Invited presentation at the 2018 Southern Agricultural Economics Association Annual Meeting, February 2-6, 2018, Jacksonville, Florida

Tariff and U.S. Paper Products Trade

Daowei Zhang[a]
Ly Nguyen[b]

[a:] Alumni and George Peake Jr. Professor at Auburn University School of Forestry & Wildlife Sciences. 602 Duncan Drive Auburn, Abalama, 36849. Phone: 334-844-1067. Email: zhangd1@auburn.edu

[b]: postdoctoral fellow at Auburn University Department of Agricultural Economics and Rural Sociology, 301D Comer Hall Auburn, Alabama, 36849. Phone: 334-728-4018. Email: ltn0002@auburn.edu

Abstract

In this paper we use the gravity model to study the effects of tariff on U.S. exports and imports of paper products that include paper, paperboard, and wood pulp. The results show that an increase in tariff would have a small, significant, and asymmetric impact on U.S. exports and imports of paper products. Furthermore, exchange rate, economic size of the U.S. and its trade partners, and U.S. internet use rate are found to be significant factors influencing U.S. paper products trade. These results show that the U.S. has some leverage in promoting free trade in paper products.

Keywords: Paper and paperboard, tariff, exchange rate, gravity model, panel data, trade

1. Introduction

The United States is the largest producer of paper products in the world (World Growth 2011). Between 1990 and 2014, U.S. production of paper products accounted for 27% of global paper production, and its imports and exports accounted for 21% and 17% of the global total imports and exports, respectively (FAOSTAT 2016). In the same period, the share of U.S. imports and exports to domestic consumption was 13.5% and 11.5% respectively (FAOSTAT 2016). Although U.S. trade in paper products grew steadily over the last two and half decades, the country has changed from a net importer to a net exporter since 2010 (Figure 1).

The purpose of this paper is to study the effect of tariff on the imports and exports of U.S. paper products. Ever since its peak in 1933 that resulted from the infamous Smoot-Hawley Act, the U.S. general tariff rate, measured as the share of tariffs collected on all dutiable goods, has declined steadily (Figure 2). In addition, the share of duty free imports to the U.S. has been increasing in the last few decades. As a result, the weighted average rate of U.S. duties on all imported goods has harbored around 1.5% in the last 30 years (Figure 2). U.S. tariff rates on imported paper products have been reduced even further, to an average of 0.8% between 1990 and 2014 (World Bank 2016). Similarly, tariff rates on exports of U.S. paper products to other countries have declined sharply, albeit not to the level of U.S. tariff rate on paper products imports (Figure 3). Yet, it is unclear if and to what extent the reduction in tariff rates in the U.S. and by its trading partners has enhanced U.S. paper products trade during the last few decades. In this paper, we intend to fill this gap by investigating the effect of tariff as a conventional tool to control trade flows of paper products between the U.S. and its trading partners.

A few scholars (e.g., Buongiorno 1978, Baudin and Lundberg 1987, Li and Zhang 2008, Hujala et al. 2013) have studied the demand and trade flows of paper products without

considering tariffs. There have been many studies on the effect of tariff and other trade measures on forest products trade besides paper products, notably softwood lumber related to the softwood lumber war between the U.S. and Canada (e.g., Zhang, 2007, Nagubadi and Zhang 2013, Parajuli and Zhang 2016) and wood furniture associated with antidumping activities in the U.S. (e.g., Luo et al. 2015). Studies on tariff have also been conducted on agricultural and other commodities such as apple (Yue et al., 2006), wheat (Koo and Uhm 2007), meat (Koo et al. 1994), salmon (Asche 2001, Kinnucan and Myrland 2005), tobacco (Pompelli and Pick 1990), Portland cement (Cohen-Meidan 2013), and chemical products (Krupp 1994). Irwin (2010) compares the deadweight losses from U.S. tariffs among various industries. Most of these studies indicate that tariff has a negative impact on U.S. trade, but the magnitude of its impact is asymmetric with tariff on U.S. imports being greater than tariff on U.S. exports. The next section describes our study method and model, followed by data and empirical results. The final section concludes with some discussion on trade policy.

2. Methods and Models

To determine the major factors that may influence U.S. paper products trade, we use the gravity model which provides consistent results and relatively compact specification (Grant and Anders 2010) in this study. Known as a "workhorse" for empirical studies in international economics, the gravity model has performed remarkably well in explaining bilateral trade flows (Eichengreen and Irwin 1998). Pioneered by Tinbergen (1962) and Pöyhönen (1963), the gravity model states in its most rudimentary form that bilateral trade increases with economic mass and decreases with commercial distance, just as the Newton's gravity equation in physics demonstrates. Anderson and van Wincoop (2003) expand this model to cover multilateral trade resistance indexes such as importer- and exporter-fixed effects. Empirically, the gravity model

has been used to explain (1) bilateral trade flows (e.g., Summary 1989, Sohn 2005), (2) investigate determinants and impacts of trading blocs (e.g., Krugman 1991, Roberts 2004), (3) predict trade potential (e.g., Frankel and Romer 1999), (4) differentiate alternative trade theories (Feenstra et al. 2001), and (5) the impacts of international borders (e.g., McCallum 1995, Evans 2003), language (Hutchinson 2002), and currency unions (e.g., Rose 2000, Frankel and Rose 2002, Buongiorno 2015). Nonetheless, the gravity model is used only to describe the behavior of trade flows, not economic welfare (Shepherd 2013). Furthermore, it has presented discrepancies in defining the parameters involved, giving rise to the "ad hoc" nature of hypotheses on the international mobility of goods (Mele and Baistrocchi 2012).

Most studies that use the gravity model are based on aggregated trade flows although studies using disaggregated, industry-level trade data are increasing. As for forest products trade, Kangas (2001) uses the gravity model to study the development of round wood trade in Europe, and Kangas and Niskanen (2003) use it to investigate the trading patterns of forest products between European Union countries and Central and Eastern European countries. Kang (2003) uses it to investigate U.S. wood products trade, while Li and Zhang (2008) and Zhang and Li (2008) analyze factors affecting China's wood products and paper products trade, respectively. Again, none of these studies include a tariff variable in evaluating the determinants of paper exports and imports.

This study applies an augmented gravity model separately to examine U.S. paper products imports and exports using panel data. The trade flow of U.S. paper products is modeled as

$$T_{it} = e^{\alpha_i} \prod_m X_{imt}^{\beta_m} \prod_k e^{\gamma_k P_{ikt}} \varepsilon_{it} \qquad (1)$$

or in its log-linear form:

$$\ln T_{it} = \alpha_i + \sum_m \beta_m \ln X_{imt} + \sum_k \gamma_k P_{ikt} + \ln \varepsilon_{it} \quad (2)$$

where, T_{it} is the value of paper products exports or imports between the U.S. and its trading partner i ($i \in M$, M is the total number of U.S. paper products trading partners) in year t (t = 1, 2, …25); X_{imt} is the mth explanatory variable for country i in year t, and P_{ikt} is the kth dummy variable; β and γ are parameters to be estimated, and ε_{it} is the error term. Equation (2) is called a fixed-effects (random-effects) panel data model if the intercept α_i is assumed to be fixed (random).

The independent variables included in this study are distance, exchange rate, U.S. Gross Domestic Production (GDP), GDP of U.S. trading partners, tariff rate, WTO membership, U.S. economic recessions, U.S. internet use rate, the U.S. trading partner internet use rate, and the lagged dependent variable for controlling possible autocorrelation. Since we use panel data which may bring potential issues of fixed effects/random effects, heteroscedasticity, and endogeneity, we apply the Passion Pseudo Maximum Likelihood (PPML) estimation including fixed effects of country and time (year), then compare the results with those of the Ordinary Least Square (OLS) regression, and Generalized Methods of Moment (GMM) estimation. The latter treats the tariff variable endogenous.

