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IMPACT OF REPEAL OF CONFERENCE ON EUROPEAN LINER MARKET

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Key words: repeal of Regulation 4056/86, Adam Smith condition of joint products.

ABSTRACT

In September 2006 the European Council decided to repeal Regulation 4056/86 with effect from October 2008. The primary issue addressed in this study is the impact of repeal of block exemption in Europe on two major Europe-based trades – the United States/North Europe trade and the Far East/North Europe trade. This paper measures empirically the economic impact of the repeal of conference on competition of EU liner shipping. Adam Smith's theory of joint products is adopted to examine the impact of the repeal after 2009. This paper considers head haul and backhaul container shipments as joint products. Two statistical equations are employed to reinterpret Smith's condition of joint products. Analysis results using available information from 2010 through 2012 reveal that the EU's repeal of conference produced a striking difference in how carriers react to deregulation reform in the two major Europe-based trade lanes.

I. INTRODUCTION

The belief that liner conferences were instrumental to the needs of international commerce was established among economic (and legal) scholars since the early years of the United States (US) antitrust doctrine, and had become almost a dogma. This dogma established that liner shipping companies must not be subject to cartel prohibitions, since price competition would have undermined the stability of maritime trades (Munari, 2009). In a similar manner, in the European Union (EU), the rules on competition are contained in Articles 81 and 82 of the European Community Treaty and the liner shipping industry is granted a block exemption for agreements under European Council Regulation 4056/86 in effect since July 1987. Liner conferences basically fix prices and regulate supplies and have enjoyed anti-trust immunity under both the US and the EU jurisdictions (Marlow and Nair, 2008).

Arguments in support of the antitrust exemption take a variety of forms, but their gravamen is that special cost and capacity problems of liner shipping make it impossible for the industry to arrive at efficient levels of supply, and that unbridled competition will lead to destructive competition, instability of prices, and undesirable oligopoly (Sagers, 2006). Meanwhile, carriers agreed unanimously that without collective rate setting, destructive competition will lead to unstable prices.

Historically, the block exemption was justified on the assumption *"that conferences bring stability, ensuring exporters reliable services which cannot be achieved by less restrictive means"* (FMC, 2012). However, US trades experienced a markedly changed business environment after Ocean Shipping Reform Act (OSRA) 1998 went into effect. Responding to the challenges of this new environment, in March 2003, the European Commission (EC) initiated a review of the liner conference block exemption. The review's main objective was to ascertain whether the policy assumptions supporting the original exemption in 1986 were still valid. Following a number of European court cases challenging how the block exemption was to be interpreted, the Directorate General for Competition (DG Comp) eventually came to the view that the liner shipping industry had changed considerably since 1986 and the block exemption was overdue for review. DG Comp proposes to end the block exemption, and argues that liner conferences in the EU trades no longer fulfilled the original conditions for the block exemption (FMC, 2012).

In September 2006, the European Council decided to repeal Regulation 4056/86 with effect from October 2008. The recitals of Regulation 1419/2006 provide expressly ample reasons to justify the removal of the block exemption. Detailed reasons are provided to explain why none of the four conditions precedent under the EC Treaty, Article 81.3 is satisfied, and therefore why no exemption from cartel prohibition can be obtained for agreement on fixing rates or allocating capacity among ship owners (Munari, 2009). The repeal impacted directly these EU-based shipping trades by eliminating all forms of conference and price-fixing agreements between ocean carriers. Consequently, Trans-Atlantic Conference Agreement (TACA), which operated in North Europe/US

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trade, was terminated, as was the Far East Freight Conference (FEFC), which operated in Far East/North Europe trade.

The repeal of Regulation 4056/86 was a significant development in the maritime sector. Any form of cooperation between carriers that are part of conferences operating on EU routes is now subject to normal competition rules unless the criteria of the Consortia Block Exemption are met. In particular, any fixing of prices or exchange of commercially sensitive information is treated as a 'hard-core' restriction and the consequences of entering into such restrictive agreements can result in a fine of up to 10% of group annual turnover as well as ongoing fines (Harwood, 2012).

