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# Risk and Uncertainty Analysis for Shrimp Trade in India using Value at Risk

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**A B S T R A C T**

India seafood exports achieved an all-time high of 11,34,948 MT and US $ 5.78 billion during 2016-17 with shrimp as the major commodity constituting about 39 percent by quantity and 67 percent by value. India also becomes one of the top shrimp exporting country in the world being USA and Japan be the major markets and followed by South east Asia, European countries, China, Middle east, etc. but there is high risk and uncertainty in shrimp trade due to trade barriers, exchange rates, high competition among shrimp producing countries. In this paper, we estimate value at risk and tried to identified more risk pron markets between the two major markets i.e. USA and Japan markets.

## Introduction

The history of seafood export of India can be traced to the year 1950 and even before, till the year 1990, seafood export was undertaken as a minor activity. Even during this period of time seafood exports from India were dominated by shrimps (*Penaeus monodon and Penaeus indicus*). The quantity and the value of seafood exported were very low. The markets to which the exports were made to were limited to selected countries. The primary market for Indian seafood prior to 1990 was Japan and followed by USA. Again, it was during this period owing to restrictive trade policies and underdeveloped market that the country faced a severe balance of payment crises. It was also during that time the world was opening out to international trade and owing to the foreign exchange crises in India the Government of India under the missionary leadership of the Prime Minister Shri P.V. Narasimha Rao and the finance minister Dr. Manmohan Singh came out with the New Economic Policy in 1991. This policy was directed towards enhancing the countries

reserve of foreign exchange by identifying key sectors that enable fastest growth in foreign exchange reserves. In this process the first step towards commercial shrimp aquaculture were taken and key areas where natural resources (of wild shrimp seed of *P. monodon*) were abundantly available were the centres for development of shrimp aquaculture like Kandaleru creek in Nellore district, Andhra Pradesh. Shrimp is the flagship seafood export product from India and the country is the 4th largest exporter of shrimp from Asia with a 2.43 per cent share in the 50 billion dollar world seafood market (Geethalakshmi *et al.*, 2010). Seafood export of India contributed 17.07 per cent of the total agricultural exports of India during the year 2016-17. Under the Special Focus Initiative of the Foreign Trade Policy of the Government of India, the marine sector has been distinguished as a sunrise sector (http://dgft.gov.in; Gopal *et al.,* 2009). India seafood exports achieved an all-time high of 11,34,948 MT and US $ 5.78 billion (Rs 37, 870.90 crores) in 2016-17 as against 9,45,892 tons and 4.69 billion dollars a year earlier, with the USA and South East Asia continuing to be the leading importers. Despite India being top seafood expoter, there is high price flunctuation, market competition, etc. So, in this this paper we studying value at risk and also recommending some measures to overcomes the issues.

## Materials and Methods

### Selection of species, size, form and data collection

The shrimp export secondary data compiled from various price indicator of marine products export (PRIME) published by Marine Products Exports Development Authority (MPEDA) on weekly basis were used for the study. The major export markets i.e. two markets USA and Japan along with different grade size of with one larger count and one smaller (16-20 and 26-30 counts) of the shrimp species i.e. *Penaeus monodon* and *Penaeus vannamei* were considered for the study. Since the USA and Japan markets are the single largest shrimp export market from India, they are considered for the study. The totals of 10 year data i.e. (520 weekly data points approx.) for the period 2007-2017 were considered for the study. But due to unavailability of data for *Penaeus vannamei*, since it was introduced in India during 2009 and its export statistics starts with late 2010. The data points for *Penaeus vannamei* was considered from 2010 onwards. The details of 16 different datasets were described in table 1.

### Simpson index of diversity (SID)

The diversification or concentration in exports with respect to a specific geographic region at a given period of time can be measured effectively by using the Simpson index of diversity and this was used for the present study (Joshi *et al.*, 2003; Shinoj *et al.*, 2009). The index ranges between 0 and 1. If there exists complete specialisation, the index tends towards 0 and in cases of complete diversification, it tends towards 1. The Simpson Index (SID) is calculated using the following equation:

$$SID = 1 - \sum_{i=1}^{n} W_i^2$$

and

$$W_i = \frac{X_i}{\sum_{i=1}^{n} X_i}$$

Where,

$X_i$ = Value of export/import of $i^{th}$ agricultural commodity,

$W_i$ = Proportionate value of export/import of $i^{th}$ agricultural commodity out of total agricultural exports/imports.

