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Estimation of EU's import demand for yellowfin tuna *Thunnus albacares* (Bonnaterre 1788) sourced from Asian countries: Implications to the Philippine tuna industry

MIKO MARIZ CASTRO[1], JON MARX P. SARMIENTO[1], PEDRO ALVIOLA IV[1,*] and LARRY DIGAL[1]

[1] School of Management, University of the Philippines, Davao City, Philippines

Abstract

Interest of consumers in the conservation of limited marine resources is influencing their purchasing behaviour towards fishery products. As a major tuna market, the European Union (EU) has promoted sustainable use of tuna resources with Asia emerging as one of its largest exporters. Using data from Eurostat, the study estimated an almost ideal demand system (AIDS) model for imported yellowfin tuna *Thunnus albacares* (Bonnaterre 1788) from China, Philippines, Taiwan, Thailand, South Korea and Indonesia. The findings suggest that the demand for yellowfin tuna from these Asian countries, especially from China, will increase as the EU's aggregate income increases. The cross-price elasticities imply that yellowfin tuna sourced from Asian countries are net substitutes relative to other yellowfin tuna producing countries that are exporting to the EU except the Philippines and China. Thus, yellowfin tuna imports from China will continue to dominate the yellowfin tuna trade between EU and Asia. The study also found that yellowfin tuna imported from the Philippines has the lowest expenditure elasticities and the estimated trend has been decreasing. As a consequence, the Philippine yellowfin tuna industry must pursue efforts to reduce the cost of compliance to EU standards and at the same time explore new markets

Keywords: demand, elasticity, European Union, Philippines, tuna

Introduction

The three largest markets for fish—the United States, European Union and Japan—consume 30 % of the world fish supply which makes them dependent on fish imports (Swartz et al. 2010). In particular, the EU absorbed 24 % of the global seafood trade and expanded its reliance on imports for its supply of fishery products as its production covers only 44 % of the consumption of 12 million tonnes of seafood products valued at 52.2 billion Euros (European

* Corresponding author. E-mail: paalviola1@up.edu.ph

Commission 2015a). Accordingly, tuna constitutes 10 % of the 1.9 million tonnes of total imports of fishery products in Europe and the increase in import demand has further boosted EU's consumption of fresh, chilled and frozen tuna. Also, the EU consumes an estimated 1.2 million tonnes of tuna per year which consists of ambient and frozen tuna products with yellowfin tuna *Thunnus albacares* (Bonnaterre 1788), being the preferred material (Garrett and Brown 2009). Over the past decade, the consumption of seafood in restaurants has increased by 30 %, and almost one-third of this increase comes from away-from-home food consumption in commercial restaurants while the remaining two-thirds come from franchised restaurant consumption (Miyake et al. 2010).

While market signals indicate that tuna consumption is increasing in the EU market, the stock status assessment of tuna resources in the Western and Central Pacific Ocean (WCPO) has been classified as having moderate to very high levels of depletion (Bianchi and Fletcher 2011). Specifically, the latest catches for yellowfin tuna are slightly above the maximum sustainable yield (MSY) while the fish mortality is below the level that can support the MSY (Davies et al. 2014). And as such, instruments such as fishery eco-labelling schemes that were developed during the 1990s were used to mitigate the overexploitation of fish stocks and diminish the direct and indirect effects of commercial fisheries on critical marine habitats (Kirby et al. 2014). Furthermore, environmental organisations have initiated labelling of marine products to indicate that these commodities were produced through sustainable practices (Miyake et al. 2010).

The EU is a stringent market to penetrate because it places a very high premium on products that are produced through the use of sustainable fishing methods. The existing criteria for their preferential trade agreements such as the generalised system of preference (GSP) have placed much importance to sustainability issues as well as concerns that cover human and labour rights (Koch 2015). Generalised system of preference is a scheme of generalised tariff preferences that offers preferential access to imports (duty reduction or elimination) into the EU market from developing countries.

However, this tariff system also acts as a barrier to cheaper imports from Southeast Asian countries, which include the Philippines (Garrett and Brown 2009). Also, non-tariff barriers such as food safety concerns become an increasingly important issue for the EU consumers and trade deflections were evident in the global seafood trade (Baylis et al. 2011). The EU's market requirements for tuna exports include compliance with EU's food law and traceability, food safety standards compliance and sustainability certification (Bragt 2015).

