The Environmental Costs of California Lumber Transport

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Abstract

As environmentalist movements in the United States continue to win legislative victories for environmental preservation, other nations around the globe are still focused on economic gains, often at the cost of environmental degradation. We see a prime example of this in the timber industry in California, as the increasingly strict regulations placed upon timber harvest practices have caused the state's timber production to be unable to keep up with lumber consumption rates. To fill this gap, most lumber in California is now imported from locations such as Canada and the Pacific Northwest, where regulations to promote sustainable harvest practices are much less strict than in California. These imports must travel much greater distances than domestically produced lumber, which increases energy consumption and air pollution emissions. This study addresses the externalities of air pollution associated with California lumber imports by assigning monetary values to the environmental impacts of air pollutants from truck, rail, and boat shipments. Accounting for the environmental costs of air pollutants under current shipment patterns increases the total cost to the market by about 2%, or $10.7 million. In order to reduce this total cost, a reduction of the quantity of lumber imported from great distances has a greater effect than adjusting the type of transport used. Policies to promote import quantity reduction should focus on internalizing the environmental costs of transport and allowing increased lumber production from California forests. The free market should react to these policies by decreasing the use of environmentally costly imports.

Introduction

As fuel becomes increasingly expensive and concern over long-term environmental damage from emissions continues to grow, fuel efficiency in the transport sector has become an extremely important aspect of the United States' industrial society. In striving for efficient fuel use, great emphasis is often placed on the local transport of goods (as opposed to cross-country or overseas transport) in order to minimize harmful emissions. Studies of the impacts of international and out-of-season grocery transport, for example, have shed light on the costly environmental impacts of global trade; those studies form the basis for current attempts at important policy change to include such costs in the overall price of consumer goods (Smith *et al*. 2005). One such study showed that it is up to three times less costly to the environment to import wheat to the United Kingdom from the United States by sea than from Italy by truck (Smith *et al*. 2005). However, it is even less costly if the wheat comes from within the UK, even by truck (Smith *et al*. 2005). By internalizing the environmental impacts of freight transport in the overall cost of transporting goods through policies that place monetary values on such harmful factors as air pollutants, suppliers can minimize the harmful effects of transporting their products to market. Although such studies comparing the environmental impacts of imports exist for markets such as UK wheat (Smith *et al*. 2005), none have directly addressed the important market of lumber production, especially in the economically powerful and growing state of California. This study will investigate current and alternative transport patterns and their economic and environmental consequences in the case of the California lumber market.

When taken in the context of the lumber industry, the environmental impacts of transport emissions, in addition to those of harvesting and milling practices, ought to be seriously considered as a primary component of total lumber production costs. United States timber harvest levels are currently about the same as they were in the late 1960s because much of their growth in the 1980s has been checked by increasingly numerous and strict regulations on harvest practices (Fig. 1) (Adams *et al*. 2006, Howard 2007). As demand for lumber increases due to the growing housing market (up until the past year), however, trends also show a rapid increase in lumber imports that is filling the gap between domestic production and consumption (Fig. 1) (Howard 2007, FAO 2005).

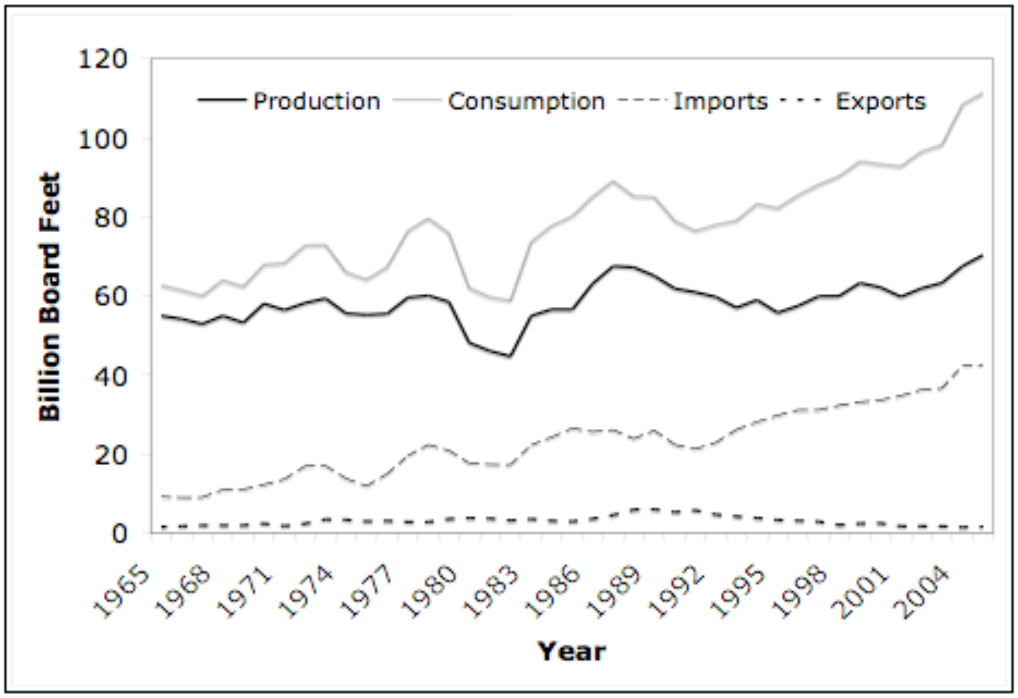

Figure 1. United States softwood lumber production, consumption, imports, and exports. (Based on data form Howard 2007.)

