A game theory analysis of China's maritime cross-border insolvency policy: from the perspective of Hanjin shipping's bankruptcy case

Zhu Li & Bingying Dong

Published online: 18 Jun 2020.

Submit your article to this journal ⬈

Article views: 8

View related articles ⬈

View Crossmark data ⬈

Routledge
Taylor & Francis Group

Check for updates

A game theory analysis of China's maritime cross-border insolvency policy: from the perspective of Hanjin shipping's bankruptcy case

Zhu Li[a] and Bingying Dong[b]

[a]Law School, Shanghai Maritime University, Shanghai, China; [b]Law School, University of International Business and Economics, Beijing, China

ABSTRACT

Financial difficulties experienced within the shipping industry have caused an increasing number of maritime cross-border insolvencies. The UNCITRAL Model Law on Cross-Border Insolvency (the Model Law) is designed to assist countries in equipping their insolvency laws with a modern framework that more effectively addresses cross-border insolvency proceedings. This paper discusses whether China should adopt the Model Law, using the method of strategic game theory based on the Hanjin Bankruptcy case. Our results show that, from the perspective of a mathematical evaluation, China should not adopt the Model Law, since Hanjin declared bankruptcy with South Korea's adoption already having taken place. Even if the Model Law is adopted, its application in China will be very limited due to the structure of Chinese shipping enterprises.

1. Introduction

Due to the economic impact of the financial crisis in 2008, the shipping industry has gone through a period of financial difficulties, with many shipping companies having to file for insolvency. The international character of the shipping industry and the mobility of its ships, which are usually the main assets of most shipping companies, produce a further complicating factor to insolvency proceedings (Göretzlehner 2019). This is not only because the creditors of shipping companies are from different countries but also because the debtors are multinational shipping companies having their insolvency assets located in different jurisdictions. This in turn has resulted in the phenomenon of maritime cross-border insolvency. One typical example is the bankruptcy of Hanjin Shipping Co. Ltd (hereinafter referred to as the 'Hanjin'). Prior to bankruptcy, Hanjin was the world's seventh largest container shipping line (Pu 2017), operating approximately 60 container lines, with 140 vessels (Xu 2019). A miscalculation of chartering risks, errors in forecasting, and the adverse shipping market conditions resulted in Hanjin's deteriorating financial situation (Shin, Lee, and Lee 2019). On 31 August 2016, Hanjin filed an application for rehabilitation protection in the Seoul Central District Court. Hanjin had approximately 27 subsidiaries or offices in 19 states and districts (Hanjin 2016, 46), and had approximately 4,000 creditors (Shi and Huang 2017a), whose claims totalled approximately 10 USD.5 billion (CSA 2017). It is the largest ever maritime cross-border insolvency in history.

The UNCITRAL Model Law on Cross-Border Insolvency (hereinafter referred to as the 'Model Law'), adopted by the United Nations Commission on International Trade Law in 1997, is designed to assist countries in equipping their insolvency laws with a modern framework that more effectively

addresses cross-border insolvency proceedings (UNCITRAL 2014, 3). There are 46 States that have adopted the Model Law as part of their domestic legislation, including some of the world's most economically powerful countries (UNCITRAL 2019), such as the United States (US), the United Kingdom (UK), Canada, Australia, and Japan. At the same time, some countries are still reluctant to adopt the Model Law, such as China and India, and most of the EU member States, including the economic powerhouses of France and Germany (Mccormack and Wan 2019). The Model Law is a short document consisting of only 32 articles. It mainly focuses on four pillars including access, recognition, relief, and cooperation. One of the main features of the Model Law is to establish simplified procedures for recognition of qualifying foreign proceedings and to provide necessary relief to assist foreign proceedings (United Nations Commission On International Trade Law [UNCITRL] 2014, 3). Although the Model Law resembles a multilateral convention or treaty it is by nature a non-binding soft-law text. Countries can freely choose whether or not to adopt, and, if adopting, they can do so with or without significant adaption (Parry and Gao 2018). The Model Law thus confers the freedom on a State to decide how to incorporate the Model Law into its domestic legislation (Mohan 2012, 5). In fact, among 46 enacting States, there have been few who have done so without significant modification. For instance, in order to protect its national interest, South Africa adopted the most restrictive reciprocity provision, which means that the adoption of the Model Law is not an effective guarantee of reciprocity under the South Africa law (Rebecca and Gao 2018). Despite the uncertainties caused by the soft law nature, the Model Law has been the milestone of a modified universalistic approach to cross-border insolvency (Erik 2019). It has done much to promote greater cooperation between courts in different states and has improved the efficiency of cross-border insolvency procedures.

In the abovementioned Hanjin Bankruptcy case, since South Korea had already adopted the Model Law in 1997, Hanjin submitted applications for recognition of foreign insolvency procedures in South Korea to a total of 15 states (Kim 2019, 116), among which 10 states (Hyeon 2019, 116) had also adopted the Model Law (Shi and Huang 2017b). Most of these states recognized the South Korea rehabilitation procedure and granted relief from arrest proceedings, including Japan, the United Kingdom, Germany, Belgium, Canada, Australia, and the United States (Erik 2019). For example, the US Bankruptcy Court recognized the South Korea rehabilitation proceedings and granted an automatic stay under Chapter 15 of the Bankruptcy Code. This ensured that Hanjin's vessels could continue operating in the normal way and enter the US territory without the risk of being arrested (Eslinger 2016). However, Hanjin did not file any application for recognition of foreign insolvency proceedings in China, mainly because China has not adopted the Model Law. According to Article 5 of the Enterprise Bankruptcy Law of the People's Republic of China, 2006 (hereinafter referred to as the 'EBL 2006'), a foreign insolvency proceeding could be recognized and enforced by a Chinese court (1) according to the relevant international treaties that China has concluded or acceded to, or (2) according to the principle of reciprocity (Standing Committee of the National People's Congress of the PRC 2006). There are neither bilateral or multilateral treaties with respect to the cross-border insolvency in China nor any precedent case of recognition of Chinese insolvency proceeding by the courts of South Korea. As a result, although Hanjin had nine offices in China, as well as one wholly owned subsidiary that was headquartered in Shanghai with 11 branches located in several Chinese coastal cities (Jingchen 2019), Hanjin never filed any application with the Chinese courts for recognition of South Korea's insolvency proceedings.

