

Inter-firm relationships and shipping services: the case of car carriers and automobile importers to the United States

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This paper is an initial exploration of inter-industry relationships and linkages in the context of automobile imports to the United States. It is our contention that the nature and structure of the engagement between automobile importers and shipping lines is central to understanding the evolution of the car carrier trade. Building on the literature on transactions costs, and supply and value chains, we show that the regimes currently governing car carriage services range from markets to vertical integration via network forms of engagement. We illustrate this through a detailed discussion of Japanese inter-firm networks and an examination of automobile import data to the US from 1980 to 2000. The findings raise important questions for future research on the impact of inter-industry relationships in various strategic decisions of steamship lines, shippers and port authorities including port entry, port choice and routeing, technological and investment choices, and trajectories of supply chain development.

1. Introduction

Corporate consolidation in the maritime shipping industry has resulted in an unprecedented need for theoretical and empirical research that accommodates the multiple, inter-related actors that populate the transportation chain. Maritime industry studies have recognized the importance of powerful trans-national corporations (TNCs) searching to expand their logistical and geographical reach [1–5]. However, studies explicitly investigating the linkages between corporate networks (inter-firm partnerships, strategic alliances and supply chain management (SCM) etc.) and transport service networks (routeing, terminal choice, etc.) remain surprisingly rare. Network studies have typically focused only on *intra*-industry relationships, particularly on strategic alliances among carriers [2, 6–8], while fewer studies have sought to explore the nature and effects of *inter*-industry business linkages. This is despite widespread recognition that networks (or what are sometimes more narrowly termed value chains) have attained as institutions that mediate economic action alongside markets and hierarchies [9–13].

It is our contention that the nature and the structure of the engagement between actors in carrier and shipper industries is central to understanding the evolution of

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maritime transportation networks as well as their future prospects. This paper is an initial exploration into the sources, shape and influence of such *inter*-industry linkages in the context of automobile imports to the United States, the world's single largest automobile market. The car carrier sector is a significant segment of the maritime industry in its own right, yet it has not received due attention. Automobile shippers relate to the owners and operators of car carrier vessels in a variety of ways that range from arms-length market relations through various forms of network organization, to vertical (or hierarchical) integration. Furthermore, car carriage is an activity at the interface between two highly and increasingly concentrated industries that are dominated by a small number of TNCs. The current wave of collaborative agreements, strategic alliances and other forms of inter-firm partnership among these TNCs reinforces the analytical challenge of defining firm boundaries.

The paper provides descriptive statistical analysis of proprietary automobile import data, supplemented by interviews with corporate informants conducted by the authors themselves and extracted from the business press. The paper begins with a primer on the car carrier industry that highlights the increasing degree of corporate concentration. Concentration processes have led to dominance by a few Japanese and Scandinavian carriers [14]. As the world's leading car producer, Japan provides a prime empirical ground to investigate relations between car carriers and manufacturers. The second section focuses on the structure of Japanese conglomerates and their inter-firm relationships, and provides a theoretical discussion of inter-firm network formation. The third section summarizes the main governance regimes in the trade. The concluding discussion includes suggestions for further research.

2. Consolidation in the car carrier industry: a primer

Ocean carriage of automobiles has been profoundly influenced by the process of containerization, but in a way that has been mediated by the patterns of inter-firm relationships. The pioneering role of American firms in the historical advent of containerization is now well documented [15], but the important role of Japanese and European firms in innovation in car carriage remains less well known. Before the container revolution, cars were carried in the holds of general cargo ships and were handled in much the same way as other general cargo [16]. A very small percentage of automobiles are carried in containers today, and container steamship lines appear unlikely to secure significant market share beyond some niche trades.

Today, most new cars and other self-propelled vehicles are transported in what are often described as floating garages, formally known as pure car carriers (PCCs) and pure car/truck carriers (PCTCs). Ever since the early 1960s, innovation in the shipment of self-propelled vehicles has been vested in a relatively small number of Japanese, Korean and Scandinavian shipping lines. The first Japanese car carriers were designed to optimize the transportation of small passenger cars. These vessels, termed PCCs, were built from the 1960s through the 1980s. In contrast, major European car carriers evolved from ferry lines with vessels designed to carry more diverse loads, and hence they were from the start, more like the current PCTCs. European vessels have higher decks and internal ramps set against the bulkhead that run straight up and down the vessel as opposed to the circular ramp configuration in the centre of the vessel found on Japanese PCCs. The modern PCTC may even include hoistable decks providing additional flexibility. The differences between

Table 1. Share of automobile imports by major line and origin, 2000 (% of total imports).

