Evolving Strategies for Asia – USA Containerized Supply Chains: Implications and Policy Recommendations

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Abstract

The nature and sophistication of Asia – USA containerized import supply chains has evolved dramatically over the past decade and continues to do so. Large nation-wide importers accounted for about 30% of total Asia–USA imports in 2003, 40% in 2007, and probably 50% now. Utilizing push-pull supply chains, they realize substantial inventory economies not available to small or regional importers. Rising costs of imported goods and rising market shares of large nationwide retailers combine to shift more imports into push-pull supply chains. This has profound impacts on volumes through alternative ports of entry and alternative landside supply channels. While inland transportation requirements are economized and inland environmental impacts can be reduced by this evolution of supply chains, port cities are stressed by considerable congestion and environmental impacts. Recommendations are provided for changes in land-use policies relative to infrastructure accommodating import supply chains.

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1. Introduction

In 2007, about 7 million containers of imports from Asia entered Continental USA ports. The supply chains which these imports followed are in a state of flux driven by changing economics both within the USA and abroad. These changes have profound implications for traffic congestion and environmental impacts in port cities. The purpose of this article is to make policymakers and supply chain participants aware of these trends, and to suggest changes to transportation and distribution infrastructure that could significantly lessen the unfavorable impacts on port cities.

2. Distribution of Asia – USA containerized imports

US Customs data on waterborne, containerized imports from Asia to the United States in 2005 were secured by the author. Table 1 classifies these imports by commodity. Customs utilizes 99 commodity types in order to assess duties. Shown in the table are the top twelve commodity types (top twelve in terms of volume). These twelve account for almost three fourths of total imports (Leachman, 2010).

Table 1. Distribution of Asia – USA Containerized Imports

Commodity	Percent of Total Volume	Avg. Declared Value ($ per cu. ft.)
Furniture & Bedding	17.1%	$7.87
Electronics	8.3%	$39.24
Machinery	8.0%	$51.08
Toys, Games & Sporting Goods	7.5%	$16.57
Clothing	6.8%	$32.98
Auto Parts & Motorcycles	6.1%	$24.65
Plastic Goods	5.0%	$14.63
Steel Goods	3.9%	$15.43
Shoes and Boots	3.5%	$24.91
Rubber Goods	3.3%	$14.37
Leather Goods (Handbags)	2.4%	$16.14
Wooden Goods	2.3%	$8.24
All other (86 commodity types)	26.0%	

Source: PIERS and WTA 2005 data. PIERS reports volumes in terms of twenty-foot equivalent units (TEUs). WTA reports total declared values by commodity. Pacific Maritime Association 2005 data on the mix of container types used for imports through West Coast ports was used to convert TEU volumes into cubic feet, leading to the ratios in the last column of the table.

The lion's share of containerized imports from Asia to the USA is accounted for by retail-ready goods or goods that are very close to retail-ready goods. Even the auto parts category in Table 1 is much more spare parts flowing to the dealer network and to auto parts retailers than parts for use in vehicle assembly plants. While 86 commodity types are not shown in the table, the missing ones are largely retail-ready goods as well.

Table 2 lists the top eight importers of waterborne, containerized imports from Asia to the USA in 2005 (by volume). As may be seen, the top importers are familiar “big-box” nation-wide retailers. General broad-category stores such as Wal-Mart, Target, Sears/K-Mart and Cosco are represented, as are home improvement and furnishing chains such as Home Depot, Ikea, Lowe’s and Ashley Furniture.

Table 2. Import Volumes by Importer

Importer	**2005 Volume (containers)**	
Wal-Mart	314,000	(696,000 in 2010)
Home Depot	170,000	
Target	110,000	
Sears/K-Mart	107,000	
Ikea	55,000	
Lowe’s	55,000	
Costco	40,000	
Ashley Furniture	38,000	

Source: PIERS

Figure 1 aggregates all 99 commodity types of Asia – USA waterborne, containerized imports in 2005 as a cumulative distribution over declared value. The yellow line in the figure is the raw data from Customs. Because very broad commodity categories such as electronics are represented by a single average declared value, the curve is more lumpy than reality. The red curve represents the author’s smoothing of the data into what is believed to be a more realistic value distribution curve. Note the curve rises steeply at low declared values and much more slowly at high declared values, i.e., in 2005 there were lots of low-value imports and much less high-value imports. A classification of imports into inexpensive, moderate-value and expensive categories has been made for reasons that will become clear later in the article. Up to about $11 per cubic foot in declared value accounts for about 25% of imports (“inexpensive imports”); from $12 per cubic foot to about $24 per cubic foot accounts for about 50% of total imports (“moderate-value imports”); and above $24 per cubic foot in declared value accounts for about 25% of total imports (“expensive imports”). Generally, expensive imports are not sourced directly from Asian factories by USA retailers. They refuse to buy such expensive items in Asia. Instead, they insist that original equipment manufacturers (OEMs) bring such goods to the USA, whereby retailers procure such items much closer to the time they can sell them.

