Shipping the Good Fish Out? An Empirical Study on the EU Seafood Imports under the EU's Generalized System of Preferences?

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Shipping the good fish out? An empirical study on the EU seafood imports under the EU's Generalized System of Preferences

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ABSTRACT

Bauman (2004) explored the Alchian–Allen result of change in a per-unit tax or shipping fee in an *n*–good world. His approach was developed in this study to evaluate the impact of the EU Generalized System of Preferences (GSP) on the relative EU's demand for seafood quality. We first explored the theoretical Alchian–Allen result of change in ad valorem tariffs in an *n*–good world, and then tested this result in the empirical study. The theoretical analysis suggests that whether a reduced ad valorem tariff in an *n*–good case raises the relative demand for high-value goods depends not only on the substitutability between high-value and low-value goods but also on the substitutability between these similar goods with their weak substitutes. In the empirical sections, we first estimated the elasticities of the substitutions and then used these elasticities to evaluate the quality composition of the EU's seafood imports from the beneficiary countries. The empirical results in general confirm the occurrence of "shipping the good fish out" due to the reduced tariff rates under the EU's GSP arrangements.

KEYWORDS: GSP scheme; quality; EU; seafood trade

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I. Introduction

The European Union (EU)'s Generalized System of Preferences (GSP) scheme provides duty-free or duty-reduction tariff treatments for certain products that come from the designated developing countries to the EU. The EU's GSP is the most generous of all the GSP schemes implemented by developed countries and regions. In 2004, the EU's imports under the GSP scheme were euro 40 billion, which were about 1.8 times as big as the import values of the American GSP scheme (European Union 2013). According to the guidelines of the EU's GSP regulations for the period of 2006–2015, the product's coverage under the EU'S GSP regulations is very high, with a possible value of 80% of tariff lines (McQueen 2007). In December 2005, the EU decided to further grant the GSP-plus incentive to vulnerable developing countries. Products from the GSP-plus qualifying countries may enter the EU market with an extension of duty-free access or at a lower tariff rate.

The GSP scheme has a great influence on the seafood trade. Globally, 38% of the total seafood production is exported in the form of various foods and feed items (FAO 2012), and as much as 78% is exposed to trade competition, indicating an overwhelming impact of seafood trade on seafood consumption (Tveterås et al. 2012). Among the main suppliers, developing countries contribute substantially to the global seafood consumption. Seafood products from developing countries accounted for 48% of the global seafood trade in 2010 (FAO 2012). In the EU market, developing countries have been responsible for 60% of the total import value of seafood products during the last decade (Table 1). At the same time, the seafood trade contributes substantially to the economies of developing countries in terms of foreign exchange earnings and labor employed (Panagariya 2002; Bostock, Greenhalgh, and Kleih 2004;

Muhammad 2007; Béné 2008; Béné, Lawton, and Allison 2010; Ghazalian, Larue, and Gervais 2011). The duty-free access under the GSP-plus arrangement would be extended to include more seafood products from developing countries, which are currently outside the standard EU'S GSP arrangement.

[Table 1 here]

A number of studies have explored the utilization of the preferential regimes and assessed the impacts of those regimes on agricultural or seafood trade flows (Guillotreau & Peridy, 2000; Asche, 2001; Brester, Marsh, & Smith, 2002; Panagariya, 2002; Bureau, Chakir, and Gallezot 2007; Muhammad, 2007 and 2009; Agostino, Demaria, and Trivieri 2010; Muhammad, Amponsah, and Dennis 2010; Serrano, and Pinilla 2014). Of them, Bureau, Chakir, and Gallezot (2007) provided evidence of the high utilization of the EU and the US GSP schemes in the agricultural, food, and fisheries sectors. Agostino, Demaria, and Trivieri (2010) investigated the relationships between the costs of compliance and the impact of the preferential margin for agricultural products under the non-reciprocal preferential regimes. Guillotreau and Peridy (2000) verified the small effect of the EU trade barriers on seafood trade, while Muhammad, Amponsah, and Dennis (2007) confirmed that expanding preferential access would probably lead to an increase in the EU imports of chilled fish fillets from Africa.

Most of the above-cited studies focused on the trade-creation or trade-reduction effects of trade policies. Little attention has been paid to trade policies' impacts on the relative demand for various quality products. Unlike a unit transaction cost, which raises the demand for high-value products (the Alchian–Allen effect), an ad valorem tariff lowers the share of high-value products that are in demand (Hummels and Skiba 2004). However, in an *n*–good world, the conclusion given by Hummels and Skiba, (2004) is not certain. Instead, the result is subject to the substitutability between the targeted high-value goods and low-value goods and the substitutability between targeted goods and their substitutes. Bauman (2004) explored the presence of the Alchian–Allen effect of changes in a per-unit tax or shipping fee in an *n*–good world. His approach is borrowed in this study to examine the impact of changes in ad valorem tariffs on import composition of trade in an *n*–good world.

Among the empirical studies on Alchian–Allen effect (e.g., Hummels and Skiba 2004; Ramos, Bureau, and Salvatici 2007; Harrigan and Deng 2010), few have directly related substitution elasticities to the occurrence of Alchian–Allen effects. To our knowledge, this study is the first one to test Alchian–Allen effect by using substitution elasticities to assess changes in the ratio of import volume of high-value products to that of low-value products. In addition to the methodological contribution, we also attempt to offer a reasonable approximation of the impact of the EU'S GSP in terms of quality updating of trade. This can supplement the existing studies (e.g., Guillotreau and Peridy 2000; Bureau, Chakir, and Gallezot 2007; Muhammad 2007; Agostino, Demaria, and Trivieri 2010; Aiello, Cardamone, and Agostino 2010), which mainly focused on trade creation of the GSP schemes.

The resulting trade composition in response to changes in tariff rates has also particular impacts on regional markets in developing countries. As stated in Béné, Lawton, and Allison (2010), the current strategy of targeting developed countries' markets with high-value seafood adopted by many African governments and international development agencies would strengthen more lower-value fish trade in the region. Asche et al. (2015) discussed the driving forces and the theoretical basis behind the flows of high-value seafood from developing countries to developed countries. It is, therefore, important to have empirical studies on whether changes in preferential regimes have strengthened this trend.

