Container Diversion and Economic Impact Study

Effects of Higher Drayage Costs at San Pedro Bay Ports

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Prepared for

THE PORT OF LOS ANGELES

AND

THE PORT OF LONG BEACH

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Executive Summary

The Clean Air Action Plan (*CAAP*) was adopted in November 2006 by the San Pedro Bay Ports of Los Angeles and Long Beach with the goal of reducing air emissions by the heavy trucks that move containers in and out of the ports. To fulfill the CAAP, a policy entitled the Clean Trucks Program (CTP) has been proposed. To help cut air pollution from harbor trucks by more than 80%, drayage truck owners will scrap and replace the oldest of the 16,000 trucks (with financial assistance from the ports) and become part of tariff-approved licensed motor carrier (LMC) concessionaires.

These changes may raise the cost of port drayage. Dr. John Husing recently estimated that truck rates could increase by up to 80% after implementation of the Clean Truck Program. However, if the effects of TWIC (or other similar security restrictions that will reduce the labor pool) are excluded, the increase in trucking costs *relative to trucking costs at other ports* is actually closer to 40%.

Moffatt & Nichol estimates that fewer than 193,000 TEU out of a total of 15,800,000 will be diverted from SPB ports due to the 40% increase in trucking costs (Scenario 2A).

Table 1. Estimated Diversion from SPB

Diversion from SPB		
Scenario:	**TEU**	**Share of Throughput**
Post-TWIC Case:	0	0.0%
# 1 - Clean Trucks Only	-75,000	-0.5%
# 2A - Clean Trucks + LMC	-193,000	-1.2%
# 2B - Clean Trucks + LMC with dray-off for 50% of long-haul moves	-178,000	-1.1%

Moffatt & Nichol also considered the likelihood that long-haul truck costs would not increase quite as much if LMC's use "dray-offs" (as they currently do) to swap container-loads moving between the ports and long-haul destinations at terminal locations close to the ports. Case 2B suggests that if these dray-off swaps between driver-tractor combinations were used in 50% of the longest haul moves, 15,000 fewer TEU would be diverted from the SPB Ports and the Southern California region, while clean trucks could concentrate their activity closer to the port region.

Diversion was predicted by first estimating the elasticity of demand for container transportation based upon a regression analysis using the ratio of total transportation costs vs. the ratio of relative port gateway market shares. For discretionary cargo movements moving inland via intermodal rail or truck, with or without transloading, elasticity was observed to be approximately 1 (that is, a 10% increase in relative transportation costs via SPB would result in a 10% loss in port gateway market share). For containers trucked to or from the local region's warehouses, distribution centers and retailers, elasticity was estimated to be only about 0.3.

Because trucking costs make up only a portion of the total transportation costs for moving containers from overseas ports to US inland locations, the impact of higher truck fees is somewhat reduced. The following figure indicates the portion (left set of bars) of SPB containers moving by via eight combinations of mode and distance and the current total transportation cost from foreign port to inland destination (middle-right set of bars). Trucking costs are a relatively small part of the overall share of transportation costs for a majority of the containers moving through the ports.

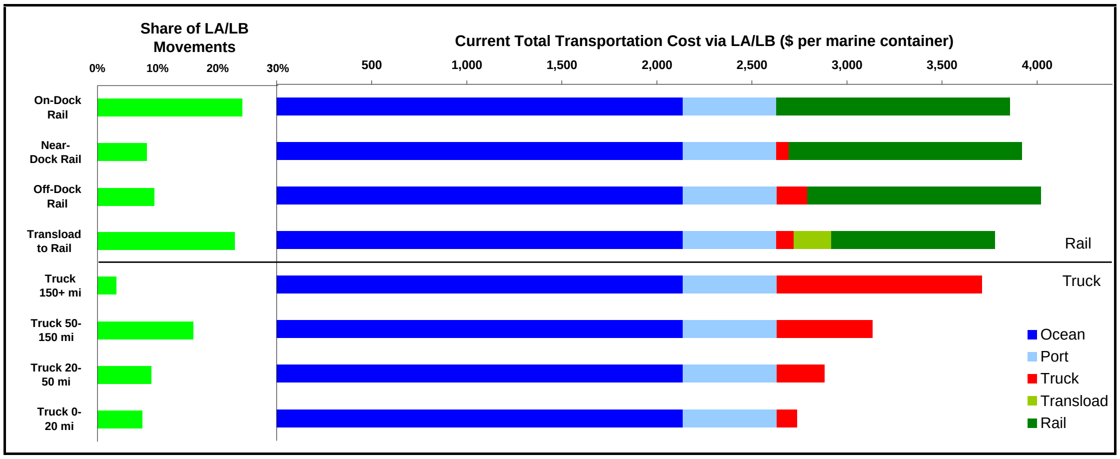


Figure 1. Transportation Costs and Share of LA-LB Throughput

Of the 178,000 to 193,000 TEU likely to be diverted from the ports' annual volumes of 15.8m TEUs, under the full program of Clean Trucks with LMC concessionaires:

- 92,000 ~ 99,000 TEU are imports
- 30,000 ~ 33,000 TEU are exports
- 55,000 ~ 60,000 TEUs are empty containers which are backhauls from the diverted loads.

It should be noted this economic analysis is based on the key assumption that *change will occur gradually and smoothly*. Higher costs for shippers and cargo owners would support new investments in trucks and attract new drivers to meet ongoing, albeit slightly reduced, demand for drayage trucking services. If actions of shippers, terminal companies or the ports, via the Clean Truck Program or the Employee Mandate Program requirements of the Clean Air Action Plan, led to a sudden and severe shortage of drayage trucks and/or drivers, a market breakdown would occur and short term results would be very different.

Under all cases, the net impact results in job losses across both the port industry and port users. The combined total employment impact of port industry and port users would be a loss of 1,194 jobs under case 2 and a loss of 3,013 jobs under case 1 in the Los Angeles 5-County region, and a loss of 3,353 jobs under case 2 and a loss of 3,852 jobs under case 1 throughout the State of California. The impact to the State is larger because approximately 25% of the port users are located within California, but outside the 5-County Region.

Unlike the impact on jobs, the port industry can be expected to see some *increases* in worker income from higher wages (and benefits) due to increased wages and employment in the trucking industry. Under Case 1 (IOO Model with Clean Trucks), the job impacts from diversion would lead to a loss of total income of $164 million within the LA Region and $200 million in the State of California. Under Case 2 (the Employee Mandate Program), the expected total compensation to both drivers and other employees is expected to increase by $125 million in the Los Angeles region and $34 million in California.

Background

The San Pedro Bay Ports Clean Air Action Plan (*CAAP*), adopted in November 2006, detailed numerous goals on how to accomplish emission reduction efforts related to port activities. The plan acknowledged that:

> The "ability [of the San Pedro Bay Ports] to accommodate the projected growth in trade will depend upon their ability to address adverse environmental impacts (and, in particular, air quality impacts) that result from such trade. The [CAAP] is designed to develop mitigation measures and incentive programs necessary to reduce air emissions and health risks while allowing port development to continue."

Among the goals of the CAAP is a reduction in pollutants by the heavy trucks that move containers in and out of the ports. The resulting plan has been designated as the "Clean Truck Plan."

While not all details have been determined, one version of the proposed plan includes:

- Replace or retrofit 16,000 harbor trucks in five years
- Use of the port tariff(s) to limit access to terminal facilities
- Charge Truck Impact Fee (TIF) to "dirty" trucks entering port starting January 1, 2008
- License "clean" truck concessions that can access terminals without paying TIF
- Use TIF revenues to fund truck replacement program
- Concession drivers:
    - During transition period, employee drivers and owner operators under contract would be both allowed
    - After transition period, drivers must be employees
    - Assure competition, adequate coverage, level playing field
- Concession truck fleet:
    - Meet CAAP "clean truck" standard
    - Clean truck replacement and retrofit grants to support transition
    - Begin progressively banning dirty trucks from port terminals starting with oldest in 2008
- Engage third party to administer Clean Trucks Program
- Maintenance and training by approved concessionaire
- Concessionaire participates in City workforce development initiatives
    - Must certify that drivers adhere to national and local security standards

Scope

Task 1: Estimate Diversion

Moffatt & Nichol is principally responsible for estimating the volume of containers diverted from the SPB ports relying on similar studies and available information. This involves the following sub-tasks:

a. Estimate transportation costs via competing ports
b. Estimate port market share versus competing ports
c. Identify additional factors "other than direct cost"
d. Develop statistical model predicting market share
e. Utilize elasticity model to evaluate Clean Truck Program scenarios

Task 2: Estimate Economic Impact of Diversions

BST Associates is principally responsible for estimating the economic impact that the diversion estimated in Task 1 would have on the SPB port region. This estimate will address direct, indirect and induced economic activity and will cover overall economic activity including jobs, and income. The analysis will utilize recent economic impact analyses developed for the SPB ports and ACTA as a basis for estimating this additional impact.

John Husing's Findings

Messrs Husing, Brightbill and Crosby have prepared an Analysis of the Proposed Clean Truck Program, making presentations to various SPB committees and stakeholder groups on September 4th & 5th, 2007, where they identified changes in the trucking and driver labor market that would:

a) make up for the expected loss in the driver pool from either the proposed Transportation Worker Identification Credential (T.W.I.C.) program of the T.S.A., or some other labor security effort that would reduce the pool of drivers, as well as the ongoing need for new drivers to support continued port growth;
b) provide additional cash flow to help both "independent owner operators" (IOO's) or "licensed motor carriers" (LMC's) pay for clean trucks;
c) support the employment of IOO's by well-capitalized LMC's with the associated tax, benefits, terminal and related employment expenses.

Table 2. Estimated Increase of Trucking Costs from SPB Ports Based Upon Study by Dr. Husing

Scenario	Revenue per truck/driver	% Increase	% Increase from post-TWIC base
Current	$ 107,100		
After TWIC	$ 137,100	28%	(TWIC affects all ports)
TWIC + Clean Trucks	$ 159,200	49%	***16%***
TWIC + Clean Trucks + LMC	$ 191,700	79%	***40%***

While the proposed TWIC program will affect all US ports, the program may have different affects depending on local labor markets. In the absence of any information on which ports will be affected the most, it is assumed for this analysis that the impact of TWIC on all port markets is similar. *Therefore, the incremental change in trucking cost beyond the increase caused by TWIC is considered to be the effect of the Clean Truck Program.*

The increased labor and truck costs will drive higher rates and increased drayage costs for moving many of the containers to and from the SPB ports.[1] The incremental increase in drayage costs will have the effect of diverting some share of SPB port container traffic to other ports. Moffatt & Nichol has considered the results of the Husing report, and has developed three post-TWIC cases:

1. A 16% incremental increase in trucking revenues to finance the acquisition of clean truck technology.

2A. A 40% incremental increase in trucking required rates necessary to employ former independent operators within the structure of an LMC.

[1] Moffatt & Nichol uses fully allocated costs of transportation providers as a proxy for rates. The total costs that a ocean carrier, trucking company, railroad pay for operating expenses (crew, fuel, maintenance), capital costs (equipment, inventory, accounts receivable, etc.), sales and administration, as well as a risk-adjusted return on investment to both debtors and equity holders, are a good estimate for the "rates" that can fluctuate based on market conditions, customer and day-of-the-week. These fully allocated costs are ultimately paid via the "rates" charged to shippers and beneficial cargo owners.