## Value at risk (VAR)

Value at Risk is a statistical technique used to measure and quantify the level of financial risk within a firm or investment portfolio over a specific time frame. This metric is most commonly used by investment and commercial banks to determine the extent and occurrence ratio of potential losses in their institutional portfolios. Value at Risk calculates the maximum expected loss or gain on an investment, given a certain confidence interval and over a defined period of time. Value at Risk has become widely used since the 1994 introduction of J.P. Morgan's Risk Metrics system, which provides the data required to compute Value at Risk for a variety of financial instruments. In recent years, we have witnessed an unprecedented surge in the usuage of risk management practices, with the Value-at-Risk-based risk management emerging as the industry standard by choice or by regulation (Dowd, 1998; Jorion, 1997; Saunders, 1999 and Basak and Shapiro, 2001). Value at Risk or VAR is a statistical measure of downside risk.

Value at Risk measures the largest percentage of the portfolio value that might you lose over a given time period, to a given degree of certainty, based on historical average return and variability. For example, for a given asset held over the next six months, you might be 95% sure that the asset value will fall by no more than 15%. (Investopaedia; J.P. Morgan and Reuters, 1996). In this study, we used two method i.e. Parametric and Historical method for risk analysis.

## Results and Discussion

The figure 1 shows the change in quantity of seafood exports from India among markets during 1995-96 to 2015-16. During 1995-96, European Union contributed the highest market share, about 29 per cent, which is followed by China (23 per cent), Japan (17per cent), South East Asia (14 per cent), USA (10 per cent), Middle East (3 per cent) and other markets (4 per cent). South East Asia became the leading contributor and its market share was about 36 per cent during the year 2015-16. India lost its market share in the European Union, China, and Japan by20per cent, 5per cent and 8 per cent respectively. While the market share of USA and the Middle East increased to 14per cent and 6 per cent respectively.

The figure 2 represented the change in market shares in seafood exports in value terms from India. Japan was the primary market for India's shrimp exports in value terms yielding a market share of about 45 per cent during 1995-96. But it reduced to only 9 per cent during 2015-16. This reduction may be due to the competition from Thailand, Vietnam, etc. Japan banned exports of shrimp from India because of the detection of the presence of antibiotic in exports consignments from India.

The USA, South East Asia and the European Union were the leading markets for Indian seafood during 2015-16 by contributing about 28 per cent, 24 per cent and 21 per cent respectively in value terms. The contribution of other smaller markets including Middle East and China was 18 per cent. Even though the bulk of exports (36 per cent) was directed towards South East Asia, they were mostly low-value products, so its share was only 24 per cent by value. The seafood exports basket consisted mainly of frozen finfish, frozen squid, dried and live items, etc. Owing to the higher purchasing power of the consumers in the developed economies countries like the European Union, the USA and Japan, most of the high-value products are exported to these countries (Shinoj *et al.,* 2009). The USA contributed 28 per cent by value, though its share was only 14 per cent by quantity.

## Simpson index of diversity of seafood export

The figure 3 shows the Simpson index of diversity which quantified the extent of diversification of seafood exports during 1995 to 2016-17. The seafood export commodity basket of India consists of frozen shrimp, frozen finfish, frozen cuttlefish, frozen squid, dried items, live items, chilled items and other items. It can be seen that the commodity basket of India's seafood exports is getting diversified over the periods. The Simpson index of diversity of seafood exports increased from 0.52 to 0.76 during the year 1995 to 2009-10, and then, decreased to 0.52 in the year 2013-14. This decrease in seafood export diversification was mainly due to introduction of *P. vannamei* during 2009 which led to increase in shrimp production and therefore focus on a single product.

The figure 4 (A) shows the item-wise market share of seafood exports from India during 1995-96in quantity as well as value terms. In both value and quantitative terms, frozen shrimp contributed the maximum share, i.e. about 67per cent and 32per centre respectively. The item such as frozen finfish, frozen cuttlefish, frozen squid and dried items followed frozen shrimp in quantity with a market share of 34, 11, 15 and 3per cent respectively. The contribution of frozen finfish in terms of quantity and value was 34 per cent and 11 per cent respectively. This difference is due to the low price of fish in comparison to shrimps.

The item-wise market share of seafood exports from India during 2015-16 by quantity as well as value terms is shown in figure 4 (B). There is no much percentage change in item-wise market share of export during 1995-96 to 2015-16. The quantity market share of frozen shrimp changed from 32 per cent to 39 per cent during the period in quantity terms but in value terms it decreased by 1 per cent during the same period. The market share for frozen fin fish decreased in quantity terms from 34 per cent to 24 per cent during 1995 to 2016, but in values terms it remained the same. Therefore it appear as if Indian frozen fin fish has gain value overtime during 1995-96 to 2015-16.