Among the various EU'S GSP arrangements, the GSP-plus component, which has been in effect since 2006, is the most influential scheme, because it provides its beneficiaries with an extension of duty- and quota-free market access. In the study, we first examine whether the GSP-plus scheme have improved the market share of the high-value seafood traded from these beneficiary countries. Since the EU has implemented an updated GSP scheme in 2014, which makes a greater number of developing countries eligible for the GSP-plus, we further predict the potential impact of the new GSP-plus scheme on the quality composition of seafood products from the eligible countries. For comparison, we also investigate the possible determinants of the quality mix of the EU seafood imports from the developing countries under all the GSP arrangements.

In the following section, we first discuss the EU trade preferential arrangements and seafood imports from developing countries. Second, the empirical models are established and the estimation results are presented. Afterwards, the impact of tariff treatments on quality mix of imports are evaluated. The final section consists of summary and implications of this study.

II. GSP and the EU seafood trade

Tariff policy remains one of the most-used instruments to protect agricultural and fisheries products. For example, the EU applies a most-favored nation (MFN) duty of 12% for frozen shrimps, 20% for cooked and peeled shrimps, and as high as 24% for canned tuna and tuna loins. The competitiveness of fisheries products from different exporting countries is subject to the relevant trade barriers they face. For example, before 2005, seafood products from Sri Lanka fell under the tariff structure ranging from 11.5% for fresh and chilled fillets to 20.5% for tuna loins, which greatly reduced the competitive advantage of Sri Lanka's seafood products compared with the similar products from other developing countries under better tariff regimes in the EU market (Garrett and Brown 2009).

However, at the same time, the EU grants duty-reduction or duty-free access to beneficiary countries for certain product lines under the GSP scheme. The current GSP scheme is comprised of three arrangements: (*i*) the standard GSP arrangement, (*ii*) the special arrangement for least developed countries, i.e., Everything but Arm (EBA), and (*iii*) the GSP-plus incentive for vulnerable countries. Under the standard GSP arrangement, the current utilization rate of fisheries product lines is 14.09%, which corresponds to a 59.44% preferential margin (the difference between the duty payable under the GSP and the duty that would be assessed in the absence of the GSP); the counterparts for fish preparation are 20.54% and 55.27%, respectively (Agostino, Demaria, and Trivieri 2010).

The GSP-plus, which provides the beneficiaries with an extension of duty- and quota-free market access, aims to encourage sustainable development and good governance in the qualifying countries. In December 2005, the EU decided to grant the

GSP-plus incentive to fifteen vulnerable developing countries, namely Moldova, Georgia, Mongolia, Sri Lanka, five Andean countries (Bolivia, Columbia, Ecuador, Peru, and Venezuela) and six Central American countries (Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama). For these countries, the EU provided duty-free treatments to nearly all products falling under the normal GSP grogram. The GSP-plus came into force on 1 January 2006 and was extended through the end of 2008. As a result of the re-examination in October 2008, the GSP-plus list for 2009–2011 covered thirteen of the current beneficiaries (with the exception of Sri Lanka and Panama) and three new countries, namely Armenia, Azerbaijan, and Paraguay. While Sri Lanka lost the qualification because it failed to fulfill the requirements, Panama missed the deadline to submit its application, which led to the cancellation.

The period of the GSP-plus scheme was extended to 31 December 2013 before the EU implemented an updated GSP on 1 January 2014. Under the new GSP scheme, the number of beneficiary countries was reduced from 176 countries to around 89 countries. Of them, 49 countries continue to receive EBA treatment. The other 40 GSP beneficiaries, with the exception of China, Colombia, India, Indonesia, Thailand, and Vietnam, are eligible to apply for the GSP-plus, i.e. so-called the GSP-plus eligible countries. Currently, ten developing countries have access to the GSP-plus benefits as of 2014. In addition, four countries are involved in discussions with the EU institutions and are expected to be granted the GSP-plus status in the future.

Before the imposition of the GSP-plus scheme, on average, the seafood trade between the beneficiary countries and the EU represented 6.2% of the total EU seafood import value in 1999–2005 (Table 1). This ratio grew steadily, reached a peak of 8.5%

in 2006–2008, and dropped slightly to 7.8% in 2009–2012 after the imposition of the GSP-plus scheme in 2005. In these three periods, the volume share of the beneficiaries in the EU market was 5.5%, 7.8%, and 8.0%, respectively. Recognizing the rising trend of the EU total seafood imports, the growths in seafood exports under the GSP-plus are actually great. Indeed, between 2005 and 2012, those beneficiary countries raised their seafood exports to the EU by 66% in term of value and 8.8% in term of volume. The growth rate is much higher in export value than in export volume, reflecting a significant change in the quality mix of seafood traded. In other words, this suggests a significant growth in the EU's imports of high-value seafood products relative to low-value seafood products from the GSP-plus beneficiary countries.

Taking Sri Lanka as an example, the impact of the GSP-plus scheme is evidenced in the observed trade pattern of seafood exports in 2005 when Sri Lanka was granted the GSP-plus benefits by the EU.[1] Compared to 2004, in 2005, seafood exports from Sri Lanka to the EU increased by 65% in value and 46% in volume. However in August 2010 when Sri Lanka's benefits were temporarily withdrawn because the Government declined to implement some of the EU's recommendations to strengthen good governance, seafood exports from Sri Lanka to the EU decreased dramatically.

III. Model and data

Connecting trade barriers and transaction costs to the quality mix of trade has a long history in the trade literature. Alchian and Allen (1964) argued that a per-unit transactions cost leads firms to ship high-value goods abroad, which in their case was called "shipping the good apples out". Hummels and Skiba (2004) extended Alchian

[1] The implementation for Sri Lanka was accelerated to 2005 in order to help boost the exporting sector after the tsunami (Wijayasiri, 2007).

and Allen's theorem and explored the impact of ad valorem tariffs on quality composition of trade. As discussed by Bauman (2004), in a two-good world, substituting out of low-value goods necessary implies substituting into high-value goods. However, this is not certain in a more complicated *n*-good world since the reduced price of high-value products relative to low-value products is not the only relative price change, instead there also exist relative price changes between the two similar goods and their weak substitutes. Bauman (2004) generalized the theorem in terms of a per-unit shipping cost in an *n*–good world. In this paper, we intend to develop the theorem in terms of ad valorem tariffs in an *n*–good world.