2B. The same 40% increase in clean trucking rates as in case 2A, with the additional assumption that 50% of long-haul truck moves will reduce their costs through "dray-offs" at LMC terminals. The LMC would use a clean truck to transport containers to/from the SPB port terminal and a truck and driver, not necessarily participating in the Clean Truck Program would transport the container between the terminal and the far-from-port hinterland location.

Diversion Analysis

Transportation Elasticity

Moffat & Nichol has conducted a variety of studies using real-world transportation data to estimate the effect of total transportation cost on the demand for those transportation services. Elasticity is an economic term that refers to the flexibility of demand when the price of a good or service increases.

When a good or service can easily be replaced by a substitute or gone without, demand for the good or service may have high elasticity. This occurs when the percent change in price is less than the percent in change in demanded volume. Airline tickets are an example of a highly elastic transportation service; price increases cause travelers to reduce their travel and/or consider alternative carriers and modes, leading to a high percentage of reduced demand.

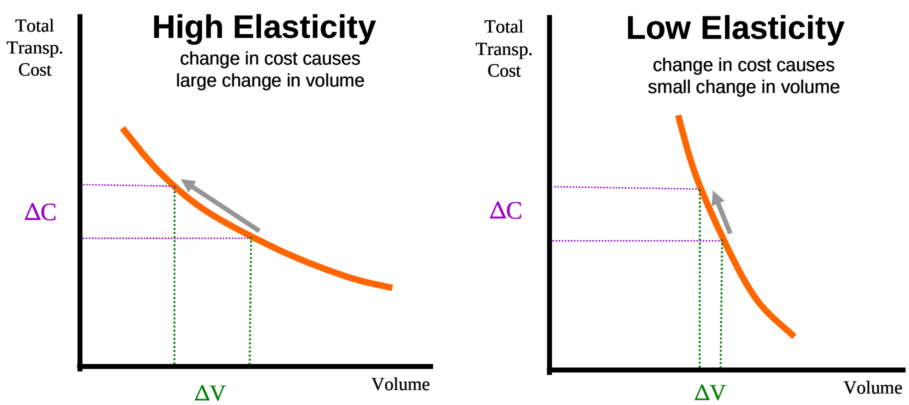


Figure 2. Illustration of High Elasticity and Low Elasticity

Alternatively, low elasticity occurs when goods or service are difficult to replace or go without and the percent change in price is then greater than the percent change in demand. Another example in the transportation sector is personal driving habits as function of fuel prices. Even over time, higher fuel prices have generally induced only small changes in the miles driven per capita.

Moffatt & Nichol's diversion study estimates the elasticity of demand for freight transportation services by observing recent, historical freight movement data and comparing the cost of those movements to shippers and beneficial cargo owners. That is, a comparison was made between the relative cost of transportation via alternate port gateways, and the relative market shares of those port gateways in serving the same Overseas Regions – Inland United States markets.

Estimation of Costs via Competing Port Gateways

The first step in estimating elasticity is to estimate the total (fully allocated) costs of moving a container from a foreign trade region to all of the possible U.S. inland destinations. This cost is a sum of:

- Ocean costs between a foreign port representing and a US gateway port.
- Port and terminal costs to move a container from a ship to an inland transportation service including any necessary fees
- Inland transportation costs, which are a blend of
    - Trucking costs between port and inland destination
    - Rail line haul costs between port and inland intermodal rail terminal plus drayage from rail terminal to destination

For the purposes of this study, the foreign ports are: Shanghai for the North Asia trade region, Singapore for the Southeast Asia trade region, and Colombo for the South Asia trade region. 92% of the SPB port's trade is with these three regions.

Moffatt & Nichol has developed a proprietary ocean shipping cost model that estimates TEU "slot" costs by port pair based upon a survey of current scheduled services. For each port pair, the model considers:

- Bunker fuel use
- Crew requirements
- Distance of a round voyage
- Time elapsed for round voyage, including port calls
- Slot capacity and capital cost (per day) of the typical vessel used
- Typical gross margin of steamship lines serving the trade region

The margin, or relative market price level for the shipping services, is based on tables published by Containerisation International and anecdotal information from other sources.

Port and terminal handling costs were developed through surveys and estimates from various efforts by Moffatt & Nichol and partners based on:

- Port authority tariffs (dockage & wharfage)
- Terminal operator rates, and
- Stevedore charges
- On-dock intermodal lift costs and off-dock intermodal drayage charges as appropriate.

Inland transportation cost between a port and an inland market is a blend of both trucking and available intermodal rail services. The blend is based on:

- The distance between the port and the particular inland market
- The intermodal share of the port
- The average distance of the port's hinterland markets.

The cost of intermodal rail is dependent on whether railroads publish direct service between the port and inland intermodal terminals near to the specific markets. If intermodal service is not available between the port and an inland market, a longer (and more expensive) drayage move might be required.

Rail costs are based on the Uniform Rail Costing System that is developed from Rail Form A, a required measure of operating and capital costs filed by various Class I railroads with the US' Surface Transportation

Board. The URCS model estimates cost per mile by equipment, tonnage, carrier, etc. for intermodal railcars in unit train service.

Included in the rail costs are:

- Fuel surcharge
- Operating margins of each railroad
- Lift costs
- Drayage costs between inland intermodal terminal and inland market destination.

Moffatt & Nichol uses a trucking cost model that estimates fully allocated costs, or rates, based on mileage, driving time, and fixed costs per move while considering factors relevant to a trucking business:

- Fuel costs
- Maintenance
- Taxes
- Sales and general administrative costs
- Capital cost of equipment
- Risk-adjusted margins

The transportation cost components described above are aggregated together to estimate a total transportation cost between an overseas Trade Region (in Asia) and an inland US market (e.g., Chicago, St. Louis, Sioux City, etc.) via a specific port gateway. For the purposes of this elasticity analysis, the transportation costs between the same Trade Region – Inland US Market pair are calculated with different intermediate gateways. That is, there is a different cost of serving North Asia to Denver via Oakland, than via Seattle/Tacoma, or via the SPB ports.

The analysis is based on finding dozens of Trade Region – Inland US Market pairs where the same two port gateways compete. For each foreign trade region and inland destination pair, the relative transportation costs between two competing ports are calculated. Then they are compared. For example if the estimated cost of moving a container from North Asia to the St. Louis area via LA/LB was $2,436, and the cost via Sea/Tac was $3,001 the transportation cost ratio of LA/LB vs. Sea/Tac would be ($2,436/$3,001 =) 0.812.

Estimation of Port Market Share vs. Competing Ports

For the port gateway elasticity analysis, the relative pair-wise market share between two competing ports for a large number of inland destinations were used as a measure of market share. Relative market shares were estimated based upon an enhanced database of PIERS container shipment data that inferred inland destinations based on company name and the location of their distribution centers. The geographic distribution of shipments has been aggregated by up to 179 unique inland regions as defined by the Bureau of Economic Analysis. Below is a map of imports from Asia via the SPB port to selected BEA regions.

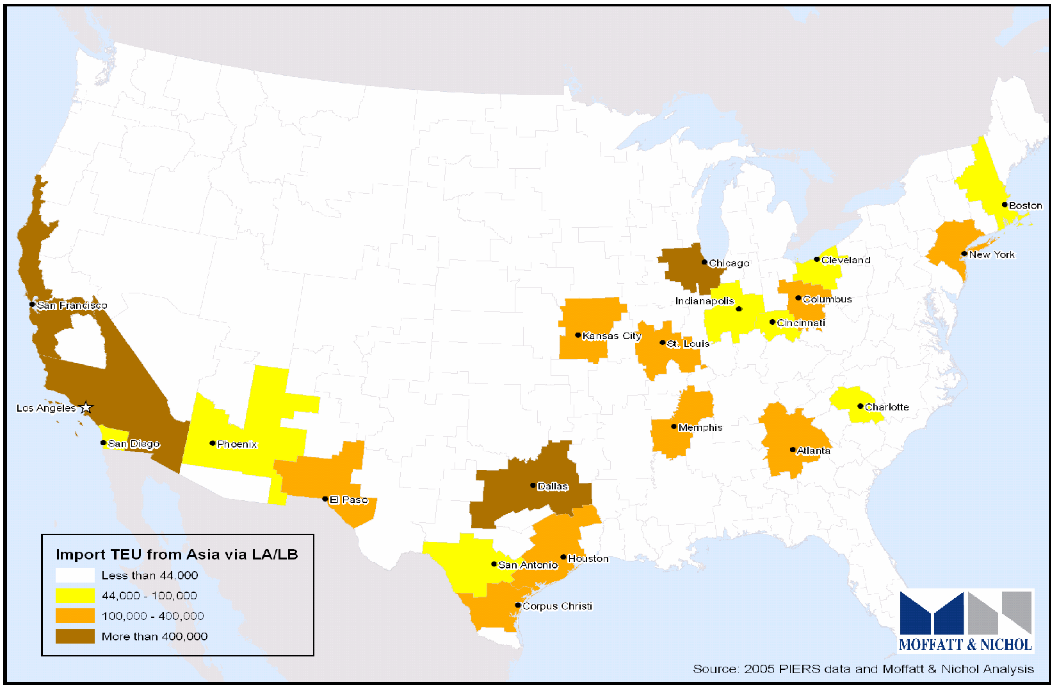


Figure 3. Inland Destination of PIERS data by BEA Region

Four ports with which San Pedro Bay competes significantly are considered in this analysis: Seattle / Tacoma, Oakland, New York / New Jersey, Savannah.

By comparing the volumes moving from a specific overseas foreign Trade Region (e.g., North Asia) to an Inland US region (BEA), via any two ports, the elative market share for combination can be estimated. PIERS data was used to estimate relative market shares for 118 unique foreign trade region – BEA combinations. For example, if 64,954 TEU were shipped from North Asia to the St. Louis region via the SPB ports while 19,497 TEU were shipped between the same market pair via Sea/Tac, the market share ratio would be (64,954/19,497 =) 3.33.

Besides direct transportation costs, there are, of course, other features of a shipper's supply chain that influence routings. Shippers moving more valuable cargo are likely to place more emphasis on speed because of the "pipeline" inventory cost of tying up the valuable merchandise while it is in transit. Such high-value shippers are also likely to favor the consolidation of inventory in fewer warehouses in order to minimize "safety stock" inventory. Shippers of perishable and refrigerated goods are also concerned about the speed of shipments.

But if changes that occur from the Clean Trucks Program lead to a (temporary) situation where Southern California trucking services to/from the San Pedro Ports cost-prohibitive or, even worse, unavailable, the results could exceed the incremental losses estimated in this study. If the trucking services market were to collapse, there would be substantial non-linear shifts of containerized goods to other ports, similar to what occurred during the PMA lockout of 2002 and the congestion during the Fall of 2004.

Develop Statistical Model Predicting Market Share

After calculating the relative market share and relative transportation costs for all foreign trade region – port gateway –inland BEA market combinations, a Log-Log regression[2] analysis was performed to compare the SPB ports with competing port gateways for where there is sufficient data. These data points were plotted on a Cartesian coordinate system with relative transportation cost as the independent variable, and relative market share as the dependent variable.

The regression analyses indicate that for each of the four port pairs considered, relative transportation cost is a statistically significant predictor of relative market share at the 95% confidence level. The following charts plot the competitive relationships of LA/LB vs. Sea Tac, Oakland, NY/NJ, and Savannah. Data points are plotted in blue circles and the regression equation is drawn as a red line.