The final models expressing the effects of the gravity variables on the exports or imports of paper products in the U.S. are presented in Equation (2) becomes:

$$\begin{aligned} \text{Ln}(\text{import}_{it})/\ln(\text{export}_{it}) = {} & \alpha + \alpha_i + \alpha_t + \beta_1 \ln(\text{import}_{i(t-1)})/\ln(\text{export}_{i(t-1)}) + \beta_2 \ln(\text{distance}_i) + \\ & \beta_3 \ln(\text{ex}_{it}) + \beta_4 \ln(\text{PNGDP}_{it}) + \beta_5 \ln(\text{USGDP}_t) + \beta_6 \text{tariff}_{it} + \beta_7 \text{recession}_t + \beta_8 \text{WTO}_{it} + \\ & \beta_9 \text{usinteru}_t + \beta_{10} \text{partnerinter}_{ti} + \varepsilon_{it} \end{aligned} \quad (3)$$

where $\ln(import_{it})$ or $\ln(export_{it})$ is the logarithm of the real value of the U.S. imports or exports with a partner country *i* in year *t*; and α_i and α_t are dummy variables representing fixed effects caused by a country *i* and year *t*, respectively. In addition to the lag value of imports or exports, ($\ln(import_{i(t-1)})$/ $\ln(export_{i(t-1)})$), the independent variables included in Equation (3) are geographical distance between countries ($\ln(distance_{it})$); exchange rate ($\ln(ex_{it})$); the economic sizes of the exporting and importing countries captured by their respective gross domestic product ($\ln(PNGDP_{it})$; $\ln(USGDP_{it})$); the tariff rate ($tariff_{it}$) applied by the U.S. for imported paper products from a county *i*; dummy variables for U.S. economic recessions; a dummy variable indicating whether a partner country is a member of the World Trade organization (WTO_{it}); the U.S. internet use rate ($usinter_t$); and the partner countries internet use rate per total population calculated as individuals using the internet ($partnerinter_t$).

The last two variables are included because a literature review reveals that technology development is one of the major driving forces to shift the demand of newsprint, printing, and writing papers (Hetemaki 2005). Recently, Hujala (2011), Latta et al. (2016), and Johnston (2016) show that the number of internet adaptation in a population is a key variable in estimating the current consumption or predicting the future demand of paper products. Both Latta et al. (2016) and Johnston (2016) demonstrate that internet usage reduces the demand of newsprint, printing, and writing papers because internet and printing and writing paper are substitutes. In addition, the growth of internet influences the investment in the paper production (Latta et al. 2016). Therefore, we assume internet use rate has a negative effect on the export supply and import demand of U.S. paper products. As domestic consumption is influenced by price, income, and other variables (Latta et al. 2016), adding the internet-use rate variable in the model could also serve as a proxy and exogenous variable for domestic consumption.

By including U.S. GDP in the model, we assume that the size of U.S. economy correlates with the import demand and export supply of paper products. The logic for a positive relationship between U.S. imports of paper products and U.S. GDP is that, when U.S. GDP increases, personal incomes and domestic consumption in the U.S. grow, which promotes imports. On the other hand, it is expected that U.S. GDP should have a negative relationship with U.S. export of paper products. The sign of the U.S. GDP variable could become positive because strong domestic demand is a prerequisite to the development of an export industry (Basevi 1970), which has been proved to be true with nondurable consumer goods (Clarida 1994).

The real GDP of U.S. trading partners also affects both US exports and imports. A country with high GDP means that it demands more imports of paper products from the U.S. and elsewhere. Yet, the sign of this variable on exports of U.S. paper products may vary depending on whether paper products in the country are normal or necessary products.

We expect that a long distance between two countries limits their trade. The exchange rate is the ratio of the local currency per U.S. dollar. An increase in exchange rate implies an appreciation of U.S. dollars, which works as an export tax and import subsidy. Thus, an increase in the exchange rate variable often leads to an increase in imports and a decrease in exports. Similarly, a decrease in exchange rate means depreciation of U.S. dollars and serves as an export subsidy and import tariff, which increases U.S. exports and decreases U.S. imports. This effect is found to be true for China's wood products trade (Zhang and Li 2009) and for softwood lumber trade in the U.S. (Bolkesjo and Buongiorno 2006, Parajuli and Zhang 2016). On the other hand, Buongiorno et al. (1988) and Nagubadi et al. (2009) show that there is no significant effect of exchange rate on softwood lumber imports to the U.S. from Canada, and Uusivuori and Buongiorno (1990) find that exchange rate has a small effect on Swedish and Finnish exports of

forest products to the U.S. which disappears within a year. Overall, these studies only cover certain specific forest products and one or a few U.S. trade partners and therefore, may not present the whole picture of U.S. forest trade with many countries.

The variable for WTO membership (WTO_{it}) is a dummy variable that takes the value of one if a partner country is a WTO member at year t, and zero otherwise. This variable is expected to be positive because a country that is open to the world trade promotes exports and imports. Another dummy variable, $recession_t$, represents the U.S. economic recessions in1990, 2001, and 2008, and takes the value of one in these years and zero otherwise. A recession is defined as a negative growth in GDP for a specific year, and this dummy variable determines whether negative shocks in U.S. economic growth affect the exports and imports of paper products. Ince and McKeever (2011) and Zhang et al. (2017) find that the economic recessions had a negative impact on U.S. paper demand and imports of U.S. forest products, respectively. Therefore, we assume the recessions caused a decrease in imports and exports of paper products during these three years as well as for the following years (1991, 2002, and 2009). The effect of a dummy variable on U.S. exports or imports of paper products is measured by a $((\exp(\beta_n) - 1)*100)$ percentage, where β_n is the estimated coefficient of the dummy variable.

The key coefficient of interest in this research is $\beta_{6,}$ which measures the effect of average annual tariff rate on U.S. imports and exports of paper products. Following the literature, we assume that tariffs impede bilateral trade. Therefore, we intend to test the hypothesis that the effects of tariff on exports and imports of paper products are significantly negative. Tariff elasticities are of interest to many researchers because they demonstrate the effectiveness of a trade policy (Kinnucan and Myrland, 2005). Asche (2001) finds that an antidumping duty on Salmon always decreases the trade with duty-levied countries. Prusa (1997) shows that tariffs

have caused U.S. imports to decrease from tariff-levied countries and to increase from not subject countries. Adams (2003), Devadoss et al. (2005), Devadoss (2006), and Song et al. (2011) evaluate the effects of the U.S. countervailing duties and anti-dumping tariffs on Canadian softwood lumber imports and find that these tariffs are effective. However, since a country chooses tariff as a tool to control the trade balance and protects the domestic production, this variable may be not an exogenous variable in the model. Some studies have suggested the potential of endogeneity of the trade barriers in trade models (Trefler 1993, Essaji 2008, Baylis et al. 2009). The theory of protection predicts that the higher level of import penetration to the greater trade barriers. Therefore, we will test the endogeneity of this variable in order to determine appropriate model for this study.

3. Data

Our data cover trade flows between the U.S. and its major trade partners of paper products from 1990 to 2014. The exporting and importing partners are not necessarily the same. In this research, we include 38 major U.S. trade partners that accounted for about 95% of total U.S. exports of paper products and 18 major trade partners that accounted for more than 95% of U.S. paper products imports in 1990, 2000, and 2014, respectively. Tables 1 and 2 list these countries and their accumulative share of U.S. exports and imports of paper products, respectively.