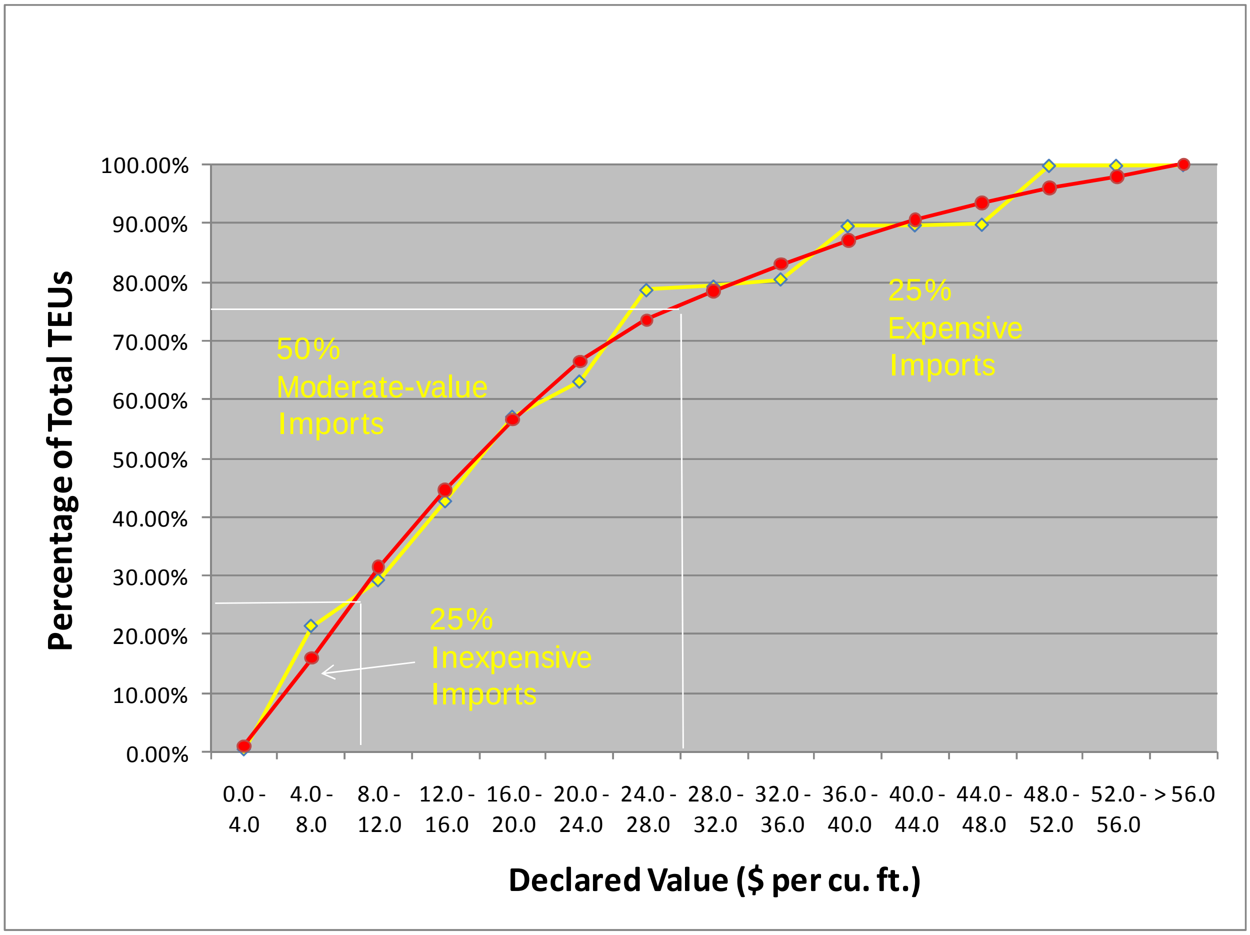

Figure 1. Value Distribution of 2005 Asia – USA Waterborne Containerized Imports

2. Nature of Asia – USA Supply Chains

A typical large US retailer operates Regional Distribution Centers (RDCs) that restock its retail outlets or its retail customers. A large, nation-wide retailer may operate on the order of 20-30 RDCs across the Continental United States; typically the retail outlets each RDC serves may be reached within an overnight drive. Whether sourced directly from Asian factories or from the import warehouse of an OEM, imports flow from factories in Asia to the RDCs. Broadly speaking, in industrial practice there are two basic supply-chain strategies for managing flows of containerized imports from Asia to RDCs in the Continental United States:

Push Supply Chains: Importers purchase transportation of marine containers from Asian factories to their regional distribution centers (RDCs). Allocation of containers to RDCs is decided by the importer before booking vessel passage. Landside movement to RDC may be via IPI (inland point intermodal service), whereby the marine box is loaded onto a railroad double-stacked well car on-dock or drayed from the port terminal to an off-dock rail intermodal terminal (AKA a *ramp*), then moved in a double-stack train to a ramp in the general area of the RDC, then re-loaded onto a chassis for final dray to the

RDC. Landside movement also may be via dray direct from port terminal to a local RDC or by over-the-road trucking to RDCs in regions not as distant as the regions for which IPI service is utilized. As of 2007, about 70% of total Asia – Continental USA imports were handled in Push supply chains (Leachman 2010).

Push-Pull Supply Chains: A set of 1-5 ports for handling all imports to the Continental USA is selected by the importer. In the hinterland of each selected port the importer maintains an import warehouse for storing goods that are imported much in advance of demands at its RDCs and for which it desires to delay making the decision to allocate goods to regions until regional demand forecasts become more reliable. Nearby each selected port the importer also contracts a trans-loader/de-consolidator (third-party logistics firm) to unload the contents of marine boxes, sort the imported goods by destination, and re-load the goods into domestic rail containers and highway trailers. Under Push-Pull, the decision is made before booking vessel passage as to how to allocate marine containers to the selected ports of entry (if there is more than one), but the decision as to how to allocate port volumes to RDCs is deferred. Just before vessel arrival, an allocation of the marine boxes is made to the trans-loader/de-consolidator in the hinterland of the port, the import warehouse in the hinterland of the port, and the local RDC. Most containers are routed via the trans-loader/de-consolidator; a smaller fraction is routed directly to the import warehouse. In the case of high-volume importers, a fraction of import containers may be routed directly to the local RDC. Drays of the marine boxes from the port terminal to these three destinations are made accordingly. For boxes routed to the trans-loader/de-consolidator, decisions are made just before the time of vessel arrival about how to allocate the contents of each marine box into domestic rail containers and highway trailers destined to various inland RDCs, the local RDC and the import warehouse. The trans-loader/de-consolidator processes the contents of the marine boxes and dispatches domestic rail containers and highway trailers accordingly. The domestic rail containers loaded by the trans-loader/de-consolidator are drayed to a nearby rail terminal, moved by train to a ramp in the general area of the destination RDC, then re-loaded onto chasses for final dray movement to the RDC. The highway trailers loaded by the trans-loader/de-consolidator are drayed to the local RDC, drayed to the import warehouse, or trucked to RDCs is regions not as distant as the regions for which domestic rail service is utilized. For boxes routed to the import warehouse, the goods in those boxes are unloaded and placed in storage. At some future times decisions will be made to allocate those goods to RDCs. For goods allocated to the local RDC, there is local dray movement. For goods allocated to distant regions, domestic rail containers are brought to the import warehouse, loaded and drayed to a nearby rail intermodal ramp. The domestic containers are moved by domestic double stack train to a rail terminal in the same area as the destination RDC, then re-loaded onto chasses for final dray movement to the RDC. For goods allocated to other regions for which rail intermodal service is not available or is not economical, the goods are loaded into highway trailers for truck movement to the RDCs in those regions. As of 2007, about 30% of Asia – Continental USA waterborne containerized imports were handled in Push-Pull supply chains (Leachman, 2010). The share of imports handled this way has been steadily rising for about a decade.

For “cube freight” (i.e., imports that reach space capacities of containers before reaching weight limits), the contents of five marine containers fit in three domestic containers or trailers. The lion’s share of imports from Asia is cube freight. For trans-loading to be practical, the import volumes need to be at a scale of at least ten TEUs per week per RDC (i.e., five marine containers per RDC per week). Importers operating at a scale smaller than this are generally restricted to Push supply chains.

Figures 2 and 3 depict these strategies in terms of the stages of transit and inventory and the types of transportation vehicles employed (marine container, line-haul domestic container or trailer, captive-to-region domestic trailer).