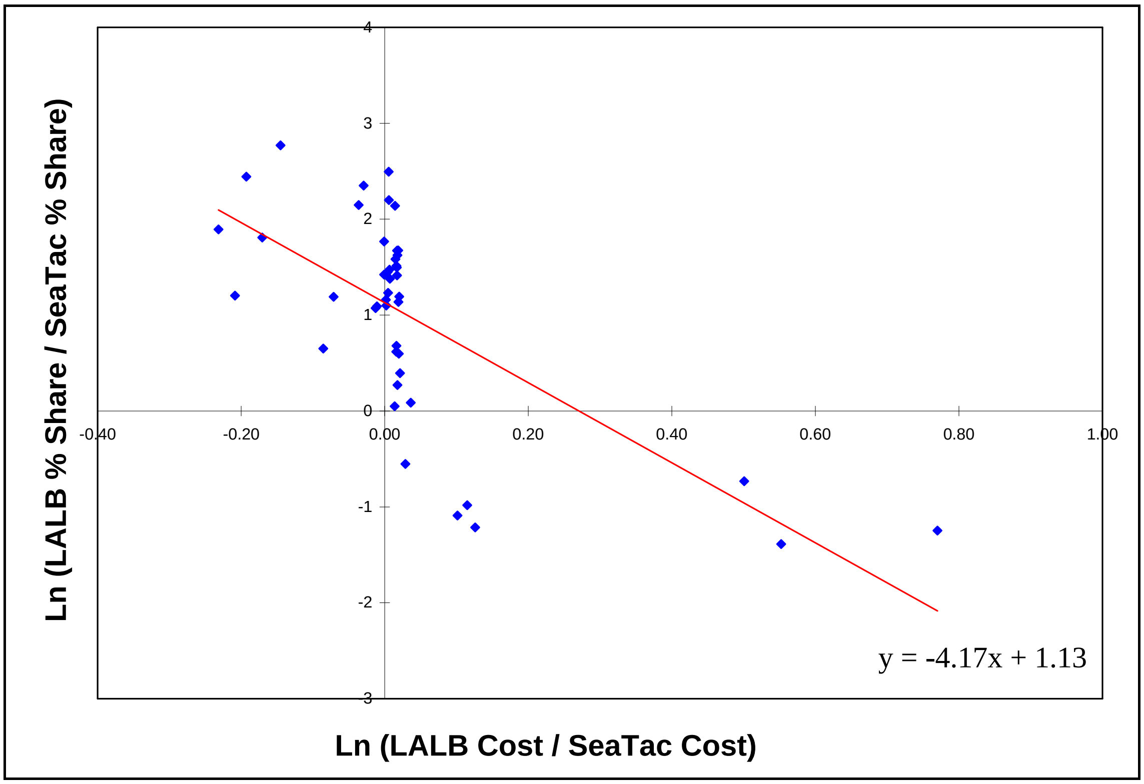


Figure 4. LA-LB versus Seattle-Tacoma

[2] Log-Log regressions are used when plotting the ratios of values to one another.

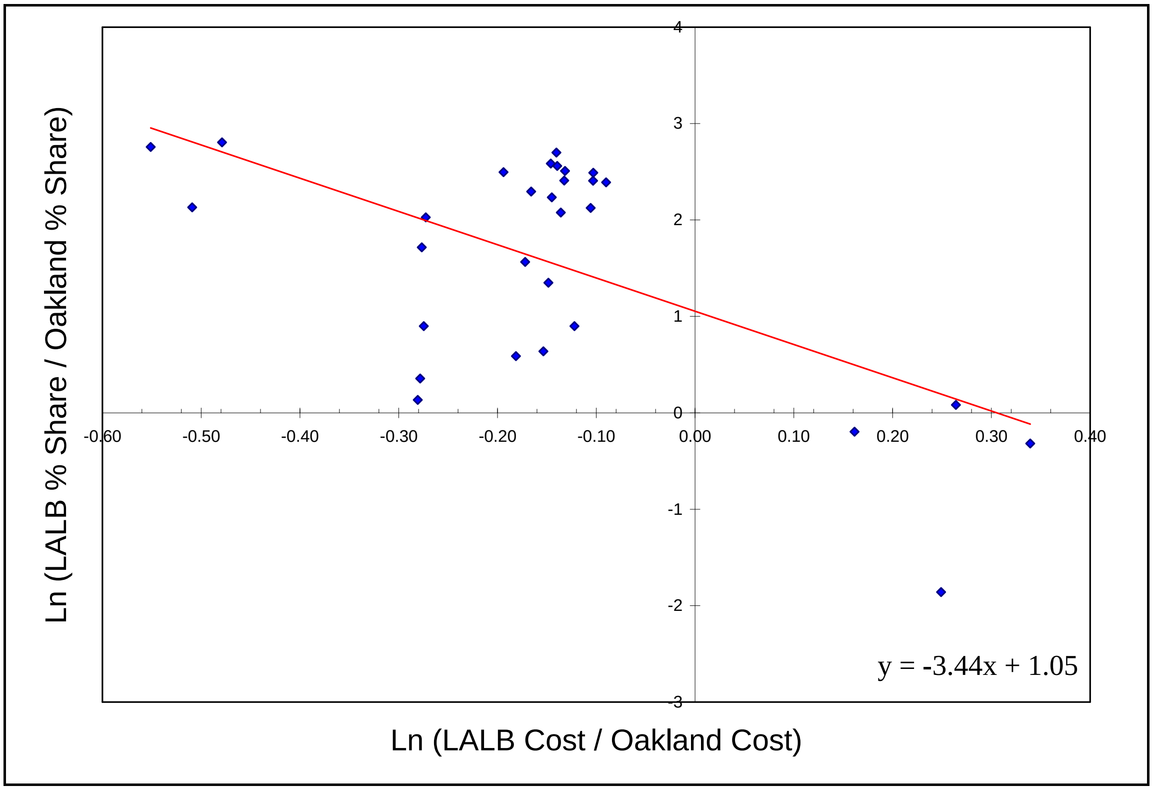


Figure 5. LA-LB versus Oakland

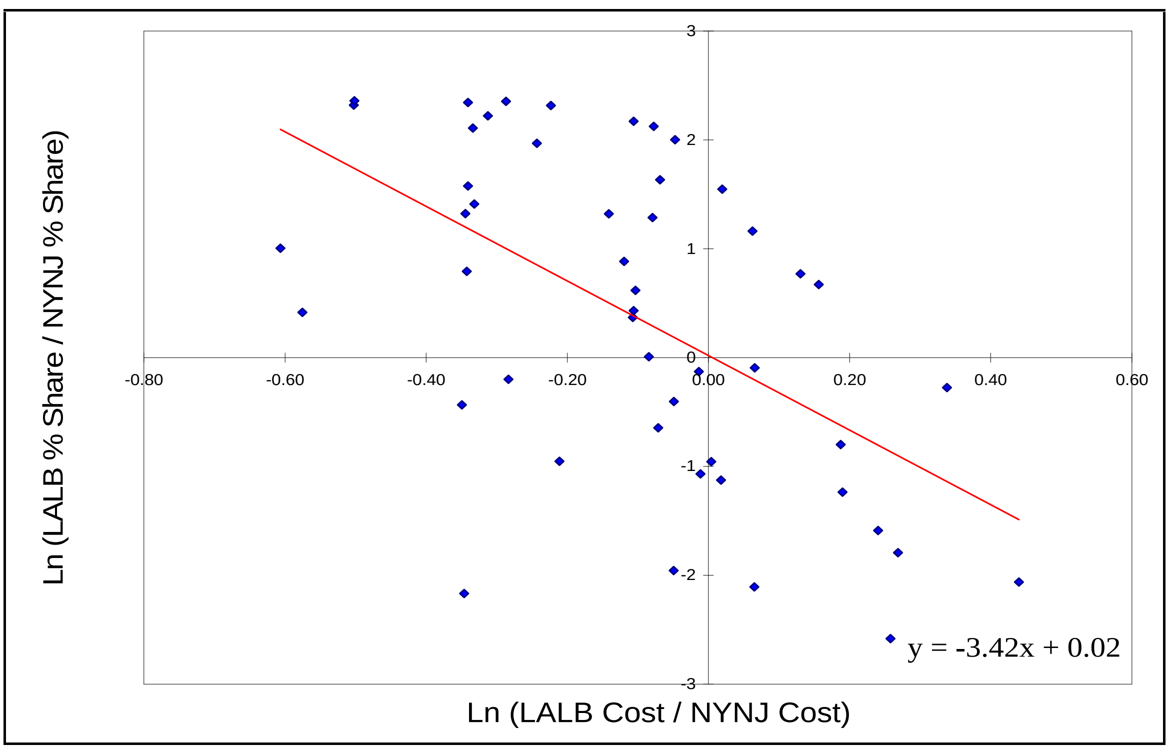


Figure 6. LA-LB versus NY-NJ

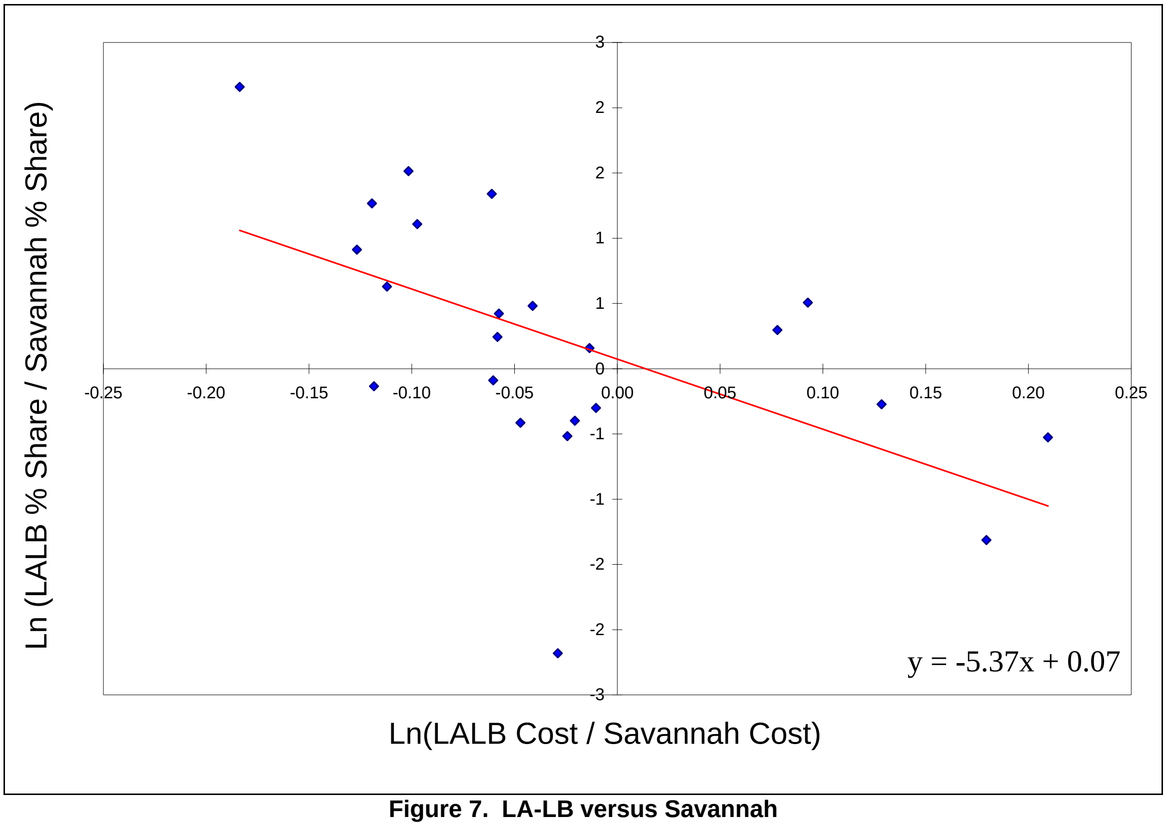


Figure 7. LA-LB versus Savannah

Seattle-Tacoma, Oakland, NY/NJ and Savannah all compete with the San Pedro Bay ports in many inland markets. While the analysis indicates that an increased cost advantage of serving an Asian – Inland BEA market tends towards an increased relative share of that market, the parameters of those relationships differ slightly.

