

## **Application of Chow Test in Evaluating the Breaks and Performance of Pepper Export**

**Ambili Sunil**

Assistant Professor, Department of Business Administration, Emirates Canadian University College, UAQ, UAE

### **Abstract**

Indian agricultural products are losing their ground in the international market which forces the producers to pool the domestic market. The major reason behind this may be of reform measures which are posing a threat to Indian producers. This study purports to analyse the international demand for Indian Pepper focusing on pre liberalization and post liberalization period. The study further attempts to analyse the changes in the export destinations because of the Specific Trade Concerns of WTO on Spices, specifically with the Sanitary and Psychosanitary measures by looking into the changes in the volume of export of Pepper with reference to two time periods viz, Pre WTO (1980-81 to 1994-95) and post WTO period (1995-96 to 2011-12). The structural break has been detected by using Chow test and other associated Econometric techniques are being applied to study the impact of variations in the international trade of Pepper.

The study reveals that there is structural break and a negative growth in the export of Indian Pepper between the two time periods.

**KEYWORDS:** Sanitary and Psychosanitary measures, Specific Trade Concerns, World Trade Organisation, Exports, Spices, Chow Test, and structural break.

### **Introduction:**

Launching of structural adjustment programme in July 1991 for macro-economic stabilisation has opened up Indian economy to outside competition and accelerated its integration with the global economy. This has serious implications for the agriculture of the country in the sense that the supportive system to agriculture has been put to resource crunch. Moreover, the feasibility and relevance of the support measures have been put under question mark both by a section of the farmers and the policy-makers<sup>[1]</sup>. These developments have brought the question of competitiveness of Indian agriculture to the centre stage of the controversy. In view of the majority of Indian population being dependent on agriculture, this question has attracted the attention of a large number of commentators, government-controlled media and researchers. The discussion on this issue has been in an extremely narrow context ignoring major issues such as global commodity prospects both in terms of commodity prices, their stability/instability, movement of domestic and world market prices, movement of agricultural prices and non-agricultural prices within the country. The overriding question of structure of global trading market is hardly brought in this discourse. The opening up of the economy with new international trade accord has opened new challenges to the Indian agricultural export. When we look at the export policies in 1960s there were more restrictions and controls, as the time passes away there emerged the need for removing the existing controls and as a result the economy opened up in the due course of time. The focus of this study is on whether the exports of India have affected by this policies or not.

Rao <sup>[2]</sup> remarked in his article that the liberalization policies have got impetus to agricultural exports. The sector registered a noticeable improvement in 4-5 years. It is asserted that there is considerable potential for raising India's share in the world export of Indian agriculture. Healthy exploitation of this potential is necessary not only for increasing the foreign exchange earnings but also for improving employment opportunities and farm income. This argument needs a thorough explanation because, those potentials have not been materialized in the later years as is seen from the data that after a few years the foreign trade started showing a negative growth especially after the initiation of GATT and the WTO. As Ramesh Chand <sup>[3]</sup> concluded, from the trade indicators that reforms initiated in 1991-92 resulted in significant improvement in India's balance of trade in the initial years. However as the tempo of economic reforms slowed down it led to sharp increase in trade deficit due to faster rate of imports compared to exports.

Most of the studies have concentrated on economic reforms and the process of liberalization has contributed more for the change in exports, but C.Veeramani<sup>[4]</sup> had pointed out various other reasons both internal and external for the deterioration in exports from India. He had stated that, it is worthwhile to undertake a detailed analysis of the response of Indian exports to the changes in the incentive structure engendered by the reforms. In order to establish a link between domestic policy changes and export growth, however, it is important to emphasise that the latter is determined not only by internal but also by external factors. Among external factors, the most crucial, perhaps, is the growth of world demand. The internal and external factors are often intertwined to determine the export performance of a country. A country may fail to exploit the buoyancy of world demand if the domestic policy environment is highly restrictive. Similarly, despite the policy reforms, a country's exports may not grow faster if world demand happens to decelerate in the post-reform period compared to the pre-reform period ("world trade effect"). Clearly, a simple before and after comparison, without taking into account world demand (or world export) conditions can be misleading. It is therefore appropriate to judge the country's export performance in the two periods in relation to the performance of world exports (which proxies world demand). A country's exports, in a given period, may grow faster than the world average for one or more of the following three reasons. First, the country's exports would have been concentrated in commodities for which world demand was growing relatively faster during the period ("commodity composition effect"). Second, the country's exports would have been going, primarily, to the fast growing regions of the world ("market distribution effect"). Third, the country would have been able to improve its overall competitiveness (possibly due to policy changes) and therefore, could expand its exports faster than the world average (overall "competitiveness effect"). It is important to disentangle these effects in order to assess the impact of domestic policy changes on export growth.

