Revealed Comparative Advantage of selected ASEAN countries’ crustacean export to Japan

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Abstract. This paper examines the factors that influence the revealed comparative advantage (RCA) of selected Association of Southeast Asian (ASEAN) countries’ crustacean export to Japan, with particular interest in the effect of Acute Hepatopancreatic Necrosis Disease (AHPND). AHPND was reported in China before spreading to Viet Nam, Malaysia, Thailand and the Philippines. The data used in this study is for the period of 2010-2016 involving six ASEAN countries’ Japanese crustacean import partners (Viet Nam, Indonesia, Thailand, Myanmar, the Philippines and Malaysia). The dataset is a balanced panel dataset for the selected six countries in seven years, estimated using random-effect model. The findings show that AHPND and exchange rate of selected ASEAN exporters to Japan are significant towards the bilateral RCA of crustacean to Japan. Meanwhile, income per capita in Japan and domestic production of crustacean in Japan were not significant towards the bilateral RCA. It is suggested that ASEAN exporters continue to increase effort to address AHPND so that export to their major market (Japan) will not be affected. Future studies may explore more countries affected by AHPND RCA and exports, not limited to ASEAN countries only, but to more major crustacean importing countries (for example, United States, Japan, China, Spain and France which imports more than USD1 billion of crustacean in 2017 and collectively imports more than 60%) of crustaceans globally.

Keywords: revealed comparative advantage; ASEAN; AHPND; crustacean; Japan.

1. Introduction

Seaweed Japan is among the world’s leading importer of seafood and is consistently the world’s leading importer of crustacean [1]. Japan’s largest seafood import in 2017 was frozen shrimps and prawns (Harmonized Commodity Description & Coding System (HS code) 030617. In 2017, Japan accounted for 9.9% of the total global crustacean import with a total import value of USD2.5 million.

The top five largest exporters of crustacean to Japan in 2017 are Russia, Viet Nam, India, Indonesia and Canada with a total export value of USD 1.7 billion, accounting for about 67% of Japan’s total import of crustacean. ASEAN continues to remain as Japan’s important partner in the supply of crustacean, with Viet Nam as the largest exporter from the ASEAN countries. Table 1 shows the largest exporters and selected major ASEAN countries exporter of crustacean to Japan for the period of 2010-2017.

Japan has continued to play more important role as importer of crustacean to ASEAN countries. For example, in first three months of 2017, Japan became the largest crustacean importer for Vietnam while imports from Thailand and Indonesia also grew 13.9% and 2.4% year-on-year, respectively [2]. Past literature is seen to be more concentrated in analysing the factors of crustacean and seafood
import into United States (the largest importer) compared to Japan (the second largest seafood importer).

In terms of studies on trade of seafood, one study in 2016 [3] investigated the effect of anti-dumping petitions to the shrimp export RCA of Vietnam, China, Thailand, Ecuador, India, Indonesia and Mexico to the USA. Using monthly panel data, the study showed that the RCA are significantly influenced by shrimp prices and US income per capita. Another study in 2015 [4] analysed USFDA import refusal and RCA of Indonesian crab export to the USA. It was highlighted that RCA shows Indonesia is a strong exporter of crabs to the USA and import refusal is mostly caused by chloramphenicol.

Table 1. Top Five Largest and Selected ASEAN Exporters of Crustacean to Japan, 2010-2017.

| Rank | Exporters | Exports (USD million) |
|------|-----------|-----------------------|
|      |           | 2010      | 2011      | 2012      | 2013      | 2014      | 2015      | 2016      | 2017      |
| 1    | Viet Nam  | 0.41      | 0.40      | 0.40      | 0.44      | 0.45      | 0.36      | 0.35      | 0.43      |
| 2    | Russia    | 0.43      | 0.57      | 0.58      | 0.40      | 0.42      | 0.29      | 0.40      | 0.38      |
| 3    | India     | 0.27      | 0.32      | 0.26      | 0.34      | 0.36      | 0.29      | 0.32      | 0.34      |
| 4    | Indonesia | 0.35      | 0.38      | 0.38      | 0.42      | 0.36      | 0.30      | 0.29      | 0.28      |
| 5    | Canada    | 0.18      | 0.23      | 0.25      | 0.20      | 0.23      | 0.23      | 0.22      | 0.25      |
| 7    | Thailand  | 0.30      | 0.35      | 0.34      | 0.22      | 0.14      | 0.11      | 0.12      | 0.13      |
| 10   | Myanmar   | 0.05      | 0.05      | 0.06      | 0.07      | 0.07      | 0.05      | 0.05      | 0.05      |
| 13   | Philippines | 0.04      | 0.04      | 0.04      | 0.04      | 0.04      | 0.02      | 0.03      | 0.04      |
| 15   | Malaysia  | 0.05      | 0.08      | 0.06      | 0.05      | 0.04      | 0.02      | 0.02      | 0.02      |
|      | Rest of the world | 0.54      | 0.67      | 0.70      | 0.65      | 0.64      | 0.56      | 0.64      | 0.59      |

*Refers to ASEAN countries.

