Competitiveness of Malaysian Fisheries Exports: A Constant Market Share Analysis

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Abstract: Malaysia, one of the global major fish producers, has highly traded fisheries products given its many water bodies. Nonetheless, it faces a serious fish trade deficit, implying that the Malaysian fisheries sector might lose its competitiveness in the global market. This paper adopts a modified constant market share (CMS) analysis, which incorporates a net-share approach index and geometric framework, to measure the export competitiveness of the Malaysian fisheries sector. The findings reveal that half of the fisheries products exhibit optimistic export competitiveness. Malaysia reflects the strongest competitiveness in exporting frozen fish and the least competitiveness in the export of crustaceans. Additional effort and attention on those less competitive groups of aquatic invertebrates, live fish and crustaceans are required to improve the export performance. Application of the modified approach is highly proposed as it is not only a simple measurement that gives relatively more accurate results but also succeeds to overcome inconsistency in the traditional approach. The findings provide evidence of unrealised fish export potential regarding product categories, which helps policymakers, traders and marketers to develop their long-term strategic plans and enhance the export competitiveness of the fisheries sector in Malaysia.

Keywords: Competitiveness Index, constant market share, export, fisheries, Malaysia
JEL classification: B27, F14, O13, Q17, Q22

1. Introduction

International trade has contributed positively to economic growth of many countries (Were, 2015). The World Bank (2018) reported that economies benefit from trade expansion through rising competitiveness and job opportunities in exporting sectors. The fisheries sector is important as a source of foreign exchange for Malaysia as fish and fish products are amongst the most traded food items in the world today (Asche, 2014; Food and Agriculture Organization [FAO], 2020). For decades, Malaysia has been benefiting from the production and exports of high-value fish commodities and utilising the foreign exchange acquired for the import of relatively cheaper fish products (FAO,

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2019). Malaysia, one of the global major producers of fisheries products, had exported products worth USD619.183 million in 2020, which was lower compared to the previous year (FAO, 2020; International Trade Centre [ITC], 2021a). Nevertheless, Malaysia exhibits a critical fish trade deficit, where fish import has been increasingly greater than the export since 2011 (Figure 1), indicating the absence of competitive strength in the sector (Gould et al., 1996; Soh & Lim, 2020). In other words, a country with comparative advantage may lose its competitiveness (Dunmore, 1986). This has raised several questions: How competitive are Malaysian fisheries exports? Are all the fisheries exports (i.e. product categories) showing the same level of export competitiveness? If not, then which category(ies) loses or gains export competitiveness globally? Which category(ies) exerts the competitive effect (CE) and growth effect (GE)? The potential of trade with other countries or regions should be realised by the government to ensure economic stability. This study also provides evidence of unrealised fish export potential regarding product categories, which helps fish traders and marketers to develop their long-term strategic plans and enhance the export competitiveness of the Malaysian fisheries sector. Besides that, it is also likely to benefit rural communities, in particular fishermen, in terms of earnings and welfare. Hence, the computation of international competitiveness of a country relative to other countries has been a great concern.

The concept of competitiveness, a widely employed approach in understanding the trade performance of a country, is comprised of two aspects in economics, microeconomic (or firm) aspect and macroeconomic aspect. The definition of competitiveness follows the statement in Porter et al. (2007) – "The most intuitive definition of competitiveness is a country's share of world markets for its products. This makes competitiveness a zero-sum game, because one country's gain comes at the expense

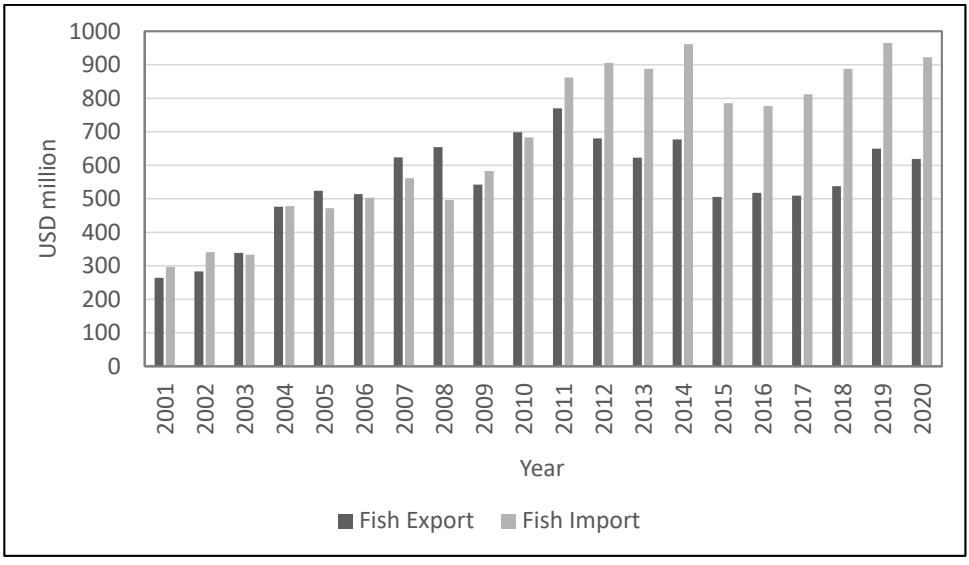

Figure 1. Malaysian fish trade in terms of export and import, 2011-2020
Source: ITC (2021a, 2021b).

of others" (p. 52). This study attempts to examine the competitiveness of Malaysian fisheries exports using a modified constant market share (CMS) analysis proposed by Aisha Nuddin et al. (2018) and Aisha Nuddin and Ibrahim (2019).

Revealed comparative advantage (RCA) which is measured by the ratio between the share in an export market and its world market share at a point in time and (traditional) CMS which generally incorporates a residual effect have been the popular methods of analysing a nation's export competitiveness compared to the rest of the world or single foreign markets. However, the former exhibits problems regarding double-counting and asymmetric value while the latter exerts an "index number problem" (Richardson, 1971) where the inconsistency of the decomposition of growth and competitive effects has resulted from the arbitrary choice of an appropriate base year (and the residual effect). In addition, other drawbacks of traditional CMS cover the interaction effects residual from the CMS identities decomposition and the discrete approximation of continuously changing trade patterns (Aisha Nuddin et al., 2018). This, in turn, will probably give inaccurate information and conflicting outcomes to readers. Unlike RCA and traditional CMS analyses, the systematic constant market share space (CMSS) and constant market share competitiveness (CMSC) methods precisely tell whether the competitiveness of the exported product is driven by the competitiveness effect (CE) (i.e. the expansion in its own net share) or the growth effect (GE) (the growth in world or regional exports) in a relatively simpler (geometric) framework by adapting the net relative change method (based on changes in the market share of a country in a specific period). Most importantly, the CMSS and CMSC measurements are a solution to the index number inconsistency problem carried by the traditional CMS analysis.

This paper is organised as follows. Section one begins with the introduction. Section two reviews the past literature. Section three shows the basic CMS model and reviews some problems of the traditional approach. Section four explains the geometric framework based on the extension and development of the previous section, as well as data sources. Section five interprets the results, and lastly, Section six is the conclusion.

2. Literature Review

One of the most robust propositions of the classical trade theory is that international trade pattern depends on comparative advantage. A country with comparative advantage in a given product exports while the other with comparative disadvantage imports (Ricardo, 1817). Some economists consider the competitiveness of a country's exports identical to the concept of comparative advantage (Krugman, 1996). Backed by the comparative advantage theory, Chandran and Sudarsan (2012) proved that Malaysia exhibited a comparative advantage in live fish and crustaceans while Lee (2020) then found that Malaysia was the only country that reported comparative disadvantage in exporting crustacean to Japan from 2010–2016.

