CHAPTER V

INSTABILITY IN INDIAN SPICES EXPORTS

Introduction

Indian spices exports earned for the first time foreign exchange worth US $1 billion during the financial year 2007-08. India has traditional comparative advantages in spices exports and with the changing food habits and preference for natural products, the global demand for Indian spices is increasing at a healthy rate. Therefore, India is aiming to become a global processing hub of spices and targeting at a foreign exchange earning of $ 10 billion by the year 2017. However, instability in export earnings is a major problem that is retarding the growth performance of Indian spices export sectors. The main reason for instability in export earnings is believed to be high dependence on selected few commodities (commodity concentration) and markets (geographical concentration). Instability in export earnings strongly affects farmer’s incomes and their living conditions. They have hardly any instruments at their disposal to hedge against the adverse effects of instability of export earnings, leading to significant dislocations in domestic investment and production activities. Also, the various policy measures to promote spice exports become ineffective and uncertain in the context of instability in export earnings.

In the previous chapter the empirical analysis of instability levels of total spices exports and its various constituent commodity groups was presented. The purpose of the present chapter is to determine whether there exists a long run relationship between the export instability of Indian spices and its major determinants on the basis of annual data 1980 to
2007. An attempt is also made in this chapter to estimate an error correction model (ECM) to integrate the dynamics of the short run changes with long run adjustment process. The chapter is structured into three sections:

i) Section-I contains an outline of the concept of export instability, the various uses of instability and the micro and macro consequences of such instability.

ii) Section-II develops the various concentration measures such as commodity concentration and geographical concentration coefficients for Indian spice exports.

iii) Section-III attempts to estimate the long run relationship between the export instability function of Indian spices and its major determinants by cointegration analysis. An error correction model (ECM) is also estimated to tie the short run behaviour of export instability of Indian spices to its long run value.

SECTION - I

5.1.1 The Concept of Export Instability

Simply the year to year fluctuations in export revenue (merchandise or merchandise plus services) is defined as export instability. Mathematically, it can be defined as sizable, short term movements of export revenue from their growth trend (linear or exponential). According to UN ¹, exports earnings instability index is the absolute difference in the value of exports from year to year, expressing this difference as a percentage of larger of the two. Thus, export instability is basically concerned with fluctuations around the trend of export earnings.
5.1.2 Causes (or) Determinants of Export Instability

We know that export revenue is the product of export volume and export price. Therefore, export instability defined as the instability in export revenue could be partly due to instability in the export prices and partly due to instability in export quantities. These fluctuations in price and volumes do not arise randomly but reflect underlying changes in demand and supply conditions and their respective elasticities. The supply conditions are generally influenced by domestic factors, whereas the demand conditions are influenced by international factors. Apart from supply and demand factors, export instability may be affected by trade policies of the trading partners, rules of trading system, market imperfections etc.

There has been a widely held view that primary goods exports suffer more instability compared to industrial goods and therefore developing countries suffer from more export instability than developed countries. Since export earnings of developing countries depend on only a few number of commodities and their sales are geographically concentrated it is believed that such commodity and geographic concentration is the major cause for the instability in their export earnings. It is often postulated that countries having large product concentration in their export basket (commodity concentration) experience large export instability because concentration on a few commodities reduces the chances of having fluctuations in one direction in some of it’s exports offset or ameliorated by counter fluctuations or stability in others. An analogous argument is made with respect to geographical concentration. For example, Massell argues that high geographical
concentration is likely to imply greater dependence on economic conditions in one or few countries. Fluctuations in demand in any recipient country will then have a more pronounced effect on the receipts of the exporting country than if receipts were more diversified among recipients. From these arguments it is clear that export instability can be reduced by product diversification and geographical diversification. However, there is no a priori theoretical foundation for this kind of relationship between diversification and instability and it needs to be empirically verified in different situations. Empirical evidence on this relationship is mixed. Studies of Coppock, (1962), Massell, (1964) and Macbean, (1966) found negative relationship between export instability and geographical concentration. Later studies by Naya (1973), Kalaf (1974) and Kingston (1976) have found geographical concentration to be an insignificant explanatory variable although it is positively linked with export instability.

With regard to commodity concentration, Coppock, Masell, Macbean and (1976) found weak relationship between commodity concentration and export instability. However, Massell’s (1970) study, found significant relationship between commodity concentration and export instability. Thus, early empirical studies do not provide any evidence for either form of concentration as an explanatory variable of export instability. However, all these studies are based on cross-country regression analysis and therefore they implicitly assume a unique relationship between a given explanatory variable and the degree of export instability across the countries. Thus, estimates using cross section data to find average relationship does not provide much information on the behaviour of producers of specific commodities in the chosen countries. Similarly, aggregation of commodities may not reveal the degree individual instabilities of products. But recent studies like that of Love (1985), Paudyal
(1988), Tegegne ¹¹ (2000) Campa ¹² (2004) using time series data on an individual country basis found that there is significant relationship between concentration and export instability. Thus, it is clear that the empirical evidence on the nexus between concentration and export instability is inconclusive. Most of the available time series studies do not address the problem of non-stationarity nature of the data. Hence it may be possible that these estimates are result of spurious regression. Mullar- Sebastian (1988) argues that studies, which lump together the exports of all goods, are misleading because export instability of a given product is influenced by the characteristics of individual product and degree of development of the exporting country.