A pessimistic attitude towards the Chinese legal regime of cross-border insolvency has been indicated in the abovementioned case. This highlights the importance of discussing whether China should adopt the Model Law or maintain a domestic approach to improving its legal framework of maritime cross-border insolvency. This decision shall be made based on an evaluation of the impact of the adoption of the Model Law on Chinese multinational enterprises. Since the internal correlation of various industries will inevitably lead to the emergence of Water Wave Effects and will also affect other industries, relationships among various stakeholders in the industry chain shall be considered in order to make the decision. The purpose of this paper is to discuss whether China should adopt the Model Law, based on the case of Hanjin Bankruptcy, using the method of strategic game theory. Our results show that the

adoption of the Model Law will not currently be advantageous to China. These results may have implications for policymakers in China when considering whether to adopt the Model law and how to improve the maritime cross-border insolvency regime.

The limited scope of this research should be acknowledged. Hanjin's financial collapse was by far the world's largest liner shipping bankruptcy in history. Due to the large number of Hanjin's creditors and assets in China, the case of Hanjin bankruptcy is selected to analyse China approach towards the maritime cross-border insolvency. It should be noted that the results in this paper only explain whether China should adopt the Model Law in a maritime context based on the Hanjin bankruptcy case. However, due to the international nature of shipping industry and the increasing number of maritime bankruptcy cases, the experience of maritime cross-border insolvency may provide some insights for cross-border insolvency in other areas.

2. The model

A strategic form of game theory expressed as $G = \langle N, (A_i), (u_i) \rangle$, the components being as follows:

The set of Players in the game theory: $N = \{1, 2, \cdots, n\}$; Each Player i has a strategy A_i ($i \in N$), with the strategy set A including all actions that the Player can choose; Each Player has a profit function $u_i : A \rightarrow R$, $A = \times_{i \in N} A_i$.

Since this paper discusses the adoption of the Model Law from the perspective of the shipping industry, shipping company status will eventually influence the state's decision. As shown in Figure 1, the shipping company has two choices: (1) bankruptcy protection; (2) no bankruptcy protection. Companies declaring for bankruptcy protection follow the standard procedures for liquidation, while those not declaring bankruptcy still bear the obligation of debt settlement.

In order to simplify the issue, the Players in the game model between shipping companies are set as two parties, liner company A and liner company B, and are defined as $N = \{1, 2\}$; the strategy set is $A_1 = A_2 = \{\text{Declare}, \text{Not Declare}\}$; the utility function is the set of utility functions among various related parties (see Figure 2), these being as follows:

$$u_1(declare, not\ declare) = u_2(declare, not\ declare) = \sum_{j=1}^{n} R_j^s \qquad (1)$$

$$u_1(not\ declare, not\ declare) = u_2(not\ declare, not\ declare) = \sum_{j=1}^{n} R_j^{ns} \qquad (2)$$

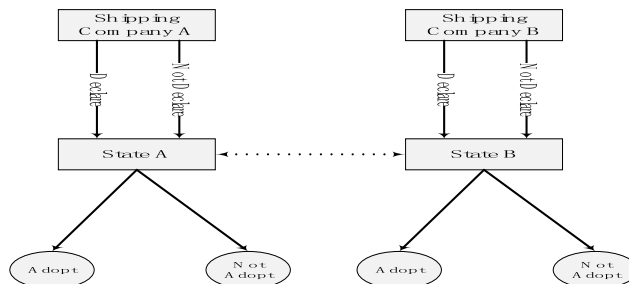$$u_1(notdeclare, declare) = u_2(declare, notdeclare) = \sum_{j=1}^{n} R_j^{m_1} \qquad (3)$$

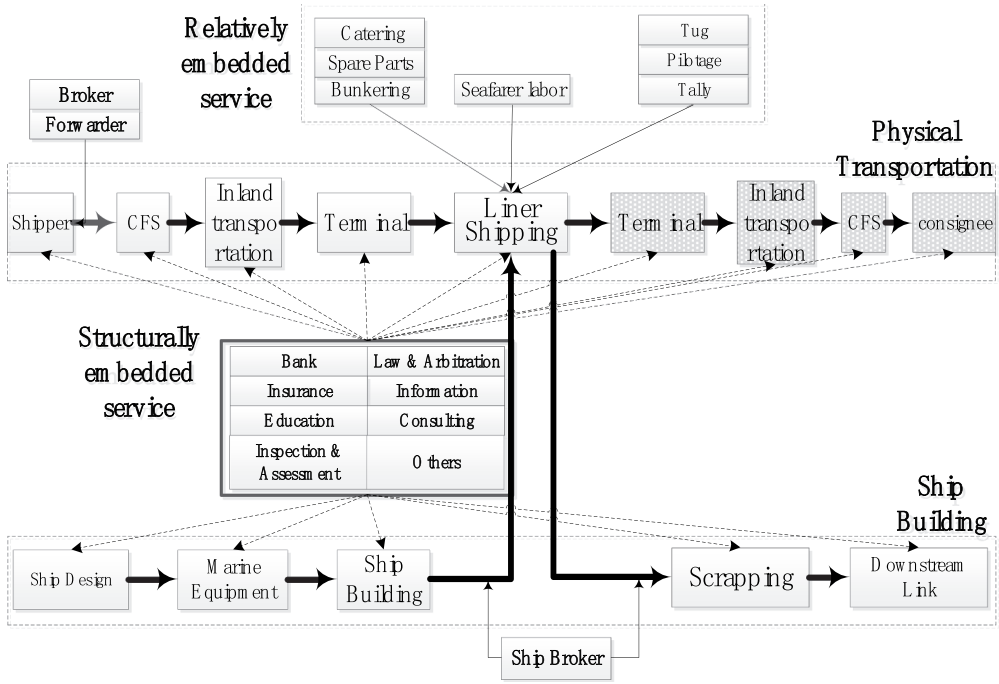Figure 1. Basic model of extensive-form game.