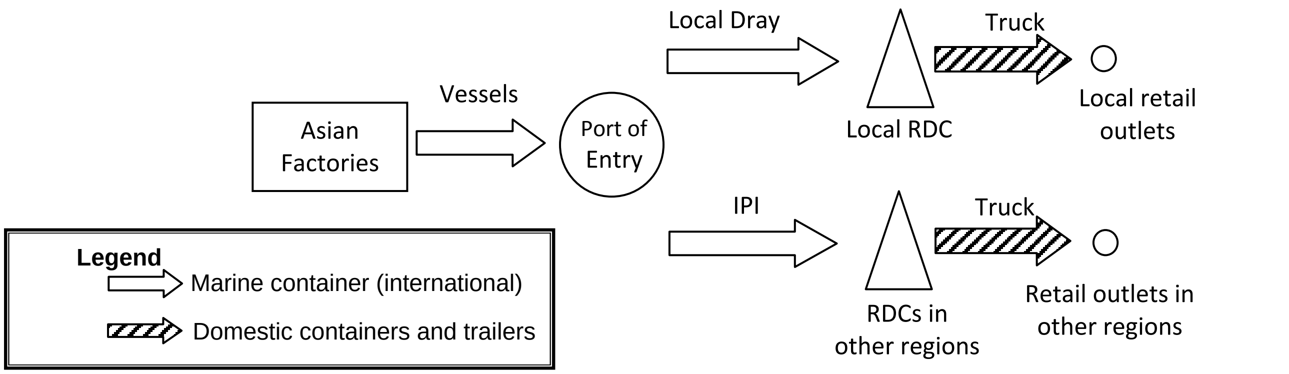

Figure 2. Push Supply Chain

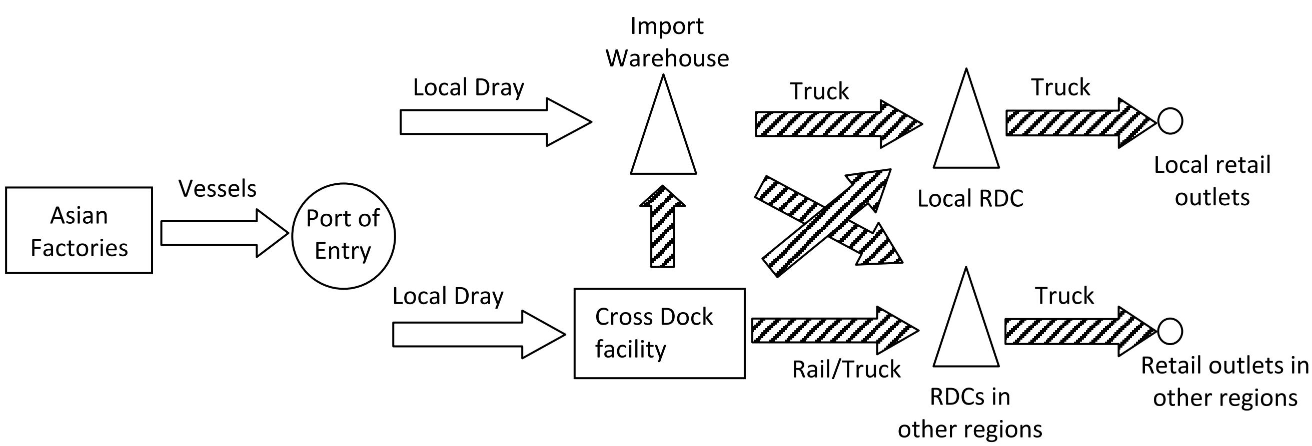

Figure 3. Push-Pull Supply Chain

Figures 4, 5 and 6 interpret the alternative supply chain strategies geographically. Figure 4 depicts a Push supply chain for a nation-wide retailer operating RDCs spread across the Continental USA. Typically, all or nearly all ports of entry are used, thereby minimizing land transportation costs. A line roughly passing through Pittsburgh and Atlanta divides RDCs served by West Coast ports from those served by East Coast ports. Texas RDCs might be served by the Port of Houston, a Mexican port of entry or the San Pedro Bay Ports (Southern California). This supply chain strategy minimizes transportation and handling costs, but experiences high inventory costs because goods must be "pushed" on RDCs from Asian factories before it is known at which RDC they would sell the earliest. Figure 5 depicts the other extreme, a Push-Pull supply chain in which all imports are passed through a cross dock or import warehouse in the hinterland of the Ports of Los Angeles – Long Beach. This supply chain permits inventory to be managed as tightly as possible, albeit with increased transportation and handling expenses. Figure 6 depicts a “Four Corners” Push-Pull supply chain, in which RDCs are allocated to cross-docks and import warehouses in the hinterlands of the Ports of Seattle-Tacoma, Los Angeles – Long Beach, Savannah and New York – New Jersey. This is a compromise strategy in the sense that both transportation and inventory expenses are intermediate to the Push strategy and the Push-Pull-All-at-San-Pedro-Bay strategy.