Apart from commodity concentration and geographical concentration some empirical studies like that of Tegegne (2000), Sarada.C, Ravishankar¹³ (2005) considered the relative importance of major commodity in the export basket, global demand conditions affecting the major commodity, internal supply conditions as determinants of export instability. Given that, a particular commodity dominates the export basket, it is natural that the fluctuations in its export earnings will destabilize the total export earnings. The fluctuations in export earnings of the prominent commodity may be due to international demand conditions and internal supply conditions and its covariance with the other export items. As mentioned earlier, the primary commodities suffer from more instability in export earnings compared to manufactures. The main reason for this is the imperfections in agricultural commodity markets. They are characterised by large supply disturbances, structural oversupply, strong competition, and volatile prices ¹⁴. Apart from these, world demand pattern for different commodity groups reveal that in case of primary products, the income elasticity of demand is relatively low. This leads to the tendency of relative prices of primary
products to be declining over time. Moreover since the price elasticity of demand for primary products also tends to be quite low, any shift in demand can cause large price fluctuations. Together these two elasticity phenomena contribute to export instability of primary products. In addition to these, some other researchers argued that export instability of these commodities is also caused by:

i) The physical characteristics of perennial crops (yields can be expected to peak after 6, 8 or even 10 years) limit the ability of producers to adjust immediately their supplies;

ii) Climatic conditions in producing areas: they can cause bumper crops or losses

iii) Stock holdings and buffer stocks.

Thus, from the above discussion it is clear that export earnings instability of agricultural commodities is believed to be a function of commodity concentration, geographical concentration, instability of major commodity in the export basket, internal supply conditions, external demand environment and demand and supply elasticites.

5.1.3 Consequences of Export Instability

Agricultural commodities are the major source of export earnings for most of the developing countries. Therefore, fluctuations in export earnings are known to have serious consequences on their economies. Among the most important effects of variability of export earnings of developing countries at the macroeconomic level are.
5.1.3.1 Impact at Macro Level

a) Impact on Growth and Poverty

The instability in export earnings severely impairs the growth of developing countries and retards their capacity for lifting their population out of abject poverty. Every dollar lost in export earnings is translated into a two-dollar loss in their GDP. The link between growth and export earnings however depends on the size of the export sector and foreign trade multiplier.

b) Impact on Investment

i) A fall in the terms of trade caused by the variability in prices of primary commodities leads to a contraction of GDP and investment levels in the developing countries.

ii) By disrupting signals about long-term market trends, this instability leads to poor resource allocation and, hence, to lower factor productivity.

iii) At the microeconomic level, since unstable markets cannot provide a reliable indication of the relative profitability of alternative lines of investment, risk-averse investors become hesitant to invest in sectors that are subject to high volatility. Furthermore, in the agricultural area, when international price instability is transmitted directly to agricultural producers, its effects are more damaging to agricultural supply as producers are often poor and unable to obtain insurance (Adebusuyi, 2004). In such circumstances, farmers are inclined either
to scale back their investment and innovation owing to their apprehension about using riskier techniques or, in a period of price drops, even to forego educating their children - a rather irreversible outcome (Guillaumont et al, 2003).

iv) High instability of a country’s commodity exports has an impact on the rate of domestic savings and also tends to favour investments (e. g. financial assets) for short gain, whereas low price instability would tend to favour long-term investment in productive assets. In other words, private investment may be channeled into domestic projects with short-term profits rather than into more risky ventures, even though the latter may reflect the country’s comparative advantage. (A. Maizels, 2000).

v) High export instability tends to exacerbate the general climate of business uncertainty and can lead to capital flight if savers prefer to invest abroad.

e) Revenue Loss

Unstable earnings might also discourage farmers from producing for export markets and can lead to a future fall in export earnings and GNP (Adebusuyi, 2004).

d) Adverse impact on exchange rate stability

- At macro level export earnings instability may also lead to instability in real exchange rate which occurs regardless of the nature of an exchange rate regime (Guillaumont, 2003).
Moreover, the impact of export earning fluctuations on the real exchange rate is not necessarily symmetric, notably owing to domestic price rigidities. An increase in export earnings during a boom period results in an appreciation of the real exchange rate, and in a loss of competitiveness of tradable goods sectors that are not associated with the boom. In a fixed exchange rate regime, the shortfall in export earnings is usually unlikely by itself to generate a real depreciation that would improve competitiveness; in a floating exchange rate regime, the nominal depreciation may be much more important than the earlier appreciation, owing to imported inflation (Guillaumont et al, 2003).

e) Adverse Impact on Public Finance

The instability of export earnings also extends to public finance, and may generate serious imbalances. The relative ease of collecting taxes on international trade, and the lack of alternative "tax handles" in several developing countries mean that government revenues in these countries, especially developing, depend heavily on taxes levied on exports and imports. This makes fiscal earnings highly vulnerable to changes in the value of export earnings (Guillaumont et al, 2003).

i) During expansionary periods, the growth of tax receipts, as well as providing an easy recourse to external borrowing, leads to an increase in public expenditure. This results in public deficits during periods of declining prices. These deficits are in turn difficult to absorb, owing to the downward rigidity of expenditures,
especially those on wages and salaries. As a result, inflation and public indebtedness become a chronic problem.

ii) Amongst public expenditures, debt service is likely to be most affected by export earnings instability. Volatility in export earnings makes the developing countries not honouring debt service obligations and may be subject to sanctions.

iii) Besides debt service, public investment constitutes one of the most flexible components of public expenditures. Its instability, induced by that of exports, results in a lower average rate of return, due to the low return of many investments launched in boom periods, compared to the higher return of those given up when shortfalls occur.

f) Adverse impact on Governance and Political Stability

Through the channels mentioned above, the instability in export earnings and the related relative price instability are likely to lead to political instability, due to their significant impact on absolute and relative incomes of small and marginal farmers and may cause social unrest.

g) Problems of the Balance of Payments

Instability in export earnings lead to the problems of balance of payments with the resulting import strangulation in times of earning shortfalls which could aggravate the debt situation
of the country. It may also cause fluctuations in exchange rates and worsen the problem of inflation (Panchamukhi, V.R).²⁰

h) Ineffectiveness of Policy Measures

The various policy measures undertaken by the governments in underdeveloping countries to promote exports become ineffective and uncertain in the context of export instability. The volatility also limits the economic horizon and destroys the sense of continuity which is necessary for planning production. (Panchamukhi, V.R).²¹

5.1.3.2 Micro Economic Level Impact

At microeconomic level, unstable earnings strongly impacts farmers and producers and increase their risk aversion. Cash crop producers are tempted to neglect obviously non-profitable crops. In the case of sharp income drops, farmers cannot buy the necessary inputs with all consequences for quality and competitiveness if activities are resumed later. Unstable earnings might thus discourage farmers from producing for export and can lead to a future fall in export earnings and GNP. Cash crop producers who suffer from earning shortfalls will also cut back their consumption, which affects the basis of public finances.