The CMS analysis was first introduced by Tyszynski (1951) in explaining international trade. Nowadays, shift-share analysis (Esteban-Marquillas, 1972) has been developed and is known as CMS analysis, which is applied to comprehend the sectoral trade of different countries. However, relatively less attention has been paid in exploring the export competitiveness in terms of CMS of the Malaysian fisheries sector. There

have been only three related past studies on fisheries commodities (i.e. ornamental fish and tuna) in the past ten years. Rani et al. (2014) and Rani and Immanuel (2015) claimed that Indian ornamental fish exports were less competitive in Malaysia from 1991 to 2009 since exports to the destination was mainly market-driven rather than its competitiveness in which the former measured competitiveness in the residual effect. Apridar (2014) deduced that Indonesian tuna was more competitive (in terms of the scale effect and commodities composition) than Malaysia's from 2005-2010.

Nonetheless, the main shortcoming of the traditional CMS measurement is the "index number problem" (Milana, 1988; Richardson, 1971). Later, this "unsolvable" problem was resolved by Aisha Nuddin et al. (2018) in coming out with a new net-share approach index with a geometric framework. As proof, Aisha Nuddin and Ibrahim (2019) used this advanced method in analysing the competitiveness of Malaysian investment instruments. They deduced that the most competitive mode of the transaction was the Islamic non-profit-loss-sharing mode of financing whereas the least competitive was the conventional mode in 2015.

To our best knowledge, this modified analysis has not yet been applied to Malaysian fisheries products since it is a contemporary approach. In addition, there are only three studies (Apridar, 2014; Rani et al., 2014; Rani & Immanuel, 2015) that considered Malaysia as the foreign countries' export market of fisheries commodities, hence motivating this present study to fill the knowledge gap about the export competitiveness (in terms of CMSC and CMSS – CE and GE) of Malaysian aggregate fisheries product categories.

3. The Basic CMS Model

This study focuses on world trade and fisheries competitiveness from a home country perspective within a given period. Assume *p* is the total value of home fish exports by category and Q is the total value of home fish exports. Therefore, $s = \frac{p}{Q}$ is the share of home fish exports by category to the total home fish exports. The formulation of the basic identity of the CMS is as follows:

$$\frac{dp}{dt} = s\frac{dQ}{dt} + Q\frac{ds}{dt} \tag{1}$$

There is an infinitesimally short time period in Equation (1) while CMS analysis is commonly used over a discrete time period. Hence, some new CMS identities (Richardson, 1971) are as follows:

$$\Delta p = s^0 \Delta Q + Q^1 \Delta s \tag{2}$$

$$\Delta p = s^1 \Delta Q + Q^0 \Delta s \tag{3}$$

$$\Delta p = s^0 \Delta Q + Q^0 \Delta s + \Delta s \Delta Q \tag{4}$$

$$\Delta p = (\alpha s^0 + (1-\alpha)s^1)\Delta Q + (\alpha Q^1 + (1-\alpha)Q^0)\Delta s \quad for\ 0 < \alpha < 1 \tag{5}$$

where Δ denotes change and the superscripts are the initial and subsequent time periods in total exports, *Q* and the share of exports, *s* while *α* is a constant.

Other than Equation (2), other identities can also be applied in CMS studies. The above-mentioned inconsistency, which has been created by (flexible) options of CMS identities, exist in the decomposition of identity: (1) $Q^1\Delta s$ implies CE and $s^0\Delta Q$ implies GE whereas in identity (2) $Q^0\Delta s$ implies CE and $s^1\Delta Q$ implies GE. Δp is decomposed in identity (3) into three parts separating the residual term $\Delta s\Delta Q$ (or called the interaction effect) from CE and GE. Again, the existence of interaction effect is also linked to base year – the selection of the same base year in their formation. The residual $\Delta s\Delta Q$ in identity (1) is part of CE but in identity (2) it is part of GE.

Setting identity (5) with $\alpha = 0.5$ (i.e. the most precise discrete-time approximation) in the light of index number theory, Milana's (1988) CMS identity that solves inconsistency caused by the residual term ($\Delta s\Delta Q$) is displayed as:

$$\Delta p = \frac{1}{2}\Delta Q(s^1 + s^0) + \frac{1}{2}\Delta s(Q^1 + Q^0) \tag{6}$$

Equation (6) is then adopted by Aisha Nuddin et al. (2018) and Aisha Nuddin and Ibrahim (2019) in formulating CE and GE. CE indicates the increment (decrement) in a country's export quantity caused by a rise (fall) merely in the country's market share while GE represents the increment (decrement) in a country's export quantity that is led by an expansion (contraction) in the global or regional market share only. As per Figure 2, GE is shown in the area of the trapezium $\frac{1}{2}\Delta Q(s^1 + s^0)$ while CE is in the area of the other trapezium $\frac{1}{2}\Delta s(Q^1 + Q^0)$, as in the formulation below:

$$\Delta p = \frac{1}{2}\Delta Q(s^1 + s^0) + \frac{1}{2}\Delta s(Q^1 + Q^0) = GE + CE \tag{7}$$

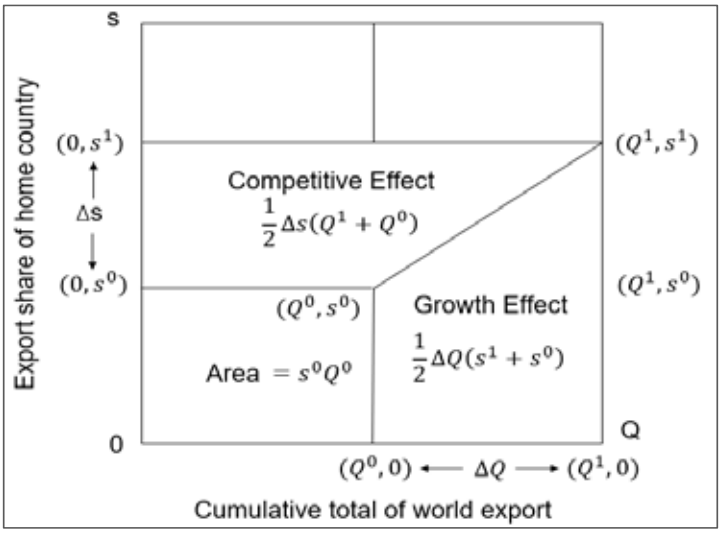

Figure 2. Area interpretation of Milana's CMS identity for $\Delta Q > 0$ and $\Delta s > 0$
Source: Aisha Nuddin et al. (2018).

4. A Geometric Framework for CMS Analysis

The CMS is now translated into a geometric space by constructing on the original geometric framework of Azhar and Elliott (2003) to develop a geometrical tool, also named Constant Market Share Space (CMSS) (Aisha Nuddin et al., 2018). The changes and differences in CE and GE are visualised within this new framework where each region has identical competitiveness characteristics.

The two-dimensional CMSS is a square and has four quadrants that can gauge every CE and GE for each of *n* countries for a given period where the CE and GE can be positive, negative or zero. The CE is represented on the vertical axis (+/– *CE*) and the GE on the horizontal axis (+/– *GE*). The lengths of the sides of the CMSS are shown by twice the maximum of the largest absolute value of whichever is greater of the CE or GE for the period of study. The CE and GE for any of the *n* countries in an analysed period are represented by a single coordinate point in the CMSS (Figure 3). The axes are labelled based on the Cartesian plane in which the centre is the origin (point F), (*CE*, *GE*) = (0,0). Points Y and Z are two representative countries' coordinates in which Y has positive values while Z has negative values for both CE and GE. In this case, Y is on the right side of the vertical (CE) axis (and relatively further away from the origin), indicating it has more export increment than Z (Figure 4). Consistent with Figure 5, the higher the position in the CMSS, the greater the export competitiveness. Y has more export competitiveness than Z due to its relatively higher position and CE value (500 units), indicating that the export performance of Y is relatively led more by the effect of competitiveness (CE). Meanwhile, Z is less competitive as it does not carry a competitive effect (CE), which is reflected by the negative CE value. Note that Figures 4 and 5 will be explained further in the later part.