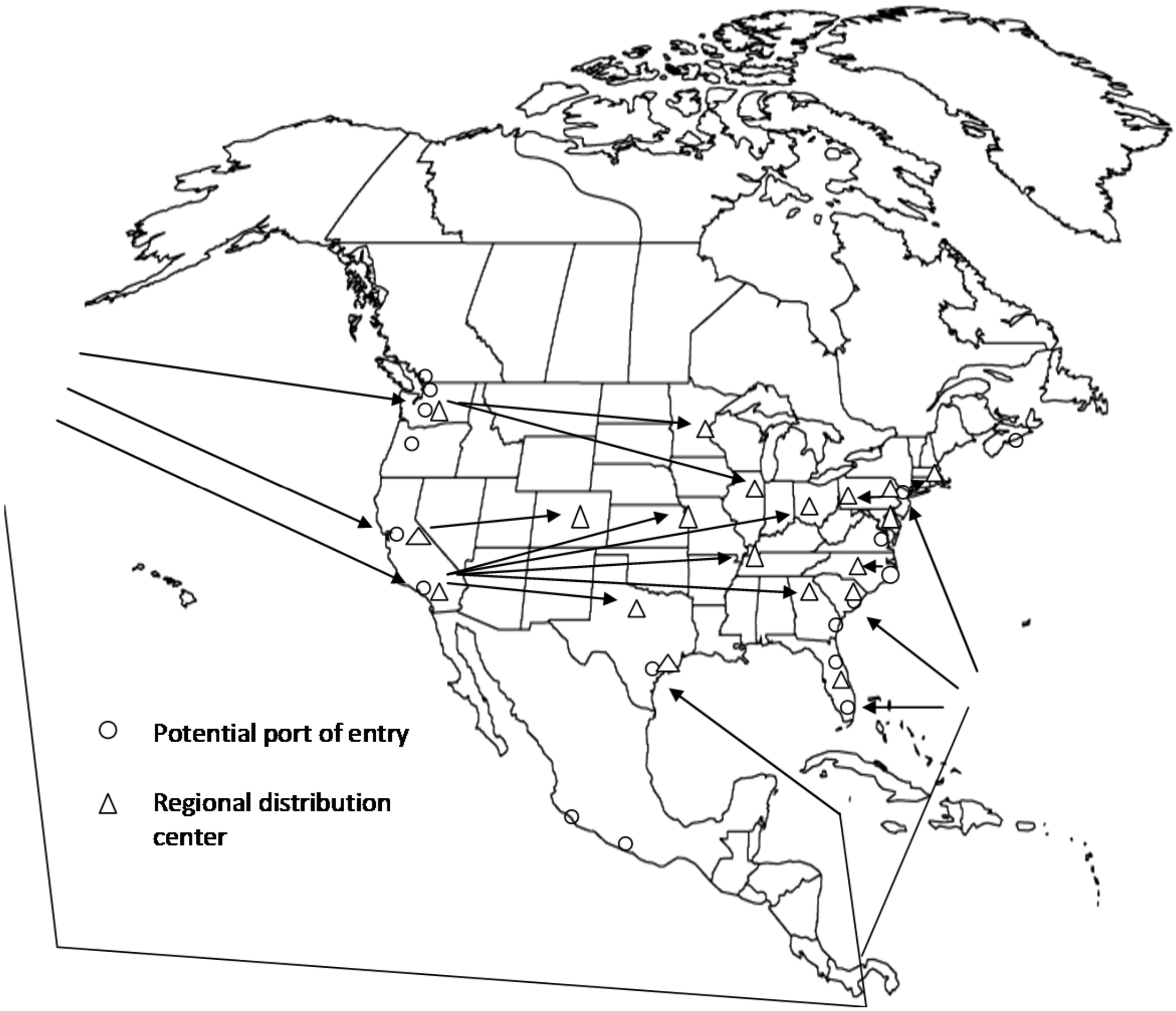

Figure 4. Push Supply-Chain Strategy

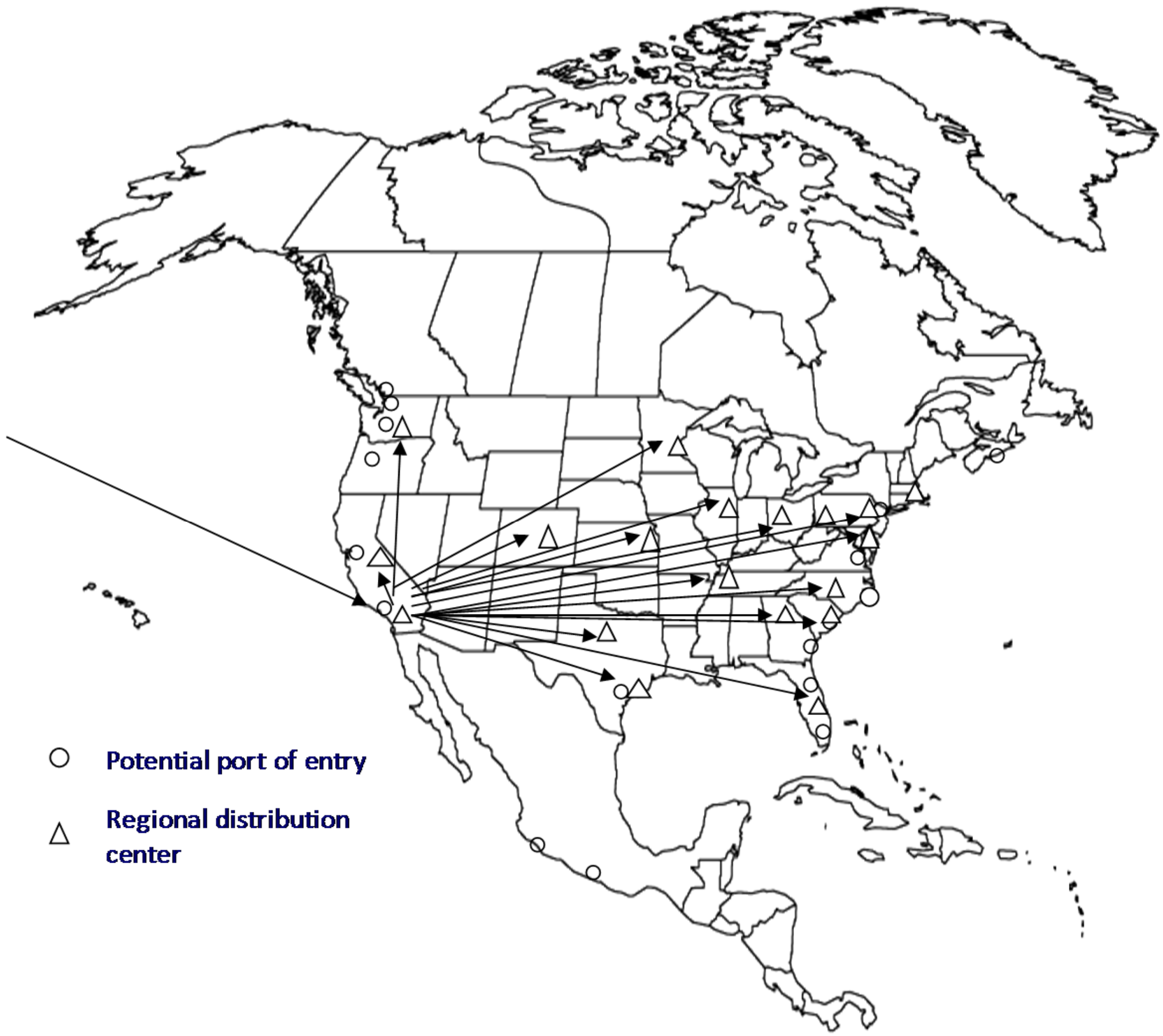

Figure 5. Push-Pull-All-at-San-Pedro-Bay Supply Chain Strategy

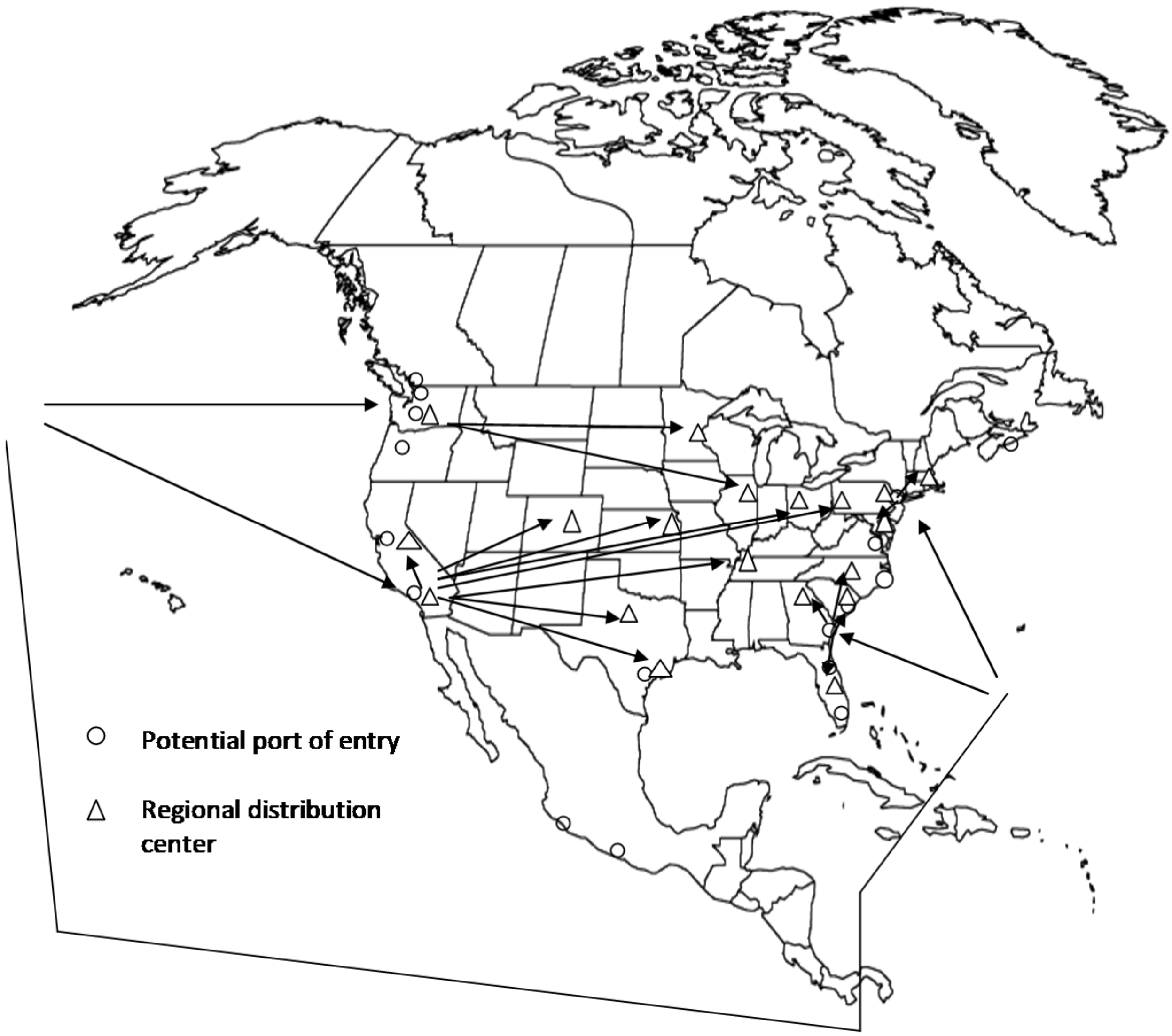

Figure 6. Four-Corners Push-Pull Supply Chain Strategy

3. Overview of supply chain optimization

A large-scale supply-chain optimization model developed by the author is used to predict import flows by port and landside channel as a function of total import volume, market share of large importers, transportation rates and fees, and infrastructure and staffing of port terminals and rail networks (Leachman 2005, Leachman 2010, Jula and Leachman 2011a, Jula and Leachman 2011b, Leachman and Jula 2011). The model is calibrated with US Customs data on import volumes and declared values by commodity and importer, confidential rate quotations from steamship lines, railroads, 3PL firms and trucking companies, and statistics on actual container flow times through the alternative North American ports of entry and landside channels to regional distribution centers.

The model is applied to an individual importer to determine its best supply chain strategy in terms of assignment of RDCs to ports and landside channels, and whether or not to use a Push strategy or to use Push-Pull strategies involving deployment of cross-docks and import warehouses. Total cost for transportation and handling, pipeline inventory and safety stock inventory at RDCs is the basis for identifying the best strategy for each importer. Roughly speaking, total inventory holding costs from factory shipment through to RDC are comparable to total transportation and handling expenses from factory to RDC, with inventory costs dominating transportation costs for expensive goods and transportation costs dominating inventory costs for inexpensive goods.

