Original Research Article

A Analysis Using AnAnnual dan Compounded Growth Rate Model on Export-Import Performance of Patchouli Oil in India

Abstract

Introduction….

The objectives of study is an attempt to examinethe annual and compound growth ratesin the export and import of patchouli oil.

The methodologies….. mentioned the research design, sampling design, instruments, types of analysis…The time series data collected through Department of Commerce, Ministry of Commerce and Industry, Government of India for a period of 2001-22 and was analyzed by using growth modeli.e., annual, compound growth rate and instability.

The findings of study….Results revealed that compound growth rates (CGRs) of export and import both are statistically significant at 1% probability level. The CGRs of quantity export and value export has 14.26% and 15.47% respectively and in case of import CGRs of quantity import is 22.15% per annum and CGRs of imported value is high i.e.,38.28% per annum.

The practical and theoretical implications of study…It is found that the import of patchouli oil is much higher than the quantity exported.

The contributions of study….The significant import of Patchouli oil was observed from countries Indonesia, Singapore, Spain and Switzerland.

Key words: *Patchouli Oil,Export& Import, Compounded Growth Rates, Cuddy-Della Valle Index*

1.0 Introduction

A Patchouli is a perennial, erect, branched aromatic herb with fragrant leaves grown in tropical and subtropical regions with warm and humid climate condition. It is cultivated under the moderately heavy rainfall (150-300 cm per annum) and it requires deep, well-drained, fertile partially acidic loamy soil, rich in organic matter which makes the loose friable texture. The pH

value of soil should have 5.5 to 7.5 for better growth and creeping well in coastal region having 80-90% relative humidity with temperature 20-35 ^{0}C.(Anonymous, 2011a).

It is cultivated mainly for its essential oil which extracted by steam distillation from the tender parts of the dried leaves and stems using a small amount of oil, with an oil content of 2.5-3.5%(Vijyakumar, 2004).Patchouli oil is deep orange to amber in color and has an exotic, heavy, earthy aroma. The aroma of patchouli oil is usually described as a blend of earthy, woody, sweet, and musky notes. The aroma of pure patchouli oil is quite strong, slightly sweet and spicy. Patchouli essential oil is therefore a key ingredient in many luxury fragrance products such as perfumes, soaps and cosmetics. It has also used as a fixative to give stability to perfume blends.It grows naturally inseveral parts of the worldin Singapore, Malaysia, and Indonesia.Patchouli was acquainted with India during 1941 in Madhya Pradesh, Tamil Nadu, Kerala and Karnataka.In India, patchouli is grown commercially in the coastal regions of South India, West Bengal, Assam, Karnataka, Madhya Pradesh and Gujarat(Kumar *et al.* 1986).

About 800 tonnes of patchouli oil are produced annually throughout the world, with Java producing the majority of that amount, followed by China and Malaysia. India's harvest has been small, but in the previous five years it has averaged 600 mh, producing 20 tonnes of oil annually(Anonymous, 2011b) and the annual demand borders around 220 tonne (Vijyakumar, 2004). India now produces relatively merger patchouli oil; as a result, each year it imports about 20 tonnes of pure patchouli oil and 100 tonnes of compounded oils (Anonymous, 2011a).Since, increase the demand of patchouli oil on both domestic and international markets, there is a significant opportunity to enhance production by expanding the patchouli crop area.It is also necessary to increase cultivation to reduce its import from other countries.

2.0. Research Objectives, Questions and Literature Review

2.1. Research Objectives

There are several of research objectives such as:

2.2. Research Questions

There are several of research questions such as:

2.3. Literature Review

There are some literature reviews on this such study…

3.0. Methods and Materials:

The present study has analyzed the trade of patchouli oil (exports and imports) over the past decade (2001-2022). The secondary data on quantity (thousand kg) and value (Rs. Lakh) are collected from Ministry of Commerce, Ministry of Commerce and Industry, Government of India and related data is available on other websites were also included in the study. To determine the exponential and linear annual growth as well as the log-linear model used to determine the volatility of exports and imports in terms of quantity and value. For coefficients of variation, the Cuddy-Della Vella index has been used.