This study focuses on these points whether the exports of pepper had any impact after liberalization policies, or whether the changes are the results of liberalization policies and so on. The theoretical background of the analysis is given hereafter.

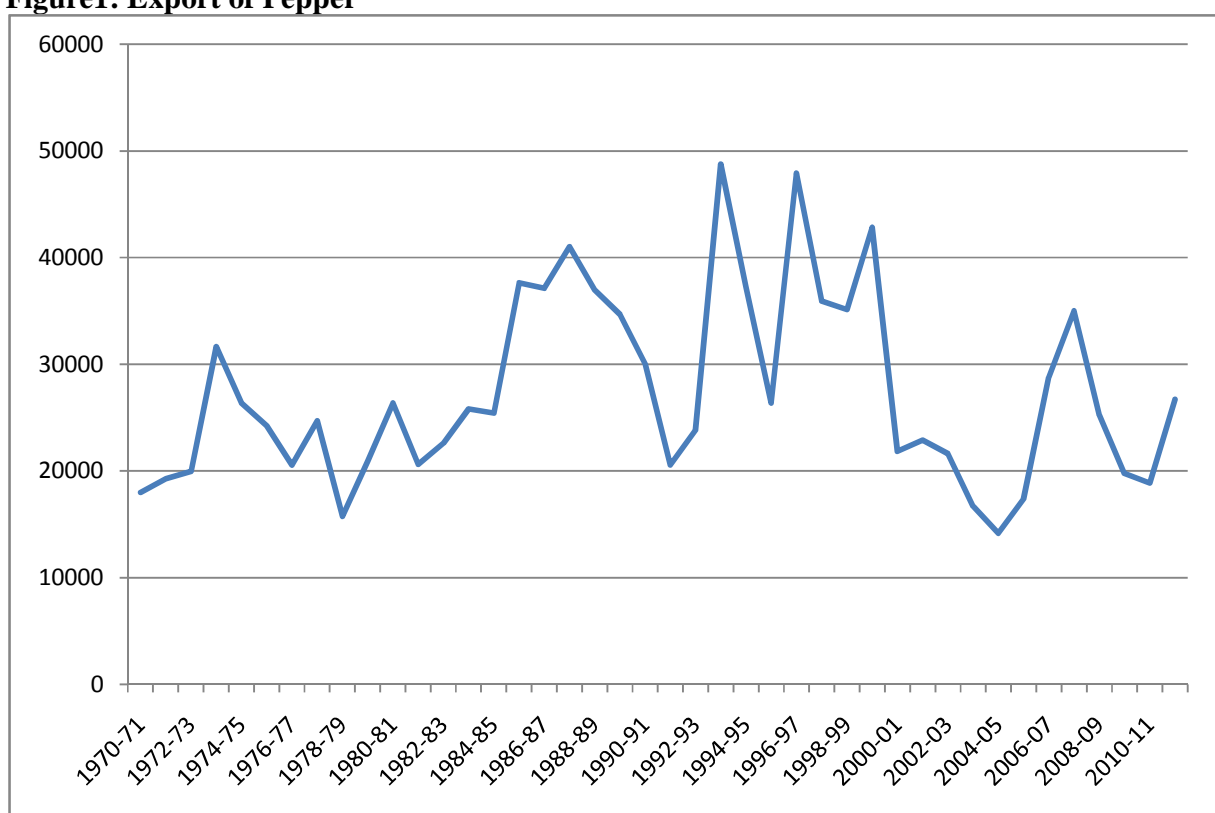
The data on quantity of export for 41 years have been analysed and to know the pattern of change in the export. Here the problem arises how we can analyse these 41 years time series data. First of all the period should be divided in order to get a clear picture. Since the objective of the study is to analyse the export performance of Indian spices especially

