

Macro Factor Analysis of Scientific Instruments Export Industries in Ambala Cluster of India

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ABSTRACT

Micro Small and Medium Enterprises (MSMEs) is major industrial base of Indian economy and provide vibrant growth to all the industrial sectors with dynamic production and exports. This sector is emerged as focused area in industry from last five decades in India. MSMEs has provided largest employment opportunity in the country after the agricultural sector, thus MSME contributes in to the economic development of the nation. MSMEs have contributed a lot in terms of 33% of the manufacturing output, 6% of the country's GDP, and almost 45% of the exports. Scientific instruments industry is a vital industry for the country. Further, Indian scientific instruments industry also provides technical and industrial inputs for the manufacturing sector as providing inputs or raw material. It also provides help to the economy in earning foreign exchange. This study covers the Ambala cluster of scientific instrument export industry and this cluster has its existence before independence. The historical background of Ambala scientific instruments export industry shows that it is based on pre independence time 100 years back. Ambala scientific instruments cluster has more than 3,000 units of various types are engaged in exports. This cluster of scientific instruments export industry is based on approx Rs. 1,700 crore using conventional and innovative production methods. More than 30,000 employees are directly employed in this industry in Ambala. The Ambala cluster is believed to be the largest in the country for manufacturing scientific instruments and apparatus. Total 150 export firms are studied and multiple regression model is used to evaluate the export performance based on macro factors. The export performance of a firm is significantly depends on the real its exchange rate of host country as compare to the other trading countries in foreign market. The gross domestic product of a country also affects the performance of exports of all the firms. Exports of a firm are also affected by domestic inflation of that country. There is perspective view that foreign direct investment (FDI) promotes exports of host country through various environment issues of investment and capital.

Keywords: Export Performance, Scientific instruments, Foreign Direct Investment, Cluster, Real Exchange Rate.

INTRODUCTION

Foreign market tends to be the threats and opportunities for the firm which affects the performance of exports. Export activities are more complicated because a firm significantly operates outside the domestic market of the country. A firm's decision on exports may depend on the environment of domestic and foreign market. The export performance of a firm

significantly depends on the real its exchange rate of host country as compare to the other trading countries in foreign market. The gross domestic product of a country also affects the performance of exports of all the firms. Exports of a firm are also affected by domestic inflation of that country. There is perspective view that foreign direct investment (FDI) promotes exports of host country through various environment issues of investment and capital.

A number of economists are in favour of Export-led growth strategies in Asian countries to promote development. Export-led growth sometimes called Export oriented industrialization or Export substitution industrialization is with a target to open domestic market for foreign competition. The growth rate of exports of a nation is depended on its size, expansion, nature and volume. Indian economy is famous for high demand and expansion of trades with new openings. Furthermore, exports can provide foreign exchange that will help in Indian economy and formation of capital for the investment in various sectors.

The condition of scientific instruments industry in Ambala is not healthy because a historical industrial base lacks proper care from the government and other related stakeholders. These industries provide inputs to the education and science industry for the growth of science products and know how. The growth of this industry will provide an incentive to the instrumentation in the country and expand science base. Lack of quality and improved instruments is a set back to the progress of other industries in the country. Most of the scientific instruments industry provides inputs to the other industry as machines and instrumentation.

This study covers the Ambala cluster of scientific instrument export industry and this cluster has its existence before independence. The historical background of Ambala scientific instruments export industry shows that it is based on pre independence time 100 years back. The history of this cluster is traced with the units, the Scientific Apparatus unit was set up in 1857 and Oriental Scientific Workshop was started in 1919 are still in existence. Ambala scientific instruments cluster has more than 3,000 units of various types are engaged in exports. This cluster of scientific instruments export industry is based on approx Rs. 1,700 crore using conventional and innovative production methods. More than 30,000 employees are directly employed in this industry in Ambala.

The Ambala cluster is believed to be the largest in the country for manufacturing scientific instruments and apparatus. The manufactured products are used in engineering industry and educational institutions. Ambala cluster has its own local market, where big and small firms deal in all type of products. The cluster exports scientific instruments and apparatus to the Gulf

nations, European countries and the neighbours like Sri Lanka, Pakistan and Bangladesh. The cluster is inspired with the innovations and match with international standards. Most of the export units expanded their product portfolio with the help of automation and added new dimension to their products. Ambala Scientific Instrument Manufactures Association (ASIMA) is a registered organisation established under Societies Act 1860 in the year 1972. This paper is an attempt to evaluate the export performance and its determinants in relation to the export volume. The frameworks, which develop in this study, will help the industry to evaluate the export performance.

LITERATURE REVIEW

Export performance of a firm is an outcome of international sale and it is affected by a numerous variables. The conceptual definition of export performance is defined in three dimensions sale, profit and change Madsen (1987), these dimensions can be divided in to objective and subjective measures.

Mewani Rekha and Sitlani Manish (2017) in their paper titled “Export Performance and Trends of Automobile Industry in India” studied the export performance of various segment of automobile products. The forecast trend values showed that the exports in the all the segments viz, personal vehicles, commercial vehicles, two wheelers and three wheelers will increased in future. According to trend line the passenger vehicles growth will be 7.41 percent, 6.45 percent and 6.06 percent in the next three financial years. Bhavani. T. and Kamalavall. A. L (2018) in their study titled "Export Performance of Indian Spice Products” identified that exports of Indian spices have been is increased with record gains in value and growth. In last five years of the study export of spices products has increased with substantial growth. Overall export of Ginger, Saffron, Turmeric, and Curry leaves from India during showed a positive growth over the review period.

