OFFICE OF INDUSTRIES WORKING PAPER
U.S. INTERNATIONAL TRADE COMMISSION

Wood Packaging SPS Regulations: Effects on U.S. Imports and Containerized Trade

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Wood Packaging SPS Regulations: Effects on U.S. Imports and Containerized Trade[1]

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September 2008

Abstract

International standards for wood packaging material (WPM) used in international trade were fully implemented by the United States in July 2006. These standards were based on guidelines of the International Plant Protection Convention (IPPC) and were designed to meet the pest eradication concerns of the countries party to the agreement. Other countries, such as Australia, the European Union, China, Canada, Mexico and New Zealand, have also implemented the IPPC standards. The IPPC standards require that WPM in international trade be either heat treated or fumigated with methyl bromide, and marked with an approved international logo. These standards are expected to raise the costs of wood packaging material used in international trade.

This paper analyzes how the effects of a sanitary and phytosanitary (SPS) regulation, such as the treatment of wood packaging, can be analyzed using a global model of international trade. The paper concentrates on the effects on U.S. imports and on the use of wood pallets, the most common type of wood packaging used in international trade. The paper includes a pallet database, based on U.S. containerized vessel trade and truck imports, to estimate the number of pallets that might be subject to these new import regulations. The Global Trade Analysis Project (GTAP) model was used to analyze how changes in pallet costs could affect U.S. imports. The increased pallet costs were incorporated into the model through the international trade and transport margins for various U.S. import sectors.

The paper includes three scenarios: (1) adoption of wood pallet treatment by all U.S. trading partners, except China, which had already met the IPPC standards, and Canada, which is exempted from U.S. wood pallet regulations, (2) requirements for alternative packaging (low-cost scenario), and (3) requirements for alternative packaging (high-cost scenario). The purpose of the last two scenarios is to further test the model to see how increased pallet costs could impact trade. The results indicate that the impact of changes in pallet costs is small due to the low value of the pallet in trade and transportation costs, but that some sectors, such as agriculture, are more likely affected. Additionally, imports from China and Canada may receive a small competitive benefit from U.S. pallet requirements due to the fact that these countries do not have to implement changes to meet the requirements in the U.S. market. However, should the United States adopt additional pallet treatment regulations, such as for alternative packaging, that affect China, the latter's imports would be the most likely affected due to the importance of China in U.S. containerized trade. Model results indicate that Latin America also has aggregate gains in exports to the U.S. because its transport margins in some large traded sectors are lower than other suppliers to the U.S. market.

Introduction

Wood packaging can play host to insect and disease pests, including the Asian long-horned beetle and the pine wood nematode, which may escape and become established in the importing country. This has led to international standards, which were fully implemented in 2006 by the United States as well as other countries, requiring treatment for wood pallets and other wood packaging used in international trade. These treatments are expected to raise the cost of wood pallets used in international trade, but the extent to which treatment costs will affect international trade in specific commodities, has not been analyzed. The purpose of this paper is to examine the possible effects of certain regulations (treatment of wood pallets and requirements for alternative packaging) on U.S. imports in a multi-commodity context using the Global Trade Analysis Project (GTAP) model (Hertel,1997). The paper may be of interest to economists and researchers interested in examining how SPS regulations, such as the pallet treatment, can be analyzed as to the effects on international trade.

Concern with regulating treatment for wood pallets[2] in international trade first surfaced in 1998 when the Animal and Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture (USDA) issued an interim rule requiring that all solid wood packaging material (SWPM) from China be treated with preservatives, heat-treated, or fumigated prior to arrival in the United States (USDA, APHIS, 1998). These requirements followed the interception of three taxa and one beetle on SWPM from China. In 2001, the EU adopted emergency measures requiring treatment and marking of all new and used coniferous, nonmanufactured wood packing material (WPM) originating in the United States, Canada, China, and Japan. In March 2002, the United States, along with other countries party to the International Plant Protection Convention (IPPC), signed the International Standards for Phytosanitary Measures Guidelines for Regulating Wood Packaging Material in International Trade (ISPM 15). The ISPM 15 regulations were fully implemented in July 2006 by the United States. All WPM entering or transiting through the United States must be either heat treated or fumigated with methyl bromide, as outlined in the

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[2] Wood packaging used in international trade includes wood pallets, dunnage, crating, cases, and skids. This paper analyzes wood pallets, as there is little quantitative information on the extent of use of other wood packaging materials.

IPPC standards, and marked with an approved international logo certifying it has been appropriately treated. In regard to the adoption of the rules in the United States, the rules do not apply to WPM for domestic use in the United States, or to wood packaging material in bilateral trade between the United States and Canada. (USDA, APHIS, 2006).

This paper concentrates on likely economic effects of wood pallet treatment on U.S. imports.[3] A pallet is a movable platform used for storing or moving freight. A difficulty in any economic analysis of wood pallets is that use of pallets is limited to supply chains servicing specific manufactured and/or value added products. As such, we first create a data set to examine the use of pallets in U.S. imports. Second, using calculated weights of the share of pallet costs in the transport margins, we then estimate some likely effects of wood pallet treatment costs and alternative packing costs on U.S. imports for various pallet-using U.S. import sectors.

Review of Literature

Strategic Design and Development (2002) completed a study of the Australian pallet in domestic and international logistics for various industry groups in Australia. The authors noted that not all supply chains are serviced by pallets, leading to a lack of specific data on the use of pallets in the movement of specific commodities. They developed three categories of goods based on the extent to which they might be on pallets: (1) bulk commodities and refined products, or automotive vehicles, that are never palletized or containerized; (2) break bulk cargoes that may be in packages and containers, and may be palletized; and (3) goods that are almost always containerized in domestic use, such as grocery and consumer items, whose import/export movements may employ pallets or slip-sheeting, or are hand-stacked within the container.

