%. That number increases to 167 once we tighten the test for a run requiring 100% arrest rate for an extended period of 91 days. That leaves us 209 and 139 suspected runs. A closer look, however, reveals that the vast majority of these episodes had, at that stage of their decline, only one vessel left. Excluding these cases we conclude that there is sufficient evidence to exclude a creditor's run for 98% or 99% of bust episodes. Clearly, it is still possible that the high arrest rates in $1\% - 2\%$ of bust episodes were actually caused by dis-functional owners.

Table 6: The distribution of the maximum daily arrest rate

	$max\left\{daily\_arrest\_rate_{d,i}\right\}_d$		$mean\left\{daily\_arrest\_rate_{d,i}\right\}_{max\pm45d}$	
	frequency	%	frequency	%
0	870	74	870	74
(0,20%)	18	1.5	55	4.7
[20%,40%)	23	2	25	2.1
[40%,60%)	35	3	40	3.4
[60%,80%)	12	1	22	1.9
[80%,100%)	9	0.8	25	2.1
100%	209	17.8	139	11.8
excluding single vessels	20	1.7	12	1

4.3 Direct costs of arrests

While the loss of income is the main cost of immobilization, it is not the only one. There are additional direct costs due to port fees, crew wages and supplies, court fees, brokerage fees etc. The existence of these additional fees does not change the analysis: in a perfect Coasian world there would be no arrests and, therefore, no additional costs of arrest. For the sake of completeness, however, we used the files of the Admiralty Marshall (the agency responsible for executing arrest warrants) in London to collected, by hand, data

[15]In that process, we lose a few observations where capacity dropped so fast that we could not identify the point where the company crossed the threshold.

about twenty two vessel arrests in England over the period 1995-2010. The results are described in Table 7: the median period the vessel was immobilized was 71 days or about two months (much lower than the sample mean). The median direct costs of arrest are 8% of the sale price. Consistent with the observation that arrested vessels tend to be small, notice that the average sale value of a vessel is only $1 million.

Table 7: Direct costs of arrests

	Immobilization (days)	Sales price (USD, millions)	Total costs as % of sales price
mean	111	3.25	18%
median	71	1.09	8%
st.dev	165	8.16	30%
min	19	0.04	2%
max	835	38.65	105%
Observations	22	22	21

5 Estimating the Fire Sale Discount

The fire-sale discount analysis in this paper uses data from ship transactions in the secondary market that occured between 1995 and 2012. Ships are relatively homogenous assets, especially within a particular type of ship, e.g. an oil tanker, allowing us to obtain an accurate estimate of a benchmark price. The number of sales of ships transacted in the secondary market varies from 1300 in 2006 to about 380 in 2012. There is also considerable variation in the number of arrests, which peaks in 1996 (48 arrests) with zero arrests in some other years.

The arrest narratives, which we have used in order to classify arrests by trigger and resolution (see Table 2 above) have many references to the poor technical condition of arrested vessels: 'auxiliary engines and boiler trouble', 'ingress of water into engine-room; hull in bad condition; cargo holds water contaminated', 'cracks in hull', 'survey revealed unseaworthiness', 'bottom damage requiring considerable steel renewal' etc. These descriptions suggest that one aspect of Myers (1977) underinvestment problem is poor maintenance of assets. If so, it raises the question as to whether a substantial part of Pulvino's (1998) 'raw' discount may have less to do with market liquidity (in the sense of the ease with which a buyer may be found at short notice) and more to do with quality of assets; an issue discussed by Pulvino, although he acknowledges that lack of data prevents him from examining this important issue in depth. Campbell et al. (2011) discusses quality component in considerable depth although he is unable to provide reliable estimates: "This confirms the suspicion that much of the estimated price effect is not directly related to the urgency of the sale, but results from unobserved poor maintenance." (Page 2119).