Likewise, the EU imposes trade sanctions against exporter countries that fail to observe rules regarding its requirements especially those which source their production from IUU fisheries (Miyake et al. 2010). Overall, EU standards have become stricter with regards to international standards (Israel 2014). Thus, for tuna exporting countries such as the Philippines, compliance to these rigid standards has been relatively costly to achieve (Pasadilla and Liao 2007; Israel 2014).

Currently in the EU tuna market, the Philippines faces stiff competition from other Asian countries such as Thailand, Indonesia and Taiwan which are also major players in the global seafood trade. These countries, including the Philippines, are among the major stakeholders in the industry and are considered the biggest exporters of frozen and fresh tuna products, not just in the EU market, but also Japan and the USA as well (Garrett and Brown 2009).

In particular, Thailand is the top supplier of canned tuna, contributing 40 % of world exports and dominating the import markets except the EU (Kuldilok et al. 2013). On the other hand, Indonesia is heavily subsidising its fisheries sector and has the highest intensity in the WCPO and covers approximately 50 % of the cost of tuna landing (Sumaila et al. 2014). The hefty subsidy has resulted in a stark difference in price of Indonesian tuna compared to other Asian countries. In the WCPO, the Philippines owns the largest purse seine fleets with 40 large vessels and 55 smaller vessels plus 18 vessels operating in PNG but is experiencing lower catches due to the closure of the WCPO high seas and the Indonesian waters (Hamilton et al. 2011). Taiwan is considered the biggest exporter of frozen tuna in the global trade (Garrett and Brown 2009). South Korea and China are also major suppliers to the EU market and are countries that have achieved competitive advantage in both production sites and a greater number of longline fishing vessels (Hamilton et al. 2011).

In this context, we aim to determine how changes in the EU's income affect the import demand from Asian countries namely, China, Philippines, Taiwan, Thailand, Indonesia and South Korea and at the same time examine how EU's demand for yellowfin tuna responds to changes in import prices of tunas from these countries. We also examine the Philippines' position in the EU market for fresh and frozen yellowfin tuna and compare its performance with other Asian countries namely, China, Taiwan, Thailand, Indonesia, and South Korea. In this study, we used the almost ideal demand system (AIDS) model to estimate the income, own-price and cross-price elasticities of six primary sources of yellowfin tuna imports from Asia traded in the EU market. By looking at the trends of the elasticities over the period 2004–2013, we aim to identify the position of the Philippines in the yellowfin tuna trade in the EU. This paper is organised as follows: the next section discusses the AIDS model, data and variable descriptions. After that, we discuss results of the price and income elasticities and the corresponding trends. Finally, we present policy implications related to trade competitiveness and sustainability of the Philippines tuna industry in the discussion and then present our conclusions.

Materials and Methods

The AIDS has been a standard approach in examining consumption patterns of food products (Chidmi et al. 2012). The approach of estimating import demand using the AIDS model is growing (Mutondo and Henneberry 2007), with studies utilising quadratic AIDS (Almas 2012), inverse AIDS (Asche and Zhang 2013), and first differenced AIDS (Muhammad 2012). In this research, we utilise the AIDS model in the estimation of demand for yellowfin tuna from Asian country exporters to the EU. These exporters include China, Philippines, Taiwan, Indonesia, South Korea, and Thailand.

Almost ideal demand system model

The equation below specifies our AIDS model where w_i represents the share of total expenditure of yellowfin from the i^{th} exporting country, P_j is the price of yellowfin in the j^{th} exporting country, and X is the total expenditure of the yellowfin tuna from the six countries.