	Asian assemblers ¹	European assemblers ¹	All assemblers ¹
Asian lines			
Hyundai Merchant Marine ²	24.3	0.0	17.1
K Line	19.6	0.0	13.8
ACT Maritime/Maritime Tokyo (Honda)	5.5	–	3.9
Nissan Motor Car Carriers	5.6	–	4.0
NYK Line	22.6	6.8	19.0
MOL (Mitsui OSK Line) ³	16.6	7.0	13.6
Toyofuji (Toyota) Line	2.0	–	1.4
European lines			
Atlantic Container Line	–	0.1	0.0
Hoegh Ugland Auto Liners ²	0.3	0.3	0.2
VAG (VW) Transport	–	21.0	8.7
Wallenius-Wilhelmsen Line ⁴	2.2	62.4	16.5
All other lines	1.4	2.3	1.8
Total	100	100	100

Source: Authors' analysis of PIERS data for October 2000.

Notes: – indicates no vehicles; 0.0% indicates a less than 0.05% share.

¹ Origin refers to the nationality of the automobile assembler. 'All assemblers' includes imports of US Big three.

² Shipment classified by shipping line, not by shipowner. Many shipowners, especially Hyundai and HUAL in the automobile shipment trade, lease vessels to other lines.

³ Includes automobile shipments of Japan Lines, part of MOL since 1964 but operated separately until 1988.

⁴ Includes automobile shipments of Wallenius Lines and Wilhelmsen Lines before their merger in 1999, and the shipments of NOSAC (Norwegian Specialist Auto Carriers) acquired by Wilhelmsen Lines in 1996.

the Japanese and European car carriers have diminished in recent years with the construction of PCTCs by Japanese lines, and scrapping of PCCs [17]. However, the historical differences in technological choice point to deeper differences in industrial organization and inter-firm relations.

In 2000, the ocean carriage of automobiles into the US was dominated by just five lines, namely the Japanese 'big three' (K Line, NYK and Mitsui-OSK Line (MOL)), the Korean Hyundai Merchant Marine (HMM), and the Norwegian-Swedish Wallenius-Wilhelmsen Line (WWL). Table 1 shows the share of automobile imports for 11 carriers [18]. Together the five biggest lines accounted for four-fifths of all new automobile imports to the US. In general, Asian carriers dominate the Pacific trade and European carriers the Atlantic trade, although this difference has become less sharp in recent years. There are no US lines active in the new automobile import trade.

Since 2000, this already highly concentrated industry became even more concentrated. In November 2002, the third largest carrier of US-bound automobile imports, WWL, acquired HMM's car carrier division. At the time HMM ranked as the second largest carrier of US-bound automobile imports. This is the most recent example of the long-term trend towards concentration indicated in table 2. The market share of the top five and the top ten lines has risen across all trade routes from 1980 to 2000.

Table 2. Concentration in the automobile carrier trade.

	Asian assemblers			European assemblers			All assemblers		
	1980	1990	2000	1980	1990	2000	1980	1990	2000
Lines with 1% + market share	13	9	9	10	5	5	14	10	9
Market share (%) of top five lines	78.9	81.6	88.7	86.4	98.6	98.3	73.7	77.4	80.0
Market share (%) of top ten lines	89.5	98.5	99.9	99.7	99.8	99.6	87.9	96.5	98.9

Source: Authors' analysis of PIERS data for October of each year. See table 1 notes.

There is thus a clear trend towards corporate concentration in the car carrier industry. At the same time, these aggregate developments display a distinct geography that is biased in favour of European and Japanese firms. Japan deserves particular attention because of its dominance in both manufacture and shipping of automobiles to the United States.

3. Network forms of corporate organization: Japanese inter-firm networks

What determines the actual structure of relations between buyers and sellers of shipping services? In particular, under which conditions would we expect automobile importers to become more involved in ocean shipping arrangements? In his seminal work, Oliver Williamson [19] advanced a Coasian theory of the firm as a transactions-cost optimizing alternative to market-based contracting, an approach that found undeniable empirical resonance in the US corporate world of the time [20]. Implicit to the Coasian view is that firms may expand in size either by reverting to classical market transactions (externalize) or through vertical assimilation of related activities (internalize). Firms are thus conceived as atomistic units that devise strategies for the governance of economic activities based on the nature and costs of transacting. Asset specificity emerges as a central variable in this approach. A supplier (or customer) may be unwilling to invest in specialized equipment, such as a car carrier vessel (or an export-oriented assembly line), without a guarantee that the customer will continue to make use of the service (or that the supplier will continue to provide services). This approach would predict and prescribe high levels of vertical integration in the car carrier market, or long-term contracts with 'price and non-price provisions to protect both parties from breach and to help ensure the smooth operation of supply relationships over time' [21]. Indeed, in a classic article, Riordan and Williamson [22] concluded that transportation equipment 'that is easily redeployable among shippers is owned by carriers while that which is specialized to shipper needs and cannot be redeployed except at great sacrifice is owned by shippers'.