The persistence of abnormally volatility in export earnings can also result in a sharp reduction in the living standards of small and marginal farmers. In such circumstances, farmers are inclined either to scale back their investment and innovation owing to their apprehension about using riskier technique Thus export-earning instability has to be
considered as a development problem because it dampens the growth rate, particularly as a result of its negative effect on productivity of capital.

From the above discussion it is clear that export instability is a serious problem for Indian spices sector, having impact both at micro and macro levels of the economy. Thus, there is a need to identify the nature of instability, measure it, analyze the factors responsible for it and find ways and means to contain it. As mentioned earlier, analysis of instability, which lumps together the exports of all goods, is misleading because export instability of a given product is influenced by the characteristics of individual product and degree of development of the exporting country. Accordingly the present study is confined to analysis of Indian spices exports and is based on the time series data after considering the problem of non-stationarity.

5.1.4 Measuring Export Instability

The various methods of measuring export instability were discussed earlier in section 3.3.4 of chapter III and are therefore not considered here.

SECTION - II

5.2 Measuring Export Concentration

In the present section an attempt is made to develop concentration measures such as commodity concentration and geographical concentration coefficients for Indian spice exports. Before selecting the appropriate measure of concentration, a detailed discussion of
the various available measures in the literature is presented here. There are about eight types of concentration indices, viz,

i. The Concentration Ratio.

ii. The Gini-Hirschman Index.

iii. The Hall-Tideman Index.

iv. The Rosenbluth Index.

v. The Comprehensive Concentration Index.

vi. The Hannah and Key Index.

vii. The Entropy Index.

viii. The Diversification Index.

All the eight concentration measures are based on the shares of individual elements. The individual elements, in the present context are the various spice export items/trading partners of India. The general form of the concentration Index can be expressed as follows.

\[ CI = \sum Si \cdot wi \quad ; \quad i = 1, 2, ..., n. \]

Where,

- \( wi \) = the weight attached to the export share of a particular export category/trading partner
- \( Si \) = the share of export category/trading partner \( i \)
- \( n \) = the number of export categories/trading partners.

There are four major types of weights:
- Weights of unity are attached to the shares of an arbitrarily determined number of product and service categories (\(wi = 1\)) and zero weights are attached to the remaining categories (\(wi = 0\)). An example of this ratio is the Concentration Ratio.

- Products’ export shares are used as their own weights (\(wi = Si\)). These indices take account of all export categories. An example is the Herfindahl-Hirschman Index.

- Product and service groups are ranked in ascending or descending order, and these rankings are used as weights. All export categories are included in computing this index, and examples of such measures are the Hall-Tideman Index and the Rosenbluth Index.

- Each export share is weighted by the negative of its logarithm (\(wi = - \log Si\)), such that a smaller absolute weight is attached to larger export shares. The Entropy Index uses this scheme.

1. The Concentration Ratio (CR):

The Concentration Ratio (CR) measures the export share of only the largest export categories. It is calculated as follows:

\[
CR(x) = \sum_{i=1}^{n} Si
\]

where \(x\) is less than the total number of export commodities/trading partners, \(n\). This ratio gives equal emphasis to the \(x\) largest export categories but neglects the remaining categories in the export market. If the ratio value is close to unity, this means that the \(x\) categories included in the ratio make up the entire export bill and hence concentration is high. In most
applications CR(4), CR(8) or CR(12) are used, but there is no rule for the determination of
the value of x, so that the number of categories included in the Concentration Index is a
rather arbitrary decision. This is this ratio’s main disadvantage but it is still widely used
because of its simplicity of calculation and limited data requirements\textsuperscript{22}.

2. The Gini-Hirschmann Index (GHI)

The Gini-Hirschmann Index (GHI) is calculated by taking the square of export shares of all
export categories in the market. The index can be expressed as flows:

$$GHI = \sqrt{\sum S_i^2} \quad i = 1, 2, \ldots, n$$

This index gives greater weight to the larger export categories and reaches a value of 1 when
the country exports only one commodity/trading partner (maximum concentration) and takes
the value of \(1/n\), when the share of all commodities/trading partners are equal (maximum
diversification).

3. The Hall-Tideman Index (HTI)

In this index the number of export categories is included in the calculation of the index to
reflect the starting conditions when exporting a new product or service. This is similar to the
concept of entry barriers in an industry. The HTI takes the following form:

$$HTI = (2 \sum S_i - 1)^{-1}; \quad i = 1, 2, \ldots, n$$

where the export share of each category is weighted by its ranking in descending order to
ensure that the emphasis is on the absolute number of categories, and also that the largest
export category receives a weight equal to one. The HTI reaches a value of unity in the case of high concentration.

3. The Rosenbluth Index (RI)

The Rosenbluth Index (RI) resembles the Hall-Tideman Index since the same formula is used but export categories are ranked in ascending order. This index is therefore sensitive to changes in the size distribution of the smaller categories, with small values of the HTI indicating high concentration.

