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ANALYZING THE IMPACT OF IMPORT COMPETITION ON THE PERFORMANCE OF INDIA'S MACHINE TOOLS INDUSTRY[1]

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Abstract

The paper tries to analyze the effects of import competition on the performance of the Indian Machine Tools industry. The analysis has been carried out for the period of 1993-94 to 2015-16. Reforms in import policy have contributed to an increased import competition in Indian Machine Tools industry. The analysis shows profit reducing effect of import competition. The foreign ownership of a firm, however, is seen to have positive impact on its profit margins. The study indicates that while import competition may have an adverse effect on performance, increased investment in RandD and optimum utilization of capacity can counter such negative impact. The results show that the risk of doing business is reduced with the advent of import competition. Growth in the manufacturing sector has led to a rapid increase in demand, especially for increasingly sophisticated Computer Numerical Control (CNC) machines. While imports have risen to meet the demand, growth of productivity through investments in RandD is crucial for ensuring good performance in the long run.

Key words: Import Competition, Indian Manufacturing, Performance, Reforms.

JEL Code (s): D40, F60, L60, O30, O40

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1. INTRODUCTION:

Machine tools Industry forms the backbone of manufacturing industries in the economy. It finds its place in almost every industry which involves production, processing raw products into finished goods with the use of mechanization. The use of machines has reduced the time required for producing the goods and increased the precision and accuracy with which the final product is obtained. Developing countries have to lay special emphasis on this industry for the success and development of various sectors of their economy. The policy of the Indian government has helped the growth of machine tools industry during post-liberalization. Various policies such as exemption from licensing, limited items reserved for small scale units, freedom in finding the location for setting up a production unit, lowered import duties, setting up of Special Economic Zones (SEZs), *etc*. Setting up of Export Promotion Units (EOUs) have been instrumental in promoting the exports and providing the facilities for skill up gradation (IBEF, 2008).

India ranks 13th in production and 10th in the consumption of machine tools in the world (IMTMA, 2016). The 'Make in India' program initiated by the government is bound to provide further boost to this industry. Under this flagship program various policy initiatives like 100 per cent allowance of FDI, exemption from obtaining industrial licensing, reduction in import duties have increased the role of foreign participation in machine tools industry. Capital intensive industries like machine tools and electrical equipment have been included as the 'focus sectors' under Make in India program. The government has also placed a lot of emphasis on developing the domestic technology and investing in skill up gradation tasks (Make in Indian, 2018). According to IMTMA (2015), around 25 companies in the large scale sector produce 70 per cent of the total output in the industry. Thus, the profits and opportunities are seen to be concentrated at one end of the industry. Around 75 per cent of the total turnover of this industry is in the organized sector and the rest is accounted by the MSME sector (Indian Machine Tool Manufacturers' Association (IMTMA), 2016). The large scale units cater to the needs of India's heavy and medium industries whereas the small players meet the demand of the ancillary units. With the current divide between demand and supply, the Indian machine tools industry offers promising investment opportunities. However, the industry is highly import dependent in sophisticated and high end technology segment.

With the increasing mechanization and the demand for Computer Numerically Controlled (CNC) machines; there is an urgent need for developing indigenous capacities in this sector to provide it with the global competitiveness.

The present paper analyzes the performance of Indian machine tools industry in the organized manufacturing sector during post-liberalization. The paper is organized into five sections. The section *two* presents the review of studies analyzing the industrial performance with special emphasis on India. Section *three* explains the methodology and data sources used in the paper. Section *four* presents the empirical analysis and the plausible explanations. Section *five* concludes the paper.