Author’s calculation based on data from UN Comtrade.

Furthermore, a study in 2015 [5] examined the determinants of international seafood trade of primary production using gravity model of trade. The findings show that seafood trade is influenced by countries with well-established seafood preference or with low labour cost for further processing. In China’s seafood trade patterns [6], it was found that that there is difference of factors affecting live and fresh seafood compared to other seafood products. For live and fresh seafood, geographical distance, income, and status of “developed country” are significant, while for trade of seafood products, GDP and border effect are significant factors.

The Acute Hepatopancreatic Necrosis Disease (AHPND) was detected when it caused mass mortality in China in 2009 [7]. Later, the disease was detected in Viet Nam (in 2010), Malaysia (in 2011), Thailand (in 2012), and the Philippines (in 2015) [8]. Shrimp supply is dependent on the state of shrimp-farming production, which is strongly affected by shrimp disease. In particular, Acute Hepatopancreatic Necrosis Disease (AHPND) has occurred in South-East Asian shrimp cultivation. Virus of *Vibrio parahaemolyticus* is known as the causal agent of AHPND [9]. The other name for this disease was Early Mortality Syndrome (EMS). It named as EMS due to mass mortality during few days after shrimp post larvae stoking. Economic losses of estimated more than USD1 billion for countries of China, Vietnam, Malaysia, Thailand and Mexico (in the years of 2009-2014) [7], and decrease in mass production of crustacean were significant in countries that reported detection of AHPND.

The objective of this study are (1) to calculate the bilateral revealed comparative advantage (RCA) for selected ASEAN crustacean exporting country to Japan and (2) to examine the factors that influence the RCA of selected ASEAN countries crustacean export to Japan, with particular interest in the effect of Acute Hepatopancreatic Necrosis Disease (AHPND) on crustacean. There is still relatively limited literature which examines the economic effects of AHPND.
Table 2. Year AHPND reported for ASEAN countries covered in this study.

| ASEAN countries covered in this study | Year AHPND reported* |
|--------------------------------------|----------------------|
| Viet Nam                            | 2010                 |
| Indonesia                           | Not reported         |
| Thailand                            | 2012                 |
| Myanmar                             | Not reported         |
| Philippines                         | 2015                 |
| Malaysia                            | 2011                 |

*Based on [7-9].

2. Data and Method

Green Firstly, the Revealed Comparative Advantage (RCA) is computed based on past literature [10, 11, 3], based on the following formula:

$$\text{RCA}_i = \frac{(X_i - M_i)}{(X_i + M_i)}$$

where $X_i$ and $M_i$ represent exports and imports, respectively, and $i = 1, \ldots, 6$ represents the crustacean exporting country.

Next, in order to examine the factors that affect the RCA of the selected six ASEAN crustacean exporters to Japan, this study employs random effect panel data estimation. The equation is provided as follows:

$$\text{RCA}_{ijt} = YPC_{jt} + \text{EXCH}_{ijt} + \text{DOMESTIC}_{jt} + AHPND_{it}$$

where RCA is the revealed comparative advantage, YPC is the income per capita, EXCH is the exchange rate and AHPND is Acute Hepatopancreatic Necrosis Disease, respectively.

The data used in this study is for the period of 2010-2016 involving the six ASEAN countries Japanese crustacean import partners. The dataset is a balanced panel dataset for the selected six countries in seven years, estimated using random effect model. Random effect panel estimation can estimate the coefficients of the variables which have a fixed value over time but cannot give good results if the samples selected in the model are heterogeneous. Hausman test is conducted to check on the suitability of using random effect panel estimation. To conduct the Hausman test, the model is first estimated with a random effect specification. The null hypothesis of Hausman test is there is no correlation between the individual effects and the regressors. If the null hypothesis is rejected, the alternative hypothesis is accepted whereby there is correlation between the individual effects and the regressors. Acceptance of alternative hypothesis indicates that fixed effect specification is a better specification compared to random effect panel estimation.

In terms of sources of data, the data used in this study is for the period 2010-2016 involving five ASEAN countries Japanese crustacean import partners. The dataset is a balanced panel dataset for the selected six countries in seven years. The import data of crustacean by Japan from these five countries is obtained from International Trade Centre (ITC). Domestic production of crustacean data is from Food and Agriculture Organisation (FAO). Meanwhile, income per capita data is from World Bank while data on exchange rate is obtained from OFX group. The year where AHPND takes place in the different countries was adopted from Table 1.