4. The Comprehensive Concentration Index (CCI)

This index reflects both relative dispersion and absolute magnitude of the categories. As with the Hall-Tideman Index, the CCI requires the export share $S_i$ to be sorted in descending order. However, this index main focus is on the largest $S_i$, share of export of a particular category. The remaining $S_i$s are used to adjust $S_i$ according to this formula:

$$CCI = S + \sum_{i=1}^{n} S_i^2 \left(1 + (1-S_i)\right)$$

This index also produces a value of unity in the case of high concentration.

5. The Hannah and Kay Index (HKI)

Hannah and Kay (1977) propose a summary index of the form:

$$HKI = \left(2 \sum_{i=1}^{n} S_i^a\right)^{1/(1-a)} ; \quad i = 1, 2, ..., n ; \quad a > 0 \text{ and } a = 0$$

Where export shares are raised by a power $a$, which is a parameter that reflects changes in
concentration arising from the exportation of new products or the ceasing of previously exported products. The fact that the choice of $a$ is left to the investigator (Hannah and Kay suggest a value in the range 0.6 to 2.5 points) allows for alternative views on what is the appropriate weighting scheme. Therefore, in addition to the distribution of the export categories, the value of the index is sensitive to the parameter $a$. The value for the HKI gives an approximation of the number of large export categories of a country. Consequently a small number indicates high concentration.

6. The Entropy Measure (ENT)

In this measure, export shares are weighed by the logarithms of the export share of each category, as follows:

$$\text{ENT} = \sum_i S_i \log S_i; \quad i = 1, 2, ..., n$$

Small values of the Entropy Index reflect high concentration.

7. The Diversification Index (DIV)

The term “diversification” refers to the spreading of operations over dissimilar economic activities and takes place in order to mitigate the effect of cyclical instability, to come closer to a full utilisation of resources, and to expand the export share. It is measured through the number of export categories/trading partners in which the country is active. It is specified as follows:

$$W = 2 \sum (iS_i - 1); \quad i = 1, 2, ..., n.$$ 

A result close to one indicates that the country is completely specialised in its exports, while
if W is, say, equal to four this would imply that the country is equally active in four export industries.

The above eight measures of concentration have their own strengths and weaknesses. The various characteristics of these measures were summarized in table 5.2 below. The present study utilizes the Gini-Hirshmann Index (GHI) to calculate the concentration indices for Indian spices exports. The rationale for selecting this index is that it includes the market shares of all commodities/trading partners. Moreover rather than simply adding the market shares, the GHI squares each market share before adding. This simple trick has added features of placing greater weight on larger market shares. This index is the most popular measure of concentration in empirical literature. The GHI as defined above can be expressed as follows for computational purpose:

\[
GHI = 100 \sqrt{\sum S_i^2} = 100 \sqrt{\sum \left( \frac{X_{it}}{X_t} \right)^2} \quad i = 1, 2, \ldots, n
\]

where, \(GHI\) = Commodity Concentration coefficient (CC)/ Geographic Concentration coefficient (GC)

\(X_{it}\) = Export earnings of commodity group i in year t / export earnings from country i in year t

\(X_t\) = Total export earnings in year t.
Table 5.1
SUMMARY CHARACTERISTICS OF CONCENTRATION INDICES

<table>
<thead>
<tr>
<th>Index</th>
<th>Range</th>
<th>Number of categories</th>
<th>Size Distribution</th>
<th>Relationship between Index and Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR</td>
<td>0,..., 1</td>
<td>x categories</td>
<td>Variation across x largest export categories ignored</td>
<td>+</td>
</tr>
<tr>
<td>GHI</td>
<td>1/n,..., 1</td>
<td>All categories</td>
<td>Greater emphasis on large categories</td>
<td>+</td>
</tr>
<tr>
<td>HTI</td>
<td>0,..., 1</td>
<td>All categories</td>
<td>Greater emphasis on large categories</td>
<td>+</td>
</tr>
<tr>
<td>RI</td>
<td>0,..., 1</td>
<td>All categories</td>
<td>Sensitive to changes in larger categories</td>
<td>-</td>
</tr>
<tr>
<td>CCI</td>
<td>0,...,1</td>
<td>All categories</td>
<td>Reflects both dispersion and magnitude</td>
<td>+</td>
</tr>
<tr>
<td>HKI</td>
<td>1/Si,..., n</td>
<td>All categories</td>
<td>Ambiguous</td>
<td>-</td>
</tr>
<tr>
<td>ENT</td>
<td>0,..., log(n)</td>
<td>All categories</td>
<td>Irregular</td>
<td>-</td>
</tr>
<tr>
<td>DivI</td>
<td>0,..., 1</td>
<td>All categories</td>
<td>Uniform sensitivity</td>
<td>+</td>
</tr>
</tbody>
</table>
5.3.1 Concentration Indices for Indian Spices Exports

The Gini-Hirschman Index (GHI) outlined above is being utilized for computing Commodity Concentration (CC) and Geographical Concentration (GC) indices for Indian spices exports earnings for the period 1980-2007. Commodity concentration reflects the commodity composition of exports. It also indicates the direction of growth in terms of variety, product differentiation and sources of value realization.

To calculate the commodity concentration index we need to identify the major items of spices exports from India. The commodity composition of Indian spices exports was given in Table 3.15. Even though India exports nearly 52 varieties of spices the major spice exports are pepper, cardamom(s), cardamom(l), chilli, turmeric, ginger, fennel, fenugreek, cumin, garlic, coriander, celery, mint products, spice oils and curry powders. These items constitute nearly 95 per cent of the total export earnings. Therefore, these items were considered in computation of the commodity concentration and the rest of the items are included as others.