Annual trade data of paper products is collected from FAOSTAT. This data contain nominal values of U.S. exports and imports of paper products to/from various countries. All these values are converted into the real values by using U.S. GDP deflator with the base year of chained 2010 dollars. Overall, we have 950 observations of panel data for the U.S. export model and 475 observations for the U.S. import model. The historical GDP and exchange rate data are

collected from the USDA Economic Research Service. Data for geographic distance between the U.S. and a trade partner country is collected from the geodistance dataset of the Centre d'Etudes Prospectives et d'Informations Internationales. Information on the year that a country becomes a member of WTO is from the WTO website. The tariff rate data for all paper products by the U.S. and the other countries are collected from the World Integrated Trade Solution (WITS) TRAINS database maintained by the World Bank. This indicator is a simple, unweighted average tariff rate effectively applied on all products and calculated based on the total values of all traded paper products. In a case where tariff data are not available for particular years from a country to which the U.S. exported paper products, we fill in with the tariff rate of the next closest year (t+1). When the tariff rate by an individual E.U. country is not available, it is replaced by the E.U. average tariff rate for Belgium, France, Germany, Italy, Netherlands, Spain, and United Kingdom. Tables 3 and 4 present the definition, descriptive statistics, and data sources of the variables used in this study. The U.S. and other countries' internet use rate as number of individual per total population is collected from United States Census Bureau and the World Bank database.

4. Empirical Results

Serial correlation and unit root tests

The OLS regression model shows a Durbin-Watson statistical value of 0.06, implying that there is possibility of positive serial correlation in the models. We use Breusch-Godfrey LM to test serial correlation of the first and second lag values of the dependent variable. The results show that there is statistically significant correlation in the first lag model. Therefore, the model with one lag of the dependent variable is presented in this study. We also apply two unit root test methods—the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Tests (Maddala and

Wu 1999) with a hypothesis that our panel data has unit root. These tests are used by Vevin et al. (2002), Breitung (2000), and Im et al. (2003). All test results reject the hypothesis, implying that the variables in the model has heteroscedasticity.

In addition, we use the Durbin-Wu-Hausman (DWH) test to test for the endogeneity of the tariff variable in the simple gravity model. The DWH test assumes that the error term is white noise. We find no evidence of an endogenous variable in the model. This result is reasonable because the value of paper products exports and imports is relatively small in comparison to the U.S. total import and import values. Therefore, we treat tariff as an exogenous variable in the import and export models.

Equation (3) is estimated using several techniques. As a first try, it is estimated by using pooled Ordinary Least Square (OLS) assuming intercepts are the same for all countries and all years. We then run a least square dummy variable LSDV regression that includes control of fixed effects for both countries and years. The first and second columns under the heading of OLS in Tables 5 and 6 present the results of these models for U.S. exports and imports, respectively. Most of the results are similar.

Since our second model for both imports and exports has less standard error and higher power of explanation, the LSDV regression with controlling for the fixed effects of countries is preferable to the OLS model. Additionally, the dummy variable of economic recessions is collinear to the annual dummy variable, we drop the annual fixed effects variable in the model to eliminate this collinearity. Thirdly, with the time control of fixed effects, the variable without time invariance such as distance and without partner invariance such as U.S. GDP have to be removed from the model.

However, because of the presence of heteroscedasticity and lagged dependent variable, estimates of the log-linear form of the gravity equation are biased and inconsistent. We thus choose to rely on the Pseudo Poisson Maximum Likelihood (PPML) specification of the trade gravity model. Using the PPML model allow us to overcome for both fixed effects and presence of heteroscedasticity for a dynamic panel dataset (Santos Silva and Tenreyro 2006, 2011). Moreover, the PPML model can use level data and thus allow zero values in the dependent variable. Interpretation of the coefficients from the PPML estimator is similar to the OLS estimator. Particularly, the coefficient is elasticity if an independent variable is taken logarithm values and it is semi-elasticity if the independent variable is formed in level (Shepherd 2013). In the latter case, the elasticity of the dependent variable with respect to a continuous independent is $\beta/100$ where β is the estimated coefficient for the independent variable.

Although the tariff variable is not endogenous in this study, we present the results of the GMM model which treats tariff as an endogenous variable to compare with those of PPML. As shown in Tables 5 and 6, there is no significant difference between these results once taking into account that the independent variables in the PPML model are log-transformed and an appropriate conversion of the coefficients is made. Hence we use the results from PPML estimation to explain our research findings.

The Export Model of U.S. Paper Products

The results estimated by OLS fixed effects, GMM, and PPML are presented in Table 5. The high R^2 value (0.96) of simple OLS model indicates a good fit. The sign and magnitude of all coefficients are relatively consistent among OLS, GMM, and PPML models. With the PPML estimation, all explanatory variables are statistically significant except the economic recession variable. The lagged dependent variable is statistically significant indicating that U.S. exports of

paper products to a trading partner country is correlated with past trend. As expected, the GDP of importing countries has a positive effect on U.S. exports of paper products. U.S. GDP has a positive effect on the export revenue of paper products, indicating that a large U.S. domestic economy enhances the development and exports of U.S. paper products.

The exchange rate variable is found to have a negative and statistically significant effect on U.S. exports of paper products. In particular, a 1% appreciation in the U.S. dollar causes export revenue of U.S. paper products to decrease by 0.56%. The coefficient of the WTO member variable is found to be positive and statistically significant, implying that being a member of WTO causes U.S. exports of paper products to that country to increase by 0.2%. This is because WTO member countries promote international trade in their policy, standards, and actions.

As expected, the tariff variable is found to have a negative effect on U.S. exports of paper products. In particular, if a country increases its tariff rate on U.S. paper products by 1%, the exports of paper products from the U.S. to this country decreases by 0.00011%. A 1% increase in tariff on U.S. export is 0.074% (7.4*1%= 0.074) in the study period. Thus, increasing tariff on U.S. exports from 7.4% to 7.474% by an "average" country of the top 38 destinations of U.S. paper products (which imported $326 million U.S. paper products annually in the study period) would only reduce annual U.S. paper products exports to that country by $0.036 million in the study period. This implies that U.S. exports of paper products are not very sensitive to tariffs. One possible explanation of this result is that the export destinations of U.S. paper products are diverse: if the tariff rate in one country increases, U.S. exporters could switch to another country.

Not surprisingly, the internet use rate variables have a negative effect on U.S. export values. In the U.S., a 1% increase of people using the internet causes U.S. paper products export

value to decrease by 0.0001%, and a 1% increase in the internet use rate of the partner country leads U.S. paper products export to that partner country to decrease by 0.00004%. The former is perplexing, as an increase in internet use in the U.S. should not have a direct impact on exports, which is foreign demand. Perhaps as domestic producers adjust their production volume and products types for domestic consumption, their exports also suffer. Although the effect of U.S. internet use rate on paper export value is much larger than those effect of partner country internet use rate, these effect is relatively small in comparison to the effects of other variables in the model.

Overall, the model for exporting revenue supports trade theory and explains the effects of tariff on the export revenues of U.S. paper products. Specifically, if a partner country increases its tariff on U.S. paper products, U.S. export revenue falls because the tariff raises the prices of these products. Our finding is consistent with tariff studies in forest and agricultural products such as U.S. softwood lumber (Devadoss et al. 2005), Mexico apple (Devadoss and Ridley 2014), and U.S. salmon (Kinnucan and Myrland, 2005). The variables that have the largest coefficients on U.S. exports are the U.S. GDP and the distance between U.S. and a partner country. The least influential variables are tariff and internet use rates.