The price index lnP is defined as $lnP = \alpha_0 + \sum_{i=1}^{n} lnp_i + \frac{1}{2}\sum_i^n \sum_j^n \gamma_{ij}\, lnp_i lnp_j$. Thus, the AIDS model (Deaton and Muellbauer 1980) is written as:

$$w_i = \alpha_i + \Sigma_{j=1}^{n} \gamma_{ij} lnP_j + \beta_i \ln(\tfrac{X}{P}) + u_{it}$$

Among its features are included the flexibility of the functional form and compatibility with both aggregated and disaggregated data (Alston and Chalfant 1993). Finally, the triad conditions of adding up, homogeneity and symmetry, were imposed in the estimation of the AIDS model:

$$\text{Adding up: } \sum_{i=1}^{n} \alpha_i = 1 \quad \sum_{i=1}^{n} \gamma_{ij} = 0 \quad \sum_{i=1}^{n} \beta_i = 0$$

$$\text{Homogeneity: } \sum_{i=1}^{n} \gamma_{ij} = 0$$

$$\text{Symmetry: } \gamma_{ij} = \gamma_{ji}$$

Elasticity estimation in AIDS demand systems

We also calculated the income, uncompensated (Marshallian) and compensated (Hicksian) elasticities for both the AIDS models using the formulas specified by Green and Alston (1990). The formula for the expenditure is expressed as:

$$\eta_i = \frac{\beta_i}{w_i} + 1$$

The uncompensated or Marshallian elasticities were computed using

$$\varepsilon_{ij}^{u} = \frac{\gamma_{ij} - \beta_i(\alpha_j + \sum_k \gamma_{ik} \ln P_k)}{w_1} - \delta_{ik}$$

where δ_{ik} = the Kronecker delta (1 if i=k and 0 otherwise). Finally, from the Slutsky's equation, the compensated or Hicksian elasticities were calculated using the formula $e_{ij}^{c} = e_{ij}^{u} + \eta_i w_j$, where e_{ij}^{u} is the uncompensated (Hicksian) price elasticities of the exporting country i with respect to country j, η_i is the income elasticity for the exporting country i while w_j is the average budget share of the exporting country j. We used the AIDS methodology of Poi (2012).

Data description

In this research, we utilised the 2004–2013 monthly import volume and value data of EU–27 yellowfin tuna from the six Asian country exporters, namely China, Philippines, Taiwan, Indonesia, South Korea and Thailand. The data were obtained in electronic format from Eurostat, which is the official data platform of the European trade statistics. Eurostat consolidates the data at the European level and ensures comparability using harmonised methods.

The data obtained for import volume are measured in kilograms while import values are reported in € (euros). Due to the large values of the import volume, the quantity variable was converted to 100 million kilograms. All import values and volume data for fresh and frozen yellowfin tuna, which includes the fresh or chilled and frozen products, were also selected. The data do not have utilisation accounts of the yellowfin tuna implying that the products could be used as raw material for canning and processing or direct consumption. Furthermore, quality grading of the yellowfin tuna was not captured in the data. We did not consider cases of non-exclusivity pertaining to *T. albacares* to ensure that the data were exclusively on yellowfin tuna. Also, the import price data from the country of origin were not publicly available. Thus, we utilised a proxy for import price by calculating the ratio of the import values and the import quantities. Finally, the prices were measured in € per 100kg. The total expenditure and budget shares were also calculated using the same data sets. A total of 119 valid samples were utilised in the model. Table 1 presents a summary of the descriptive statistics of the variables used in the estimation of the AIDS model.

Table 1. Descriptive statistics of volume, price, budget shares, and total expenditures.

	Descriptive Statistics					
Volume	Minimum	Maximum	Median	Mean	Std. Deviation	Variance
China	27.27	71.57	44.06	46.13	10.03	100.60
Philippines	0.41	1.87	0.83	0.94	0.35	0.12
Taiwan	1.54	5.98	2.48	2.71	0.73	0.53
Indonesia	7.82	35.24	18.17	18.66	4.38	19.21
South Korea	2.90	14.34	6.10	6.24	1.90	3.61
Thailand	2.20	8.16	3.90	4.21	1.39	1.93
Price (in €.100kg^{-1})						
China	220.64	697.54	453.05	429.36	118.57	14,057.95
Philippines	245.90	2,527.99	549.75	577.13	262.21	68,752.22
Taiwan	371.38	1,293.37	755.37	757.12	157.43	24,783.94
Indonesia	32.27	134.58	57.00	62.51	20.00	400.02
South Korea	252.98	904.99	524.08	529.58	139.46	19,449.59
Thailand	145.56	604.96	338.69	344.91	113.74	12,937.74
Budget Shares						
China	0.57	0.77	0.71	0.70	0.05	0.00
Philippines	0.01	0.05	0.02	0.02	0.01	0.00
Taiwan	0.05	0.12	0.07	0.08	0.02	0.00
Indonesia	0.03	0.06	0.04	0.04	0.00	0.00
South Korea	0.08	0.16	0.11	0.12	0.02	0.00
Thailand	0.04	0.07	0.05	0.05	0.01	0.00
Total expenditure	15,440.73	37,475.74	27,254.02	27,288.90	5,543.05	30,725,387.47