Figure 2. International shipping industry chain structure chart. (Chen and Wang 2014, 18-20 + 47).

$$u_1(declare, notdlare) = u_2(notdeclare, declare) = \sum_{j=1}^{n} R_j^{m_2} \qquad (4)$$

In the above formulas, R is the utility function of the related party, j is the number of the related party, R_j^s is the utility function of the related parties when both liner companies declare bankruptcy, R_j^{ns} is the utility function of the combination of the related parties when both liner companies do not declare bankruptcy. $R_j^{m_1}$ and $R_j^{m_2}$ indicate the utility function under the other two combinations of the strategy, namely A declares and B does not declare, and vice versa. Therefore, the following game matrix shall be obtained, which is the first level of the game model. In other words, the Players are the liner company A and the liner company B, and their actions are in no particular order, as shown in Table 1.

Based on the first level of the game model, the utility function is refined. The related party combinations and utility functions of the subgame are clarified to establish the second level of the game model.

The Players in the inter-country strategic game model are set as China and State H. In particular, based on the actions of the liner companies, the States choose to adopt the strategy (I) or not (U), which forms a secondary strategy combination, as (I, I), (I, U), (U, I), (U, U). The game between

Table 1. First level of the game model.

		Liner company A	
		Declare	Not declare
Liner company B	Declare	$\sum_{j=1}^{n} R_j^s$, $\sum_{j=1}^{n} R_j^s$	$\sum_{j=1}^{n} R_j^{m_1}$, $\sum_{j=1}^{n} R_j^{m_2}$
	Not declare	$\sum_{j=1}^{n} R_j^{m_2}$, $\sum_{j=1}^{n} R_j^{m_1}$	$\sum_{j=1}^{n} R_j^{ns}$, $\sum_{j=1}^{n} R_j^{ns}$

States is a static game that has no order. However, a State's decision depends on the actions of another State. This strategic formulation of the game is shown in Table 2. Taking *(I, U)* in the first row of Table 2 as an example, both liner company A and liner company B choose to declare bankruptcy, $u_1((I, U)) = \sum_{j}^{R} s_i$ indicates that China adopts the Model Law while State H does not.

Similarly, when company A does not declare bankruptcy, the utility function is expressed as in Table 3.

2.1. Combination of related parties

As shown in Figure 2, the parties that are directly related to liner shipping companies include freight forwarding companies, ports, and shipbuilding companies, while banks and insurance companies are indirectly related. Obviously, the large number of related parties in the international shipping industry will result in a geometric growth of the combination, which is not conducive to effective evaluation. Therefore, related parties with less external influence (such as information and technology advisory services, crew service companies, ship spare part companies, etc.) are excluded. Only the combinations of key enterprises are analysed and calculated (see Table 4).

2.2. Determination of utility function value

The core issue of the utility function is whether the claims of the creditors (the related parties) can be satisfied in the liner company bankruptcy proceedings. In this paper, the economic loss caused by the bankruptcy of the liner company is regarded as the data for utility evaluation. Taking the shipper as an example, if a liner shipping company registered in one of the enacting States of the Model Law declares bankruptcy in courts of the State and other enacting States, the shipper cannot be either fully or partially

Table 2. Strategic formula of the game when liner company A declares bankruptcy.

Liner company A declares bankruptcy	(I, I)	(I, U)	(U, I)	(U, U)
Liner company B declares bankruptcy	$\sum_{j=1}^{n} R_j^{s_i}$, $\sum_{j=1}^{n} R_j^{s_i}$	$\sum_{j=1}^{n} R_j^{s_i}$, $\sum_{j=1}^{n} R_j^{s_u}$	$\sum_{j=1}^{n} R_j^{s_u}$, $\sum_{j=1}^{n} R_j^{s_i}$	$\sum_{j=1}^{n} R_j^{s_u}$, $\sum_{j=1}^{n} R_j^{s_u}$
Liner company B does not declare bankruptcy	$\sum_{j=1}^{n} R_j^{ns_i^1}$, $\sum_{j=1}^{n} R_j^{ns_i^1}$	$\sum_{j=1}^{n} R_j^{ns_i^1}$, $\sum_{j=1}^{n} R_j^{ns_u^1}$	$\sum_{j=1}^{n} R_j^{ns_u^1}$, $\sum_{j=1}^{n} R_j^{ns_i^1}$	$\sum_{j=1}^{n} R_j^{ns_u^1}$, $\sum_{j=1}^{n} R_j^{ns_u^1}$

Liner company A and liner company B respectively represent cross-border liner companies registered in State H and China. Liner company A declares bankruptcy protection in court of State H.

Table 3. Strategic formula of the game when liner company A does not declare bankruptcy.

Liner company A does not declare bankruptcy	(I, I)	(I, U)	(U, I)	(U, U)
Liner company B declares bankruptcy	$\sum_{j=1}^{n} R_j^{ns_i^1}$, $\sum_{j=1}^{n} R_j^{ns_i^1}$	$\sum_{j=1}^{n} R_j^{ns_i^1}$, $\sum_{j=1}^{n} R_j^{ns_u^1}$	$\sum_{j=1}^{n} R_j^{ns_u^1}$, $\sum_{j=1}^{n} R_j^{ns_i^1}$	$\sum_{j=1}^{n} R_j^{ns_u^1}$, $\sum_{j=1}^{n} R_j^{ns_u^1}$
Liner company B does not declare bankruptcy	$\sum_{j=1}^{n} R_j^{ns_i^2}$, $\sum_{j=1}^{n} R_j^{ns_i^2}$	$\sum_{j=1}^{n} R_j^{ns_i^2}$, $\sum_{j=1}^{n} R_j^{ns_u^2}$	$\sum_{j=1}^{n} R_j^{ns_u^2}$, $\sum_{j=1}^{n} R_j^{ns_i^2}$	$\sum_{j=1}^{n} R_j^{ns_u^2}$, $\sum_{j=1}^{n} R_j^{ns_u^2}$

Liner company A does not declare bankruptcy protection in court of State H.