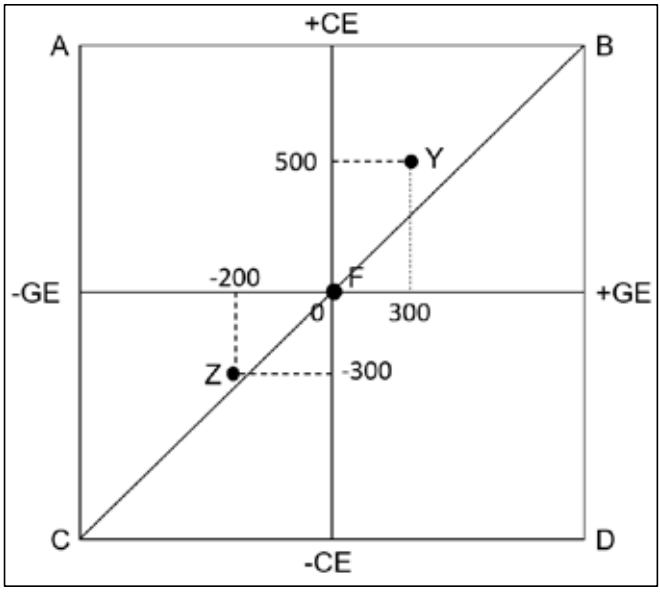

Figure 3. The CMSS

The CMSS for *n* countries provided by Aisha Nuddin et al. (2018) is shown in set notation as:

$$CMSS = \{(x,y)| - |max(CE_t, GE_t)| \leq x \leq max(CE_t, GE_t),$$
$$-|max(CE_t, GE_t)| \leq x \leq max(CE_t, GE_t), \quad t = 1,2,3, \dots m\} \tag{8}$$

Assume a hypothetical CMS study on exports for *n* countries for a given number of years. This is represented as follows where CE_i is the competitive effect of country *i*, $\sum_{i=1}^{k} CE_i$ is the sum of the CEs above the x-axis (which are all positive) and $\sum_{i=1}^{f} CE_i$ is the sum of all the CEs below the x-axis (which are all negative). Given that the total of all the CEs is equivalent to zero (since CE is presumed to be a zero-sum game),

$$\sum_{i=1}^{n} CE_i = 0 \quad implies \sum_{i=1}^{k} CE_i + \sum^{f} CE_i = 0, \quad n = k + f$$

$$therefore \quad \sum_{i=1}^{k} CE_i = -\sum_{i=1}^{f} CE_i \tag{9}$$

From equation (7), $\Delta p = GE + CE$, hence for any specific Δp, the locus of equi-Δp can be illustrated by a straight line with a slope of minus unity in the CMSS (lines parallel to diagonal AD in Figure 4). The corresponding Δp for all the locus of equi-Δp, is the vertical intercept where; $\forall \Delta p_t > \Delta p_{t-1}$ means $(CE + GE)_t > (CE + GE)_{t-1} = \Delta p_{t-1}$. The direction of rising Δp isoclines within the CMSS (Figure 4) was developed by Aisha Nuddin et al. (2018) to overcome the afore-stated problems specified by previous

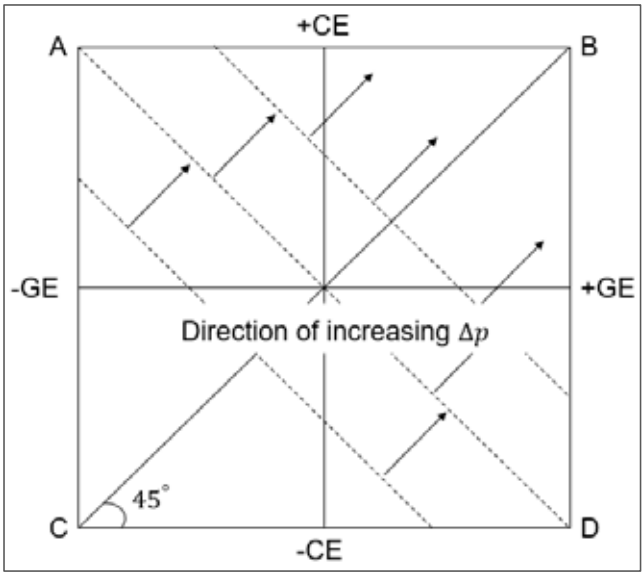

Figure 4. Isoclines of equi-Δp
Source: Aisha Nuddin et al. (2018).

research in this area. The further (right side) the coordinate from the origin, the larger the increment in exports (Δp).

4.1 The Constant Market Share Competitiveness Index

In computing a new competitiveness index, Milana's identity (equation 5) was used by Aisha Nuddin et al. (2018) in decomposing the change in the total amount of fish exports into GEs and CEs. Consistent with the earlier mentioned statement by Porter et al. (2007), the proposed CMS Competitiveness (CMSC) index is following changes in the market share of the fish exports (either positive or negative) in a specific period.

As mentioned before, $s = \frac{p}{Q}$ is the fisheries exports share of the home country by category. Thus, at the beginning of the analysis period:

$$s^0 = \frac{p^0}{Q^0} \tag{10}$$

while at the end of the analysis period, it is:

$$s^1 = \frac{p^1}{Q^1} \tag{11}$$

The change in the share $\Delta s = s^1 - s^0$ measuring the changes in the export shares of countries in a region for a given period also symbolizes the "net share" of the export share where $-1 < \Delta s < 1$ and $\sum_{t=1}^{n} \Delta s_i = 0$. The CMSC index, a modified version of the index proposed by Aisha Nuddin and Ibrahim (2019), is expressed as:

$$CMSC = \frac{s^1 - s^0}{\max(s_m^1, s_m^0)} \tag{12}$$

Note that the denominator, $\max(s_m^1, s_m^0)$ represents the highest export share between these periods. Proportionality of CMSC index and CE is reflected in horizontal lines parallel to the x-axis (Figure 5). A positive CMSC index above the horizontal axis implies that the category gains stronger export competitiveness while a negative index below the axis reflects an absence of competitiveness.

In essence, the CMSC index does not rely on a base period but it illustrates the competitiveness of a category of fisheries product relative to all the other categories of fisheries products in the CMSS. This property of the CMSC index solves the inconsistency problem carried by the traditional analyses. The CMSC index indicates measure of competitiveness while CE refers to the effect of the competitiveness. Over two different periods, a country with the same CMSC indices might not have identical CE values. By using this index, the export performance of countries can be compared over several different analysing periods and can also be analysed in any field or sector.

4.2 Data

The data were obtained from the Trade Map's website (ITC, 2021a) from 2011-2012 to 2019-2020 under the four-digit level of Harmonised System (HS) code with all values in USD million. The present study centres on the Malaysian fisheries sector, practising

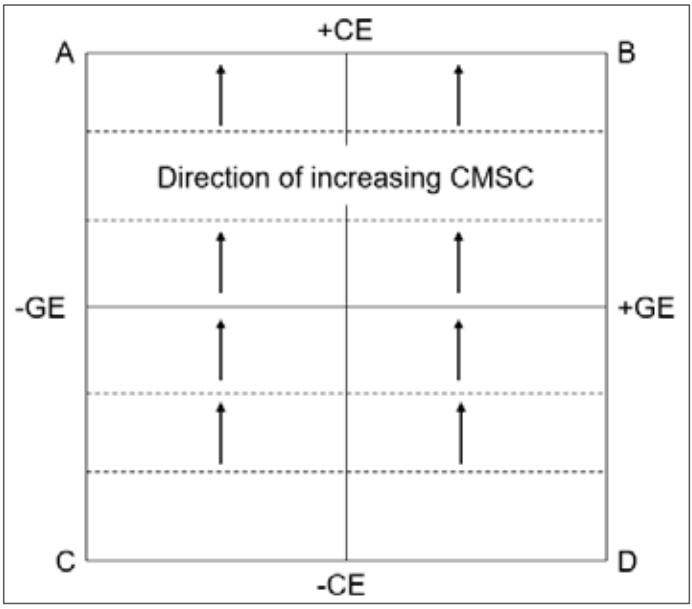

Figure 5. Competitiveness index isoclines
Source: Aisha Nuddin et al. (2018).

