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Measuring The Comparative Advantage of Fishery Industry in Malaysia using the Revealed Comparative Advantage Model

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Abstract

Purpose

This paper aims to measure and rank the comparative advantage of Malaysia's fishery industry with selected neighbouring countries.

Design/Methodology

This study adopts Balassa's (1989) 's Revealed Comparative Advantage (RCA) model to identify the comparative advantages of Malaysia in the fishery sector compared with the neighbouring countries. The data span the period from 1995 up to 2015 (annually). The primary data on export (X) and import (M) flows based on the Harmonized System (HS) nomenclature, which is derived from the UN COMTRADE database and the Department of Fishery Malaysia. The broad product groups in the HS code will be referred to under the fishery code of HS03. The results from these data are computed using the EViews software.

Findings

Based on the results, Malaysia and Singapore were identified to have a comparative

advantage in the production of live fish, while Vietnam is a comparative advantage in fish fillet and frozen fish meat, Thailand is a comparative advantage in dried fish, and Indonesia has a comparative advantage in terms of aquatic invertebrates. This allows the countries to specialize in their comparative advantage to increase fishery export production. Besides that, in the long run, if the nation improves its comparative advantage in export in terms of its production by improving the allocation of resources, this will contribute to the country's economic growth.

Research Limitation

The study can be extended to different aspects of issues such as the effectiveness of trade policies, the impact of global issues and the preferences of the consumers by incorporating different competitiveness models.

Practical Implications

This study provides references to the policymakers to determine the appropriate policies to aid the difficulties faced by the fish sector in increasing their competitiveness in the global market and to aid the shortages in food security.

Keywords Aquaculture, Ricardian Model, Fish Farmers, Fishery Sector, Competitiveness

Introduction

Fish, along with agricultural products, is one of the crucial sources of cheap animal protein for people worldwide (Kaleem and Sabi, 2021). In the domestic market, a large proportion of fish production will be consumed fresh by the locals. However, in the international market, the fishery sector is one of the critical sectors of international trade, given its importance in supplying seafood to the world's population (Naylor et al., 2021). Some researchers indicated that the fishery sector would become undependable in the long term as many fish production stocks have been over-exploited in coastal areas by commercial fishery (Andrew et al., 2021). Due to this issue, aquaculture was identified to play a significant role in overcoming fish stock depletion due to over-exploitation (Naylor et al., 2021). Genetics researchers and culturists have significantly increased fish production through aquaculture (Yue and Shen, 2022).

Malaysia has been essential as a producer and trading nation for fishery products in Southeast Asia. Being strategically located in the middle of Southeast Asia with suitable climate conditions and free from any natural disaster, Malaysia can improve its comparative advantage in the fishery (Soh, Lim, and Chua, 2021). According to Malaysian Biotechnology Corporation (2009), they discovered new genes to increase the comparative advantages in the fishery sector. They modified rebreeding of fish, improved water quality management in the aquaculture industry, and restructured the aquaculture system design and regeneration of aquaculture production by seed production technique and icthio-physiology. By implementing these innovations along with the government legal framework to obtain sustainability, the fishery sector will be able to increase its self-sufficiency rate (Yusoff, 2020 and; Soh, Lim, and Chua, 2021).

Literature Review

The Revealed Comparative Advantage (RCA) approach was developed by Balassa (1965). The RCA approach is defined as the index under international trade to measure the relative advantages of a specific nation in producing a specific commodity. It is also known as the index of revealed comparative advantage. Balassa (1965) suggested the following model in his paper:

$$\mathrm{RCA} = \ln \frac{X_{iB}/X_B}{X_{iA}/X_A}$$

The description of the terms in the RCA model is as follows:
X_{iB} is country B's exports of produce i to the world
X_B is country B's total commodity exports to the world
X_{iA} is rival country's export of produce i to the world
X_A is rival country's total commodity exports to the world

Based on the computed value from the model above, a positive RCA value indicates that the country has a comparative advantage in exporting production of i against its rival countries in the global market, while a negative RCA value indicates otherwise. Therefore, the output results of this RCA model could be used to determine the relative advantages of a specific sector in a nation (Yap and Selvaratnam, 2018). Numerous empirical studies adopted the Balassa index to identify a country's strong sectors and competitiveness in the international trade market (Erokhin, Tianming and Ivolga, 2021; Kaimakoudi et al., 2014; Kuldilok et al., 2013).

In a study by Erokhin, Tianming and Ivolga (2021) to evaluate the comparative advantage in the fish and seafood trade among the RCEP member states, they adopted the RCA model. They concluded that trade potentials correspond with more decisive comparative advantages. The lower comparative advantage is associated with the more prominent traders' lower value in the RCA indices. Their results show that Myanmar and Vietnam have a more substantial comparative advantage in fish, crustaceans and molluscs than other Southeast Asia.