To test the under maintenance hypothesis, we use the detailed technical information that LLI provides us, particularly the age at which a vessel is scrapped (or broken up in industry jargon). As a first step, we execute duration analysis to demonstrate that the remaining life of vessels under arrest is shorter than that for non-arrested vessels. Put differently, the effective age of an arrested ship is roughly 2 years greater than its registered age.We convert this higher effective age to a price effect to show that at least half of the raw discount is due to poor maintenance. We will revert back to this issue in the next sub section.

The fire-sale discount is calculated using a hedonic model that maps characteristics of the ships to the prices at which they were transacted. We have over 20,000 shipping sales that allows us to obtain a reliable estimate of this mapping. In the second stage, we calculate the difference between the transacted price of the arrested ship and the counterfactual price that comes from the hedonic model. The difference between the actual (transacted) price and the counterfactual price (imputed from the hedonic model) provides an estimate of the fire-sale discount.

5.1 Hedonic Regression

To calculate the fire-sale discount, we need the sales price of a given (arrested) ship assuming it not been involved in a forced sale. We calculate the discount in two stages. In the first stage, we estimate a hedonic model (characteristics-based approach) to calculate the benchmark price of a ship which is not under arrest. The graph below shows that, conditional on a given age, arrested ships have a shorter remaining life expectancy than non-arrested ships, suggesting significant quality differences between the two groups. We control for this quality difference by calculating the remaining life expectancy of the [distressed] ship and use this as an extra control variable in our first-stage regression. As can be seen in Table 8, columns 1 and 2, the hedonic model provides a good benchmark (R-square is approx. 88 percent) for the price of a ship. In the second stage, we use the coefficients from the hedonic model to calculate the fire sale discount on arrested ships.

The first stage equation of the hedonic model is given by:

$$log(Price)_{ijt} = \beta_j + \beta_t + \sum \beta_i X_{it} + \epsilon_{ijt} \tag{3}$$

The subscript i indexes a ship, j indexes the type of the ship and t indexes the year. β_j and $\beta_t$are ship-type and year fixed effects and X_{it} are ship characteristics which are used as controls. These include whether the ship sold was part of a block sale of ships or was sold individually (captured by a indicator variable Block), the age of the ship, the deadweight tonnage (Sale DWT) and other physical characteristics of the vessel such as the length, breadth, freeboard and draft of the ship.

A key innovation of this study is that it controls for the quality of the ship at the time of sale using the imputed life expectancy of the ship. We can only make this correction because ships have a finite life and are eventually broken up.[16]We calculate the life expectancy of a ship by calculating the conditional hazard rate. At a given age we examine how many of the ships that are alive at that age transition to the next year. This gives us the conditional survival rate, which when subtracted from 1 gives us the conditional hazard rate. It should be noted that in calculating the hazard rate, we pool all ships together irrespective of their type. We could calculate a hazard rate this way for each ship type, but stastistical power issues prevent us from controlling for ship cahracteristics in such a non-parametric manner. In robustness tests, however, we estimate a cox proportional hazard model that allows us to some extent to control for the characteristics of ships. We show the life expectancy correction is virtually unaffected when we invert the hazard rates derived from a cox hazard model.[17]

Figure 5 plots the hazard function for both arrested and non arested sales of ships. The graph shows that for a given age of a ship the probability of it dying, i.e., being broken up, is higher for arrested ships than for non arrested ships.We use this hazard function to calculate the life expectancy of both arrested and non arrested ships at the point of sale; and, we add life expectancy as a further control variable in our first stage.

The results of the first stage hedonic regression in Table 8 show that ships sold in blocks command 3.3 percent higher prices than those sold individually. It should be noted that the regression included ship type fixed effects and year fixed effects. Some other characteristics such as the length, extreme breadth, depth and draft enter positively in the regression suggesting that, within a category of ships (we have ship type fixed effects), larger ships command a higher price. The variable 'Life Expectancy' suggests that an extra year of life expectancy commands a 7.5% higher price.