Table 4. Combination of relationships.

j	The combination of related parties
1	Liner company and shipper
2	Liner company and inland transport companies
3	Liner company and port company
4	Liner company and financial institution
5	Liner company and insurance company
6	Liner company and other related parties

paid by effective means. In such a circumstance, the liner shipping company is able to evade debt to the greatest extent. However, if a liner shipping company registered in one of the enacting States of the Model Law declares bankruptcy in court of the States and other non-enacting States, its assets cannot be effectively protected in other non-enacting States, except under the principle of reciprocity. At the same time, if a liner shipping company is registered in one of the non-enacting States of the Model Law, its assets also cannot be effectively protected in other States according to the Model Law, except under the principle of reciprocity. When a ship of this company enters the ports of non-enacting States, it may encounter the risk of being arrested. In the latter two circumstances, the foreign proceedings might be recognized and some reliefs might be provided under the private international laws of other non-enacting States. However, in fact, most of the non-enacting States are reluctant to recognize foreign proceedings, or impose strict conditions on the recognition of the foreign proceedings. Even if a foreign proceeding is recognized, limited reliefs are provided in order to protect the interests of domestic creditors. After all, the need to protect local parties and economic interests is immensely important to most states, despite the temptation to articulate a seemingly enlightened universalist approach (Chandra 2012, 20). Under those circumstances, the liner shipping is difficult to evade debt to the greatest extent.

Based on the relationship between the liner shipping company and these related parties, claims that could arise out of bankruptcy of the liner shipping company are analyzed as follows.

2.2.1. Liner company and shipper

Generally speaking, the shipper transports the goods through a booking consignment, purchasing liner shipping services and paying freight charges. According to international practice, most freight is paid for in advance. The bankruptcy of the liner company could thus directly cause the loss of freight, loss of customs clearance fees, and a series of expenses incurred in reorganizing the transportation. At the same time, other indirect losses could be caused by trade contract defaults. The cargo owner, who is usually the seller or buyer under the trade contract, is in charge of shipping or delivering the cargoes according to the trade terms specified in the trade contract. If a liner company goes bankrupt, goods arriving at a port may not be delivered, which in turn will frustrate the performance of the trade contract. In the Hanjin bankruptcy, according to an official website of a Chinese port, as of 13 September 2016, Hanjin had about 500,000 containers drifting at sea, producing a series of risks, including delayed delivery, deterioration of goods, and general average, so the cargo owner and the freight forwarder must come under huge economic pressures and possible economic losses (Eworldship 2016). In this paper, the sum of loss of freight, loss of customs clearance fees and a series of expenses incurred in reorganizing transportation of the cargo interest are set as C_1; the amount claimed by the shipper from the liner company is set as $C_1(1 + i)$ (i being the interest rate).

2.2.2. Liner company and shipping interest

A liner company usually needs to charter some vessels from other shipowners to supplement its ship capacity and to serve shipping networks. For example, according to Alphaliner, as of 1 August 2016, prior to its bankruptcy, Hanjin operated 98 ships, of which 61 ships were chartered, accounting for 55.2% of the total capacity (Shipping Industry 2016). Data from Clarkson show that the charter rate for a 5000 TEU container ship was approximately 15,000 USD per day during the period from 1 January 2017 to 15 January 2017. The daily hire for chartered vessels amounted to nearly one million dollars. If the liner shipping company goes bankrupt, the shipowners who provided such vessels could thus be exposed to the risk of loss of hire and the risk of the arrest of their vessels. In this paper, the loss to shipowners caused by arrest, delay, and default is set as C_2; the amount claimed by shipowners from the liner company is set as $C_2(1 + i)$.

2.2.3. Liner company and port company

Ships arriving at the ports need to pay a series of fees, such as port handling charges, storage fees, tugboat fees, pilotage fees, and so on. These fees are usually settled on a monthly or quarterly basis. The bankruptcy of a liner shipping company could cause the failure of settling these fees. This is the

reason why Hanjin's vessels were prohibited from entering into several ports after the commencement of the insolvency proceedings. In this paper, the loss suffered by the port company caused by the liner shipping company's failure to pay a series of port charges is set as C_3; the amount claimed by the port company from the liner company is set as $C_3(1 + i)$.

2.2.4. Liner company and bank (Hyeon 2019, 115)

Banks have been the principal source of finance for building a new ship or purchasing a second-hand ship (Giryin 2019). The main creditors of Hanjin include Hana Bank (KEB), Industrial Bank, Daegu Bank, Kaixuan Investment, BNP Paribas, and Korea Development Bank. The bankruptcy of a liner company could thus cause the failure to repay the loan provided by banks. Under this circumstance, the bank is usually entitled to arrest and subsequently sell the vessel according to the mortgage contract. However, in the current declining shipping market, the bank would suffer a loss due to the decrease of the ship price. In this paper, the loss incurred by banks is set as C_4; the amount claimed by banks from the liner company is set as $C_4(1 + i)$.

2.2.5. Liner company and insurance company

Insurance is one of the most effective mechanisms for a liner shipping company to distribute and minimize the individual risk. However, from the perspective of insurance companies, they may thus suffer huge losses due to the bankruptcy of liner companies. Since Hanjin carried about 7% of the trans-Pacific container trade volume (IMI 2016), cargo of more than 14 billion USD was stranded at sea (IMI 2016). According to Credit Suisse's analysis (IMI 2016), the insurance and reinsurance sector could ultimately encounter a loss of up to 2 billion USD due to the bankruptcy of Hanjin. In this paper, the insured loss of the cargo insurance company is set as C_5; the amount claimed by the insurance company from the liner company is set as $C_5(1 + i)$.

2.2.6. Other related parties

Other related parties refer to companies who provide supporting services to liner shipping companies, such as container leasing companies, oil suppliers, shipping service companies, and so on. According to the official website of Hanjin, as of 15 January 2017, there were 2,999 companies that had raised claims against Hanjin (Hanjin Shipping Co., Ltd. 2017). As shown in Table 5, the top 10 major creditors of Hanjin mainly include shipowners, container leasing companies, oil suppliers, port companies, and shipping service companies. These companies provide basic elements such as vehicles and labor for the entire transport chain. The services they provide usually generate a huge cash flow, so Hanjin's bankruptcy would also cause great economic loss to these companies. Therefore, the loss of other related parties is set as C_6; the amount claimed by other related parties from the liner company is set as $C_6(1 + i)$.