Between July 1987 and Oct. 2008, Regulation 4056/86 provided liner conferences operating on EU routes with a specific block exemption from Article 81. Normal and effective competition in liner shipping sector did not seem to exist prior to the repeal. However, after the repeal of conference, the shipping industry should move on and embrace a new procompetition paradigm where market efficiency, innovation and competitiveness is determined by free and fair competition in the provision of liner shipping services. Thus, observing the industry's behavior after EU's repeal provides an excellent opportunity to test the predictive accuracy of the competitive market mechanism.

The market structure of both US/North Europe trade and Far East/North Europe trade were examined to see if these markets are competitive subsequent to the repeal of Regulation 4056/86. In this paper, head haul and backhaul routes of both trade lanes were taken as joint products. Two statistical equations were employed to examine the structure of EU's liner shipping market. Statistics data were split into two sectors: North America/Europe and Far East/Europe trade, because of their substantially different market structures. OLS test conducted on the price series of both trade routes yielded mixed results.

II. LITERATURE REVIEW

The literature review is divided into two parts. First, we review the literature on the topic of the repeal of Regulation 4056/86, and then introduce the literature on joint products.

1. Literature on Repeal of Regulation

Shipping policy has been dramatically redesigned in the past several years, mainly by way of OSRA. OSRA's first steps towards deregulation and the introduction of price competition through confidential, individual service contracts have hastened the virtual demise of the conference system in less than 10 years (Sagers, 2006). In response to the changing global shipping environment, several studies were conducted to investigate the possibility and the effect of removing the exemption.

OECD (1976) observed that liner industry had failed to demonstrate that price fixing was indispensable to regular, efficient and sustainable shipping services. Thus, it recommended to *"Member countries, when reviewing the application policy in the liner shipping sector, to seriously consider removing anti-trust exemptions for price fixing and rate discussions"* (Munari, 2009).

Following a number of European court cases challenging how the block exemption was to be interpreted, the DG Comp came to the view that the liner shipping industry had changed considerably since 1986 and the block exemption was overdue for review. In March 2003, the EC initiated a review (FMC, 2012) of the liner conference block exemption. The review's main objective was to ascertain whether the policy assumptions supporting the original exemption in 1986 were still valid. It concluded that liner conferences in the EU trades no longer fulfilled the original conditions for the block exemption (Stragier, 2004). The review resulted in the repeal of the block exemption. This DG Comp's claim is reevaluated by Munari (2009).

Munari (2009) examined the origins and the rationale of the EC antitrust immunity granted to the shipping industry and explained the causes of this historical change. He assessed the new EC regime on agreements restricting competition in the liner shipping industry. Munari's study also raised the concern about the effects of the repeal on trades with third countries. He pointed out the need for further investigation on those trades between Member States parties abiding the UN Code of Conduct and third countries adhering to the UN Convention. Munari believed that the Member States affected might well encounter difficulties in justifying their conduct *vis-à-vis* the third country.

The Federal Maritime Commission (FMC, 2012) has published its report on the EU's repeal of conference. The report was launched to see whether the EU's repeal might cause freight rate reductions in EU liner trades in comparison with its US counterpart by looking at changes in container rates from 2008 to 2011 in the Transatlantic, Asia-Europe and Transpacific trade lanes. FMC concluded that *"the repeal of the block exemption does not appear to have resulted in any negative impact on US liner trades"* through 2010. However, FMC's study was criticized by the European Shipper Council (American Shipper, 2012b) that: *"The FMC seems to have underestimated some of the market differences between the Asia-Europe trades and those of the Asia-Pacific."*

During the course of October 2009, a number of important liner trades within the jurisdiction of the EU exhibited a range of activities that raised concerns that some form of parallel conduct might have been the cause of capacity withdrawals and price increases. These concerns were reinforced when on 17 May 2011 the EC announced that it had conducted 'dawn raids' at the premises of 12 shipping lines within the EU. EC disclosed that their investigations would be centered on potential violations of antitrust law including the co-ordination of prices and/or liner transport capacity to and from the EU and the Far East Asia (Harwood, 2012).