To illustrate the model in an *n*–good world, it is sufficient to set the analysis in a 4–good situation, where q_1 and q_2 denote quantities (and names) of similar goods and q_3 and q_4 denote quantities (and names) of their weak substitutes. The Hicksian demand depends on the CIF (cost, insurance, and freight) prices of high-value and low-value products and their weak substitutes. This means the following Hicksian compensated demand function:

$$q_i = h_i(p_1, p_2, p_3, p_4) \tag{1}$$

where i denotes products (1 = high-value good, 2 = low-value good, 3 and 4 = week substitutes); q and p are the quantity and the CIF price at the destination border, respectively. Here, we assume the two products of interest and their week substitutes are all imported from developing countries, noting the strong competition between seafood products from these countries (Zhang, Tveterås, and Lien 2014). The CIF price depends on the border price (p^*) in the exporting country, a common ad valorem tariff rate ($g > 1$), and a per-unit shipping charge (f_i). For goods 1 and 2, it means:

$$p_i = p_i^* g + f_i \tag{2}$$

The impact of changes in ad valorem tariffs on the quantity ratio is given by taking the derivate q_1/q_2 with respect to g:

$$\frac{\partial(q_1/q_2)}{\partial g} = \frac{1}{q_2^2}\left(q_2 \frac{\partial q_1}{\partial p_1} p_1^* + q_2 \frac{\partial q_1}{\partial p_2} p_2^*\right) - \frac{1}{q_2^2}\left(q_1 \frac{\partial q_2}{\partial p_1} p_1^* + q_1 \frac{\partial q_2}{\partial p_2} p_2^*\right) \tag{3}$$

Using equation (2) and the formula for the compensated elasticities ($e_{ij} = \frac{\partial q_i}{\partial p_j}\frac{p_j}{q_i}$), we can rewrite equation (3) as:

$$\frac{\partial(q_1/q_2)}{\partial g} = \frac{q_1}{q_2}\left(e_{11}\frac{p_1^*}{p_1} + e_{12}\frac{p_2^*}{p_2} - e_{21}\frac{p_1^*}{p_1} - e_{22}\frac{p_2^*}{p_2}\right) \tag{4}$$

The homogeneity constraint due to the demand theory implies:

$$\sum_{j=1}^{4} e_{ij} = 0 \tag{5}$$

Next, we use equation (5) to substitute e_{12} and e_{22} in equation (4), resulting in:

$$\frac{\partial(q_1/q_2)}{\partial g} = \frac{q_1}{q_2}\left((e_{11} - e_{21})(\frac{p_1^*}{p_1} - \frac{p_2^*}{p_2}) + (e_{23} - e_{13})\frac{p_2^*}{p_2} + (e_{24} - e_{14})\frac{p_2^*}{p_2}\right) \tag{6}$$

A negative sign of (6) indicates the existence of quality upgrading, following a reduced tariff rate. More specifically, it means that a tariff reduction increases the relative price of the low-value product and results in the substitution out of the low-value product with the high-value product.

In equation (6), the ratio of the high-value product prices is generally bigger than the ratio of the low-value product prices.[2] If the effects of the weak substitutes (q_3 and

[2] Replacing p_i^* with equation (2) yields $\frac{p_1^*}{p_1} - \frac{p_2^*}{p_2} = \frac{f_2 p_1 - f_1 p_2}{g p_1 p_2}$, which is positive given $p_1 > p_2$ and the same per-unit shipping charge for the two goods (Hummels & Skiba, 2004). When f_1 does not equal f_2, noting $f_2 p_1 - f_1 p_2 = f_2(p_1 - p_2) - (f_1 - f_2)p_2$, an insignificant gap between

q_4) are ignored, the sufficient condition for a negative sign of equation (6) is that q_1 and q_2 are not highly complementary ($e_{11} < e_{21}$). In other words, e_{21} is not negative enough. Taking q_3 and q_4 into account, the similar degrees of substitutability of q_1 and q_2 for q_3, and q_1 and q_2 for q_4 can result in a negative sign of equation (6). As observed by Bauman (2004), there is another possibility: the closer prices, the greater substitutability between the products of interest, indicating the possibility that $e_{23} < e_{13}$ and $e_{24} > e_{14}$, given $p_3 > p_4$. While the former inequality strengthens quality upgrading due to a reduced tariff rate, the latter inequality weakens this effect. The upshot of all this is that the effect of changes in an ad valorem tariff is an empirical issue. Whether a reduced ad valorem tariff in an n–good case raises the relative demand for high-value good depends not only on the substitutability between high-value and low-value goods but also on the substitutability between these similar goods and their weak substitutes.

Following the same logic, the analysis can be applied to the situation in which high-value product q_3 and low-value product q_4 are close products, with q_1 and q_2 being weak substitutes. The derived equation is in the form:

$$\frac{\partial(q_3/q_4)}{\partial g}=\frac{q_3}{q_4}\left((e_{33}-e_{43})(\frac{p_3^*}{p_3}-\frac{p_4^*}{p_4})+(e_{41}-e_{31})\frac{p_4^*}{p_4}+(e_{42}-e_{32})\frac{p_4^*}{p_4}\right). \qquad (7)$$

The Import demand model

Among the demand system models, Deaton and Muellbauer's (1980) almost ideal demand system (AIDS) model has been extensively applied to study the seafood product demand (Eales Durham, and Wessells 1997; Salvanes and DeVoretz 1997; Asche, Bjørndal, and Salvanes 1998; Abdulai and Aubert 2004; Tonsor and Marsh

freight rates (a reasonable assumption for a particular product group like seafood) yields a positive sign of the above term.