Pepper and Cardamom in the context of globalization. The data has been divided broadly into two Pre liberalization i.e, from 1970-71 to 1990-91 and post liberalization 1991-92 to 2011-12. on a priory assumption that the export is affected by the reform and the liberalization policies have affected the demand for Indian spices in the international market. This problem has been addressed by studying the nature of time series data on Econometric theoretical background. The division data into pre liberalization and post liberalization should be tested by using the concept of structural break.

### Structural Break:

The figure given below shows the export of Pepper from 1970-71 to 2011-12. There are seasonal variations in the figure. It is difficult to identify the exact breaks in the time series data by just looking into the figure. Hence, as stated earlier, the time period has been divided into two on a priory assumption.

**Figure1: Export of Pepper**



Export of pepper has been affected over a period of time because of the policy changes at the international level. Before reforms Indian pepper had a very good demand in the world market. But after the reforms have implemented the market for Indian pepper lost its ground. The reason is increased competition, international price of Indian pepper compared to the other pepper producing countries like Indonesia, Brazil and so on. This assumption should be statistically tested for theoretical validation. Here we want to test whether there is a structural change has really happened or not.

The sample data is divided into two time periods:

1970-71 to 1990-91: The pre liberalization period

1991-92 to 2011-12: The post liberalization period.

1970-71 to 2011-12: The whole period

Now we have three possible regression functions:

The pre liberalization period: 1970-71 to 1990-91,  $Y_t = \lambda_1 + \lambda_2 X_t + u_{1t}, n=21$ . -----

(1)

The post liberalization period: 1991-92 to 2011-12,  $Y_t = \alpha_1 + \alpha_2 X_t + u_{2t}, n=21$ -----

--- (2)

The whole period: 1970-71 to 2011-12,  $Y_t = \gamma_1 + \gamma_2 X_t + u_t, n = (n_1 + n_2) = 42$  -----

(3)

Regression (3) assumes that there is no difference between the two time periods and therefore estimate the relationship between export of pepper and time for the entire time period. This assumes that there is no structural change.

That is,

$$\alpha_1 = \lambda_1 = \gamma_1 \text{ and } \alpha_2 = \lambda_2 = \gamma_2.$$

The regression (1) and (2) assume that regressions in two time periods are different: that is the intercept and the slope coefficients are different.

The empirical counterparts of the preceding three regressions are as follows.

**The whole period:**

|              | Coefficients | Standard Error | t Stat   | P-value  |
|--------------|--------------|----------------|----------|----------|
| Intercept    | 10.12981     | 0.098692693    | 102.6399 | 4.51E-50 |
| X Variable 1 | 0.001711522  | 0.003998683    | 0.428021 | 0.670931 |

The pre liberalization period:

|              | Coefficients | Standard Error | t Stat   | P-value  |
|--------------|--------------|----------------|----------|----------|
| Intercept    | 9.824725     | 0.0914         | 107.4914 | 6.35E-28 |
| X Variable 1 | 0.029993     | 0.007279       | 4.120463 | 0.000582 |

The post liberalization period:

|              | Coefficients | Standard Error | t Stat   | P-value  |
|--------------|--------------|----------------|----------|----------|
| Intercept    | 10.91861     | 0.388227       | 28.12429 | 6.01E-17 |
| X Variable 1 | -0.02313     | 0.011921       | -1.94004 | 0.067365 |

**Chow test:**

Let  $S_C$  be the sum of squared residuals from the combined data,  $S_1$  be the sum of squared residuals from the first group, and  $S_2$  be the sum of squared residuals from the second group.  $N_1$  and  $N_2$  are the number of observations in each group and  $k$  is the total number of parameters (in this case, 2). Then the Chow test statistic is

$$\frac{(S_C - (S_1 + S_2)) / (k)}{(S_1 + S_2) / (N_1 + N_2 - 2k)}$$

The test statistic follows the F distribution with  $k$  and  $N_1 + N_2 - 2k$  degrees of freedom.