2. REVIEW OF LITERATURE:

The impact of import competition on performance of firms has been discussed widely in literature. The effect is multifaceted and requires the analysis of both firm and trade specific variables. According to Kambhampati and Parekh (2003), the introduction of reforms can have a negative (pro-competitive or reducing) effect on the profits of firms. This is attributed to the disciplining of firms in response to import competition. However, this may not always be the case. The possibility that liberalization provides an impetus to research and development initiatives could lead to the development of better quality products culminating into higher profit margins. Pant and Pattnayak (2005) demonstrate that contrary to the much believed notion, trade openness does not itself lead to decrease in profit margins. The increased firm efficiency due to trade openness results in the rise in their profits. The other variables which have been widely contested as the performance indicator is the total factor productivity (TFP) and capacity utilization (CU). Productivity increases when the growth of output is greater than the growth in inputs. TFP includes the amount of technology and the efficiency of inputs used in the production process. In this respect, it accounts for both level of technology and technical efficiency in production. Studies such as Krishna and Mitra (1998) and Sen (2008) state that import competition can increase TFP due to firms cutting slack or gaining from knowledge transfers via intermediate imports. The advent of liberalization can also affect productivity negatively if domestic firms are unable to catch up with their foreign counterparts or compete efficiently. Studies such as Balakrishnan, *et al*., (2000), Kaur and Kiran (2008)

have found a negative association between firm productivity and import competition. Study by Goldar and Renganathan (2008) has found import competition leads to an increase in capacity utilization in the next time period. However, the import competition leads to the fall in capacity utilization in the contemporaneous period. This could be the result of domestic firms not being able to expand their production due to the sudden rise in competition. Thus, the study states that import competition improves firm performance after some time has passed by. Hence, a brief overview of studies provides the evidence for both beneficial as well as adverse impact of import competition on performance in Indian context.

Saxena and Sharma (2014) present a descriptive analysis of Indian machine tools industry. The study states that Indian machine tools industry contributes approximately 0.8 per cent in the global machinery production. The total consumption of machine tools in India is three times the production which points out the production potential in this sector. Machine tools industry also bears strong inter linkages with other important sectors such as automobile, infrastructure, healthcare, defense, aerospace and medical engineering. Hence, the growth of this industry is capable of producing positive externalities for all the other industries depending on the use of machine tools. The study points out to the presence of technology gaps and low levels of research and development and states that these are the causes of excessive dependence on imports. The study emphasizes the role played by imports on providing technology transfers in this industry. The study highlights the importance of RandD in this industry to provide much needed impetus to its growth. However, the study does not present its findings with any empirical arguments.

Sutton (2000) analyses the productivity and quality of Computer Numerically Controlled (CNC) machine tools in India. The study covered eight major firms which produced a significant amount of machine tools in India for the year 1999-2000. Labour productivity measure has been used to study productivity differential between Indian and foreign firms. The study adopted a survey of firms which specialized in production of CNC machines. A comparison was made with the leading producers producing the same machines in Japan and Taiwan. The main findings of the study stated that the productivity standards achieved by the Indian producers were less than half of that produced by the foreign firms. The study also observed significant gaps in wages

between Indian and foreign firms. The labour cost per machine was found to be much lower for the Indian producer as compared to their foreign counterpart. The productivity differentials between the two types of firms were not as wide as the wage gap. The findings stated that Indian producers operate a sufficiently large service network, however, the quality of machines was inferior to that of their foreign competitors. The short time frame of analysis however raises questions on generalizing the findings of this study.

Singh (2011) presents a report on the working of machine tools industry in India. The study has presented the excerpts from the report on the 'Capital Goods and Engineering Sector' set up by the planning commission for formulating the 12th five-year plan (2012-2017). Some of the key challenges faced by the machine tools industry include technology denial by developed countries, lack of capacity creation through expansion of new units, high interest rates on loans, reduction of import duties under free trade agreements, shortage of skilled manpower, inadequate infrastructural facilities and fragmented nature of this industry. The study undertakes a SWOT analysis to examine the performance of this industry. The study also cites some of the important lessons to be learnt from the Chinese machine tools industry. China has declared the development of precision CNC machine tools as one of the country's important targets over the next 15 years. The Chinese government has also vowed to reduce its dependence on imported machine tools over the coming years. The government policies are designed to attract foreign investments at the cost of eventual transfer of technology. The study thus highlights the importance of strategic policy coupled with institutional and funding support in uplifting the performance of this industry.

3. DATA SOURCES AND METHODOLOGY:

This section discusses the data sources, construction of important variables and detailed methodology applied for the analysis. Sub-section 3.1 covers the data sources and variables used in the study. The following sub-section analyzes the methodology of the study and construction of important variables such as IPR, capital stock, *etc*.