3.1. Annual Growth Rate Analysis

The annual trend or performance of export and import (quantity and value) was find-out with the help of following formula:

$$\mathbf{AGR= [(EV/ BV)-1]*100}$$

Where:

AGR= Annual Growth Rate

EV= Ending value of export and import for the year t

BV= Beginning value of export and import for the year t

*100= Percent growth rate

3.2. Compound Growth Rate Analysis

For computing compound growth rate of export and import of patchouli oil in India, the exponential function of the following form was used.

$$Y = ab^t e^{ut} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where,

Y = export and import (quantity and value),

a = Intercept,

b = Regression coefficient ('a' and 'b' are the parameters to be estimated)

ut = Disturbance term in year't'

The equation (1) was transformed into log linear form and written as;

$$\log Y = \log a + t \log b + Ut \quad \ldots\ldots\ldots\ldots (2)$$

Equation (2) was estimated by using Ordinary Least Squares (OLS) technique.

Compound Growth Rate (g) was then computed

$$g = (b - 1)*100 \quad \text{……..(3)}$$

Where,

g: Compound growth rate in percent perannum

b: Antilog of log b

The standard error of the growth rate was estimated and tested for its significance with‘t’ statistic.

3.3. AInstability Analysis

The coefficient of variation was used as measure to study the variability in export and import of patchouli oil. The coefficient of variation or index of instability was computed by using the following formula:

$$\mathbf{C.V.} = \frac{\boldsymbol{\sigma}}{\mu} \times \mathbf{100}$$

The level of instability is also computed around the trend i.e., coefficient of variation is multiplied by the square root of the difference between the unity and coefficient of multiple determinants (R^2) in cases where R^2 was significant to obtain the instability index. The following formula has suggested by J.D.A. Cuddy and P.A. Della Valle in (1978) is called the Cuddy-Della Valle index.

$$\textbf{Cuddy} - \textbf{Dell Valle Instability index}\ (\%) = \mathbf{C.V.} \times \sqrt{\mathbf{1} - \mathbf{R^2}}$$

Where,

C.V = Coefficient of Variation in per cent,

R^2= Coefficient of determination from a time trend regression adjusted for its degrees of freedom.

4.0. Result and Discussions:

A. Growth performance of patchouli oil export and import from India:

4.1.A. Export Performance of patchouli oil:

In terms of developmental economics, export growth is an essential contributor to economic growth. However, this contribution depends on the stability of exports earnings. For the years 2000-01 to 2021-22, the quantity and value of patchouli oil exports from India were estimated and presented in Table1, Figure 1 and Figure 2.The export quantity of patchouli oil export has been increased from 1.91 thousand Kg in 2001-02 to 17.91 thousand kg in 2021-22. Moreover, India earns the foreign exchange from patchouli oil export increased by 125.58 lakh to 788.98 lakh it may due to growing demand for patchouli is stimulated by its major uses in cosmetics, shops and other herbal products.

The quantity exported of patchoulioil have been found to be highest (104.05 thousand kg) in 2012-13, whereas value was found to be highest (Rs. 3,648.90 lakh) in the same year. It is also revealed that the maximum and positive to negative annual growth rate of the export of patchouli oil. The highest percentage increase in annual growth rate has been observed 1,622.98 percent in quantity and 1,383.60 percent increase in value during the year 2011-12.

The compound growth rate of quantity exported has been estimated as 14.26 percent found satisfactory and statistically significant at 1.00 per cent level of probability, while the compound growth rate in term of value of patchouli oil exported has been recorded as 15.47 percent statistically significant at 1.00 ($p<0.01$).

The data also revealed that between 2001-02 to 2021-22, India exported both quantity and value of patchouli oil. The calculated mean, standard deviation and instability index or coefficient of variation is presented in Table1. According to data coefficient of variation of both quantity and value exported has been recorded as 175.15 per cent and 159.58 per cent respectively. It is also concluded from Table1, that patchouli oil export from India seems instable from last decade except some augmentation in quantity and value in one or two years, this is due to the increase in internal consumption or price fluctuations in oil price.

