Evaluation of international competitiveness of China’s marine mollusca trade

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China’s marine mollusc export has been increasing continuously both in quantity and value over the period from 1992 to 2014, with the increasing rate slowing down in recent years; in addition, its average export price did not rise correspondingly with the increase of export value. China has comparative advantages in production resources and surplus surpasses of marine mollusc trade, whereas has noticeable comparative disadvantages concerning export proportion and export prices.

[Keywords: China’s marine mollusc trade, International competitiveness, Indexes, Principal component analysis]

Introduction
Fisheries and aquaculture not only contribute to food nutrition, but also create fortune and job opportunities. Alonso Aguilar Ibarra and Chris Reid pointed out that aquaculture plays a major role in economic society development in such aspects as earning foreign exchange through export, providing domestic protein consumption, increasing employment opportunities and alleviating poverty. Indeed, aquatic products are one of the most-traded food commodities worldwide. China is by far the biggest aquatic production and aquaculture country, and also the largest aquatic products supplier in the world since 2002, exhibiting an export value of about 196.79 billion dollars of aquatic products in 2014, almost 26.07% of the world total. The trade of aquatic products still has direct impacts on the development of national agricultural economy. Total export value of China’s agricultural products amounted to 676.27 billion dollars in 2014, where 27.97% was generated by aquatic products, stressing the important role it plays in the trade of agricultural products.

Meanwhile, despite the large share in global market, the export of China’s marine molluscs is mainly concentrated on several key markets, with the first five major importing countries (regions) taking roughly above 62% share of its total export over the period from 2010 to 2014 (Table 1). This relatively high market penetration enlarged the risk of being influenced by such tariff and non-tariff barriers as anti-dumping and technical barriers, which is, to certain extent, has negative impacts on the development of export trade in marine molluscs. With growing competition in global market, continued growth in China’s export of marine molluscs is expected to be an important part in its national economic development. Therefore, it is necessary to explore the international competitiveness of China’s marine mollusc products for its sustainable development. International competitiveness refers to relative strengths and weaknesses of given products in the trade of a country. It can clearly demonstrate the underlying dynamic factors driving the development of trade in a country.

To-date, however, researches have been largely focused on different factors influencing China’s aquatic products export, such as unfavorable factors affecting the export of aquatic products like tariff and non-tariff barriers, positive factors in promoting the export of aquatic products like abundant natural resources and comparative advantages, or relationships between demand and supply, the product structure and the market structure of aquatic products, etc. Little attempt were made to portrait the international competitiveness of export of China’s marine molluscs in an integrated manner.

This paper comprehensively evaluates the international competitiveness of marine molluscs
from the perspective of production, importation and exportation. With the use of principal component analysis, it not only clearly demonstrates the strength and weakness in products and export patterns of marine molluscs, but also explores the underlying dynamic factors driving the export development, which, to certain extent, can shed light on the improvement of China’s marine mollusc trade.

**Materials and Methods**

Firstly, a review of China’s marine mollusc trade from 1992 to 2014 was made to gain a full insight into the objective. Trade review before 1992 were not included in this paper for the data availability; then, an evaluation index system was built with eight indexes from three aspects, namely production factors, import and export level to comprehensively evaluate the international competitiveness of China’s marine molluscs. The formulas of eight indexes used, namely resource endowment index (EF), the market share(MS), trade specialization coefficient index(TSC), net exports (TE), the revealed comparative advantage index (RCA), comparative advantages (CA), quality price(QP) and market concentration ratio (NAT) are as following:

\[
EF (\text{represented by } X_a) = \frac{(V_c/V_w)}{(Y_c/Y_w)}
\]

\[
MS (\text{represented by } X_b) = \frac{E_{cv}}{E_{Gv}}
\]

\[
TSC (\text{represented by } X_c) = \frac{(E_{cv}-I_{cv})}{(E_{cv}+I_{cv})}
\]

\[
TE (\text{represented by } X_d) = \frac{E_{cv}}{E_{Acv}}
\]

\[
RCA (\text{represented by } X_e) = \frac{(E_{cv}/E_{Acv})}{(E_{Gv}/E_{AGv})}
\]

\[
CA (\text{represented by } X_f) = \frac{RCA-(I_{cv}/I_{Acv})}{(I_{Acv}I_{AGv})}
\]

\[
QP (\text{represented by } X_g) = \frac{P_T}{P_{T-1}}
\]

\[
NAT (\text{represented by } X_h) = \frac{\Sigma E_{cv}+E_{cvk}+E_{cve}+E_{cvl}}{E_{cv}}
\]

where \( V_c \) and \( V_w \) stand for China’s and global marine mollusc resources respectively; \( Y_c \) and \( Y_w \) refer to China’s and global gross output value respectively; \( E_{cv} \) refers to the export and \( I_{cv} \) to the import value of Chinese marine molluscs separately; \( E_{Acv} \) and \( I_{Acv} \) are the export and the import value of all China’s products separately; \( E_{cvk}, E_{cvl}, E_{cve} \) and \( E_{cvU} \) point successively to the export value of China’s marine molluscs to its four major markets, that is, Japan, Korea, Europe and U.S.A.; \( E_{Gv} \)is the export value of global molluscs; \( E_{AGv} \)stands for the export and \( I_{AG} \), for the import value of all global products; \( P_T \) and \( P_{T-1} \) refer to the average export price of China’s marine molluscs in t year and in t-1 year separately.