The Geographical concentration Index was computed considering USA, USSR, EU, East Asia, West Asia and the rest as Others (Table 3.16). The interpretation of the index is that, higher value of index implies concentration and lower value indicates diversification. The data for the computation of these indices is obtained from the various issues of Spices Statistics, published by Spices Board, Cochin. The empirical results were given in Table 5.2.
SECTION - III

5.3.2 Determinants of Indian Spices Exports Instability

In section 5.1.1, the various determinants of export instability for primary commodities were identified based on theoretical knowledge and empirical studies. The prominent determinants of export instability being identified are:

   a. Commodity concentration of exports (CC)
   b. Geographical concentration of exports (GC)
   c. Relative instability of the major commodity (IP)
   d. Internal supply conditions (O)
   e. International demand conditions (D)

Thus, the year to year Instability in Indian spices exports earnings may be expressed as function of the above variables. The commodity concentration and geographical concentration of Indian spices exports as measured by the Gini-Hirschman Concentration Index are considered as the major determinants. Traditionally the major commodity in India spices export basket is Pepper. The proportion of pepper exports in total spice exports is subjected to wide fluctuations over the years (Table 4.1), therefore instability in pepper exports is hypothesized as one of the determinants of instability in Indian total spices exports. The analysis of instability in total Indian spices exports and its constituent commodity groups done in section 3.4.5 and 3.4.6 shows that explanation for instability is likely to be found in volume fluctuations rather than unit price fluctuations. Also the sources of export volume fluctuations of Indian spices seem to be originated from supply side (section 3.4.6). Similarly
the analysis of identifying determinants of Pepper and Chilly exports in chapter V shows that internal supply conditions are the dominant factors that are influencing the Indian spices exports. External demand conditions being captured by the export prices seems to have only marginal influence on Indian spices exports as reflected by their low price elasticities (section 6.3.6). Considering these factors, we may choose only domestic output of spices and not international demand for spices as determinant of instability in Indian spices exports. Keeping in view the above discussion the instability in Indian spices exports may be hypothesized as follows:

\[
ISE = f (CC, GC, IP, IO) \quad \text{---------(1)}
\]

\[
(+) \quad (+) \quad (+) \quad (+)
\]

where, \( ISE \) = instability index of spices exports

\( CC \) = commodity concentration.

\( GC \) = geographical concentration.

\( IP \) = instability index of pepper output.

\( IO \) = instability index of total spices production.

(expected signs of determinants are given in the parenthesis)

5.3.2.1 Expected Signs of Determinants

On the basis of theoretical reasoning, the commodity concentration is expected to have a positive influence on export instability. This is because high degree of commodity concentration reduces the chances of having fluctuations in one direction in some of the exports offset or ameliorated by counter fluctuations or stability in others. That is high
commodity concentration nullifies the chances of counterbalancing swings with roundabouts in export earnings. An analogous argument is advanced with regard to the effect of geographical concentration on export instability. An individual market may be highly volatile. However, its incorporation with another market may decrease the overall instability in total export earnings because of counterbalancing effects. Therefore, it is likely that the larger the spread of exports over several markets the more stable the export earnings. Thus we may expect a positive link between geographical concentration and export instability.

Since pepper is the major item in the export basket of Indian spices, its instability is expected to contribute positively to the overall instability of total export earnings. This is because when the major commodity disproportionately contributes to the total export receipts, there is a positive association between and export earnings instability and the relative instability of the major commodity. We know that export revenue is the product of export volume and export price. Therefore, export instability defined as the instability in export revenue could be partly due to instability in the export prices and partly due to instability in export quantities. As the quantity of spices exports in India is influenced primarily by domestic supply, which mainly depend on domestic production it is natural that instability in production translates into instability in export quantity and thus export revenue of spices. Thus we may expect a positive link between instability of production leading to export earning instability of Indian spices.

To sum up, all the hypothesized determinants of Indian spices export instability are expected to have a direct influence on export instability.
5.3.3 Computational Framework

To establish the cause and effect relationship between the major determinants and spices export instability the present study employs Multiple Linear Regression model and yearly time series data (1980-2007). A log-linear functional form is preferred because of its superior fit and ease of interpretation. Most of the available studies on determinants of export instability using time series data do not address the issue of non-stationarity nature of the data. Hence it may be possible that these estimates are based on spurious regression. That is, the estimates may turn out to be statistically significant but the relationship may have no meaning. Therefore, the present study uses the time series data to study the determinants of Indian spices exports instability after considering the non-stationarity nature of the data. The Indian spices export instability function (equation -1) in a double log linear form can be specified as follows:

\[
\ln(ISE_t) = \beta_0 + \beta_1 \ln(CC_t) + \beta_2 \ln(GC_t) + \beta_3 \ln(IP_t) + \beta_4 \ln(IO_t) + \varepsilon_t \quad \text{-------(2)}
\]

Where,
- \(\ln\) = natural logarithm, \(ISE\) = Index of instability in spices exports.
- \(GC\) = Geographical Concentration, \(CC\) = Commodity Concentration.
- \(IP\) = Instability index of Pepper output,
- \(IO\) = Instability Index of total spices output.
- \(\varepsilon\) = error term, such that \(\varepsilon \sim N(0,1)\) and \(t = 1\) to \(28\)

and \(\beta_0, \beta_1, \beta_2, \beta_3, \beta_4\) are the coefficients to be estimated.
5.3.4. Data Definition and Sources:

Data for the regression analysis consists of 28 observations pertaining to the years 1980-2007. The description of the dependent and explanatory variables is as follows.

i. ISE (Instability Index of Spices Exports): The instability of total spices exports is represented by year to year deviations from exponential growth trend. Data for this variable is obtained from the residuals of the fitted exponential growth trend equation for total Indian spices exports (Chapter III).

ii. CC (Commodity Concentration) and GC (Geographical Concentration): commodity concentration and geographical concentration of Indian spices exports is represented by year to year concentration coefficients, calculated by using Gini-Hirschman Concentration Index. Data for the calculation of these coefficients were obtained from various issues of Spices Statistics, published by Spices Board, Cochin.

iii. IP (Instability in Pepper Production): The instability in pepper production is represented by year to year deviations from exponential growth trend path. Data on production of pepper for the study period is also obtained from the Spices Statistics of Spices Board, Cochin.