From other analyses performed by Moffatt & Nichol, it is understood that cargo from North Asia most likely to go All Water and use East/Gulf Coast ports is generally of lower value (less time sensitive) than cargo that moves via West Coast ports. Higher-value and time-sensitive cargo is moderately less likely to use non-West Coast ports. While Oakland serves some of California, Salt Lake City and even Denver, its lack of intermodal rail connectivity to most of the Inland U.S. market limit its ability to be a full-competitor to San Pedro Bay. Therefore, for most cargo moving to the continental United States, Sea/Tac is the diversion port gateway of choice for SPB port shippers.

Based upon the above charts, the relationship between Sea/Tac and the SPB ports is approximately:

$$Ln\left(\frac{\mathrm{SPB}_{\%Share}}{\mathrm{SeaTac}_{\%Share}}\right) = 1.1 - 4.1 * Ln\left(\frac{\mathrm{SPB}_{Cost}}{\mathrm{SeaTac}_{Cost}}\right)$$

or

$$SPB_{\%Share} = SeaTac_{\%Share} * e^{1.1-4.1*Ln\left(\frac{SPB_{Cost}}{SeaTac_{Cost}}\right)}$$

A typical example application of this result is as follows:

For the 11,216 TEUs moving between Southeast Asia and the St. Louis area,
7,544 or 67.3% move via the SPB Ports at an estimated total cost of $3,033 / container

1,236 or 11.0% move via Sea/Tac at an estimated total cost of $3,598 / container

Based on the formula above, the market share ratio can be predicted:

$$\frac{SPB_{\%Share}}{SeaTac_{\%Share}} = e^{1.1-4.1*Ln\left(\frac{\$3,033}{\$3,598}\right)} = 6.05$$

based on the total transportation costs, the regression predicts that the San Pedro Bay market share should be approximately 6 times the Seattle/Tacoma market share. This is equivalent to an estimate that that of the cargo handled by both ports from Southeast Asia to St. Louis, 86% would be through SPB and 14% through SeaTac.
Then, if transportation cost via the SPB ports for this origin destination pair were to increase by 5.0%, from $3,033 to $3,185, the predicted market share ratio would decrease to:

$$\frac{SPB_{\%Share}}{SeaTac_{\%Share}} = e^{1.1-4.1*Ln\left(\frac{\$3,185}{\$3,598}\right)} = 4.95$$

representing a new split of approximately 83% SPB and 17% SeaTac. Based on the decrease from 86% to 83%, SPB's market share would decrease 3.5% relative to its initial value. This loss of 3% out of 86% is 3.5% of SPB's market share, based on a cost increase of 5%. Therefore, elasticity at this particular point on the regression line is estimated to be

$$\varepsilon = \frac{\Delta \text{ market share}}{\Delta \text{ cost}} = \frac{3.5\%}{5.0\%} = 0.7$$

Elasticity described by the regression equation varies somewhat over the range of the regression because it is a non-linear relationship. Therefore, the elasticities have been estimated for each data point along the regression, and a weighted average elasticity has been calculated. The weighted average elasticity of SPB vs. SeaTac is approximately 0.8. Elasticities between SPB and the East Coast ports, are slightly higher, above 1.0. This is consistent with the observation that the cargo shipped AllWater is typically of lower value and hence more sensitive to transportation costs.

When data only for markets closest to Southern California was reviewed, Moffatt & Nichol observed much lower elasticities of 0.2~0.4. These markets are primarily served by truck to/from the West Coast ports and would be affected to a greater degree by the Clean Truck Program. Still, it is logical to observe that local traffic moving to and/or through the warehouses, distribution centers and retailers of Southern California, is somewhat less likely to be diverted to ports farther away. If the elasticity of container diversions moving to and from near port locations is substantially less than 0.8, it is appropriate to consider that diversions of container movements to and from intermodal-rail served locations is probably higher.

Other Observed Truck Cost Diversions

The experience in Southern California with PierPASS supports the idea that diversion can occur in response to changes in cost. It does not make sense to calculate elasticity from the initial implementation of PierPASS because besides imposing new costs, the marine terminals and warehouses began to operate gates and truck docks for extended hours. It is unclear how much of the diversion to OffPeak can be attributed to the PierPASS fee or to the fact that a critical number of terminals began operating gates at night, supporting a pre-existing need for OffPeak operations.

However, elasticity for truck movements was observed based on a second observation of truck diversion which occurred in April, 2006 when PierPASS fees increased by $80 to $100 per FEU. Figure Y-Y below indicates that this incremental fee caused an additional 1.0% of gate volumes to move to off-peak times over and above the one-year trend line. In this case, it is possible to estimate elasticity of demand because the idea of moving cargo through the gates OffPeak was already entrenched.

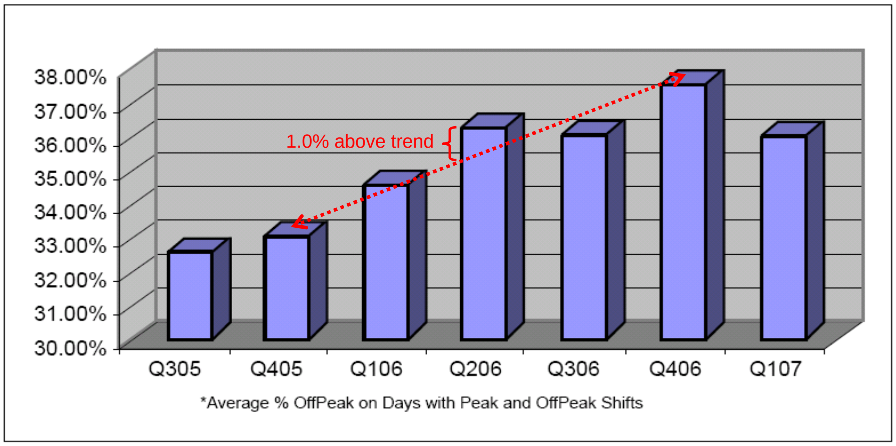


Figure 8. OffPeak Terminal Utilization, from PierPASS

In the 2nd quarter of 2006, 1st shift movements decreased as a share of total gate movements by 1.0% from a base of 65.5% in the previous quarter. The relative change in share of 1st shift truck movements was

$$\Delta \text{ share} = \frac{1.0\%}{65.5\%} = 1.5\%$$

Shippers choosing whether to move their containers during the 1st shift or OffPeak have already chosen San Pedro Bay as their port gateway, and thus, the trucking cost need only be considered. 1st shift trucking costs increased by $20 from approximately $360, based upon an estimated weighted average $280 trucking cost per container plus the previous PierPASS fee of $80. It can be reasoned that shippers who diverted were comfortable paying an average $360 per move, but were not comfortable with the new average cost of $380. Thus the relative change in cost was

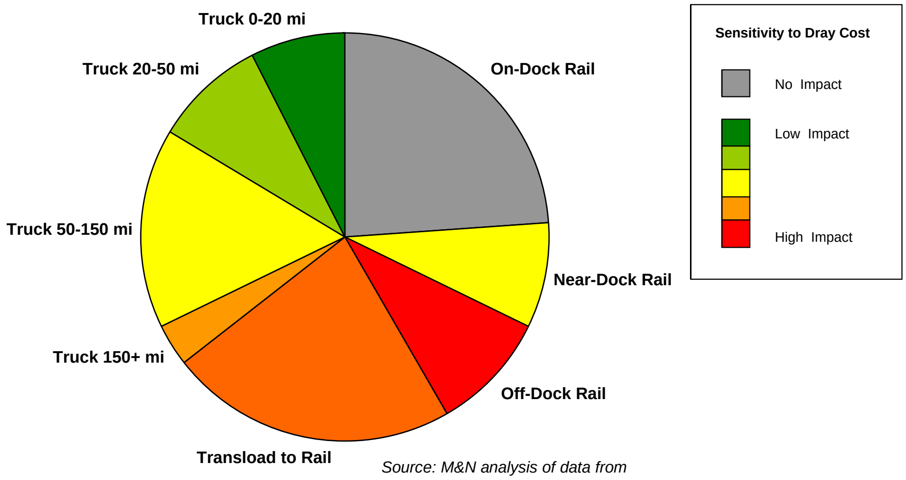
$$\Delta \text{ cost} = \frac{\$380 - \$360}{\$360} = \frac{\$20}{\$360} = 5.5\%$$

And therefore, we can estimate the elasticity of local truck movements from San Pedro Bay to be:

$$\varepsilon = \frac{\Delta \text{ share}}{\Delta \text{cost}} = \frac{1.5\%}{5.5\%} \approx 0.3$$

Applying Elasticities to Estimate Diversion

Containers moving through the SPB ports move via truck or rail over distances that range from short dray moves to near-dock intermodal yards, to half-day moves to warehouses and distribution centers within the Inland Empire, to 1,000+ mile long-haul truck moves to inland customers. Moffatt & Nichol has estimated the percentage of containers moving through the SPB port terminals by mode and distance using data from multiple sources. Note that a very large percentage of container volume moving through the SPB ports that travels by railroad from/to on-dock rail will be unaffected by higher trucking costs.



Source: M&N analysis of data from ACTA, August, 2007 and Meyer Mohaddes Associates, April 2004

Figure 9. Movements at San Pedro Bay Ports, 2006

In review, the moves through SPB ports that will be most affected by increased trucking costs are:

- Long-haul truck movements (>150 miles to/from inland locations), and
- Transloads to intermodal rail that begin with significant (>50 mile) drayage movements to distribution centers.

Containers that move less than 50 miles by truck from the port terminals will be affected less because the trucking cost increase will have less of an overall impact on total transportation cost, and no other ports are competitive with SPB in the local region. The observations are based on the effect that a percentage increase on trucking costs would have on the total cost of Asian => US container transportation costs and the inland destination of the container.