In light of these alleged collusions, Global Shippers (2011) pointed out that European competition regulation had moved

on to compliance and enforcement of the repeal. The implementation of competition policy in tandem with deregulation provides an essential framework that encourages market discipline, promotes economic efficiency and eliminates anti-competitive behavior and other market distorting influences.

2. Literature on Smith's Condition of Joint Products

The classic case of joint supply – wherein two products such as beef and hide are gotten from each animal – is the foundation for a number of theoretical adaptations of important cases of real-world supply and demand. Ekelund and Thompson (2001) reviewed the evolution of joint supply theory from early Smith-Mill-Marshall construction to today's peak load pricing theory and traced them over the course of two centuries where the variety of joint supply includes joint products, backhauls, peak load pricing and some aspects of public goods. After reviewing various models related to joint supply theory, they pointed out the differences existing among microeconomics models of joint products, public goods and price discrimination.

In reviewing Smith's contribution, Ekelund and Thompson (2001) found that Smith examined the presence of joint products from the market side instead of the production side and proposed: *"Equilibrium requires that the price of all joint products at least cover the total cost of production; in a competitive market, of course, the summed prices and the cost would be equal. Ceteris paribus, the prices of the joint products will be inversely related. If the price of meat falls, the price of hides must increase enough to again cover the cost of the animal."* In 1904, Smith set two conditions for the presence of competitive equilibrium of joint supply. They are: (1) assuming individual goods to be produced in constant proportions, and that an increase in the demand for one good (hides/meat) must reduce the price of the other (meat/hides); and (2) in equilibrium, the summed prices and the cost must be equal. Competitive equilibrium of joint supply exists when these two conditions are met.

Bell (1968) found that the decree by Pope Paul VI to allow Catholics to eat meat on Fridays had a negative influence on fish prices which had become one of the most familiar illustrations of the demand theory. Thornton (1992) also found that the increase in the demand for beef resulting from the Pope's decree was indeed accompanied by a noticeable increase in the quantity of cowhides, which was jointly supplied with beef through the cattle production. However, Thornton's study did not provide enough pricing evidence to fulfill Smith's condition of joint products.

Mixon and Green (2002) also explained the predicted impact of the Pope's decision on the market for red and white wine. Two panels were issued to explain that the decision made by Catholic Bishops in the U.S. to terminate obligatory meatless Fridays would have led many consumers to substitute beef for fish on many of the 46 non-Lent Fridays. They concluded that this would have predictably led to an increase (decrease) in the demand for red (white) wine. However, no empirical test was conducted by Mixon and Green.

The issue of "backhaul problem" could be dated back to the 1840s when engineers studied railway pricing problem. Following the discussion of backhaul problem existing in early railway literature, Ekelund and Thompson (2001) pointed out, *"If the movement of freight or passengers from A to B necessarily and in fixed proportion required a movement from B to A, the actual activity was intertemporal. The movement was, in effect, time dated and constituted two distinct services with two demand curves, DAB and DBA. The result, dubbed "time jointness" by early writers, was, of course, to be called peak load pricing by the mid-twentieth century."* In the 1950s, the theory of peak load pricing, which was developed by Steiner (1957) and Williamson (1966), focused on developing a general rule for pricing a public utility's service subject to periodic demand.

In the literature on transport, the joint cost phenomenon is known as the backhaul problem (Felton, 1981). One area to which the principle of efficient pricing has been applied is the pricing of backhaul. Kahn (1970) showed the determination of forward and backhaul truck rates in a purely competitive market under different relative demands for forwards and backhauls. By assuming the backhaul quantity to be smaller than the forward quantity, he concluded that all joint costs would be borne by the forward shippers, while the backhaul shippers will pay only the separable, i.e., marginal, loaded backhaul costs. Felton (1981) demonstrated that making transport rates direction-dependent affects positively total welfare in the context of perfect competition. He concluded that high and inflexible backhaul rates are the consequence of rate regulation. The elimination of rate controls should improve utilization by promoting peak-load pricing and discouraging non-price competition. Davies (1987) thought that a peak load pricing policy might promote efficient allocation of shipping capacity. However, no empirical study had been performed to substantiate the suggested pricing theory mentioned in his articles.