In Table 9, we report the price discount on various categories of ship transactions.In columns 1 and 2 we examine the fire sale on arrested ships and find that on aveage arrested ship are sold at a discount of 25.9 percent relative to normal ship transactions (see column1). These estimates are quite similar to what have been reported in Pulvino (1998). In column 2, where we control for the quality of the ship this discount reduces to 13.4 percent, suggesting that rougly half of the fire sale discount seems to be driven by difference

[16]Such a correction would be difficult in housing becuases houses do not die.

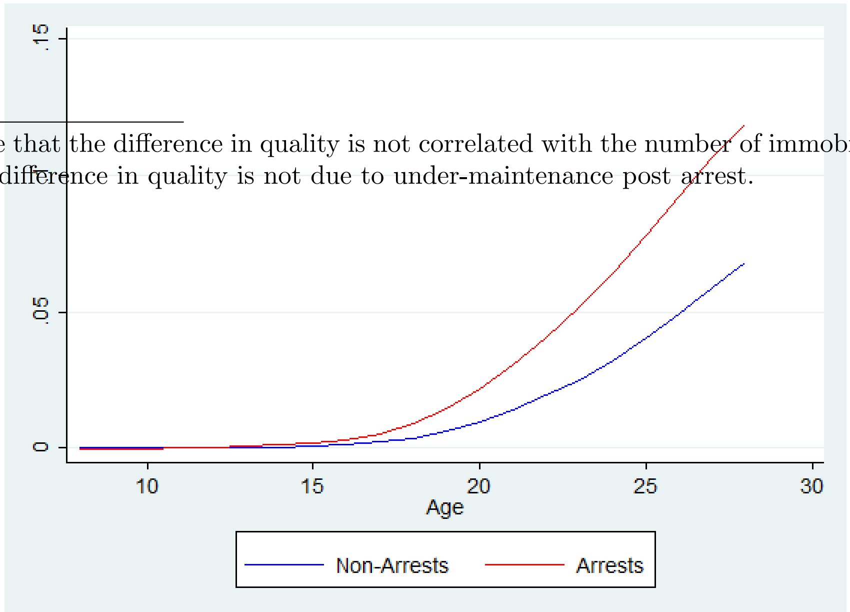
[17]The details of the cox proportional analysis can be requested from the authors.

in quality of ships. Arrested ships tend to be poorly maintained and that partially explains the fire sale discount. In terms of life expectancy this roughly corresponds to an average of 1.7 years difference in life expectancy with arrested ships, conditional on age, having a lower life expectancy. [18]

In columns 3 and 4, we calculate the fire sale discount on ships that are sold by distressed owners. The variable 'Distressed' is an indicator variable that takes on a value of 1 if the firm has undergone a 50 percent decline in capacity in the last 5 years and is 0 otherwise. We find that the fire sale discount for distressed owners to be 4.1 percent and reduces to 3.2 percent when we control for quality. The small quality discount suggests that under-maintenance does not seem to be a significant issue for these ships. In columns 5 and 6 we include both the arrest and the distress indicator variables in our regressions and find that virtually the entire quality discount is driven by arrested ships. The overall discount for arrested ships goes down from 24.9 percent to 10.1 percent when one controls for the quality of ships. The fire sale discount for distressed ships is around 2.5 percent and is unaffected by any quality correction.

In summary, we find that arrested ships generate a fire sale discount of rought 25 percent, which is similar to what has been documented in prior studies. Interestingly, however, we find that as much as half of this discount is due to unobserved quality of arrested ships. In the next sub section, we explore some other determinants of the fire sale discount.

Figure 5: Hazard Regression



[18]It is important to note that the difference in quality is not correlated with the number of immobilized days suggesting that this difference in quality is not due to under-maintenance post arrest.