The history of California timber flow reflects these same national trends in production and consumption that have affected lumber import patterns and subsequent degrees of environmental impacts over the past five decades (Fig. 2) (Howard 2007, Morgan *et al*. 2004).

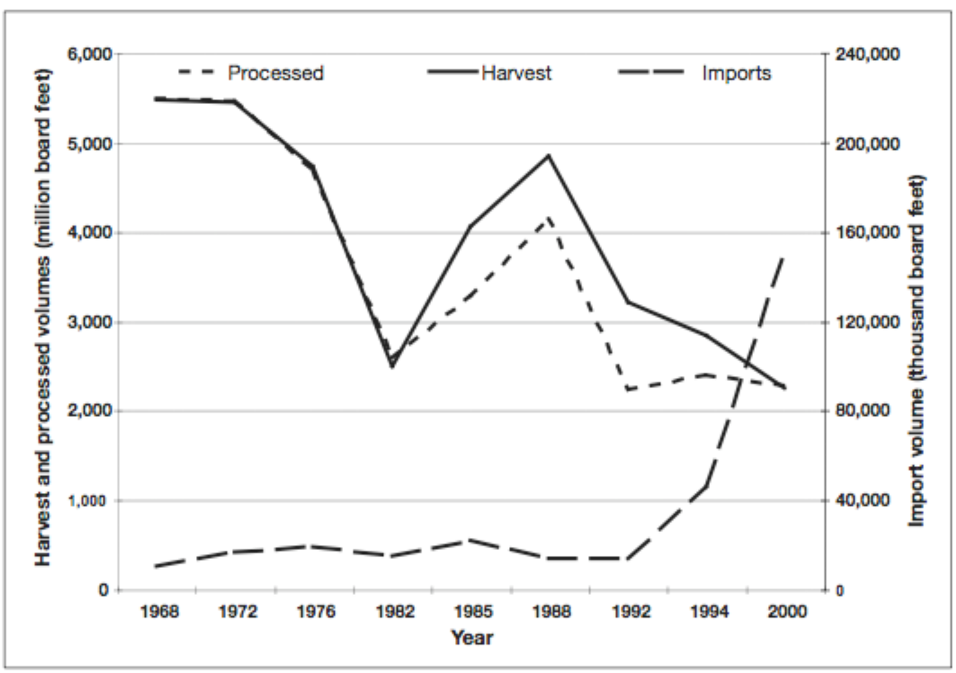

Figure 2. California timber volumes: harvested, processed, and imported. (Morgan *et al*. 2004)

California lumber production has decreased by 40% on private lands and 90% on government-owned lands since 1988, when stricter regulations began to be implemented. In response to these drastic cuts in production, with California now producing only 26.5% of the lumber it uses, 29.6% is currently imported from other U.S. states and 43.9% is imported from international sources, primarily Canada (see Appendix I) (WWPA 1997, USITC 2008). This translates to increased transport from further distances, and, therefore, increased transport-related emissions. The environmental impacts of emissions from all methods of lumber transport are multiplied as most imports must travel long distances to reach California. By adjusting current methods and distances of lumber transport to minimize the negative environmental effects of trade, the lumber industry can play an important role in reducing society's impacts on the environment and be an example for other industries to follow.

In order to account for the environmental impacts of air pollution, we can utilize the common economic theory of "internalizing the externalities," in which a monetary cost is assigned to the various types of air pollution (the 'externalities') and is then included in the overall cost of lumber shipment. It is difficult to accurately place a monetary value on the present or long-term environmental effects of these harmful transport emissions because we currently have little information to forecast such effects; still, society must attempt to quantify these impacts in order to justify and formulate plans to minimize them (OECD 2006). A few studies of the environmental impacts and costs of freight transport in Western Europe and the United States show that the emissions per unit are significantly higher from road freight transport than from rail, air, or water freight transport (Kroon *et al*. 1991, Maibach 2000). This is due in part to the fact that much larger volumes are transported per water and rail load than by truck, so the ratio of pollutants to volume shipped is much lower (Kroon *et al*. 1991). Once the environmental costs of air pollution have been internalized, recent studies have calculated the total cost of freight transport (private cost to suppliers plus the cost to society) to be $0.0972 per ton-mile for truck transport, $0.049 to $0.087 per ton-mile for rail (based on distance), and $0.0212 per ton-mile for boat (Grier 2002, Gorman 2008). My study only accounted for the environmental impacts of *air* pollution emissions, since they are assumed to be the primary negative impact of increased transport distances. Due to time constraints, this study will not address the environmental impacts of such aspects as variations in harvest practices, the specific location of each harvest, potential marine oil spills, or wildlife collisions, among other important variables.