Boyer (1997) studied the market competition and backhaul pricing problem and showed that competitive pressures will ensure efficient cost allocation for making a round trip between the front-haul and the backhaul. Although Boyer had not conducted any empirical study on the subject of backhaul pricing, he did compare the difference in freight rates between Transpacific eastbound and westbound trade routes. Boyer (1997) found *"The fact that the price differential is not even larger is perhaps a reflection of the fact that competition is not completely free on the route, but governed partly by a legal cartel."* Rietveld and Roson (2002) also regarded the backhaul problem as a phenomenon of joint cost in their study of public transport.

Ferguson (1972) developed a model to examine the route-by-route actual and estimated forward haul rates for the transport of wool in Australia in 1970 and found that forward and backhaul rates put together would approximate the sum of separable and joint costs. Under the assumption of perfect

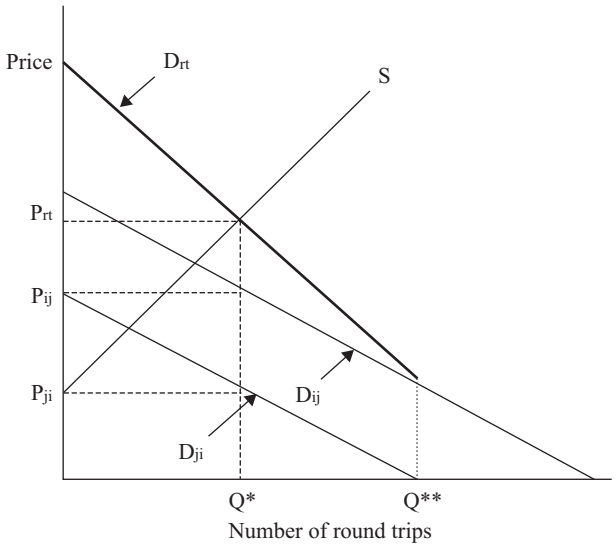


Fig. 1. Determination of head haul and backhaul freight rates.

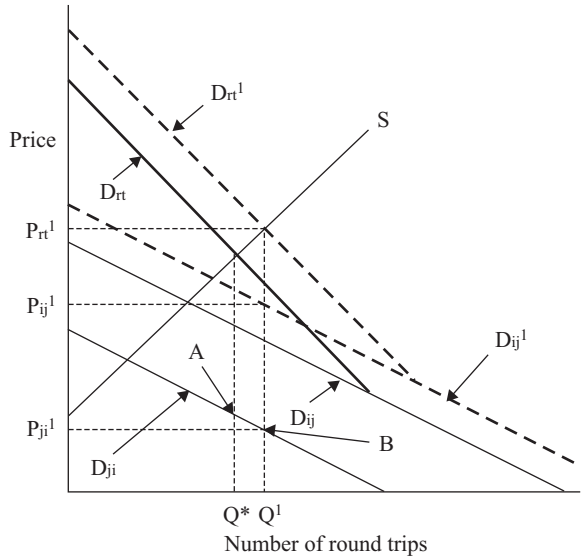


Fig. 2. Increase in demand for head haul shipments.

competition, Jonkeren et al. (2011) also applied a joint pricing equation to the backhaul pricing problem and concluded that imbalances in trade flows affect substantially transport traffic service prices. In contrast to the studies of Jonkeren et al. (2011) and Ferguson (1972), this research is explicitly designed to elucidate Smith's condition of joint products; i.e., in a competitive equilibrium, head haul and backhaul transport prices will move in opposite directions, and the summed prices equal the cost. To examine whether the EU's liner market is competitive, pairs of homebound and outbound freight rates are collected from both North America/Europe and Far East/Europe trade (Containerisation International online, 2013).