Critiques of this determination of the boundaries of the firm typically proceed from the empirical observation that the governance of economic activities displays considerable variation between market and hierarchy [10–11]. At the same time, scholarly enthusiasm for new forms of inter-firm collaborative arrangements and alliances should not overshadow the importance of power in shaping actual supply chains. The 'power perspective' has been most forcefully presented by Andrew Cox and colleagues [23–24] in a series of recent supply chain analyses. The approach has

been used by Robinson [4] to argue that SCM represents a 'paradigm shift' for the maritime industry. Cox [23] argues that the success of the Japanese production model, as symbolized by Toyota, has led to exaggerated claims about the universality and transferability of the 'lean-integration' SCM paradigm. Williamson's approach (and the current SCM orthodoxy) implies mutuality, in the sense that agents share a common interest in reducing transactions costs. In contrast, Cox argues that agents are as interested in capturing value as in minimizing its loss in the contracting process. Hence, agents face not only the choice between the internalization or externalization of functions (or between collaborative versus arms-length interaction), but they also face choices about the degree to which they are willing to share value with others in the supply chain. If one agent is able to control a critical asset in a given supply chain, they may have every (profit-maximizing) reason to engage in adversarial relationships with others in the chain, even those with whom they collaborate closely. From the perspective of an agent in a given supply chain, it is the relative control over critical assets that this agent enjoys that will determine which relationships may be most appropriate at any given time. There is also no reason to expect supply chain relations to remain static since a given asset need not be critical at all times and in all places, and the conditions of control may change [4, 24]. For instance, consolidation in the car carrier industry surely raises the possibility that steamship lines may be able to exercise market power over this critical supply chain asset.

Meanwhile, economic sociologists have sought to identify alternative economic governance types in a way that is more tolerant of cultural-societal differences in global business practice. The work of Gary Hamilton and Nicole Biggart [25–26] illustrates this critique of Williamson. They have argued that a critical factor in east Asian economies is the *network* in which both individuals and firms are embedded. They argue that firm autonomy is 'institutionalized' under different conditions in Asian nations. In contrast to the US where inter-firm linkages have been submitted to an array of legal monitoring institutions (e.g. anti-trust laws) and have only been deregulated in the last 15 or so years, such ties constitute the norm in Asia. They conclude that 'network organization is an institutional feature of Asian capitalism' [27]. In the end, the phenomenal performance of successive Asian economies shows that the market-hierarchy dichotomy only partially captures the variety of ways in which economic action may be institutionalized.

Recently, Gereffi *et al.* [13] have offered a general framework to explain governance patterns in global value chains that also embraces a power analysis. The framework articulates power relations in terms of knowledge flows along the value chain as well as through capability imbalances between buyers and suppliers. They present five forms of value chain governance that correspond to different buyer-supplier relations: (1) markets; (2) modular value chains; (3) relational value chains; (4) captive value chains; and (5) hierarchy. In other words, they provide a framework that differentiates three network forms of governance that lie between market and hierarchy. This sub-typology is based on three criteria: (1) complexity of transaction; (2) ability to codify transactions; and (3) relative capabilities in the supply base. For example, when codification of knowledge is possible (i.e. simple transactions), weak suppliers (shipping lines) may become captive to buyers (manufacturers), without the buyers needing to engage in vertical integration to guarantee ongoing supply. When knowledge is tacit and transient, relational ties, such as national ties, trust, reciprocity and formalized corporate networks, protect the

relationship. However, when suppliers acquire strong capabilities, they may acquire some independence by becoming modular suppliers to multiple buyers.

In contrast to the transactions cost approach, these alternative views emphasize positionality within chains as well as the contingent and historical nature of economic organization. Nevertheless, a point of consensus that has emerged out of this debate is the notion that markets, hierarchies and networks are not mutually exclusive. Instead, these are three modes of governing economic action. Where markets provide price signals and hierarchies provide formal roles and procedures, networks provide long-term relationships [11, 26]. At the same time, actual inter-firm relations are always susceptible to the exercise of power, and are conditioned by their specific historical circumstances. Gereffi *et al.* [13] highlight the importance of 'local industrial agglomerations' and 'national level rules and institutions' in shaping the governance of global value chains by influencing, *inter alia*, the conditions under which knowledge may (or may not) be transferred.