The source of these increased lumber imports, and thus the increased distance that lumber must travel to reach California consumers, affects the level and type of transport used and consequent harmful environmental impacts. Lumber shipments from Canada used to be primarily shipped by rail, but transport has shifted to primarily truck transport since the mid-1980s; this shift was due primarily to faster delivery times and overall increased cost efficiency (Granholm 1983). Current trends still imply that, due to the ease of truck transport and its relatively similar private costs to train, both imported and domestic U.S. lumber shipments travel primarily by road, the most polluting form of freight transport per ton-mile shipped (Fig. 3) (Kroon *et al*. 1991,WWPA 1997, Gorman 2008, USITC 2008).

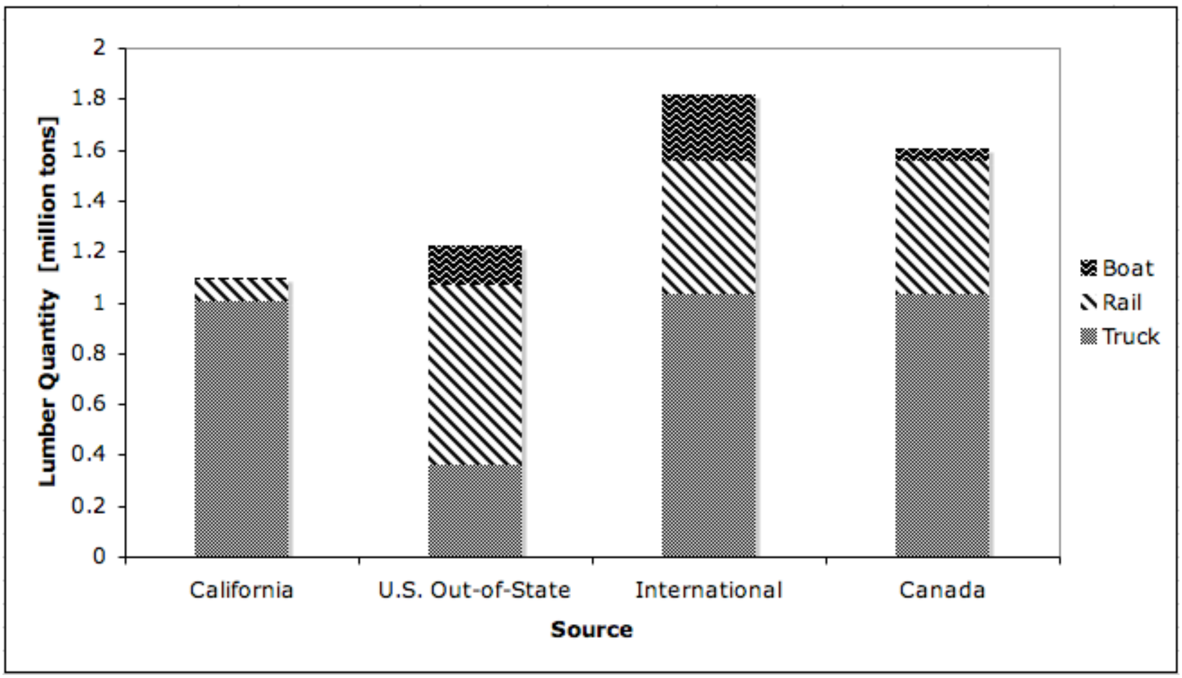

Figure 3. Lumber quantity shipped to California per supply region. *(WWPA 1997, USITC 2008)*

Lumber shipment by water between United States ports, although far less polluting than road transport (Kroon *et al*. 2001), has a difficult time competing with water-shipped lumber from Canada and other countries due to the Jones Act of 1920, which places restrictions on domestic trade by boat, but not on international trade (Boyd 1983). In addition to variations in harvest practice regulations, these restrictions on domestic trade are a probable cause of the noted increase in lumber imports, since it is less expensive to produce and ship timber products under fewer restrictions. One reason for concern here is that U.S. emissions regulations cannot govern international vehicles (Boyd 1983), so as imports increase, so too may the amount of harmful pollution emissions.

Based on the distances and types of lumber shipping routes between California and its lumber suppliers in other states and countries, this study investigates the relative levels of environmental impacts from current lumber importation methods and presents a measure of their associated environmental costs. In general, I hypothesize that local lumber transport and consumption within California pollutes far less than imports from other states and countries. This is based on the expectation that although instate transport is almost entirely by truck, imports will in fact produce significantly higher levels of pollution as emission quantities add up over long distances. The calculated environmental costs of current lumber shipment practices for both California imports and domestic production are compared to current market costs, by summing the environmental costs of air pollution emitted from each form of transport for various routes in- and out-of-state. Based on calculations from these first results, this study also investigates two different types of policy scenarios and their expected effects on total cost. Since I consider total cost to include both current private costs and the environmental costs of transport, I also hypothesize that the total cost of lumber shipment to California is minimized when import methods are shifted so that lumber from all sources is shipped primarily boat and rail. In a society that is becoming increasingly aware of its negative impacts on the environment and the need to minimize these impacts, I hope this study will be quite useful in informing lumber and other industries, and perhaps in affecting new, environmentally aware regulations in California and the United States.