Fahmi et al. (2015) also adopted the RCA model to evaluate the Indonesian crab's export competitiveness in the US market. They also adopted the unrevised RCA model to measure the comparative advantages of the selected crab exporters, precisely Indonesia's comparative advantage in the crab sector. They calculated the RCA index for three Harmonized (HS) codes, including frozen crab, unfrozen crab, and prepared/preserved crab. Based on their findings, they concluded that in the case of Indonesia, among all the HS codes for crab, the prepared/preserved crab is the most competitive commodity in the US market. This Indonesian crab competitiveness was due to the abundant aquatic resources of the blue swimming crabs and processors, which include plant and labour. They use Airtight Container (ATC) to prepare the crab for exportation in the US market.

Kaimakoudi et al. (2014) also adopted the RCA index to measure the export competitiveness in the fisheries sector among Balkan and Eastern countries. They adopted the basic RCA model and indicated that the RCA index will be useful in measuring competitiveness and identifying specialization patterns. They computed the RCA index for selected member countries of European Union-27, namely Greece, Cyprus, Bulgaria, Romania, Hungary, Slovenia, Poland, and the Czech Republic. Their findings concluded that most of the imported species had a comparative advantage during the study period. They also concluded that Greece has export competitiveness in producing fresh or chilled Gilt-head Sea bream, Bulgaria has a competitive advantage in frozen sprats and snails, the Czech Republic is very competitive in live carp, while Hungary will be in the production of live freshwater fish, Poland will be in smoked fillets of pacific salmon, and lastly, Slovenia holds export competitiveness in fresh or chilled fillets of freshwater fish.

Kuldilok et al. (2013) solely employed the RCA model to analyze the export competitiveness in the canned tuna industry in Thailand from 1996 to 2006. They modified the RCA model in two different ways: the first RCA index was computed to determine the country's competitiveness in exporting the product, and the second RCA index was computed to determine the country's comparative advantage in exporting its product to a specific country. Based on their findings using the RCA index, they concluded that Thailand still wins its comparative advantage among all the major canned tuna exporters such as Indonesia, Mauritius, Ecuador, the Philippines, the Seychelles, and Spain over the production of canned tuna. It also had a consistent rate in its exports to the USA, Canada, the Middle East, and Japan.

Methodology

Based on the past literature, Balassa (1989) developed Revealed Comparative Advantage (RCA) model to compare a country's share of the world market in one commodity relative to its share of all traded goods. This index will be a valuable tool in identifying the comparative advantages of Malaysia in the fishery sector. The formula is expressed in the following form:

$$RCA = \ln \frac{X_{iB}/X_B}{X_{iA}/X_A}$$

Where X_{iB} is country B's exports of produce i to the world, X_B is country B's total fishery exports to the world, where else the X_{iA} is rival country's export of produce i to the world and X_A is a rival country's total fishery exports to the world.

Based on the formula above, a positive RCA value indicates that Malaysia has a comparative advantage in exporting production of i against its rival countries in the global fishery sector, while a negative RCA value indicates otherwise. The dataset includes Malaysia's trade in terms of the fisheries sector with Indonesia, Thailand, Vietnam, and Singapore. These data will be used to compute the RCA index. The data span the period from 1995 up to 2015 (annually). The primary data on export (X) and import (M) flows is based on the Harmonized System (HS) nomenclature, which is derived from the UN COMTRADE database and the Department of Fishery Malaysia. The broad product groups in the HS code will be referred to under the fishery code of HS03. The empirical analysis constitutes a three-dimensional balanced panel of 84 observations (4 country pairs X 1 product group X 21 years). Under this, the four countries that will pair with Malaysia are Indonesia, Thailand, Vietnam, and Singapore. These countries have a strong trade relationship with Malaysia regarding the fishery sector (DOF, 2021).

Results and Discussion

Descriptive statistics are helpful to have a clear picture of the quantitative description in a manageable form. It describes the primary feature of the data used in this study. The results for descriptive statistics for Malaysia are illustrated in Table 1.1 below. There is significant variation across the series, which further justifies the empirical analysis.

Table 1.1: *Descriptive Statistics for Malaysia*

Variables	Mean	Median	Maximum	Minimum	Std. Dev	Skewness	Kurtosis
			Malaysia				
BI	4.686716	4.612471	6.851443	3.445604	0.832366	0.697248	3.390046
X	45103122	41264742	80427329	23245782	17737443	0.570361	2.092407
GDP	3.60E+10	2.55E+10	9.38E+10	1.00E+10	2.96E+10	1.067510	2.544030

To examine the comparative advantage of the five countries, the results of the comparative advantage are demonstrated in Table 1.2 below. It is necessary to mention that most of the countries in the sample have close results to comparative advantage in all the HS Code for the fishery sector, but only those selected HS Code are mentioned where the Balassa Index is vital and where BI is nonstationary at the level and stationary at first difference. Therefore, static properties are checked after calculating Balassa Index.