The Import Model of U.S. Paper Products

The import model also fits well (Table 6). The results show that the economic recessions and WTO memberships have no significant effect on U.S. imports of paper products. All other variables show statistically significant effects on U.S. imports of paper products. The distance variable is found to have a significant negative impact on U.S. imports of paper products from a partner country. U.S. GDP and the partner economic mass are found to have positive and significant impacts on U.S. imports. So does the exchange rate variable. Specifically, a 1%

increase in the exchange rate causes U.S. imports to increase by 0.15%. A statistically significant U.S. and the partner country internet use rate variables indicates that, as domestic demand for paper products decreases, U.S. import demand for paper products also decreases. And as the partner country internet use rate increases, their investment in the paper industry decrease, causing a reduction in their production as well as exports to the U.S. Specifically, a 1% growth of the internet use rate in the US and a partner country causes US imports of paper products to fall by 0.0055% and 0.0018%, respectively. Comparing to the export model result, the effects of internet use rate on the import values is 55 times larger than their effects on the export values. However, there is a similarity between export and import models is both the U.S. economy size and distance between the U.S. and a partner country are two largest effect variables.

The tariff variable has a negative and significant effect on U.S. imports. In particular, if the U.S. tariff on imports of paper products from a particular country increases by 1%, the exports from that country to the U.S. decreases by 0.0007%. This value is nearly 7 times that of the tariff elasticity in the export model. A 1% increase in U.S. tariff on paper products is 0.008% (0.8*1%= 0.008%) in the study period. Thus, increasing U.S. tariff on paper products from 0.8% to 0.8008% on an "average" country of its top 19 exporters (which exported $738 million of paper products to the U.S. annually in the study period) would only reduce annual U.S. paper products import from that country by $0.509 million in the study period. However, once U.S. paper industry petitions the U.S. government for actions against imports of certain paper products, the alleged dumping and subsidy margins could be much higher (and thus tariff) that the existing import duty (which is near zero). For example, in a petition by North Pacific Paper Company on August 9, 2017 for the imposition of antidumping and countervailing duties on

imports of Certain Uncoated Groundwood Paper from Canada, it alleged that Canada's dumping margin alone was 23.45% - 54.97% (Neely 2017).

Thus, exports of paper products from other countries to the U.S. are more sensitive to U.S. tariffs than U.S. exports to a tariff placed by a trading partner. This finding confirms the results of many previous studies that tariff has a smaller impact on U.S. exports than on U.S. imports (Prusa 1997, Devadoss and Ridley 2014).

5. Conclusions and Discussion

This study uses the gravity model to investigate determinants of U.S. trade in paper products between 1990 and 2014, including the effects of tariff rates. U.S. exports and imports of paper products are modeled separately, using different methodologies. Overall, the results show that the gravity model fits well and results are relatively consistent among these models in which the PPML is "best fit" to deal with the zero value of dependent variable and heteroscedasticity.

Results from the export model suggest that an importing country's GDP, distance between the U.S and a partner country, tariff rate, U.S. GDP, exchange rate, WTO membership, U.S. internet use rate, and partner country internet use rate all significantly affect exports of U.S. paper products. Importing country's GDP, U.S. GDP, and WTO membership have positive effects, and all other variables have negative effects on U.S. exports of paper products. Results of the import model show that imports of U.S. paper products are affected by U.S. GDP, partner economic size, tariff rate, distance, exchange rate, partner country internet use rate, and U.S. internet use rate. In addition, both export and import models show lagged values contribute significant effect on the current export or import values.

We find that tariff has a small but significant effect on both U.S. exports and imports of paper products and that the tariff elasticity on U.S. exports of paper products is much lower than

that on U.S. imports. In other words, foreign exporters of paper products to the U.S. are more sensitive to changes in U.S. tariff rate, which is already very low compared to that of its trade partners. This result may be due to the fact that U.S. export destinations of paper products are more diverse than its import sources. On the other hand, this result may explain why there has been an increase in petitions for anti-dumping and countervailing duties from U.S. paper producers on imports of U.S. paper products in recent years. For example, we find in a search of Federal Register that, in 2017 alone, there are U.S. industry petitions (and follow-up investigations and actions by the U.S. Government) on lined paper from China and India, uncoated groundwood paper from Canada, and uncoated paper from Australia, Brazil, China, Indonesia, and Portugal.

Our results also mean that the U.S. could have some leverage in negotiating reciprocal free trade agreements with other countries in trading paper products. Although paper products may only be a small issue in the current renegotiation of North America Free Trade Agreement, the U.S. could use the result of this paper and the threat of tariff as a bargaining chip to achieve its overall goals. The U.S. could also use the result of this study in its negotiation of bilateral trade deals that include paper products.

References

Adams, D.M. 2003. Market and resource impacts of a Canadian lumber tariff. *J. For.* 101: 48-52.

Anderson, J. and E. van Wincoop. 2003. Gravity with Gravitas: A solution to the border puzzle. *Amer. Econ. Rev.* 93 (1): 170–192.

Asche, F. 2001. Testing the effects of an anti-dumping duty: The U.S. salmon market. *Empirical Econ.* 26: 343-355.

Basevi, G. 1970. Domestic demand and ability to export. *J. Pol. Econ*. 78(2): 330-337.

Baylis, K., Martens, A., Nogueira, L., 2009. What drives import refusals? *Amer. J. Agri. Econ.* 91(5): 1477-1483.

Baudin, A., and L. Lundberg. 1987. A world model of the demand for paper and paperboard. *For. Sci.* 33(1): 185-196.

Bolkesjo, T., and J. Buongiorno. 2006. Short-and long-run exchange rate effects on forest products trade: Evidence from panel data. *J. For. Econ.* 11: 205-221.

Buongiorno J. 1978. Income and price elasticities in the world for paper and paperboard. *For. Sci.* 24(2): 231-246.

Buongiorno, J. 2015. Monetary union and forest products trade–the case of the Euro. *J. For. Econ.* 21 (4): 238-249.

Buongiorno, J., J. P. Chavas, and J. Uusivuori. 1988. Exchange rates, Canadian lumber imports, and United States prices: A time-series analysis. *Can. J. For. Res*. 18: 1587-1594.

Breitung,J. 2001. The local power of some unit root tests for panel data, in Badi H. Baltagi, Thomas B. Fomby, R. Carter: Advances in Econometrics 15: 161-177

Cheng, C, G. Chen, and S. Yao. 2011. Do imports crowd out domestic consumption? A comparative study of China, Japan, and Korea. *Research Paper Series China and the World Economy*. The University of Nottingham.

Clarida, H. R. 1994. Cointegration, aggregate consumption, and the demand for imports: A structural econometric investigation. A*mer. Econ. Rev.* 84(1): 198-308.

Cohen-Meidan, M. 2013. The Heterogeneous Effects of Trade Protection: A Study of U.S. Antidumping Duties on Portland Cement. *Rev. Indu. Org.* 42(4): 369-394.

Devadoss, S., A. H. Aguiar, S. R. Shook, and J. Araji. 2005. A spatial equilibrium analysis of U.S. – Canadian disputes on the world softwood lumber market. *Can. J. Agri. Econ.* 53: 177-192.

Devadoss, S. 2006. Is there an end to U.S.-Canadian softwood lumber disputes? *J. Agri. Applied Econ.* 38(1): 137-153.

Devadoss, S. and W. Ridley. 2014. Effects of the Mexican apple tariff on the world apple market. *Rev. Develop. Econ.* 18(4): 763-777.

Eichengreen, B., and D. Irwin. 1998. The role of history in bilateral trade flows. In J.A. Frankel (ed.) *The Regionalization of the World Economy*. Chicago, IL: University of Chicago Press.

Essaji, A. 2008. Technical regulations and specialization in international trade. *J. Inter. Econ*. 76: 166-176.

Evans, C. 2003. The economic significance of national border effects. *Amer. Econ. Rev.* 93(4): 1291-1312.

Frankel, J. A., and D. Romer. 1999. Does trade cause growth? *Amer. Econ. Rev.* 89: 379-399.