Results

In this section, we discuss the expenditure, own-price and cross-price elasticities that were derived from the estimation of the AIDS model. Furthermore, we also discuss the estimated elasticity trends for each country that exports fresh/frozen yellowfin tuna to EU.

Expenditure elasticities

Table 2 shows the AIDS expenditure and price elasticity estimates of EU yellowfin tuna imported from China, Philippines, Taiwan, Indonesia, South Korea and Thailand. For example, the average income elasticity for yellowfin tuna imported from China is 1.09. This means that a 1 % increase in EU's aggregate income would increase tuna quantity demand sourced from China by 1.09 %. Furthermore, yellowfin tuna imported from all the other countries under consideration also have positive income elasticities: the Philippines (0.49), Taiwan (0.72), Indonesia (0.70), South Korea (0.88), and Thailand (0.79). The yellowfin tuna sourced from China has the highest response while that sourced from the Philippines has the lowest in terms of quantity demanded response from the EU.

Table 2. Income, compensated and uncompensated elasticities using AIDS estimates.[1]

	China	Philippines	Taiwan	Indonesia	South Korea	Thailand
Expenditure/Income	1.09	0.49	0.72	0.70	0.88	0.79
	(0.01)	(0.15)	(0.06)	(0.03)	(0.02)	(0.02)
Compensated/Hicksian						
China	**-0.11**	-0.01	0.01	0.03	0.05	0.04
	(0.04)	(0.01)	(0.01)	(0.00)	(0.02)	(0.01)
Philippines	-0.36	**-0.52**	0.42	0.12	0.23	0.11
	(0.28)	**(0.13)**	(0.09)	(0.02)	(0.02)	(0.02)
Taiwan	0.05	0.10	**-0.69**	0.07	0.37	0.10
	(0.10)	(0.01)	**(0.03)**	(0.00)	(0.04)	(0.01)
Indonesia	0.46	0.05	0.12	**-0.90**	0.16	0.11
	(0.04)	(0.01)	(0.02)	**(0.00)**	(0.02)	(0.00)
South Korea	0.27	0.04	0.24	0.06	**-0.69**	0.09
	(0.04)	(0.01)	(0.02)	(0.00)	**(0.02)**	(0.01)
Thailand	0.55	0.04	0.15	0.09	0.22	**-1.04**
	(0.04)	(0.01)	(0.01)	(0.00)	(0.01)	**(0.02)**
Uncompensated/Marshallian						
China	**-0.88**	-0.03	-0.07	-0.02	-0.08	-0.02
	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
Philippines	-0.70	**-0.53**	0.38	0.10	0.17	0.09
	(0.20)	**(0.14)**	(0.11)	(0.03)	(0.05)	(0.03)
Taiwan	-0.45	0.09	**-0.75**	0.04	0.29	0.06
	(0.09)	(0.02)	**(0.05)**	(0.01)	(0.06)	(0.01)
Indonesia	-0.03	0.04	0.07	**-0.93**	0.08	0.07
	(0.01)	(0.00)	(0.01)	**(0.01)**	(0.01)	(0.01)
South Korea	-0.34	0.02	0.17	0.02	**-0.80**	0.05
	(0.06)	(0.00)	(0.03)	(0.00)	**(0.04)**	(0.01)
Thailand	-0.01	0.03	0.09	0.06	0.13	**-1.08**
	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	**(0.01)**

[1]Values in parenthesis refer to standard errors. Bold figures refer to own-price elasticities.