**The test results are as follows:**

The F statistic calculated value is 7.26880 which is very high than the table value at 5% and 1% level of significance. We can reject the null hypothesis and clearly show that there is structural break between the two time periods.

**Interpretation:**

India was one of the founding members of International Pepper Community (IPC) in 1972. India had a leading role when a subcommittee on spices and condiments was formed in the early 1960s at the International Organisation for Standardization (ISO). In 1986 the Spices Board of India was established to provide coordinated support to the development and promotion of India's spice exports and to regulate these exports, including through quality control and licensing. A year later, the All India Spices Exporters Forum was formed as an industry association to liaise with the Spices Board and other governmental departments and agencies; to address emerging issues facing spice companies; and to disseminate technical, regulatory, and other information to its members.

By 1991, there was growing awareness that the inward-looking import substitution and overvalued exchange rate policy coupled with various domestic policies pursued during the past four decades, was out of line with new world economic order. Hence the new economic policy of 1991 stressed both external sector reforms in the exchange rate, trade and foreign investment policies, and internal reforms in areas such as industrial policy, price and distribution controls, and fiscal restructuring in the financial and public sectors. In addition, India's membership and commitment to World Trade Organization (WTO) in 1995 was a clear sign of India's intention to take advantage of globalization and face the challenge of accelerating its economic growth. Ahluwalia (1996) explains that for economic growth around 5% indirectly requires an improvement in agricultural growth from between 2 and 3 per cent in the past to about 4 per cent per year. Although initially, with respect to agriculture, there was no major policy reform package in the 1990s, it was however anticipated that the opening up of the agricultural sector to foreign trade, the move to a market determined exchange rate and reduction of protection for industry would, over time, benefit the agricultural sector. Manmohan Singh (1995), the then Finance Minister, in his inaugural address at the 54th Annual Conference of the Indian Society of Agricultural Economics, brought to notice that a policy of heavy protection of the industrial sector operated to disadvantage of the agricultural sector when industrial prices were raised relative to world prices and thus the profitability of investing in industry was raised relative to agriculture. This would lead to a shift of resources from agriculture to industry. A policy of heavy industrial protection also led to an appreciation of the exchange rate. Ahluwalia (1996) noted that over-valuation of the exchange rate (before the Indian rupee was devalued by 18 per cent in two phases starting in July 1991) discouraged agricultural exports more than industrial exports because Indian industrial policy had sought to offset the constraints faced by industries via a system of export incentives for market support. Agricultural exports on the other hand were denied any such incentives as they did not use imported inputs. Ahluwalia (1996) argued that in the past, the agricultural sector was negatively protected because of the above two

reasons and the fact that farmers were denied access to the world markets due to trade barriers.

### **Conclusion:**

Exports of plantation crops and a few commercial crops were free from export restriction but exports of essential commodities, particularly food products, were subject to bans, quotas and other restrictions. Interestingly, Kruger and others (1991) showed that while many developed countries continue to protect agriculture, developing countries do not do so. In this context, the situation of pepper has been affected and the analysis shows that there is a negative growth in the post liberalization period. In other words, the economic reforms have brought in a major setback in pepper export for two decades prior to the reform the growth rate was 2.99 per annum but after two decades in the post reform period we find a negative growth rate which is -2.313.

The distinguishing features of the Indian spice scene are too well known. These are on the positive side, high volume of production, huge domestic demand that consumes 92% of the production and variety. In that context, Indian Spice industry is less vulnerable compared to those economies with poor domestic demand and therefore a larger reliance on international market. Fairly high cost of production, slow pace of growth of value addition in export, disproportionate dependence on certain items and markets for export are the main negative factors.

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