APHIS (2003) examined the likely impact of increased pallet treatments costs on U.S. imports as whole, but not on specific commodities in its regulatory analysis of the wood packaging rule. APHIS' analysis of treatment costs used data on standard 48" x 40" pallets, the most commonly used size of pallet,

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[3] Requirements for alternative packaging are not part of the IPPC standards. However, however we analyze this scenario in the paper to examine how increased pallet costs might affect international trade.

which accounts for 31 percent of all pallet sizes. APHIS estimated that 70 percent of all goods traded internationally are accompanied by some type of solid wood packing material.

The APHIS analysis noted that increased pallet costs may add to the cost of packaging and transporting goods, which in turn, would affect importers of goods transported on pallets. However, APHIS' impact analysis found that increased pallet costs were not expected to have a measurable impact on trade due to the small cost of the pallet compared to the value of trade. APHIS assumed that, in 2001, approximately 100 to 125 million pallets per year were used for goods imported into the United States.[4] Based on a price of $4 per imported pallet, APHIS estimated that imported pallets accounted for .044 percent of the value of U.S. imports of goods in 2001. Increased treatment costs of approximately $2 per pallet were not expected to appreciably affect the overall value of U.S. trade.

The APHIS analysis also noted that as all countries signatory to the IPPC adopt the new treatment standards, U.S. exports on wood pallets will also be affected. However, according to APHIS, a significant portion of U.S. softwood lumber pallets is kiln dried and thus meets the IPPC standards (p. 17). Hicks estimated in 2001 upward of 30 percent of new pallets produced annually in the United States, as well as a higher percentage of new pallets used for exports, are made of entirely of softwood (coniferous) lumber.

Molina-Murillo, et. al. (2005) examined the impact of U.S. adoption of the IPPC standards on U.S. exporters to gain insight into the role of wood pallets in the international supply chain and competition from alternative materials. Based on a survey of U.S. exporters of containerized products in September, 2003, the study estimated the number of pallets used in U.S. exports at 60-70 million. The study estimated the number of export pallets based on shipments in twenty-foot equivalent units (TEUs), and response data from the survey that indicated that 90 percent of containers shipped include pallets, 93 percent of such pallets are made of wood, and that containers with pallets held, on average 20.75 pallets.

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[4] This number is based on the assumption that pallets used to transport imported goods accounted for 25 percent of the number of new pallets manufactured each year in the United States in 2001. This share is based on the estimated share of imports less petroleum and related products in personal consumption expenditures of durable and nondurable goods.

The study further found that pallet strength and price are the major attributes associated with purchase of pallets.

A study by Ray et. al. (2007) examined the likely impact of EU Directive 2004/102/EC that will require wood packaging materials to be "debarked" by 2009. Their study showed the proposed EU regulation could add $2.7 billion over 10 years to the cost of U.S. pallets in international trade. Ray. et. al. examined the potential that such regulations could lead to replacement of solid wood pallets with alternatives, such as plastic pallets. They estimated that a one-way plastic pallet could cost from $15 to $43.75 per pallet, compared to current U.S. pallet prices of $8 to $12.

A final paper by Raballand and Aldaz-Carroll (2005) examined the impact of the multiplicity of different pallet sizes on trade costs. The authors found depalletizing and repalletizing goods, due to differing standards among countries, resulted increased delivery time and cost.

Estimates of Pallet Use in U.S. Imports

Imports may enter the United States by vessel, air, rail, truck, or pipeline. For estimates of pallet use in U.S. imports, we concentrated on imports via containerized vessels and by truck. As noted by Strategic Design and Development (2002), pallets may be used in break bulk shipping, which is not containerized, and not all containers include pallets. However, containerized vessel trade is a good start for this estimation, given the extensive use of pallets in this mode. The Department of Commerce (DOC), through its USA Trade Online database, provides detailed information on the shipping values and volumes, by vessel and air, for U.S. imports and exports, including containerized vessel shipments for 2006. Although shipments by air may use wood pallets, there is less known about their use of pallets as compared to containerized vessel traffic.

Truck and rail shipments are important for U.S. imports entering from Canada and Mexico. The Bureau of Transportation Statistics (BTS) TransBorder database includes detailed data by transport mode for trade between NAFTA countries. We included data on truck shipments from this database for Mexico to account for pallet use in container trucks. We did not include truck shipments from Canada because, for the purpose of the IPPC regulations and pallet treatment, Canadian pallets are treated the same as

those manufactured for domestic use in the United States, and thus do not require treatment. In 2006, shipments by truck accounted for 61.1 percent of U.S. goods trade with NAFTA partners.[5]

Containerized Vessel Trade

In 2006, U.S. imports via containerized vessels amounted to $511.3 billion, or 27.6 percent of total U.S. imports (figure 1). China was the largest source of such imports, accounting for 37.9 percent of containerized vessel imports, followed by the European Union (EU-25) and Japan. Containerized vessel imports also accounted for the bulk of U.S. imports from China (67.1 percent), as well as from Indonesia (66.6 percent), and from Vietnam (75.3 percent). U.S. containerized vessel imports tend to be highly concentrated among certain countries. The top 11 countries (including the EU-25) accounted for 90.7 percent of containerized vessel imports in 2006.

Examination of U.S. containerized vessel imports by commodity sector indicates that textiles, apparel, and footwear tend to be the most highly containerized, with 72.2 percent of such imports arriving in containers in 2006, followed by agricultural products (55.0 percent) and chemicals and plastics (33.3 percent) (figure 2). However, textiles, apparel, and footwear are unlikely to be palletized, as most containers include garments hung on racks or products stacked in cardboard boxes.[6] Agricultural products are most likely to use pallets in U.S. imports. Some products, such as fertilizers, petroleum,