Uncompensated and compensated price elasticities

Table 2 also shows the calculated Marshallian (uncompensated) and Hicksian (compensated) price elasticities. We focus the discussion on the Hicksian price elasticities as these elasticities take into account the income effects, and the compensated price elasticity is a better measure if we are interested in examining substitution possibilities. For China, the Hicksian own-price elasticity value is -0.11 which means that a 1 % increase in the price of imported yellowfin tuna from China will decrease EU quantity demand for Chinese imported tuna by 0.11 %. Furthermore, the Hicksian own-price elasticity for the Philippines (-0.52), Taiwan (-0.69), Indonesia (-0.90), South Korea (-0.69), and Thailand (-1.04) are all negative. Almost all the compensated cross-price elasticities are positive which indicates net substitutability, except for the Philippines and China with negative cross-price elasticities indicating complementary relationship. For example, the estimates show that if the price of imported tuna from the Philippines increases by 1 %, the EU quantity demand for imported yellowfin from Taiwan, Indonesia, South Korea, and Thailand will increase by 0.10 %, 0.05 %, 0.04 %, and 0.04 %, respectively while there is negative effect of 0.01 % in the Chinese tuna exports. Hence, except for the Philippines and China, EU's quantity demand for imported yellowfin tuna from Taiwan, Indonesia, South Korea and Thailand are net substitutes.

Expenditure and price elasticity trends

The time-varying elasticities were calculated using the constant AIDS estimated parameters with time-varying budget shares (Ito et al. 1989). Fig. 1 shows the monthly expenditure elasticity trends of yellowfin tuna imported from China, Philippines, Taiwan, Indonesia, South Korea and Thailand from 2004 to 2013. Among the six yellowfin tuna exporting countries, an increase in EU's aggregate income would rank yellowfin imported from China as having the most considerable growth in quantity demanded followed by tuna imported from South Korea, Thailand, Taiwan, Indonesia, and the Philippines.

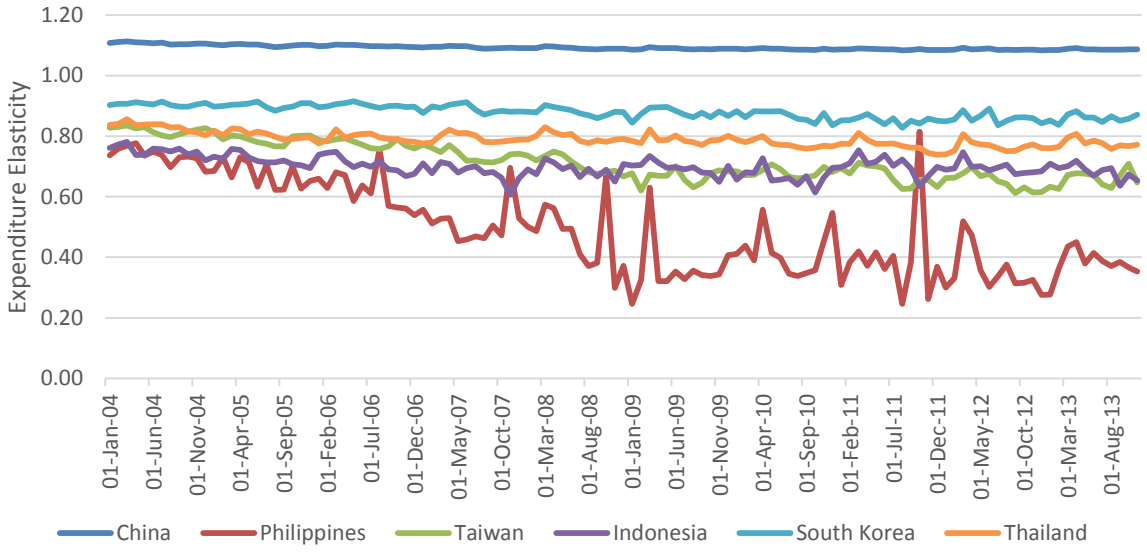

Fig. 1. Expenditure elasticity trends of EU yellowfin tuna imported from China, Philippines, Taiwan, Indonesia, South Korea and Thailand from 2004–2013.