Methods

To address the important issue of internalizing the environmental costs of human actions, with regard to the California lumber industry, this study utilized a simple economic transport equation that, most importantly, accounted for variations in transport cost based on the given environmental costs of transport-induced air pollution. I first calculated and compared the private costs (the market cost that suppliers currently pay) and environmental costs of current lumber shipment practices for both California imports and domestic production. From this data, I then determined the overall lowest total cost methods of lumber transport for the California market, based on certain quantity adjustments.

This study employed the transport cost portion of Roy Boyd's 1983 North American Lumber Industry Transportation Model[1], modified to separate the different modes of transport. The equation used in this study is: $S_{ij} = d_{ij}[t_{ijA}X_{ijA} + t_{ijB}X_{ijB} + t_{ijC}X_{ijC}]$,

where d_{ij} is the distance in miles between supply point *i* and demand point *j*;

t_{ij} is the transport cost in dollars per ton-mile of truck shipment (*A*), rail (*B*), and boat (*C*);

X_{ij} is the quantity in tons of lumber shipped per transport method from supply point *i* to demand point *j*;

and S_{ij} is the total cost of shipping a certain quantity of lumber from supply point *i* to demand point *j*. I used transport cost data from recent studies that have quantified both the private and social (i.e. environmental) costs of freight transport in general, assuming lumber transport is included as 'freight' (Grier 2002, Gorman 2008). The private and total (private + environmental) costs of truck transport are \$0.0945 per ton-mile and \$0.0972 per ton-mile, respectively (Gorman 2008). Rail cost varies by distance, so my private cost inputs ranged from \$0.0490 per ton-mile from Canada to \$0.0870 per ton-mile from Northern California to San Francisco; total costs ranged from \$0.0494 per ton-mile to \$0.0874 per ton-mile (Gorman 2008). The private and total costs of boat transport are \$0.0210 per ton-mile and \$0.0212 per ton-mile, respectively (Grier 2002). The distance (d_{ij}) between supply points and the demand point of San Francisco was approximated on Google Maps as the shortest road distance between the two points. Although trains and boats travel different routes than trucks, it was assumed that the distance for all transport methods was approximately equal for each supply point. For countries that only ship lumber via boat, the distance was approximated as the shortest navigable distance around continents. The quantity (X_{ij}) of lumber shipped per transport method (*A, B, C*) from each supply point was collected from United States International Trade Commission databases and from publications from the Western Wood Products Association (WWPA 1997, USITC 2008). Some data for certain states or transport methods was outdated or otherwise unavailable, so more current data was extrapolated based on current data for other regions. Supply points (*i*) were assigned as the central point of each defined supply region, which were based on available data.

[1] Original North American Lumber Industry Transportation Model, accounting for variability in pine and fir supply, among other economic factors (Boyd 1983):

$$W = \sum_{j=1}^{n}\left(\lambda_{Pj}P_j + \lambda_{Fj}F_j - \frac{1}{2}(\mu_j F_j^2 + 2\beta_j P_j F_j)\right) - \sum_{i=1}^{m}\left(\omega_i F_i + \frac{1}{2}\phi_i F_i^2\right) - \sum_{j=1}^{n}\sum_{i=1}^{m}(t_{ij}^P X_{ij}^P + X_{ij}t_{ij}^F)$$

The defined supply regions included Northern California, Arizona/New Mexico, Colorado, Idaho, Montana, Oregon, South Dakota, Utah, Washington, Wyoming, Africa, Asia, Australia/New Zealand, British Columbia, Canada (excluding British Columbia), Eastern Europe/Russia, Indonesia, Mexico, South/Central America, and Western Europe. For distance calculation purposes, San Francisco was defined as the central demand point (j) in California, although the quantity numbers represent California as a whole.

To compare the current lumber transport costs with the environmental costs they actually incur, I ran the equation in Excel for each supply region to first include only private costs and second to include both private and environmental costs. I then calculated percent differences between these two results to compare the results for shipment from each region to see if the internalization of these environmental costs had a significant effect on the overall cost to the lumber industry.

The second part of this study further utilized the modified transport model in Excel to develop a suggestion for the optimum, lowest total cost quantities and methods of transport, based on various scenarios, for each supply region. Part 2a total costs were based on shifts of quantity of certain percentages (1, 2, 5, 10, and 50 percent) of truck transport to either rail or boat, within each supply region. Regions that were not adjacent to water had all quantity shifts added to rail transport (e.g. Montana). Regions that could only ship by boat remained the same (e.g. Australia/New Zealand). Regions with the potential to ship by all three means had all quantity shift amounts split equally between rail and boat. The total quantity imported from each supply region was held constant for this set of scenarios.