3. Result and Discussion

Table 3 shows the RCA calculation results for the sample countries. Myanmar showed the highest maximum RCA at 1.00 followed by Viet Nam (0.96), Indonesia (0.95), Thailand (0.94), Philippines (0.64) and Malaysia (0.14). In terms of median for RCA, Viet Nam, Indonesia, Thailand and Myanmar show high RCA (between 0.77 and 1.00) compared to Philippines at 0.35, while Malaysia showed negative median. Malaysia is the only country with minimum RCA showing negative sign, indicating comparative disadvantage in exporting crustacean.
Table 3. RCA calculation results.

|            | Viet Nam | Indonesia | Thailand | Myanmar | Philippines | Malaysia |
|------------|----------|-----------|----------|---------|-------------|----------|
| Minimum    | 0.76     | 0.90      | 0.64     | 0.85    | 0.08        | -0.44    |
| Maximum    | 0.96     | 0.95      | 0.94     | 1.00    | 0.64        | 0.14     |
| Median     | 0.88     | 0.91      | 0.77     | 1.00    | 0.35        | -0.33    |

The result of the random effect estimation is presented in Table 4. The coefficient of AHPND variable is statistically significant with the coefficient having negative sign. The empirical results show that the severe shrimp disease has statistical significance on bilateral RCA for Japan’s import from ASEAN countries. This result differs from past study [5] that found no significance between USA’s seafood RCA and AHPND. The difference may be due to the fact that this study selects only sample of ASEAN countries and AHPND is prevalent in these countries. AHPND is a serious disease in the shrimp industry, with the first outbreak in shrimp farms in China in 2009, and spreads rapidly to other shrimp producing and exporting countries in Asia. The disease reduced shrimp production substantially, and also increased shrimp prices significantly.

Japan’s per capita income (YPC) also did not show significant effect although the coefficient has positive sign. There is little relationship between the demand for imports shrimp in Japan from ASEAN countries with increasing per capita income. In terms of exchange rate variable, it is significant at 1% level and indicates that there is an impact for the exchange rates of the currency of ASEAN crustacean exporting countries against the Japanese yen on bilateral RCA. Domestic Japan shrimp production (DOMESTIC) shows no significant impact on the bilateral RCA indexes, with a low coefficient value.

The Hausman test is used to test whether the pooled random effects or fixed effects model is preferred statistically. The Hausman test results indicate that the null hypothesis cannot be rejected, which means there is no significant correlation between the individual effects and the explanatory variables. Hence, the random effect estimation is suitable to be employed in this study.

In view of the significant effects of AHPND on RCA, it is suggested that ASEAN exporters continue to increase effort to address AHPND so that export to their major market (Japan) will not be affected. These efforts include monitoring and detecting potential AHPND among crustacean early so that actions can be undertaken to prevent high economic losses and mass mortality. Within the Asian market, Japan market continues to serve as among the largest and most important market for ASEAN exporters, and exporters should continue to tap on the noticeable demand of crustacean in this market, especially when there is already existing regional free trade agreement between ASEAN and Japan.

Table 4. Random effect estimation results.

| Variable   | RE Estimation |
|------------|---------------|
| YPC<sub>jt</sub> | -0.0000004  |
| EXCH<sub>ijt</sub> | 0.002***  |
| DOMESTIC<sub>jt</sub> | -0.0000004  |
| AHPND<sub>it</sub> | -0.477***  |
| Adj R<sup>2</sup> | 0.39         |
| Breusch-Pagan LM test | χ<sup>2</sup>(1) = 3.716231  |
|                | (Prob > χ<sup>2</sup> = 0.0539)  |

Note: *** denotes significance at 1%, ** 5%, * 10%.
4. Conclusions
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In summary, the empirical results show that AHPND and exchange rate of selected ASEAN exporters to Japan are significant towards the bilateral RCA of crustacean in Japan. Meanwhile, income per capita in Japan and domestic production of crustacean in Japan were not significant.

The findings of the paper contribute empirical evidence that AHPND has effect on Southeast Asian exporters of crustacean. RCA continue to serve as an important measure of competitiveness. With various technical studies being undertaken and steps to mitigate the effect of AHPND in these countries, the situation of AHPND appears to be in control now. It is suggested that ASEAN exporters continue to increase effort to address AHPND so that export to their major market (Japan) will not be affected.

Future studies may examine the relationship between major importers and exporters in a more comprehensive manner. Future studies may explore more countries affected by AHPND RCA and exports, not limited to ASEAN countries only, but to more major crustacean importing countries. For example, United States, Japan, China, Spain and France imports more than USD1 billion of crustacean in 2017 and collectively imports more than 60% of crustaceans globally.

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