Table 1. Product categories of fisheries based on HS (03) international classification

HS codes	Fisheries products	Abbreviation
0301	Live fish	LIVE
0302	Fish, fresh or chilled (excluding HS 0304)	FRESH
0303	Frozen fish (excluding HS 0304)	FROZEN
0304	Fish fillets and other fish meat, whether or not minced, fresh, chilled or frozen	FILLET
0305	Fish, fit for human consumption	FISH
0306	Crustaceans, fit for human consumption	CRUSTA
0307	Molluscs, fit for human consumption	MOLLUSC
0308	Aquatic invertebrates other than HS 0306 and HS 0307	AQUAINV

the analysis on eight categories under HS 03 (fish and crustaceans, molluscs and other aquatic invertebrates) as in Table 1.

5. Results and Discussion

Computations of all relevant figures of Malaysian fisheries products from 2011-2012 to 2019-2020 are provided in Tables 2 to 10 and the CMSS analyses in Figures 6 to 14. Tables 2, 3, 5, 7 and 10 represent the calculations when Malaysia experiences decreasing fish exports: -USD90.009 million, -USD56.929 million, -USD171.418 million,

-USD7.883 million and -USD29.996 million in 2011-2012, 2012-2013, 2014-2015, 2016-2017 and 2019-2020 respectively, with negative GE values while Tables 4, 6, 8 and 9 show increments of USD53.941 million, USD12.037 million, USD27.791 million and USD111.800 million in 2013-2014, 2015-2016, 2017-2018 and 2018-2019 respectively, with positive GE values. A positive (negative) GE value indicates any rise (fall) in the exports of products caused by an expansion (contraction) in the total fisheries exports merely for Malaysia. Despite the fact that the most and least competitive categories change over time, FROZEN has been the most export competitiveness among all categories owing to its greater positive values of CMSC index and CE while CRUSTA exerts the least competitiveness given its (negative) CMSC index and CE values in which its overall GE is a negative value. This also implies that FROZEN gains the greatest share among all categories where its export expansion remains the highest (e.g. in 2014-2015, 2015-2016 and 2019-2020). Although CRUSTA constitutes the biggest part of total Malaysian fisheries exports, it still loses the most in terms of export share (e.g. in 2011-2012, 2014-2015, 2015-2016 and 2019-2020). Unlike CRUSTA, the CE of FROZEN is always more than the GE, meaning that the FROZEN category relatively has its own competitive nature. The Malaysian fish processing sector, which is export-oriented and incorporates frozen products, has obtained an important position given its "ready to eat" form (Malaysian International Food and Beverage [MIFB] Trade Fair, 2020; Yew et al., 2020). The collapse in oil prices (from 2014-2016) is likely to encourage more exports (competitiveness) of higher-value products like FROZEN through lower transportation cost where frozen transport (i.e. commonly from -20°C to -40°C) is relatively more energy-demanding than refrigerated transport (i.e. at 4°C) (Index Mundi, 2021; Muir, 2015). Moreover, the Coronavirus disease in 2019 (COVID-19) which was later declared a pandemic boosts (foreign) consumers demand for packaged and frozen products since they prefer to stock up on non-perishable (sea)food during times of uncertainty (Chase, 2020). The outbreak of acute hepatopancreatic necrosis disease (in 2011) has greatly hurt the production and export (competitiveness) of CRUSTA (FAO Fishery Statistics [FishStat], 2020; Lee, 2020), which may eventually lead to the ongoing trade deficit as well as lack of competitiveness and food availability regarding the fisheries sector.

For most periods, FROZEN, FRESH and FILLET are influenced by the effect of competitiveness that is reflected from their positive CE and negative GE values (even though the CE value of FRESH and FILLET is small) whilst MOLLUSC is led by CE since 2014-2015. This means that these categories are relatively more in demand in global markets, which may due to the competitive price and/or the quality of the categories. Namely, fresh seafood (e.g. oysters and sea bass), which has been always the most significant seafood globally, as well as frozen fillets and whole frozen tilapia are exported by Malaysia at a relatively lower price (MIFB, 2020; Towers, 2017).

The CMSS (Figures 6 to 14) not only gives the ranking in export competitiveness of the categories based on their position but also the increment in the amount involved in the categories. As per Figures 6, 7, 9, 11 and 14, all coordinate points of the categories are on the left side of the vertical (CE) axis, therefore showing a decrement in the total fisheries exports in Malaysia during the respective periods while Figures 8, 10, 12

Table 2. Analysis of the export performance of fisheries product categories in Malaysia, 2011-2012

Category	p^0	Δp	p^1	s^0	s^1	$\Delta s = s^1 - s^0$	CMSC Index	$CE = \frac{1}{2}(Q^0 + Q^1)\Delta s$	$GE = \frac{1}{2}(s^0 + s^1)\Delta Q$
LIVE	70.757	-3.362	67.395	0.09191	0.09913	0.00722	0.01154	5.23581	-8.59781
FRESH	22.168	2.327	24.495	0.02880	0.03603	0.00724	0.01156	5.24444	-2.91744
FROZEN	59.104	1.424	60.528	0.07677	0.08903	0.01226	0.01959	8.88600	-7.46200
FILLET	34.998	1.998	36.996	0.04546	0.05442	0.00896	0.01432	6.49302	-4.49502
FISH	14.349	-4.177	10.172	0.01864	0.01496	-0.00368	-0.00588	-2.66481	-1.51219
CRUSTA	481.721	-90.752	390.969	0.62573	0.57509	-0.05064	-0.08094	-36.70966	-54.04234
MOLLUSC	86.754	2.533	89.287	0.11269	0.13133	0.01865	0.02980	13.51519	-10.98219
AQUAINV	0	0	0	0	0	0	0	0	0
Total	769.851	-90.009	679.842	1	1	0	0	0	-90.009

Table 3. Analysis of the export performance of fisheries product categories in Malaysia, 2012-2013

Category	p^0	Δp	p^1	s^0	s^1	$\Delta s = s^1 - s^0$	CMSC Index	$CE = \frac{1}{2}(Q^0 + Q^1)\Delta s$	$GE = \frac{1}{2}(s^0 + s^1)\Delta Q$
LIVE	67.395	-14.126	53.269	0.09913	0.08552	-0.01362	-0.02368	-8.87006	-5.25594
FRESH	24.495	1.46	25.955	0.03603	0.04167	0.00564	0.00980	3.67162	-2.21162
FROZEN	60.528	-0.101	60.427	0.08903	0.09701	0.00797	0.01387	5.19452	-5.29552
FILLET	36.996	-0.878	36.118	0.05442	0.05798	0.00356	0.00620	2.32143	-3.19943
FISH	10.172	-4.261	5.911	0.01496	0.00949	-0.00547	-0.00952	-3.56500	-0.69600
CRUSTA	390.969	-37.937	353.032	0.57509	0.56674	-0.00834	-0.01451	-5.43538	-32.50162
MOLLUSC	89.287	-11.728	77.559	0.13133	0.12451	-0.00682	-0.01187	-4.44551	-7.28249
AQUAINV	0	10.643	10.643	0	0.01709	0.01709	0.02971	11.12934	-0.48634
Total	679.843	-56.929	622.914	1	1	0	0	0	-56.929