Part 2b reduced the quantity shipped from each supply region except Northern California by a certain percentage (1, 2, 5, 10, and 50 percent) in each scenario. The percentage of each transport method used per region was held constant for this set of scenarios. The total quantity subtracted from these supply regions was then added to the quantity from Northern California, to satisfy the assumption of equal consumption. For both Part 2a and 2b, I ran the economic transport equation for each supply region, thus calculating the new total cost for each supply region under each scenario. The sum of all new total costs for each supply region under each scenario accounts for the least total cost to both the lumber industry and society.

Results

The first part of this study compared the private cost of shipping lumber (the cost that suppliers and consumers currently incur) to a total cost that accounts for both private costs and external environmental impacts. The total cost of shipping lumber, which includes the environmental costs of pollution emissions, is consistently higher than the current, market cost (private cost) of lumber shipments (Table 1). The total environmental cost of current lumber import patterns is $10,681,532 (2.22% of the current market costs). The environmental cost per unit quantity for each region is based on the shipping distance and the type of transport used. The environmental cost per unit quantity for in-state truck, rail, and boat transport is $0.83, $0.12, and $0.06 per ton, respectively. On average, truck, rail, and boat imports from elsewhere in the United States incur environmental costs of $2.81, $0.42, and $0.21 per ton, respectively. Canadian shipments average $7.16, $1.06, and $0.53 for truck, rail, and boat transport, respectively.

Table 1. Part 1: Annual private and total cost of lumber transport to California.

Source	Private Cost [$]	Total Cost [$]	Percent Difference
California (N.Cal)	31,463,482	32,308,415	2.69%
U.S. Out-of-State	59,056,321	59,901,022	1.43%
Oregon	36,714,714	37,201,872	1.33%
Washington	14,568,434	14,762,043	1.33%
International	390,002,813	398,994,710	2.31%
British Columbia	6,789,991	6,954,141	2.42%
Canada (excluding B.C.)	353,419,487	361,963,488	2.42%
Total	**480,522,615**	**491,204,147**	**2.22%**

Part 2 of this study found more optimal quantities of lumber for California from each source by minimizing the total cost within the formula $S_{ij} = d_{ij}(t_{ijA}X_{ijA} + t_{ijB}X_{ijB} + t_{ijC}X_{ijC})$ in two different ways: (a) by shifting the methods of transport used by each source to less polluting methods, and (b) by reducing the total quantity shipped from each out-of-state source to CA while increasing the quantity produced and shipped within California. For example, British Columbia alone currently ships about 23,500 tons of lumber per year to California by truck, 12,000 tons by rail, and 1,100 tons by boat. A five-percent quantity shift, under Part 2a, would reduce its truck shipments by 5% to about 22,300 tons. The 1,200 tons would be split in half and added to the quantities shipped by rail and boat, so that rail shipments would increase to 12,600 tons and boat would be 1,700 tons. This procedure results in a decrease in total cost of lumber from British Columbia from $6,954,141 to $6,779,787 (2.5% decrease for that region). Overall, when the total quantity from each supply region is held constant and the transport method is shifted by arbitrary percentages (1, 2, 5, 10, and 50 percent), the overall cost tends to be minimized when truck transport is minimized from each region (Fig. 4). The current overall total cost is $491,180,514; a 1% quantity shift resulted in a total cost of $489,091,808 (0.43% decrease); a 2% shift gave $487,003,102 (0.85% decrease); a 5% shift resulted in $480,736,986 (2.13% decrease); a 10% shift gave $470,293,457 (4.25% decrease); and a 50% shift lowered the total cost to $386,745,232 (21.26% decrease) (Fig. 4).