So far, the general formula of the utility function is $R_j = C_j(1 + i)$.

Table 5. Top 10 major creditors of Hanjin.

S/N	Creditor	Type of company	AMT (M$)
1	Seaspan Corporation	Container ship chartering company	3769
2	DANAOS Corporation	Container ship company	3251
3	Peter Doehle	Maritime service company	3155
4	World Fuel Services	Oil suppliers (for ships)	1957
5	Berlinton Northern and Santa Fe Railroad	American rail carrier	1307
6	Yantian International Container Terminal	Port company	1211
7	Textainer Equipment Management	Container leasing company	1146
8	Santoku Senpaku Co. Ltd	Maritime service company (for providing technical and crew management services)	1045
9	Triton Container International	Container leasing company	987
10	Union Pacific Railroad	Rail carrier	987

3. Results

Since the main legal issues involved in the case of Hanjin bankruptcy are recognition of foreign proceedings and reliefs granted to debtors, the purpose of game theory in this paper is to consider Player's decisions with respect to the recognition and relief in the Model Law and hereby analyze whether China should adopt the Model Law.

In summary, the general formula for the utility function is described as $R_j = C_j(1 + i)$. According to the list of creditors announced by Hanjin as of 15 January 2017, the loss of major creditors in China is illustrated in Table 6.

In order to simplify the calculation, we have made several assumptions, as follows:

Interest rate is set as i, i = 6%; After a liner shipping company declares for bankruptcy protection, the creditor's compensation rate is set at 3% according to international practice, where the objective of constraint is the creditors of those States adopting the Model Law; Liner shipping companies will remove 97% of their debts after filing for bankruptcy protection; Creditors of non-adopting States can recover all their losses through ship arrest and other measures; China's creditors and State H's creditors bear the same losses, and losses to creditors in China (State H) are caused by the bankruptcy of a liner shipping company from State H (China); A liner shipping company that does not declare bankruptcy has no impact.

Since the utility function is the sum of the revenue and loss of the liner company and related parties, the general value of the game is shown in Table 7.

According to the above assumptions, where both liner company A and liner company B declare bankruptcy, there are four scenarios, as follows:

If both State H and China adopt the Model Law, both A and B will remove 97% of the debts. Under this circumstance, as to B's debts, State H has to bear the loss of 97% of the debts, while China bears 3% of the debts. At the same time, as to A's debts, China must bear the loss of 97% of the debts, while the State H bears 3% of the debts.

If State H adopts the Model Law but China does not adopt the Model Law, A's debt will be fully recovered and 97% of B's debts will be removed. Under this circumstance, as to A's debts, State H has to bear 100% of the debts, while China bears no loss. On the other hand, as to B's debts, State H has to bear 97% of the debts while China bears 3% of the debts.

If China adopts the Model Law but State H does not adopt the Model Law, B's debts will be fully recovered, and 97% of A's debts will be removed. Under this circumstance, as to B's debts, China has to bear 100% of the debts, while State H bears no loss. On the other hand, as to A's debt, China has to bear 97% of the debts while State H bears 3% of the debts.

If neither State H nor China adopts the Model Law, the debts of both A and B will not be recovered. Under this circumstance, both State H and China must bear 100% of their own debts, but will not be liable for each other's debts.

Where liner company A (B) files for bankruptcy protection but liner company B (A) does not declare bankruptcy:

If both State H and China adopt the Model Law, 97% of A's (B's) debts will be removed. Under this circumstance, China (State H) has to bear the loss of 97% of the debts while State H (China) bears 3% of the debts.

If State H (China) adopts the Model Law but China (State H) does not adopt the Model Law, A's (B's) debt will be fully recovered. Under this circumstance, State H (China) bears 100% of the debts, while China (State H) bears no loss.

If China (State H) adopts the Model Law but State H (China) does not adopt the Model Law, 97% of A's (B's) debts will be removed. Under this circumstance, China (State H) has to bear 97% of the debts, while State H (China) bears 3% of the debts.

If neither State H nor China adopts the Model Law, A's (B's) debts will not be recovered. Under this circumstance, State H (China) has to bear 100% of the debts while China (State H) bears no loss.

Table 6. Loss of major creditors in China (intercept part).

☐	Creditor	AMT (ten thousand RMB)
Cargo interest	COSCO SHIPPING Logistics Co. Ltd	4655
	Jiangsu Ever-rich Logistics Co. Ltd	91
	Jiangsu KaiTong Logistics Co. Ltd	61
	Chongqing Pacific International Logistics Co. Ltd	138
	Jiangsu Uniwill Logistics Co. Ltd	167
Shipping interest	UNISCO Ltd	663
	Qingdao United International Shipping Agency Ltd	157
	SUNISCO Ltd	762
	China Marine Shipping Agency Co. Ltd	409
	PENAVICO Co. Ltd	1509
	GuangYun Shipping Co. Ltd	241
	Ningbo Xingang Shipping Agency Co. Ltd	227
	Fuzhou Port-town Shipping Agency Ltd	200
	COSCO Shipping Lines Co. Ltd	2797
	SINOTRANS Tianjin Co. Ltd	63
	SINOTRANS Jiangsu Co. Ltd	444
	Chu Kong Transhipment & Logistics Co. Ltd	316
	Ningbo Ocean Shipping Co. Ltd	268
	SINOTRANS Container Lines Co. Ltd	80
	SINOTRANS Chongqing Co. Ltd	169
	CSCL Co. Ltd	8827
	OOCL Co. Ltd	60
	Chongqing Changjiang National Shipping Co. Ltd	58
	AR FLY Co. Ltd	49
	Fuzhou Worde Shipping Co. Ltd	45
	Shanghai Haihua Shipping Co. Ltd	33
Port company	Yantian International Container Terminals Ltd	8797
	COSCO Shipping Ports Ltd	1039
	Shekou International Container Terminals Ltd	3443
	Hongkong International Container Terminals Ltd	1900
	Shanghai Zhendong Container Terminals Co. Ltd	1688
	Shanghai Guandong Container Terminals Co. Ltd	276
	Shanghai Shengdong Container Terminals Co. Ltd	1604
	SIPG Yangtze Logistics Co. Ltd	990
	Ningbo Meishan-island Container Terminals Co. Ltd	282
	Ningbo Yuandong Container Terminals Co. Ltd	261
	NingBo Beilun International Container Terminal Ltd	1495
	Tianjin Port Euroasia International Container Terminal Co. Ltd	888
	Qingdao Qianwan Container Terminal Co. Ltd	789
	Xiamen Port Group Co.	531
Financial institution	Minsheng International Transport Co. Ltd	95
	Orient International Asset Management Co. Ltd (Hongkong)	1413
Other creditors	CSCL Florentine Container Holdings Ltd	67,000
	Tianjin CML Maritime Ltd	88
	COSCO Tug Co. Ltd	31
Total		115,099