3.1. Data coverage and Adjustments:

The study has used the CMIE database 'Prowess' for the analysis. Prowess is a database of large and medium Indian firms. It encompasses listed and unlisted companies of India. The data for listed companies is taken from stock exchanges in the economy. The companies in the database together comprise 60 to 70 percent of the economic activity in the organized industrial sector and account for 75 percent of corporate taxes and 95 percent of excise duty collected by the Government of India (Goldberg *et al.,* 2008). This shows a greater coverage of organized manufacturing sector as compared to the unorganized sector. Prowess also provides a detailed annual information on firm's product mix. Indian firms are required to disclose product level information in their annual reports according to the Companies Act (1956). Prowess compiles this information and provides product level data on sales and quantity of units produced by companies.

The paper uses the data for variables such as sales, RandD expenditure, salaries and wages, total imports, total exports, advertising expenditures, ownership status, gross fixed assets and depreciation for analyzing firm level performance of this industry. The data has been arranged according to 2 digit NIC-2008 classification for the period of analysis. The employment data is extremely limited in prowess. Hence, the study derived this measure by dividing the data on salaries and wages provided in this database by the average industrial wage rate obtained from Annual Survey of Industries (ASI). Before estimating the IPR, trade data was deflated using real effective exchange rates with 2004-05 as the base year (RBI, 2014). The sales variable has been deflated using wholesale price index with 2004-05 as the base year (GOI, 2014).

The firms included in the analysis represents on an average 87 percent of the entire machine tools industry. The data used in the analysis is an unbalanced panel because some firms exit while others fail to report the data for the chosen period. After sorting the data, 136 firms have been included in the analysis.

3.2. Methodology:

Prior to explanation on the methodology of the study, understanding the construction of important variables used in the study is essential. The following section deals with the description of variables used in this study.

3.3. Construction of variables:

3.3.1. Import Penetration Ratio (IPR) –

IPR represents the competition faced by domestic firms from imports. IPR is defined as:

$$IPR = \frac{M_{it}}{(Dit + Mit - Xit)} \quad \text{..... (1)}$$

Where,

M_{it} = Value of imports of firm i at time t

D_{it} = Value of domestic output (total sales) of firm i at time t

X_{it} = Value of exports of firm i at time t

A higher value of IPR connotes higher competition from imports and vice-versa. The value of this ratio falls within the range of zero to one. The value zero will signify that the share of imports in the total domestic output available for consumption is zero. This would be true in case of a 'closed' economy. On the other hand, the value of one will imply that all the domestic demand in a particular industry is being met by only imports (Berthet *et al*., 1985). The study has used total sales as a proxy for representing output of a firm.

3.3.2. Capital stock series –

The study uses the method suggested by Goldar (1986) to compute capital stock. According to this method, doubling the book value of fixed capital stock for benchmark year provides an estimation of the replacement cost figure of the benchmark year. Goldar (1986) has allowed for 2% rate of discard of capital goods and used a composite weighted price index for building materials, manufacture of machine tools and parts and transport equipment as deflator. (Burange and Randive, 2014).

Capital stock for the benchmark year is:

$$K_0 = 2\ (B_t) \qquad \text{..... (2)}$$

Where,

K_0 = Capital stock in the benchmark year (1993-94)

B_t = Book value of gross fixed assets in the year t

t = 1993-94

For consecutive years, gross real investment is taken as the measure of capital stock. The gross real investment for year t is given by,

$$I_t = (\ B_t - B_{t-1} + D_t) / P_t \qquad \text{..... (3)}$$

Where,

B_t = Book value of gross fixed assets in the year t.

D_t = Depreciation in the year t.

P_t = Composite price index for capital goods

Thus, the gross fixed capital series at 2004-05 prices is derived as follows:

$$K_t = K_{t-1} + I_t - dK_{t-1} \qquad \text{..... (4)}$$

Where,

d = rate of discard of capital goods.

3.3.3. Profits before Depreciation, Interest, Tax and Amortization (PBDITA) –

The measure for profits has been constructed by subtracting total expenditure from the sum of total income and change in inventory figure obtained from prowess database. Depreciation, direct tax, interest payments and amortization is then added to this final profit figure. PBDITA is thus constructed for the analysis. Taxes are an externality and have a significant impact upon profits. More importantly, often, the tax rate depends upon the various fiscal benefits available to the sector. Export oriented industries have remained exempt from direct taxes for over a decade (Prowess IQ, 2016). Hence, taking this figure can lead to biases in true value of profits earned by companies. The constructed measure for profits gives an edge over the other measure of price cost margins used in literature as it accounts for depreciation and change in stock which is

left out if price cost margins are derived by simply deducting the expenditures on labour and other intermediate inputs from the total sales figure.