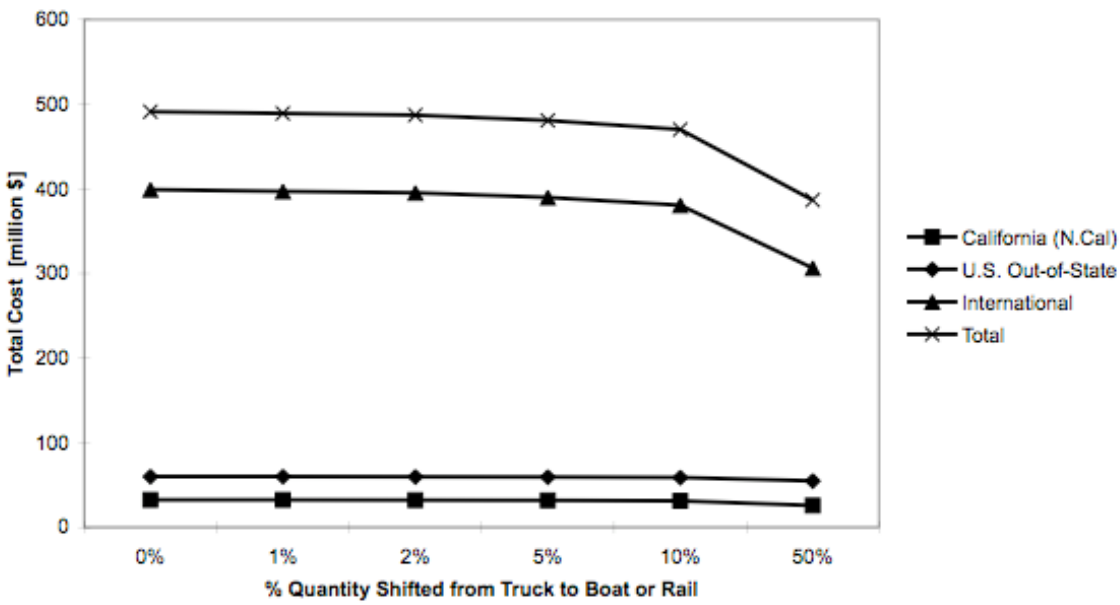

Figure 4. Part 2a: Calculated total cost of lumber transport per supply region.

If production and shipment were to increase in California, however, import quantities would be expected to decrease. Part 2b represented this scenario by reducing the total quantity shipped from each supply region by an arbitrary percentage (1, 2, 5, 10, and 50%) and adding that reduction quantity to the quantity produced and shipped within California (Fig. 5). When the quantity shipped from each supply region is reduced and shipment methods from each region are held constant, the overall cost is minimized as California shipments are maximized (Fig. 5). Compared to the current overall total cost of $491,180,514, a 1% quantity reduction resulted in a total cost of $487,366,838 (0.78% decrease); a 2% reduction gave $483,553,163 (1.55% decrease); a 5% reduction resulted in $472,112,136 (3.88% decrease); a 10% reduction gave

$453,043,758 (7.76% decrease); and a 50% reduction lowered the total cost to $300,496,735 (38.82% decrease) (Fig. 5).

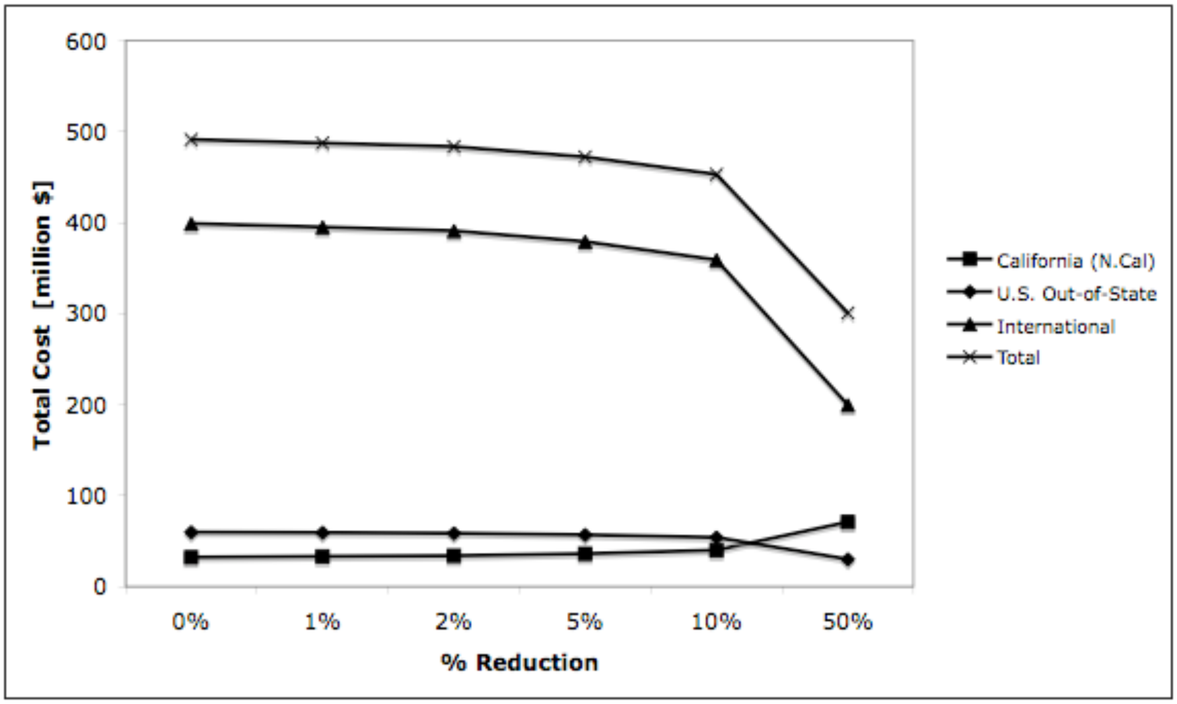

Figure 5. Part 2b: Minimized total cost: quantity reduction per supply region.