iv. IO (Instability in Spices Output): The instability in the output of spices is represented by the deviations from the trend growth path of total spices production. The data for this variable is obtained from, data bank of Indian Institute of Spices Research, Calicut.
5.3.5 Estimation Procedure

To establish the cause and effect relationship between spices export instability and its major determinants, the export instability function of Indian spices exports as specified in equation – (2) is considered here for estimation. Estimating such long run relationship is likely to pose some problems because the variables in the analysis are typically non-stationary and may result in spurious regression (Granger and Newbold, 1987)\textsuperscript{26}. This means that the estimates of the model may turn out to be statistically significant but the relationship may have no meaning. Non-stationarity is usually removed by taking first differences of variables (Box and Jenkins, 1970)\textsuperscript{27}. However, differencing may lead to loss of long-run information, thereby making the model capable of explaining only short run effect. This is because economic theories are generally formulated for levels of variables rather than for differences. Thus the estimation of Indian spices export instability function should be based on methods which take into account the non-stationarity features of the data. The theory of cointegration is capable of tackling the issue of non-stationarity in an efficient and significant manner. The concept of cointegration is that, if two or more variables are themselves non-stationary but a linear combination of them is stationary then the variables are said to be cointegrated. Economically speaking, two variables are said to be cointegrated if they have a long-term or equilibrium relationship between them (Gujarati, 2005). This means that variables may drift apart due to random shocks in the short run, but in the long run economic equilibrium processes forces these variables back to their equilibrium path (Engle and Granger, 1991)\textsuperscript{28}. The implication here is that cointegration technique is apt for investigating relationships that are believed to be of long run nature. Once cointegration is
established between variables the disequilibrium between short run changes and long run adjustment process can be corrected by the Error Correction Mechanism (ECM). That is, while cointegration conveys long run relationship, ECM is used to understand the short-run dynamics. The correspondence between cointegration and ECM is formalized by Granger's Representation Theorem (1987). The size of the error correction term indicates the speed of adjustment of any disequilibrium towards long equilibrium states.

Thus it is clear that to establish a meaningful relationship between instability in Indian spices exports and its various determinants, cointegration procedure is appropriate. Similarly, to understand the link between short - run dynamics and long run equilibrium relationship between instability in spices exports and its determinants we have to resort to Error Correction Mechanism. Keeping these things in mind the cointegration and ECM techniques are being utilized here to estimate the export instability function of Indian spices. The major steps involved in such procedure are:

i) Determination of order of integration of each variable by performing the Augmented Dicky-Fuller (ADF) test, where a unit root null hypothesis is tested against the stationary alternative.

ii) Determination of optimum lag length.

iii) Estimating the Error Correction Model (ECM) which ties the short run behavior of the variable with their long run values.

The processing and analysis of the data is done with the help of computer software SHAZAM 9. The empirical results of the analysis are presented in the next section.
5.3.6 Empirical Results and Discussion

Before applying the cointegration tests, we shall first carry out the unit root tests of the time series properties of the concerned variables outlined by equation (2). For each series, we examine the time series properties of the macro variables using the Augmented Dickey-Fuller unit root test (with trend and intercept) on both levels and first differences. Results from the unit root tests were presented in Table.1 and they provide strong evidence of nonstationarity of variables at levels as the estimated statistic for all these variables does not exceed their critical values at standard significance level. However the unit root tests for the variables in first differences confirms our assertion that the all the series are nonstationary at levels but are stationary in their first differences. Therefore, we conclude that all the series contain a single unit root. Since all the variable appear to have a unit root, testing for cointegration is feasible.

An examination of series of all variables suggests us to use the specification that the cointegration test assumes deterministic trend in the data. We adopt Johansen–Juselius Multivariate cointegration technique to test for cointegration. It is well known that the results of the Johansen-Juselius procedure are sensitive to lag length for the VAR (Vector Auto Regression), therefore first we should determine the optimal lag length to be used in cointegration test. One of the most commonly used method to identify optimum lag length is to, estimate VAR using un-differenced data and compare their AIC (Akaike Information Criterion (Gujrati, N, 2005). Based on AIC results we choose lag length of 1 for the equation. Since, all the variables are I (1), we apply the Johansen-Juselius cointegration test
to establish whether there is a long run equilibrium relationship among the variables in equation (2). The results of the Johansen-Juselius cointegration tests were reported in Table 2. The Johansen method suggests two statistics to determine the number of cointegration vectors, viz., trace statistics and maximum eigenvalue tests. The appropriate critical values for the tests are provided in Osterwald Lenum (1992). The null and alternative hypotheses are tested using trace statistics and maximum eigenvalues. Among five variables there is a possibility of zero, one or two cointegration vectors. Starting with trace statistics tests for the null hypothesis of zero cointegrating vector (r = 0), against the alternative one cointegrating vector (r > 0) rejects the null hypothesis. Next, the null hypothesis of r ≤ 1 and r ≤ 2 against the alternative of r > 1 and r > 2 can be rejected at the standard significance level. But the null hypotheses of r ≤ 3 and r ≤ 4 against the alternative r > 3 and r > 4, can not be rejected at the standard level of significance. In Table 2, where the trace statistics indicates presence of more than two cointegrating vectors at 5% and 1% level. The maximum eigenvalue test is similar to trace statistic's results. These results from both the tests suggest the presence of more than one cointegrating vectors indicating that there is a long run relationship between variables. That is although the variables in the equation are individually nonstationary, a linear combination of these variables is stationary. Hence it can be inferred that the long run relationship represented by equation (2) is stable. Based on the highest eigenvalue we considered the first cointegrating equation and normalized long run cointegration equation on variable ln(ISE). Then the cointegrating vector corresponding to maximum eigenvalue is represented as follows.

\[
\ln(ISE) = 1.21 \ln(CC) + 3.02 \ln(GC) - 0.25 \ln(IP) + 2.56 \ln(IO) \quad (3)
\]

\[
\begin{align*}
(1.89) & \\
(2.14) & \\
(0.09) & \\
(2.08)
\end{align*}
\]
The long run relationship between variables in equation (3) shows that the estimated coefficients have expected signs. Commodity concentration (CC), Geographical Concentration (GC) and Instability in production (IO) of spices have a positive impact on instability in export of spices where as instability in export of pepper, the major spice export of India has a negative but insignificant impact on instability.