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[5] Rail shipments may also use pallets, but such use was not estimated in the paper. In 2006, U.S. imports from Mexico via rail amounted to $25.9 billion compared to $126.5 billion via truck as estimated by the BTS (*Press Release*, 2007).
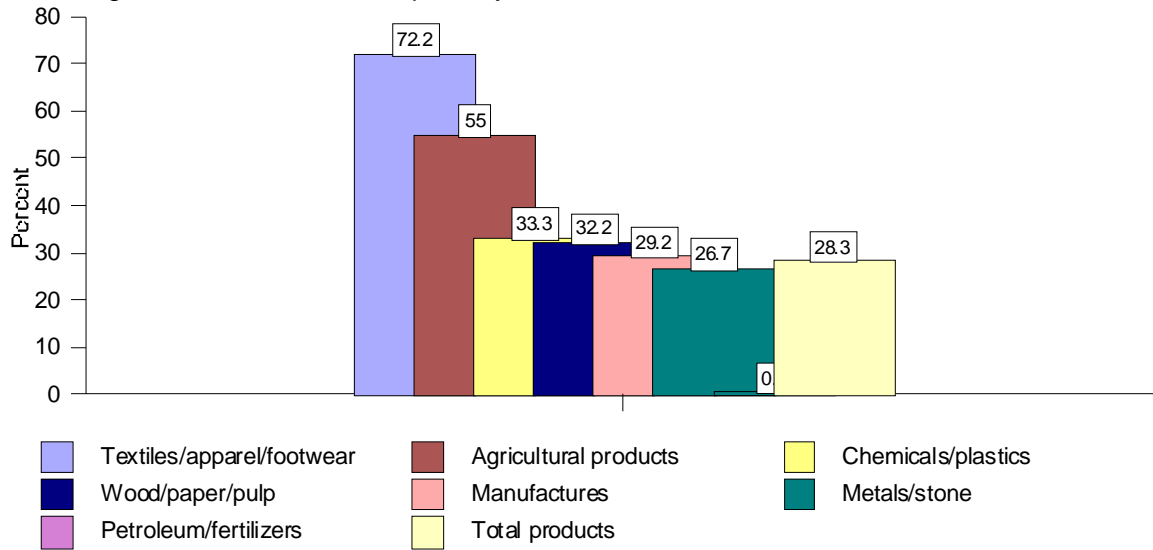
[6] This information was conveyed via a U.S. customs officer and by a representative from the Maersk shipping line.

Figure 1.   U.S. imports total and by vessel container
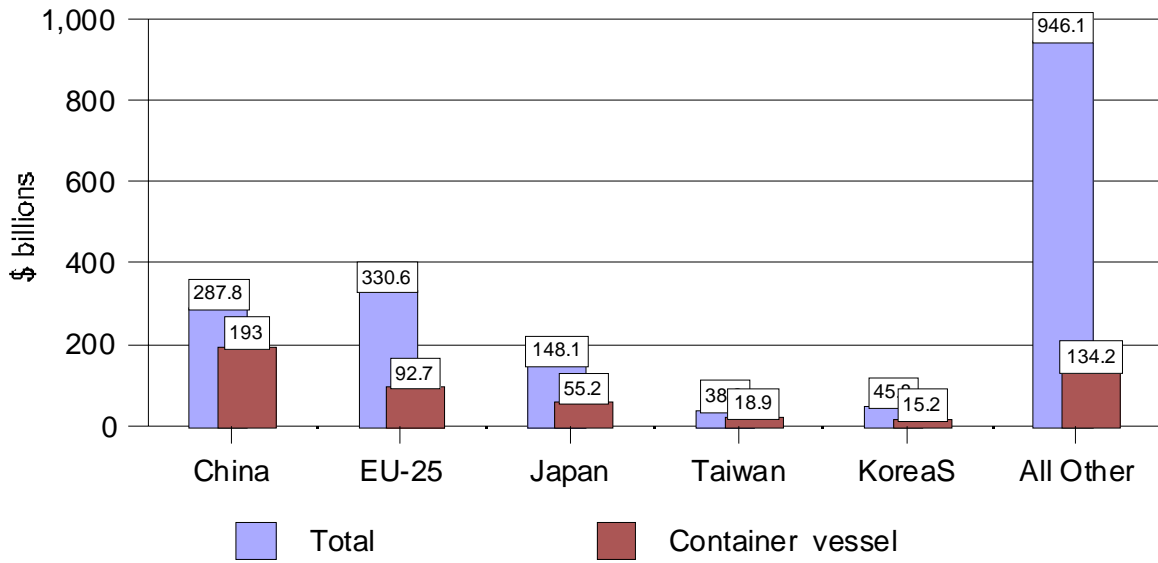
Source: U.S. Department of Commerce

Figure 2. Share of U.S. Imports by Container Vessel

Source: U.S. Department of Commerce

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and some petroleum products are shipped in bulk, and only a few products in these sectors are containerized. Air shipments tend to be important for pharmaceutical products, therefore containerized vessel values for such products are relatively low compared to other sectors.

For the largest source of U.S. containerized imports, China, nine HS chapters accounted for 70 percent of the containerized vessel import value in 2006: nuclear reactors, boilers, and machinery; electrical machinery; furniture, bedding and lamps; toys, games, and sports equipment; footwear; plastics; articles of iron and steel; leather, saddlery, and handbags; and certain vehicles and accessories. For Indonesia, apparel, electrical machinery, and rubber articles accounted for the bulk of U.S. containerized imports. In the case of Vietnam, containerized imports were largely apparel and footwear, furniture and bedding, fish, and coffee. Unroasted coffee beans are also unlikely to be palletized. Such products are usually shipped in lined containers, or in bags placed directly in the containers, and then palletized on reaching the United States.[7]

Adjustment for Truck Shipments from Mexico

Estimates of containerized trade using vessel port traffic, shown in figure 1, understate the importance of shipments from Canada and Mexico, the United States' first and third-largest import suppliers in 2006. In particular, imports from these countries may enter by containerized trucks and be palletized, similarly to containerized vessel traffic. As an example of this key omission, a representative from the Fresh Produce Association of the Americas, a trade association whose members import fruits and vegetables from Mexico, indicated that most fruits and vegetables imported from Mexico are shipped in containerized trucks and packed on wooden pallets.

To account for U.S. imports via truck in the estimation of pallet use, we added in the value and volume data for U.S. imports via truck for Mexico[8] from the BTS TransBorder database. In 2006,

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[7] This information was conveyed via a representative from Louis Dreyfus, a major coffee importer.