4.1.B. Import Performance of patchouli oil:

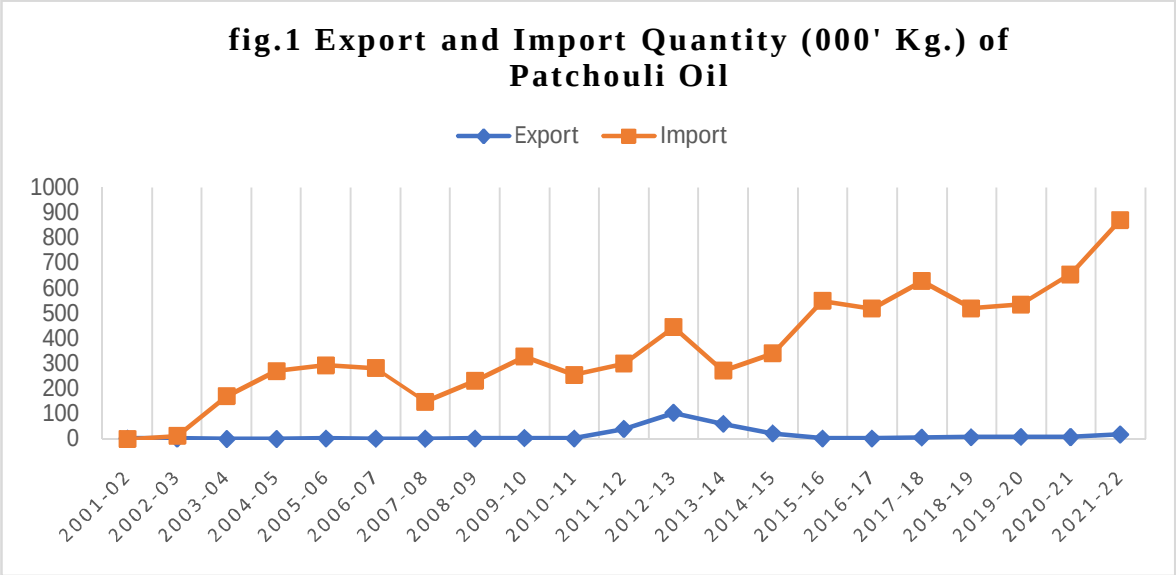
The growth of import of patchouli oil to India both in the quantity and value for the period of 2001-02 to 2021-22 were estimated and showed in Table 1. It could be seen that the quantity of import in 2001-02was 0.10 thousand kg and it reached the higher level of 872.53 thousand kg in 2021-22. Import quantity was found to be the highest growth 12,650.00 percent in the year 2002-

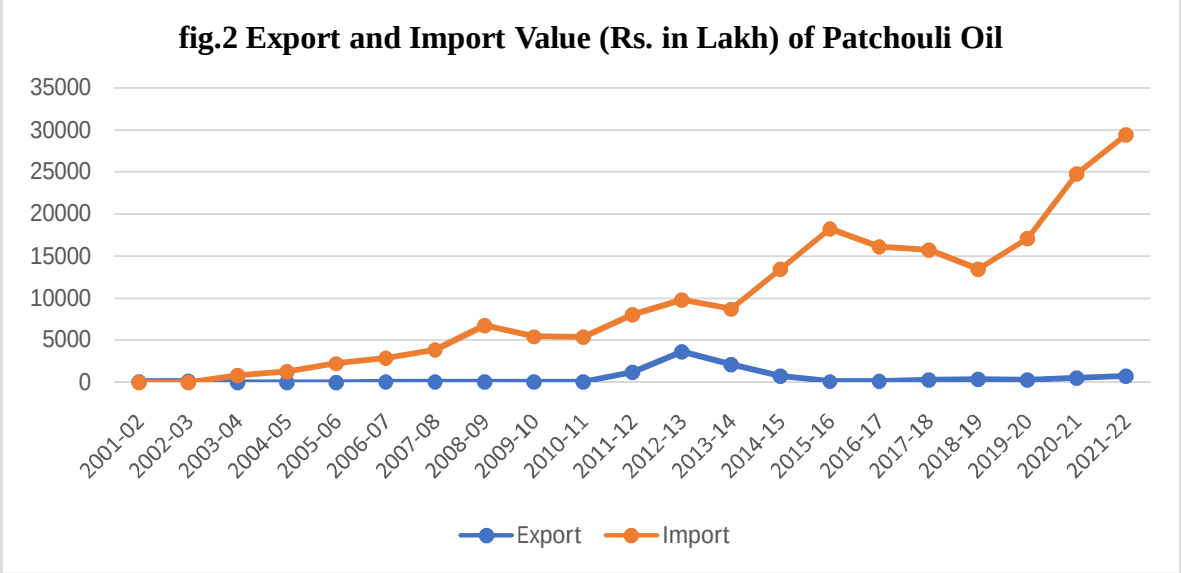
03. The quantity of import has statistically significant growth rate of 22.15 per cent per annum at 1 per cent probability level, while the value of exports has a high and significant growth rate of 38.28 per cent per annum. The instability in patchouli oil import quantity and value from India has been recorded 58.00 percent and 83.37 percent respectively.