Rajan A. Reshmi (2018) analysed in the study titled “An Investigative Study on Export Performance of Gems and Jewelry in India” that India is acting as a prominent country related to diamond polishing and jewelry work due to traditional, customs and cultural background of the society. But India is facing a stiff competition from countries like China, Thailand and Sri Lanka. As per the study found that, there is a continuous increase in the export of Gems and Jewelry in India.

Uysal Ozgur and Mohamoud Said Abdulakadir (2018) analysed the selected variables which affect the export performance of six East Africa countries. The researcher used panel regression

analysis on all the selected variables labour resources, Foreign Direct Investment and exchange rate variables have significant positive effect on export performance. The GDP of East Africa countries do not affect the export value and inflation rate have negative impact on export values. It is identified that infrastructure facilities are not good for export in selected East Africa countries, government need to improve the transportation, energy, water and gas facilities.

Gamariel Gladys and Seedwell Hove (2019) analysed the direct impact of Foreign Direct Investment (FDI) on export competitiveness in Sub-Saharan Africa, with influencing variables. The results of the study shows that with the increase of FDI flow export competitiveness is improved by getting high trade income from that product. Increase in demand of exports also have positive significant effect on export competitiveness and also enhance the productivity of the nation. The innovation and technology are also related competitive factors. The analysis of the variables shows FDI and export competitiveness have significant relationship and positively correlated in growth of the host country.

Sarah S. Ebadzadeh Semnani, Hossein Dadfar and Staffan Brege (2015), evaluated the Role of Export Clusters in Export Performance of SMEs: The Case of Iranian Energy Industry. The results confirmed that all three export clusters managed to successfully identify their members' needs and undertook certain measures within their own authority and control, to mitigate these risks. Moreover, the secondary data showed positive growth rate of export level after the establishment of these export clusters. Interestingly, the strong suits of all three export clusters were mainly related to communication and relationship aspects.

Shivangi Singh , Pawan Kumar Chugan (2014) empirically analyze the Clustering on Export Performance of the Constituent Units: A Study of Brassware Manufacturing Firms in Jamnagar. The results of this study let us to draw some interesting conclusions. Primarily, it has been found that clustering has emerged as a significant determinant in explaining the firm-level export performance, with linkages and knowledge sharing within the clusters as the most important attributes enhancing the firm's export performance.

It is derived from the above literature that the export performance of a firm is significantly depends on the real its exchange rate of host country as compare to the other trading countries in foreign market. The gross domestic product of a country also affects the performance of exports of all the firms. Exports of a firm are also affected by domestic inflation of that country. There is perspective view that foreign direct investment (FDI) promotes exports of host country through various environment issues of investment and capital.

OBJECTIVES OF THE STUDY

The most important part of this study is to evaluate the effect of composite factors on export performance level of selected scientific instruments export industries in Ambala cluster. The paper has identified and achieves the following objectives.

- To study the macro factors of export performance of selected firms in Ambala cluster of India.
- To evaluate the impact of macro factors on export performance of selected firms in Ambala cluster of India

RESEARCH METHODOLOGY

The research questions of the study have been set to find out the major factors of export performance in selected 150 scientific export industries from Ambala cluster, and the researcher use a research design on the basis of literature available. The correlation between export performance and various indicators is studied on the basis of determinants in developing countries. Secondary data is used to evaluate the relationship of export performance of selected industries. The export performance of selected scientific instruments export industries is dependent on other four independent variables i.e. gross domestic product, real effective exchange rate, inflation rate and foreign direct investment. The above-discussed literature, suggested that these variables are the most important for measuring the impact on the exports of the selected firms. These major identified factors affect the export performance.

Macro factors of export performance

This paper has studied specifically macro factors effects the export performance of selected scientific instruments export industries in Ambala cluster of India.

Gross Domestic Product (GDP)

Exports and economic growth have become a very interesting area of research and received great interest of the researchers over the years. The growth of a country is sustained through international trade. The performance of exports of a firm escalates the income of the inputs used in the production and it increases the demand of the factors of production. The higher demand of the factors in export goods exceeds the exports and also spill over the entire economy. Lin and Li (2001) examined the role of GDP in export performance; it is observed

that one percent increase in GDP leads to increase ten percent exports of China. Arnold and Hussinger (2005) analysed the impact of productivity on export and it facilitate that productivity is an important factor of exports and export is not a stimulating variable to promote productivity.

Heriques and Sadorsky (1996) studied that GDP of Canada and its exports are interdependent. The results showed that change in GDP influence the change in exports. The empirical studies show that exports and the economic growth of a country are positively and significantly related to each other. P.K. Mishra (2011) analyzed the presence of a relationship between export growth and GDP. The study rejects the hypotheses of exports-led growth in favor of growth-led exports. Nidugala (2001) stated that export-led hypotheses held in the Indian context in the year 1980. The study proves that the growth of industrial products significantly affect the growth of income. The reviews of various empirical studies find the reasons of the relationship between GDP and export performance. Moreover, GDP is most influential factor of export performance. GDP is taken as one of the most important external factors of export performance of selected firms. The values of GDP at the current price of India are given as in Table 1.