Table 4. Analysis of the export performance of fisheries product categories in Malaysia, 2013-2014

Category	p^0	Δp	p^1	s^0	s^1	$\Delta s = s^1 - s^0$	CMSC Index	$CE = \frac{1}{2}(Q^0 + Q^1)\Delta s$	$GE = \frac{1}{2}(s^0 + s^1)\Delta Q$
LIVE	53.269	-0.426	52.843	0.08552	0.07807	-0.00744	-0.01205	-4.83803	4.41203
FRESH	25.955	-2.120	23.835	0.04167	0.03521	-0.00645	-0.01044	-4.19353	2.07353
FROZEN	60.427	-7.589	52.838	0.09701	0.07806	-0.01894	-0.03065	-12.31075	4.72175
FILLET	36.118	4.183	40.301	0.05798	0.05954	0.00156	0.00252	1.01332	3.16968
FISH	5.911	1.519	7.430	0.00949	0.01098	0.00149	0.00241	0.96701	0.55199
CRUSTA	353.032	65.246	418.278	0.56674	0.61797	0.05123	0.08290	33.29363	31.95237
MOLLUSC	77.559	-2.361	75.198	0.12451	0.11110	-0.01341	-0.02170	-8.71550	6.35450
AQUAINV	10.643	-4.511	6.132	0.01709	0.00906	-0.00803	-0.01299	-5.21615	0.70515
Total	622.914	53.941	676.855	1	1	0	0	0	53.941

Table 5. Analysis of the export performance of fisheries product categories in Malaysia, 2014-2015

Category	p^0	Δp	p^1	s^0	s^1	$\Delta s = s^1 - s^0$	CMSC Index	$CE = \frac{1}{2}(Q^0 + Q^1)\Delta s$	$GE = \frac{1}{2}(s^0 + s^1)\Delta Q$
LIVE	52.843	-18.183	34.660	0.07807	0.06857	-0.00950	-0.01537	-5.61414	-12.56886
FRESH	23.835	-7.218	16.617	0.03521	0.03288	-0.00234	-0.00378	-1.38200	-5.83600
FROZEN	52.838	11.770	64.608	0.07806	0.12783	0.04976	0.08052	29.41663	-17.64663
FILLET	40.301	-2.879	37.422	0.05954	0.07404	0.01450	0.02346	8.57005	-11.44905
FISH	7.430	5.834	13.264	0.01098	0.02624	0.01527	0.02470	9.02408	-3.19008
CRUSTA	418.278	-160.874	257.404	0.61797	0.50927	-0.10870	-0.17590	-64.25913	-96.61487
MOLLUSC	75.198	-3.178	72.020	0.11110	0.14249	0.03139	0.05080	18.55692	-21.73492
AQUAINV	6.132	3.310	9.442	0.00906	0.01868	0.00962	0.01557	5.68760	-2.37760
Total	676.855	-171.418	505.437	1	1	0	0	0	-171.418

Table 6. Analysis of the export performance of fisheries product categories in Malaysia, 2015-2016

Category	p^0	Δp	p^1	s^0	s^1	$\Delta s = s^1 - s^0$	CMSC Index	$CE = \frac{1}{2}(Q^0 + Q^1)\Delta s$	$GE = \frac{1}{2}(s^0 + s^1)\Delta Q$
LIVE	34.660	-7.235	27.425	0.06857	0.05300	-0.01558	-0.03059	-7.96668	0.73168
FRESH	16.617	-0.756	15.861	0.03288	0.03065	-0.00223	-0.00437	-1.13834	0.38234
FROZEN	64.608	35.144	99.752	0.12783	0.19277	0.06494	0.12752	33.21451	1.92949
FILLET	37.422	-0.425	36.997	0.07404	0.07150	-0.00254	-0.00499	-1.30090	0.87590
FISH	13.264	9.995	23.259	0.02624	0.04495	0.01870	0.03673	9.56654	0.42846
CRUSTA	257.404	-45.352	212.052	0.50927	0.40978	-0.09949	-0.19535	-50.88333	5.53133
MOLLUSC	72.020	17.059	89.079	0.14249	0.17214	0.02965	0.05822	15.16538	1.89362
AQUAINV	9.442	3.604	13.046	0.01868	0.02521	0.00653	0.01282	3.33984	0.26416
Total	505.436	12.037	517.473	1	1	0	0	0	12.037

Table 7. Analysis of the export performance of fisheries product categories in Malaysia, 2016-2017

Category	p^0	Δp	p^1	s^0	s^1	$\Delta s = s^1 - s^0$	CMSC Index	$CE = \frac{1}{2}(Q^0 + Q^1)\Delta s$	$GE = \frac{1}{2}(s^0 + s^1)\Delta Q$
LIVE	27.425	-0.98	26.445	0.05300	0.05189	-0.00110	-0.00240	-0.56657	-0.41343
FRESH	15.861	3.611	19.472	0.03065	0.03821	0.00756	0.01644	3.88242	-0.27142
FROZEN	99.752	-30.780	68.972	0.19277	0.13535	-0.05742	-0.12487	-29.48673	-1.29327
FILLET	36.997	-3.522	33.475	0.07150	0.06569	-0.00581	-0.01262	-2.98128	-0.54072
FISH	23.259	3.428	26.687	0.04495	0.05237	0.00742	0.01614	3.81157	-0.38357
CRUSTA	212.052	22.279	234.331	0.40978	0.45984	0.05006	0.10886	25.70663	-3.42763
MOLLUSC	89.079	-0.918	88.161	0.17214	0.17300	0.00086	0.00187	0.44239	-1.36039
AQUAINV	13.046	-1.001	12.045	0.02521	0.02364	-0.00157	-0.00342	-0.80847	-0.19253
Total	517.473	-7.883	509.590	1	1	0	0	0	-7.883

Table 8. Analysis of the export performance of fisheries product categories in Malaysia, 2017-2018

Category	p^0	Δp	p^1	s^0	s^1	$\Delta s = s^1 - s^0$	CMSC Index	$CE = \frac{1}{2}(Q^0 + Q^1)\Delta s$	$GE = \frac{1}{2}(s^0 + s^1)\Delta Q$
LIVE	26.445	4.142	30.587	0.05189	0.05692	0.00502	0.01030	2.62998	1.51202
FRESH	19.472	4.641	24.113	0.03821	0.04487	0.00666	0.01366	3.48652	1.15448
FROZEN	68.972	-1.179	67.793	0.13535	0.12615	-0.00919	-0.01886	-4.81272	3.63372
FILLET	33.475	4.129	37.604	0.06569	0.06998	0.00429	0.00879	2.24384	1.88516
FISH	26.687	4.687	31.374	0.05237	0.05838	0.00601	0.01233	3.14803	1.53897
CRUSTA	234.331	27.662	261.993	0.45984	0.48754	0.02769	0.05680	14.49764	13.16436
MOLLUSC	88.161	-17.825	70.336	0.17300	0.13089	-0.04212	-0.08639	-22.04773	4.22273
AQUAINV	12.045	1.534	13.579	0.02364	0.02527	0.00163	0.00335	0.85443	0.67957
Total	509.588	27.791	537.379	1	1	0	0	0	27.791

Table 9. Analysis of the export performance of fisheries product categories in Malaysia, 2018-2019

