New York Shipping Exchange

Supply Chain Value Destruction

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How much do shipping lines and their customers have to gain from improving the ocean freight markets? In this interview Mike Ehrlich and Jim Shi, Professors at the New Jersey Institute of Technology, discuss the economic value that is being destroyed by recent developments in the container shipping industry.

Both shipping lines and their customers stand to benefit significantly from solving the inefficiencies in the ocean freight markets today. The economic value currently destroyed in the process of container shipping is far greater than most realize. This interview highlights common situations where industry participants take action to maximize their profits without considering the significant knock-on costs that are incurred elsewhere in the value chain. If the freight market were allowed to operate more efficiently, economic forces would incentivize the players to create value across the full supply chain. This scenario presents a significant opportunity for a true "win-win" outcome.

What is causing inefficiency in the ocean freight market?

From an outside economist's perspective, there are three striking features of the container shipping industry today.

Firstly, the current contracting practices are a recipe for market failure. It's astonishing that shippers are not accountable for missed minimum quantity commitments, or even "no shows" once their cargo is booked. The practice of carriers unilaterally applying general rate increases to pre-agreed contract rates is also bizarre to us.

Secondly, it is surprising that the price of container shipping is opaque when each carrier typically provides a similar level of service to all of their customers. Essentially every container loaded on the same ship from Shanghai to Long Beach gets the same basic transportation service. We realize certain shipper segments may have a propensity to pay higher freight rates,

but we know that carriers struggle to capture these premiums under today's competitive conditions[1]. The consequence of an opaque market is price cannot facilitate the equilibrium between supply and demand, often resulting in unnecessary unmet demand or unused supply.

Thirdly, most carriers offer flat prices that cover a range of vessel departures spanning from one to twelve months. Certainly within that range there will be some sailings that are more in demand than others. Without a relative higher price for the specific sailings in high demand, and visa-versa, there are bound to be over-subscribed and under-utilized sailings.

[1]Daily Maersk service cancelled because premium prices could not be charged. K+N and other Maersk customers say they are prepared to pay premiums.

Freight rate volatility is not surprising

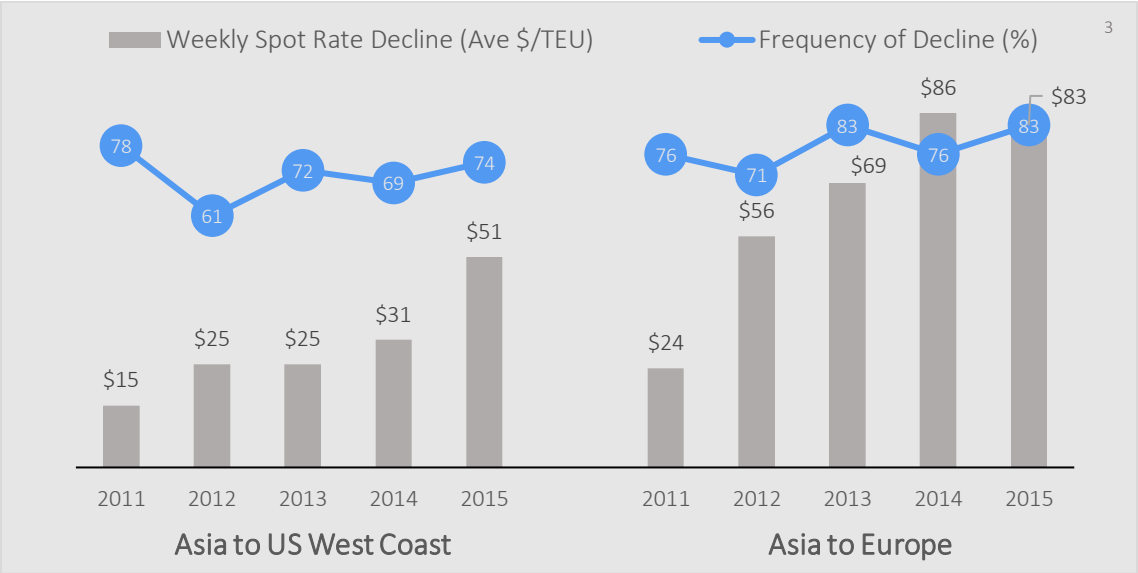
We understand the market for container shipping was destabilized after 2008[2] with the end of conference anti-trust immunity. So we are not surprised by the subsequent volatile prices, which can be expected in any market with largely fixed supply and varying demand. However, what is surprising; is the significantly negative impact that volatile freight rates have on the whole industry.

[2]End of anti-trust immunity for shipping conferences in the European Union

Most similar markets manage volatility with forward or futures contracts that allow price risks to be mitigated. However, in container shipping it would seem the common contracting practices don't afford carriers or shippers a hedge against volatility.