Table 1: Gross Domestic Product at Current Prices of India during 2009-10 to 2020-21

GDP at Factor Cost, Base Year 2004-05 (2009-10 to 2011-12)

Gross Value Added at Basic Prices, Base year 2011-12(2012-13 to 2020-21)

GVA at Basic Prices base year 2011-12 2012-13 to 2020-21	GDP at factor cost base year 2004-05 2009-10 to 2011-12
Years	Gross Domestic Product at Current Prices (Amount in Crore)
2009-10	61089.03
2010-11	72488.60
2011-12	83916.91
2012-13	99440.13
2013-14	112335.22
2014-15	124679.59
2015-16	137718.74

2016-17	153623.86
2017-18	170950.05
2018-19	190101.64
2019-20	203510.13
2020-21	203510.13

Source: Reserve Bank of India Statistics Reports, RBI Bulletin.

Real Effective Exchange Rate

Real effective exchange rate (REER) is the relation of a country's currency with a basket of currencies in terms of weighted average. The exchange rate of currency is used to measure the value of a currency in relation to other currencies in international trade. Real effective exchange rate is defined as the effect of inflation rate on every currency of the basket, it has given a purchasing value against the currency in the REER is a value which describes the performance of a currency against other currencies and itself as performed in the previous period. REER is an effective tool to calculate the weighted average rate with values of currencies of other trading countries in terms of appreciated price. REER can be calculated by taking weighted average value of the real exchange rates (RER) as compare to the other trading countries, and then measure the weighted average by allocating trade value of each country with adjustment of inflation rate. The calculation of REER is complicated to some extent for anyone and it can be understood easily with an example as given below. Reserve Bank of India (RBI) usually take a currency basket of 36 countries to measure the real effective exchange rate (REER), here we are taking an example of only six trading countries of India. In this example, we use Indian rupee currency to calculate REER by using same method opt by RBI with six currencies of countries namely Germany, United States of America, United Arab Emirates, Hong Kong, Saudi Arabia and China The formula given by RBI for calculating REER as follows;

$$REER = \prod_{i=1}^n [(e/e_i)(P/P_i)]^{w_i}$$

Where,

n = total number of countries of the basket

i= 'i'th currency of the basket

e= exchange rate of the Indian rupee against the Special Drawing Rights (SDRs)

e_i = exchange rate of foreign currency 'i' against the Special Drawing Rights (SDRs) w_i = weight attached to the foreign currency 'i'

P_i = consumer price index of the country in foreign currency 'i'

P = India's consumer price index (CPI).

REER is nominally adjusted against the inflation rate in India. Weights given to the rate is depending on export value or total trade value during a period of time. India has adopted new exchange rate norms from 1993. Real effective exchange rate of India during 2009-10 to 2020-21 is given below in Table-2.

Table 2: Real effective exchange rate of India during 2009-10 to 2020-21

Base-2015-16=100

Years	Real Exchange Rate
2009-10	92.68
2010-11	100.53
2011-12	98.38
2012-13	94.19
2013-14	92.13
2014-15	97.21
2015-16	100.00
2016-17	101.80
2017-18	105.94
2018-19	100.63
2019-20	103.20
2020-21	103.46

Source: Reserve Bank of India Statistics Reports, RBI Bulletin.

The performance of exports of a country is highly dependent on its real effective exchange rate. Various research studies have shown that the export volume of a nation increases with the falls in export prices as compare to prices of in the world. Depreciation in currency of a country in relation to other currency like as dollar, then the exports of that country will be cheaper. Sharma (2001) evaluated the export prices and foreign demand of Indian products, it is identified that

with the fall in the export prices of Indian products its demand will increase in the foreign market. Babatunde (2009) analysed the export performance in Sub-Saharan Africa (SSA) in relation with real effective exchange rate. The panel regression result of the study shows that export performance of SSA is directly related to its real exchange rate. Mold and Prizzon (2008) studied the export performance of forty eight African countries using panel regression on different independent variables.

The results revealed that there is negative relationship between the export performance and real exchange rate, prices of exports, tax rates and fund diversifications. Menji (2010) analysed the export performance based on various determinants in Ethiopia using correlation analyses and revealed that export performance is having insignificant relationship with exchange rate and real effective exchange rate and foreign direct investment. Srinivasan (2003) found that Indian exports have direct relation with real exchange rate during the period of the study. Joshi and Little (1994) and Veeramani (2007), revealed that exports and real exchange rates are negatively related to each other. Lka Inayah, Rina Oktaviani, Heny K Daryanto (2015) highlighted that export performance of Indonesian pepper has negative relationship.

Inflation Rate

Constant increase in the Consumer Price Index (CPI) with weighted average prices of final goods and services is known as Inflation rate. A consumer price index is calculated as a proportionate change in the prices of goods and services during a specified time for a fixed quantity and characteristics and it is the amount paid by the consumers for acquiring quantity of goods and services. An inflation index is measured as weighted average of all the prices of goods and services. Indices of inflation are estimated by using prices of goods and services given by the residents of an area from the given market for the consumption with specific demand of goods and services. Index of set of goods and services is derived on the basis of prices given for the consumption of a basket. Inflation rate is an important tool of measuring the international trade capacity. In theoretical framework, it assumed that a lower price of products increases the purchasing power and spending on goods which increases the demands. Inflation rate during 2009-10 to 2020-21 is given in the table-3.

Table 3: Inflation rate in India during 2009-10 to 2020-21

From 2009-10 to 2011-12 Base: 2001=100 for new CPI

From 2012-13 to 2020-21 Base: 2012=100 for new CPI

Years	Inflation Rate (in Percentage)
2009-10	13.9
2010-11	10
2011-12	8.2
2012-13	9.9
2013-14	9.4
2014-15	5.9
2015-16	4.9
2016-17	4.5
2017-18	3.6
2018-19	3.4
2019-20	4.8
2020-21	5.13

Source: Data compiled from Reserve Bank of India Statistical Reports.