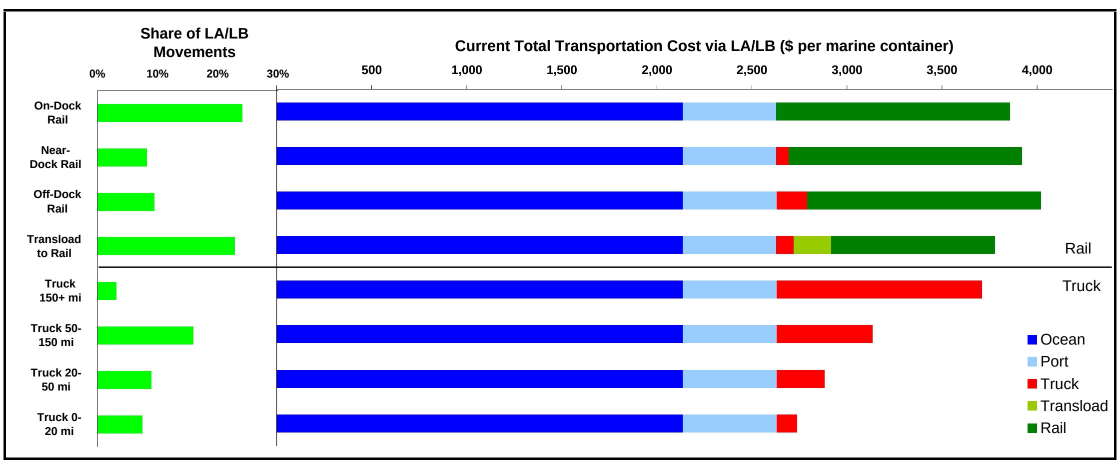


Figure 10. Breakdown of SPB Container Throughput and Transportation Costs by Category

For example, the typical total transportation costs that a shipper or cargo owner faces to move a container from North Asia through a SPB port terminal to a location 50 ~ 150 miles away (e.g., Redlands, Lancaster, Victorville, etc.) are approximately $3,130 of which $500 is truck transportation. There were approximately 2.5 million TEU that moved to and from the SPB port terminals during 2006. If truck transportation costs increase by 40% ($200), the relative increase in transportation costs for these containers moving through SPB would be ($200/$3,200 =) 6.4%.

Using a conservative elasticity of 0.3 for the local region, SPB would lose 6.4% x 0.3 = 1.9% of this traffic, or 48,000 TEU to other port gateways. The other seven categories are analyzed similarly. Each category is assigned an estimate of total transportation costs and the portion based on truck transportation.

As described in the Scope, John Husing's economic analysis suggests that truck transportation costs would increase by 16% for Case 1, and 40% for Case 2A.

For Case 2B, a 40% increase in truck costs is also assumed, with the provision that half of the longest-haul movements would reduce their trucking costs by dray-offs (as is currently the practice in various operations). The "dray-off" would comprise the swap of a container between a port-approved driver-truck combination and a long-haul driver-truck combination at an LMC truck terminal. While the additional truck start, as well as the increment of increased cost for the port truck transportation is assumed to be approximately $200, for many long-haul truck moves, this would be less than the 40% increase. The dray-off would reduce the increased cost of the longest truck moves while also tending to keep clean trucks in the Southern California region. Case 2B considers the realistic likelihood that many (estimate to be half of) long-haul truck moves are *not* impacted by the full 40% increase, but rather incur a flat cost of $200 for the extra clean truck dray to the LMC terminal where the clean truck is swapped for a truck not participating in the clean truck program..

This study uses elasticities, for traffic moving to inland locations, at the high end of the observed range in order to ensure that the impacts of the truck cost increases are not underestimated. For these discretionary movements, i.e. those not destined for the local market, elasticity was observed to be 1.0. For local movements, i.e., movements of containers to/from near-port locations, an elasticity of 0.3 is utilized based on our various analyses.

Table 3 below summarizes the estimated diversion of SPB throughput under the three most likely Cases. The Clean Trucks Program will lead to a loss of between 75,000 TEU and 193,000 TEU out of a current total of 15,800,000 TEU. This represents a loss of 0.5% to 1.2% of throughput.

Table 3. Diversion Summary

Diversion from SPB		
	TEU lost	**Share of Throughput**
Post-TWIC Case:	0	0.0%
# 1 - Clean Trucks Only	-75,000	-0.5%
# 2A - Clean Trucks + EMP	-193,000	-1.2%
# 2B - Clean Trucks + EMP with dray-off for 50% of long-haul moves	-178,000	-1.1%

The following tables document how diversion was estimated in each case.

Table 4. Results under Case 1: 16% increase in truck cost

	SPB Throughput (M TEU)	Trucking Cost ($ per box)	Transportation Cost ($ per box)	Change in Transportation Cost ($)	Change in Transportation Cost (%)	Elasticity (E)	Change in Market Share (%)	Change in SPB Throughput (ΔV)
On-Dock Rail	3,800,000	$0	$3,860	$0	0.0%	1.0	0.0%	0
Near-Dock Rail	1,300,000	$60	$3,920	$10	0.3%	1.0	-0.3%	-3,000
Off-Dock Rail	1,500,000	$160	$4,020	$30	0.7%	1.0	-0.7%	-11,000
Transload to Rail	3,600,000	$90	$3,780	$10	0.3%	1.0	-0.3%	-10,000
Truck 150+ mi	500,000	$1,080	$3,710	$170	4.6%	1.0	-4.6%	-23,000
Truck 50-150 mi	2,500,000	$500	$3,130	$80	2.6%	0.3	-0.8%	-19,000
Truck 20-50 mi	1,400,000	$250	$2,880	$40	1.4%	0.3	-0.4%	-6,000
Truck 0-20 mi	1,200,000	$110	$2,740	$20	0.7%	0.3	-0.2%	-3,000
Total or Average	15,800,000	$184	$3,570	$29	0.9%		-0.5%	-75,000

Table 5. Results under Case 2A: 40% increase in truck cost

	SPB Throughput (M TEU)	Trucking Cost ($ per box)	Transportation Cost ($ per box)	Change in Transportation Cost ($)	Change in Transportation Cost (%)	Elasticity (E)	Change in Market Share (%)	Change in SPB Throughput (ΔV)
On-Dock Rail	3,800,000	$0	$3,860	$0	0.0%	1.0	0.0%	0
Near-Dock Rail	1,300,000	$60	$3,920	$20	0.5%	1.0	-0.5%	-7,000
Off-Dock Rail	1,500,000	$160	$4,020	$60	1.5%	1.0	-1.5%	-22,000
Transload to Rail	3,600,000	$90	$3,780	$40	1.1%	1.0	-1.1%	-38,000
Truck 150+ mi	500,000	$1,080	$3,710	$430	11.6%	1.0	-11.6%	-58,000
Truck 50-150 mi	2,500,000	$500	$3,130	$200	6.4%	0.3	-1.9%	-48,000
Truck 20-50 mi	1,400,000	$250	$2,880	$100	3.5%	0.3	-1.0%	-15,000
Truck 0-20 mi	1,200,000	$110	$2,740	$40	1.5%	0.3	-0.4%	-5,000
Total or Average	15,800,000	$184	$3,570	$74	2.2%		-1.2%	-193,000

Table 6. Results under Case 2B: 40% increase in truck cost, with dray-off

	SPB Throughput (M TEU)	Trucking Cost ($ per box)	Transportation Cost ($ per box)	Change in Transportation Cost ($)	Change in Transportation Cost (%)	Elasticity (E)	Change in Market Share (%)	Change in SPB Throughput (ΔV)
On-Dock Rail	3,800,000	$0	$3,860	$0	0.0%	1.0	0.0%	0
Near-Dock Rail	1,300,000	$60	$3,920	$20	0.5%	1.0	-0.5%	-7,000
Off-Dock Rail	1,500,000	$160	$4,020	$60	1.5%	1.0	-1.5%	-22,000
Transload to Rail	3,600,000	$90	$3,780	$40	1.1%	1.0	-1.1%	-38,000
Truck 150+ mi	500,000	$1,080	$3,710	$320	8.6%	1.0	-8.6%	-43,000
Truck 50-150 mi	2,500,000	$500	$3,130	$200	6.4%	0.3	-1.9%	-48,000
Truck 20-50 mi	1,400,000	$250	$2,880	$100	3.5%	0.3	-1.0%	-15,000
Truck 0-20 mi	1,200,000	$110	$2,740	$40	1.5%	0.3	-0.4%	-5,000
Total or Average	15,800,000	$184	$3,570	$70	2.1%		-1.1%	-178,000

Sensitivity of Southern California Exports

Whereas imports to California tend to be of high value, some exports are considerably lower in value. Some have suggested that low value exports may be especially impacted if trucking costs for exports increase, because the additional cost could significantly increase the total cost of delivering these products to foreign markets and therefore, make exports of these products uneconomic on the world market.

This analysis assesses the possible impact to exporters in the region shown below and defined by Bureau of Economic Analysis region numbers 97, 145, and 136.

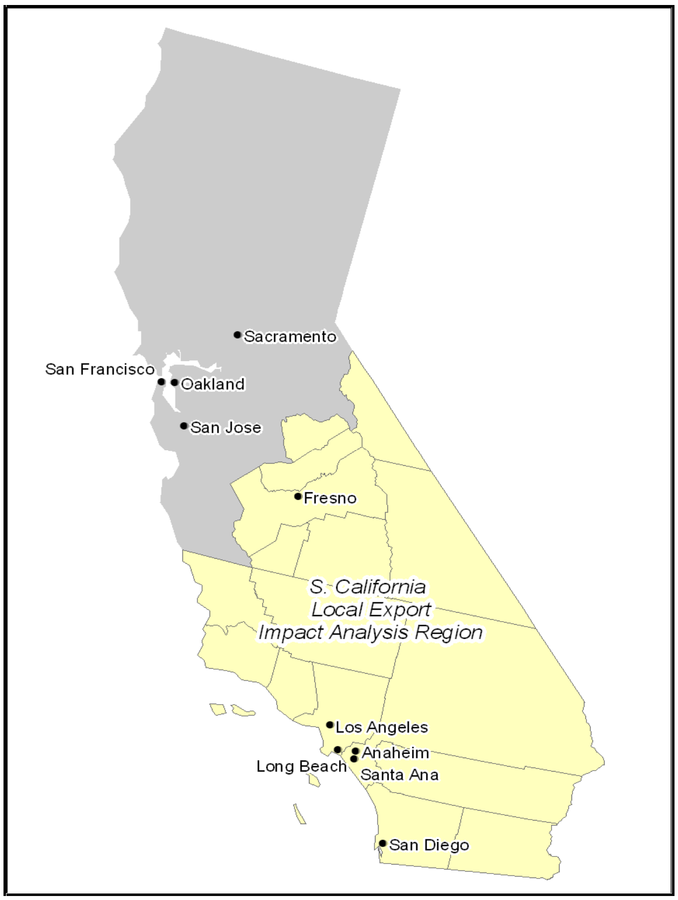


Figure 11. Local Export Impact Analysis Region

Waste paper and plastic, hay and animal feed, and cotton and fabrics are commodities which are low in value and make up a significant share of containerized exports from Southern California. Of these, hay exports may be the most sensitive to increases in trucking costs. Waste paper and plastic, and cotton are commodities that should be more resilient.

Other exports, such as: equipment, electronics, chemicals, metals, food products, fruits and vegetables, and miscellaneous household goods, tend to be higher in value, and may be less sensitive to additional trucking costs. Exports of these higher-value goods from Southern California are likely to be diverted in a manner similar to the diversion of imports to the Southern California region, and are considered within the percentages of import diversions described elsewhere in this report.