Frankel, J. A., and A.K. Rose. 2002. An estimate of the effect of common currencies on trade and income. *Quarterly J. Econ.* 117: 437-466.

FAOSTAT. 2016. http://faostat.fao.org/site/381/default.aspx. (accessed: November 20, 2016).

Feenstra, R. C., J.R. Markusen, and A.K. Rose. 2001. Using the gravity equation to differentiate among alternative theories of trade. *Can. J. Econ.* 34(2): 430-447.

Grant, J. and S. Anders. 2010. Trade deflection arising from U.S. import refusals and detentions in fishery and seafood trade. *Amer. J. Agri. Econ.* 93(2): 573-580.

Hetemaki, L. 2005. ICT and communication paper markets. In Hetemaki, L. & S. Nilsson (eds.) *Information Technology and the Forest Sector. IUFRO World Series*. Volume 18. IUFRO. Vienna. http://www.metla.fi/julkaisut/muut/ICT-forest-sector-2005.pdf (accessed September 02, 2017).

Hujala, M., H. Arminen, R.C. Hill, K. Puumalainen. 2013. Explaining the shifts of international trade in pulp and paper industry. *For. Sci.* 59 (2): 211-222.

Hujala, M., 2011. The role of information and communication technologies in paper consumption. *Inter. J. Busi. Info. Systems* 7(2): 121-135.

Im, K. S., M. H. Pesaran, and Y. Shin. 2003. Testing for unit roots in heterogeneous panels. *J. Econometrics* 115: 53–74.

Ince, Peter J., D. B. McKeever. 2011. Wood supply and demand. P. 371-375 in *McGraw-Hill Yearbook of Science & Technology*, New York: McGraw-Hill.

Irwin, D. A. 2010. Trade restrictiveness and deadweight losses from U.S. tariffs. *American Economic Journal: Economic Policy* 2(3):111-133.

Johnston, C.M.T. 2016.Global paper market forecasts to 2030 under future internet demand scenarios. *J. For. Econ.* 25: 14-28.

Kang, M. 2003. U.S. Wood product exports and regional trade. *Atlantic Econ. J.* 31(4): 386.

Kangas, K. 2001. Trade liberalization, changing forest management and roundwood trade in Europe. *Nota Di Lavoro* 53: 1-15.

Kangas, K., and A. Niskanen. 2003. Trade in forest products between European Union and the central and eastern European access candidates. *For. Policy Econ.* 5: 297-304.

Kinnucan, W.H. and O. Myrland. 2005. Effects of income growth and tariffs on the world salmon market. *Applied Econ.* 37: 1967-1978.

Koo, W.W., D. Karemera, D., and T. Richard. 1994. A Gravity Model Analysis of Meat Trade Policies. *Agricultural Economics* 10(1): 81-88.

Koo, W.W. and I. H. Uhm. 2007. Effects of dumping vs. anti-dumping measures: the u.s. trade remedy laws applied to wheat imports from Canada. *J. World Trade* 41(6): 1163–1184.

Krugman, P.R. 1991. *Geography and Trade*. Cambridge, MA: MIT Press.

Krupp, C. 1994. Antidumping cases in the U.S. chemical industry: A panel data approach. *The journal of Industrial Economics* 42(3): 299-311

Latta, S. G., A. J. Plantinga, and M. R. Sloggy. 2016. The effects of internet use on global demand for paper products. *J. For.* 114(4): 433-440.

Li, Y., and D. Zhang. 2008. A Gravity model analysis of China's pulp and paper products trade. *TAPPI J.* 91(9):28-32.

Luo, X., C. Sun, H. Jiang, Y. Zhang, Q. Meng. 2015. International trade after intervention: The case of bedroom furniture. *For. Policy Econ.* 50(1): 180-191.

Maddala, G.S. and S. Wu. 1999. A comparative study of unit root tests with panel data and new simple test. *Oxford Bull. Econ. Stat.* 61: 631-652.

Nagubadi, R.V., H. Thompson, and D. Zhang. 2009. productivity and trade during the softwood lumber dispute. *Inter. Trade J.* 23(3):301-324.

McCallum, J. 1995. National noarders matter: Canada-U.S. regional trade patterns. *Amer. Econ. Rev.* 85(3): 615-623.

Mele, M. and P.A. Baistrocchi. 2012. A Critique of the gravitational model in estimating the determinants of trade flows. *Inter. J. Busi. Commerce* 2(1): 13-23.

Nagubadi, R.V., and D. Zhang. 2013. U.S. imports for Canadian softwood lumber in the context of trade dispute: A cointegration approach. *For. Sci.* 59(5): 517-523.

Neely, J. 2017. Petition Summary: Uncoated groundwood paper from Canada. https://www.tmtindustryinsider.com/2017/08/petition-summary-uncoated-groundwood-paper-from-canada/ (accessed December 2).

Parajuli, R., and D. Zhang. 2016. Welfare impacts of the 2006 United States-Canada Softwood Lumber Agreement. *Can. J. For. Res.* 46: 950-958.

Pompelli, K. G., and D. Pick. 1990. Pass-through of exchange rates and tariffs in Brazil - U.S. tobacco trade. *Amer. J. Agri. Econ.* 72(3): 676–681.

Pöyhönen, P. 1963. A tentative model for the volume of trade between countries. *Weltwirtschaftliches Archiv* 90(1): 93-99.

Prusa, J.T. 1997. The trade effects of U.S. antidumping actions. P. 191-214 in Robert C. Feenstra (ed) *The Effects of U.S. Trade Protection and Promotion Policies*. University of Chicago Press.

Roberts, B.A. 2004. A gravity study of the proposed China-ASEAN free trade area. *Inter. Trade J.* 18(4): 335-353.

Rose, A.K. 2000. One money, one market: The effect of common currencies on trade. *Econ. Policy* 15(30): 7-46.

Santos Silva, J.M.C., and S. Tenreyro. 2006. The log of gravity. *Rev. Econ. Stat.* 88(4):641-658.

------2011. Further simulation evidence on the performance of the poisson pseudo-maximum likelihood estimator. *Econ. Letters* 112: 220-222.

Shepherd, B., 2013. The gravity model of international trade: A user guide. *ARTNet Gravity Modeling Initiative, United Nations Economic and Social Commission for Asia and the Pacific.*

Sohn, C. 2005. Does the gravity model explain South Korea's trade flows? *Japanese Econ. Rev.* 56(4): 417-30.

Song, N., S.J. Chang, and F.X. Aguilar. 2011. U.S. softwood lumber demand and supply estimation using cointegration in dynamic equations. *J. For. Econ.* 17:19-33.

Summary, R. M. 1989. A political-economic model of U.S. bilateral trade. *Rev. Econ. Stat.* 71(1): 179-182.

Tinbergen, J. 1962. *Shaping the World Economy: Suggestions for An International Economic Policy*. New York: The Twentieth Century Fund.

Trefler, D. 1993. Trade liberalization and the theory of endogenous protection: an econometric study of U.S. import policy. *J. Poli. Econ.* 101(1): 138-60

USITC (U.S. International Trade Commission). 2016. http://datatweb.itc.gov/ (accessed December 1).

Uusivuori, J. and J. Buongiorno. 1990. Short- and long-run effects of changes in exchange rates on United States imports of paper from Finland and Sweden. *Scandinavian J. For. Res.* 5: 285-296.

Wang, Z. S. Ma, and C. Y. Wang. 2015. Variable selection for zero-inflated and overdispersed data with application to health care demand in Germany, *Biometrical J.* 57(5):867-884.

World Growth. 2011. The economic impact of U.S. trade sanctions on imports of paper products. *A Research and Analysis Report* by Dr. Robert Shapiro and Sonecon, LLC, International Economic Advisory Firm.