Export performance is directly related to inflation as certain properties of export performance could either trigger the inflationary tendencies or act as a deflationary or counter inflationary force. It is the net effect of these properties along with other more important factors like import price increases, increased money supply, budget deficits, inter alia, that determine levels of inflation in the country. With regard to inflation-induced factors on the export sector, export prices and earnings trigger price increases via exogenous mechanisms, while the wage increases of the plantation sector and devaluation in the export incentive package, transmit their influence through endogenous mechanisms.

The export prices transmit global inflation via prices in international markets (price effect) while export earnings fuel inflation by creating an excess demand in the economy through improved current balances (demand effect), augmenting the money income through increase of money supply (liquidity effect) and providing necessary purchasing power for the community for the realisation of other global linkages such as international inflationary expectations and demonstration effects. Atapattu (1982) further verify the statistical significance of export performance and general price level (domestic) by estimating the coefficient of determination between domestic price level and export earnings/prices. Macleod and Gurben (2004) evaluated a negative relationship between exports performance and inflation and also highlighted that countries having afloat exchange will have stronger

relationship. Friedman (1977) observed negative significant relationship between economic performance and inflation rate in an economy, there are two major reasons of this relationship firstly, volatility in price is due to the long term contracts which are expensive and future value of dollar is uncertain. Second reasons is increased prices of goods declines the efficiency of market for sharing information to the firms about the fluctuation of prices. Qayyum (2006) analysed the relationship of inflation rate and economic growth in Pakistan and find the negative relation in both. The flow of money through customers in the market affects the inflation and GDP of Pakistan. If the flow of money increases in Pakistan prices of goods has also increased.

Thus excessive flow of money in market has become the important factor of inflation in Pakistan. Gylfason (1997) used statistical techniques on data of 160 countries to study the relationship of export performance and other determinants including inflation rate. Further, Gylfason observed that high inflation rate has become the cause of low performance of exports. Dexter et al. (2005) have studied the USA economy in export performance prospects relation to the inflation.

It is identified that exports in USA have crucial relationship with inflation rate. Exports have significant impact on inflation rate and imports also have indirect relationship with international trade in USA. Khan et al. (2007) have evaluated the external factors of export performance in Pakistan and concluded that a number of variables are responsible for high prices in Pakistan like exchange rate, government loans, funding support, demand of product and investment. Inflation rate have negative relationship with export performance of Pakistan economy.

Foreign Direct Investment (FDI)

Foreign direct investment (FDI) occurs in a company when multinational companies create a venture of business and control the ownership of that in the host country. Foreign companies invest money in different business and carried out business operations in other countries. Investment of money by foreign in a country also brings know how, technology, and employment with them. FDI is a backbone of an economy and operations of a foreign company create healthy environment of competitiveness in local market. A business operation of that investing company also brings foreign assets including innovation for the development of host country.

In recent India has opened its economy for the FDI by abolishing number of restrictions in number of sectors. Now they don't need to take any prior approval of RBI in some conditions for investing in some important sectors in India. The flow of foreign direct investment in India from 2009-10 to 2020-21 is given in the table 4.

Table 4: Trend of Foreign Direct Investment (FDI) in India during 2009-10 to 2020-21

Years	FDI (in US \$ Million) in India
2009-10	37,745
2010-11	34,847
2011-12	46,556
2012-13	34,298
2013-14	36,046
2014-15	45,148
2015-16	55,559
2016-17	60,220
2017-18	60,974
2018-19	62,001
2019-20	74,391
2020-21	81,973

Source: Data Compiled from Foreign Direct Investment India, Annual Reports.

Exports of a firm are also affected by FDI mostly cost analysis based on the availability of skilled employees, raw material, basic infrastructure like physical, technology and financial and market demand. Amelia and Santos (2000) have discussed the impact of trade openness in forty eight developing countries and observed that export performance of selected countries is directly affected by FDI.

It is also identified that FDI has significant relationship with volumes of exports in developing countries. Blomstrom et al. (2000) analysed the role of FDI in the exports of China and they found that exports are directly and indirectly affected by FDI in China. Van Dijk (2002) also conducted the same study on Indonesia and found that Foreign Direct Investment had a influence on export performance in the country. Agasha (2007) observed that sometimes a

country invited foreign investment with an objective to create competition in the domestic market and improve its business environment, which may affect the exports of firms. Sarbapriya (2012) studied the relationship of Indian growth and FDI. Empirical results of the paper show that FDI in India have casual relationship with economic growth and estimation of effect has also been performed to measure the future implication.

CONCEPTUAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

Export performance of the selected scientific instruments export industries in Ambala cluster is linked with the independent variables as suggested in the literature. In order to test the extent of significant of the relationship and nature of the relationship between identified dependent and independent variables, a multiple regression model has been designed and tested. To measure the degree of relationship between variables multiple correlation is calculated and analysed. Multiple correlations is an useful statistical method to analyze the relation of dependent and independent determinants of export performance in the scientific instrument industries in Ambala. Four Hypotheses are set in this study to test the significant relationship between export performance and related variables. Four null hypotheses are developed for testing the significance of the relationship using a multiple regression model. The developed hypotheses are as follows;

- Null Hypotheses 1 (H01): There is no significant relationship between Gross Domestic Product and export performance of selected scientific instruments export industries in Ambala cluster.
- Null Hypotheses 2 (H02): There is no significant relationship between Real Effective Exchange Rate and export performance of selected scientific instruments export industries in Ambala cluster.
- Null Hypotheses 3 (H03): There is no significant relationship between Inflation Rate and export performance of selected scientific instruments export industries in Ambala cluster.
- Null Hypotheses 4 (H04): There is no significant relationship between Foreign Direct Investment and export performance of selected scientific instruments export industries in Ambala cluster.