2007; Zhang, Tveterås, and Lien 2014; Zhang 2015) and to evaluate the impacts of trade policies (Irwin 2003; Feleke and Liu 2005). As noted by Pollack and Wales (1992), the complete demand system generally represents the process of allocating expenditures, which satisfies the budget constraint. Furthermore, analogous to any typical ordinary demand system, the AIDS model is derived from a multi-stage budgeting process based upon the weak separability assumption. In a high-level stage, the EU importers decide how much of a particular commodity group (such as seafood) to import. In the next step, given the total amount to be imported, the importers decide how much to import for each sub-group. The conventional AIDS model is in the form:

$$w_{i,t} = a_i + \beta_i \log(x_t/P_t) + \sum_{j=1}^{4} \gamma_{ij} \log p_{j,t}, \quad (8)$$

where i represents the seafood product, t denotes the monthly unit of observation, w_i is the expenditure share, and $p_{j,t}$ denotes the nominal CIF price of imported good j at time t. Here, x_t is the total expenditure and P_t is a non-linear price index. Hence, x/P represents the "real" expenditure.

In the model for the GSP-plus beneficiary countries, a dummy variable (D) is incorporated into equation (8) to account for possible structural change due to the imposition of the GSP-plus as of 2006. Our data cover the period from 1999 to 2012. The dummy variable has a value of one between 2006 and 2012 when the GSP-plus was granted to the beneficiary countries, and is zero otherwise. A significant positive coefficient of the dummy variable in the high-value product equation but not in the low-value product equation supports the hypothesis of "shipping the good fish out", which is probably related to the reduction in the ad valorem tariff as of 2006.

As is common in the literature, the non-linear price index is approximated by the Stone index P^*, i.e. $\log P_t^* = \sum_{j=1}^{4} w_{j,t} \log p_{j,t}$. This specification gives rise to the following empirical model:

$$w_{i,t} = a_i + \beta_i \log (x_t/P_t^*) + \sum_{j=1}^{4} \gamma_{ij} \log p_{j,t} + \delta_{ij} D_t + u_{i,t}. \quad (9)$$

Error term ($u_{i,t}$) in the equation captures the unobserved factors which may affect the demand for seafood from developing countries. The properties of the demand system imply the following general restrictions on the demand parameters:

$$\sum_j \gamma_{ij} = 0 \quad \text{(Homogeneity)} \quad (10a)$$

$$\gamma_{ij} = \gamma_{ji} \quad \text{(Symmetry)} \quad (10b)$$

$$\sum_{i=1}^{4} \alpha_i = 1, \; \sum_{i=1}^{4} \beta_i = \sum_{i=1}^{4} \gamma_{ij} = \sum_{i=1}^{4} \delta_{ij} = 0 \quad \text{(Adding up)} \quad (10c)$$

Using the estimated demand parameters, we can derive the income and Hicksian price elasticities:

$$e_i = 1 + \beta_i / \overline{w}_i \quad \text{(Income elasticity)} \quad (11a)$$

$$e_{ii} = -1 + \gamma_{ii} / \overline{w}_i + \overline{w}_i \quad \text{(Own-price elasticity)} \quad (11b)$$

$$e_{ij} = \gamma_{ij} / \overline{w}_i + \overline{w}_j \quad \text{(Cross-price elasticity)} \quad (11c)$$

where $\overline{w}_i$ and $\overline{w}_j$ are the average expenditure share of commodity *i* and *j*, respectively.

For the GSP-plus eligible countries and all the developing countries under the GSP scheme, the conventional AIDS models exclusive of the dummy variable are applied. After estimating the three demand models, we derive the Hicksian price elasticities from the estimation and then use equations (6) and (7) to evaluate changes in the quality composition of seafood imports from the beneficiary countries.

Empirical application and data processing

The External Trade Section of the Statistical Office of the EU (Eurostat) provides monthly data on seafood trade under different tariff regimes. For the GSP-plus beneficiaries, there are a total of 66 products (species) traded. For a particular tariff regime, when estimating substitutability between these products, the demand system confined to individual countries ignores the competition between products from different countries. Accordingly, our study focuses on the impact of changes in the EU trade policies on the quality mix of seafood imports at the product level rather than individual countries. We aggregate those fisheries products to four groups which have different level of quality regarding prices of species within the product group, see more below.

A growing number of studies have estimated substitutability between seafood products by using the demand system models (Asche, Bjørndal, and Gordon 2007; Gatllet 2009). The empirical results can be borrowed to evaluate the impact of trade policies on quality composition of some particular species. In this paper, we estimate the substitutability between high-value finfish, low-value finfish, crustaceans, and mollusks. This means the import allocation is in a high-level budgeting stage. In this stage, given the total amount to be imported, the importers decide how much to import for each seafood subgroup. Demand system confined to a lower level budgeting stage may bias the estimates due to interactions between products in the parallel sub-groups (Yang and Koo 1994).

The monthly seafood trade data from 1999 to 2012 are gathered from Eurostat and are based on the 8-digit Harmonized System (HS) classifications 03, 1604, and 1605. The Harmonized System has been updated several times during the sample period. In

2002, there were 145 and 296 HS 8-digit codes for the GSP-plus beneficiaries and the GSP-plus eligible countries, respectively. When processing the data, the first step is to match those entries to species such as tuna, haddock, Alaska pollock, and so on. This results in 66 and 72 products (species) for the GSP-plus beneficiaries and the GSP-plus eligible countries, respectively. Next, following Delgado et al. (2003), we classified the fisheries products into four groups on the basis of species and prices, i.e. high-value finfish (mainly marine fish and high-value freshwater fish), low-value finfish (mainly small marine fish and freshwater fish), crustaceans, and mollusks. Take the GSP-plus beneficiaries as an example: High-value finfish includes mainly tuna, cod, hake, bonito, swordfish, and its average price is about 2.89 Euros / kg. Low-value finfish is composed mainly of mackerel, anchovy, sardine, and Alaska pollock, and its average price is about 0.42 Euros/kg. While shrimp is the dominant product in crustaceans group, mollusks, scallops, and squids are the major products in mollusks. The average prices of crustaceans and mollusks are 5.51 Euros / kg and 3.17 Euros / kg, respectively.

After grouping seafood products, we examine the impacts of the GSP arrangements on the quantity ratio of high-value finfish to low-value finfish and the quantity ratio of crustaceans to mollusks. To study pairwise high-value finfish and low-value finfish, crustaceans and mollusks are treated as weak substitutes, and vice versa.