The trend in the compensated (Hicksian) price elasticities from the six countries shows that yellowfin tuna imported from China are becoming less responsive to own-price changes (Fig. 2). It implies that if the price of yellowfin tuna increases, the decrease in EU quantity demand for yellowfin tuna is lowest for tuna imported from China. In contrast, yellowfin tuna imported from Thailand is the most responsive because a 1 percent increase in the price of imported yellowfin will result in more than 1 percent decrease in the quantity demanded from the EU. In this case, if substitutes are available then a price change may lead to a higher adjustment in the quantity demand for imported Thailand yellowfin tuna. Again, from Table 2, the compensated cross-price elasticities of yellowfin tuna from countries such as China (0.04), Philippines (0.11), Taiwan (0.10), Indonesia (0.11) and South Korea (0.09) may represent viable substitutes for Thailand imported yellowfin tuna in the EU market.

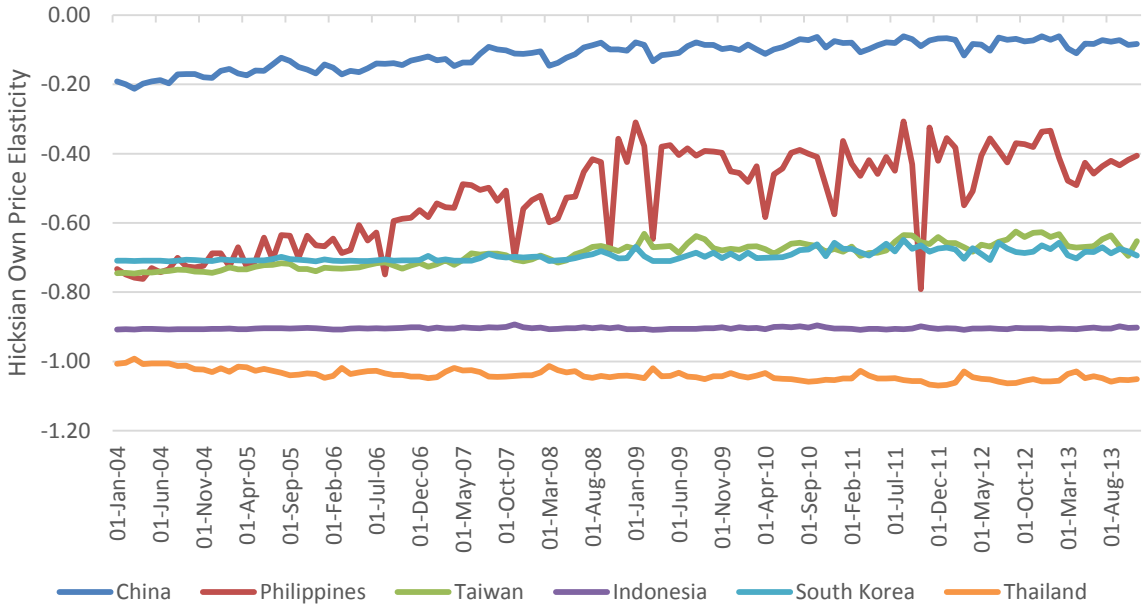

Fig. 2. Hicksian own-price elasticity trends of EU yellowfin tuna imported from China, Philippines, Taiwan Indonesia, South Korea and Thailand from 2004– 2013.

With the exception of the imported yellowfin tuna from China, the trend of cross-price elasticities with respect to the Philippines indicates that if the imported price of Philippine yellowfin increases, EU's quantity of yellowfin tuna demanded from Taiwan, Indonesia, South Korea, and Thailand will also increase (Fig. 3). For example, yellowfin tuna that are imported from Taiwan are the Philippines' closest substitute. In terms of ranking the responses, this is followed by Indonesia, Thailand and South Korea. Again, this may mean that except for imported yellowfin tuna from China, there are substitutes available for EU's imported yellowfin tuna from the Philippines such as from Taiwan, Indonesia, Thailand, and South Korea.