Export performance is taken as a dependent variable in terms of export value of the selected scientific instruments export industries in the cluster during study period. Export value describes the status of the industry and other variables affect it positively and negatively.

Gross Domestic Product is taken as first independent variable. GDP is chosen at current price factor cost and for the period 2009-10 to 2011-12 base year is 2004-05, for period 2012-13 to 2020-21 base year is 2011-12. Based on the various studies it is assumed that GDP is positively significant in relation to the export performance of selected scientific instruments export industries in Ambala cluster.

Real Effective Exchange rate is the second independent variable on the basis of 36 country bilateral trade weights based on the base year 2004-05. REER has a positive significant affect on the export performance of selected scientific instruments export industries in Ambala cluster as suggested by various literatures available.

Inflation rate is taken as third independent variable in terms of percentage for period 2009-10 to 2011-12 base year is 2001, for period 2012-13 to 2020-21 base year is 2012. High inflation rate reduces the purchasing power in the market and leads to economic instability. Based on various studies it is expected that inflation rate have negative level of significant of relationship with export performance.

FDI is the fourth independent variable as value of in terms of in US \$ Million. FDI promotes competition in the local market with capital contribution, higher production in an economy leads to the higher income from the trade and it will help in generating revenues and employment. FDI will also promote opportunities for the new entrants in the business. It is analysed that FDI promotes growth in the exports of the host country as an impact of trade openness. In other words FDI has significant positive impact on the export performance of the host country.

Multiple Regression Equation Model

This study adopts multiple regression equation model technique to study the nature of relationship between identified dependent and independent variables. The multiple regression equation model is described as;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_n X_n + \mu \quad \dots \dots \dots (1)$$

Y= is the dependent/response variable

X₁, X₂, X₃ and X₄ are the independent/explanatory variables

β₀, β₁, β₂, β₃ and β₄ determine the partial contributions to each of the X-variables

μ is the random error term

$$\beta_1 = aY/aX_1, \beta_2 = aY/aX_2, \beta_3 = aY/X_3, \beta_4 = aY/X_4, \dots, \beta_k = aY/X_k$$

The major objectives of this research study is to evaluate whether or not all the identified variables like GDP, REER, Inflation rate and FDI are significant determinant of the export performance of selected scientific instruments export firms in the Ambala cluster. Thus export is treated as dependent variable in this model.

In this multiple regression equation model export performance is a function of following variables:

$$EXP = f(GDP, REER, INF, FDI) \dots \dots \dots (2)$$

Estimation Model

To calculate the significant nature of relationship of all the identified determinants the following estimation model is used.

$$EXP = \beta_0 + \beta_1GDP + \beta_2REER + \beta_3INF + \beta_4FDI \dots \dots \dots (3)$$

Where,

EXP = Annual Export Value of selected scientific instruments export industries in Ambala cluster in Lakhs over the period of study.

f= Function.

GDP = Annual Gross Domestic Product at current prices at factor cost over the period of study.

REER = Real Effective Exchange Rate based on 36 country bilateral trade weights over the period of study.

INF = Annual Inflation rate in terms of percentage over the period of study.

FDI = Annual inflows of foreign direct investment in US Dollars to India over the period of study.

μ = Normally distributed Random error.

RESULT ANALYSIS

Table 5: Multiple Correlation Matrix

Variables	Total Exports	Gross Domestic Product	Real Effective	Inflation Rate	Foreign Direct Investment
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	Exchange Rate				
Total Exports	1	0.88	0.74	-0.87	0.83
Gross Domestic Product	0.87	1	0.81	-0.89	0.86
Real Effective Exchange Rate	0.74	0.80	1	-0.83	0.69
Inflation Rate	-0.88	-0.89	-0.83	1	-0.82
Foreign Direct Investment	0.83	0.86	0.69	-0.82	1

Source: Calculations of software XLSTAT

Table 5 shows that total export value have high degree positive correlation with GDP, REER and FDI variables. Inflation rate has high degree negative correlation with total export value of the selected scientific instruments export industries in Ambala cluster. All the four determinants of export performance have significant correlation. In this analysis problem of multicollinearity also checked in order to identify that independent variables may contain same information to a large extent, one gains little by using both in the regression model. If multicollinearity exists it leads to unstable the estimates and increases the variances of regression coefficients.

Table 6: Multicollinearity Statistics

	Gross Domestic Product	Real Effective Exchange Rate	Inflation Rate	Foreign Direct Investment
Tolerance	0.25	0.28	0.26	0.25
Variance Inflation Factor (VIF)	3.46	4.01	4.18	3.54

Source: Calculations of software Xstrata

Table 6 explains the status of multicollinearity in the correlation results, which is essential before using multiple correlation model. It is analysed that any independent variables do not have much high and significantly different correlation with each others. Tolerance value in multicollinearity statistics is more than 0.2 for all the four variables and variance inflation factor (VIF) is also less than 5 of all the four variables. All these stats show that there is no multicollinearity problem in the relationship of all the determinants of export performance. It gives the result that multiple regression model will give a fair view of estimation of relationship of variables.