Table1: Annual, Compound Growth Rates and Instability of the Quantity and Value of Patchouli Oil During 2001-02 to 2021-22:

Year	Export				Import			
	Quantity ('000' kg.)	AGR	Value (Rs. Lakh)	AGR	Quantity ('000' kg.)	AGR	Value (Rs. Lakh)	AGR
2001-02	1.91	0.00	125.58	0.00	0.10	0.00	0.18	0.00
2002-03	1.97	3.14	179.15	42.66	12.75	12650.00	36.70	20288.89
2003-04	0.45	-77.16	10.22	-94.30	170.05	1233.73	822.11	2140.08
2004-05	0.57	26.67	25.76	152.05	271.63	59.74	1271.89	54.71
2005-06	1.77	210.53	42.1	63.43	294.54	8.43	2255.97	77.37
2006-07	1.64	-7.34	53.86	27.93	283.35	-3.80	2883.65	27.82
2007-08	1.55	-5.49	75.9	40.92	148.98	-47.42	3856.63	33.74
2008-09	2.02	30.32	121.25	59.75	232.83	56.28	6785.08	75.93
2009-10	4.08	101.98	68.85	-43.22	329.38	41.47	5449.58	-19.68
2010-11	2.35	-42.40	83.05	20.62	256.32	-22.18	5413.07	-0.67
2011-12	40.49	1622.98	1232.13	1383.60	300.94	17.41	8084.31	49.35
2012-13	104.05	156.98	3648.9	196.15	446.35	48.32	9809.57	21.34
2013-14	60.65	-41.71	2104.05	-42.34	272.95	-38.85	8720.92	-11.10
2014-15	22.46	-62.97	784.58	-62.71	340.75	24.84	13464.4	54.39
2015-16	1.82	-91.90	126.11	-83.93	550.44	61.54	18255.6	35.58
2016-17	2.36	29.67	140.72	11.59	519.97	-5.54	16124.6	-11.67
2017-18	6.13	159.75	341.79	142.89	629.39	21.04	15744.9	-2.35
2018-19	7.15	16.64	384.82	12.59	520.35	-17.32	13466.8	-14.47
2019-20	8.64	20.84	344.11	-10.58	536.7	3.14	17095.2	26.94
2020-21	7.98	-7.64	525.70	52.77	655.63	22.16	24835.44	45.28
2021-22	17.91	124.44	788.98	50.08	872.53	33.08	29451.89	18.59
CGR's (% p.a.)	**14.26**	**-**	**15.47**	**-**	**22.15**	**-**	**38.28**	**-**
Instability index (%)	**175.15**	**-**	**159.58**	**-**	**58.00**	**-**	**83.37**	**-**

Source: Ministry of Commerce and Industry, GOI.(Various years)