The theoretical advances reviewed here remain to be empirically substantiated in the context of shipper-carrier relations. The rise of the Japanese TNC has provided an empirical starting point from which to question whether the dualism implied by transactions costs analysis can account for the observed relationship between network organizational structure and corporate management success [28]. Moreover, powerful shipping lines have been central to the articulation of Japan's economic globalization.

The corporate structure of Japan is characterized by two types of formalized network relationship: the *kigyo shudan* (aka inter-market groups or horizontal *keiretsu*) and the *keiretsu* (aka vertical *keiretsu*), corresponding respectively to horizontally and vertically controlled networks. There are currently six major *kigyo shudan* in Japan: Mitsui, Mitsubishi and Sumitomo which derive from the pre-war *zaibatsus* (or family conglomerates), and the newer 'city bank groups', Fuyo, Sanwa and Dai-Ichi Kangyo Bank (DKB). All six horizontal groups share common structural features. The *kigyo shudan* revolves around a network core comprised of a powerful bank, an insurance company and a trading company. They are held together through: (1) presidents' councils where group strategy is addressed through monthly meetings of member firms' CEOs; (2) cross-shareholding; (3) interlocking directorships; (4) a group-wide trading company; and (5) intra-group trade patterns that act as a buffer against recession [29]. Cross-shareholding levels vary among the six groups and are highest among the oldest groups, namely Mitsubishi, Mitsui and Sumitomo.

Member firms sitting on presidents' councils are usually industry leaders in their own right, each overseeing a vertical *keiretsu*. *Keiretsus* are characterized by a large leading parent firm to which a complex vertical alignment of subsidiaries and affiliates is attached either through joint ownership of stocks or reciprocal subcontracting. The leading firm sits at the apex of a pyramid-like structure and is the convergence point where vertical and horizontal networks meet. *Keiretsu* ties to a particular *kigyo shudan* vary in form and intensity. A *keiretsu* may be a member firm of one of the powerful six *kigyo shudan* in which case its own group of firms may be thought of as a sub-network. In some cases, ties are loose and fuzzy enough for a given *keiretsu* to be considered 'independent' or to be affiliated to more than one *kigyo shudan*. Likewise, vertical *keiretsus* may reach size and power thresholds justifying minimal ties to the prestigious six horizontal groups. From its sheer size

Toyota Motor Corporation—with its estimated 15,000 subcontracting affiliates and its own financial arm—has acquired such an independent status.

There is a vibrant theoretical debate about the capacity of traditional *keiretsu*-based linkages to survive ongoing changes in the Japanese economy, changes such as the series of mergers of major financial institutions that occurred in the early 2000s [30]. Likewise, Japanese assemblers are prominent in several of the international strategic alliances and mergers that have transformed the automobile industry globally [31]. However, any future scenarios must be built from an understanding of the influence of the past and present system of network-type inter-firm relations. It is to evidence of the influence of these relationships on the car carrier industry that we now turn.

4. Evidence from the Japanese car carrier industry

The development of specialized car carriers by Japanese shipping lines was undertaken with the active involvement of the automobile manufacturers through the mechanisms afforded by national industrial policy and the network-based system of business organization. Current maritime corporate structures can be traced to the policy-directed re-organization of the Japanese economy in the 1960s. For example, the Kawasaki Kisen Kaisha and Iino Kisen Lines were merged in 1964 to form K Line. K Line's first car carrier vessel, the *Toyota Maru No. 1*, was built in 1968 [32].

Typically, each *kigyo shudan* has its own ocean carrier: Mitsubishi has Nippon Yusen Kaisha, Mitsui and Sumitomo rely on MOL [33], DKB has K Line, and Fuyo has Showa Line. Each ocean carrier is vertically organized as a *keiretsu*, with a myriad subsidiaries and affiliates in shipping, logistics and port operations. Based on available data, calculations of cross-shareholding confirm the theoretical claims. In 2002, Mitsubishi Group firms owned roughly 37% of NYK, Mitsui Group firms 15.1% of MOL, while DKB Group owned 13% of K Line [34].