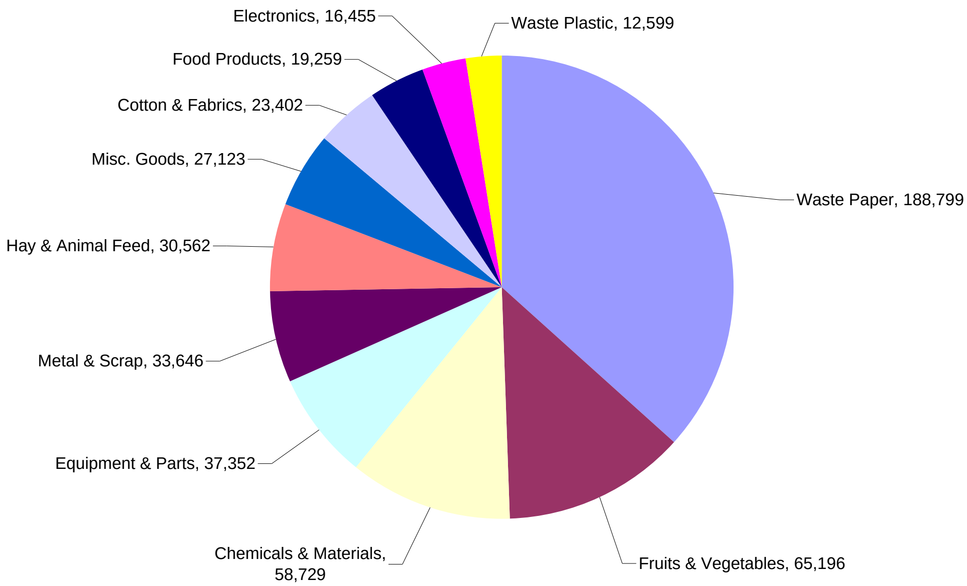


Figure 12. Southern California Exports via San Pedro Bay Ports (TEU)

Source: Moffatt & Nichol Analysis of 2005 PIERS data

Hay

Hay is typically used for animal feed, and the region exports a significant amount of hay to feed cattle in Asia. Hay accounts for 6% of the region's exports, and is produced primarily in the south-central agricultural area from San Joaquin County to Kern County (see Figure X). A large amount of hay is also produced in Imperial County, near San Diego. Prices at the producing farms range from $170-$200 per ton, or roughly $3,500 to $4,000 per 40' container.

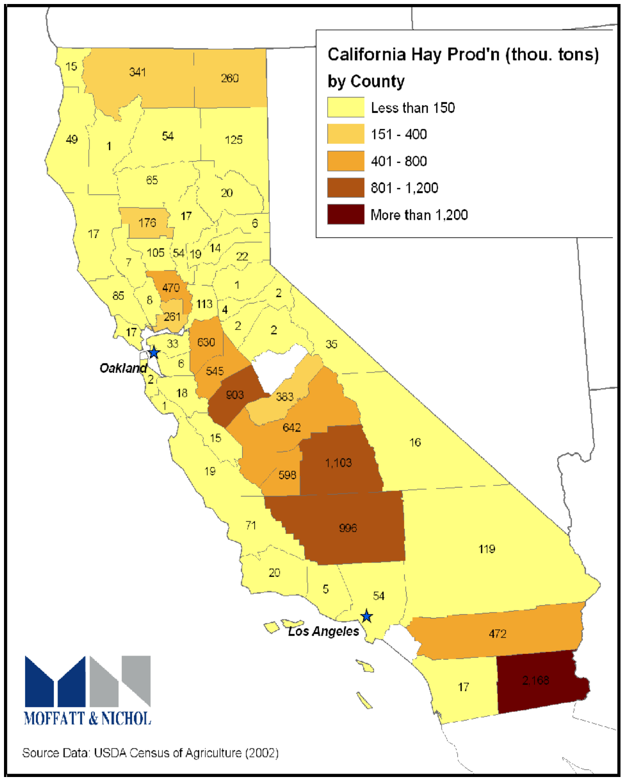


Figure 13. California Hay Production

Exports from California's Central Valley will be affected by higher trucking costs more than exports from Southern California because there are relatively few containers imported to and unloaded within the area. Instead, the exporters must bear the full round-trip cost of trucking from the nearest off-dock empty container terminal and back to the SPB ports, estimated at $700-$800. Therefore, the cost of trucking containerized hay from the Central Valley to the SPB ports could increase by 24.3%, 48.6%, or 80%. Thus, the incremental cost of exporting hay could be anywhere from $170 to $640 per container, or somewhere between 4% and 18% of the value of the cargo.

Because the world market for hay is highly competitive, and is subject to alternate supply, some diversion of hay shipments from San Pedro Bay Ports to other ports on the West Coast may occur. In the absence of rigorous analytical methods to predict the production and movements of hay, a high elasticity of 2.0 is assumed due to the highly competitive nature of the world hay market and the possibility of substitution by other animal feed products. In this case, hay exports from Southern California via San Pedro Bay Ports will decrease by 8% to 36%. That is a reduction of 2,400 to 11,000 TEU or 24,000 to 110,000 dry tons of hay per year.

There are two possible mechanisms for diversion of hay exports based on higher trucking prices to the SPB Port terminals:

1. Hay containers currently exported via the SPB ports could be trucked to the Port of Oakland, which is roughly the same distance, despite the greater shortage of empty containers.
2. Some of the foreign hay demand currently served by Southern California hay producers could be satisfied by the Pacific Northwest. Especially in Southeastern Washington, Southeastern Oregon, and Southern Idaho, production of hay is very high, as mapped in Figure 14.

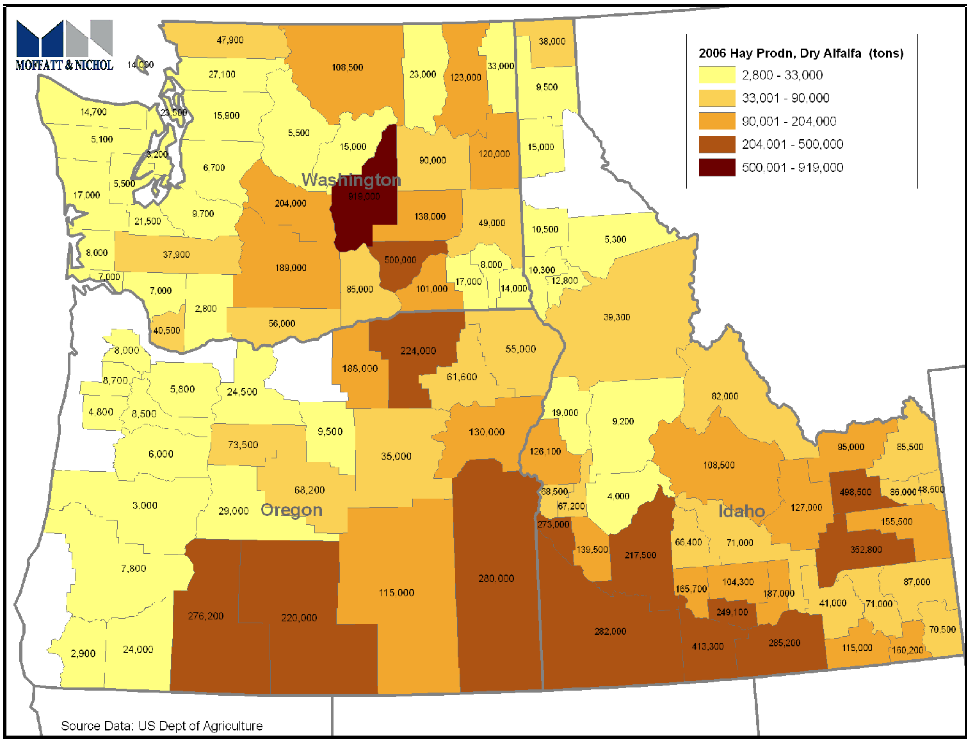


Figure 14. Pacific Northwest Hay Production

Waste Paper and Waste Plastic

Waste paper and waste plastic have almost no economic value, but make up 39% of exports from the region. Exports of waste paper are a service to California residents rather than a product to be consumed in a foreign country. Sorting and processing the waste is labor intensive, and can be accomplished more efficiently in countries that have lower wages. California benefits greatly from this service and pays for it accordingly. Any increases in the cost of delivering the waste to foreign processors are likely to be passed on to California residents in the form of higher waste disposal fees.

Consider the following:

- California produces 92 million tons solid waste, of which 36% is waste paper and waste plastic.[3] The large and growing quantities of these wastes must be disposed. Los Angeles County alone produces over 2.8 million tons of waste paper and 0.9 million tons of waste plastic. (Figure 15) By comparison, waste paper exports from Southern California total about 1.9 million tons, and waste plastic 130,000 tons.
- A large share of waste paper and plastic is produced in the populous regions near the port. The increases in trucking costs will be relatively small because of the short distances involved in finding an empty container close to where it is needed and sending it back to Asia loaded with waste paper as opposed to empty.
- The wastes currently exported cannot simply be deposited in landfills if trucking costs increase; the California Integrated Waste Management Act of 1989 requires individual cities and counties to increase solid waste diversion levels, i.e. to divert a large share of the solid waste stream from landfills to recycling and reuse. California has achieved great progress by reaching an overall diversion rate of 54% in 2006, but many municipalities are in non-attainment of the statewide diversion goals, and thus will need to find more waste to divert in the future. Also, the California

[3] Source: California Integrated Waste Management Board

Integrated Waste Management Board's slogan "Zero Waste California" indicates that diversion goals may continue to increase in years to come.

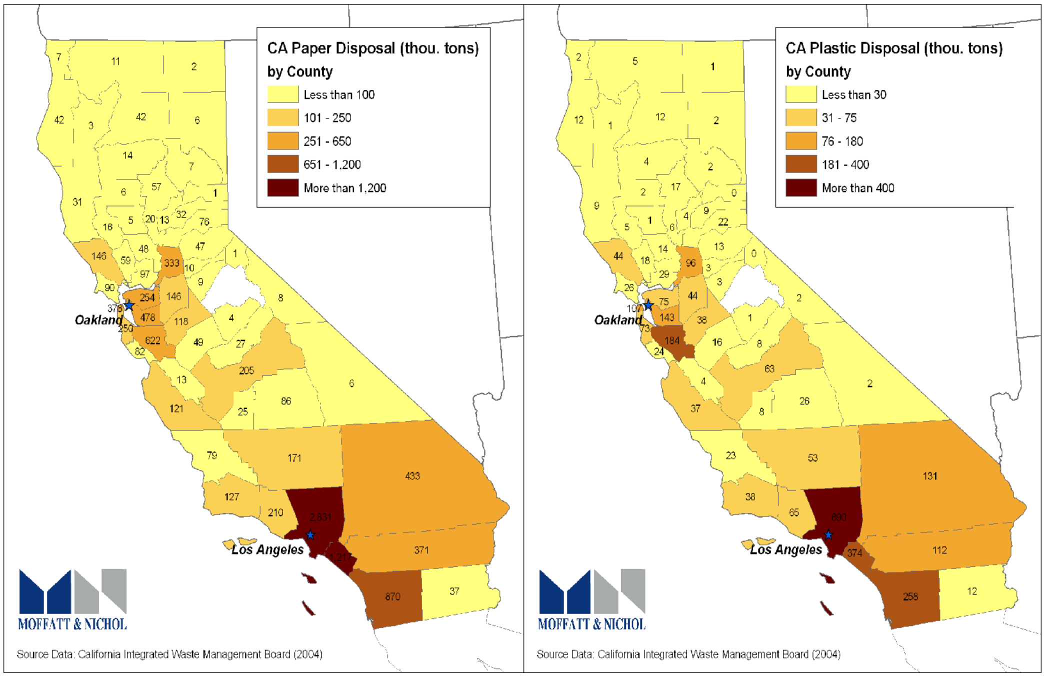


Figure 15. California Disposal of Paper and Plastic

- In the event that waste exports shift to domestic recycling, local activities of waste processing and downstream product manufacturing would result.