Zhang, D. 2007. *The Softwood Lumber War: Politics, Economics, and the Long US-Canadian Trade Dispute*. Resources for the Future Press. Washington, DC.

Zhang, D. and Y. Li. 2008. forest endowment, logging restrictions, and China's wood products trade. *China Econ. Rev.* 20: 46-53.

Zhang, D., Y. Lin, and J. Prestemon. 2017. From deficit to surplus: An econometric analysis of U.S. forest products trade. *For. Sci.* 63(2): 209-217.

Table 1. The Value and Accumulative Share of U.S. Paper Products Exports for Selected Countries in 1990, 2000, and 2014

No.	Year	1990		2000		2014	
	Country	Exports ($)	Accumulative %	Exports ($)	Accumulative %	Exports ($)	Accumulative %
1	Canada	1,362,618,800	26.53	3,793,811,873	32.68	5,092,097,109	31.17
2	Mexico	659,168,792	39.36	2,474,043,813	54.00	3,858,931,000	54.79
3	Japan	515,583,489	49.40	807,551,734	60.96	799,691,939	59.68
4	China	84,175,888	51.04	399,214,110	64.39	660,632,646	63.73
5	UK	245,718,270	55.82	319,390,284	67.15	355,786,253	65.91
6	Hong Kong	180,199,636	59.33	248,921,124	69.29	275,665,601	67.59
7	Netherlands	124,036,222	61.74	229,149,025	71.27	258,073,553	69.17
8	Germany	155,389,398	64.77	222,024,611	73.18	250,398,631	70.70
9	Australia	136,498,876	67.43	191,340,993	74.83	248,732,763	72.23
10	Taiwan	95,426,454	69.28	165,083,548	76.25	239,883,767	73.70
11	Korea South	127,923,329	71.77	159,626,121	77.62	234,925,825	75.13
12	Costa Rica	68,726,018	73.11	145,699,014	78.88	222,204,363	76.49
13	Italy	91,534,717	74.89	133,392,952	80.03	197,349,717	77.70
14	Dominican Rp.	28,360,097	75.45	130,878,840	81.16	189,553,690	78.86
15	Ecuador	86,996,252	77.14	128,455,262	82.26	189,166,686	80.02
16	Brazil	36,818,787	77.86	124,525,433	83.34	188,211,325	81.17
17	Belgium	58,124,546	78.99	112,996,388	84.31	183,596,490	82.30
18	France	64,745,828	80.25	103,278,293	85.20	168,177,674	83.32
19	Guatemala	33,616,573	80.90	102,977,691	86.09	157,248,904	84.29
20	Spain	40,639,682	81.70	97,905,468	86.93	151,681,624	85.22
21	Singapore	60,522,668	82.87	95,095,014	87.75	148,215,561	86.12
22	Malaysia	70,096,115	84.24	90,588,448	88.53	141,711,723	86.99
23	Colombia	43,691,481	85.09	80,913,873	89.23	128,782,606	87.78
24	Venezuela	36,469,996	85.80	78,414,452	89.90	118,666,121	88.51
25	Israel	45,793,170	86.69	76,416,644	90.56	114,946,684	89.21
26	Philippines	53,448,681	87.73	75,173,051	91.21	114,727,652	89.91
27	Saudi Arabia	54,428,555	88.79	73,225,185	91.84	98,413,424	90.51

28	Indonesia	17,412,436	89.13	72,860,924	92.47	85,297,080	91.04
29	El Salvador	16,588,078	89.45	65,510,942	93.03	82,796,332	91.54
30	Argentina	6,591,035	89.58	62,108,315	93.57	80,225,021	92.03
31	Honduras	39,483,759	90.35	60,366,096	94.09	78,445,756	92.51
32	Panama	55,953,443	91.44	57,111,198	94.58	65,480,819	92.91
33	Thailand	13,779,128	91.71	53,234,991	95.04	64,160,036	93.31
34	Chile	22,112,385	92.14	44,983,166	95.42	63,011,259	93.69
35	South Africa	73,427,277	93.57	39,962,603	95.77	62,205,292	94.07
36	Peru	3,026,447	93.63	36,629,165	96.08	57,924,230	94.43
37	Jamaica	26,086,304	94.13	34,628,916	96.38	55,615,878	94.77
38	Turkey	5,487,107	**94.24**	32,543,391	**96.66**	54,466,977	**95.10**
	World	5,136,528,878	100.00	11,607,480,545	100.00	16,337,334,253	100.00

Table 2. The Value and Accumulative Share of U.S. Paper Products Imports from Selected Countries in 1990, 2000, and 2014

		1990		2000		2014	
No.	Country	Imports	Accumulative %	Imports	Accumulative %	Imports	Accumulative %
1	Canada	6,324,188,125	73.9	10,133,404,676	65.8	6,832,719,096	42.6
2	China	53,866,925	74.5	618,246,038	69.9	2,765,067,270	59.9
3	Mexico	193,167,612	76.8	510,141,384	73.2	972,438,528	66.0
4	Finland	382,186,436	81.2	690,508,805	77.7	793,268,280	70.9
5	Germany	298,154,160	84.7	585,968,513	81.5	721,371,449	75.4
6	Korea South	74,108,319	85.6	319,400,839	83.5	523,256,438	78.7
7	Indonesia	4,363,750	85.6	191,021,019	84.8	442,140,523	81.4
8	Japan	243,000,642	88.5	521,543,536	88.2	373,832,026	83.8
9	Brazil	9,537,115	88.6	99,754,072	88.8	285,400,198	85.6
10	France	123,739,237	90.0	201,422,733	90.1	263,517,704	87.2
11	UK	158,962,249	91.9	365,044,330	92.5	243,792,581	88.7
12	Italy	71,646,503	92.7	162,508,594	93.6	181,509,675	89.9
13	Portugal	146,763	92.7	448,130	93.6	168,731,246	90.9
14	Australia	2,761,204	92.7	19,385,220	93.7	147,601,489	91.8
15	Taiwan	62,739,331	93.5	49,703,442	94.0	143,553,633	92.7
16	Spain	21,565,285	93.7	64,447,591	94.4	122,003,144	93.5
17	Vietnam	0	93.7	139,565	94.4	115,375,548	94.2
18	Sweden	128,227,472	95.2	133,404,679	95.3	105,788,312	94.9
19	Hong Kong	24,150,500	**95.5**	56,641,690	**95.7**	94,211,458	**95.5**
	World	8,561,820,362	100.0	15,389,880,242	100.0	16,023,036,541	100.0

Table 3. Definitions and Descriptive Statistics of Variables in the Export Model

No.	Variable	Unit	Mean	Max	Min	Standard Deviation
1	Real export	US Dollars	326,000,000.0	5,480,000,000.0	4,532,373.0	782,000,000.0
2	Distance	Km	7,936.3	16,374.6	734.3	4,502.3
3	Exchange rate	Local currency unit/USD	1,184.3	44,167.0	0.5	4,955.2
4	Partner GDP	Billions of 2010 US dollars	812.2	8,230.5	7.6	1,194.3
5	Tariffs	Percentage	7.4	38.2	0.0	6.7
6	USGDP	Billions of 2010 US dollars	12,838.7	16,282.0	9,057.7	2,313.4
7	US Internet use rate	Internet users per 100 persons	46.0	87.4	0.8	29.9
8	Partner internet use rate	% of population	23.4	93.9	0	27.0

Data sources: US GDP Deflator: https://research.stlouisfed.org/fred2/series/GDPDEF#

WTO member: https://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm

Free trade agreement with the US: https://ustr.gov/trade-agreements/free-trade-agreements

Real GDP https://www.ers.usda.gov/data-products/international-macroeconomic-data-set.aspx