Consequences of volatility

Looking at the Shanghai Shipping Exchange data, we see that spot freight rates on the major trades tend to go down about 75% of the time, and the magnitude of these weekly spot rate declines has increased over recent years. Of course freight rates do also go up about 25% of the time, and those rate increases generally take place around Chinese New Year and the peak season lead up to year-end holidays. So the increases and decreases are fairly predictable.



[3]Shanghai Containerized Freight Index from 2011 to June 2015

These patterns provide an incentive for shippers to shop around in the spot market for as long as possible in order to benefit from the predictably declining rates. Considering the astonishing booking downfall rate in China of 24% in 2014[4], it shows shippers are shopping around for lower rates right up until the very last minute. It would seem that even after a shipper has confirmed a booking with one carrier, they are still able switch to another carrier with a cheaper spot rate. Of course when a ship sets sail with an empty slot that was reserved for a "no-show" booking, the economic value of that slot is destroyed. Ultimately, the cost of this economic waste becomes part of the supply chain cost.

[4]Estimates provided by a capacity manager at one leading global carrier

The carriers' response to the downfalls is to compete even more aggressively in the spot market by lowering their prices and overbooking their vessels. We also see carriers taking aggressive steps to keep their costs as low as possible. Many of these cost reduction initiatives have negative effects on service quality and reliability, again increasing the overall supply chain cost.

Quantifying supply chain value destruction

It is not easy to accurately quantify all the supply chain value that is destroyed by post 2008 developments in the container shipping industry. However, based on our preliminary analysis, it seems to be significantly greater than the short term savings carriers may gain through cost savings, or shippers may be gaining through discounted freight rates[5].

[5]$11 Billion Price War in 2011 as an indication of discounts received by shippers. Source: Seaintel

Firstly, many carriers have implemented "slow steaming" programs to save fuel and to decrease the effective supply of vessel capacity. Some carriers have also added port calls to their services in order to optimize their network costs. Whilst the carriers may have achieved savings, most have not considered the impact of supply chain costs due to extended transit and lead times.

Our initial analysis suggests the global supply chain value destroyed by the 10% increase in transit times is $54.3 billion (TABLE I). This is based simply on the incremental cost to finance the inventory for the incremental in transit time.

Secondly, we have found that global on-time-container-delivery rates are at record lows, dropping to an average of 53.6% in 2014. We believe this results from carriers cancelling or "blanking" their underutilized sailings, rerouting cargo to optimize vessel utilization, and "rolling" cargo where sailings have been overbooked.

Our initial analysis suggests the between 2012 and 2014, increases in safety stock levels required to compensate for the reductions in reliability, and the incremental inventory holding costs amount to $14.7 billion each year (TABLE II).

This doesn't consider the cost of lost sales or production line stoppages that are caused by unreliable shipping. Some have implied this could amount to $1.9 Billion in the U.S. alone[6] for each day of unexpected delays. Unfortunately we were unable to validate this cost based on the available data.

[6]Martin Associates estimate in 2001 referring to the daily impact of the U.S. West Coast port shut down.

Value destroyed in the transportation network

Supply chain costs include the cost of shipping, so we must also consider the economic waste incurred by shipping lines and ports as a result of the post 2008 developments. An obvious cause of value destruction in the shipping industry is “no shows”. Our analysis of the increasing booking downfalls estimates an industry cost of $4.7 Billion (TABLE III).

We also analyzed the increasing incidence of “blanked” sailings, and we estimate that cost to be $3.6 Billion (TABLE IV).

Finally, we considered the downstream impact on port infrastructure, and our conservative estimate is additional investments of $1.7 Billion are required each year (TABLE V) just to account for the increasing unreliability of vessel schedules.

Significant opportunity for a win-win

Based on our rough estimations of the economic value destroyed by developments in the industry since 2008, the opportunity is in the region of $79 Billion. If the market is allowed to function more efficiently, we believe the economic incentives will drive value creation, from which both carriers and shippers stand to gain handsomely.

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Jim Shi is the professor of supply chain and finance at New Jersey Institute of Technology’s School of Management. Jim has researched the interface between finance and supply chain management.