Scatter plots of correlation results of total export value of selected industries and other four variables i.e. GDP, REER, INF and FDI.

Figure 1

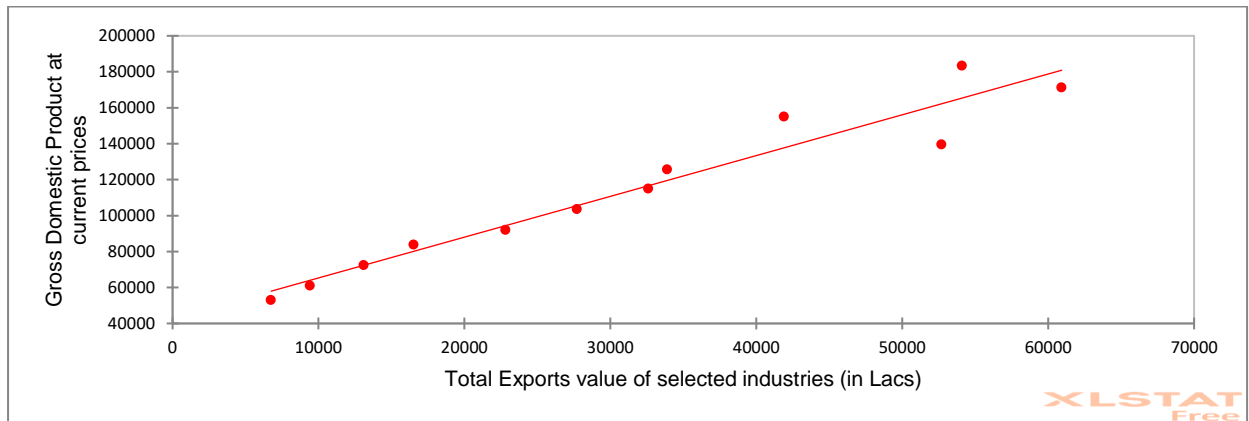


Figure: 2

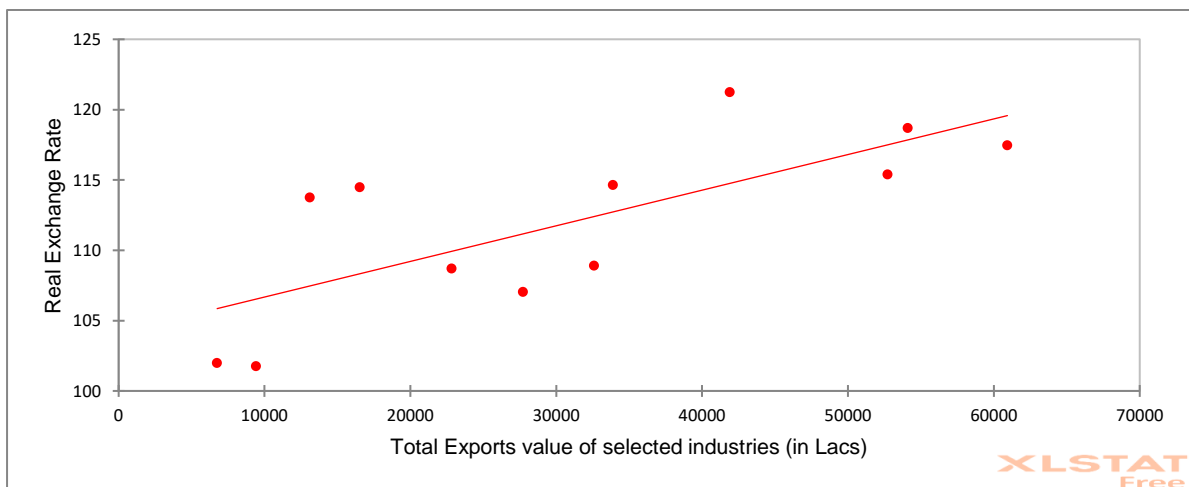


Figure: 3

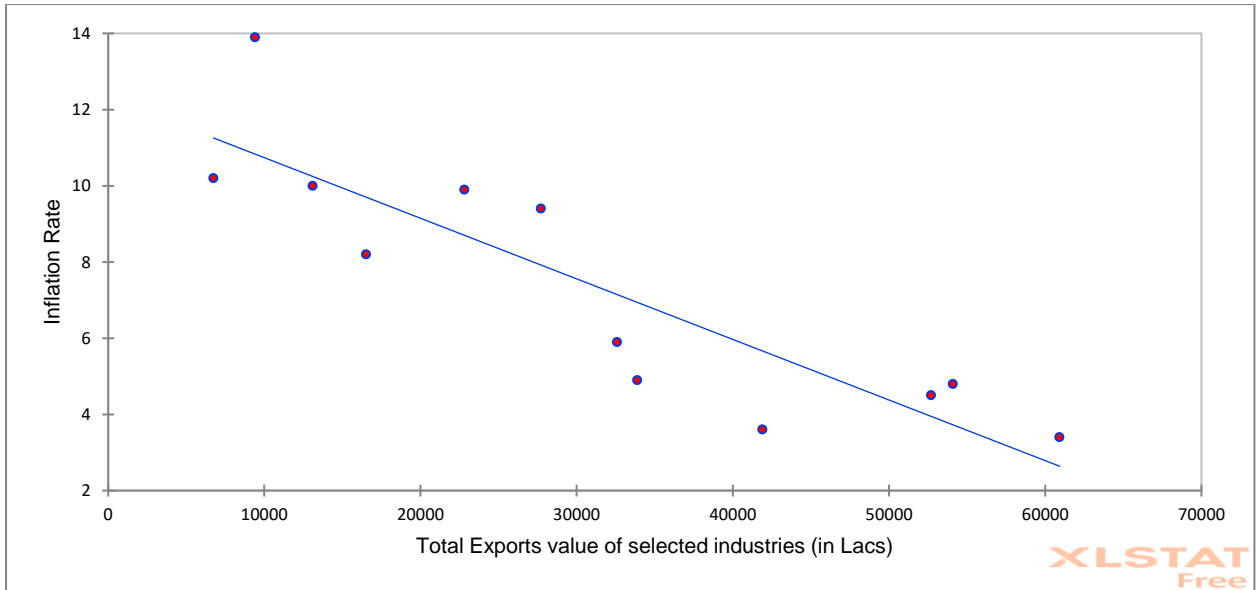
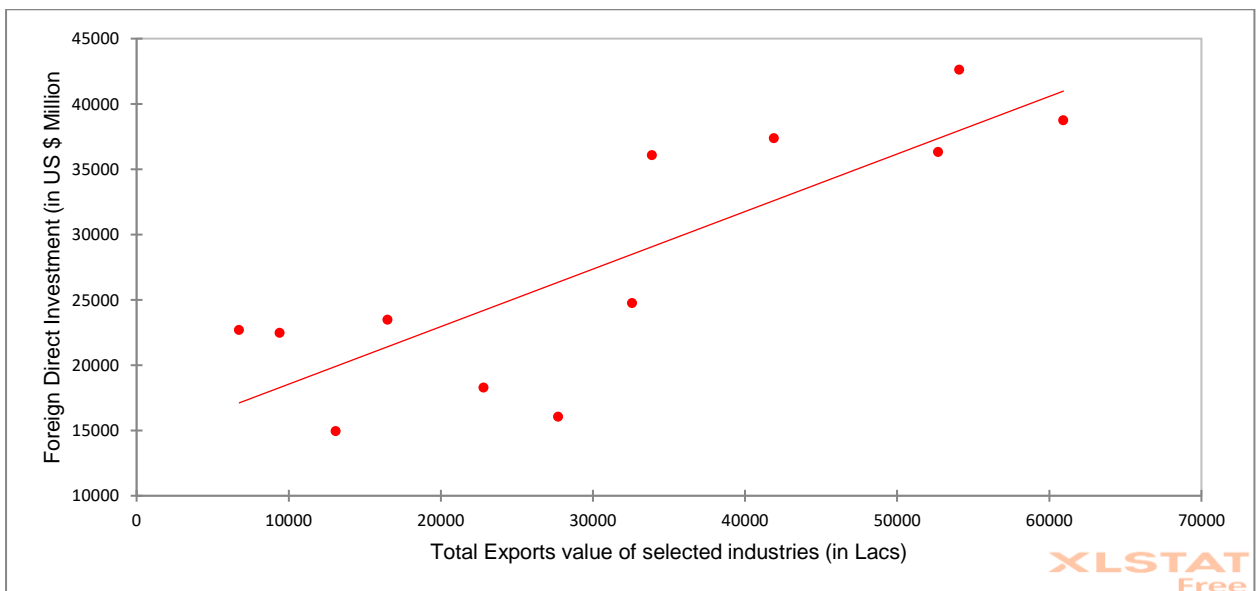


Figure: 4



In figures 1, 2 and 4 slopes of correlation show that GDP, REER and FDI have positive correlation with export performance of the selected scientific instruments industries in Ambala cluster. Graph 3 shows that Inflation rate has negative correlation with export performance. It means increase in inflation rate resultant is decrease in export value of the selected scientific instrument export industries.

Table 7: Regression Statistics

Multiple R	0.973
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R Square	0.947
Adjusted R Square	0.917
Standard Error	8.468
Observations	12

Table 7 explain the multiple regression model results, the statistical output shows that approximate 95 percent variation in the export performance of selected scientific instruments export industries is due to the four independent determinants i.e. GDP, REER, INF and FDI. The result shows value of R-Square is 0.947, which shows the proportion of changes in dependent variable due to the selected