

# Dynamic Analysis of Product Lifecycle and Sea/Air Modal Choice: Evidence of Export from Japan\*



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## Abstract

Here, we test the hypothesis that commodities at their peak valuation are transported by air, while those at their inception and maturity are shipped by sea, as well as the theory that shippers choose air to transport high-valued commodities. We empirically investigated how the product lifecycle of commodities is reflected by shippers' choices of air over seaborne transportation. We also assumed that commodities that achieved substantial innovation in their lifecycles would be moved by air transportation so that these commodities could reach targeted markets as quickly as possible to avoid the opportunity costs that might be generated by missed business chances. We constructed two sets of unbalanced panel data of 14 commodities for 24 years drawn from Japan's customs, demographic, and international statistics. By estimating structural equation systems that consisted of commodity-specific export and export air ratio functions, we found that the product lifecycle of cargo outgoing from Japan exactly matched the upward and downward movement of the air ratio.

Key Words : Product Lifecycle, Modal Choice, Structural Equations

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## **I. Brief Overview of Japanese Economy and Logistics**

Japan has experienced several economic phases over the past 20 years, including the “bubble” economy (around the year 1990), followed by a long-term recession that the Japanese call the “lost 20 years,” which included a “deflation-spiral,” the “inflation of crude oil (early 2008)” and the “Lehman shock in 2008.” During the latter, many companies that had led industries in Japan went bankrupt or reorganized. During the “lost 20 years,” stock prices fell and the Japanese yen grew stronger over time. These trends were followed by an increase in Japanese foreign investment in Asian countries such as China, Thailand, Indonesia, and Vietnam, and by the relocation of some company headquarters and/or factories to these foreign countries. During the same period, Japan’s economy came to depend on imports rather than exports, and its international trading balance became negative due to this increase in imports, especially from East Asian countries.

In accord with these shifts in Japanese economic activities from domestic to international markets, manufacturers and companies had to develop international logistics systems, which have played an important role in their supply chain management (SCM). While some companies relegated the operation of international logistics or SCM to third-party logistics providers, others internalized these operations. For example, Toyota Motor Corp. manufactures and assembles car parts that are commonly used over its product lineup, such as wire harnesses, brake pedals, and antennas, in Vietnam. The in-process goods are then imported into Japan where the cars are assembled.<sup>1)</sup> It is commonly known that some manufacturers relegate logistical activities to logistics-service providers (LSPs) associated with shipping companies, freight forwarders, and airlines. Air freighters such as FedEx and UPS have evolved high-quality SCM systems called integrators, but not many manufacturers of middle- or lower-quality goods use them. Instead, in light of the valuation of their cargo, they use LSPs.

Regardless of whether a manufacturer chooses an LSP or an integrator, they must decide on the mode of transportation for trans-ocean and/or trans-continental exports or imports by negotiating with LSPs. In the case of

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1) From an author interview at Toyota Motor Vietnam, Hanoi, Vietnam, in July 2008.

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