At last, a principle component analysis was made to comprehensively estimate and monitor the data obtained. One of the key processes in this step was to standardize the data used for accurate results. With SPSS17.0 Software, an standardizing process was made as follows: at first, all the data collected for evaluating China’s international competitiveness were saved as initial variables, and then were converted into standardized ones with KMO method, resulting in the test value of 0.75( > 0.5), the value of which indicates the adaptation of application of exploratory factor analysis. Next, based on the eigen value principle, with the exclusion of the variables whose eigen values were less than 0.10, two main components were extracted through correlation matrix, and they were qualified to reflect the initial eigenvalues the eight indexes carry by extracting 84.57% loadings of them (Table 2). Third, varimax rotation was used to further simplify the eigenvalues extracted and integrate the diverse factors. Last, according to the loadings in table 2, the cumulative values of the two components as well as the ranks of all these values over the period from 1992 to 2014 were calculated using the formula:

\[
F_1 = \Sigma F_{ij} \times X_j \quad (i = 1, 2; \quad j = 1, 2, \ldots, 8)
\]

that is, \( Y_1=1.958YX_{r}+.936YX_{s}+.501YX_{r}-2.69YX_{d}+.357YX_{e}+.914YX_{r}+.367YX_{s}+.82 \quad 3YX_{b}Y_{2}=1.151YX_{s}+201YX_{s}+.766YX_{r}+.731YX_{r}+.910YX_{r}+.351YX_{r}-.632YX_{s}+.520YX_{b}
\]

\[
Y=:.58638Y_{r}+.25932Y_{s} \quad \text{and the results were shown in table 3.}
\]
**Results**

As is shown in table 2, in the first component, $X_a$, $X_b$, $X_f$ and $X_h$ have large loadings, indicating the relation of the first component to the production resources, the market share and the trade comparative advantage of China’s marine molluscs; in contrast, $X_c$, $X_d$, $X_e$ and $X_g$ have large loadings in the second component, presenting its relation to the export proportion, the revealed comparative advantage as well as export prices in China’s marine molluscs trade. Further, as is indicated in table 3, the values of component 1 show an overall tendency of increase over the period from 1992 to 2014, and are higher than those of component 2.

In contrast, with all the values being negative, component 2 exhibits a weak performance. Influenced by component 2, though following a parallel pattern of increase as that of component 1, the cumulative values of the two components are much lower than those of component 1, and are all negative except in the years of 1997, 2005, 2007, as well as all the years after 2009.

More specifically, from 1992 to 2004, the values of component 1 fluctuated around 0.5, and climbed to more than 1 after 2003. However, except for fluctuating in some years, the values of component 2 kept less than -0.5. In terms of cumulative values of the two components, it remained at relatively low levels and improved significantly to a historic high of 1.721 in 2000, as it was the case for the value of component 1 (1.465).

In case of ranks, generally, all three kinds of values improved their performances year by year, but at different paces, with the values of component 2 much slower. In fact, despite fluctuations observed in some years, the performance of component 2 was relatively much worse than those of component 1 and the cumulative ones after the year of 2010.

Hence, the above statistics show that China has comparative advantages in production resources of marine molluscs; besides, it also has decided

Fig. 1— Time series data of production of marine molluscs in China (a), calculated annual growth rates (b), and production % of marine molluscs to all aquatic production (c). Straight line represents trend line.  
Note: Source: FAO Fisheries and Aquaculture Department, China’s fisheries yearbooks.

Fig. 2— Time series data of export quantity of China’s marine molluscs (a), export value (b), and calculated annual growth rates of both quantity and value in export (c). Straight line represents trend line.  
Note: Source: FAO Fisheries and Aquaculture Department, China’s fisheries yearbooks.
Discussion

Benefited from extension of market economy reform as well as entering into WTO, China experienced a tremendous increase in marine mollusc production from 1992 to 2014; however, it seems that it has reached its extreme output limit with the growth rate manifesting a slower growth rate in recent years. In fact, with continuous rising of costs in production materials, labor, capital, energy and land, China has been losing its comparative advantages in labor-intensive marine mollusc products. In case of export, it also showed consistent increase both in quantity and value at the same period, which is, to some extent, benefited from the resource superiority and scale advantage in production. Nevertheless, it showed a fluctuating decline in the year of 1997, 2003, 2005 and 2007, the decline of which might partly due to the implement of technical barriers on imports of marine molluscs from China’s major markets, that is, a range of strict regulations imposed by European Community in 1997, Japanese Positive List System in 2006, and the National Shellfish Sanitation Program enforced by US Food and Drug Administration(FDA) in 2007, all of which negatively affected the export of Chinese marine mollusc products. At the same time, China also experienced a slower growth rate in import over the past decade, and it might be the result of the advantages in market share and trade surplus surpasses. However, it has noticeable disadvantages in terms of export proportion and export prices.