Category	p^0	Δp	p^1	s^0	s^1	$\Delta s = s^1 - s^0$	CMSC Index	$CE = \frac{1}{2}(Q^0 + Q^1)\Delta s$	$GE = \frac{1}{2}(s^0 + s^1)\Delta Q$
LIVE	30.587	-1.779	28.808	0.05692	0.04438	-0.01254	-0.02568	-7.44139	5.66239
FRESH	24.113	5.635	29.748	0.04487	0.04582	0.00095	0.00195	0.56512	5.06988
FROZEN	67.793	2.612	70.405	0.12615	0.10845	-0.01770	-0.03624	-10.50255	13.11455
FILLET	37.604	9.042	46.646	0.06998	0.07185	0.00188	0.00384	1.11367	7.92833
FISH	31.374	-9.426	21.948	0.05838	0.03381	-0.02457	-0.05031	-14.57955	5.15355
CRUSTA	261.993	55.130	317.123	0.48754	0.48850	0.00096	0.00197	0.56952	54.56048
MOLLUSC	70.336	19.943	90.279	0.13089	0.13907	0.00818	0.01674	4.85260	15.09040
AQUAINV	13.579	30.644	44.223	0.02527	0.06812	0.04285	0.08772	25.42348	5.22052
Total	537.379	111.800	649.179	1	1	0	0	0	111.800

Table 10. Analysis of the export performance of fisheries product categories in Malaysia, 2019-2020

Category	p^0	Δp	p^1	s^0	s^1	$\Delta s = s^1 - s^0$	CMSC Index	$CE = \frac{1}{2}(Q^0 + Q^1)\Delta s$	$GE = \frac{1}{2}(s^0 + s^1)\Delta Q$
LIVE	28.808	-5.075	23.733	0.04438	0.03833	-0.00605	-0.01238	-3.83458	-1.24042
FRESH	29.748	2.565	32.313	0.04582	0.05219	0.00636	0.01302	4.03496	-1.46996
FROZEN	70.405	47.169	117.574	0.10845	0.18989	0.08143	0.16670	51.64347	-4.47447
FILLET	46.646	0.955	47.601	0.07185	0.07688	0.00502	0.01028	3.18567	-2.23067
FISH	21.948	-4.642	17.306	0.03381	0.02795	-0.00586	-0.01199	-3.71574	-0.92626
CRUSTA	317.123	-67.041	250.082	0.48850	0.40389	-0.08461	-0.17320	-53.65695	-13.38405
MOLLUSC	90.279	1.495	91.774	0.13907	0.14822	0.00915	0.01873	5.80369	-4.30869
AQUAINV	44.223	-5.423	38.8	0.06812	0.06266	-0.00546	-0.01117	-3.46149	-1.96151
Total	649.179	-29.996	619.183	1	1	0	0	0	-29.996

and 13 are in the opposite situation. Consistent with the CMSC index, FROZEN is the most export competitive due to its highest position with respect to equi-CMSC index isoclines whilst CRUSTA reports the lowest position with respect to equi-CMSC index isoclines (i.e. implying that it is the least competitive) in general terms. Interestingly, FROZEN and MOLLUSC always compete vigorously with each other to obtain a higher position in which the export performance of FROZEN has surpassed MOLLUSC since 2014-2015. MOLLUSC, which is the second-largest category in exports, and FISH are also favoured among international markets since they obtain the second and third highest position, respectively. The export competitiveness of FILLET, FRESH, AQUAINV and LIVE is average since their coordinate points are close to the origin in some periods, implying nearly zero change in the amount and share of the products in which LIVE has typically resulted from GE in terms of the growth in total Malaysian fisheries export. As proof, AQUAINV in 2011-2012, 2016-2017 and 2017-2018; FRESH in 2015-2016 and 2018-2019; LIVE in 2016-2017; and FILLET during 2015-2016 whereby the coordinate of AQUAINV is exactly at origin during 2011-2012 that is aligned with Table 2. In addition, LIVE and FRESH show a relatively stable (average) export performance throughout the whole period (Table 11) since live ornamental freshwater fish (HS 030111) and fresh or chilled fish (HS 030289), which are the respective biggest component of LIVE and FRESH, exhibit a stable pattern of export volume as well.