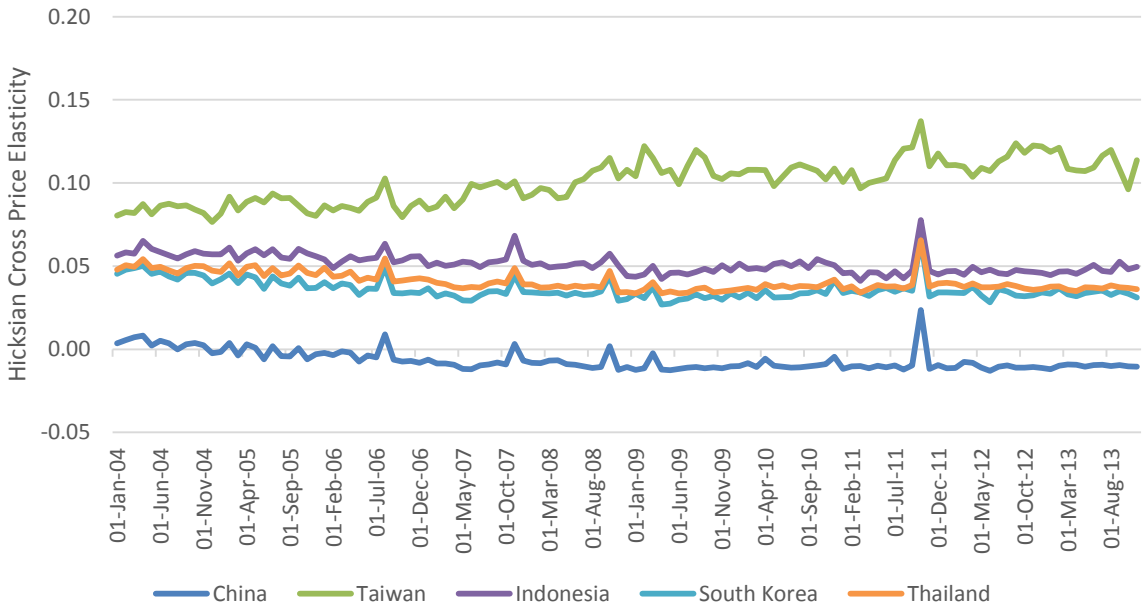

Fig. 3. Hicksian cross-price elasticities trends of EU yellowfin tuna imported from China, Taiwan, Indonesia, South Korea and Thailand with respect to the Philippines, 2004–2013.

Discussion

The European Union market for tuna has become stricter because of its insistence on recognising tuna catching schemes that utilise sustainable methods. The continuous overharvesting of fish stocks, as well as the increasing consumer demand for environment-friendly products, are the likely drivers of EU's current strict policy. The EU, being dependent on imports, sources its yellowfin tuna from neighbouring EU nations and also from Asian countries such as China, Philippines, Thailand, Indonesia, Taiwan, and South Korea. Thus, in this regard, the study aimed to examine how responsive demand is for tuna from China, Philippines, Thailand, Indonesia, Taiwan and South Korea when there are income and price changes in the EU market. Also, we wanted to determine the status of the Philippines with regard to trading with large tuna country exporters in EU.

This study finds that yellowfin tuna sourced from China dominates the EU market, and will continue to dominate as suggested by the expenditure elasticity trend. Because of China's economic reforms in fishery production and exports, the country's fishery export industry has grown significantly and has led to an increased number of Chinese fish processing plants gaining access to the EU market (Xubing and Rui 2004). Also in 2002, China started to export fish raw material for processing by the final buyer and coupled with the general policy of open trade in both import and export of fishery products, China's exports of fishery raw materials have increased (Xubing and Rui 2004). Next to China, South Korea has the second highest expenditure elasticity among Asian exporting countries to EU. South Korea is also a major EU exporter of fresh/frozen yellowfin tuna for canning (Globefish Research Programme 2004). Around 20 % of South Korea's catch landed in its principal port is exported to EU and is usually packaged in vacuum packs. Although, Japan is still its primary market, South Korea is continuing to explore other alternative markets including the European market.