The model is applied importer by importer for the top 83 actual importers, considering the average declared value of each importer's portfolio of imports. The top 83 are those whose import volumes are large enough to consider practicing Push-Pull supply chains. The model also is calculated for 19 "generic proxy" importers representing all small and regional importers. These importers must use Push supply chains, and so the optimization is only over which ports and landside channels to use for direct shipment of marine containers from Asian factories to RDCs. The results are tallied across all importers to deduce total import volumes by port and landside channel.

Application of the model using 2007 season rate quotation data and 2006 statistics on container flow times results in agreement with actual 2007 volumes by port and landside channel within 1-2% (Leachman 2010).

Iterative calculations of the supply chain optimization model with varying levels of potential container fees applied to imports entering the USA through one or several ports may be made to conduct so-called elasticity analysis, tracing out curves of import volume vs. fee value.

Two versions of the elasticity analysis have been developed. The Long-Run Elasticity Model takes container flow-time distributions by port and landside channel as fixed in application of the supply chain optimization model. In the Long-Run Model it is tacitly assumed that ports and landside channel operators will make whatever infrastructure investments or staffing expansion necessary to maintain current flow times under increased market shares of imports. The Short-Run Elasticity Model takes infrastructure and staffing levels as fixed and utilizes queuing models to predict container flow times as a function of import volume. Queuing models are calibrated for ports, for rail intermodal terminals, and for rail line-haul networks. Iterative queuing and supply-chain optimization calculations are made until an equilibrium solution is reached (Leachman and Jula, 2011).

4. Import Strategies

The general structure of optimal supply-chain strategies is summarized in Table 3. Push-Pull-All-at-San-Pedro-Bay is the best strategy for OEMs importing expensive goods re-sold to retailers throughout the Continental USA. This segment accounted for approximately 13.5% of total imports in 2009 and includes commodities such as electronics, fashion, auto parts, and shoes. Push-Pull using 3, 4, or 5 Corners is the best strategy for large, nationwide retailers importing broad portfolios of goods with a moderate-valued average declared value. Such strategies are used by large importers such as Wal-Mart, Target, and Sears/K-Mart. This segment accounted for approximately

27% of total imports in 2009. For large nation-wide importers of inexpensive goods, the Push strategy is best. This strategy is used by importers such as Ashley Furniture and Lowe's. This strategy also is used to some extent by large nation-wide importers of moderate-value goods for those goods marketed in one-time sales events such as patio furniture at Memorial Day or back-to-college refrigerators. In addition, this strategy must be used by all small and regional importers, as they do not possess the scale or scope to practice Push-Pull strategies. This segment accounted for approximately 59.5% of total imports in 2009 (Leachman, 2010).

Generally, the large nation-wide importers practicing Push-Pull supply chain strategies enjoy an overall 18-20% cost advantage (in terms of total transportation and inventory costs) over small and regional importers unable to effectively adopt such strategies (Leachman, 2008).

Table 3. Optimal Supply Chains for Various Types of Importers

Push	Push-Pull 3, 4 or 5 Corners	Push-Pull All at San Pedro Bay
Nation-wide Importers of Inexpensive Goods and One-Time-Sale Goods (13.5%)	Large Nation-wide Importers of Moderate-value Goods (27%)	Original Equipment Manufacturers of Expensive Goods with Nation-wide Sales (13.5%)
Small and Regional Importers (46%)		

During the period 2005-2010, the use of Push-Pull supply chains grew while the use of Push supply chains declined. Nation-wide, it is estimated that in 2006 total Push imports to Continental USA from Asia were 64% and total Push-Pull imports were 36%, whereas in 2009 the split was 59% Push and 41% Push-Pull. That is, the share of Push-Pull climbed five points in just three years. The effect of this change is most pronounced in Southern California, because the San Pedro Bay ports are utilized in both Push-Pull-All-at-San-Pedro-Bay supply chains and Push-Pull- 3, 4, or 5-Corner supply chains. It is estimated that total import volume in 2006 at San Pedro Bay was 53% Push and 47% Push-Pull, whereas in 2009 it was 43% Push and 57% Push-Pull. That is, the Push-Pull share at San Pedro Bay rose by 10 points in just three years. At the present time, more imports leave the Los Angeles Basin for inland USA points in domestic containers and trailers than leave the Basin in marine containers.

The reasons for this dramatic change are several. First, large nation-wide importers are learning to manage their supply chains better and re-engineering them accordingly. They are realizing the "Power of Postponement" afforded by waiting to commit destinations for imports until after regional demands materialize. By routing goods to where they can be sold first, cash flow is accelerated. Second, in some cases importers and their third-party logistics (3PL) providers are able to engineer "DC Bypass" strategies into supply chains. For example, a 3PL operating cross-dock services for both a large nation-wide retailer and an OEM may be able to build outbound loads to the RDCs of the retailer blending both moderate-value imports sourced from Asia by the retailer plus expensive imports sourced from Asia by the OEM. As another example, an OEM may be able to sell full container loads of its various imports to its retail customers before a vessel arrives at the ports, whereby these container loads can be built from the contents of multiple inbound marine containers at a cross-dock, thereby moving the imports directly from Asia to the retailer's RDC without stopping at the OEM's import warehouse. Third, the product portfolios of certain importers include both "weight freight" imports and "cube freight" imports sourced from different factories in Asia, perhaps from different countries. The marine boxes of these imports may be routed to the same cross-dock, where the contents can be blended into domestic container loads that weight-out exactly when the cubic capacity is reached, thereby sharply reducing inland transportation requirements.

Fourth, the cost advantages of large, nation-wide retailers enable them to undercut small and regional retailers and drive them out of the market. The 2008-2009 recession was particularly hard on many small and regional retailers. For example, in California, the Mervyn's and Gottschalk's chains closed down. Their market shares were taken by the likes of Wal-Mart, Target and Sears/K-Mart, and thus their import volumes moved from Push supply chains to Push-Pull supply chains.

Finally, the steamship lines enjoyed long-term (e.g., 10-year) contracts from the railroads for inland point intermodal (IPI) service to haul marine boxes inland at attractive rates. These legacy contracts started to expire in 2007; the last of them expired in the spring of 2011. They have been replaced by single-year contracts at much higher rates, typically 25-35% higher. Thus rail rates on marine boxes have risen more than rail rates on domestic boxes. This serves to offset the extra handling costs associated with cross docking, thereby making Push-Pull more attractive and Push less attractive than otherwise.

The sophistication and complexity of supply chains as practiced by large, nation-wide importers is illustrated by the hypothetical example in Figure 7. Actual volumes in the various channels vary by time of year and from day to day, so this example is simply representative but nonetheless realistic.

We imagine a 10,000-TEU vessel arriving at the Port of Los Angeles. Big-Box Stores, Inc. accounts for 10% of total Asia – USA waterborne, containerized imports; accordingly, 500 out of the 5,000 forty-foot boxes on this vessel contain imports that will ultimately be sold in Big-Box Stores' retail outlets. However, only 400 of the 500 boxes are imported with bills of lading showing Big-Box as the importer; the other 100 boxes contain expensive goods imported by OEMs, and Big-Box will purchase these goods from the OEMs sometime after clearing customs.

Tracing the 400 boxes for which Big-Box is the importer, 140 of these boxes contain inexpensive imports or one-time-sale imports that are passed through a Push supply chain. Thirty of these are drayed from the port terminal to the RDC serving the Southern California region (the "local RDC"). The other 110 are loaded into rail double-stack well cars for inland movement under IPI service.