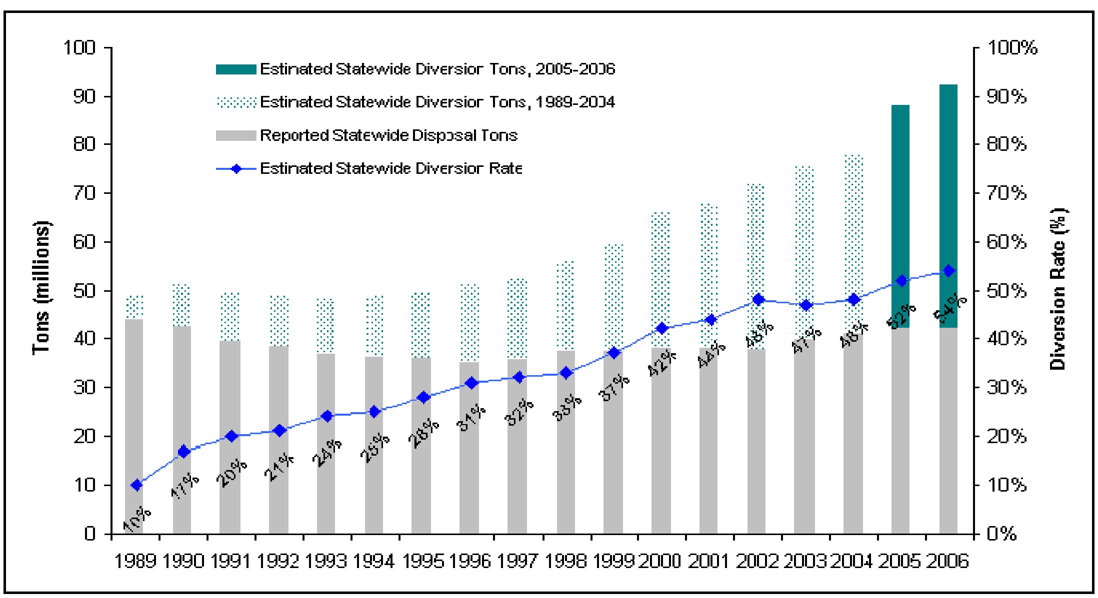


Figure 16. California Waste Diversion

Source: California Integrated Waste Management Board

The increase of trucking cost for waste exports will be relatively small due to the short distances involved. A large amount of waste will continue to be diverted to recycling programs either in California or abroad.

Disposing of recyclable waste in land fills is inconsistent with California's waste management goals. Therefore, waste paper will continue to be exported from Southern California to Asia. The small increases in trucking costs that may occur due to the TWIC program and the clean trucks program will be borne by California residents as part of the cost of waste management.

Cotton

Cotton is primarily used in the production of knit and woven textiles for garments and other uses. A large amount of cotton is produced in the US and exported to Asia in the form of either cotton bales, or in the form of fabrics. Production in Southern California is focused in the San Joaquin Valley near Fresno as mapped below.

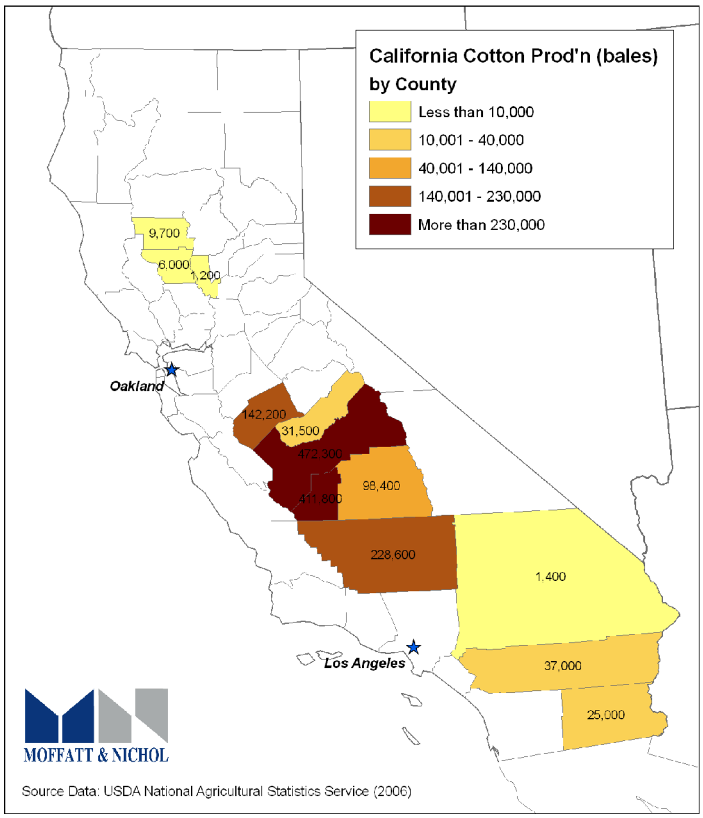


Figure 17. California Cotton Production

Cotton is a medium-value export at $0.60 per pound, or roughly $24,000 per 40-foot container. The increase in trucking costs from the San Joaquin Valley to the San Pedro Bay Ports is estimated to be $170 to $640 per container, depending on the Case, representing only 1% to 3% of the value of the cargo. Therefore, the higher costs of trucking is unlikely to significantly impact the cost of delivering cotton from Southern California to foreign garment producers in a manner different than the diversion of other containerized cargo.

The cotton industry will not be significantly impacted by the increases in trucking costs associated with the TWIC program. Some cotton shipments may divert to terminals at the Port of Oakland, but these movements are encompassed in the general elasticity analysis.

Economic Impact Methodology

The Southern California trade gateway is a vital component of the nation's economy with $256 billion in containerized trade moving via the SPB ports during 2005. This flood of trade moves between overseas trade partners, particularly China and other Pacific Rim countries, and every state in the lower 48. It is therefore critical to the economy of the United States that these ports, along with the road and rail networks serving them, continue to function efficiently. The ports have been successful in adding capacity to meet the demand for marine terminals. Solving problems with inland transportation system is more complicated, involving more players and directly affecting the everyday lives of Southern California residents.

In particular, air quality has become an issue that needs to be resolved. This was the reason for the proposed Clean Truck program. However, there has been a concern by industry participants that the additional cost associated with the Clean Truck program could divert cargo from the Los Angeles area and thus impact the regional and state economies.

BST Associates was retained by the Ports of Long Beach and Port of Los Angeles to estimate the economic impact that might occur in the Southern California Region (including Los Angeles, Orange, San Bernardino, Riverside, Ventura counties) and the State of California from the diversions estimated in the previous section(s) of this report.

Description of Trade Impacts

A port complex generates economic impact by creating activity between two primary groups of businesses and their customers. The port industry, which includes individuals and firms that are directly involved in handling or assisting in the flow of cargo, including: steamship lines, stevedores, longshoremen, customs brokers, truck drivers, warehousemen, and other service providers. In addition, there are port users that include the businesses that produce or consume the products that move through the port - the importers and exporters. These businesses use the San Pedro Bay port facilities because they are the most efficient, or otherwise most favorable method to move goods between foreign and domestic locations.

If cargo were diverted from the SPB ports then a portion of the jobs, income, and business revenues associated with these transportation-related industries in and around Southern California would either shift to other port gateway regions and/or cease to exist.

The flow of economic activities is described in Figure 18. Economic activity is generated by the port industry and port users, which in turn, creates spending on payrolls for people working directly for the firm, retained earnings/dividends/investments and local purchases of supplies, materials, and outside labor. The local purchases by firms create indirect jobs. Payroll for direct employees creates additional expenditures, which creates induced jobs. Total impacts include direct, indirect and induced effects.

BST Associates estimated the economic impact of cargo diversions caused by the Clean Truck Program, base on the estimates of cargo diversions developed by Moffat & Nichol. The direct impacts for the port industry were calculated using updated information on per-container expenditures that was originally developed for the Port of Long Beach economic impact analysis. Direct impacts for industries that use the ports for moving goods were calculated by BST Associates based on the methodology developed for the Trade Impact Analysis completed in March 2007.

For both the port industry and the port users, BST Associates estimated the indirect and induced impacts using the IMPLAN model, which estimates the multiplier effects of inter-industry purchases. BST used IMPLAN to create two sets of multipliers, one for the state of California and one for the five-county region near the ports (Los Angeles, Orange, San Bernardino, Riverside, and Ventura counties).

Total economic impacts incorporate the sum of direct, indirect, and induced impacts. It is important to note that these effects are limited for any region because of spending "leakages" at each round of inter-industry and household purchases. That is, the goods and services required at each stage are partly purchased from outside the study area, thus reducing the total supplies provided locally.

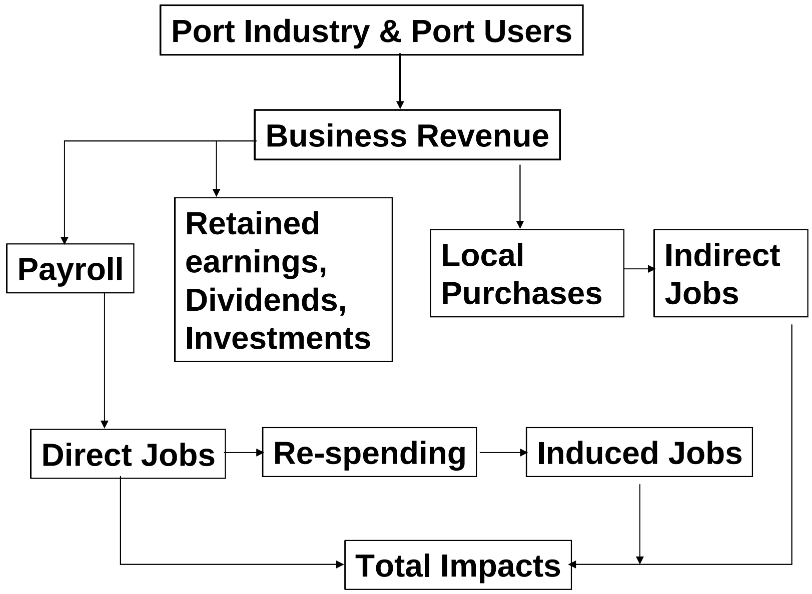


Figure 18. Flow of Impacts

Economic Impact Analysis Findings

BST Associates was directed to focus on the job impacts of cargo diversions, including the effects on employment and income within both the port industry and port user groups.

Quantitative Results

As described earlier in this report, the quantitative impacts from implementation of the Clean Truck Program focus on potential diversion of import containers, which vary in magnitude depending on the increase in costs associated with the program. Moffatt & Nichol developed three cargo diversion scenarios, each of which assumed that: 1) TWIC would be in place at all U.S. ports and would increase costs at all ports, and 2) cargo diversions from the Ports of Los Angeles and Long Beach would be due to the increase in trucking costs due to the Clean Truck Program and not due to TWIC. The three scenarios and their results are:

- Independent Owner-Operators would continue to provide most drayage. Across all types of container moves the average increase in transportation cost of $29 per box would cause the diversion of 75,000 TEU.
- With employee drivers, the average transportation cost across all types of container moves would increase by $74 per box, resulting in the diversion of 193,000 TEU.
- With employee drivers and with “dray-offs” the average transportation cost across all types of container moves would increase by $70 per TEU, resulting in the diversion of 178,000 TEU.

Jobs

Table 7 presents a summary of the employment impacts associated with the Clean Truck Program. Under all cases, the net impact results in job losses across both the port industry and port users.