Thus it is clear from these results that instability in export earnings of Indian spices exports is caused by concentration of exports in few commodities and few markets and also due to year to year fluctuations in production. For instance a one per cent increase in instability of production leads to 2.56 per cent increase in instability in export earnings. The maximum impact on instability seems to be from Geographical concentration of exports. Even though Pepper is the chief item of export instability in pepper exports does not have any significant impact on total instability of spices exports. The final step in the analysis is the estimation of an error correction model. When the variables in the equation are cointegrated, there exists an error correction mechanism, which combines both the long run equilibrium relationship with the short-run adjustment dynamics. The error correction mechanism explains the short run discrepancies from the long run behaviour in the adjustment process. Based on the Granger’s Representation Theorem, the existence of a cointegration relationship among a set of $I(1)$ variables implies the following dynamic error correction representation of the data:

$$\Delta \ln(\text{ISE}_t) = \beta_0 + \beta_1 \sum_{i=1}^{m} \Delta \ln(\text{CC}_{t-i}) + \beta_2 \sum_{i=1}^{n} \Delta \ln(\text{GC}_{t-i}) + \beta_3 \sum_{i=1}^{o} \Delta \ln(\text{IP}_{t-i}) + \beta_4 \sum_{i=1}^{p} \Delta \ln(\text{IO}_{t-i}) + \delta \text{ECT}_{t-1} + \epsilon_t \quad (4)$$
The equation (4) is estimated with a general specified lag structure for all the variables in equation (2), a constant term and one lagged correction term. The empirical counterpart of equation (4) is as follows.

\[ \Delta \ln(ISE_t) = 0.23 + 0.56 \Delta \ln(CC_{t-1}) + 1.59 \Delta \ln(GC_{t-1}) - 0.05 \Delta \ln(IP_{t-1}) \\
(0.58) \quad (1.01) \quad (0.21) \quad (1.41) \\
+ 1.04 \Delta \ln(IO_{t-1}) - 0.27 \ ECT_{t-1} \quad \text{(5)} \]

The estimates in equation (5) show that except for instability in production of spices all the remaining variables did not have any significant short run impact on the instability in Indian spices exports. Also the short term coefficients are smaller than their long run counterparts. This could be due to product differentiation and standardization practices that became inevitable in the post WTO scenario. The estimated coefficient of the Error Correction Term is \(-0.27\) which is significant at 5 per cent level, suggesting that the system corrects to previous period disequilibrium by 27 per cent in a year. These findings not only support the validity of long run equilibrium relationship among the variables but also indicates that instability in spices exports is sensitive and tends to depart from the equilibrium value of the previous period.

5.3.7 Findings

Based on the above empirical analysis of the relationship between instability of Indian spices exports and its various determinants, the following findings are made:
1. There is a long run equilibrium relationship between the instability of Indian spices exports and its determinants, viz., Commodity Concentration of exports, Geographical Concentration of exports, Instability in pepper exports and Instability in spices production.

2. Commodity concentration of Indian spices exports is related directly with spices export instability.

3. Geographical concentration of Indian spices exports has a significant positive impact on its export instability.

4. Instability in production of spices is found positively related with the level of instability in exports of spices.

5. Instability in pepper exports is found not significant in explaining instability in total spices exports.

6. Instability in spices exports is sensitive and tends to depart from the equilibrium value of the previous period and the system corrects to previous period disequilibrium by 27 per cent in a year.

5.3.8 Testing of Hypotheses

1. In the light of our above findings, we accept the second hypothesis that commodity concentration of Indian spices exports is directly related to instability in spices exports as the estimated elasticity is positive and statistically significant.
2. The third hypothesis that Geographical Concentration of Indian spices exports has positive influence on export instability is also accepted as it is clear from our findings that it has statistically significant positive elasticity with respect to export instability.

3. Regarding the fourth hypothesis that the instability in pepper exports is causing instability in total spices exports, our findings did not support it as the estimated coefficient is not statistically significant. Thus, we reject the null hypothesis that instability in pepper's exports is responsible for instability in total spices exports.

4. The fifth hypothesis that instability in total output of spices is directly related to instability in spices exports is accepted. The estimates show a statistically significant positive relationship between instabilities of output and exports of spices.

5.3.9 Summary and Conclusions

The present chapter investigates the long run relationship between instability of Indian spices exports and its various determinants. The concept of export instability and its micro and macro economic consequences were first discussed and then the various theoretical and empirical determinants of export instability were identified. Based on this it was hypothesized that, commodity concentration of exports, geographical concentration of exports, instability in output and instability in pepper exports are the major determinants of instability in Indian spices exports.

Commodity concentration and geographical concentration of Indian spices exports was measured by Gini-Hirschmnn Concentration Index for the period under consideration. Instability in output of spices and pepper exports were represented by annual deviations of
the respective variables from their exponential growth trend path. The instability in Indian spices exports and its various hypothesized determinants are then expressed as an export instability function in a double log linear form and was considered for empirical estimation for the period 1980-2007.

The Johansen-Juselius multivariate cointegration technique and ECM techniques have been used to estimate the instability function. Results show that the instability in Indian spices exports is cointegrated with commodity concentration of spices exports, geographical concentration of spices exports and instability in spices output. Thus, our econometric estimation of instability function of Indian spices exports suggests that instability in Indian spices exports is largely explained by commodity concentration of spices exports, geographical concentration of spices exports and instability in output of spices. However, instability in pepper exports, the most important spice export item of India did not have significant impact on overall spice exports instability.