Table 1.2: *Results of Balassa Index*

Countries	Comparative Advantage (Based on HS Code)
Singapore	0301 and 0303
Malaysia	0301
Vietnam	0304
Thailand	0305
Indonesia	0308

Table 1.3: *Unit Root Test Results (ADF Test)*

Countries	Variables	With Trend[1]	Without Trend
Singapore	BI	-2.415433 non stat	-1.541279 non stat
	ΔBI	-4.200369**,***	-4.379550*,**,***
	X	-1.247476 non stat	-1.904265 non stat
	ΔX	-2.307041 non stat	-2.409930 non stat
	GDP	-2.936300 non stat	-2.353380 non stat
	ΔGDP	-6.121729*,**,***	-6.231650*,**,***
Malaysia	BI	-3.448199***	-3.279176**,***
	ΔBI	-5.839144*,**,***	-6.025331*,**,***
	X	-1.742456 non stat	-1.950397 non stat
	ΔX	-1.039605 non stat	-0.701594 non stat
	GDP	-2.870586 non stat	-3.005517***
	ΔGDP	-4.104177**,***	-4.448248*,**,***
Vietnam	BI	-2.447444 non stat	-2.535878 non stat
	ΔBI	-5.413098*,**,***	-5.531798*,**,***
	X	-2.504923 non stat	-2.567032 non stat
	ΔX	-5.450552*,**,***	-5.582647*,**,***
	GDP	-2.119793 non stat	-2.129104 non stat
	ΔGDP	-4.834722*,**,***	-4.888229*,**,***
Thailand	BI	-2.761909 non stat	-0.532736 non stat
	ΔBI	-6.535500*,**,***	-6.731265*,**,***
	X	-2.151705 non stat	-2.008414 non stat
	ΔX	-5.638869*,**,***	-5.719454*,**,***
	GDP	-2.281594 non stat	0.408138 non stat
	ΔGDP	-3.011570 non stat	-2.819122***
Indonesia	BI	-3.908785**,***	-1.495084 non stat
	ΔBI	-4.568335*,**,***	-4.710327*,**,***
	X	-3.295655***	-0.124880 non stat
	ΔX	-6.319702*,**,***	-6.333342*,**,***
	GDP	-3.091831 non stat	-1.849029 non stat
	ΔGDP	-6.654193*,**,***	-6.834438*,**,***

Notes: BI = Balassa Index, X = Exports GDP =Gross domestic Product, Δ = Difference, * Shows statistical significance at 1 % level, ** shows significance at 5% and *** shows

[1] In Eviews, trend means with trend and Intercept.

significance at 10% respectively. Lags are chosen according to minimum Akaike Information criterion and Schwarz Bayesian criterion.
H_0: Variable is nonstationary or exist unit root
H_1: Variable is stationary, or unit root does not exist

The unit root test examines the relevant variables' time series properties (Arltova and Fedorova, 2016). The ADF test is commonly used to examine the stationarity of the variables and checks the unit root problem in the variables (Prabhakaran, 2019). This test is applied to the time series data to test the stationarity of the variables. Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests are most applied among scholars (Mamum et al., 2018).

The degree of integration of each variable in this analysis is determined using the ADF test. In a series, the existence of a unit root indicates that a series is nonstationary. In this case, the null hypothesis of non-stationarity for the Balassa Index variable, exports and economic growth is investigated against the alternate of stationarity. The results of the unit root test are reported in Table 1.3.

To investigate the hypothesis above, the ADF test on the first difference is applied for all three variables used in this paper. Most of the test statistics results in Table 1.3 above indicate that the variables are stationary at first. The values for ADF test statistics reported in Table 1.3 are less than critical values under the first difference except for Singapore's and Malaysia's total export and Thailand's gross domestic product (GDP) under the trend. Singapore's and Malaysia's total export and Thailand's gross domestic product (GDP) rejected the null hypothesis at second level difference with the results less than critical values. In the level form, the null hypothesis of non-stationarity is not rejected at different levels of significance. The series is integrated into order one. Therefore, all the series are random walk which requires the first difference to make it stationary, except for Singapore's and Malaysia's total export and Thailand's gross domestic product (GDP) under the trend, which requires the second difference to make it stationary. Therefore, the results it proves that the series are integrated at order one, I(1), except for Singapore's and Malaysia's total export and Thailand's gross domestic product (GDP) under the trend at order two, I(2). After compiling the order of integration, the cointegration test will be applied to the variables using the EViews software.