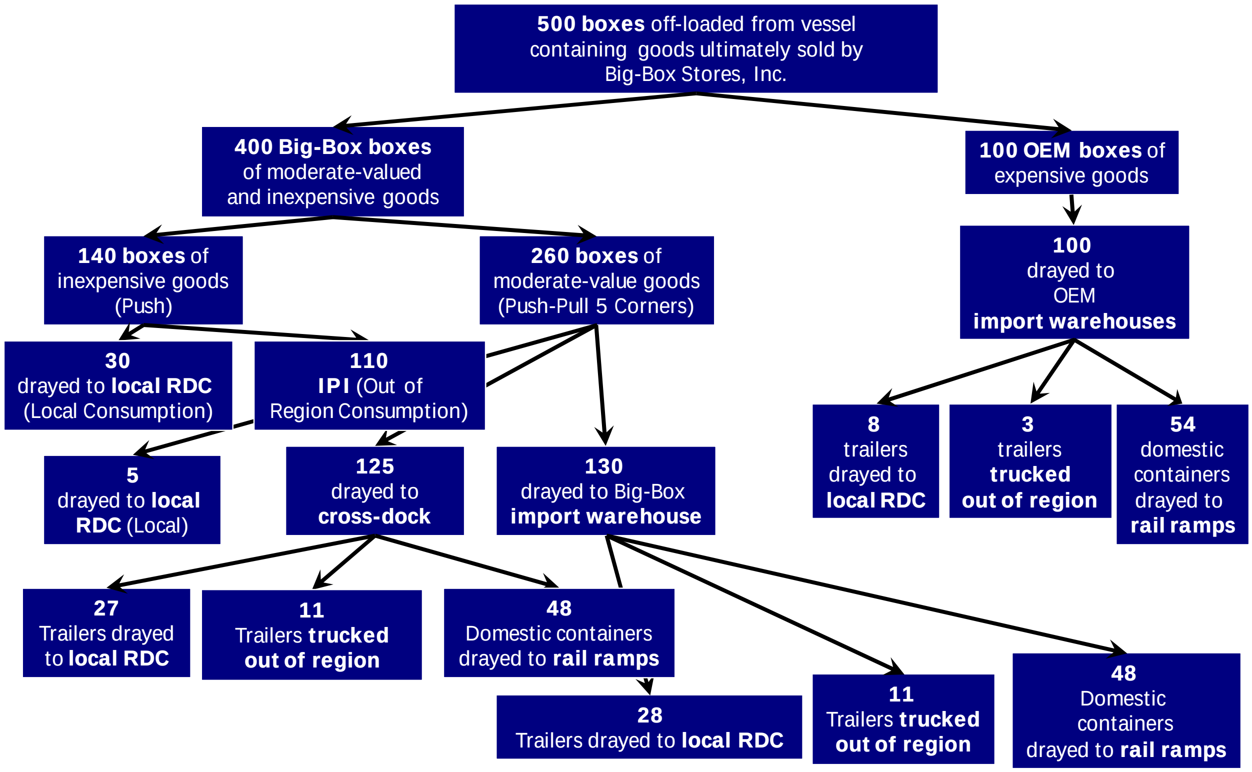

Figure 7. A "Big-Box Stores Example"

The 260 boxes containing moderate-value goods are passed through a Push-Pull supply chain. The entire contents of five of these boxes are in current demand in Southern California, so they are drayed directly to the local RDC. Another 130 boxes contain goods not in demand in any region yet, so they are drayed to the import warehouse operated by (or on behalf of) Big-Box Stores in the Inland Empire region of the Los Angeles Basin. The other 125 boxes contain goods that are being routed to multiple destinations, so they are drayed to a cross-dock.

The 125 marine boxes routed to the cross-dock generate domestic-box loads as follows: 27 trailer loads to the local RDC, 11 trailer loads trucked to the Northern California RDC, and 48 domestic container loads drayed to domestic rail intermodal ramps in downtown Los Angeles or the Inland Empire.

The contents of the 130 marine boxes routed to the import warehouse are unloaded and stored. But later they will become in demand at various RDCs. When they do, the breakout of the corresponding outbound volume from the import warehouse is as follows: 28 trailer loads will be drayed to the local RDC; 11 trailer loads will be trucked to the Northern California RDC; and 48 domestic container loads will be drayed to the domestic container rail terminals.

Finally, we turn to the 100 boxes of expensive goods imported by OEMs. They are drayed to the OEM's import warehouse, pending sale to Big-Box Stores. As they are sold, they generate truck trips as follows: 8 trailer loads drayed to the local RDC, 3 trailer loads trucked to the Northern California RDC, and 54 domestic container loads drayed to the domestic container rail intermodal terminals.

Re-capping this example, for the 500 marine boxes arriving at the port terminal, 110 went IPI (loaded in rail cars), 35 were drayed to the local RDC, 230 were drayed to import warehouses, and 125 were drayed to a cross-dock facility. From the import warehouses and the cross-dock, truck trips were generated as follows: 63 trailer loads to Big-Box's local RDC, 22 trailer loads trucked to Northern California, and 150 domestic containers drayed to domestic rail intermodal ramps.

Evan if all 110 IPI boxes are loaded at an on-dock rail terminal (and thus there are no truck trips outside the port terminal for these boxes), the other 390 boxes generate **1,350 truck trips** in the Los Angeles Basin (675 loaded container movements plus 675 movements of empty boxes or chasses), not counting distribution from the local RDC to retail outlets!

It should be noted that the trans-loading to domestic boxes reduces inland transportation significantly. Considering the lengths of marine and domestic double-stack well cars, and considering the cubic capacity of marine and domestic containers, total train length to move a given import volume inland is reduced by 17% (i.e., 17% less trains are needed to move the cargo inland), the weight of the trains hauling the imports is reduced by 1.3 tons per TEU, and dray trips at the destination end of the rail trip are reduced by 40% (because three domestic containers do the work of five marine containers). But, in terms of local truck traffic, the hardship on the port cities serving as Push-Pull trans-load centers is severe.

Most of the legacy logistics infrastructure in port cities is oriented to Push supply chains and not to Push-Pull supply chains. For example, at San Pedro Bay, the $2.4 billion Alameda Corridor provides a high-capacity, grade-separated rail link between the Ports of Los Angeles and Long Beach and main-line rail connections in downtown Los Angeles. But almost no domestic containers are handled in the Corridor, it is essentially exclusively for IPI (marine-box) stack trains, unit bulk trains and carload trains (the latter not port related). While cross-dock facilities are mostly located close to the Ports, domestic rail intermodal terminals to which the domestic boxes emanating from the cross docks must be drayed are located near downtown Los Angeles or in the Inland Empire, not near the ports. Import warehouses also are predominantly located in the Inland Empire. Lift productivity at on-dock rail terminals lags that at off-dock rail intermodal terminals, so that on-dock terminals are unable to accommodate the total IPI volume, and a significant portion of IPI traffic must be drayed between the Ports and downtown intermodal terminals. Moreover, the westbound marine boxes often contain domestic backhauls which marine terminals do not want to handle. At the marine terminals, outbound drays are predominantly scheduled by the importers and not by the terminal operators. This results in the requirement to "dig" into container piles to move other boxes out of the way in order to retrieve a desired box.

The results of all these factors are that there are (1) unnecessary transportation (dray movement of boxes), (2) unnecessary pollution (from the unnecessary dray transportation), (3) unnecessary congestion, and (4) unnecessary transportation infrastructure compared to what would be most ideal design to accommodate Push-Pull supply chains.