The overall exports of frozen shrimp from India during 2015-16 was to the tune of 373.87 thousand tons worth US $ 3097 million, which increased from 111.87 thousand tons and US $ 985 million during 2000-01. From table 2, it is observed that Japan was the leading shrimp importer from India during 2000-01 with a quantity of 45.77 thousand tons worth US $ 501 million, which is followed by the USA (25 thousand tons worth US $ 216 million), the European Union (21.74 thousand tons worth US $ 135 million), South East Asia (6 thousand tons worth US $ 49 million), China (6 thousand tons worth US $ 39 million), Middle East (4.25 thousand tons worth US $ 21million) and other markets (3.09 thousand tons worth US $ 24 million).

India has lost its market share to Japan while the country gained other markets such as USA, EU, South East Asia, China and Middle East during the period 2000-16. The USA became India's single largest frozen shrimp exports market with a share of 36 per cent by quantity and 41 per cent by value in the year 2015-16. But India also experienced a decline in market share in the USA during the period 2004-09. During 2006-07, value of shrimp exports from the USA dropped by 23 per cent. After the anti-dumping duties came into effect, the number of Indian exporters to the United States declined in a significant way from 280 in 2005 to just 68 in 2009 (Ancy and Raju, 2014). Since 2009-10, the market share of India started improving in the USA and thus has emerged as the largest shrimp

exporter. This may also be due to the disease (Early Mortality Syndrome, EMS) that hit Thailand's shrimp production during that period of time; diversification of Indian shrimp culture from low-volume, high-value *Penaeus monodon* (black tiger) to high-volume *Penaeus vannamei* (white shrimp).

## Unit value realization

The figure 5 gives the unit price realisation for frozen shrimp exports to Japan, USA, EU and South East Asia from India. It can be seen that unit price increased over time. It was also found that average unit price for frozen shrimp in USA market was higher than Japan, South East Asia and EU markets. EU market recorded the lowest unit price compared to other markets. These may be due to the reason that the USA and Japan were importing high-value species as well as higher grade (count) while South East Asia and EU were importing lower value species and smaller counts.

## Value at risk

Value at risk was calculated for the return series of both the export and import prices of *P. monodon* and *P. vannamei* of larger (16-20) and smaller (26-30) count to Japan and USA using normal distribution VaR and historical VaR at 90 percent and 95 percent confidence limits.

The result of VaR for import and export prices of *P. monodon* and *P. vannamei* to Japan are shown in table 3. Normal distribution VaR for import price of *P. monodon* of larger count ($M^{PL}$) were -6 percent and -7 percent at 90 percent and 95 percent confidence limits which means we are 90 percent sure that in future the maximum decline in prices of $M^{PL}$ will not be 6 percent and 95 percent sure that the price will not decline below 7 percent. Historical VaR for $M^{PL}$ at 90 percent and 95 percent were -3 percent and -6 percent respectively. This difference in normal distribution VaR and historical VaR indicated that the return distribution of the $M^{PL}$ price series is not strictly normal. Maximum decilne in price were found for import price series $M^{VL}$ and $M^{VS}$ which were -15 percent and -18 percent and -20 percent and -23 percent at 90 percent and 95 percent confidence limits respectively. It can be said that import price of *P. vannamei* has the maximum price risk while import price of *P. monodon* has least price risk to Japan from India.

The result of VaR for import and export prices of *P. monodon* and *P. vannamei* to USA from India are shown in table 4. Normal distribution VaR for import price of *P. monodon* of larger count ($M^{PL}$) were -3 percent and -5 percent at 90 percent and 95 percent confidence limits which means we are 90 percent sure that in future the maximum fall in prices of $M^{PL}$ will be 3 percent and 95 percent sure that the price will fall below 5 percent. Historical VaR for $M^{PL}$ at 90 percent and 95 percent were -1 percent and -2 percent. This difference in normal distribution VaR and historical VaR indicated that the return distribution of the $M^{PL}$ price series is not strictly normal. It is seen from the table that USA has lower price risk of both import and export price for both the species (*P. monodon* and *P. vannamei*) when compared to Japan. The VaR value for the price series to Japan ranged from -3 percent to -23 percent while to USA, it ranged from -1 percent to -12 percent regardless of size and species.