III. THEORETICAL MODEL

According to the theory of joint products, the competitive market will automatically allocate a higher proportion of freight rates to the head haul route and a smaller proportion to the backhaul route. As shown in Fig. 1, the horizontal axis measures the number of round trips made during a year by container ships, while the vertical axis measures the prices where P_{rt} represents the prices for a round trip as well as P_{ij} and P_{ji} represent the two individual one-way trips (Hoffmann and Kumar, 2010). The two demand curves shown are for the use of a ship to carry containers for head haul (D_{ij}) and backhaul (D_{ji}). D_{rt}, representing the combined demand for a ship's round trips, is derived by summing D_{ij} and D_{ji} vertically, since the consumption of head haul and backhaul are non-competing. The combined demand curve (D_{rt}) has a kink corresponding to the number of voyages for container shipment under no charge (Demirel et al., 2010) for using the ship in the backhaul shipment. The specific number of voyages at zero price is shown as Q^{**} in Fig. 1. If the number of voyages is smaller than Q^{**}, both head haul and backhaul shippers are willing to pay a positive price to use the ship. The combined demand curve (D_{rt}), shown as a bold line, is steeper than either of the directional demand curves since it represents changes in the combined willingness of head haul and backhaul shippers to pay with changes in the number of voyages.

In Fig. 1, the positive slope line, S, shows the supply curve of round-trip voyages. In equilibrium, the number of voyages is presented as Q^*, which is the quantity equating a ship's demand and supply. P_{ij} is the price paid by the shipper for head haul shipment (D_{ij}), whereas P_{ji} is the price charged for backhaul shipment (D_{ji}). In a competitive market, this sharing of the costs of a head haul and backhaul trip balances exactly the revenue (P_{rt}) obtained from head haul and backhaul shippers.

In the theory of Smith's condition of joint products, two transport prices (P_{ij} and P_{ji}) move in opposite directions as shown by dashed lines in Fig. 2. For instance, an increase in the demand for head haul trips will shift the demand curve to D_{ij}^1, which results in the combined demand for a ship's round trips D_{rt} shift to D_{rt}^1. As the freight rate of a round-trip shipment rises to P_{rt}^1, the freight rate of head haul trip rises to P_{ij}^1, while that of backhaul voyage falls to P_{ji}^1. To accommodate the increase in demand for head haul trips with more voyages traveled, the freight rate of backhaul voyage must fall because there was no increase in demand for backhaul trips, only an increase in quantity demanded of backhaul shipment (from point A to point B).

Algebraically, the equilibrium condition can be summed as follows:

$$P_{ij} + P_{ji} = \text{LRAC or}$$

$$P_{ji} = a + (-1)^* P_{ij} \quad (1)$$

where LRAC is the long-run average cost of providing the "bundle" of services ij and ji.

The focus of this algebra equation is on testing whether

Table 1. Container cargo flows on major East-West container trade routes.

(in unit of million TEUs)

Year	Transpacific		Europe Asia		Transatlantic	
	Far East/ North America	North America/ Far East	Far East/ Europe	Erope/ Far East	Europe/ North America	North America/ Europe
1995	3.97	3.54	2.40	2.02	1.68	1.69
1996	3.99	3.65	2.61	2.21	1.71	1.60
1997	4.57	3.46	2.96	2.32	2.06	1.72
1998	5.39	2.86	3.58	2.10	2.35	1.66
1999	6.11	2.92	3.90	2.34	2.42	1.50
2000	7.31	3.53	4.65	2.46	2.70	1.71
2001	7.43	3.40	4.71	2.47	2.58	1.55
2002	8.35	3.37	5.11	2.64	2.63	1.43
2003	9.00	3.61	6.87	3.76	3.03	1.64
2004	10.58	4.09	8.17	4.30	3.53	1.88
2005	11.89	4.48	9.33	4.42	3.72	1.99
2006	13.16	4.71	11.22	4.46	3.74	2.05
2007	13.54	5.30	12.98	4.97	3.51	2.41
2008	12.90	6.38	13.31	5.24	3.39	2.62
2009	10.62	6.12	11.36	5.46	2.74	2.05
2010	12.80	6.00	13.50	5.60	3.10	2.80
2011	12.70	6.00	14.10	6.20	3.40	2.80

Sources: Review of Maritime Transport 2011-2012.

there is a statistically significant linear inverse relationship between the freight rates of head haul and backhaul container shipments in Europe. That is in a competitive market if P_{ij} falls, P_{ji} must increase enough to cover the LRAC. Statistically, the most interesting parameter in the above linear equation is to test if the value of the slope of the above regression line is equal to (-1).