Table 2--- Loadings of Components

<table>
<thead>
<tr>
<th>Variables</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>F2</td>
</tr>
<tr>
<td>Xa</td>
<td>.958</td>
</tr>
<tr>
<td>Xb</td>
<td>.936</td>
</tr>
<tr>
<td>Xc</td>
<td>.501</td>
</tr>
<tr>
<td>Xd</td>
<td>-.269</td>
</tr>
<tr>
<td>Xe</td>
<td>.357</td>
</tr>
<tr>
<td>Xf</td>
<td>.914</td>
</tr>
<tr>
<td>Xg</td>
<td>.367</td>
</tr>
<tr>
<td>Xh</td>
<td>.823</td>
</tr>
</tbody>
</table>

Cumulative Loadings 0.586 0.259
Total 0.845
diversion of an increasing proportion of Chinese mollusc products from export routes to domestic supply with the increasing demand stimulated by the growing urbanized middle class.

Generally, China has increased its competitiveness remarkably in production resources, market share as well as trade surplus surpasses, but also has noticeable disadvantages in terms of export proportion and export prices. Low export proportion indicates the low contribution marine molluscs make in trade with the respect of its large scale of production, and in this sense, China’s marine mollusc products mainly supply domestic needs, that is to say, its trade in marine molluscs belongs to intra-industry trade. In addition, its export price of marine mollusc products are comparatively low compared with that of the world’s because of the lacking of green products with high quality and high added-value.

Several reasons may be accounted for the export problems of China’s marine molluscs mentioned above. Firstly, In China, most marine mollusc production companies are extensive and family-run entrepreneurs characterizing labour-intensive operations. Without well-planned programs and adequate governance, they tend to extend their production scale intensively and fully exploited, sometimes even overexploited mariculture resources. Such rapid growth of intensive mollusk mariculture has brought series of negative effect on marine environment as well as ecosystem; besides, in order to promote output for more benefits, sometimes they use drugs or other chemicals disproportionately, resulted in marine mollusc products with drug residues or heavy metal residues, not only causing detrimental impacts on health and food security, but also failing to meet the strict requirements imposed by consuming nations, all of which, in turn, have disadvantageous influence on the export of marine molluscs. Secondly, without technological and financial supports from fishery departments and assistances at national and local levels, most marine mollusc producers in local coastal communities fail to provide deep and fine processing work during production, resulted in mollusc products with low added-value. Several countermeasures should be adopted in order to improve the international competitiveness of China’s marine molluscs.

Firstly, adapted policies and governance must be effectively implemented to aquaculture industries by governmental bodies and management authorities at
both local and national levels to guide the development of marine mollusk trade. During the formulating process, the inclusion of stakeholders, such as farmers, producers and salesmen can lead to selection of policies more practical and implementable\textsuperscript{24}.

Secondly, safety and health management and adequate supervising system must be strengthened in pre-harvest and post-harvest farming process of mollusc production to ensure the safety of the products, thus to meet with requirements by a range of import regulations and control procedures of health and quality standards in various markets. What’s more, it is also necessary to adjust export structure of marine mollusc products, weaken the degree of geographical concentration of main export markets, and occupy emerging markets to eliminate negative effects by different regulations and procedures enforced by importing countries (regions).

Thirdly, industrial restructuring and technological upgrading should be implemented in China’s mollusc industries through increasing government funds, attracting foreign investment as well as expanding bilateral cooperation for the application of deep and fine processing in marine mollusk products to increase their added values. In addition, brands built on the basis of internal resources contribute to the improvement of profitability and competitiveness of a firm\textsuperscript{24}. Hence, giving play to the superiority of Chinese marine mullosc resource to build advantage enterprise brand of products can also help to promote products quality to overcome technical barrier of trade in marine molluscs.

Conclusion

The results show that China is highly competitive in terms of production resources, market share and trade surplus surpasses, but still has comparative disadvantages in export proportion and export prices. To strengthen the international competitiveness, action should be taken in building up practical policies and implementing governance not only in the farming, but also in the production process of molluscs; the paper also points out that more linked, effective and comprehensive policies needs the inclusion of stakeholders in the policy-making process. Besides, industrial restructuring and technological upgrading are also suggested for more green products with high quality and high added-value. Still, diversifying of export markets should also be taken into consideration. In a word, taking account of the above factors can be advantageous in development of China’s marine mollusc trade. However, factors affecting marine mollusc trade at macroeconomic level (e.g., exchange rate) are excluded in this paper, which leaves the direction for future researches.

References