The intercept part of the loss of major creditors in China is domestic enterprises with claims of more than 200,000 RMB.

Table 7. General formula of the game value.

Liner company A (B) declares bankruptcy	(I, I)	(I, U)	(U, I)	(U, U)
Liner company B (A) declares bankruptcy	−0.03x-0.97y, -0.97x-0.03y	-x-0.97y, -0.03y	−0.03y, -x-0.97y	-x,-y
Liner company B (A) doesn't declare bankruptcy	−0.03x,-0.97x	-x,0	−0.03x,-0.97x	-x,0

Any credit loss to China or State H are represented by X and Y respectively.

Taking the actual situation into consideration, the specific game values of the game model can be obtained by substituting the data, as shown in Table 8.

Among various strategic combinations, Nash equilibrium is a concept of game theory where the optimal outcome of a game is one where no player has an incentive to deviate from his chosen strategy after considering an opponent's choice. That is to say, for the strategic game

Table 8. Specific game value of the model.

Liner company A declares bankruptcy	(I, I)	(I, U)	(U, I)	(U, U)
Liner company B declares bankruptcy	−118,552,-118,552	−233,547,-3557	−3557,-233,547	−118,552,-118,552
Liner company B doesn't declare bankruptcy	−3557,-114,995	−118,552,0	−3557,-114,995	−118,552,0

$G = \langle N, (A_i), (u_i) \rangle$, the action combination $a^* = (a^*, \cdots, a^*_n)$, if the following conditions are satisfied: For any i ∈ N, any either $a_i \in A_i$ and $a_i \neq a_i^*$, it has $u_i(a_i^*, a^*_{-i}) \geq u_i(a_i, a^*_{-i})$.

According to Table 8, the Nash equilibrium of the game can be obtained. In particular, based on the game between liner shipping companies, each State acts with the largest utility function and the least loss. Furthermore, as indicated in Table 8, when both liner companies declare bankruptcy, or A declares while B does not, the best choice for China is not to adopt the Model Law. Taking Hanjin's bankruptcy as an example, since South Korea is one of the adopting countries of the Model Law, according to the Nash equilibrium of the above game theory China should not adopt the Model Law. It should be noted that although the above games are calculated based on available data of the Hanjin case, the general formula in Table 7 also applies for other similar cases. Therefore, from the perspective of pure mathematical analysis, it can also be concluded that China should not adopt the Model Law.

4. Discussion and conclusions

In the Hanjin bankruptcy case, in spite of having many assets and creditors within China, Hanjin never applied for China to recognize its Korean proceedings and thus to enjoy bankruptcy protection in China. One of the reasons for this pessimistic attitude towards the Chinese cross-border insolvency policy is that China has not adopted the Model Law. With the increasing number of maritime cross-border insolvency cases, it has thus been under discussion for a long time as to whether China should adopt the Model Law.

The purpose of this paper is to analyze whether China should adopt the Model Law. The above game theory is adopted, with players, strategies, and utilities as the basic elements, to achieve utility maximization among each party. Specifically, under the strategy of bankruptcy declaration and Model Law adoption, the game is divided into two levels. The first level is the game between liner shipping companies A and B with the strategy of bankruptcy declaration. The second level is the adoption strategy game between China and State H, whose action is constrained to the first level. Furthermore, both levels of the game have no particular order, which is also true of a static game, but one player's decision depends on the actions of the other. Combining the above general formula, and basing it on the case of the Hanjin bankruptcy, the losses of major creditors in China are evaluated, their utility function being the sum of the revenue and loss of the liner company and related parties. The Nash equilibrium of the game shows that States act under the largest utility, namely, the least loss on the basis of the strategy between liner shipping companies. Two scenarios are identified for China not adopting the Model Law, one with both liner companies declaring bankruptcy, and the other when A declares but B does not. Thus, from the perspective of mathematical evaluation, China should not adopt the Model Law, since Hanjin has declared bankruptcy with South Korea's adoption already having occurred.

In 2019, 112 Chinese enterprises were listed on the Fortune Global 500 (Sohu 2019) and only 21% of those enterprises are privately owned. Despite the declining dominance of State-Owned Enterprises (hereinafter referred to as 'SOEs'), SOEs still play a key role in the Chinese domestic economy, especially in the politically and economically significant sectors, such as transportation, natural resources, energy resources, technology, etc. (China Institute at the University of Alberta 2018). (see Figure 3) As one of the strategic sectors, China's shipping industry is dominated by large SOEs, such as China Cosco Shipping Co. Ltd and China Merchants Energy Co. Ltd. In the year
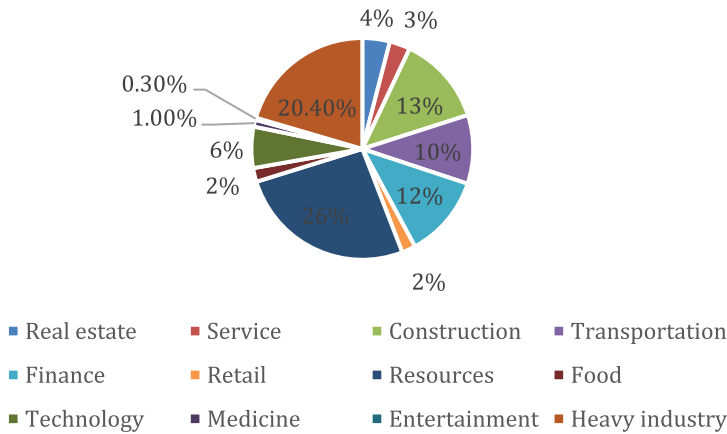
Figure 3. Distribution of SOE industries in China.