B. Growth and variation of patchouli oil exported and imported from major countries:

4.2.B. Major export destination

Among the top four patchouli oil importers, USA has largest importer of patchouli oil with a share of 27.58 % quantity and 26.71 % value followed by Singapore having 17.03% share in quantity and 15.10% share in value and other major importing countries mentioned in Table 2. Here,it has been revealed that the export of patchouli oil from India has been unstable during the previous twelve years (2010–11 to 2021-22) utilizing the coefficient of variance and the Cuddy–Dell–Valle Index. The results are showed in Table 2. The instability of export earnings is defined as the short-term variation of the earnings from the trend value over a given period. Export instability may be influenced by a variety of factors, including price unpredictability, commodity

concentration, regional export market concentration, bilateral and multilateral trade agreements, currency rate variations, and others.

The results show that the most volatile markets for the import of Indian patchouli oil are USA and Singapore. To analyzed the country wise growth performance in quantity and value of patchouli oil, it is observed that in four importing countries; France has accounted the highest growth rates (14.49%) followed by USA (-2.74%), Switzerland (-16.54%) and Singapore (-31.40%) respectively per annum and instability over the year Singapore has highest variation (160.48%), followed by USA (122.67%), France (81.68%) and Switzerland (71.96%) respectively. The performance of earning of foreign exchange from patchouli oil export from India in positive to negative growth rates has analyzed for major countries i.e.,France (21.89%) followed by USA (9.13%), Switzerland (-8.49%) and Singapore (-19.91%)respectively. In the same progression the variation of top four destinations is also exceeded are given in Table2.

Table 2: Export Volume and Foreign Earnings of Patchouli Oil From Major Importing Countries (2010-11 to 2021-22)

Country	Export quantity (In '000' kg.)	CAGR (% p.a.)	Instability (%)	Foreign earnings (Rs. lakh)	CAGR (% p.a.)	Instability (%)
USA	77.77 (27.58)	-2.74	122.67	2809.02 (26.71)	9.13	118.37
Singapore	48.03 (17.03)	-31.40	160.48	1587.73 (15.10)	-19.91	153.47
Switzerland	43.58 (15.45)	-16.54	71.96	1529.02 (15.54)	-8.49	234.00
France	15.63 (5.54)	14.49	81.68	861.38 (8.19)	21.89	80.99
Other	97.30 (34.50)	-4.33	125.61	3727.79 (35.45)	-0.83	120.18
Total	**281.99 (100.00)**	-8.06	126.38	**10514.94 (100.00)**	-3.49	114.13

Source: Ministry of Commerce and Industry, GOI (various years).

4.2.B. Major Import Countries:

The Table3 revealed that the growth and variation of patchouli oil imported in quantity for the period during 2010-11 to 2021-22 in India. Over this period the major imports of patchouli oil have been found highest from Indonesia (81.90%) followed by Singapore (15.77%), Switzerland (1.50%) and Spain (1.28%). In the same progressionthe value imported of top four destinations are also exceeded are given in Table3.The country wise growth performance in quantity of patchouli oil, it is observed that top four exporting countries; Singapore, Indonesia,Switzerland and Spain have accounted the highest growth rates i.e., 12.27%, 9.76%, -12.39%and -16.17% respectively per annum. The result isalso given in Table3 that showed the variation of patchouli oil imports has analyzed the highest variation, Spain (99.89%) followed by Switzerland (85.91%), Singapore (38.54%) and Indonesia (27.21 percent).

The data presented in Table3also reveals that the growth and variation in value of patchouli oil import from India for the period of 2010-11 to 2021-22. The value of patchouli oil import of growth has maximum of Singapore with 27.46% followed by the Indonesia (13.42%), Switzerland (8.21%) and Spain (-0.18%) respectively. The variation of patchouli oil value imported has been highest recorded forSpain (121.15%) followed by (57.52%), Singapore (48.52%) and Indonesia (47.80%) respectively. The overall imported patchouli oil from India in both quantity and value has been recorded the growth and variation i.e. (9.82 % and 13.08%) and (25.63% and 44.33%) respectively.