The port industry is expected to see a direct loss of 405 jobs under the IOO model, and given the economic multiplier effect the total job loss is expected to be 847 jobs in the region and 945 jobs in the state. Under

Case 2A, mandating that only licensed motor carriers employ drivers, there is expected to be an increase of 2,303 direct jobs, resulting in and increase of 4,128 total jobs (state) and 4,380 total jobs (region). The job increase occurs because additional employees are required in the trucking industry to compensate for activities performed by truckers as IOOs that would not be performed as employees. According to Dr. Husing, there would need to be 28% additional employees to perform these functions. The gain in employment in the trucking industry outweighs the loss of jobs in the rest of the port industry resulting from the diversion of containers.

The port users (wholesale trade industry) are expected to have total job losses of between 2,166 (region) and 2,907 (state) under case 1 and a loss of 5,574 jobs (region) and 7,481 (state) under case 2 due to container diversions.

The combined total employment impact of port industry and port users would be a loss of 1,194 jobs under case 2 and a loss of 3,013 jobs under case 1 in the Los Angeles 5-County region, and a loss of 3,353 jobs under case 2 and a loss of 3,852 jobs under case 1 throughout the State of California. The impact to the State is larger because approximately 25% of the port users are located within California, but outside the 5-County Region.

Table 7. Total Employment Impacts Associated with the Clean Truck Program

	Direct		Total	
	LA Region	California	LA Region	California
Port Industry				
IOO Model + Clean Trucks (Case 1)	(405)	(405)	(847)	(945)
Employee Drivers + Clean Trucks (Case 2A)	2,303	2,303	4,380	4,128
Port Users				
IOO Model + Clean Trucks (Case 1)	(1,034)	(1,379)	(2,166)	(2,907)
Employee Drivers + Clean Trucks (Case 2A)	(2,661)	(3,548)	(5,574)	(7,481)
Total				
IOO Model + Clean Trucks (Case 1)	(1,439)	(1,784)	(3,013)	(3,852)
Employee Drivers + Clean Trucks (Case 2A)	(358)	(1,245)	(1,194)	(3,353)

Source: BST Associates, using data from Moffatt & Nichol, Port of Long Beach and IMPLAN

Income

Table 8 below presents a summary of the impacts on income. Unlike the impact on jobs, the port industry can be expected to see some *increases* in worker income from higher wages (and benefits). Separate from the Clean Truck Program, attracting more drivers to replace ones lost due to the imposition of TWIC, or other security, regulations as well as to meet expected port expansion would require higher driver compensation. Dr. Husing estimates that average hourly trucking compensation would increase from the current level of approximately $12.00 per hour to $20 per hour. Dr Husing also projects that under Case 2, trucking employees would make approximately $27.11 per hour including benefits and that there would need to be 28% additional employees to compensate for tasks no longer performed by the truckers as employees.

The Case 1 IOO Model with Clean Trucks would not provide any substantial increases in income to truck drivers (i.e., the hourly rate remains at $20 per hour under both scenarios), therefore the job impacts from diversion would lead to a loss of total income of $164 million within the LA Region and $200 million in the State of California

Under Case 2, the Employee Mandate Program, the expected total compensation to both drivers and other employees of Licensed Motor Carriers is projected to increase. The increased income to trucking industry employees offsets the loss of income in the other sectors of the port industry and the port user sector. The result is increased total income of $125 million in the Los Angeles region and $34 million in California.

Table 8. Total Income Impacts Associated with the Clean Truck Program ($ millions)

	Direct		Total	
	LA Region	California	LA Region	California
Port Industry				
IOO Model + Clean Trucks (Scn 1)	($27)	($27)	($57)	($57)
Employee Drivers + Clean Trucks (Scn 2A)	250	250	403	404
Port Users				
IOO Model + Clean Trucks (Scn 1)	(61)	(82)	(108)	(144)
Employee Drivers + Clean Trucks (Scn 2A)	(158)	(211)	(277)	(370)
Total				
IOO Model + Clean Trucks (Scn 1)	(88)	(109)	(164)	(200)
Employee Drivers + Clean Trucks (Scn 2A)	92	39	125	34

Source: BST Associates, using data from Moffat & Nichol, Port of Long Beach and IMPLAN

Qualitative Results

Exports

As described in previous sections, there may also be additional impacts from implementation of the Clean Truck Program on the export of loads and movement of empty containers. The following section briefly describes the impacts on exports.

According to the California State Department of Agriculture, California's export shipments of merchandise in 2006 totaled $128 billion, ranking California second only to Texas ($151 billion) among the states in terms of total exports in 2006. California firms exported globally to 224 foreign destinations in 2006. In 2003, export-supported jobs linked to manufacturing accounted for an estimated 4.9 percent of California's total private-sector employment. Nearly one-fifth (18.4 percent) of all manufacturing workers in California depend on exports for their jobs (2003 data are the latest available). A total of 51,679 companies exported goods from California locations in 2005. Of those, 49,337 (95 percent) were small and medium-sized enterprises (SMEs) with fewer than 500 employees.

Exports of agricultural products are an important component of the state’s economy. Loss of these exports could cause ripple effects through the state’s economy. This is particularly true for commodities that depend primarily on export markets, such as cotton, plums, almonds and rice (among other products). Other commodities, like peaches, strawberries and hay (among other commodities) are primarily consumed in domestic markets. If the price of the export product reaches a higher level, it could shift the sale from international to domestic markets.

Non-agricultural commodities like wastepaper could also be impacted with a decrease in export sales. These potential impacts are not included in the quantitative economic impact assessment.

Table 9. Ratio of farm quantity exported to farm quantity produced, 2002, 2003, 2004 and 2005 [1]

Commodity	2002 Percent	2003 Percent	2004 Percent	2005 Percent	Average 03-07
Cotton [2]	93	103	73	117	97
Dry plums [7]	48	42	154	85	82
Almonds	61	65	69	77	68
Rice	43	48	38	69	50
Pistachios	29	70	29	59	47
Walnuts	39	39	42	43	41
Oranges	27	40	30	31	32
Grapes all [3]	21	25	28	23	24
Tomatoes, processed	11	14	12	15	13
Lettuce	10	10	9	13	11
Dairy [4,5,6]	5	N/A	9	12	9
Peaches & Nectarines	10	12	12	12	12
Strawberries	12	12	11	12	12
Hay	7	7	7	7	7
Weighted average [8]	18	21	24	26	22

Source: USDA/NASS and AIC estimates, in California's International Agricultural Exports in 2003 and 2005

1 The quantities are converted to farm level equivalent using conversion factors from the United States Department of Agriculture, National Agricultural Statistics Service.
2 The ratio for cotton is higher than 100 because volumes of past season inventories were exported in 2005.
3 Grapes, all includes grape juice, raisins, table grapes, and wine.
4 The farm quantity exported for dairy and products is calculated by converting cheese, condensed milk, fluid milk, ice cream, nonfat dry milk, whole dry milk, and whey products to their fluid milk equivalents.
5 There is no addition of farm quantity of milk allotted to whey exports because whey is a byproduct from cheese production. Other products including casein, lactose, milk albumin, products for infant use, pudding, and rennet are converted to farm equivalent by multiplying California's share of U.S. milk production to the United States export quantity for these products, and then applying a conversion factor of 1 pound of product to 8 pounds of milk equivalent. The same conversion factor is used for nonfat dry milk.
6 The 2004 dairy export value was revised.
7 The ratio for dried plums is higher than 100 because plums from prior season inventories were exported in 2004.
8 The weighted average is based on each of the 52 commodity's share of production value. Values for chickens, mushrooms, and flowers and nursery products are not included because reliable data on export quantity is not available."

Description of IMPLAN Model

Minnesota IMPLAN Group, Inc. or MIG, Inc was founded in 1993 by Scott Lindall and Doug Olson as an outgrowth of their work at the University of Minnesota starting in 1984. This developmental work closely involved the U.S. Forest Service's Land Management Planning Unit in Fort Collins, and Dr. Wilbur Maki at the University of Minnesota.

In 1993, Scott and Doug entered into a technology transfer agreement with the University of Minnesota that allowed them to form the company. At first, MIG, Inc. focused on database development and provided data that could be used in the Forest Service version of the software. In 1995 MIG, Inc. took on the task of writing a new version of the IMPLAN software from scratch. This new version extended the previous Forest Service version by creating an entirely new modeling system that included creating Social Accounting Matrices (SAMs) – an extension of input-output accounts, and resulting SAM multipliers. Version 2 became available in May of 1999.

Input-output accounting describes commodity flows from producers to intermediate and final consumers. The total industry purchases of commodities, services, employment compensation, value added, and imports are equal to the value of the commodities produced.

Purchases for final use (final demand) drive the model. Industries produce goods and services for final demand and purchase goods and services from other producers. These other producers, in turn, purchase goods and services. This buying of goods and services (indirect purchases) continues until leakages from the region (imports and value added) stop the cycle.

These indirect and induced effects (the effects of household spending) can be mathematically derived. The derivation is called the Leontief inverse. The resulting sets of multipliers describe the change of output for each and every regional industry caused by a one dollar change in final demand for any given industry.

Creating regional input-output models require a tremendous amount of data. The costs of surveying industries within each region to derive a list of commodity purchases (production functions) are prohibitive.

IMPLAN was developed as a cost-effective means to develop regional input-output models. The IMPLAN accounts closely follow the accounting conventions used in the "Input-Output Study of the U.S. Economy" by the Bureau of Economic Analysis (1980) and the rectangular format recommended by the United Nations. It was designed to serve three functions: 1) data retrieval, 2) data reduction and model development, and 3) impact analysis. Comprehensive and detailed data coverage of the entire U.S. by county, and the ability to incorporate user-supplied data at each stage of the model building process, provides a high degree of flexibility both in terms of geographic coverage and model formulation.

The IMPLAN database, created by MIG, Inc., consists of two major parts: 1) a national-level technology matrix and 2) estimates of sectorial activity for final demand, final payments, industry output and employment for each county in the U.S. along with state and national totals. New databases are developed annually by MIG, Inc.
IMPLAN easily allows the user to do the following:

- Develop multiplier tables;
- Develop a complete set of SAM (Social Accounting Matrix) accounts;
- Change any component of the system, production functions, trade flows, or database;
- Generate type I, II, or any true SAM multiplier internalizing household, government, and/or investment activities
- Create custom impact analysis by entering final demand changes;
- Obtain any report in the system to examine the model's assumptions and calculations.

There are two components to the IMPLAN system, the software and databases. The databases provide all information to create regional IMPLAN models. The software performs the calculations and provides an interface for the user to make final demand changes.

IMPLAN Software

MIG developed the current version of IMPLAN Professional® version 2.0 in 1999. It is a Windows based software package that performs the calculations necessary to create the predictive model. The software reads the database, creates the complete set of social accounting matrices (SAM), the I/O accounts, and derives the predictive multipliers. The software also enables the use to make changes to the data, the trade flows, or technology. It also enables the user to make final demand changes which results in the impact assessment.

There are more than 1,500 users of the Implan model, including:

- Federal Government (Agricultural Statistics Service, Animal & Plant Health Inspection Service, Appalachian Regional Commission, Argonne National Laboratory, Army Corp of Engineers, Bureau of Economic Analysis, Bureau of Land Management, Bureau of Reclamation, Economic Research Services, Environmental Protection Agency and Federal Reserve Bank, among others)
- State Government (Several departments in California State including Dept of Finance, Dept of Transportation, Dept of Water Resources, and State Water Res Control Board, among several others in other states)
- Colleges and universities (Stanford University; California Poly; California State University, at Chico, Fresno, Fullerton, Northridge, Sacramento, Stanislaus; University of California at Santa Barbara, Berkeley, Los Angeles, Riverside, San Bernardino, San Diego among others) as well as others in the other states.