[8] As noted earlier, since the purpose of the paper is to estimate pallet use for economic analysis of pallet treatment costs, the shipments via truck from Canada were not included because Canadian pallets are treated the same as U.S. domestic pallets and do not require treatment.

over 80 percent of U.S. imports via truck from Mexico consisted of electrical and other machinery, vehicles and accessories, fruits, vegetables, apparel, articles of iron and steel, and miscellaneous manufactured goods. The importance of containerized vessel and truck shipments for the top three U.S. importers is shown in table 1.

Table 1. U.S. imports: Top three import sources, total and via truck and containerized vessel, 2006			
Country	Imports via truck/containerized vessel ($1,000)	Total U.S. imports ($1,000)	Truck/containerized share (percent)
China	193,043,093	287,772,786	67.1
Mexico	127,784,651	198,258,639	64.4
Canada	150,319,512	303,416,248	49.5
Source: U.S. Trade On Line and BTS TransBorder database.			

Estimated Pallet Use

Calculations of the estimated pallet use by U.S. import sectors are shown in table 2. The first three columns provide information on the total value of U.S. imports by sector, the containerized trade by value and shipping weight, as defined by containerized vessel traffic (excluding Canada) plus truck shipments from Mexico.   In addition, two other adjustments were made to this data.   Molina-Murillo et. al. noted that not all containers shipped include pallets, and not all pallets are wood. Based on information provided by shipping companies on the use of pallets for specific products, we eliminated containerized imports for all apparel and unroasted coffee, and included only 15 percent of shipments of textiles.[9] The estimates of containerized trade in table 2 are adjusted downward for these products.

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[9] Molina-Murillo et. al. adjusted their estimates of pallets used in exports by deducting for containers that do not include pallets and for pallets not made of wood.

Table 2. U.S. imports and estimated pallet data, 2006

Sector	Imports ($1,000)[1] (1)	Containerized/truck imports ($1,000)[2] (2)	Containerized/truck imports shipping weight (metric tons)[2] (3)	Twenty-foot equivalent units (TEUs)[3] (4)	Number of pallets[4] (5)	Pallet/margin (percent)[5] (6)
Meats	6,808,262	4,620,815	1,435,686	200,403	4,008,057	13.4
Fruits and vegetables	11,123,251	8,070,685	10,751,230	1,500,730	30,014,601	19.1
Grains, milled grains	1,723,637	690,014	1,070,388	149,412	2,988,241	20.9
Oilseeds, fats, oils	4,710,145	2,550,322	1,238,540	172,884	3,457,677	16.2
Processed products, beverages, tobacco	38,009,299	25,083,486	15,462,070	2,158,301	43,166,025	18.3
Fish, other agriculture	20,232,047	8,127,613	1,859,691	259,588	5,191,767	3.9
Salt, ores, slags	6,024,975	1,179,208	7,360,994	1,027,498	20,549,955	14.5
Petroleum, fertilizers	337,052,681	1,355,543	5,445,802	760,162	15,203,244	1.4
Chemicals, plastics	131,719,688	57,066,935	20,048,438	2,798,498	55,969,955	9.6
Pharmaceuticals	42,349,177	6,512,142	121,675	16,984	339,685	1.3
Hides, furskins	10,738,423	6,764,946	996,914	139,156	2,783,121	3.7
Wood, pulp, paper	50,424,853	17,648,240	12,700,630	1,772,841	35,456,812	13.1
Textiles, apparel, footwear	113,299,000	4,747,255	848,683	118,465	2,369,300	0.4
Stone, ceramic,	17,554,819	13,459,526	15,470,251	2,159,443	43,188,864	19.8
Metals and articles	158,286,716	47,497,993	19,354,504	2,701,634	54,032,674	9.7
Machinery	473,101,271	213,397,749	22,049,381	3,077,803	61,556,061	5.4
Vehicles, transport	236,269,473	47,555,690	8,152,142	1,137,932	22,758,632	5.7
Manufactures	137,130,083	75,999,115	16,200,657	2,261,398	45,227,965	5.6
Total	1,796,557,800	542,327,185	160,567,676	22,413,132	448,262,636	

Source: USA Trade Online, BTS TransBorder database.

[1]Imports in HS chapters 1-97 only.

[2]Includes imports via containerized vessels and truck shipments from Mexico. Data do not included containerized shipments of apparel or unroasted coffee, and include only 15 percent of shipments of textile products.

[3]Shipping weight divided by 7.164 mt per TEU.

[4]TEU multiplied by 20 pallets per TEU.

[5]Number of pallets multiplied by $9 per pallet to get the pallet value. Pallet/margin percent is the share of the pallet value divided by the transport margin between cost, insurance, and freight (c.i.f.) and customs value imports in 2006.