Table 3: Import Volume and Foreign Earnings of Patchouli Oil FromMajor ExportingCountries (2010-11 to 2021-22)

Country	Import quantity (In '000' kg.)	CAGR (% p.a.)	Instability (%)	Foreign earnings (Rs. lakh)	CAGR (% p.a.)	Instability (%)
Indonesia	8875.42 (81.90)	9.76	27.21	284029.90 (84.10)	13.42	47.50
Singapore	1708.58 (15.77)	12.27	38.54	43022.58 (12.74)	27.46	48.92
Spain	138.27 (1.28)	-16.17	99.89	2783.08 (0.82)	-0.18	121.15
Switzerland	162.15 ()1.50	-12.39	85.91	2846.64 (0.84)	8.21	57.52
Other	249.49 (2.30)	27.95	59.91	58693.19 (17.38)	32.63	293.79
Total	**10836.48 (100.00)**	9.82	25.63	**337719.80 (100.00)**	13.08	44.33

Source: Ministry of Commerce and Industry, GOI (various years)

5.0. Conclusions:

The study revealed that the export and import of patchouli oil increased from 2001-02 to 2021-22, as well as a significant growth in quantity and value. The compound growth rates of export in both case of quantity (14.26 percent) and value (15.47 percent) and for import compound growth rate has found in both quantity (22.15 percent) and value (38.28 per cent) respectively. Instability analysis showed that the more variation in growth followed by quantity and value of exported of patchouli oil and more variation in value followed by quantity in case of imported of patchouli oil from India. Among the major four countries exported the patchouli oil from India more contributed by of USA followed by Singapore, Switzerland and France and in case of import of patchouli oil in India, the highest contribution of Indonesia followed by Singapore, Switzerland and Spain. Patchouli oil consumption has been gradually emergent both domestic and globally, opened up a number of opportunities for foreign currency earnings and the development of India's fragrance industry. To increase the area under patchouli cultivation significantly increases employment opportunities for rural inhabitants, particularly agricultural labors. It also provides greater options for year-round farm income, crop diversification, and techniques for exploiting marginal land. Systematic cultivation also reduces the dependency from import. (Please re-write)

6.0. Recommendations

6.1. Recommendations to the study

6.2. Recommendations to the future researchers.

References

Anonymous (2011a). Patchouli - Booklet No. 494. Medicinal Plants: MPS-21 Available at: www.inseda.org/Additional%20 material/CD%20.../Patchouli-494.doc. Accessed 02 May,2011.

Anonymous (2011b). Essential oil directory:Patchouli Essential oil. Available at: http://www.auracacia.com/auracacia/ aclearn/eo_patchouli.html. Accessed 8 July, 2012.

Cuddy, J.D.A. and Della Valle, P.A. (1978). Measuring the instability of time series data. Oxford Bulletin Econ. Stat., 40(10): 79-84.

Choudhri, HPS., Verma, D.K., Bhise, R.N., Sharma, R.S., Srivastva, R.K. and Kumar, S. (2022). Export performance of Palmarosa oil in India: A Growth and Instability Analysis, Economic Affairs, 67(02):43-48.

Farooqui, A. A,M. Vasundhara, and K. N. Srinivasappa(2001). A Guide to the Cultivation of Commercially Important Aromatic Crops, Division of Horticulture, University of Agricultural Sciences, Bangalore and Association for Promotion of Medicinal and Aromatic crops, Bangalore.

Kumar, A., A. K. Gauniyal, and O. P. Virmani. (1986). Cultivation of Pogostemoncablin for its oil. Current research on medicinal and aromatic plants, 8: 79-86.

Vijay Kumar, K. (2004). Patchouli and India- A great leap forward. In:National Seminar of Prospectus and Potentials of Medicinal and Aromatic Crops, held at Bangalore, 18-19 June 2004, 106-107.

Sarwar, M., M.R.Narayana, and O.P. Virmani. (1983). Patchouli and its cultivation in India. Central Institute of Medicinal and Aromatic Plants. Farm Bulletin, 17: 13.

Ministry of Commerce and Industry, GOI (missing)