2018, vessels owned or chartered by SOEs accounted for approximately 93% of China's merchant fleet on a deadweight tonnage basis (Ministry of transport of People's Republic of China 2018, 5–6).

Since the SOEs play a dual role as both government entities and profit-seeking firms, as well as maximizing shareholder wealth, SOEs have to pursue other goals, such as maintaining employment and social stability (Wei and Chen 2018). At the same time, when facing financial distress, SOEs can easily obtain government support, such as bank loans and government subsidies (Hu and Zheng 2015). In addition, due to the central role of the State in China's transition to a market economy, the government is playing a special role in enterprise bankruptcies and is adopting a necessarily cautious approach to any non-viable SOEs, for example, encouraging mergers to address financial difficulties, rather than the shock of liquidation (Parry and Long 2019). Despite the decline in State influence after the enactment of the EBL 2006, such State influence is likely to remain, especially in cases where there is a prospect of social instability, and the number of cases of formal insolvencies has therefore been low (Rebecca and Long 2019). Thus, bankruptcies of large multinational SOEs, which may have a significant impact on social stability, cannot occur frequently in China.

On the other hand, the majority of private shipping companies in China are medium-sized or small-sized enterprises with limited cross-border business. Taking liner shipping as an example, vessels owned or chartered by private liner shipping companies only account for approximately 12% of the international liner shipping market in China on a deadweight tonnage basis (Ministry of transport of People's Republic of China 2018, 49), and thus the vast majority of private liner shipping companies in China only operate on domestic routes. As a result, the private shipping companies are rarely related to cross-border insolvency cases to which the Model Law shall be applicable.

Therefore, it is not difficult to ascertain that the application of the Model Law in China will be very limited, which is consistent with the results of this study. Nevertheless, with the global financial crisis and decline of the shipping market over recent years, more and more foreign multinational shipping enterprises with assets or creditors in China, like Hanjin, would expect to enjoy bankruptcy protection in China. Under current Chinese bankruptcy law, Article 5 of the EBL 2006 only provides a few general rules with respect to cross-border insolvency, which has resulted in uncertainty and unpredictability for both creditors and debtors. Besides this, it is even more complicated if the case involves the bankruptcy of shipping companies. This is due to the conflicts between maritime law and bankruptcy law. These two legal regimes are established on totally different legal concepts and policy objectives. Bankruptcy law requires all the debtor's assets to be distributed to the creditors under a single, orderly system of distribution (Davies 2018). On the other hand, maritime creditors are allowed to arrest vessels in rem to enforce their claims, no matter

where the ship is located. When the bankruptcy proceeding meets the arrest proceeding, which one shall take priority? This is still uncertain under current Chinese law, which is creating difficulties for both shipping and legal practitioners. Therefore, it is necessary for China to modify the current domestic bankruptcy law, or to promulgate new laws and regulations in this area, in order to establish a cross-border insolvency regime as well as to balance the conflicts between maritime law and insolvency law. The results of this study are expected to provide some helpful insights to policymakers in China when considering whether China should adopt the Model Law, and how to improve its maritime cross-border insolvency regime.

Note

(1) A non-enacting State refers to a State that has not adopted the Model Law.
(2) When Hanjin applied for the recognition in Singapore, Singapore had not adopted the Model Law. But Singapore has adopted the Model Law since 2017.
(3) Two main legal issues are involved in the Hanjin bankruptcy case, including recognition of cross-border insolvency proceedings and reliefs. They are the most important issues in the Model Law. In the game-theoretical model in this paper, the 'adoption' of the Model Law means a restrictive way of adoption. The model only considers Player's decisions with respect to recognition and relief in the Model Law.
(4) In this paper, the term 'shipper' refers to the cargo owners and freight forwarding companies.
(5) In this paper, the term 'shipping interest' refers to a shipowner who charters its vessels to the liner shipping company.
(6) Taking the actual situation of Hanjin bankruptcy and significance of China's adoption the Model Law into consideration, the first-level game model in this paper considers the case where liner company A chooses to declare bankruptcy. The fact that Liner company A chooses not to declare bankruptcy does not affect China's overall economic interests, so it is not discussed in this paper.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

References

Chen, Y., and X. Wang. 2014. "Re-understanding of the International Shipping Industry Based on the Industrial Chain: A New Analytical Framework." *Modern Management Science* 06: 18–20+47. http://kns.cnki.net/KXReader/Detail?TIMESTAMP=637150272532265000&DBCODE=CJFQ&TABLEName=CJFD2014&FileName=XDGL201406006&RESULT=1&SIGN=Gw7poDgaO%2fRJHUDzjkkM60xFG5w%3d

Mohan, C. 2012. "Cross-border Insolvency Problems: Is the UNCITRAL Model Law the Answer?" *Journal of International Insolvency Review*. Published online: 12 October 2012. doi:10.1002/iir.1203.

China Institute at the University of Alberta. 2018. *State-owned Enterprises in the Chinese Economy Today: Role Reform, and Evolution*. Edmonton: China Institute at the University of Alberta.