It is also found that maximum fall in price was found for the $X^{PL}$, $X^{PS}$, $X^{VL}$ and $X^{VS}$ were -9 percent and -12each at 90 percent and 95 percent confidence limits respectively. It can be said that export and import prices of *P. monodon* and *P. vannamei* has the maximum price risk to Japan while export and import prices of *P. monodon and P. vannamei* has

least price risk to the USA from India. This may be due to the reason that India is the major shrimp exporter (about 32 percent by volume; 2016-17) to the USA but Vietnam is the major shrimp exporter to Japan while India's contributed only 16 percent by volume to Japan. So India has least influence on price in Japan. Price decline is seen more pronounced in higher counts and lesser in smaller counts. Price risk is less for smaller counts as they are mostly used for value addition, say for fish fillets and breaded shrimps (Ravi, 2018).

## Some recommendation for controlling trade risk and uncertainty of shrimp trade in India

Shrimp exports now are facing high competition in world market, although shrimp exports have been growing at ~30% per annum since 2010. In this study, we are trying to see the general price trends, competitiveness, diversification, the price transmission and forecast the prices of Indian shrimp in the export markets. Few suggestions for handling trade risk and uncertainty of markets are given below

Brackish water aquaculture farms are being registered by the CAA. But there is an urgent need to speed up the procedure. So that all functional farms are registered. Registration enables easy traceability and reduction of trade risk.

Use of certified inputs are necessary in shrimp farms. Use of uncertified and unethically produced and marketed inputs contaminate the output and lead to high trade risk and uncertainty bearing as these consignments have a good chance of getting rejected if they are tested for contamination.

Disease free certified shrimp seed (post larvae), brood stocks and other inputs must be made available within affordable price to farmers. This will help them to practice shrimp farming honestly without resorting to malpractices which increase risk both in production and trade.

To improve the post-harvest supply chain, it is required to support establishing shrimp/fish farmers group which lead to encourage coordinated seeding, farm management practices and harvesting minimizing production risk and ensuring easy traceability.

Capacity building for shrimp farming, processing and hatchery operating is needed. Capacity building enhances knowledge in all spheres and integrates and unifies the efforts of shrimp farming cluster groups.

The ECGC Limited (Formerly Export Credit Guarantee Corporation of India Ltd) provides export credit insurance support to Indian exporters and is controlled by the Ministry of Commerce. But unfortunately the seafood exporters are not covered by APEDA Agri Exchange. Trade risk could be considerably reduced by this arrangement.

The absence of a domestic market is direly felt in the shrimp market panorama. The fall back to the domestic markets in times of a glut in the export market or a drop in international prices for the shrimp does not happen. The domestic market is constrained to receive cultured shrimp as it is not a product purchased by the Indian public on a regular basis for home consumption. The domestic market needs to be restructured and reconfigured in terms of consumption habits of the fish eating population.

Diversification of export markets will lead to spread of risk. To a large extent this has been happening since shrimp enjoys a

seller's market.

Strengthen the market integration: There is also a need to ensure the forward and backward linkages in the fisheries sector. The fishers and the buyers need to be integrated in the market place (Araya *et al.*, 2014).

Promotion of shrimp in the domestic market is woefully lacking. This needs to be done. Shrimp needs to be promoted as a food item of great health benefit especially in urban markets.

Shrimp and shrimp products need to be promoted more vigorously. Exclusivity of the Indian shrimp as an unique product needs to be promoted. MPEDA and other agencies related to seafood exports need to actively create new markets as well as develop existing ones.

India may lead in total shrimp production and exports. Volumes need to be converted to value. In order to achieve this, it is necessary to diversify the portfolio of products exported from the country. Reliance on frozen shrimp for the last several decades and its consistent demand has made the processors and exporters placid. The desire for innovation for extracting more value up the chain by value addition to the base product seems to be lacking.

India's shrimp export to EU has a good opportunity as there is a preferential arrangement or Generalised scheme of preferences (GSP) scheme offered by the EU. Moreover, the EU market still opens a high demand of value added products. To get more export value from shrimp products, India has to get beneficial from these two issues. While, India's shrimp export is also facing some barrier and non-barrier to international shrimp trade related to tariff, value added tax, and EU regulation.

Trade policy and tariff preference become very important tools in international trade. On a global level, WTO through the general Agreement on Tariff and Trade (GATT) has been doing many trade negotiations and agreements subjected to reduction of import tariff and the implementation of the Sanitary and Phytosanitary Measures (SPS) and the Technical Barriers to Trade (TBT) for fishery products. Tariff preference also gives beneficial for developing and least developing countries including India by getting more special tariff reduction to access the EU market.

India need to develop a more competitive domestic value chain by providing a better shrimp chain from input supply of production until the product received by the final user or customer. It should minimize the role of middlemen, since they cause the chain longer and more expensive.