5. Results of Analysis of Future Scenarios

As interest rates rise from their current low levels, as Asian currencies are re-valued higher against the dollar, as salaries in Asia rise, the declared values of imports will rise and inventory costs will rise. Figure 8 depicts the change in the value distribution assuming a 15% across-the-board rise in inventory costs. This would be the result if, for example, the interest rate rose from 10% to 11.5%, or if the dollar were devalued by 15% against Asian currencies. Comparing against Figure 1, it may be seen that the result of such a rise is that the share of total imports accounted for by the inexpensive category drops from 25% to 19% of total imports while the expensive imports category rises from 25% to 32%. The moderate-value category remains essentially unchanged. This change results in a sharp rise in Push-Pull imports at San Pedro Bay. Coupled with the trend of increasing market share for large, nation-wide big-box retailers, this suggests a substantial rise in Push-Pull imports is in the offing for Southern California.

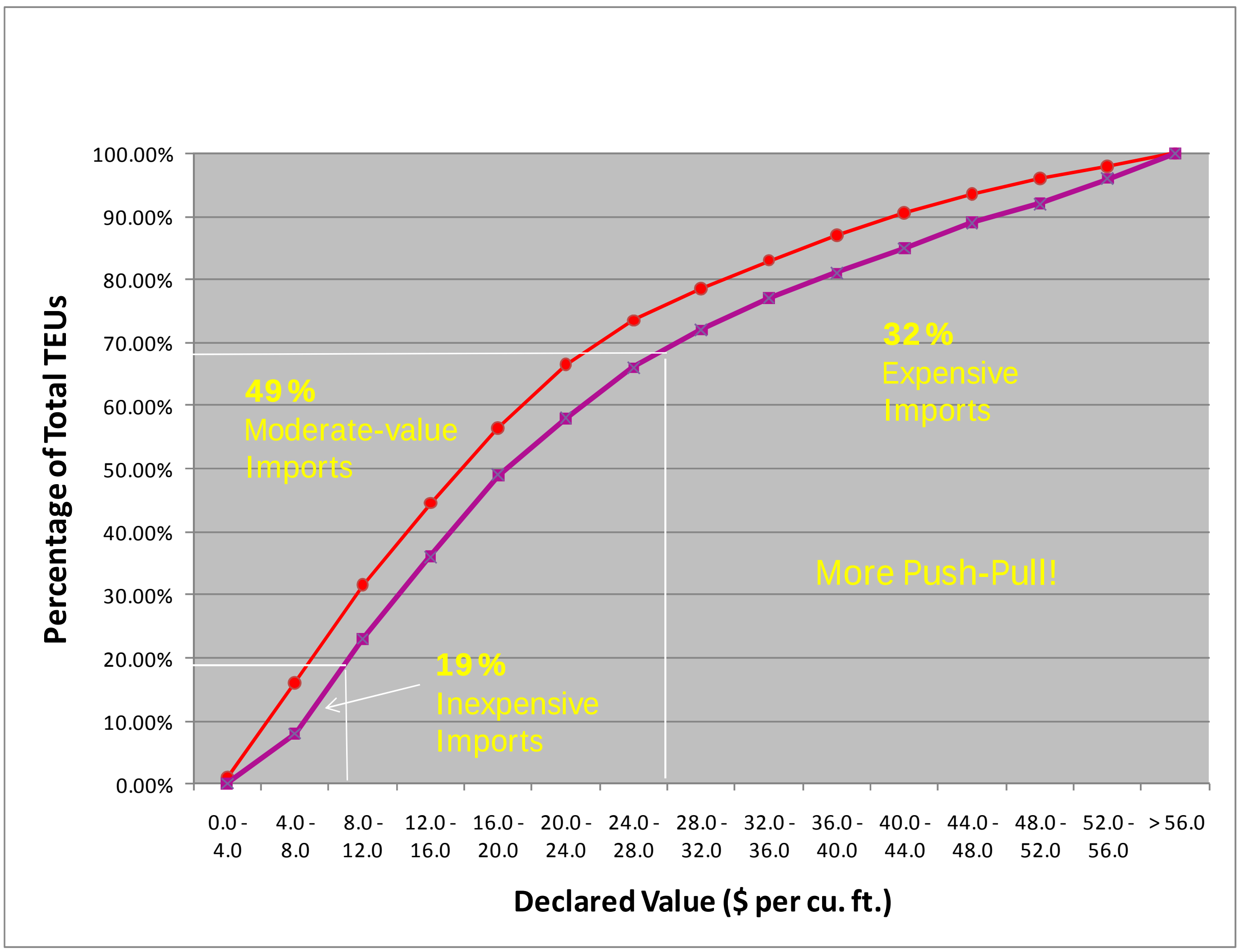

Figure 8. Distribution of Declared Values for Asia – USA Imports, 2005 Actual vs. a 15% Rise in Values

The Short-Run and Long-Run Elasticity Models were exercised with assumptions corresponding to several future scenarios. In each scenario, the 2006 total import volume (most recent peak volume) from Asia to the USA was assumed, supplemented by assumptions concerning rates and infrastructure. The 2006-2007 Base Case Scenario assumed 2007 transportation rate quotations juxtaposed with 2006 infrastructure, staffing and container flow-time statistics by channel. The Near-Term Likely Scenario modified the Base Case to reflect infrastructure and rail rate changes anticipated during the 2008 – 2010 period. The Optimistic I Scenario modified the Near-Term Likely Scenario with the assumption of a 10% rise in so-called “all-water” steamship rates via the Panama Canal with no rise in rates via West Coast ports. Such a change is “optimistic” from the point of view of the San Pedro Bay Ports, in the sense that shipping via West Coast ports of entry becomes more attractive as rates via the Panama Canal rise. The Optimistic II Scenario modified the Near-Term Likely Scenario with the assumption of a rise in the market share of large, nation-wide importers from 40% of total Asian imports (as was the case in 2007) to 50%. Such a change is “optimistic” for San Pedro Bay as well, because it results in increased application of Push-Pull and therefore a higher share of imports routed via San Pedro Bay. The Pessimistic Scenario modified the Near-Term Likely Scenario with the assumption that steamship rates to West Coast ports and IPI rates rise by 10% while there is no change in all-water rates. Results of analysis of these scenarios are depicted in Figures 9 and 10.

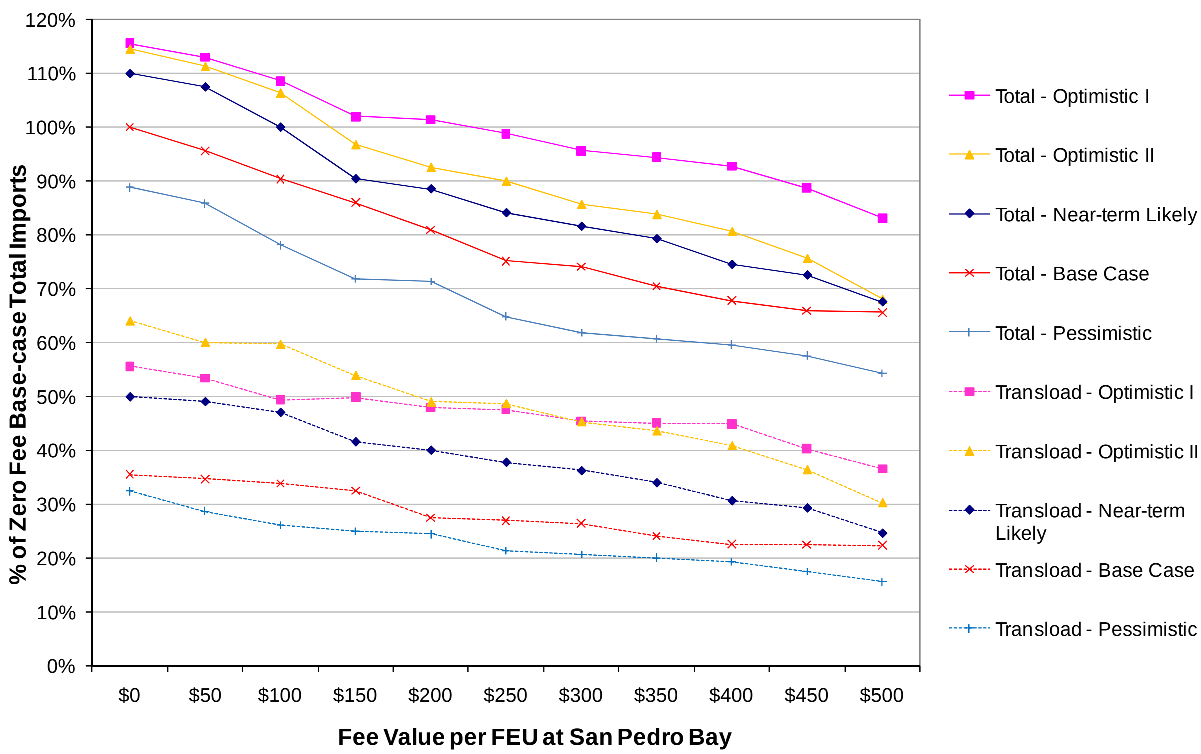

Figure 9. Short-Run Elasticities of Imports via the San Pedro Bay Ports in Future Scenarios