CSA (China Shipowner's Association).. 2017. "Hanjin Shipping: Creditors Claim More than USD 10 Billion, and Currently Only Raise USD 220 Million." http://www.csoa.cn/doc/10282.jsp

Eslinger, B. 2016. "Bankrupt Hanjin Shipping Unloading Cargo at California Port." *Law360*, September 12. http://www.law360.com/articles/838737/bankrupt-hanjin-shipping-unloading-cargo-at-calif-port

Eworldship. 2016. "Hanjin Shipping's $14 Billion Cargo Drifting at Sea." September 9. http://www.eworldship.com/html/2016/ShipOwner_0909/119630.html

Giryin, S. 2019. "Aspects of Ship Finance: The Market, Ship Mortgages and Their Enforcement." *CML Working Paper Series* 19 (5): 6. http://law.nus.edu.sg/cml/wps.html

Göretzlehner, E. 2019. *Maritime Cross-border Insolvency: An Analysis for Germany, England & Wales and the USA*. Berlin: Springer, Cham.

Hanjin Shipping. 2016. 분 기 보 고 서 (제 8 기) *[the First to Third Quarter Business Report of Hanjin Shipping]*. Seoul: Hanjin Shipping.

Hanjin Shipping Co., Ltd. 2017. "The Statistics of the Reported Claims." http://www.hanjin.com/hanjin/CUP _ HOM _ 1764.do? brdSeq= 1216&currentPageGroup=1&pageCnt=13&sessLocale=en&ctgId=CEN _ 100003&prntMnuId=CEN _ 100003&mnuId=CEN _ 200015&currentPage=1&p_srchKey=00

Hu, D., and H. Zheng. 2015. "Does Ownership Structure Affect the Degree of Corporate Financial Distress in China?" *Journal of Accounting in Emerging Economies* 5 (1): 35–50. doi:10.1108/JAEE-09-2011-0037.

Kim, H. 2019. 한진해운 파산백서 *[White Paper of Hanjin Shipping Bankruptcy]*. Seoul: Korea Maritime Logistics Association, the Korea University Legal Research Institute.

IMI (International Maritime Information). 2016. "Hanjin's Bankruptcy Has a Huge Impact, the Global Insurance Industry May Suffer a Huge Loss of 2 Billion US Dollars." October 20. http://www.simic.net.cn/news_show.php?id=188511

Davies, M. 2018. "Cross-Border Insolvency and Admiralty: A Middle Path of Reciprocal Comity." *Am J Comp L* 66: 101–103. https://comitemaritime.org/wp-content/uploads/2018/05/Cross-border-insolvency-and-admiralty-a-middle-path-Martin-Davies-.pdf

Mccormack, G., and W. Y. Wan. 2019. "Model Law on Cross-border Insolvency Comes of Age: New Times or New Paradigms." *Texas International Law Journal* 54 (2): 273. https://heinonline.org/HOL/LandingPage?handle=hein.journals/tilj54&div=16&id=&page=

Ministry of transport of People's Republic of China. 2018. *The report on China's shipping development. 2017*, Beijing: China Communications Press.

Parry, R., and N. Gao. 2018. "The Future Direction of China's Cross-border Insolvency Laws, Related Issues and Potential Problems." *Journal of International Insolvency Review*. Published online: 6 April 2018. doi:10.1002/iir.1294.

Pu, X. 2017. "Hanjin Shipping Was the Number One Shipping Company in South Korea and the Seventh in the World." Xinhua Net, February 18. http://www.xinhuanet.com//world/2017-02/18/c_129484044.htm

Parry, R., and Y. Long. 2019. "China's Enterprise Bankruptcy Law, Building an Infrastructure Towards a Market-based Approach." *Journal of Corporate Law Studies*. Published online: 20 Aug 2019. doi:10.1080/14735970.2019.1647018.

Shi, J., and Y. Huang. 2017a. "The Recognition and Relief in Cross-border Insolvency—A Perspective from Hanjin Shipping Co." *Journal of Renmin University of China* 31 (2): 34. http://kns.cnki.net/KXReader/Detail?TIMESTAMP=637150238119296250&DBCODE=CJFQ&TABLEName=CJFDLAST2017&FileName=ZRDX201702004&RESULT=1&SIGN=d5OTGPrsjPhVuTQE6fo7pI9jhig%3d

Shi, J., and Y. Huang. 2017b. "Sino-US Milestone of Cross-border Bankruptcy Co-operation—Comment on Topoint Solar Case." *Journal of Application (Judicial Case)* 4: 51. http://kns.cnki.net/KXReader/Detail?TIMESTAMP=637150258184765000&DBCODE=CJFQ&TABLEName=CJFDLAST2018&FileName=FLSS201704010&RESULT=1&SIGN=OCjR%2bfdYFZFM2PJVs4mfsVVEYsk%3d

Shin, H., P. T.-W. Lee, and S.-W. Lee. 2019. "Lessons from Bankruptcy of Hanjin Shipping Company in Chartering." *Maritime Policy & Management* 46 (2): 136–155. doi:10.1080/03088839.2018.1543909.

Shipping Industry. 2016. "Global Container Liner Company Top 100 Chinese List." http://info.jctrans.com/news/cgs/images/2016/8/2/100791.jpg

Sohu. 2019. "2019 World Fortune 500 List Released." July 22. http://www.sohu.com/a/328543152_100174712

Standing Committee of the National People's Congress of the PRC. 2006. "Article 5 of the Enterprise Bankruptcy Law of PRC." *Law-lib*. August 27. http://www.law-lib.com/law/law_view.asp?id=171394

UNCITRL (United Nations Commission On International Trade Law). 2014. "UNCITRAL Model Law on Cross-Border Insolvency with Guide to Enactment and Interpretation." https://uncitral.un.org/sites/uncitral.un.org/files/media-documents/uncitral/en/1997-model-law-insol-2013-guide-enactment-e.pdf

UNCITRL (United Nations Commission On International Trade Law). "Status: UNCITRAL Model Law on Cross-Border Insolvency (1997)." Accessed 17 December 2019. https://uncitral.un.org/en/texts/insolvency/modellaw/cross-border_insolvency/status

Wei, C., and Y. Chen. 2018. "The Predicament of Bank Creditors in Chinese Bankruptcy and the Way Out." *International Insolvency Review* 27 (1): 110–134. doi:10.1002/iir.1298.

Xu, J. 2019. "Maritime Cross-border Insolvency in China." *CML Working Paper Series* 19 (4): 2. doi:10.2139/ssrn.3412628.