IV. Estimation results

The monthly data on import value and quantity extended from January 1999 to December 2012 are used to estimate the demand system for the GSP-plus beneficiaries, the GSP-plus eligible countries, and the developing countries under all the GSP arrangements. For each model, the import value is measured in euros and the import quantity is measured in kilogram units, resulting in a price with a unit of euros per kilogram. The expenditure share is further calculated by dividing the import value by the total import value of the four products in the demand system.

The demand system is composed of four equations distinguished by high-value finfish, low-value finfish, crustaceans, and mollusks. The system is estimated by using the generalized method of moments (GMM) estimator, which is robust to departures from normality. The Newey–West covariance matrix is employed to correct for simultaneous-equation bias and cross-equation correlation in the error terms. When estimating the system equations, one equation is dropped to avoid singularity in the variance–covariance matrix. The relevant coefficients for the dropped equation are recovered on the basis of the demand constraints. When estimating the demand models, the theoretical constraints (homogeneity and symmetry) are imposed. The Durbin–Wu–Hausman approach is applied to test the endogeneity of the price variable. In each case, the null hypothesis of the endogeneity is rejected at the conventional significance level, indicating the GMM estimator is unbiased.

In total, we estimated three import demand models distinguished by the sample countries, i.e. the GSP-plus beneficiary countries, the GSP-plus eligible countries, and the developing countries under all the GSP components (the estimation results are available upon request). In the model for the GSP-plus beneficiary countries, the dummy variable is directly related to the quality composition of the seafood imports. The estimation results show that the dummy variable is not significant in the high-value finfish and low-value finfish equations, suggesting the rejection of the "shipping the good fish out" hypothesis. However, the dummy variable is significant in the crustaceans equation but not in the mollusks equation. The positive value of the dummy variable (D_3 = 0.025) in the crustaceans equation indicates that, since 2006, more crustaceans relative to mollusks were imported by the EU. This provides a sufficient statistical evidence to say that shifts have occurred in favor of high-value crustaceans and the GSP-plus has contributed to some of that better position in the market. However, other potential sources of shifts in demand may occur during the sample period. Moreover, dummy variable coding disregards partial coverage of trade preferences and may bias the estimated coefficients (Aiello, Cardamone, and Agostino 2010). Thus we mainly rely on substitutability (Equations 6 and 7) to assess quality upgrading for the GSP-plus beneficiaries, in the same way that we work in scenarios of the GSP-plus eligible countries and the developing countries under all the GSP arrangements.

For the three models, the derived expenditure and Hicksian price elasticities are listed in Table 2. The estimates are appealing in terms of size and magnitude. For the GSP-plus beneficiary countries, the expenditure elasticities are positive and the own-price elasticities are negative, as expected under the demand rule. The cross-price elasticities are mostly positive, indicating net substitutes. For the GSP-plus eligible countries, 14 out of the 16 cross-price elasticities are significant with a positive sign, suggesting a substitute relationship between those goods. For all the GSP countries, the estimated expenditure elasticity is close to unity with the exception the one in the low-value finfish equation (e_3 = 0.76). This suggests that the EU preferences for high-value finfish, crustaceans, and mollusks are homothetic. Again, most pairs of products are substitutes as indicated by the positive cross-price elasticities.

[Table 2 here]

V. Evaluating the occurrence of "shipping the good fish out"

The substitution elasticities between high-value goods, low-value goods, and their weak substitutes are reported in Table 3. These elasticities were further used to predict the signs of Equations (6) and (7). The suggested signs associated with the estimated elasticities can help us understand the effect of free market access on the quality composition of seafood imports from developing countries. For the GSP-plus countries, the comparison between the estimation results (the significant dummy variable in the crustaceans equation) and the prediction results can shed light on the consistency between those two methods. Next, we will discuss the three scenarios one by one.

[Table 3 here]

GSP-plus countries

In this model, for finfish products (q_1 vs. q_2), only the difference between the own-price elasticity of high-value finfish and the cross-price elasticity of low-value finfish with respect to high-value finfish is statistically significant by using the Wald test ($e_{11} - e_{21} = -1.277$). The insignificant differences between e_{23} and e_{13} and between e_{24} and e_{14} suggest the same substitutability of high-value and low-value finfish with respect to either crustaceans or mollusks. In the case of crustaceans and mollusks (q_3 vs. q_4), the crustaceans product is a closer substitute for high-value finfish than mollusks ($e_{41} - e_{31}$

= –0.698), which would strengthen the negative magnitude of equation (7). Altogether, those results indicate a negative sign for equations (6) and (7) (Table 3). This means a positive response of the relative demand for high-value finfish (versus low-value finfish) and crustaceans (versus mollusks) to the imposition of the GSP-plus scheme.

However, the estimation results of the dummy variable in the demand model suggest an increased demand for crustaceans but not for high-value finfish. This can be partially explained by the substitutability between high-value finfish and crustaceans. In the crustaceans and mollusks equations, the strong substitutability between crustaceans and high-value finfish is evidenced by cross-price elasticity (e_{31} = 0.632); however, low-value finfish is a weak substitute for crustaceans (e_{32} = 0.028). Thus, consumers may substitute high-value finfish with crustaceans following price changes due to a reduced tariff duty, which offsets the rise in the demand for high-value finfish due to changes in the relative prices of high-value and low-value finfish. Another reason that may explain the estimation results is related to the quantity ratio. From 1999 to 2005, on average, the quantity ratio of high-value finfish to low-value finfish was about 17.6. The corresponding ratio for crustaceans and mollusks was about 1.3. Thus, while the evaluation results indicate a positive response of the quality composition of finfish to a tariff rate reduction, the dominant share of high-value finfish probably make it difficult for the estimation to identify a small increase in the relative demand for high-value finfish.

GSP-plus eligible countries

For the model of the GSP-plus eligible countries, the evaluation results for this model can reveal the maximal effect of the GSP-plus on the seafood imports from the eligible countries.

The evaluation results indicate a significant difference between the own-price elasticity of the high-value product and the cross-price elasticity of the low-value product with respect to the high-value product (for finfish $e_{11} - e_{21} = -1.069$; for crustaceans and mollusks $e_{33} - e_{43} = -1.177$). For the pair of high-value and low-value finfish, referring to equation (6), the negative magnitude of $e_{11} - e_{21}$ is offset by the difference between the cross-price elasticities of those two products with respect to mollusks ($e_{24} - e_{14} = 0.390$), which makes the equation's sign ambiguous. After considering further the large quantity ratio of high-value finfish to low-value finfish (17.3), the positive impact of a tariff reduction on the relative demand for high-value finfish is probably out of expectation.