Discussion

This study looked at the effects of internalizing the environmental costs of air pollution emissions from lumber transport to and within California. Part 1 showed that the current costs paid by society (both suppliers and consumers) for shipment of its lumber needs are about 2.2% less than the total cost that accounts for the shipments' actual impacts on the environment. Part 2 of this study showed that reducing the distance that shipments travel will reduce the total cost more than changing the transport method will. It also showed, however, that only large changes in either transport methods or quantities per supplier will have a significant (>5% difference) effect on the overall total cost, even when environmental costs are accounted for.

While the additional environmental costs added in Part 1 totaled almost $10.7 million, this only represents an average two-percent increase per region. Such a small increase in costs per supplier would be expected to have little effect on market dynamics (Boyd and Krutilla 1987). However, the addition of environmental costs is spread out in proportion to the distance that the lumber travels, so that suppliers further away from California incur much greater environmental costs and would thus be affected more significantly by policies that would directly internalize these environmental costs. Such policies, however, may be too drastic for the more distant suppliers in particular; legislation may thus need to be more oriented toward long-term goals and gradually enforce shifts in shipment method or changes in supply locations until a significant reduction in environmental impacts is achieved.

The environmental cost per ton of lumber shipments is higher by truck than rail or boat from all supply regions that utilize truck transport. The environmental cost per ton also increases with increasing distance from the destination, for each form of transport. This shows that impacts on the environment are greatly dependent on the distance they travel, regardless of quantity shipped. Ideally, this argues for 100% in-state production and zero imports; however, this is not feasible given our current state of trade agreements and economics.

A shift of lumber shipment methods to less-polluting forms of transport, as modeled in Part 2a, has the greatest effect on supply regions with higher percentages of truck transport. Costs from Canadian shipments decrease significantly (>5%, >$18.5 million) when at least 10% of its truck shipments are shifted to rail and boat. Although Oregon and Washington are large suppliers to the California market, they are not significantly affected by quantity shifts (until approximately a 50% shift) because most of the lumber from those regions is currently transported by train. In-state lumber shipments would also see a large decrease in costs, but only after approximately a 15% quantity shift. Since this technique has little effect on the overall cost until large quantities (at least 10%) are shifted to less-polluting transport methods, policies enforcing immediate implementation of such large quantity shifts would be infeasible in today's economy. Infrastructure adjustments to make such large changes possible would be difficult and costly within a short timeframe. The data suggests, however, that small quantity shifts (1-2%) every few years may allow the market to gradually adjust, thus easing the burden on suppliers yet still eventually reaching the ultimate goal of decreased environmental costs and impacts.

A quantity reduction per supply region and subsequent increase in California shipments, as modeled in Part 2b, had a slightly greater effect on overall costs than did the quantity shift technique of Part 2a. In general, although the cost of transport within California increases due to the addition of lumber volume lost from other suppliers, the total cost of all lumber being consumed in the state decreases because the wood is coming from much shorter distances to its destination. This overall decrease in cost is significant with at least a 7% quantity reduction per supply region, which is approximately a 17% increase in the cost of California-produced lumber. Potential policies to affect this type of change might set quotas on imported lumber or might simply allow for more timber harvesting within California. Setting quotas has been attempted in the past, however, with poor results: Canada fought strongly against having its exports regulated, arguing violations of the North American Free Trade Agreement (NAFTA); heated discussions on this lumber dispute still persist (Uhler 1991). By allowing for more harvesting on California lands, especially in the National Forests that are barely utilized today, the state could increase its production and thus require less imported material. This technique could inherently cause a gradual reduction of imports, since the reopening of California mills and the recruitment and training of loggers and millworkers may take ample time. With small reductions over an extended period of time, the global market could more easily adjust to California's change in import patterns. Such a change would both reduce air pollution and create healthier forests within the state, in addition to reducing total supply costs.

Policy changes to influence the methods used to transport lumber would likely be very difficult to implement except at very slow rates, due to the increased impact on rail and/or boat infrastructure and job loss considerations for the trucking and out-of-state logging industries. Current constraints on California production, such as regulations requiring specific spotted owl or fisher habitat requirements, also limit the degree to which policies could be implemented that would address this study's results. Reducing or eliminating such restrictions on domestic production may be necessary in order to effectively implement policies and practices that would reduce lumber imports and thus increase domestic production. Import quantity shifts, however, cannot realistically be very large because California's current consumption rate is too high for the state to sustainably produce enough lumber to entirely replace the import market. (Uhler 1991, Howard 2001). The difficulty with implementing these types of policies is in creating international agreements to require such behavior. Other nations, especially Canada, would be very unlikely to agree to any such decrease in their revenue.