Table 8: Hedonic Model based on characteristics of ships provided by LLI

	(1) Without quality correction	(2) With quality correction
Block	0.033***	0.024**
	(0.010)	(0.009)
Sale age	-0.001	0.145*
	(0.081)	(0.081)
Sale age x sale age	0.001***	-0.001***
	(0.000)	(0.000)
Special unit	0.007**	-0.002
	(0.004)	(0.004)
Sale DWT	-0.000	-0.000
	(0.000)	(0.000)
Gross weight	-0.000***	-0.000***
	(0.000)	(0.000)
Length	0.005***	0.005***
	(0.000)	(0.000)
Breadth extreme	0.034***	0.035***
	(0.003)	(0.003)
Depth	0.042***	0.046***
	(0.005)	(0.005)
Draft	0.012***	0.014***
	(0.005)	(0.005)
Freeboard	-0.000	-0.000
	(0.000)	(0.000)
Life Expectancy		0.075***
		(0.011)
Observations	10,893	9,479
Adjusted R2	0.877	0.873
FE (year & type)	Yes	Yes

Table 9: Second stage (residuals): Difference between the actual price and the imputed price

	(1) W/O QC	(2) With QC	(3) W/O QC	(4) With QC	(5) W/O QC	(6) With QC
Arrested	-0.259***	-0.134***			-0.248***	-0.101***
	(0.035)	(0.035)			(0.035)	(0.036)
Distressed			-0.041***	-0.032***	-0.025***	-0.026***
			(0.009)	(0.009)	(0.009)	(0.009)
Constant	-0.000	0.000			0.000	0.000
	(0.003)	(0.003)			(0.003)	(0.003)
Observations	9,673	9,673	9,673	9,673	9,673	9,673
Adjusted R2	0.011	0.003	0.002	0.002	0.012	0.003

5.2 Other determinants of the fire sale discount

In the previous sub section, we documented that roughly half of the discount was driven by quality differences between arrested and non-arrested sales. Even after controlling for quality the discount is quite large at between 10 to 13 percent. The analysis above gives equal weight to all shipping sale transactions. In other words, a fire sale discount on a 100 million dollar ship is treated similarly to a fire sale discount on a 10,000 USD yacht. So if the fire sale discount on the 100 million dollar ship is 0 percent and the fire sale discount on the 10,000 USD is 40 percent, the average discount (equally weighted) would be 20 percent. The value weighted discount, however, is very close to 0 percent. Thus, while an equally weighted discount provides us with a useful metric to gauge the extent of loss, a value weighted fire sale discount provides a better indication of the extent of overall economic loss. Before we report the price weighted results it is important to note that the median price of the arrested ship is significantly lower than the median price of a transacted ship (3.3 million USD vs. 9.0 million USD). In Figure 6, we show the distribution of values of ships sold under arest and those sold privately.

In Table 10 we report the price weighted fire sale discount. As can be seen from columns 1 and 2, the price weighting reduces the entire fire sale discount to only 5.1 percent and it is not statiscally significant. In columns 3 and 4, we conduct additional cross-sectional tests to investigate the heterogeneity in the fire-sale discount documented above. This test examines how the fire-sale discount varies with institutional differences such as the quality of the ports. We expect the quality of a country's jurisdiction to increase the length of time a ship spends in port after arrest. i..e the period of immobilization, and the resulting economic costs. These increased costs derive from higher port charges, payments to suppliers and crew and any side payments (bribes) to officials. Sales of an arrested ship can be sold within six weeks of the arrest in an efficient port while the period of immobilization may take years in an inefficient port (average days of arrest are 213 for corrupt ports and 142 for less corrupt ports). For this purpose we use a country corruption index described below. We would expect the fire sale discount of the arrested ship to be positively correlated with the corruption index. For a corruption index we use the one devised by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1999) which has a range from 0 to 10.