Graphically, the shifting of joint demand curve from D_{rt} to D_{rt}^{1} indicates a nonlinear inverse relationship between the freight rates of head haul and backhaul container shipments in Europe. That is in a competitive market if P_{ij} falls, P_{ji} must increase. Statistically, the most interesting parameter in the above linear equation is to test if the value of the slope of the above regression line is negative.

Accordingly, the competitive equilibrium condition of Smith's joint products can be summed as follows:

$$P_{ij} + P_{ji} = P_{rt} = \text{LRAC or}$$

$$P_{ji} = a - b^{*} P_{ij} \quad (2)$$

where a and b are two positive parameters.

Following Ekelund and Thompson's definition (2001) of competitive equilibrium of Adam Smith's joint products, there are two main contents in Eq. (2). First, P_{ij} and P_{ji} are to sum up to cover some constant cost in order to fulfill the condition of competitive equilibrium, because competition drives economic profit to zero. That is, as in a competitive market, the sum of two freight rates ($P_{ij} + P_{ji}$) equals total cost. Statistically, the value of constant term (a) in Eq. (1) has to be a significant positive number. Second, the value of slope of P_{ij} is a positive value (b) in order to fulfill the condition of joint products. That is, two prices (P_{ij}, P_{ji}) move in opposite directions (Wang, 2012). Therefore, this study focuses on testing whether there is a statistically significant positive constant term (a); and whether the value of slope (b) is a significant positive value or equal to 1 (Wang, 2012).

IV. EMPIRICAL RESULTS

According to Review of Maritime Transport (2011-2012), the balance of 2.4 billion tones of dry cargoes is made up of containerized (56 per cent) and general cargoes. Driven by the increasing international division of labor and productivity gains within the sector, container trade, the fastest-growing cargo segment expanded at an average rate of 8.2 per cent between 1990 and 2010. Table 1 features container trade volumes on the three major East-West container routes from 1995 to 2011. Over this period, the continuing expansion in container trade volume is compelling, as is the drastic drop in volumes recorded in 2009. Growth in container trade volumes was propelled by the double-digit rates involving Asia, namely Far East/North America and Far East /Europe.

The three major trade lanes around the world are Far East/ North America, Far East/Europe and North America/Europe; and among them, the latter two are related to the Europe market. Traditionally, consumer goods from Europe moving to the North America comprised the head haul direction of the

Table 2. World liner data all-in monthly freight rate changes compared with average rate in each trade lane for 2008.

Month/Year	Far East/ Europe	Europe/Far East	North America/ Europe	Europe/North America
07/2010	119	116	106	85
08/2010	119	112	107	83
09/2010	113	106	108	85
10/2010	108	103	108	86
11/2010	102	100	107	87
12/2010	95	93	107	88
01/2011	93	89	107	87
02/2011	91	84	106	88
03/2011	85	85	105	87
04/2011	80	85	107	88
05/2011	78	85	110	88
06/2011	77	84	110	89
07/2011	74	82	110	89
08/2011	76	79	109	89
09/2011	76	77	109	88
10/2011	75	73	108	88
11/2011	77	69	107	88
12/2011	75	64	105	89
01/2012	65	70	103	91
02/2012	64	71	103	89
03/2012	83	77	103	89
04/2012	99	88	104	90
05/2012	104	99	103	91
06/2012	101	104	103	91
07/2012	100	104	103	91
08/2012	95	102	100	90
09/2012	87	101	100	90
10/2012	79	98	99	92
11/2012	79	100	98	92
12/2012	99	99	97	91