Both Long-Run and Short-Run model calculations were made for these scenarios, overlaid with potential fees ranging from $0 to $500 per FEU (forty-foot equivalent unit) assessed on all San Pedro Bay import containers. The solid-line curves in the top half of the figures show the trends in total import volume routed via San Pedro Bay (expressed as a percentage of the 2006 "Base Case" San Pedro Bay import volume); the dotted-line curves in the bottom half of the figure show the trends in trans-loaded import volumes via San Pedro Bay.

Results for the Near-Term Likely Scenario indicate that changes in rail and steamship rates since 2007 have been favorable for San Pedro Bay. In the case of no new container fees, this scenario results in a 10% gain in market share in the short run and a potential 20% gain in the long run if additional infrastructure and staffing investments are made to enable 2006 container flow times to be realized at the higher volume levels. In the long run, fees up to about $75 per FEU could be assessed while still realizing the 2006 market share. Considering just the trans-loaded import volumes, fees up to about $125 per FEU could be assessed.

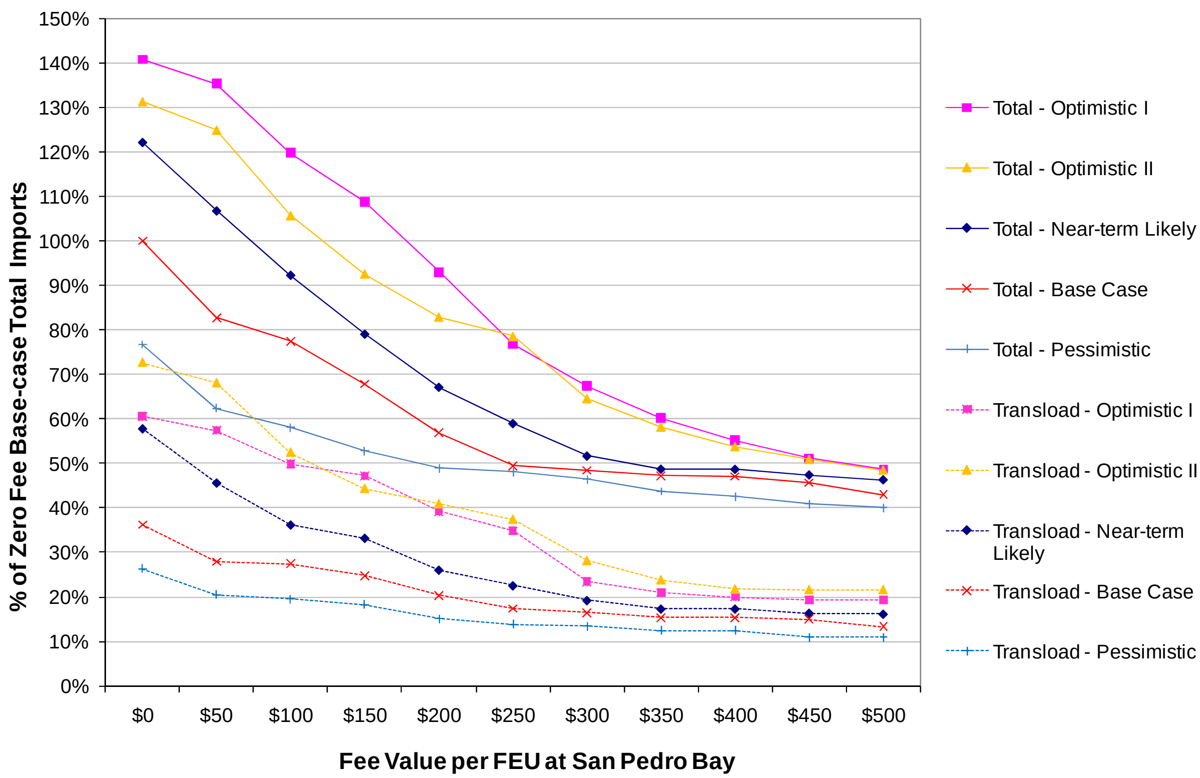

Figure 10. Long-Run Elasticities of Imports via the San Pedro Bay Ports in Future Scenarios

The Optimistic scenarios are even more favorable to the Southern California ports. Without new fees, these scenarios result in a 15% gain in market share in the short run and potentially a 30-40% gain in the long run. If new fees are instituted, these gains are abated; in the long run, a fee in the range of $125 - $175 per FEU brings total market share back to the 2006 level. Trans-loaded imports in these scenarios are much less elastic to fees, exceeding 2006 volume levels until new fees rise to $250 per FEU.

On the other hand, the Pessimistic scenario exhibits serious drops in market share for the San Pedro Bay Ports. Even if no new fees are introduced, a 10% drop in all-water rates results in a about a 12% drop in total San Pedro Bay imports in the short run, and a drop of almost double that in the long run. If a $200 per FEU fee were introduced in the Pessimistic scenario, total volume routed via San Pedro Bay is predicted to drop almost 30% in the short run and more than 50% in the long run.

It is clear from this analysis that total volume routed via San Pedro Bay is quite elastic to potential container fees. In particular, IPI volumes are very elastic. The trans-loaded imports are more inelastic but still decline with fees. The result of potential fees depends heavily on the future scenario of rates charged by the steamship lines and the railroads, and on the share of total imports accounted for by large, nationwide importers. For further details of this analysis, see Leachman (2010).

6. Policy Recommendations

In spite of the strong shift from Push to Push-Pull supply chains evident, the railroads and the ports are still strongly oriented to accommodating growth in the IPI business. Proposals are in the environmental review process for new infrastructure supporting increased IPI business. Yet there is little or no infrastructure proposed that is suited to Push-Pull supply chains.

Increased logistics land-use in proximity to the ports could reduce the need for costly transportation infrastructure to dray imports to inland points as well as significantly reduce the unfavorable environmental impacts from same. If import warehouses and domestic rail intermodal terminals were developed close to the Ports, there would be a very dramatic reduction in truck trips within the Los Angeles Basin, and the shift from Push to Push-Pull could be accommodated while reducing environmental impacts.

Unfortunately, cities in proximity to the Ports are generally hostile to logistics infrastructure development. New rail terminals, new import warehouses and new cross-docks are generally opposed, with opponents highlighting unfavorable local environmental and traffic impacts. Not well understood is the fact that defeating proposals for new infrastructure close to the ports does not reduce the environmental impact. Infrastructure will simply be built out in the hinterland, and trucks will pass through town on the freeway instead of terminating their trip at a cross-dock, import warehouse or rail terminal in town. Also not well understood is the fact that Push-Pull systems reduce the nation-wide carbon footprint of imports compared to Push systems, and they reduce inland traffic substantially.

These national concerns need to be properly weighed against local impacts in order to most wisely decide on proposals for land use by import supply chain infrastructure.

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