Improve the relationship between government and all actors' links to shrimp industries to get more benefits from trade through optimizing the function of supporting products and services, promote partnership in the supply chain and provide all necessary information related to exports.

As price of shrimp export are very sensitive to India's shrimp export, government intervention related to this matter is needed. Asche and Bjorndall (2000) and Leung and Engle (2006) found that demand for shrimp is considered to be quite price elastic. It means that a change in shrimp product will highly affect to demand for shrimp. A study on elasticity for shrimp also affirms this and links to shrimp product as a high-valued species that tends to have a more elastic demand.

**Table.1** Details of different 16 datasets

| Abbreviation | Long form | Period | Data point |
|---|---|---|---|
| $\mathbf{M^{PL}}$ | Import price of *P. monodon* of larger count to Japan market | 2nd March, 2007 to 17th March, 2017 | 525 |
| $\mathbf{M^{PS}}$ | Import price of *P. monodon* of smaller count to Japan market | 2nd March, 2007 to 17th March, 2017 | 525 |
| $\mathbf{M^{VL}}$ | Import price of *P. vannamei* of larger count to Japan market | 27th August, 2010 to 17th March, 2017 | 343 |
| $\mathbf{M^{VS}}$ | Import price of *P. vannamei* of smaller count to Japan market | 27th August, 2010 to 17th March, 2017 | 343 |
| $\mathbf{X^{PL}}$ | Export price of *P. monodon* of larger count to Japan market | 2nd March, 2007 to 27th May, 2016 | 483 |
| $\mathbf{X^{PS}}$ | Export price of *P. monodon* of smaller count to Japan market | 2nd March, 2007 to 27th May, 2016 | 483 |
| $\mathbf{X^{VL}}$ | Export price of *P. vannamei* of larger count to Japan market | 27th August, 2010 to 3rd February, 2017 | 337 |
| $\mathbf{X^{VS}}$ | Export price of *P. vannamei* of smaller count to Japan market | 27th August, 2010 to 28th October, 2016 | 324 |
| $\mathbf{M^{PL}}$ | Import price of *P. monodon* of larger count to USA market | 9th March, 2007 to 17th March, 2017 | 524 |
| $\mathbf{M^{PS}}$ | Import price of *P. monodon* of smaller count to USA market | 9th March, 2007 to 17th March, 2017 | 524 |
| $\mathbf{M^{VL}}$ | Import price of *P. vannamei* of larger count to USA market | 27th June, 2014 to 17th March, 2017 | 143 |
| $\mathbf{M^{VS}}$ | Import price of *P. vannamei* of smaller count to USA market | 20th June, 2014 to 17th March, 2017 | 144 |
| $\mathbf{X^{PL}}$ | Export price of *P. monodon* of larger count to USA market | 2nd March, 2007 to 17th March, 2017 | 525 |
| $\mathbf{X^{PS}}$ | Export price of *P. monodon* of smaller count to USA market | 2nd March, 2007 to 17th March, 2017 | 525 |
| $\mathbf{X^{VL}}$ | Export price of *P. vannamei* of larger count to USA market | 6th August, 2010 to 17th March, 2017 | 346 |
| $\mathbf{X^{VS}}$ | Export price of *P. vannamei* of smaller count to USA market | 14th May, 2010 to 17th March, 2017 | 358 |

**Table.2** Country wise frozen shrimp exports from India during 2000-16 (Quantity in '000' tons and Value in the US $ million)