As for the automobile assemblers, the scenario is somewhat more complex since some assemblers have reached size and structural complexity thresholds to afford them the status of 'independent' *keiretsus*. The 'independents' include Toyota, Nissan and, to a lesser extent, Honda. Mazda and Mitsubishi maintain more formalized ties to their respective group. Although 'independent', Toyota sits as an 'observer' on the Mitsui council. Its top ten shareholders include banks from four different *kigyo shudan*. Second to Toyota is Nissan, entirely 'independent' and increasingly international in strategic outlook. This is both reflected in, and reinforced by its merger with Renault and its use of non-Japanese senior management. Finally, Honda, Japan's third largest car manufacturer is considered 'independent' but maintains ties with the Bank of Tokyo-Mitsubishi, its main lender and shareholder. Mitsubishi Motor Corporation and Mazda, respectively Japan's fourth and fifth manufacturers, are formal members of the Mitsubishi and Sumitomo groups respectively. Figure 1 diagrammatically summarizes these affiliations and strategic linkages.

How then does national industrial structure and policy influence the actual inter-firm relations in the car carrier trade today? There are four approaches to ocean carriage of new automobiles, namely: (1) market-based 'tramp' services chartered for a specific shipment; (2) quasi-market 'liner' services where the shipping line provides a regular scheduled service; (3) network-based consignment guarantee arrangements, where the automobile importer and the shipping line are involved

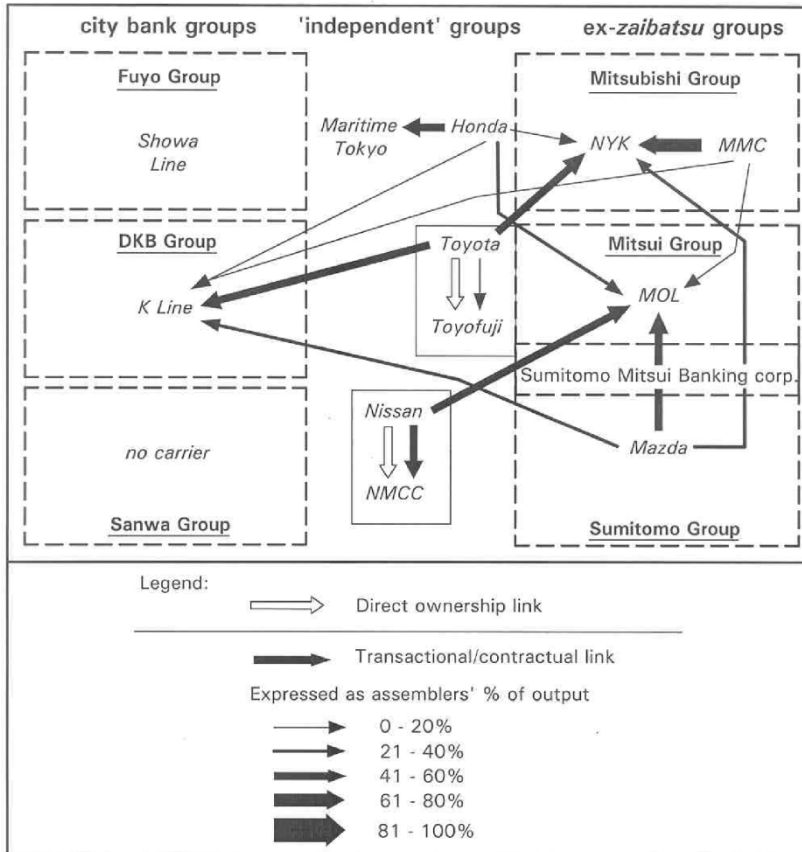


Figure 1. Relational diagram of Japan's assembler-carrier associations, 2000.

in some longer-term agreement; and (4) 'hierarchies' or vertically integrated 'house lines' where the automobile importer operates its own shipping line. The distribution of governance regime cannot be reduced to a sovereign choice between internalized or externalized transactions but instead reflects, among other things, national differences in industrial organization and supply chain power dynamics.

In the remainder of this section we focus on liner consignment guarantee arrangements and house lines as governance regimes commonly found in the industry. In general terms, European importers have tended to use more transient market-based arrangements or quasi-market liner services. Japanese importers have used network-type arrangements or vertical integration. However, even in cases where Japanese assemblers own car carrying subsidiaries, they still outsource considerable shares of their transportation requirements. We do not discuss tramp services in detail here, in part because they are less commonly used in the new automobile trade. New market entrants, those importing batches of automobiles infrequently, or experiencing a demand spike or supply disruption, may use market-based tramp services.