It is common knowledge throughout the U.S. timber industry that one reason Canada has such a large share of the U.S. lumber market is because it subsidizes its timber production (Uhler 1991). Studies that have looked into the reality of this claim found that it is true to a small degree; but they also found that timber, labor, and capital prices are much lower in Canada, and the typical exchange rate tends to favor the Canadian market (Uhler 1991). Additionally, Canada seems to be generally more efficient in producing lumber, in part due to their loose environmental regulations compared to those that U.S. timber harvesters must face (Uhler 1991). The economies of other states and nations currently depend so heavily upon California's large lumber consumption rate that such drastic policy changes, which would result in California importing a significant amount less than current rates, may cause great harm to economies such as Canada (Uhler 1991). All of these factors inhibit the effectiveness of potential policies that would aim to reduce quantities imported from Canada and increase domestic production.

This study had a number of limitations to its detail and accuracy. First, both the quantity and environmental cost data were very difficult to collect. I pieced together and extrapolated the data I found as accurately as possible because some data was up to ten years old and some was incomplete for certain regions. Combining the input data in such a way may increase error, due to variability in the initial data collection techniques and presentation by different agencies and researchers. My data manipulations made the study much more generalized than would be ideal. An ideal study, which would take a lot more time than my timeframe allowed, should collect all the quantity and cost data firsthand, using consistent methods and should map out more specific transport routes. Also, the model used in this study turned out to be too simple and general because it could not account for real life policy limitations, economic factors, or timber availability. A stronger model should be developed that will consider production limitations, current policies (such as trade agreements), and realistic infrastructure changes.

Despite these limitations, however, the results of this study are sufficient for its scope as a general introduction to the subject of lumber importation methods and associated environmental costs. Based on this study's general results, the ideal method to minimize the environmental cost of lumber transport-related air pollution emissions is to minimize the distance of transport, regardless of transport method. This can perhaps be most effectively done by internalizing the environmental costs of emissions and allowing more timber harvesting on forestlands in California, then allowing the free market to shift toward the lowest total environmental and economic cost.

California has abundant timber resources that are not being utilized. It is true that logging practices were not always sustainable, such as the clearing of multiple mountainsides to build cities and the decimation of old growth populations; these practices are perhaps some of the main causes of the strict environmental regulations that are now in place. But now that most

California timber managers have much more sustainable practices than even their modern-day neighbors and competitors, they are still too regulated to be able to supply their own state. That is why we see such a disproportionate amount (73.5%) of lumber imports coming into California, which contributes much more air pollution emissions than local transport would. With the most strict timber harvest regulations in the country, California is not solving any environmental problems, it is merely exporting its environmental damage to other states and countries (Knudson 2003). The lumber market, in California and beyond, is not currently in an ideal economic situation because current costs do not account for environmental impacts that may become very costly down the road. Assuming that consumption reduction is not an immediate option, this study, in addition to bringing awareness to and hopefully reducing air pollution externalities, also effectively supports the increased utilization of local timber. The most promising policies to reduce transport-related air pollution emissions may enforce small reductions in import quantities every few years: the burden to suppliers of revenue loss would be minimized, while society would still eventually reach our ultimate goal of decreased environmental costs and impacts. Current restrictions on timber harvests can hopefully be adjusted to allow more local harvesting, with the aim of reducing air pollution cost. It is my hope that any such policies that effectively address air pollution emission reductions may also indirectly promote a decrease in imports and an increase in more local California timber production. Now that some light has been shed on the environmental impacts of our global consumption practices, there is hope that we, as a society, can slowly but surely change our ways to encourage a simultaneously environmentally and economically efficient situation.

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Appendix

I. Lumber quantity shipped to California per supply region

i	Source	Truck Quantity [tons]	Rail Quantity [tons]	Boat Quantity [tons]	Total Quantity [tons]	Percent of Total
1	California (N.Cal)	1,003,156	82,335	9,179	1,094,670	26.45%
2	Arizona/New Mexico	9,154	4	0	9,158	0.22%
3	Colorado	491	45	0	536	0.01%
4	Idaho	25,536	34,485	0	60,021	1.45%
5	Montana	13,870	11,802	0	25,672	0.62%
6	Oregon	258,387	521,446	13,267	793,099	19.17%
7	South Dakota	2,733	0	0	2,733	0.07%
8	Utah	1,842	0	0	1,842	0.04%
9	Washington	48,196	136,839	146,522	331,557	8.01%
10	Wyoming	702	567	0	1,269	0.03%
11	Africa	0	0	305	305	0.01%
12	Asia	0	0	492	492	0.01%
13	Australia area	0	0	101,005	101,005	2.44%
14	British Columbia	23,561	12,034	1,127	36,721	0.89%
15	Canada (excluding BC)	1,005,552	513,587	48,080	1,567,218	37.87%
16	Eastern Europe/Russia	0	0	1,837	1,837	0.04%
17	Indonesia area	0	0	61	61	0.00%
18	Mexico	na*	na*	743	743*	0.02%
19	South/Central America	0	0	101,440	101,440	2.45%
20	Western Europe	0	0	7,540	7,540	0.18%
	TOTAL	**2,393,179**	**1,313,143**	**431,597**	**4,137,919**	**100%**