Column 4 shows the estimated number of shipping containers, based on standard twenty-foot equivalent units (TEUs) for the volume shipped.[10] The DOT/BTS (2003) estimated the volume of U.S. containerized imports via coastal ports in 2001 (80.7 million metric tons) and the corresponding TEUs (11.3 million), providing a relationship of 7.164 metric tons per TEU in that year. This same relationship was applied to the containerized volume data for 2006 for each sector to provide the estimated TEUs. The number of pallets (column 5) was estimated based on 20 pallets per TEU (Molina-Murillo, et. al.).
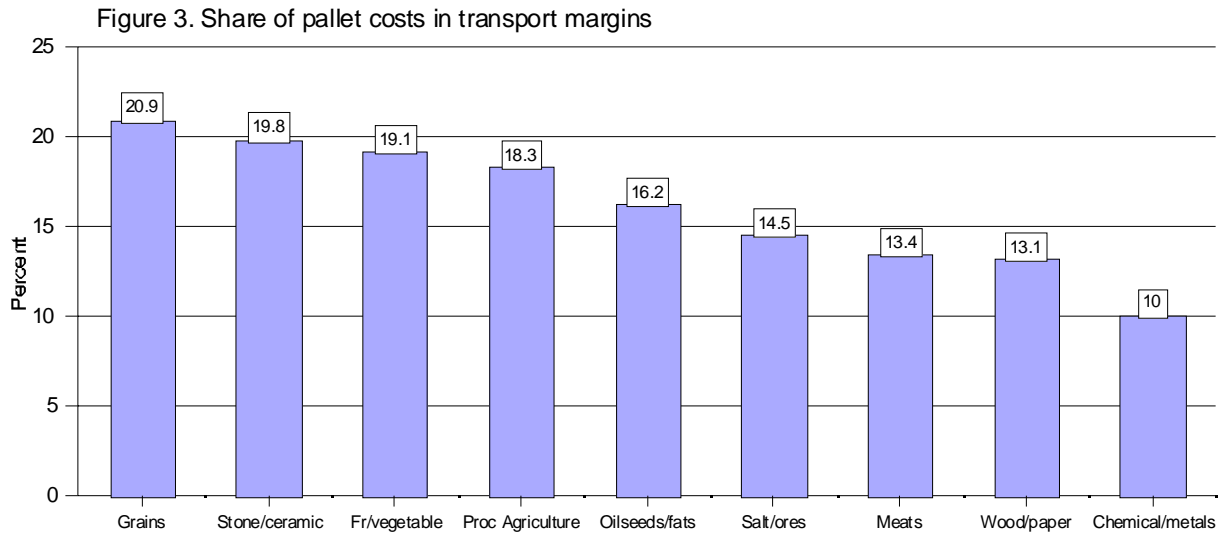
Column 6 shows the estimated relationship between pallet cost and the margin between imports valued at cost plus insurance and freight (*cif*) and customs value. This relationship is used as a ball park estimate of the share of the pallet value in international transport cost. The data were used in the GTAP analysis below to analyze the effects of pallet treatment costs on U.S. imports. According to the Wood Pallet and Container Association, the current cost of a new, standard pallet ranges from $8-$12. Imported pallets tend to be new, and usually lower priced, than U.S. pallets. Thus, we multiplied the number of pallets by $9 per pallet, which is at the lower part of the range, to get this estimate.

The pallet margin shares take into account both the estimated pallet usage and the value of trade. For example, most agricultural products (except other agriculture) and the stone and ceramic sector have relatively high pallet share margins due to higher containerized volumes and the lower estimated product value per pallet. The lowest pallet margin shares, aside from products commonly shipped in bulk such as fertilizers and petroleum, are those for manufactured goods and vehicles, where pallets may be used less and/or the value per pallet is higher.[11] Figure 3 summarizes the pallet margin shares for the top sectors.

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[10] The TEU is a measure of containerized cargo capacity equal to one standard container.
[11] For example, the average containerized value of imports per pallet for agricultural products in HS chapters 1-24 is estimated at $760 while for manufactured goods in HS chapters 90-97, this value is $3,500.

Figure 3. Share of pallet costs in transport margins

Category	Percent
Grains	20.9
Stone/ceramic	19.8
Fr/vegetable	19.1
Proc Agriculture	18.3
Oilseeds/fats	16.2
Salt/ores	14.5
Meats	13.4
Wood/paper	13.1
Chemical/metals	10

Source: Authors' calculations

Analysis of Pallet Treatment Costs on U.S. Imports

In this section, we analyze the likely effects of pallet treatment regulations implemented by the United States in 2006. In addition to treatment costs, we also look at scenarios in which the United States imposes requirements that pallets used in U.S. imports be made from alternative material. The purpose of these scenarios is to further test the model as to the impact of higher pallet costs in international trade. In comments submitted to APHIS regarding treatment options, some environmental groups were concerned that the IPPC regulations would cause other harm to the environment, namely increased depletion of the ozone layer due to use of methyl bromide as a fumigant (APHIS, 2003). Thus, APHIS was urged to examine the use of pallets made from materials other than wood.

Pallet Treatment Costs in the GTAP Model

For the analysis, we use a 7-region, 22-sector version of the standard GTAP model. The seven regions (U.S., Canada, China, EU-25, Asia, Latin America, and ROW) were defined based on the major import sources for U.S. containerized trade shown in table 1. We defined the 22 sectors of the model by aggregating industries that have similar magnitudes of pallet use relative to the total costs of transporting

goods from the exporting to the importing country. The model has two factors of production (labor and capital). We assume a standard GTAP closure.

An advantage of the GTAP framework in this analysis is that the database and model explicitly account for trade and transportation costs in bilateral trade flows. Data on trade and transport margins in GTAP are based on detailed (SITC4 and 5 digit-level) commodity statistics for 1997 from the United States Bureau of the Census, Foreign Trade Statistics. U.S. statistics report the import value of commodities including cost, insurance and freight (*cif*) charges, but excluding import tariffs. U.S. statistics also report the customs import value *(civ)* of commodities. Similar to free on board (*fob)* values, the *civ* is the price of a merchandise import excluding freight, insurance, and import duties. Differences between *cif* and *civ* for U.S. imports therefore provide a measure of trade and transport margins on a bilateral and commodity basis.

Gehlhar and MacDougal (2002, 2005) describe their procedure for extrapolating information on U.S. bilateral trade and transport margins to the GTAP database on global bilateral margins. Treating U.S. trade and transport margins as representative of typical costs, trade-weighted U.S. margins are applied to all global trade flows with exceptions for some commodities, and with lower margins assumed for intra-regional bilateral trade flows.

The bilateral trade and transportation margins that apply to U.S. imports in the model are reported in table 3 as a proportion of the *cif* value. Note the variation in margin rates across commodities. In general, margin rates are relatively high for products with a low value per ton, particularly minerals, mineral products, wood/paper products, and some agricultural products. Differences in margin rates also vary due to the location of trade partners, with costs for many commodities being lower for U.S. imports from Canada compared to other regions. Differences in margin rates for a commodity across trade partners are also due to differences in the composition of the commodity and in the underlying transport costs.