5.3.10 SHAZAM SYNTAX FOR JOHANSEN-JUSELIUS COINTEGRATION PROCEDURE

```plaintext
SAMPLE 1 27
READ (D:\dsr\instab.xls)
FILE PROC JOHANSEN
NLAG: 4
VARS LISE LCC LGC LIP LIQ
EXEC JOHANSEN
STOP
```
Table 5.2
Concentration Indices of Indian Spice Exports

<table>
<thead>
<tr>
<th>Years</th>
<th>Commodity Concentration Index</th>
<th>Geographical Concentration Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>21.7</td>
<td>61.2</td>
</tr>
<tr>
<td>1981</td>
<td>21.3</td>
<td>58.3</td>
</tr>
<tr>
<td>1982</td>
<td>16.4</td>
<td>58.7</td>
</tr>
<tr>
<td>1983</td>
<td>17.8</td>
<td>60.1</td>
</tr>
<tr>
<td>1984</td>
<td>20.1</td>
<td>55.6</td>
</tr>
<tr>
<td>1985</td>
<td>41.5</td>
<td>51.2</td>
</tr>
<tr>
<td>1986</td>
<td>51.7</td>
<td>65.4</td>
</tr>
<tr>
<td>1987</td>
<td>65.6</td>
<td>71.5</td>
</tr>
<tr>
<td>1988</td>
<td>35.8</td>
<td>45.3</td>
</tr>
<tr>
<td>1989</td>
<td>31.8</td>
<td>47.2</td>
</tr>
<tr>
<td>1990</td>
<td>22.1</td>
<td>45.0</td>
</tr>
<tr>
<td>1991</td>
<td>13.9</td>
<td>42.8</td>
</tr>
<tr>
<td>1992</td>
<td>11.6</td>
<td>43.1</td>
</tr>
<tr>
<td>1993</td>
<td>16.1</td>
<td>43.8</td>
</tr>
<tr>
<td>1994</td>
<td>19.1</td>
<td>41.9</td>
</tr>
<tr>
<td>1995</td>
<td>15.4</td>
<td>38.3</td>
</tr>
<tr>
<td>1996</td>
<td>17.6</td>
<td>41.2</td>
</tr>
<tr>
<td>1997</td>
<td>16.8</td>
<td>35.2</td>
</tr>
<tr>
<td>1998</td>
<td>18.8</td>
<td>29.3</td>
</tr>
<tr>
<td>1999</td>
<td>23.9</td>
<td>27.5</td>
</tr>
<tr>
<td>2000</td>
<td>13.2</td>
<td>24.9</td>
</tr>
<tr>
<td>2001</td>
<td>14.2</td>
<td>21.5</td>
</tr>
<tr>
<td>2002</td>
<td>15.8</td>
<td>18.1</td>
</tr>
<tr>
<td>2003</td>
<td>14.2</td>
<td>18.5</td>
</tr>
<tr>
<td>2004</td>
<td>14.8</td>
<td>17.2</td>
</tr>
<tr>
<td>2005</td>
<td>17.0</td>
<td>28.3</td>
</tr>
<tr>
<td>2006</td>
<td>18.2</td>
<td>15.8</td>
</tr>
<tr>
<td>2007</td>
<td>18.6</td>
<td>17.7</td>
</tr>
</tbody>
</table>
Table 5.3 Augmented Dickey-Fuller Unit Root Test Results.

<table>
<thead>
<tr>
<th>Variables</th>
<th>At levels</th>
<th>At First differences</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>LISE</td>
<td>-1.34</td>
<td>-4.29</td>
<td>I(1)</td>
</tr>
<tr>
<td>LCC</td>
<td>-2.08</td>
<td>-4.41</td>
<td>I(1)</td>
</tr>
<tr>
<td>LGC</td>
<td>-2.76</td>
<td>-4.56</td>
<td>I(1)</td>
</tr>
<tr>
<td>LIO</td>
<td>-2.16</td>
<td>-5.01</td>
<td>I(1)</td>
</tr>
<tr>
<td>LIP</td>
<td>-2.65</td>
<td>-5.89</td>
<td>I(1)</td>
</tr>
</tbody>
</table>

At levels
1% Critical value -3.96
5% Critical value -3.41

At first differences
1% Critical value -3.98
5% Critical value -3.52

Table 5.4 Johansen Cointegration Test Results

<table>
<thead>
<tr>
<th>Null Hypotheses</th>
<th>Trace Values</th>
<th>Critical Values</th>
<th>( \lambda ) Max Values</th>
<th>Critical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 %</td>
<td>5 %</td>
<td>1 %</td>
</tr>
<tr>
<td>( r = 0 )</td>
<td>129.71</td>
<td>102.82</td>
<td>93.94</td>
<td>44.92</td>
</tr>
<tr>
<td>( r \leq 1 )</td>
<td>78.35</td>
<td>75.10</td>
<td>67.26</td>
<td>41.82</td>
</tr>
<tr>
<td>( r \leq 2 )</td>
<td>62.31</td>
<td>53.84</td>
<td>46.16</td>
<td>36.14</td>
</tr>
<tr>
<td>( r \leq 3 )</td>
<td>23.59</td>
<td>34.38</td>
<td>28.19</td>
<td>15.56</td>
</tr>
<tr>
<td>( r \leq 4 )</td>
<td>5.53</td>
<td>19.12</td>
<td>14.78</td>
<td>4.46</td>
</tr>
</tbody>
</table>

Note: “\( r \)” refers to the number of cointegrating vectors
REFERENCES


5. ibid pp 3


20. ibid., pp 4.

21. ibid., pp 4