To make this measure more refined, the impact of net prior period and extraordinary income has also been removed from this figure. Prior period incomes include transactions such as bad debts recovered. Other income in prowess include expenses recovered, liquidated damages or claims received and other miscellaneous income. Large gains or losses on account of prior period and extra-ordinary transactions can skew the profits of a company.

This final profit figure hence yields operating profits of non-financial of companies. It represents the value of profits earned by a company from its core business operations. By excluding depreciation, amortization, direct taxes, the net impact of prior period and extraordinary transactions, income from financial services and other income; the derived measure for profit of non-financial companies measures the profits that can be purely attributed to the core business operations in the current year.

3.3.4. Capacity utilization:

Capacity refers to the output that can be produced in a fixed period of time given the existing stock of capital. However, there are several interpretations of the phrase 'can be produced'. Ragan (1976) states that the engineering concept describes this phrase as the maximum producible output when plants and equipment are operated for the average amount of time producing the normal mix of output. Hence, capacity utilization is an extent to which an enterprise uses its installed productive capacity. Some studies also define capacity as the level of output where the average per unit cost is minimum or the level beyond which the cost of producing additional amount of output increases sharply.

Capacity utilization rates were estimated at firm level using the methodology applied in by Sastry(1984) and Uchikawa (2001). Uchikawa (2001) stated that while the investment boom of mid-1990s raised production capacities significantly, the demand did not rise leading to underutilization of capacity. If consumers require less products than what can be potentially producible, the plants do not function at full productive capacity. This leads to the widening of the gap between actual output and

potential output. The widening of this gap also leads to an increased fixed cost of the firms due to idling of capacity leading to increased fixed costs. This could hamper profitability of firms further reducing their performance. Hence, analyzing the impact of this variable on firm performance was crucial.

The study estimates the utilization rates on the basis of minimum capital output ratio. First, the ratio of capital to output is calculated. A benchmark year is then assigned depending on the minimum capital output ratio in the period of analysis. The estimate of capacity is obtained by dividing capital stock by minimum capital output ratio. The utilization rate is then given by the actual output as a proportion of the estimated capacity.

$$\text{Utilization Rate} = \frac{\text{Actual Output}}{\text{Potential Output}} \qquad \ldots\ldots\ldots\ldots\ldots (5)$$

The potential output in equation (5) can be defined as:

$$\text{Potential Output} = \frac{C}{(K/O)\min} \qquad \ldots\ldots\ldots\ldots\ldots (6)$$

Where,

K is Gross fixed capital stock.

(K/O) min is the minimum ratio of capital stock to output.

3.3.5. Business Risk:

The analysis for risk of doing business is usually undertaken using the coefficient for variance of earning (Kakani *et al*., 2001). Business risk can be defined as the uncertainty of earnings caused due to fluctuations of firm's sales due to internal as well as external environment. This can be measured as the fluctuation in operating income over a period of time. This fluctuation can be measured by studying the standard deviation of earnings over a given period of time. A low co-efficient of variation is desirable as it suggests low variability in the earnings of the firm. The measures used to calculate the risk of business are coefficient of variance in cash flow measure (VCFM), coefficient of variance of return on assets (VCROA) and coefficient of variance of return on capital employed (VROCE). The formula for calculating the business risk is given as:

$$\textbf{Business Risk} = \frac{\textbf{Standard Deviation of operating earning}}{\textbf{Mean operating earning}} \quad \ldots\ldots\ldots\ldots \quad (7)$$

The coefficient for measuring business risk is calculated for the period of 1993-94 to 2015-16 using the above mentioned formula. This coefficient is regressed on the simple averages taken for import competition and the other firm specific variables in the study.