Table 3. *GTAP model: Trade and transport margins as a share of U.S. cif import value*						
	Canada	China	EU-25	Latin America	Asia	ROW
Cereals	2.23	0.35	5.51	4.67	12.20	3.31
Horticulture	9.16	3.10	20.62	14.13	7.65	12.95
Oilseeds	2.44	4.37	4.10	4.58	4.45	4.91
Misc. pallet-using ag.	5.17	8.58	8.94	10.57	9.48	6.15
Other agric.	10.00	2.92	4.19	12.11	8.67	4.88
Natural Resources	2.72	5.93	6.37	5.16	8.59	6.19
Minerals	14.01	16.33	15.55	20.63	14.31	11.64
Meat prods.	2.13	1.35	2.84	4.74	7.22	6.75
Oils and fats	2.74	4.56	5.65	4.81	10.77	5.25
Dairy prods.	2.79	1.51	4.20	4.47	5.32	4.31
Sugar and prods.	3.59	3.66	7.35	9.96	9.21	10.05
Other food preps.	3.13	6.29	6.29	6.67	5.49	6.48
Beverages	2.84	2.58	4.74	3.23	5.06	5.02
Textiles/leather	2.35	5.69	5.54	3.27	4.93	4.41
Wood/paper	4.64	9.18	7.78	5.80	9.27	9.44
Petroleum/coal	3.53	8.66	6.81	6.79	6.91	7.27
Chems., rubber, plastic	2.82	6.43	2.15	3.94	4.65	3.36
Mineral prods.	5.66	11.16	11.10	10.25	11.48	11.90
Metal prods.	2.29	6.50	5.42	4.43	6.29	3.44
Vehicles and parts	1.07	6.28	1.79	1.18	2.50	1.87
Electronics, other mfg.	1.57	4.43	2.58	1.43	2.29	1.73
Source: GTAP, v.6, 2001.						

In the GTAP model, when a single margin has been specified, the trade and transport margin (VTFSD) on good *I* from region *r* to region *s* is described as the price gap between the *cif* and customs value imports:

$$VTFSD(i,r,s) = VIWS(i,r,s) - VXWD(i,r,s)$$

here VIWS is the *cif* value of imports and VXWD is the customs value of imports. The quantity of bilateral trade and transport services (QTFMSD) are assumed to be demanded in fixed proportion to traded quantities (QXS):

$$QTMFSD(i,r,s) * ATMFSD(i,r,s) = QXS(i,r,s)$$

where ATMFSD refers to the bilateral, commodity-specific level of technical efficiency of trade and transport margin services. A negative change in this productivity parameter raises the amount of margin services required for a bilateral trade, and therefore directly raises the *cif* price of an import. We use this productivity parameter in our model simulations to introduce changes in the costs of trade and transport services due to changes in regulations regarding treatment of pallets. We assume that our estimated

percentage change in bilateral margin costs due to new pallet regulations is equivalent to a change in quantity of margin services required for the bilateral trade route.

GTAP Scenarios

We use the model to explore three scenarios as to the effects on U.S. imports:[12]

- (1) Heat/fumigation treatment--We assume that new global treatment requirements will lead to EU-25, Asia, Latin America and ROW adoption of pallet treatment in their global trade. We assume no change in Chinese, U.S. or Canadian treatment under the assumptions that this trade has already adjusted to meet bilateral European and U.S. regulatory requirements. Canadian pallets are treated the same as U.S. pallets.

- (2) Pallet treatment plus low-cost alternative packaging--The change in treatment in (1) is combined with the imposition of alternative packaging rules unilaterally by the United States. China is assumed to adopt alternative packaging with respect to the United States. EU-25, Asia, Latin America and ROW adopt both treatment and alternative packaging practices to the United States, but treatment only to non-U.S. trade partners. There are no changes in U.S. or Canadian packaging practices.

- (3) Pallet treatment plus high-cost alternative packaging–Pallet treatment is combined with alternative packaging requirements by the United States, but at a higher cost. China adopts alternative packaging with respect to the United States. EU-25, Asia, Latin America and ROW adopt both treatment and alternative packaging practices to the U.S., but heat treatment only to non-U.S. trade partners. There are no changes in U.S. or Canadian packaging practices.

The effects of the changes in scenarios 1, 2, and 3 on commodity margin costs are shown in table 4. The percent changes are based on the change in pallet costs and the share of the pallet cost in the commodity transport margin (table 2, column 6). The pallet treatment is assumed to raise the cost of the

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[12] Note that as all countries adopt IPPC pallet guidelines, all global imports will be affected. The scenarios analyzed in this paper are from a U.S. perspective.

pallet by 22 percent, at a cost of $2 per pallet. The cost of alternative pallet packaging is assumed to range from $15 per pallet (low-cost scenario) to about $28 per pallet (high-cost scenario), which is within the range described by Ray et. al. The costs associated with alternative packaging do not include disposal or other adjustment costs.

Results

Our results support these general conclusions:

At the aggregate level, impacts of pallet treatment regulations on the value of U.S. imports by region is relatively low, with changes in regional imports of $151 million or less from the base year of the model (2001) (table 5). Trade expansion by China and Canada is mainly explained by trade diversion, as other countries' trade and transport margins increase. Latin America also has aggregate gains in exports to the United States because its transport margins in some large traded sectors (electronics and vehicles and parts) have a lower share as a percent of the *cif* price as compared to other suppliers to the U.S. market. The changes in bilateral trade are very small (less that 0.1 percent) as shown in figure 4, and the percentage change in overall U.S. imports is negligible.

Table 4. Effects of new pallet regulations on margin costs (percent change from base margin cost)		Alternative packaging	
	Pallet treatment	Low cost	High cost
Cereals	5.6	9.1	37.2
Horticulture	5.6	9.1	37.2
Oilseeds	2.2	3.6	14.9
Misc. pallet-using agriculture	4.4	7.3	29.8
Other agriculture	1.1	1.8	7.4
Natural resources	0.4	0.7	3.0
Minerals	3.3	5.5	22.3
Meat products	3.3	5.5	22.3
Oils and fats	4.4	7.3	29.8
Dairy products	3.3	5.5	22.3
Sugar and products	3.3	5.5	22.3
Other food preparations	5.6	9.1	37.2
Beverages	4.4	7.3	29.8
Textiles/leather	0.4	0.7	3.0
Wood, pulp, paper	2.2	3.6	14.9
Petroleum/coal	0.4	0.7	3.0
Chemicals, rubber, plastics	2.2	3.6	14.9
Mineral products	2.2	3.6	14.9
Metal products	2.2	3.6	14.9
Vehicles and accessories	1.1	1.8	7.4
Electronics, other manufacturing	1.1	1.8	7.4
Source: Authors' calculations.			
Note: Pallet shares were rounded and range from 2-25 percent.			