independent variables. Adjusted R Square is also very high with 0.917, which is also shows a high significant relationship between the determinants of export performance of the selected scientific instruments export industries in the Ambala cluster.

Table 8: ANOVA

	Degree of freedom	Sum of Square (SS)	Mean of Square (MS)	F	Significance F
Regression	4	3495.712	873.928	14.469	.002
Residual	7	195.627	27.946		
Total	11	3691.339			

	Coefficients	Standard Error	t-stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	57.423	0.579	0.992	0.035	-79.408	1942.565	-79.408	1942.565
Gross Domestic Product	0.417	0.095	4.361	0.003	0.191	0.643	0.191	0.643

Real	-0.089	0.328	-	0.029	-0.866	0.686	-0.866	0.686
Effective			0.273					
Exchange								
Rate								
Inflation	-11.465	11.914	-	0.036	-	1670.792	-39.638	1670.792
Rate			0.962		39.638			
Foreign	-5.582	4.759	-	0.007	-	567.286	-16.838	567.286
Direct			1.173		16.838			
Investment								

Table 8 shows important results of the multiple regression equation model as significance F value is 0.002, which is less than 0.05 and explained that model is highly significant at 95% confidence level. P-values of all the four independent variables in the table is less than 0.05 as it explain that all the four null hypotheses are rejected and alternative hypothesis must be accepted.