In the case of the pair of crustaceans and mollusks, the crustaceans product is a closer substitute for high-value finfish than mollusks ($e_{41} - e_{31} = -0.509$), which offsets the marginal inverse impact of their relative substitutability for low-value finfish ($e_{42} - e_{32} = 0.114$), and further leads to a net negative size of Equation (7). The negative sign of (7) indicates the occurrence of the "shipping the good fish out" effect when all the GSP-plus eligible countries are granted the benefits.

Developing countries under all the GSP arrangements

Finally, we focus on the impact of the EU trade arrangements on the relative demand for the high-value seafood products from all developing countries. Considering the large share of seafood from those countries in terms of either value (about 58.5%) or quantity (about 59.7%) in the EU import market (as shown in Table 1), the evaluation results have an important implication from the perspectives of both developing countries and the EU consumers. The average quantity ratio of high-value finfish to low-value finfish during the sample period is about 2.7, which is much lower than the corresponding ratio for the GSP-plus countries and is probably sensitive to the relative price changes due to a reduced tariff rate. The quantity ratio of crustaceans to mollusks is about 0.99, indicating the close share of those two products.

The cross-price elasticity for low-value finfish with respect to high-value finfish is bigger than the own-price elasticity of high-value finfish in absolute value ($e_{21} = 0.315$ and $e_{11} = -0.239$). This yields a significant negative value of –0.555 for $e_{11} - e_{21}$. The crustaceans product is a substitute for high-value finfish, but not for low-value finfish as evidenced by the cross-price elasticities. These findings confirm Bauman's (2004) proposition that products with close prices tend to be close substitutes, although the difference between those two elasticities ($e_{23} - e_{13}$) is statistically insignificant. In contrast, the difference between the cross-price elasticities of high-value and low-value finfish with respect to mollusks is statistically significant with a value of –0.347 ($e_{24} - e_{14}$). Altogether, the sign of equation (6) is unambiguously negative, indicating the occurrence of "shipping the good fish out" following a reduced tariff duty.

Turn to the case of competition between crustaceans and mollusks. The magnitude of the own-price elasticity of crustaceans is close to the cross-price elasticity of mollusks with respect to crustaceans (–0.334 vs. 0.338). This leads to a significant negative difference with a value of –0.671 (= $e_{33} - e_{43}$). The substitutability between crustaceans and high-value finfish is not dominant, which makes the value of $e_{41} - e_{31}$ insignificant. On the other hand, the complementarity between mollusks and low-value finfish and the lack of interaction between crustaceans and low-value finfish generate a negative difference between the relevant cross-price elasticities ($e_{42} - e_{32} = -0.305$). Thus, the sign of equation (7) is also unambiguously negative. This means that a tariff reduction would increase the relative demand for crustaceans.

VI. Conclusion

In this study, we evaluated the impacts of the EU'S GSP scheme on quality composition of seafood imports from developing countries. Our comparative analysis suggests that in an n–good case, whether a tariff reduction raises the relative demand for high-value seafood depends on substitutability between high-value and low-value products, as well as substitutability between these similar products and their weak substitutes. This study first estimated the demand elasticities of high-value finfish, low-value finfish, crustaceans, and mollusks from developing countries under different trade arrangements, i.e. the GSP-plus countries, the GSP-plus eligible countries, and the developing countries under all the GSP arrangements. Using the derived substitution elasticities, we justified the effects of the tariff reduction on demand for these products. The empirical results generally support the hypothesis that the EU'S GSP scheme leads to the occurrence of the "shipping good fish out" phenomenon.

For the GSP-plus countries, both the estimation results and evaluation results suggest a growing import demand for crustaceans due to the imposition of the GSP-plus from 2006 to 2012. The evaluation results also indicate more high-value finfish would be shipped out than low-value finfish. This, however, is not supported by estimation results. This is probably due to the dominant shares of high-value finfish out of the total finfish products exported from the GSP-plus beneficiary countries.

The evaluation results suggest that, for the GSP-plus eligible countries, more crustaceans would be shipped out due to a reduced tariff rate. Besides the replacement of mollusks with crustaceans, the strong substitutability between crustaceans and high-value finfish also contributes to this result. For developing countries as a whole, following a reduced tariff rate, more high-value finfish and crustaceans would be shipped out than low-value finfish and mollusks, respectively. One reason for this result is related to the complementary relationship between low-value finfish and mollusks. The demand for high-value finfish would be raised due to the increased relative price of mollusks, and hence the reduced consumption of mollusks and their complement, low-value finfish. This should strengthen the demand for high-value finfish relative to low-value finfish.

The EU is one of the leading seafood importers in the world and its total import demand for seafood has grown exponentially during the last few decades. In the EU market, developing countries are the primary suppliers of seafood products. Since the 1990s, a pro-fish trade narrative has emerged, which is further echoed by a number of national and international institutes through trade policies targeting the promotion of the seafood trade. Whether the EU'S GSP scheme affects quality mix of seafood imports from developing countries has a strong implication on their regional trade and development. First, quality upgrading of exports to the EU would strengthen the growing intro-regional demand for lower-value fish and hence benefit the economies of developing countries and regions like sub-Saharan Africa (Béné, Lawton, and Allison

2010). Second, the proceeds of fish exports can raise incomes for employees in the fishery sectors and provide funds for the emerging aquaculture sector (e.g. tilapia farming in Africa). Third, in terms of food sovereignty, the increased incomes from the seafood trade allow for the purchase of other substitutes, which makes people in developing countries better (Asche, et al. 2015). Thus, the impact on quality composition of seafood imports should be taken into account when evaluating the efficiency of trade policies like the new EU'S GSP scheme.