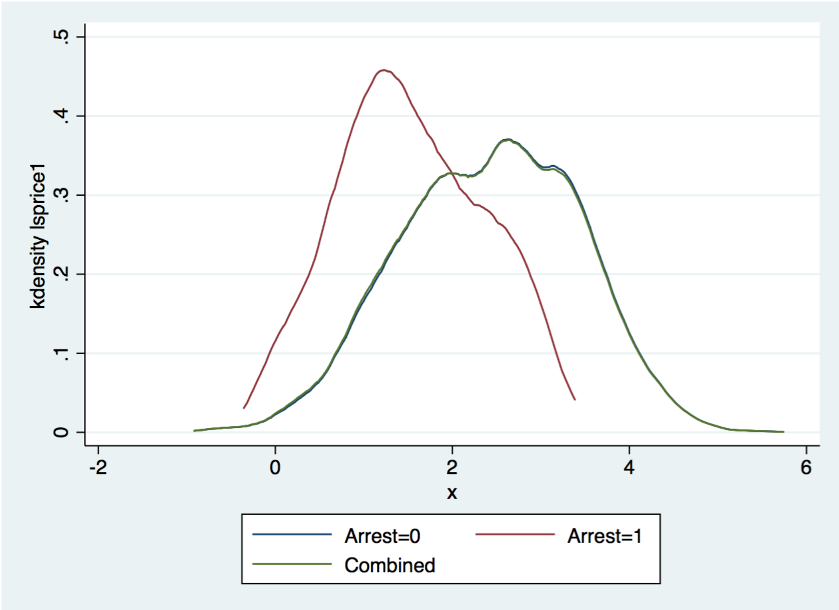
We split the data of arrested ships into two sub samples, depending upon whether they were arrested in high or low corruption countries. A cutoff of 8 was used to separate the two samples, and provides the following two groups of countries. The high corruption countries include: Bahamas, Chile, Cyprus, Greece, India, Italy, Malaysia, Malta, Mexico, Panama, Sri Lanka, Trinidad and Tobago, Turkey and Venezuela. The low corruption countries include: Australia, Belgium, Canada, Denmark, France, Germany, Gibraltar, Holland, Hong Kong, Israel, Japan, Montenegro, Netherlands Antilles, South Africa, Singapore, Tahiti, the UK and the US. As can be seen in Table 10 , ships arrested in countries with less corruption (above the average of 7.9 for the corruption index), observe a smaller fire sale discount, 11 percent in low corruption countries compared with 21.4 percent in high corruption countries; this difference is statistically significant (at the 10 percent level) and economically significant (columns 3 and 4). In columns 5 and 6 we redo the analysis, but this time run a price weighted regression instead. We find that while there is a fire sale discount in the high corrupt ports, the firm sale discount is virtually disappears (3.1 percent and not statistically significant) in low corruption ports.

In summary, the raw fire sale discount in our paper is very similar to the fire sale discount that has been documented in Pulvino (1998). On decomposing the fire sale discount, we find that about half of this discount is due to quality differences between arrested and non-arrested ships. Furthermore, the discount seems to be concerntrated in lower valued ships. A value weighted regression estimate, further reduces the discount to roughly 5 percent. A cross-sectional analysis reveals that higher valued ships arrested in less corrupt ports carry a very small discount.

Table 10: Fire-sale Discount Decomposition Analysis: Second Stage Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
	All	All	High Corruption	Low Corruption	High Corruption	Low Corruption
	No Weighting	Price Weighted	No Weighting	No Weighting	Price Weighted	Price Weighted
Arrested	-0.134***	-0.051	-0.214***	-0.110***	-0.139**	-0.037
	(0.035)	(0.034)	(0.060)	(0.040)	(0.063)	(0.038)
Constant	0.000	0.044***	0.000	0.000	0.044***	0.044***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	9,673	9,623	9,550	9,627	9,503	9,578
Adjusted R2	0.003	0.000	0.003	0.002	0.001	0.000

Figure 6: Value distribution of arrested and non arrested ships



5.3 Auctions

In Table 11 we describe the average number of bidders for a vessel arrested and sold in UK ports. The average number of bidders, based upon a small number of sales, is high at 8, which is consistent with the view that the market in second hand vessels is liquid. In one case the number of bidders reached twenty three. However, the evidence is of a significant spread between the top two bidders. This may reflect the small sample.