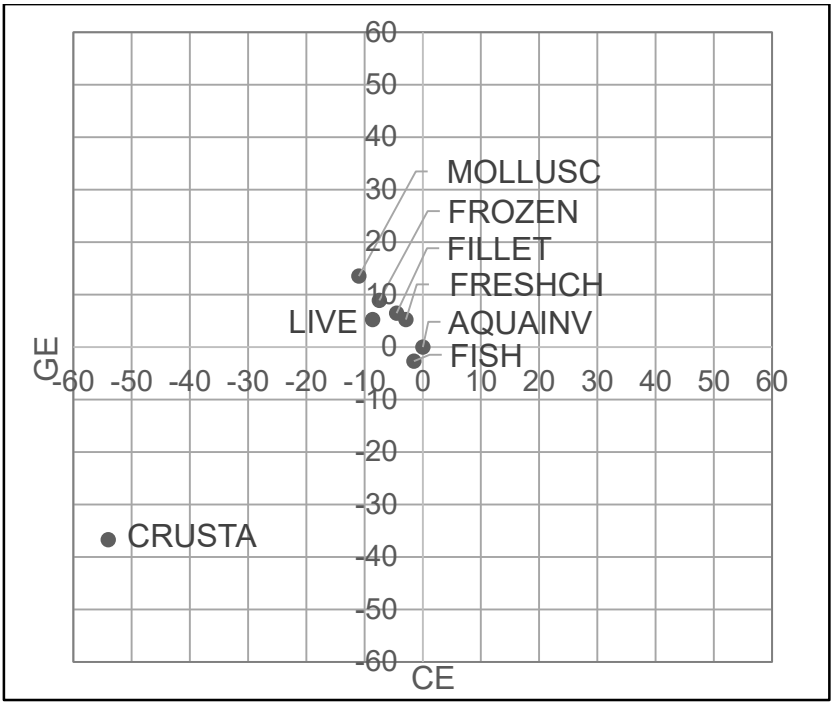

Figure 6. CMSS analysis based on Table 2, 2011-2012

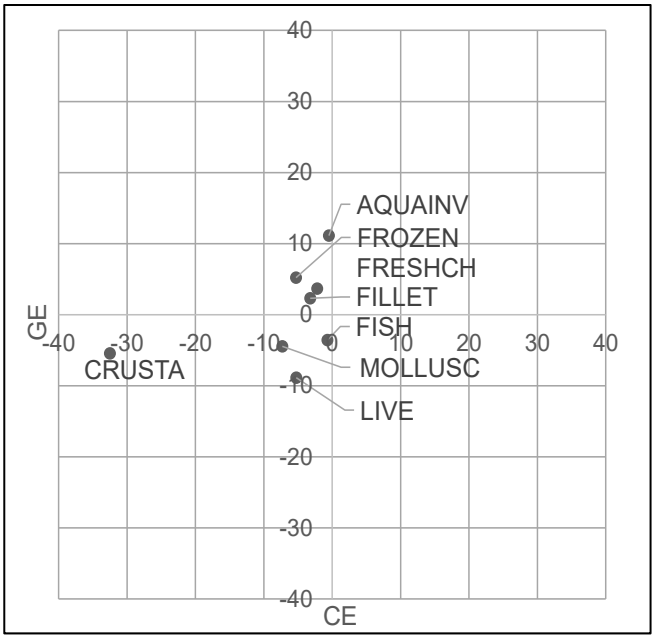

Figure 7. CMSS analysis based on Table 3, 2012-2013

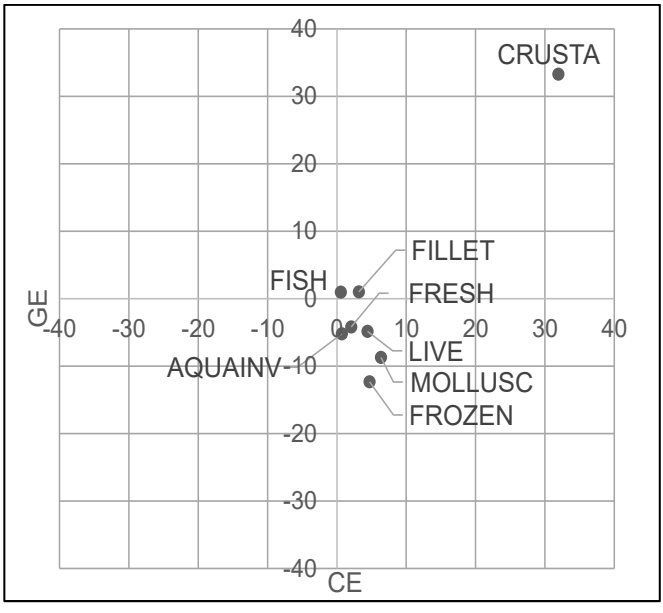

Figure 8. CMSS analysis based on Table 4, 2013-2014

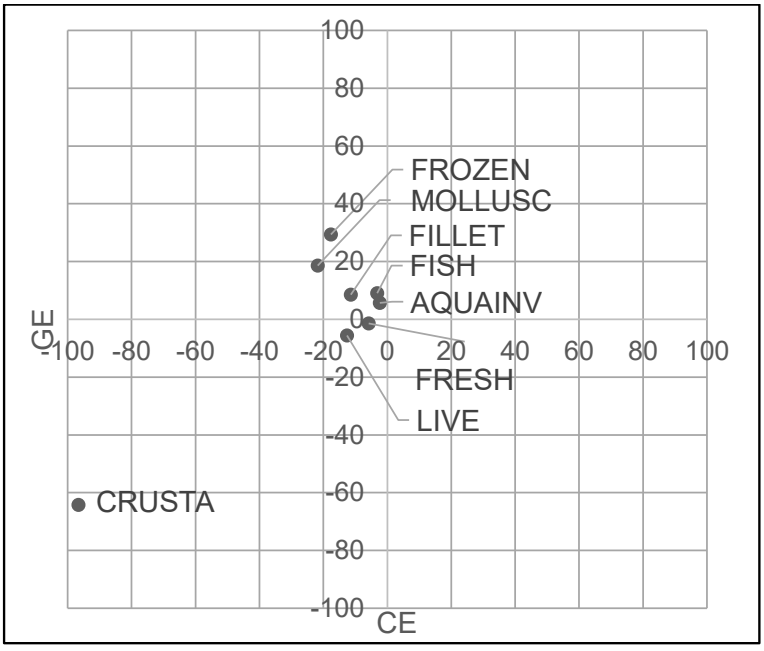

Figure 9. CMSS analysis based on Table 5, 2014-2015

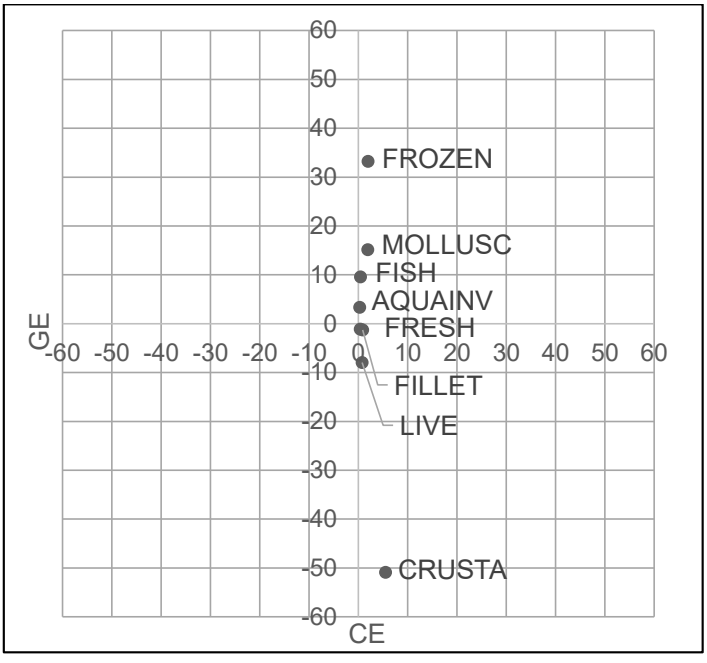

Figure 10. CMSS analysis based on Table 6, 2015-2016

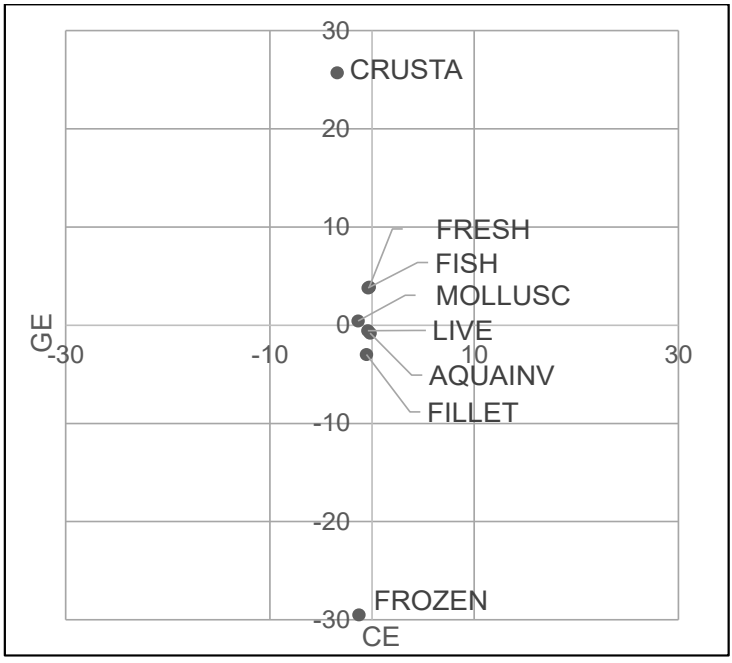

Figure 11. CMSS analysis based on Table 7, 2016-2017

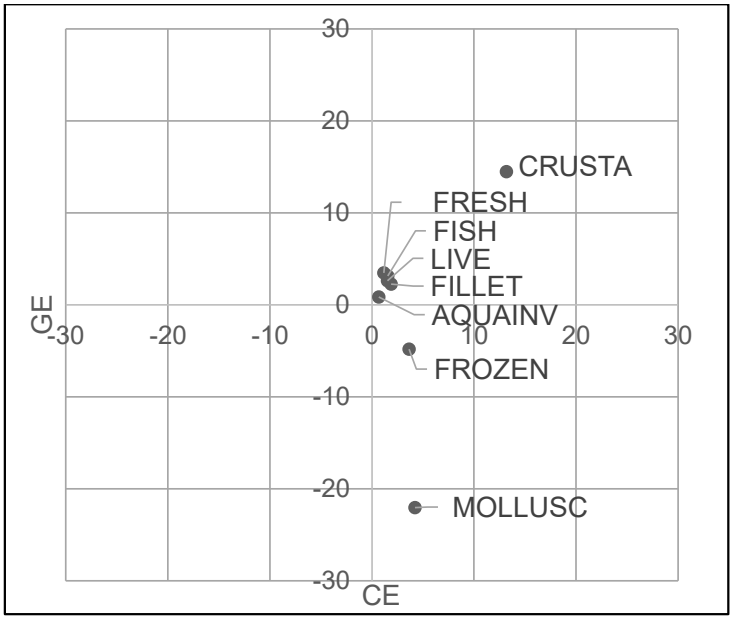

Figure 12. CMSS analysis based on Table 8, 2017-2018

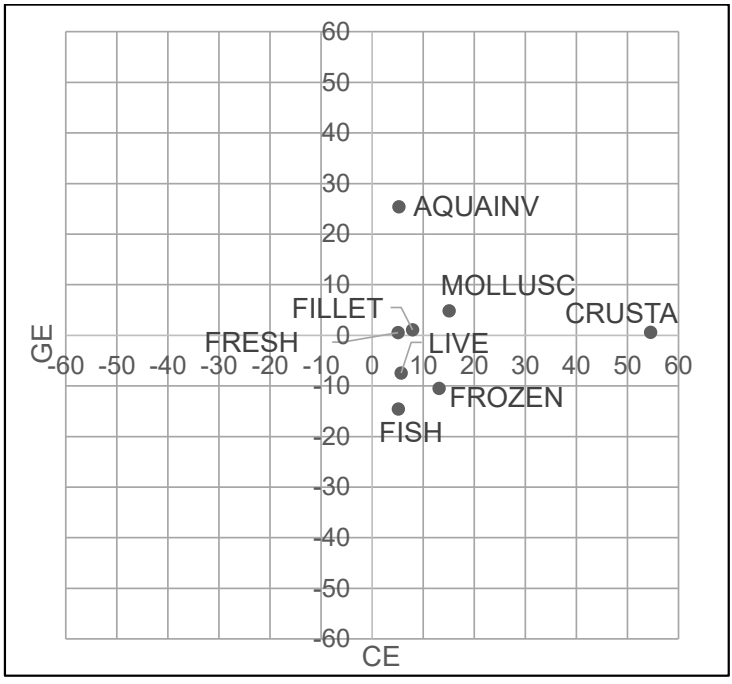

Figure 13. CMSS analysis based on Table 9, 2018-2019

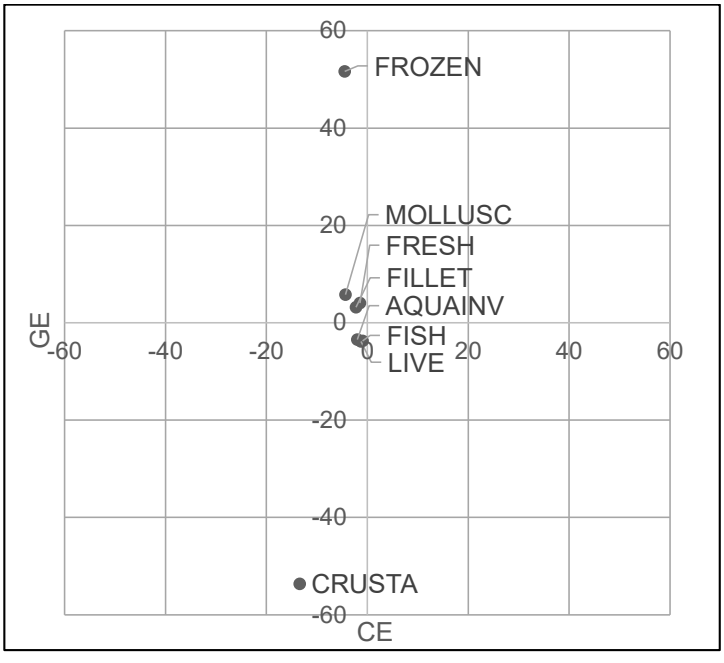

Figure 14. CMSS analysis based on Table 10, 2019-2020

Table 11. Ranking in export competitiveness of the fisheries product categories from 2011-2012 to 2019-2020

Rank	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020
1st (Most)	MOLLUSC^{+}	AQUAINV^{+}	CRUSTA^{+}	FROZEN^{+}	FROZEN^{+}	CRUSTA^{+}	CRUSTA^{+}	AQUAINV^{+}	FROZEN^{+}
2nd	FROZEN^{+}	FROZEN^{+}	FILLET^{+}	MOLLUSC^{+}	MOLLUSC^{+}	FRESH^{+}	FRESH^{+}	MOLLUSC^{+}	MOLLUSC^{+}
3rd	FILLET^{+}	FRESH^{+}	FISH^{+}	FISH^{+}	FISH^{+}	FISH^{+}	FISH^{+}	FILLET^{+}	FRESH^{+}
4th	FRESH^{+}	FILLET^{+}	FRESH^{-}	FILLET^{+}	AQUAINV^{+}	MOLLUSC^{+}	LIVE^{+}	CRUSTA^{+}	FILLET^{+}
5th	LIVE^{+}	FISH^{-}	LIVE^{-}	AQUAINV^{+}	FRESH^{-}	LIVE^{-}	FILLET^{+}	FRESH^{+}	AQUAINV^{-}
6th	AQUAINV^{+}	MOLLUSC^{-}	AQUAINV^{-}	FRESH^{-}	FILLET^{-}	AQUAINV^{-}	AQUAINV^{+}	LIVE^{-}	FISH^{-}
7th	FISH^{-}	CRUSTA^{-}	MOLLUSC^{-}	LIVE^{-}	LIVE^{-}	FILLET^{-}	FROZEN^{-}	FROZEN^{-}	LIVE^{-}
8th (Least)	CRUSTA^{-}	LIVE^{-}	FROZEN^{-}	CRUSTA^{-}	CRUSTA^{-}	FROZEN^{-}	MOLLUSC^{-}	FISH^{-}	CRUSTA^{-}

Note: $^{+}$ indicates positive value of CMSC and CE while $^{-}$ implies negative CMSC and CE value.

Overall, FROZEN is the most competitive, followed by MOLLUSC, FISH, FILLET, FRESH, AQUAINV, LIVE and lastly CRUSTA. The product gained (lost) the largest share (CMSC) among all categories when it has the greatest increment (decrement) in its exports (Δp) that is caused by a rise (fall) in the Malaysian fisheries market share (CE) for these analysed periods. The lack of export competitiveness in the Malaysian fisheries sector is mainly related to LIVE, FISH and CRUSTA (having negative CMSC and CE values) whereas FROZEN, FRESH, FILLET and MOLLUSC exert their competitive nature.

6. Conclusion