Though our paper is probably the first empirical study using the estimated substitution elasticities to directly test the Alchian–Allen effect, it also raises a number of questions requiring further empirical research. The first issue that needs to be addressed is related to the data aggregation. We estimated the demand model at a high level of aggregation to make the parameter requirement reasonable. Although this coincides with the demand theory and is consistent with a clear picture of trend in demand across species (World Bank 2013), using disaggregate data can provide detailed insight into the efficacy of the EU'S GSP scheme. Second, we analyzed the impacts on quality mix of a one-percent change in tariff rates and specially justified the sign of the ratio of high-value and lower-value products. Subsequently, we need to work on individual commodities by taking into account the detailed tariff rates and preferential margins. Finally, if data for border prices are available, it would be possible to assess the exact extent to which substitutability between high-value and low-value goods and their week substitutes strengthens (or weakens) the Alchian–Allen effect.

Acknowledgement

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Table 1. EU seafood imports by tariff regime: 1999:2012.

	Seafood imports from							
	Total		GSP–plus beneficiary countries		GSP–plus eligible countries		All developing countries	
Year	Volume (1000 tones)	Value (mil. euro)	Volume share (%)	Value share (%)	Volume share (%)	Value share (%)	Volume share (%)	Value share (%)
1999	3,704	10,410	5.41	5.79	7.23	7.78	55.0	53.6
2000	3,757	11,733	5.75	4.86	7.46	6.96	57.9	56.6
2001	4,084	12,862	5.93	4.86	7.28	6.53	58.5	58.1
2002	4,020	12,453	5.96	5.15	7.94	7.21	58.0	57.8
2003	4,303	12,380	6.46	5.55	8.41	7.43	59.4	59.9
2004	4,294	12,162	6.60	5.75	8.16	7.31	58.7	58.4
2005	4,528	13,770	7.87	7.01	9.44	8.35	60.6	58.6
2006	4,911	15,832	7.96	7.08	9.64	8.35	62.3	59.3
2007	5,006	16,143	8.56	7.55	10.2	8.76	61.9	59.0
2008	4,992	16,149	9.20	8.97	10.8	10.3	62.8	60.9
2009	4,927	15,230	7.96	7.89	9.54	9.15	61.4	59.8
2010	5,016	17,151	7.62	7.69	9.32	8.88	61.2	58.5
2011	5,031	18,544	7.88	7.79	9.31	8.89	60.9	59.6
2012	4,930	18,493	7.87	8.67	9.11	9.84	57.8	59.6

Data source is the Eurostat.

Table 2. Demand elasticities for EU imports of seafood products (1 = High–value finfish, 2 = Low–value finfish, 3 = Crustaceans, 4 = Mollusks).

i =	e_i	e_{i1}	e_{i2}	e_{i3}	e_{i4}
Model for GSP–plus beneficiary countries					
High–value finfish	1.121*	–0.488*	0.038*	0.461*	–0.011
	(0.062)	(0.040)	(0.008)	(0.035)	(0.026)
Low–value finfish	0.473*	0.789*	–1.313*	0.414*	0.110
	(0.225)	(0.171)	(0.156)	(0.183)	(0.145)
Crustaceans	0.711*	0.632*	0.028*	–0.804*	0.144*
	(0.084)	(0.048)	(0.012)	(0.057)	(0.031)
Mollusks	1.696*	–0.066	0.032	0.631*	–0.597*
	(0.144)	(0.157)	(0.042)	(0.136)	(0.103)
Model for GSP–plus eligible countries					
High–value finfish	1.175*	–0.460*	0.030*	0.420*	0.010
	(0.053)	(0.040)	(0.007)	(0.035)	(0.017)
Low–value finfish	0.836*	0.609*	–1.232*	0.224	0.400*
	(0.166)	(0.134)	(0.150)	(0.134)	(0.118)
Crustaceans	0.678*	0.577	0.015*	–0.692*	0.101*
	(0.072)	(0.049)	(0.009)	(0.054)	(0.022)
Mollusks	1.449*	0.068	0.129*	0.485*	–0.682*
	(0.103)	(0.110)	(0.038)	(0.107)	(0.094)
Model for all GSP countries					
High–value finfish	1.007*	–0.239*	0.099*	0.080*	0.061
	(0.045)	(0.058)	(0.043)	(0.032)	(0.039)
Low–value finfish	0.762*	0.315*	–0.167	0.138	–0.287*
	(0.118)	(0.136)	(0.133)	(0.09)	(0.076)
Crustaceans	1.035*	0.109*	0.059	–0.334*	0.167*
	(0.053)	(0.043)	(0.038)	(0.048)	(0.031)
Mollusks	1.114*	0.167	–0.247*	0.338*	–0.258*
	(0.088)	(0.106)	(0.065)	(0.062)	(0.081)

Authors' estimation. Values in parentheses are standard errors. *: Significant at the 5% level or less.

Table 3. Relative Substitutability and Evaluation Results (1 = High–value finfish, 2 = Low–value finfish, 3 = Crustaceans, 4 = Mollusks).

	GSP–plus beneficiary countries	GSP–plus eligible countries	All GSP countries
	q_1 versus q_2		
$e_{11} - e_{21}$	–1.277*	–1.069*	–0.555*
	(0.176)	(0.151)	(0.176)
$e_{23} - e_{13}$	–0.046	–0.196	0.058
	(0.192)	(0.145)	(0.105)
$e_{24} - e_{14}$	0.121	0.390*	–0.347*
	(0.151)	(0.122)	(0.103)
Sign of Eqn. (6)	–	+/–	–
	q_3 versus q_4		
$e_{33} - e_{43}$	–1.435*	–1.177*	–0.671*
	(0.175)	(0.141)	(0.09)
$e_{41} - e_{31}$	–0.698*	–0.509*	0.058
	(0.17)	(0.123)	(0.118)
$e_{42} - e_{32}$	0.004	0.114*	–0.305*
	(0.050)	(0.043)	(0.085)
Sign of Eqn. (7)	–	–	–

Authors' estimation. Values in parentheses are standard errors. *: Significant at the 5% level or less.

APE-2016-0358
Shipping the Good Fish Out? An Empirical Study on the EU Seafood Imports under the EU's Generalized System of Preferences

Referee: 1

Comments to the Author

This is a nicely crafted paper, which integrates theoretical considerations and empirical work in the area of international trade.

My main concern is the estimation of demand: regarding the identification problem and the use of instrumental variables, the authors are only assuming that policy changes (dummy variable D) affect supply, but are not controlling for other potential sources of shifts in supply. This may be fine, but needs to be explained and justified.