The Johansen cointegration test is applied to investigate the long run relationship among the variables (Naidu, Pandaram and Chand, 2017). The cointegration test is used to test autocorrelation to check for the error terms. This test is conducted together among all variables involved. If the linear combinations of I(1) variables are I(0), then the variables are said to be co-integrated.

The method of trace statistics and the maximum eigenvalue statistics are used to examine the cointegration relationship. The null hypothesis of no cointegration vector is tested against the alternative hypothesis of one co-integrating vector. The trace statistics tell us whether there is any cointegration between the variables, and the max statistics tells the number of co-integrating equations. The results of this procedure are presented in Table 1.4.

Table 1.4: *Johansen Co-Integration Results*

Null H0	Alternative H1	Trace Statistics	Critical Value 5%	Max-Eigen Statistics	Critical Value 5%
		Singapore (Lag 1 to 1)			
r = 0	r = 1	43.59588	29.79707	23.78739	21.13162
r ≤ 1	r = 2	19.80849	15.49471	15.74326	14.26460
r ≤ 2	r = 3	4.065226	3.841466	4.065226	3.841466
		Malaysia (Lag 1 to 1)			
r = 0	r = 1	28.22404	29.79707	19.10456	21.13162
r ≤ 1	r = 2	9.119482	15.49471	9.027171	14.26460
r ≤ 2	r = 3	0.092311	3.841466	0.092311	3.841466
		Vietnam (Lag 1 to 1)			
r = 0	r = 1	54.78566	29.79707	34.27761	21.13162
r ≤ 1	r = 2	20.50805	15.49471	12.48891	14.26460
r ≤ 2	r = 3	8.019147	3.841466	8.019147	3.841466
		Thailand (Lag 1 to 3)			
r = 0	r = 1	147.5438	29.79707	124.1495	21.13162
r ≤ 1	r = 2	23.39430	15.49471	16.51130	14.26460
r ≤ 2	r = 3	6.883005	3.841466	6.883005	3.841466
		Indonesia (Lag 1 to 1)			
r = 0	r = 1	45.71846	29.79707	22.25049	21.13162
r ≤ 1	r = 2	23.46797	15.49471	19.04297	14.26460
r ≤ 2	r = 3	4.424996	3.841466	4.424996	3.841466

Notes: * represents the rejection of null hypothesis at 5 % significance level. Likelihood ratio test is taken to choose the lag length for each series.
H_0: Variable is co-integrated
H_1: Variable is not co-integrated

The null hypothesis of no cointegration between Balassa Index, exports and economic growth (i.e., r = 0) is rejected at 5 per cent and 1 per cent significance levels in this case. However, the null hypothesis of $r \leq 1$ and $r \leq 2$ is accepted at a 5 per cent significance level. This implies that there is one cointegration equation in all cases. The result suggests that there is a long-run equilibrium relationship among the variables. The variables are co-integrated, implying that residuals obtained from the long-run relationship are integrated of order zero.

The results for the Johansen cointegration test are demonstrated in Table 1.4. The existence of the cointegration between the Balassa Index, exports and economic growth is shown in the trace statistics results. The trace statistics results show the rejection of the no cointegration hypothesis for all the countries. The maximum Eigenvalue statistics show the number of co-integrating equations. In this case, the results explain that all the countries have one co-integrating equation among the three variables. The cointegration relationship shows a long-run relationship between comparative advantage export and economic growth in each developing country mentioned in this paper.

For the case of Singapore and Malaysia, the results prove non-stationarity on the first difference in the unit root test. Therefore, the cointegration test is not applied. As a summary of the regression, the null hypothesis of no cointegration among the comparative advantage calculated by the Balassa Index, exports, and economic growth (r = 0) is rejected at 5 per cent and 10 per cent of significance levels for all the countries in this paper.

Conclusion and Recommendations

It can be concluded that the neighbouring countries surrounding Malaysia have a different comparative advantage in fishery production. Malaysia and Singapore have a comparative advantage in the production of live fish, Vietnam is a comparative advantage in fish fillet and frozen fish meat, Thailand is a comparative advantage in dried fish, and Indonesia has a comparative advantage in terms of aquatic invertebrates. This allows the countries to specialize in their comparative advantage to increase fishery production globally. Besides that, in the long run, if the nation improves its comparative advantage in export in terms of its production by improving the allocation of resources, this will contribute to the country's economic growth. In addition, it also provides more job opportunities and better income distribution among its citizens. However, this study recommends further research to be conducted on different aspects of issues such as the effectiveness of trade policies, the impact of global issues and the preferences of the consumers and incorporating different competitiveness models to get more accurate results as well as to gain the full benefits of specialization in terms of international trade and to increase the food security in the nation.

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