Exchange rate: http://www.ers.usda.gov/data-products/agricultural-exchange-rate-data-set.aspx

The US export and import share to total domestic production and consumption: http://faostat3.fao.org/download/F/FO/E

Distance: http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8

Tariffs database TRAINS from World Bank: http://databank.worldbank.org/data/reports.aspx?source=UNCTAD-~-Trade-Analysis-Information-System-(TRAINS)#

Table 4. Definition and Descriptive Statistics of Variables in the Import Model

No.	Variable	Unit	Mean	Max	Min	Standard Deviation
1	Real export	US Dollars	738,000,000.0	10,400,000,000.0	146,763.0	1,900,000,000.0
2	Distance	Km	8,515.5	16,374.6	733.7	4,131.6
3	Exchange rate	Local currency unit/USD	687.5	21,770.4	0.5	2,652.4
4	Partner GDP	Billions of 2010 US dollars	1,501.2	8,230.5	104.1	1,437.6
5	Tariff rate	Percentage	0.8	4.2	0.0	1.1
6	USGDP	Billions of 2010 US dollars	12,838.7	16,282.0	9,057.7	2,314.8
7	US internet use rate	Internet users per 100 persons	46.0	87.4	0.8	29.9
8	Partner internet use rate	% of population	32.8	94.8	0	31.8

Table 5. Results of U.S. Paper Products Export Model

Variable	OLS (*LNEXPORT)*		GMM *(LNEXPORT)*	PPML (*EXPORT)*
	1	2	3	4
LNEXPORT(-1)	0.932***	0.672***	0.928***	0.003***
	(0.010)	(0.020)	(0.014)	(0.000)
LNDISTANCE	-0.069***	0.022	-0.072***	-1.024***
	(0.013)	(0.042)	(0.013)	(0.041)
LNEX	0.004	-0.439***	0.004	-0.557***
	(0.003)	(0.043)	(0.003)	(0.075)
LNPARTNERGDP	0.030***	0.091*	0.032***	0.315***
	(0.006)	(0.049)	(0.007)	(0.057)
LNUSGDP	0.498	0.621**	0.208***	1.306**
	(0.319	(0.307)	(0.037)	(0.543)
TARIFFS	-0.001	-0.005**	-0.002	-0.011***
	(0.002)	(0.002)	(0.002)	(0.003)
RECESSION	-0.042	-0.003	-0.043*	0.003
	(0.025)	(0.022)	(0.025)	(0.026)
WTO	-0.033	0.076***	-0.028	0.205***
	(0.027)	(0.027)	(0.029)	(0.035)
US Internet Use	-0.004**	-0.006***	-0.003***	-0.010***
	(0.002)	(0.002)	(0.001)	(0.003)
Partner Internet Use	0.0002	-0.0006	0.0002	-0.0041***
	(0.0004)	(0.0005)	(0.0004)	(0.0010)
Country fixed effects	no	yes	yes	yes
Tariff endogenous	no	no	yes	no
R^2	0.962	0.981		0.988
SE of Regression	0.208	0.251		
Durbin-Watson Stat	1.920	2.170		

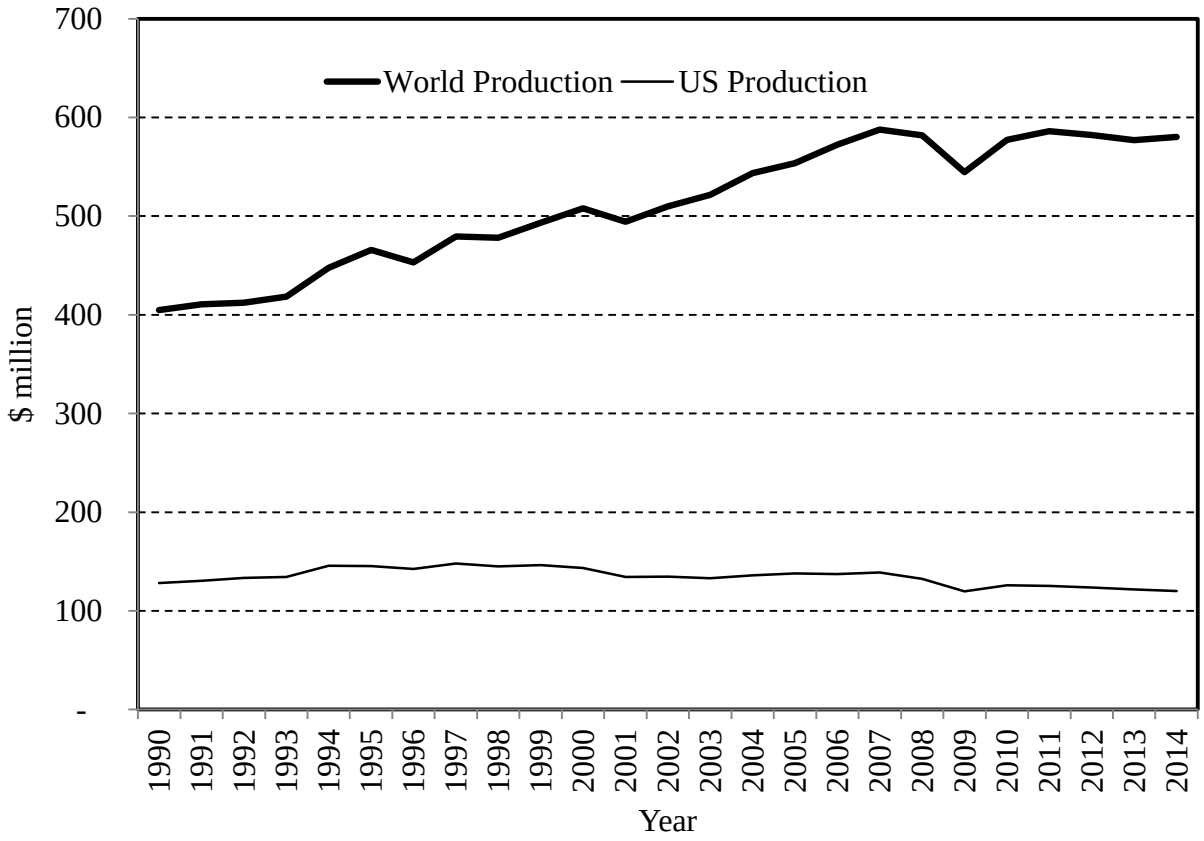
Country fixed effects refer to dummy variables for each exporter, number in parenthesis is standard error, and *, **, and * indicate the estimated parameter is significantly different from zero at the 1%, 5%, and 10% levels, respectively.*

Table 6. Results of U.S. Paper Products Import Model

Variable	OLS (*LNIMPORT)*		GMM *(LNIMPORT)*	PPML (*IMPORT)*
	1	2	3	4
LNIMPORT(-1)	0.946***	0.904***	0.941***	0.764**
	(0.010)	(0.019)	(0.018)	(0.043)
LNDISTANCE	-0.034	-0.543**	-0.052*	-0.676***
	(0.026)	(0.253)	(0.031)	(0.227)
LNEX	0.005	0.139	0.007	0.148*
	(0.005)	(0.091)	(0.006)	(0.083)
LNPARTNERGDP	0.011	-0.087	0.011	0.149**
	(0.014)	(0.091)	(0.010)	(0.062)
LNUSGDP	0.592	0.854	0.176***	0.938***
	(0.561)	(0.566)	(0.062)	(0.333)
TARIFFS	-0.072***	-0.111***	-0.042	-0.069***
	(0.021)	(0.025)	(0.036)	(0.027)
RECESSION	-0.053	-0.066	-0.056	-0.005
	(0.045)	(0.044)	(0.042)	(0.024)
WTO	0.005	-0.013	0.029	0.078
	(0.048)	(0.053)	(0.052)	(0.068)
US Internet Use	-0.423	-0.465	-0.001	-0.551***
	(0.342)	(0.343)	(0.001)	(0.200)
Partner Internet Use	-0.132**	-0.199*	-0.001***	-0.178*
	(0.067)	(0.117)	(0.000)	(0.105)
Country fixed effects	no	yes	yes	yes
Tariff endogenous	no	no	yes	no
R^2	0.979	0.981		0.992
SE of Regression	0.223	0.251		
Durbin-Watson Stat	1.918	2.170		
Log likelihood	23.01	-0.648		