Aside from having the lowest expenditure elasticity among six Asian tuna exporting countries in the EU, the expenditure elasticity trend of imported fresh/frozen tuna from the Philippines also suggests a declining pattern. It implies that as EU's aggregate income increases, the demand for Philippine tuna continues to increase but the level of increase will decline over time; hence the Philippines' share of tuna exports may likely decrease. Both yellowfin tuna domestic production and exports to EU, especially Spain and Italy, are still increasing (Barut and Garvilles 2016; Philippine Statistics Authority 2016). According to Bragt (2015), the EU's market requirements for tuna exports include adherence to EU's food law and traceability, food safety standards compliance and sustainability certification. In the Philippines, EU standards are much stricter relative to international standards making compliance costly for Philippine tuna exporters (Israel 2014). For example, the EU's move to reduce the maximum lead content in tuna may impose a prohibitive cost, especially to small and medium scale tuna exporters because the natural conditions in Philippine tuna fishing grounds preclude compliance with the mandated lower residue limit (Pasadilla and Liao 2007; Israel 2014). Also, since 2000, the number of handline fishing vessels has dropped from 2,500–3,000 to approximately 1,000. This reduction in the Philippine handline fishery fleet size has led to longer trips to reach their target catch levels. It has resulted in a decline of the quality of fresh fish, thus reducing the share of first-grade product for sashimi export (Hamilton et al. 2011). With these factors, yellowfin tuna imported from the Philippines may likely lose its share in the EU yellowfin market.

The closest alternative for Philippine tuna exports are products coming from Taiwan, Indonesia, Thailand and South Korea. Taiwan is among the major EU exporters of fresh/frozen yellowfin tuna raw material for canning (Globefish Research Programme 2004). Indonesian tuna catches have declined since the late 1990s due to the catch reduction in its main fishing ground, the Indian Ocean. Although this has significantly limited the country's capacity as a supplier of sashimi-grade tuna, Indonesia has remained a significant producer of low-grade frozen tuna. The price of Indonesian tuna is relatively cheap due to the heavy subsidy afforded to its fisheries sector (Sumaila et al. 2014). However, since 2006, its exports to the EU market have declined because of sanitary and phytosanitary issues (Hamilton et al. 2011). Also, during the first quarter of 2015, Thailand was given a yellow card for failure to monitor and control cases of illegal fishing. The European Commission concluded that Thailand has not made sufficient effort to control it. However, in the same period, the Philippines and South Korea have made appropriate reforms in their fisheries governance with particular emphasis on illegal fishing and alignment of their respective legal systems to international law. These measures prevented these two countries from being given the "identification procedure" (red card) after both countries were warned in November 2013 and June 2014, respectively (European Commission 2015b).

The results further suggest that the Philippine tuna industry should explore emerging tuna markets such as China, Thailand, South America and the Middle East because, as the EU growth increases overtime, the share of Philippine tuna exports may likely decrease. In addition, efforts that can minimise the cost of promoting and complying with quality and safety standards of tuna products must be pursued as well.

For example, there are currently, three private incentive mechanisms available to Philippine tuna fishers who plan to improve the sustainability of their fishing practices – the fishery improvement project model of the World Wide Fund for Nature, the Marine Stewardship Council certification, and the Pro-Active Vessel Register of the International Seafood Sustainability Foundation (Tolentino-Zondervan et al. 2016). These are good options to consider in establishing a good reputation for Philippine tuna products. However, these certifications are expensive and hence difficult to comply with for tuna fishers in developing countries (Pérez-Ramírez et al. 2012). Thus, efforts by the public sector to reduce the burden of unnecessary regulations on the Philippine's tuna industry and the strengthening of key certification processes can contribute to reducing the cost of complying with international standards imposed by the EU market (Llanto et al. 2017). Thus, these measures can enable the Philippine-sourced yellowfin tuna industry to be more competitive (Hamilton et al. 2011).

Conclusion

In this study, we estimated an AIDS model for fresh and frozen yellowfin tuna in the European market and analysed the changes in both expenditure and price elasticities. Our findings show that as the EU's income increases, its demand for fresh and frozen yellowfin tuna will continue to increase especially for product coming from China. While the demand for tuna sourced from the Philippines also continues to increase, the trend suggests that the level of increase is declining over time. Moreover, in the EU market, there are available substitutes for Philippine tuna from Taiwan, Indonesia, Thailand and South Korea. Hence, although both yellowfin tuna domestic production and exports to EU are still increasing, with EU's stringent standards, there is a likely possibility that the share of yellowfin tuna sourced from the Philippines may decrease in the future. As a consequence, efforts to reduce the cost of EU compliance standards for sustainability must be prioritised for the Philippine yellowfin tuna industry to become more competitive in the market.

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