Most automobile imports from Europe are carried by steamship lines that have historically not shared the same close relationships with automobile manufacturers

as the Asian lines. Furthermore, unlike the Japanese carriers which are active in a diversity of shipping markets (i.e. containers, dry and liquid bulk, etc.) car carriage constitutes the core specialty of the largest European car carrier lines. In general, the relationships between carriers operating liner services and shippers are typically arms-length contractual arrangements. This observation does not contradict transactions cost theory, in the sense that European car carriers, as noted above, are known to operate more flexible vessels that imply a lower degree of asset specificity. However, there are also convincing reasons for arguing that at least one European specialist car carrier has acquired advanced capacities and is now acting more like one of Gereffi *et al.*'s 'modular suppliers'. In the discussion that follows we focus on this steamship line.

Wallenius-Wilhelmsen Line (WWL) accounts for over three-fifths of all trans-Atlantic new car imports to the US, and carries vehicles of almost all importers except Volkswagen (see table 1). WWL was formed by the merger in 1999 of Wallenius Lines of Stockholm and Wilhelmsen Lines of Oslo. Today it is the largest ro-ro and automobile logistics company in the world. Prior to the merger, Wilhelmsen acquired (in 1995) the car carrier line Norwegian Specialized Auto Carriers (NOSAC), and its 2002 purchase of Hyundai Merchant Marine's car carrier division expanded its reach into the trans-Pacific trade. A shipping line such as WWL offers any interested automobile importer a regularly scheduled service. Without the certainties provided by the type of network relationships that characterize the consignment guarantee arrangements discussed below, WWL has been very active in trying to secure cargo through other means. In so doing it has acquired some advanced supplier capabilities.

For example, the line is attempting to take over an ever-greater portion of an automobile importers' logistics operation. An important component of this door-to-door service has been WWL's involvement in automobile processing. WWL has established subsidiary automobile port processing firms in locations on both US coasts [35]. In a related strategy, WWL is also trying to develop a hub and spoke system for automobile distribution [35–36]. It is, however, not clear whether these strategies will allow WWL to secure significant market share among Japanese automobile importers. In part, this is because the network-type relationships between Japanese carriers and shippers appear highly durable, and in part because automobile importers, such as Toyota and Nissan, choose to operate their own port processing facilities as integral components of their distribution systems [37]. This may explain why the carrier is also attempting to secure deeper relationships with various automobile assemblers. Although it has not yet entered into any similar formal arrangements in the US, in 2001 WWL purchased a 20% stake in the consortium that acquired Renault's transport and logistics company, Compagnie d'Affrètement et de Transport [38]. Ties with Renault could reach out to ties with Nissan eventually due to their strategic alliance.

All of these strategies are designed by WWL to place the steamship line as the intermediary, directly providing and/or arranging logistics on behalf of the client. This mirrors recent trends in the container trades where lines are getting involved in third-party logistics arrangements.

Consignment guarantee arrangements (CGA) are closest to what Gereffi *et al.* refer to as relational chains. These freight guarantees are especially common on the trans-Pacific routes. In contrast, without the integrated ownership structures found in Asia, such consignment guarantee arrangements are less common in the case

of Atlantic routes. A CGA involves the carrier making a vessel available on a regular and exclusive basis for a particular automobile assembler. Approximately 60% of Toyota's shipments with K Line and NYK are carried in this way. Similar arrangements exist between other Japanese carriers and automobile importers. For example, Honda is traditionally closest to MOL, but divides its business between all three big Japanese carriers [39–40].

Through such agreements, a *kigyo shudan's* given assembler will typically have a group member as its prime carrier. This is the clearest indication that historical and institutional context does indeed exert, at the very least, a patterning influence on inter-firm relations. However, it is also important to stress that, in many cases, carrier selection transcends group affiliation. Over the years, both carriers and assemblers have diversified their customer and supplier bases respectively. For example, Mitsubishi Motor Corporation's strong affiliation to the Mitsubishi group makes NYK its prime carrier, but it also deals substantially with MOL and K Line as back-up carriers. Another case is Mazda, formally a Sumitomo member firm using MOL as its prime carrier but also maintaining transactional ties with NYK and K Line. Hence, although strong internal linkages exist between a group's assembler and carrier, the picture is more chaotic than theoretically expected. The complexity is further increased by the fact that groups like Mitsubishi have traditionally maintained closer ties among their members than other groups [29].

'Independent' groups such as Toyota and Nissan have developed similar risk-reducing diversification strategies in carrier selection. Given Toyota's 'self-contained' structure and size, it has also set up its own in-house carrier (see below). However, despite partial internalization of its transport operations, Toyota has maintained a close relationship with outside lines, particularly K Line. A logistics planner for another automobile importer described Toyota and K Line as being 'married to each other' [40], while a K Line official emphasized their close working relationship at the planning through operational levels [41]. This is consistent with Toyota's broader *keiretsu*-type network relationships: five of Toyota's ten largest shareholding companies are also top ten shareholders in K Line.