Since Malaysia experiences a persistent fish trade deficit, the export performance of the sector should be evaluated. This study conducts the new CMS net-share approach index (or CMSC index) together with the developed geometric tool in analysing the competitiveness of different categories of fisheries exports in the country. Predominantly, some categories of Malaysian fisheries exports like Frozen fish (HS 0303), Fish, fresh or chilled (HS 0302), Fish fillets and other fish meat (HS 0304) and Molluscs (HS 0307) exhibit their competitive nature due to the positive value of the CMSC index and competitiveness effect but show the negative value of growth effect. To demonstrate a clearer picture of the Malaysian fisheries export competitiveness, this study has more precisely discussed the categories of fisheries products. The most competitive Malaysian fisheries exports category is Frozen fish (HS 0303), followed by Molluscs (HS 0307), Fish (HS 0305), Fish fillets and other fish meat (HS 0304), Fish, fresh or chilled (HS 0302), Aquatic invertebrates (HS 0308), and Live fish (HS 0301); while the export of Crustaceans (HS 0306) is the least competitive. The collaboration of public and private authorities plays a crucial role in developing the Malaysian fisheries sector by urging the fisheries exports to be more competitive in the international market through the contribution of more innovative ideas in value addition and policy implementation. The competitiveness of Aquatic invertebrates (HS 0308), Live fish (HS 0301) and Crustaceans (HS 0306) exports should be strongly highlighted and strengthened with the efforts of both parties (i.e. through assistance from the government business support services, exploring new international markets, product development and others). With quality enhancement and better production management under the collaboration of private and public authorities, the trade deficit of the fisheries sector could be seemingly mitigated. Yet, to rectify the situation of the trade deficit in the fisheries sector requires more efforts and comprehensive studies. This study highly recommends that future research be conducted in different aspects of the issue (i.e. preference of consumers, the effectiveness of trade policy, supply chain management and others). Besides, the modified CMS analysis is also recommended as a general descriptive analysis tool that can be implemented across goods, sectors or even industries over the years. Most importantly, it provides relatively more accurate results and at the same time succeeds to be a solution to the inconsistency problem carried by the traditional approach.

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