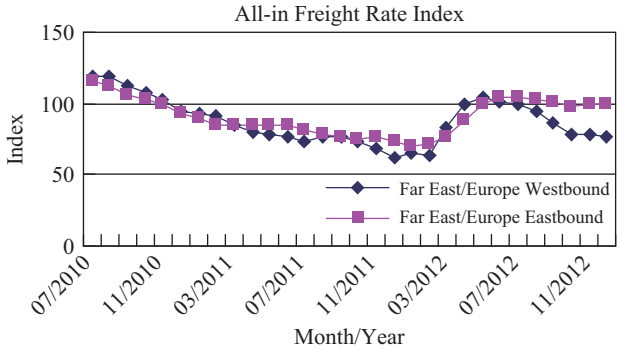
Source: Containerisation International online 2013.

trade, meaning the direction of the trade with the greatest quantity of cargo that usually generates the highest revenue (FMC, 2012). Similarly, consumer goods from Far East to Europe also comprised the head haul direction of the trade.

According to Table 1, in year 1995, the shipment ratio in terms of TEU between North America and Europe head haul and backhaul shipment was roughly equal to (H/B = 1.68/1.69 = 1.00) 1.00. The trade ratio rose sharply after 1996, and reached 1.88 in 2004. In 2006, head haul and backhaul shipment ratio dropped substantially and reached the low point of (H/B = 3.10/2.80 = 1.11) 1.11 in 2010. The ratio rose slightly to 1.21 in 2011. In contrast, the shipment ratio in terms of TEU between Far East and Europe head haul and backhaul shipment was low (H/B = 2.40/2.02 =1.19) in 1995. The trade imbalance between head haul and backhaul rose sharply after 1996, and reached the record high of (H/B = 12.98/4.97 = 2.61) 2.61 in 2007. The ratio dropped slightly after 2008 and fell to 2.27 in 2011.

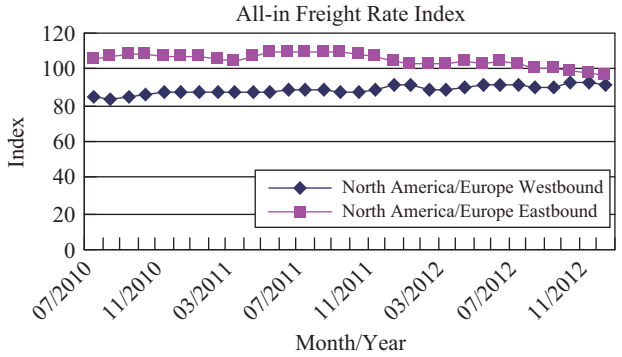
Substantial trade imbalance existed in Europe-based trade lanes creates a situation of excess shipping capacity with too many slots chasing too few containers in the backhaul container shipment. After the repeal of conference, the existence of excess capacity in the backhaul shipments will ensure that carriers adopt an efficient pricing policy to fill their empty slots.

Table 2 presents the development of liner freight rates on cargoes loaded or discharged by liners in Europe for the period of July 2010 – December 2012. The data history of Far East/Europe and Europe/Far East in Table 2 shows a tendency for the two freight rate indices to move in the same direction during the period of study. Examining these time-series data reveals that the correlation coefficient is equal to 0.841 for this period, implying that both head haul and backhaul indices move in the same direction. In contrast, the data of North America/Europe and Europe/North America show that as the head haul freight rates fluctuate, the backhaul freight rates move in the opposite direction to maintain the competitive equilibrium. Statistical examination for these two freight rate data shows that the value of correlation coefficient equals -0.534, thus confirming the conjecture that North



Source: Containerisation International online 2013.

Fig. 3. Far East/Europe freight rate index.



Source: Containerisation International online 2013.

Fig. 4. North America/Europe freight rate index.

America/Europe head haul and backhaul indices move in opposite direction. Figs. 3 and 4 show the trends of two freight rate indices.