| Country | | 2000-01 | 2002-03 | 2004-05 | 2006-07 | 2008-09 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Japan** | **Q** | 45.77 | 31.41 | 27.83 | 26.42 | 23.24 | 27.82 | 32.22 | 28.65 | 28.72 | 30.43 | 34.20 |
| | **V** | 501 | 260 | 207 | 217 | 187 | 271 | 334 | 261 | 315 | 351 | 316 |
| **USA** | **Q** | 25.01 | 48.58 | 34.02 | 24.70 | 17.50 | 34.24 | 50.57 | 75.42 | 95.93 | 112.70 | 134.14 |
| | **V** | 216 | 394 | 302 | 238 | 152 | 372 | 549 | 663 | 1219 | 1376 | 1254 |
| **European Union** | **Q** | 21.74 | 31.56 | 44.85 | 56.97 | 61.97 | 57.57 | 55.85 | 63.82 | 73.49 | 81.95 | 81.85 |
| | **V** | 135 | 154 | 239 | 344 | 347 | 379 | 415 | 430 | 661 | 727 | 605 |
| **China** | **Q** | 6 | 3.16 | 2.84 | 3.28 | 1.78 | 2.41 | 2.43 | 4.43 | 6.19 | 5.30 | 9.54 |
| | **V** | 39 | 12 | 12 | 16 | 10 | 15 | 18 | 33 | 54 | 45 | 67 |
| **South East Asia** | **Q** | 6 | 9.10 | 8.37 | 3.41 | 1.56 | 4.33 | 13.96 | 17.43 | 52.53 | 69.07 | 65.19 |
| | **V** | 49 | 68 | 57 | 25 | 11 | 30 | 138 | 135 | 537 | 656 | 487 |
| **Middle East** | **Q** | 4.25 | 5 | 7.06 | 7.37 | 7.21 | 8.58 | 12.90 | 13.63 | 15.16 | 21.64 | 17.48 |
| | **V** | 21 | 22 | 35 | 46 | 50 | 66 | 107 | 101 | 139 | 199 | 139 |
| **Others** | **Q** | 3.09 | 6.02 | 13.11 | 15.24 | 12.79 | 16.52 | 21.21 | 25.25 | 29.42 | 36.42 | 31.46 |
| | **V** | 24 | 42 | 87 | 111 | 82 | 129 | 180 | 180 | 286 | 357 | 229 |
| **Total** | **Q** | 111.87 | 134.82 | 138.08 | 137.40 | 126.04 | 151.46 | 189.13 | 228.62 | 301.44 | 357.51 | 373.87 |
| | **V** | 985 | 953 | 938 | 998 | 839 | 1262 | 1741 | 1803 | 3211 | 3710 | 3097 |

Source: MPEDA

**Table.3** Value at Risk (VaR) for import and export prices to Japan from India

| | Confidence limits | $M^{PL}$ | $M^{PS}$ | $M^{VL}$ | $M^{VS}$ | $X^{PL}$ | $X^{PS}$ | $X^{VL}$ | $X^{VS}$ |
|---|---|---|---|---|---|---|---|---|---|
| **Normal Distribution VaR** | 90 % | -6% | -5% | -15% | -18% | -8% | -10% | -7% | -12% |
| | 95 % | -7% | -6% | -20% | -23% | -10% | -13% | -9% | -15% |
| **Historical VaR** | 90 % | -3% | -4% | -5% | -6% | -4% | -7% | -5% | -10% |
| | 95 % | -6% | -5% | -9% | -12% | -7% | -10% | -9% | -15% |

**Table.4** Value at Risk (VaR) for import and export prices to the USA from India

| | Confidence limits | $M^{PL}$ | $M^{PS}$ | $M^{VL}$ | $M^{VS}$ | $X^{PL}$ | $X^{PS}$ | $X^{VL}$ | $X^{VS}$ |
|---|---|---|---|---|---|---|---|---|---|
| **Normal Distribution VaR** | 90 % | -3% | -3% | -5% | -8% | -9% | -9% | -9% | -9% |
| | 95 % | -5% | -4% | -7% | -10% | -12% | -12% | -12% | -12% |
| **Historical VaR** | 90 % | -1% | -1% | -3% | -3% | -6% | -6% | -6% | -7% |
| | 95 % | -2% | -3% | -4% | -6% | -10% | -12% | -11% | -10% |