Despite these close and enduring relationships with major shipping lines, the largest Japanese automobile manufacturers, Nissan, Toyota and Honda, have also become directly involved in ocean carriage (see table 3). For example, Toyota jointly owns Toyofuji Line along with transportation company, Fujitrans. Toyofuji operates four ships on trans-Pacific routes, of which the newest, the *New Century 1*, is a vessel that can carry up to 6,000 vehicles. When explaining the relationship between Toyota and Toyofuji, a representative of Toyofuji suggested that it be regarded as a 100% consignment guarantee arrangement, just a higher percentage guarantee than is the case in Toyota's relationships with other shipping lines [42]. While glossing over the subtle difference between network and hierarchy, the point being made by this industry informant is that both are instances of close, deep and enduring non-market relationships.

Indeed, Japanese assemblers typically show greater stability in their relationships with carriers, while European assemblers show more transient behaviour in carrier selection. This transience is characteristic of more arms-length market-based approaches and looser relationships with assemblers. In table 4 we present an index of stability in importer-carrier relationships from 1980–2000. Toyota, Mazda and Mitsubishi show very little change in carrier selection, while the higher index score for Nissan reflects the fact that it consolidated cargo carriage in its

Table 3. Manufacturers car carrier distribution as percent of output, 1980 and 2000.

	Toyota		Nissan		Mazda		Honda		Mitsubishi	
	1980	2000	1980	2000	1980	2000	1980	2000	1980	2000
Asian lines										
Hyundai Merchant Marine	–	–	–	–	–	–	–	–	–	–
K Line	34.2	43.1	2.9	–	29.9	28.1	24.4	6.9	8.5	19.3
ACT Maritime/Maritime Tokyo (Honda)	–	–	–	–	–	–	8.8	45.8	–	–
Nissan Motor Car Carriers	–	–	5.9	42.7	–	–	–	–	–	–
NYK Line	47.9	45.5	–	–	21.6	29.6	–	15.3	54.8	64.3
Mitsui OSK Line	0.3	0.0	55.7	54.6	34.7	42.3	43.3	31.8	6.1	16.1
Toyofuji (Toyota) Line	–	6.8	–	–	–	–	–	–	–	–
European lines										
Atlantic Container Line	–	–	–	–	–	–	–	–	–	–
Hoegh Uglund Auto Liners	–	–	7.4	1.9	–	–	–	–	–	–
VAG (VW) Transport	–	–	–	–	–	–	–	–	–	–
Wallenius-Wilhelmsen Line	–	0.0	–	0.0	0.0	0.0	12.8	0.0	0.0	0.1
All other lines	17.7	4.7	28.1	0.8	13.8	0.0	10.7	0.0	30.6	0.1
Total	100	100	100	100	100	100	100	100	100	100

Source: Authors' analysis of PIERS data for October 2000. See table 1 notes.

Table 4. Index of stability in importer-carrier relationship.

	Importer	1980–2000 index	Comments
European assemblers	VW/Audi	1.01	Switch share from K Line & HUAL to NYK & house line
	BMW	0.25	Consolidates all imports with WWL
	Mercedes	0.27	Switch share from ACL to NYK & MOL; WWL maintains share
Japanese assemblers	Honda	0.23	Switch share from K Line to house line & NYK
	Nissan	0.21	Switch share from small carriers to house line
	Mitsubishi	0.12	Switch share from small carriers to NYK
	Mazda	0.03	K Line, MOL and NYK maintain stable shares
	Toyota	0.03	K Line, NYK and house line maintain stable shares

Source: Authors' analysis of PIERS data for October of each year. See table 1 notes. Index is the sum of the squares of the change in the proportion of imports handled by each of 11 carriers.

house line during a period in which its US automobile market share declined sharply. Note, however, that despite greater stability in carrier selection even those Japanese assemblers with in-house car carrying subsidiaries still rely heavily on the network forms of SCM. Honda shows the highest level of flexibility among Japanese importers in its carrier selection and, in spite of its independent stance, has yet to adopt full internalization of ocean carriage. It should be noted that Honda's more flexible carrier selection over the past 20 years is consistent with its more flexible approach to other elements in its distribution system [37].

In contrast, European automobile firms have displayed less stability in their relationships with carriers. Despite the increasing dominance of the Atlantic trade by the liner services offered by WWL, European assemblers have shown some willingness to engage Asian carriers. For example, Mercedes has switched market share from Atlantic Container Lines to NYK and MOL. Volkswagen is the only European automobile importer to operate its own 'house line'.