To examine the existence of a positive constant term (a) and an inverse relationship between the freight rates of head haul and backhaul container shipments in Europe, we examine the linear Eq. (2) as follows:

$$P_{ji} = a - b^* P_{ij}$$

where the constant term (a) is the value of LRAC, the long-run average cost of providing the head haul and backhaul service, while P_{ij} and P_{ji} are the head haul and backhaul freight rate indices, respectively. To examine whether the liner market is competitive, our statistical test focuses on estimating the value of the constant term (a). That is, P_{ij} and P_{ji} are to sum up to cover some constant cost in order to fulfill the condition of competitive equilibrium. Moreover, we are also interested in how the movement of P_{ij} affects the movement of P_{ji}, the parameter (b) of the above equation is designed to be positive to reflect the opposite relationship between P_{ij} and P_{ji}. Statistically, we can conduct the following hypothesis test:

H_0: both constant term (a) and slope (b) are positive.
H_1: both constant term (a) and slope (b) are non-positive.

Table 3. Result of regression analysis for backhaul freight rate indices.

	North America/Europe		Far East/Europe	
variables	b	s. e.	b	s. e.
Constant	195.978***	21.950	30.957***	7.143
P_{ij}	-1.024***	0.247	0.682***	0.080
R^2	0.3798		0.7196	
Adj-R^2	0.3577		0.7096	
F	17.151***		71.891***	
N	30		30	

*** $P < 0.001$

In order to investigate the structural change after the repeal of conference after 2009, the sample runs from July 2010 to December 2012. OLS test has been applied to the price series of both trade lanes and results are shown on Table 3.

For the North America/Europe trade lane, the empirical result of estimation by OLS is as follows:

$$P_{ji} = 195.978 - 1.024^* P_{ij} \quad (3)$$

By comparing Eqs. (1) and (2), we know that Eq. (1) is a stricter test than Eq. (2). So long as we can empirically confirm the result of Eq. (1), we can also confirm the result of Eq. (2). According to the result of our empirical study (Eq. (3)), we can conclude that both linear and nonlinear conditions are fulfilled.

Following the above estimation, the null hypothesis (H_0: both constant term (a) and slope (b) are positive) cannot be rejected because the empirical test shows that the data are consistent with the null hypothesis for the North America/Europe trade lane. The above empirical result confirms our main hypothesis that the North America/Europe trade lane is competitive after the repeal of conference.

In contrast, for the Far East/Europe trade lane, the empirical result of estimation by OLS is as follows:

$$P_{ji} = 30.958 - (-0.682)^* P_{ij} \quad (4)$$

The null hypothesis (i.e., H_0: both constant term (a) and slope (b) are positive) is rejected. This empirical result reflects the fact that competition is not completely free in the Far East/Europe trade lane. The increasingly larger ships plying the Far East/Europe trade route seem to be the main reason contributing to this non-competitive market structure. For instance, for an Asia-Europe string, 12 ships of at least 12,000 TEUs are needed and that is an outlay of at least $1.4 billion. *"But to be competitive, at least three strings are needed, raising this investment level to $4.2 billion."* (American Shipper, 2012a)

V. CONCLUSIONS

By the end of June 2008, TACA and FEFC terminated its

tariff and discontinued operating as a conference. Meanwhile, the occurrence of recession in the USA and North Europe began to unfold, coinciding with the repeal of conference in Oct. 2008. The growth of world container trade was cut down. At the time, no one can know for certain what the impact of the repeal of liner conferences in the EU will be. However, one can reasonably expect that some form of market restructuring in the liner sector over the medium term as well as impetus to new business models and innovation.

Theoretically, the end of carrier conferences to and from Europe heralds a new era for shipping and trade liberalization. Shipping deregulation helps provide an essential framework that encourages market discipline and eliminates anticompetitive behavior. Our main hypothesis that the liner shipping market is competitive after the repeal of conference is confirmed by the empirical result of the North America/Europe trade route.

This study described the repeal of conference as the prime reason for the major structural change in the Europe liner shipping industry. However, further research is still needed to assess the robustness of these preliminary conclusions. Meanwhile, there are some other variables that might probably affect the shipping freight rates, such as Bunker Adjustment Factor (BAFs), could be considered in the further research of this field. The authors of this paper also suggest that the Smith's condition of joint products can further be applied to airline and road transport industries to assess the impact of deregulation.

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