**Fig.1** Quantum change in market share (1995-96/2015-16)

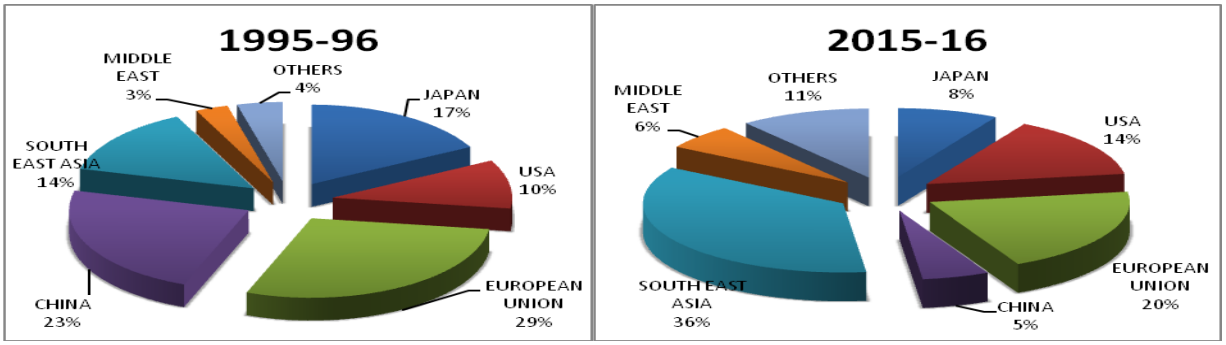



**Fig.2** Change in Market share in value terms (1995-96/2015-16)

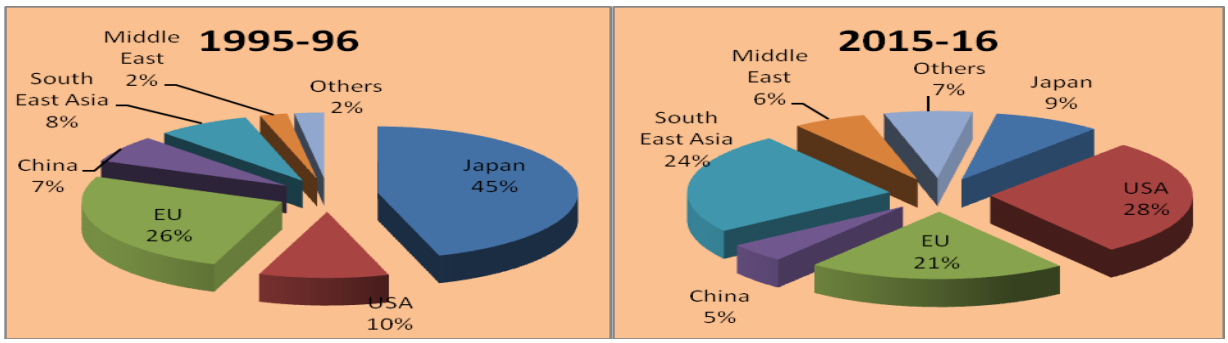



**Fig.3** Simpson Index of diversity of seafood export (1995-2017)

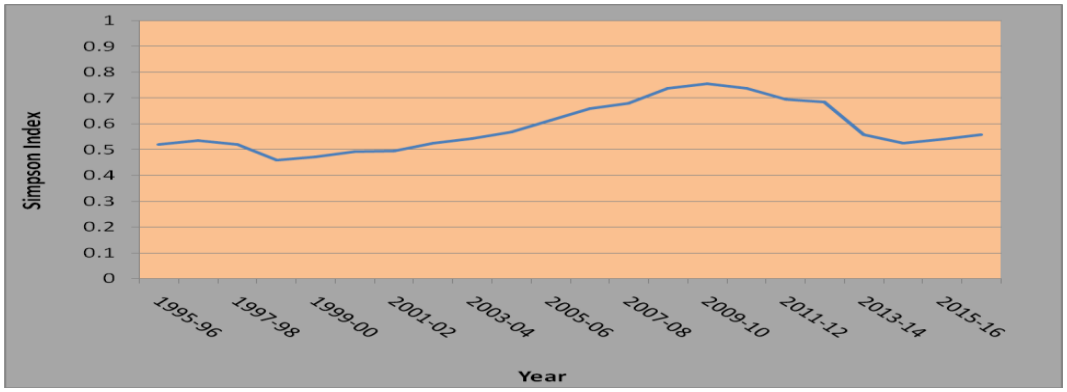


**Fig.4 (A)** Item wise market share of seafood exports from India (1995-96)

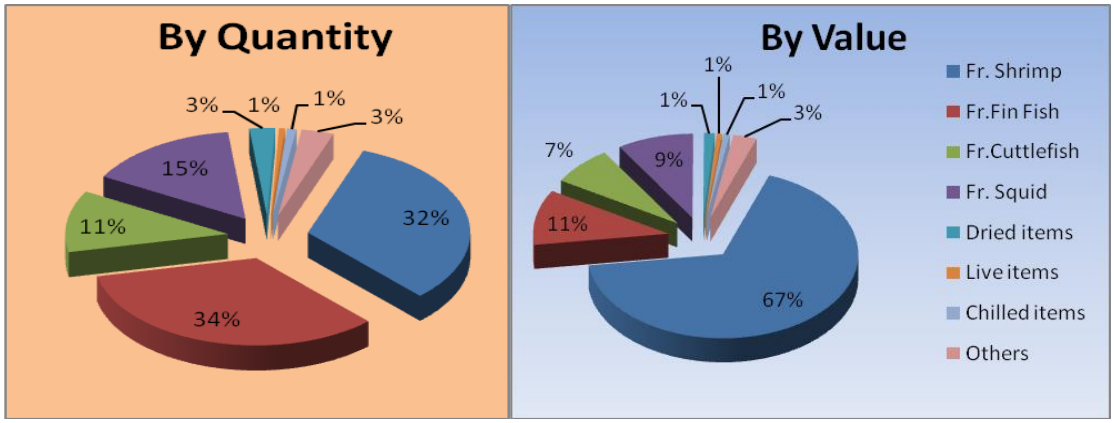



**Fig.4 (B)** Item wise market share of seafood exports from India (2015-16)

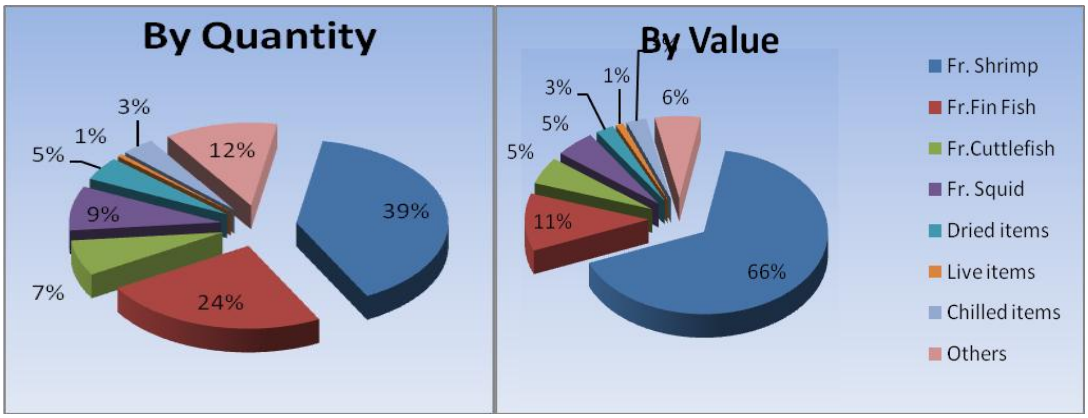
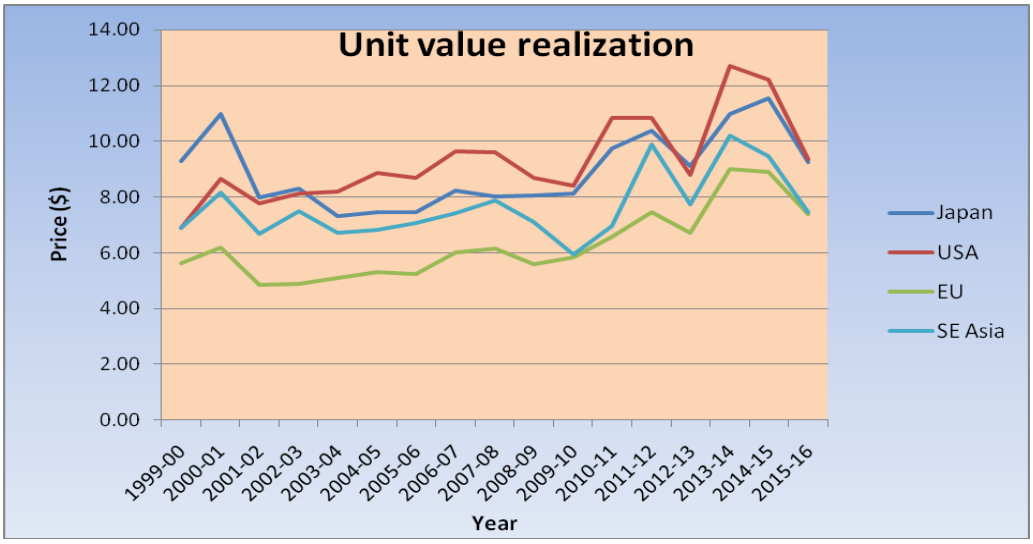



**Fig.5** Unit value realisation for frozen shrimp (1999-2016)



It is concluded as in India, fisheries sector contribute 17.07% to the total agricultural exports during the year 2016-17 with annual earnings of US$ 5.78 billion (37,870 crores). Indian seafood exports achieved an all-time high of 11, 34, 948 MT and US$ 5.78 billion (37, 870.90 crores) in 2016-17 with the USA and South East Asia continuing to be the leading importers. Indian export markets and seafood exports basket were found to be diversified (Singh, 2018). Higher price risk was also observed in export and import of *P. monodon* and *P. vannamei* to and from Japan as compared to US. This may be due to various trade barriers such as anti-dumping, countervailing duties, etc. So, in order to reduce the trade risk, we need strong domestic markets, improvised value added products, etc. Improve the relationship between government and all actors' links to shrimp industries to get more benefits from trade through optimizing the function of supporting products and services, promote partnership in the supply chain and provide all necessary information related to exports. Since the price of shrimp export are very sensitive to India's shrimp export, government intervention related to this matter is also needed.

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