Hypotheses results of the models are as follows;

- Null Hypotheses 1 (H01): In first null hypothesis p-value is 0.003, which is less than 0.05 (level of significance) thus the proposed null hypothesis is rejected. Now the alternative Hypotheses has to be accepted as there is significant relationship between Gross Domestic Product and export performance of selected scientific instruments export industries in Ambala cluster. Both the variables are significantly related with each other and have positive significant relationship. Both might be increased in the same direction, means if GDP of the country increases then export value of the selected firms will also be increased.
- Null Hypotheses 2 (H02): In second null hypotheses p-value is 0.029, which is less than 0.05 (level of significance) thus this null hypotheses is rejected. Alternative Hypotheses is to be accepted as there is significant relationship between Real Effective Exchange Rate (REER) and export performance of selected scientific instruments export industries in Ambala cluster. Both the variables have significant positive relationship, which means increase in REER results in increase in export performance of selected industries.
- Null Hypotheses 3 (H03): In third null hypotheses p-value is 0.036, which is less than 0.05 (level of significance), this null hypotheses is also rejected. Now alternative hypotheses is

to be accepted as that there is significant relationship between Inflation Rate and export performance of selected scientific instruments export industries in Ambala cluster. There is negative significant relationship between inflation rate and export performance of selected industries, it means export performance decreases with the increase in inflation rate.

- Null Hypotheses 4 (H04): fourth null hypotheses with p-value 0.007, it is less than 0.05 (level of significance) thus null hypotheses is rejected. Alternative hypotheses need to be accepted that there is significant relationship between foreign direct Investment and export performance of selected scientific instruments export industries in Ambala cluster. A positive significant relationship between FDI and export value shows that increase of FDI resultant into the increase in export value of the selected export industries.

CONCLUSION

Ambala is a city of major scientific instruments products. It is a hub of scientific manufacturing products like glass apparatus, microscopes, laboratory equipment etc. Ambala is contributing almost 34 percent of the total production of scientific instruments production in India. The scientific instruments cluster of Ambala has more than 3,000 units in terms of small and medium units engaged in exports as well. This cluster of scientific instruments export industry is based on approx Rs. 1,700 crore using conventional and innovative production methods. More than 30,000 employees are directly employed in this industry in Ambala. The Ambala cluster is believed to be the largest in the country for manufacturing scientific instruments and apparatus. The manufactured products are used in engineering industry and educational institutions.

Ambala cluster has its own local market, where big and small firms deal in all type of products. The cluster exports scientific instruments and apparatus to the Gulf nations, European countries and the neighbouring countries. Total export value has high degree positive correlation with GDP, REER and FDI variables. Inflation rate has high degree negative correlation with total export value of the selected scientific instruments export industries in Ambala cluster.

Statistical output shows that approximate 95 percent variation in the export performance of selected scientific instruments export industries is due to the four independent determinants i.e. GDP, REER, INF and FDI. Export performance of scientific instruments export industry in Ambala cluster is significantly related to Gross Domestic Product. Both the variables are

significantly related with each other and have positive significant relationship. Both might be increased in the same direction, means if GDP of the country increases then export value of the selected firms will also be increased. Export performance of scientific instruments export industry in Ambala cluster is also significantly related to the Real Effective Exchange Rate (REER). Both the variables have significant positive relationship, which means increase in REER results in increase in export performance of selected industries.

REFERENCES

- Katsikeas, C., Piercy, N., and Ioannidis, C. (1996), Determinants of export performance in a European context, *European Journal of Marketing*, 30(6), 6-36.
- Roper, S. & Love, J. (2002), "Innovation and export performance: evidence from the UK and German manufacturing plants", *Research Policy*, 31, pp. 1087–1102.
- Ibeh, K. (2003), On the internal drivers of export performance among Nigerian firms: Empirical findings and implications, *Management Decision*, 41(3), 217-225.
- Bhaduri, S. & Ray, A. (2004), "Exporting through technological capability: econometric evidence from India's pharmaceutical and electrical/electronics firms", *Oxford Development Studies*, 32(1), pp. 87–100.
- Contractor, F., Hsu, C., and Kundu, S. K. (2005), Explaining export performance: A comparative study of international new ventures in Indian and Taiwanese software industry, *Management International Review*, 45(3), 83-110.
- Sousa, C., Martínez-López, F. J., and Coelho, F. (2008), The determinants of export performance: A review of the research in the literature between 1998 and 2005. *International Journal of Management Reviews*, 10(4), 343-374.
- Freeman, J., and Styles, C. (2014), Does location matter to export performance? *International Marketing Review*, 31(2), 181-208.
- Hooy, C.W., Law, S.H. and Chan, T.H. (2015), "The impact of the real exchange rate on ASEAN disaggregated exports to China", *Economic Modelling*, Vol. 47, pp. 253-259.
- Mukherjee, S. (2018), Challenges to Indian micro small scale and medium enterprises in the era of globalization, *Journal of Global Enterprise Research*, 8(28), 1–19.

Tripathy, I.G. & Kumar, P. (2019), Challenges to Indian MSME exporters: A review. *Small Enterprise Development, Management & Extension Journal*, Vol. 46(3), 189–195.

Malca, Oscar, Jesús Peña-Vinces, and Francisco Acedo (2020), Export Promotion Programmes as Export Performance Catalysts for SMEs: Insights from an Emerging Economy, *Small Business Economics* Vol.55, 831–851.