Calculation Tables, Sources and Assumptions

Table I: Cost of Extended Ocean Transit Times			Ref
Average Container Transit Time Increase:	9.6%		A
Value of Liner Cargo:	$9.60	Trillion	B
Value of Container Cargo:	$8.62	Trillion	C
Financing Cost of Cargo on Water:	$566.2	Billion	D
Increased Financing Cost Due to Transit Time	$54.3	Billion	E

A. Average transit time from Shanghai to Long Beach increased from 13 to 15 days from 2011Q3 to 2014Q3. Source; Seaintel Maritime Analysis
B. IHS Global Insight estimated $7.7 trillion in 2007. OECD Growth rate estimated 24.62% from 2007 to 2014
C. Lloyds register estimated 89.81% of liner shipping DWT is containerized
D. Industry Average WACC from NYU Stern Damodaran weighted by Container Cargo industry from Seabury (6.57%)
E. Function of Financing Cost (D) x Transit Time Increase (A)

Table II: Inventory Cost From Reduced Service Reliability			Ref
Reduced Global On Time Container Delivery	-7.8%		F
Increase in Safety Stock Holdings	15.6%		G
Estimated Global Inventory Holdings	$970	Billion	H
Estimated Safety Stock Holdings	$400	Billion	
Incremental Safety Stock Holdings	$62	Billion	J
Financing Cost of Incremental	$4.1	Billion	K
Storage Costs of Incremental	$2.3	Billion	L
Risk Costs of Incremental	$8.4	Billion	M
Total Increased Carrying Costs	$14.7	Billion	N

F. Seaintel Analysis. Average global on time container delivery in 2012 was 61.4%. In 2014 it was 53.6%
G. SAS Rule of Thumb: 1% increase in reliability or predictability results in 2% decrease in contingency
H. Supply Chain Metrics estimate weighted by share of container cargo is 8.9 inventory turns. Derived Cargo Value divided by inventory turns
I. Lambert et al. estimate average safety stock holdings for 97.7% fill rate is 41% (see: Fundamental of Logistics Management Page 143)
J. Function of Global Inventory from Increased Stock (G) x Estimated Safety Stock (I)
K. Function of Incremental Safety Stock (J) x Industry Average WACC (D)
L. Cisco Warehouse Cost Benchmarks Storage Cost per Pallet at $117 per year
M. REM Associates: Risk of Holding Inventory is 13.5% and Incremental Holdings (J)
N. Function of Finance (K), Storage (L) and Risk Costs (M) of Incremental Revenue

Table III: Wasted Economic Value from Booking Downfalls			Ref
Average Booking Downfall	23.9%		O
Standard Deviation Downfall	1.7%		P
Overbooking Common Practice	20.0%		Q
Ratio of Downfall (after Overbooking)	3.9%		R
TEU Downfall	4,882,370		S
Fixed and Semi-Fixed Cost per TEU	$956.08		T
Economic Value Destroyed	$4.7	Billion	U

O. Mean Booking Downfall rate of 23.88% in 2014 out of China
P. Booking Downfall Standard Deviation is 1.7% in 2014 out of China
Q. Average Overbooking Rate of 20% based on interviews with vessel capacity manager
R. Monte Carlo Simulation Results
S. Function of Ratio of Downfalls (R) x Estimated Global Market Size of 125.8 Million TEU
T. APMoller Maersk Annual Report
U. Function of Non-Variable Cost per TEU (T) x TEU Downfall (S)

Table IV: Wasted Economic Value from Blanked Sailings			Ref
Number of Vessel Sailings	612, 094		V
Number of TEUs per Sailing	196		W
Ratio of Sailings Blanked	8.68%		X
Fixed Vessel Cost per TEU	$349		Y
Economic Value Destroyed	$3.6	Billion	Z

V. IHS Global Insight estimated 10,000 per week in 2007. OECD Growth rate estimated 17.71% from 2009 to 2014
W. Function of Number of Vessel Sailings (V) / Global Containers Shipped of 125.8 Million TEU
X. Seaintel Analysis. Approximately 8.68% of Sailings Blanked
Y. APMoller Maersk Annual Report
Z. Function of Number of Vessels Sailings (V) x Number of TEUs per Sailing (W) x Ratio of Sailings Blanked (X) x Fixed Vessel Cost per TEU (Y)

Table V: Downstream Impact on Terminal Infrastructure			Ref
Liner Terminal Annual Investment	$11.93	Billion	AA
Container Infrastructure Investment	$10.71	Billion	BB
"Incremental" Variation in Throughput	8.15%		CC
"Incremental" Investment to Handle 99.9%	16.31%		DD
Investment for Incremental Variation	$1.7	Billion	EE

AA. IHS Global Insight estimated $10.6 Billion in 2009. OECD Growth rate estimated 12.5% from 2009 to 2014
BB. See 2: Lloyds register estimated 89.81% of liner shipping DWT is containerized
CC. Global Schedule Reliability worsened from 80.5% in 2012 to 72.4% in 2014
DD. SAS Rule of Thumb: 1% increase in predictability results in 2% decrease in contingency
EE. Function of Incremental Investment (DD) x Container Infrastructure Investment (BB)