In the demand system model (Equation 9 page 14), the determinants include total expenditure, own-price, and prices of substitutes. This is a typical demand model on the base of demand theory. We agree that there may be other factors affecting demand, which are normally assumed to be reflected in the error terms. We modified the relevant sentence as follows: **"Error term ($u_{i,t}$) in the equation captures the unobserved factors which may affect the demand for seafood from developing countries**."

In the text, we pointed out the significant dummy variable attributed, 'at least partly', to the GSP-plus benefits. The narrative was further modified to be more explicit (page 18): **"This provides a sufficient statistical evidence to say that shifts have occurred in favor of high-value crustaceans and the GSP-plus has contributed to some of that better position in the market. However, other potential sources of shifts in demand may occur during the sample period. Moreover…"**

The authors briefly address the endogeneity problem (price p being a function of error term) and the issue of potentially inducing a bias in the estimation of elasticities, but only in a passing in footnote 3, p.17. It might deserve to be addressed in the main body of the text, instead.

The footnote has been moved to the main body of the text.

On page 14, the authors write: "When estimating substitutability between these products, it is questionable to confine a demand system to individual countries." I believe that this statement might benefit from further elaboration.

The sentence was re-written and more narrative was added (page 15):

“For a particular tariff regime, when estimating substitutability between these products, the demand system confined to individual countries ignores the competition between products from different countries. Accordingly, our study focuses on the impact of changes in the EU trade policies on the quality mix of seafood imports at the product level rather than individual countries. We aggregate those fisheries products to four groups which have different level of quality regarding prices of species within the product group, see more below.

Additional, minor comments:

1. There are two typos in equation (3): the second p1 in the first term should be p2* and the first p2* in the second term should be p1*. (But equation (4) is correct.)*

Corrected.

2. Reference "Bureau, Chakir, and Jacques, 2007" (twice on page 4 and once on page 5) should be "Bureau, Chakir, and Gallezot".

Corrected. Thanks.

*3. Page 10, second paragraph: since pi = pi*g + fi for goods 1 and 2 only, should we assume that goods 1 and 2 are imported and goods 3 and 4 are domestic goods? Furthermore, does this imply pi = pi* for goods 3 and 4? If so, please state so clearly; if not, please clarify. (Note that equation (7) would then simplify substantially.)*

Absolutely, it would substantially simplify Equation (6) by assuming goods 3 and 4 are domestic goods (then $p_3 = p_3^*$ and $p_4 = p_4^*$), and Equation (7) by assuming goods 1 and 2 are domestic goods (then $p_1 = p_1^*$ and $p_2 = p_2^*$). However, the unavailability of data for domestic goods leads to the current version. This is also based on the findings of competition of fish products from developing countries in the literature (Zhang, Tveterås, and Lien 2014). In response to this comment, the following sentence is added to the text (page 10):

Here, we assume the two products of interest and their week substitutes are all imported from developing countries, noting the strong competition between seafood products from these countries (Zhang, Tveterås, and Lien 2014).

4. Table 2: please also provide standard deviations.

Standard errors have been added to Tables 2 and 3.

5. Section 5, p.18. I'm not sure I would use the term "simulation". The way I see it, the authors are merely calculating the marginal effects given by equations (6) and (7).

Totally agree. This is not a typical process of simulation. The term has been changed to **'prediction' or 'evaluation'** results of the impact of tariff treatments on quality mix of seafood imports.

We have also changed the title of simulation sector to:

V. Evaluating the occurrence of "shipping the good fish out"

6. Conclusion, p. 24. What is meant by Sahara(n) countries? African countries, sub-Saharan, or North African countries?

Corrected. It is "sub-Saharan African".

Thank you for your helpful comments, which has greatly improved the quality of our study.

APE-2016-0358
Shipping the Good Fish Out? An Empirical Study on the EU Seafood Imports under the EU's Generalized System of Preferences

Referee: 2

Comments to the Author
The following are my comments/questions regarding the manuscript:

1) How do the author define quality? Can you be more explicit?

Fish quality often refers to the aesthetic appearance and freshness or degree of spoilage that fish has undergone. In this paper, we follow Delgado et al. (2003) and confine quality to species on the base of their prices relative to other species (e.g. within finfish, or crustaceans versus mollusks). This is accordant with the research purpose, i.e. testing the Alchian-Allen effect, which relies on price changes of the (expensive) high-quality good relative to the (cheap) low-quality good.

Responding to this point, the following narrative was added in the text (page 15).
We aggregate those fisheries products to four groups which have different level of quality regarding prices of species within the product group, see more below.

See also the following reply.

2) Is high-value/low-value grouping done using the price? Can you be more explicit?

As discussed above, the answer is yes. To be more explicit, the relevant sentences (page 16) are modifies as:
"Next, following Delgado et al. (2003), we classified the fisheries products into four groups on the basis of species and prices, i.e., high-value finfish (mainly marine fish and high-value freshwater fish), low-value finfish (mainly small marine fish and freshwater fish), crustaceans, and mollusks."

In the following sentences where we take GSP-plus countries as an example, we have listed the main species in each group and reported the average prices for groups.

3) In equation 1, qi is function of prices but then the analysis is done by grouping products into two groups, what is the rationale behind it?

Equation 1 defines a demand system where two similar goods (e.g. goods 1 and 2) and their week substitutes (e.g. good 3 and 4) complete in the same market. When we evaluate how changes in ad valorem tariff affect quantity ratio between q_1 and q_2 (equation (3) in the text), q_3 and q_4 are not affected by the changes. However, the impacts of good 3 and 4 on the ratio of q_1 / q_2 are reflected in the elasticities (equation (6) in the text).

4) I do not think the simulation section can be called simulation. In my opinion, it is just a "plugging-numbers" section. Could you make clear why it is a simulation?

Yes, this is not a typical simulation as also suggested by another reviewer. We have changed the title of the section to:

V. Evaluating the occurrence of "shipping the good fish out"

The relevant sentences in the text were also changed, like **"then use Equations (6) and (7) to evaluate the impact of the GSP on product mix of seafood product imported by the EU."**

Thank you for your comments, which are great helpful in improving the paper.