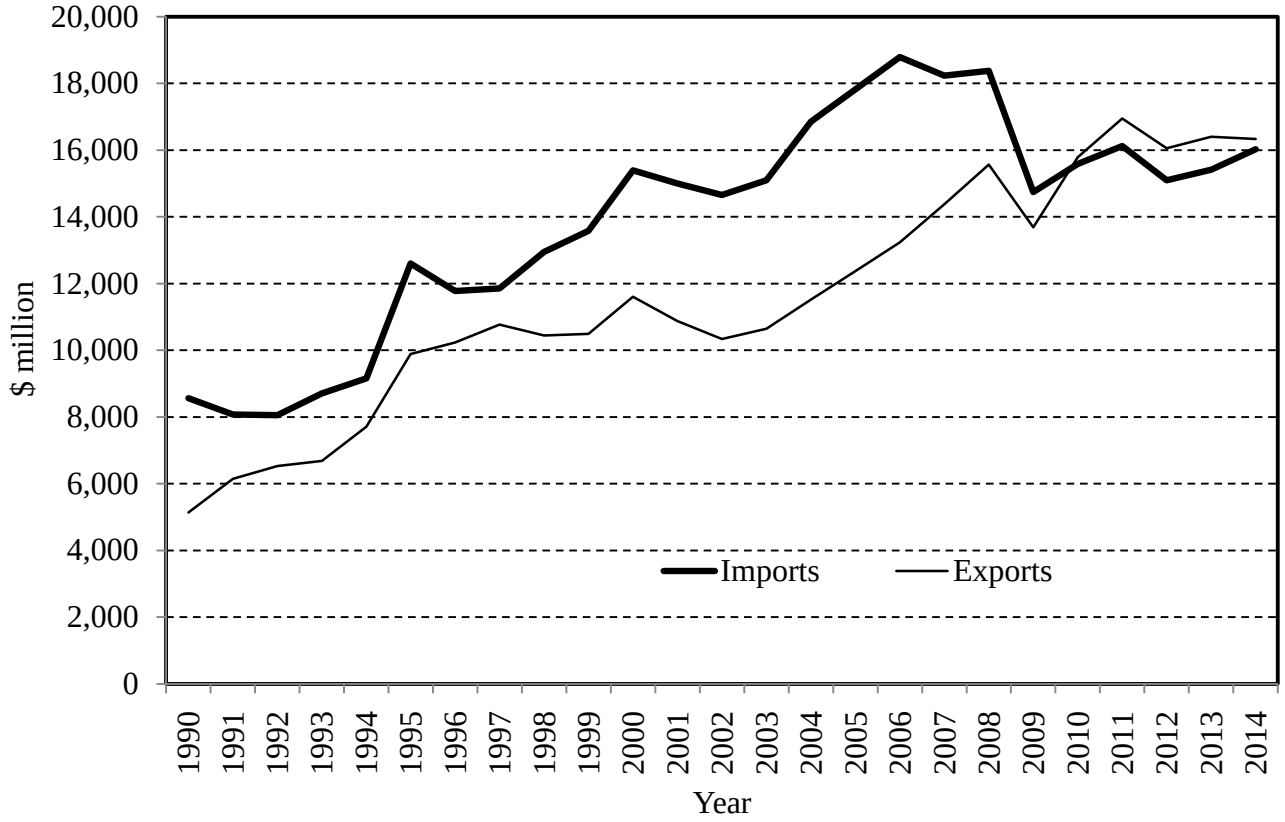
Country fixed effects refer to dummy variables for each exporter, number in parenthesis is standard error, and *, **, and * indicate the estimated parameter is significantly different from zero at the 1%, 5%, and 10% levels, respectively.*

Figure 1. U.S. and world total production of paper products: 1990-2014



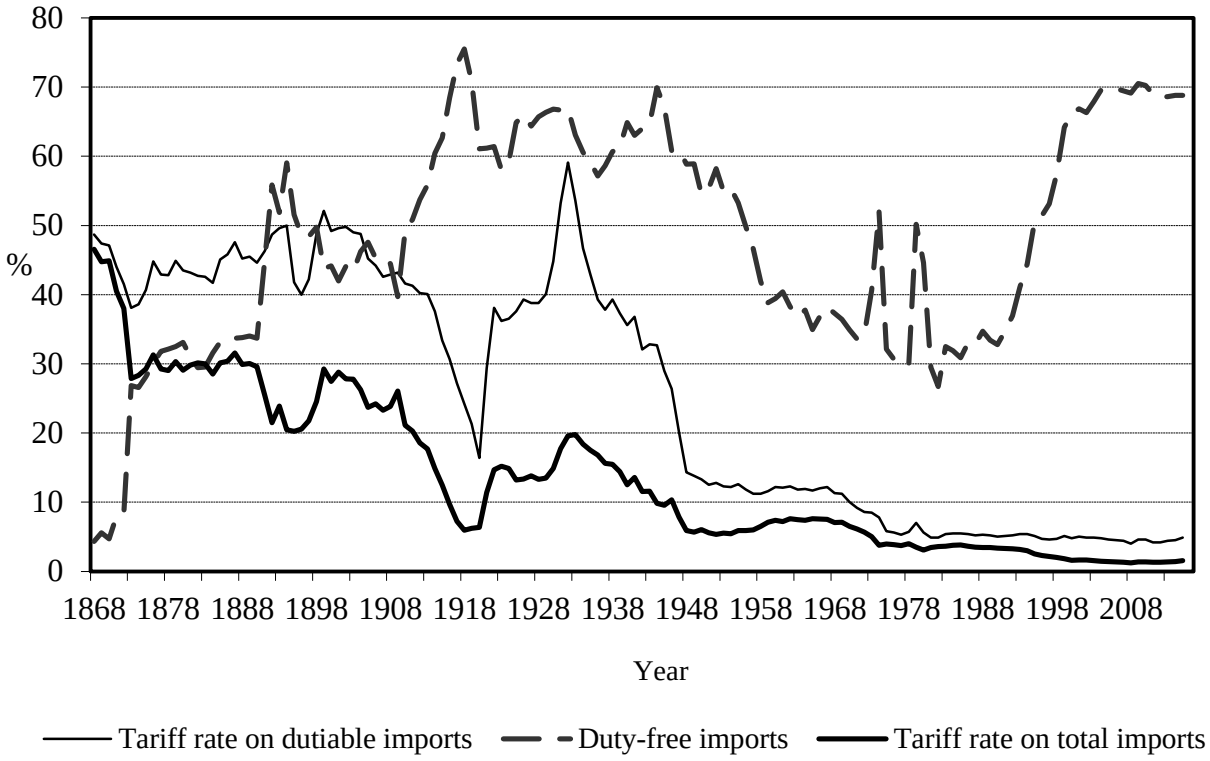
Source: FAOSTAT (2016).

Figure 2. Trade flows of U.S. paper products: 1990-2014



Source: FAOSTAT (2016).

Figure 3. Tariff rates on dutiable and total imports and share of duty-free imports in the United States, 1868–2015



Sources: Zhang (2007); USITC (2016).