Table 11: Auction data from UK ports

	No. of bids	Spread between:	
		Top 2	Top 3
mean	8.5	24%	30%
median	8	22%	31%
st. dev.	4.9	20%	10%
min	1	1%	10%
max	23	79%	60%
Observations			

6 Conclusion

Shipping provides an important laboratory for testing Hayek's natural experiment in 'spontaneous order'. Because ships move from one jurisdiction to another, and often 'go bust' on the high seas outside any country's territorial waters and jurisdiction, the creditor (with or without the debtor's assistance) can arrest and auction a ship at a maritime port. Ideally it will wish to choose the port of arrest to minimise costs. The proceeds of auction will then be used to repay creditors, according to the laws of that jurisdiction.

There are two important qualifications. First, creditors of shipping companies rely on maritime courts to arrest ships, in the event of default, and auction them in a timely and cost efficient manner. Thus, there is an important role of enforcement for the courts. Second, the courts of some countries, for example the US, may sometimes try to thwart the arrest or auction of ship in foreign ports, where the debtor is in some way connected with the US and seeks protection under Chapter 7 or Chapter 11 of the 1978 Bankruptcy Code. However, the exercise of US 'imperium' in shipping bankruptcies can and has been thwarted by contractual innovations, as illustrated in the case of Eastwind.

This paper has addressed the question of how costly are bankruptcy procedures which have largely evolved out of private commercial contracts, with the courts playing little more than the role of contractual enforcer. There are three measures of costs. First, how frequently do creditors of distressed and defaulting shipping companies resort to the bankruptcy procedure of arrest and auction in maritime ports? We find a relatively low proportion of arrests, with the debtor frequently resorting to the private sale of ships. Only when the debtor seems to have run out of cash, or when the ships are of such a low value that the debtor or owner's equity is far out of the money, do we find arrests and forced sales taking place. This is evidenced by the value of arrested ships which is far below the median value of ships sold by non-distressed companies. The value of those forced sales is frequently close to, or at, 'break up' value'.

Second, using a hand collected sample of ships arrested and auctioned in UK ports, we find that the direct costs of arrest and sale are around 8 percent of the proceeds of auction. The arrests are triggered by both the mortgage holder, crews (who are owed wages) and unsecured creditors including suppliers to the ships. The costs vary with the value of the ship suggesting a fixed element.

The third cost is the 'fire sale discount'. Following Pulvino (1998) we might expect a significant discount from the arrest and forced sale of ships due to the illiquidity of the market for second hand ships. We find on average a discount of 26 percent compared with ships of similar age and use. This is very similar to the discount estimated by Pulvino. However, we also find that ships which are arrested and sold are of lower quality than comparable ships sold outside distress. Forced sales of ships tend to be under-maintained and are therefore of lower quality. In effect this lower quality is equivalent to an age premium of 1.7 years compared with other ships. Adjusting for this factor reduces the discount from 26 to 13 percent. This average discount is for ships sold in both inefficient and efficient ports. As a proxy for efficiency we have used La Porta et al's (1999) corruption index and when we re-estimate the index for arrests and sales at low corruption ports we find the discount is 11 percent compared with 21 percent for high corruption ports.

Finally, we explore how the discount varies with the price of ships. Our results suggest that where the price is above the median value of arrested ships the discount virtually disappears. The fire sale discount of 11 percent is almost wholly concentrated in ships with values well below the median. The evidence is that these low valued ships are usually close to the end of their economic life and are frequently purchased by 'breakers' who will tow the ship to Pakistan or India to be sold for scrap. The overall conclusion from this evidence suggests that in terms of distress and bankruptcy the shipping industry passes Hayeck's test of 'spontaneous order'.

The question remains, however, to what extent these results might extend to other industries? Do we need Chapter 11 type reorganizations to mitigate the risk of fire sale discounts which was one of the motivations for the original legislation? Shipping has advantages in so far as there is a large market for second hand ships, and the brokers who sell the ships are able to market the vessels to a global market. Moreover, there is often little intangible value in ships compared with other industries. In that respect, we would be cautious in suggesting that our results extend to other industries. However, even here we might speculate that contractual innovations and well developed capital markets might mitigate many of the costs claimed as justifying a highly active bankruptcy code.

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