Table 5. Change in value of U.S. imports ($US million, *fob* value)							
	Canada	China	EU-25	Latin America	Asia	ROW	U.S. global imports
Pallet treatment	50.9	66.4	-143.4	139.7	-150.5	46.0	9.1
Treatment plus low-cost alternative packaging	336.1	-848.6	-480.8	9.9	-405.2	-75.5	-1,464.1
Treatment plus high-cost alternate packaging	1,357.0	-2,050.9	-2,258.1	-890.1	-2,598.0	-773.4	-7,213.5
Source: Authors' calculations.							

The addition of alternative packaging requirements leads to a reduction in the value of U.S.

overall imports, and to increased trade diversion of U.S. imports toward Canadian supply, given that in

this scenario increased pallet costs are also applied to Chinese trade. The high estimate of the alternative

Figure 4. Effects of pallet regulations on U.S. imports
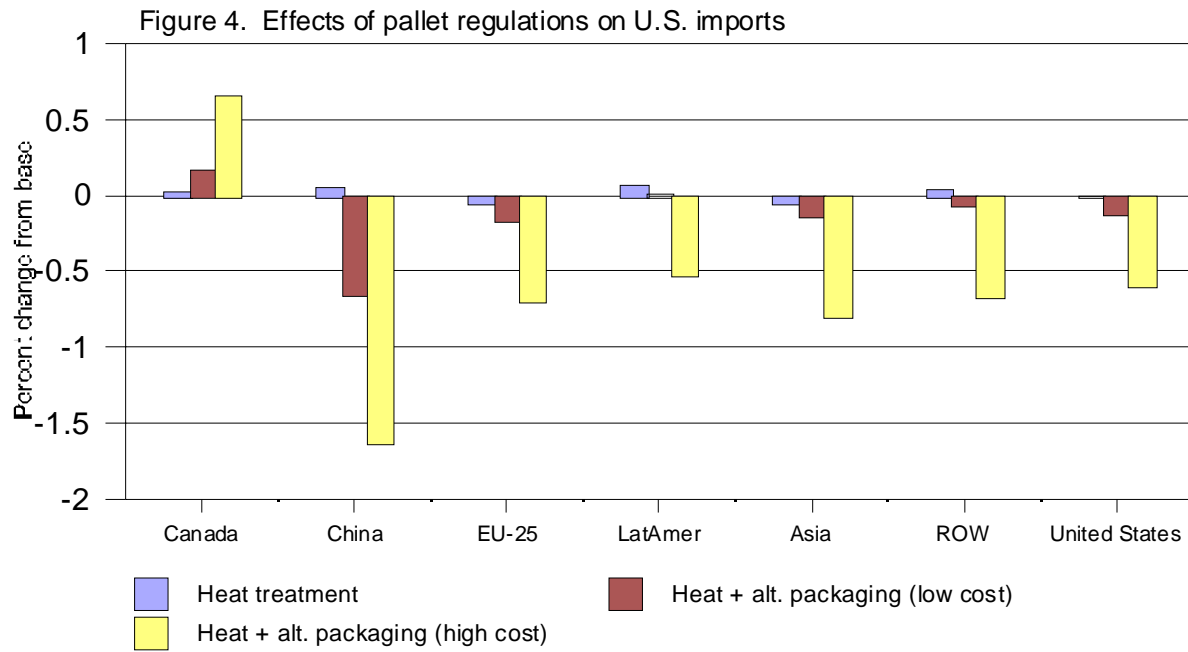
Source: Authors calculations

treatment cost leads to more substantial changes in bilateral import sourcing by the United States – of up to $2.6 billion in the case of Asian supply. But these changes in flows are in all cases less than 1.6 percent of the initial regional imports, valued in *fob*. U.S. imports from China show the greatest decline in the alternative packaging scenarios. This seems reasonable given that China is the largest source of containerized U.S. imports.

Sectoral Effects

The general equilibrium framework captures the macroeconomic implications of pallet

regulations that raise transport costs for imports. Similar to the imposition of a tariff, a transport

regulation raises the domestic price of the import, reducing domestic demand for it and causing its world

price to fall relative to that of the home good. Similar to tariffs, this appreciation of the importer's real

exchange rate helps offset the effects of the regulation on import demand. In the pallet treatment only

experiment, we find exchange rate appreciation in the United States, Canada and China and depreciation

in the EU-25, Latin America, Asia and ROW (table 6). The real exchange rate appreciation of the U.S.

mitigates the effects of higher margin costs in dampening U.S. demand for imports from the regions

facing new treatment regulations. For products with low margin costs – vehicles and parts, and

electronics/misc. manufactures, the U.S. appreciation becomes dominant, and leads to increased U.S.

imports of low-margin goods from the EU-25, Latin America, Asia and the ROW. Real exchange rate

appreciation in Canada and China causes their exports of low-margin goods to the U.S. to decline.

Table 6. Effects of pallet regulations and alternative packaging requirements on real exchange rates (percent change from base)							
	United States	Canada	China	EU25	Latin America	Asia	ROW
Pallet treatment	0.05	0.06	0.06	-0.02	-0.05	-0.04	-0.05
Treatment plus low-cost alternate packaging	0.06	0.12	0.02	-0.03	-0.06	-0.05	-0.05
Treatment plus high-cost alternate packaging	0.10	0.36	-0.05	-0.04	-0.14	-0.08	-0.08
Source: Authors' calculations. Real exchange rate is defined as the ratio between the average country factor price and the world factor price index.							