5. Discussion: corporate networks and the building of logistics chains

This paper represents an initial exploration of inter-industry relationships and linkages in the context of automobile imports to the United States. Data limitations do not permit us to address questions such as the relative efficiencies of particular supply chains; instead we have focused on the question of why distinct supply chains exist, and under what conditions they may persist or change. We drew on recent SCM perspectives as well as the work of economic sociologists that has striven to find theoretical 'middle ground' and address the central yet neglected issue of power within supply chains. In this regard, we cited the works of Cox, Robinson and Gereffi *et al.* as promising pathways. However, given the newness of this literature, empirical substantiation of theoretical claims remains somewhat shallow and general.

The range and variety in carrier–shipper relationships that we have identified leads us to conclude that inter-firm supply networks, in addition to market-based

contracting and vertically integrated hierarchies, are a durable and important organizational form in the ocean transport industry. This provisional finding leads us to question the sharp distinction that is drawn between shipper and carrier, and to highlight the extent to which maritime shipping capabilities are embedded in: (1) national policies of economic globalization; and (2) transport-sensitive global production chains. Corporate behaviour should thus not be conceived in dichotomist terms as is often the case in the transportation literature. We have argued this proposition discursively, and concede that we are unable to test it quantitatively with the data available to us.

The four regimes of inter-firm relationships that were identified appear to map approximately onto the five types of value chain governance identified by Gereffi *et al.* (see table 5). At one extreme, Toyota, Nissan and VW have pursued vertical integration, while at the other extreme we note WWL's migration from arms-length market-based supplier to 'modular' supplier that offers increasingly advanced logistics services. Any disagreements with the Gereffi *et al.* model appear to derive from the fact that the ocean carriage industry is somewhat unique [2, 4, 15]. In particular, advances in maritime technology and global demand for upgraded car carriage capacity have precipitated levels of (over)-investment that may have reached constraining levels. Carriers thus have had to look for ways to secure their investments, leading several of them to prefer long-term arrangements over spot market-based mechanisms. We believe that this explains the relatively infrequent use of tramp services by major automobile importers to the US.

Perhaps the most important contribution of the power perspective to supply chain analysis is the valuable insight it offers into the circumstances under which inter-firm relations may change. As noted, quasi-integration in ocean carriage is particularly common in the trans-Pacific automobile trade, and may be regarded as an extension of the horizontal and vertical networks that structure inter-firm relationships in the Japanese economy. The relationship between Mitsubishi Motor Corporation and NYK within the Mitsubishi group remains the most consistently durable of these *keiretsu*-type relations. However, most other Japanese carrier–shipper linkages display more flexibility suggesting buyer–supplier diversification is a strategy of both carriers and shippers to suppress oligarchic power structures. Hence, although the *kigyo shudan* and *keiretsu* remain relevant units of analysis when approaching Japan's business networks, recent structural change among the groups' gravitational core suggest that analysis will increasingly need to look beyond these structures. Likewise, global alliances among assemblers may also eventually restructure linkages by intermeshing historically national networks into more globally integrated networks. As such, further consolidation in the way of WWL's takeover of HMM's car carrier division may be expected, and our longitudinal analysis suggests that change is a fundamental characteristic of supply chains.

A focus on inter-firm linkages opens up exciting avenues for further research. The first would address regional differentiation: one question raised by this research is why network relationships are not, at least in our data, prevalent in the trans-Atlantic car carrier trade? A second line of investigation could deal with the development of methodological tools to address questions of efficiency, performance and scope in inter-firm governance arrangements in maritime supply chains. As this study attests, triangulation techniques can only partially offset data limitations. A third line of investigation could consist of building cross-industry case studies to further test emerging theoretical claims in SCM and TNC studies. While studies

of the car carrier industry should certainly reach beyond the Japanese firm, network forms of corporate organization are not unique to Asia, and strong inter-corporate ties with banks are found in economies outside Japan, such as South Korea, Germany and Scandinavia. Finally, and most importantly, a fourth line of enquiry could revolve around logistical integration per se. To be complete, such an approach to the evolution of logistics chains should look beyond shippers and carriers to the role of port authorities and facilities. The key differences of interest here concern the extent to which automobile firms are directly involved in the logistics and transport decision-making process. Market-based governance structures tend to distance shippers from direct involvement in logistics. In contrast, governance structures involving direct control over the transport process bring an assembler into a broader transportation stakeholder community. It is hoped the present effort may give guidance in these research directions.

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