The impacts of pallet treatment only and pallet treatment plus the high-cost alternative packaging

scenarios on individual commodity sectors are shown in appendix figures 1 and 2. For most

commodities, the impact of pallet treatment costs on the import value to the United States is relatively low

– 1 percent or less (appendix table 1). Agricultural products experience the largest percentage changes,

on a value basis–with horticultural products and vegetable oils experiencing the largest declines in U.S.

imports. These commodities generally have higher shocks to the trade and transport margins, due to the

higher use of pallets and their importance in trade and transport margins.   The high-cost alternative

packaging scenario shows a higher impact on commodity sectors. In this scenario, the largest impacts are on agricultural products, with products such as textiles and leather, and petroleum and coal, which have low pallet use, exhibiting small increases in trade.   In this scenario, products such as vehicles and parts, and electronics, show a small percentage decline, due to the inclusion of higher pallet costs on China's trade.

Conclusions

As globalization and international trade expands, new regulations on trade may arise due to environmental concerns.   In this paper, we analyzed how the impact of an SPS measure, such as treatment and alternative packaging rules for wood pallets used in international trade, could be treated in a global model of international trade. We created a database to estimate the use of pallets in U.S. imports, and explored how increased pallet costs might affect sectoral trade with the use of the GTAP model. Increased pallet costs were incorporated into the model through the international trade and transport margins. Although the effects appear to be small, the data and model results indicate that agricultural products might be the most affected with increased pallet costs. In addition, U.S. imports from China could be the most affected if pallet rules are introduced that would involve additional pallet costs due to China's role as the largest U.S. supplier of containerized vessel trade. The alternative packaging rules examined do not include disposal or other costs that might be associated with pallets made from alternative materials.

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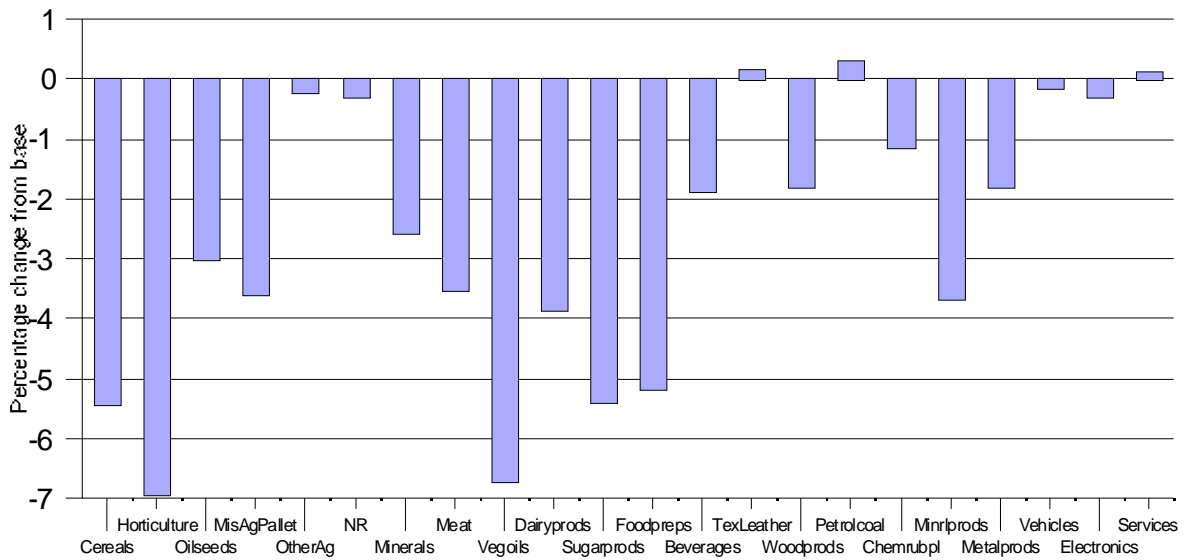www.bts.gov/press_releases/2007/bts010_07/html/bts010_07.html.

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Appendix figure 1. Effects of pallet treatment on U.S. imports
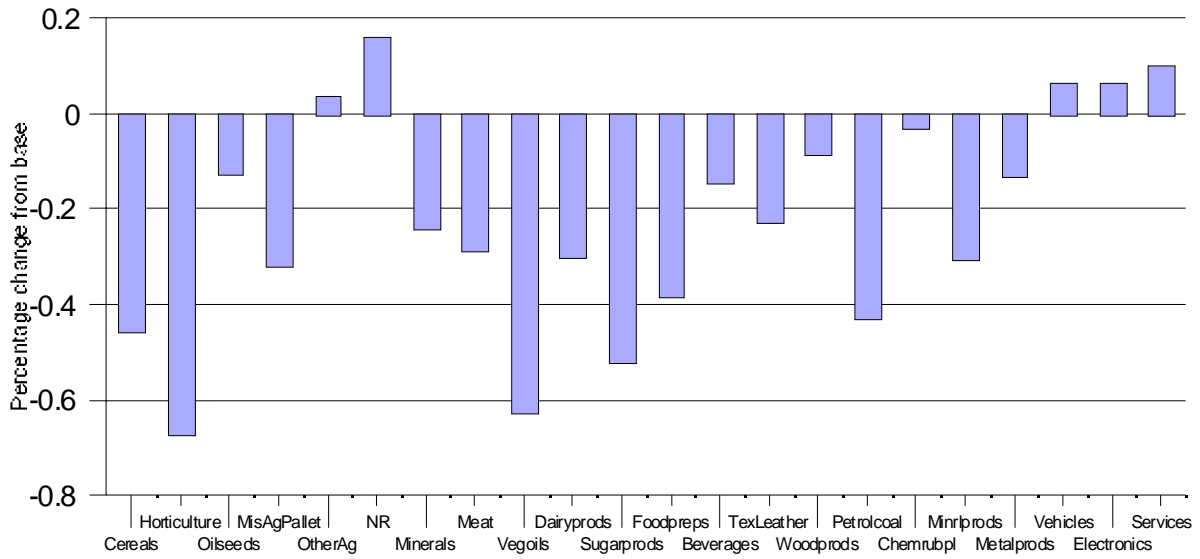
Source: Authors' calculations

Appendix figure 2. Pallet treatment and alternative packaging (high cost)

Source: Authors' calculations