The other firm specific variables such as RandD, capital stock, advertising expenditure and exports have been calculated as the ratio of their respective value to the firm's total sales figure. The variable for market share has been constructed as the ratio of the firm's total sales to the total sales and imports of the industry. The study initially adopted a fixed effects approach to determine these effects after accounting for firm level heterogeneity. Hausman test is used to decide between choosing the fixed versus random effects model. In cases where the firm specific heterogeneity is likely to be associated with the explanatory variables; fixed effects model is a better choice.

However, the Durbin-Wu test revealed the presence of endogeneity amongst the regressors. The test was first proposed by Durbin (1954) and separately by Wu (1973) and Hausman (1978). Durbin-Wu-Hausman test is numerically equivalent to the standard "Hausman test". The null hypothesis for which states that an ordinary least squares (OLS) estimator of the same equation would yield consistent estimates. This indicates that any endogeneity among the regressors would not have deleterious effects on OLS estimates. A rejection of the null indicates that endogenous regressors' effects on the estimates are meaningful, and instrumental variables techniques are required (Baum *et al*., 2003). Hence, the paper adopted a System Generalized Method of Moments (S-GMM) approach to account for endogeneity and unobserved firm specific heterogeneity in the model. Prior to testing for these effects, the study runs a partial correlation analysis to analyze the effects of import competition on performance indicators. This indicates if there exists a link between import competition and performance indicator after keeping the effect of other independent variables constant. For maintaining the parsimony of the analysis, the variables found endogenous in the study have not been included for calculating the partial correlations. The results of the analysis indicate that effect of import competition is felt on four out of the five

performance indicators examined. This analysis is taken further using a System–GMM method. The presence of endogeneity in the model requires the analysis in the dynamic framework thereby negating the use of fixed effects model.

The System-GMM can be used in following cases:

- Dynamic linear panel regression with large 'N' and small 'T': many individual units and few time periods.
- Dependent variable depends on its own past realizations.
- Independent variables can either be exogenous, endogenous or pre-determined.
- Error term constitutes the individual specific fixed effect and idiosyncratic disturbance term.
- Idiosyncratic disturbances have individual specific heteroscedasticity and serial correlation; however, disturbances are not correlated across individuals.

Profit is regressed on variables such as size, import penetration ratio (IPR), market share, capital, advertising, export and ownership indicator. The values for the variables stated below have been taken in log form. A basic equation for testing the effect of these variables on the firm's profits can be stated as:

$$PROF = f(L.PROF, IPR, RD, K, AD, X, OWN, MS, CU) \quad \ldots\ldots\ldots\ldots (8)$$

Where,

PROF = Ratio of PBDITA to total sales of a firm.

L.PROF = Lagged profits of a firm

IPR= Import penetration ratio.

RD= Research and Development expenditure of a firm.

K = Capital stock of a firm.

AD = Advertising expenditure of a firm.

X= Total exports of a firm.

OWN = Dummy assigned value '1' if the firm is a foreign firm.

CU = Capacity Utilization of a firm.

In the next step of analysis, the effect of import competition and other variables has been regressed on the total factor productivity of the firms. TFP is estimated using

a Cobb-Douglas production function (Trivedi, *et al*., 2011). Cobb-Douglas production function is more suitable for lesser data points because it has fewer parameters to estimate and yields better results (Murthy, 2002). The study further makes an argument for the use of Cobb-Douglas production function even in case of imperfections in the markets as it does not introduce distortions of its own. The production function used for our analysis is as follows:

$$Y_{it} = A_{it} K_{it}^{\alpha} L_{it}^{\beta} \quad \ldots\ldots\ldots\ldots (9)$$

Where,

Y_{it} = Output is defined as total sales of the i^{th} firm in period t

K_{it} = Capital stock used by the i^{th} firm in period t

L_{it} = Labour used by the i^{th} firm in period t

A_{it} = Technology parameter capturing TFP of i^{th} firm in period t

α and β are the capital and labour coefficients respectively

Taking log on both the sides, TFP is calculated as,

$$\ln A_{it} = \ln Y_{it} - \alpha \ln(K_{it}) - \beta \ln(L_{it}) \quad \ldots\ldots\ldots\ldots (10)$$

The basic equation for analyzing the impact of trade and firm specific variables on the TFP can be stated in the equation given below. The values for the variables have been taken in log form.

$$A = f(\text{L.A, IPR, RD, AD, MS, X, OWN, CU, PROF}) \quad \ldots\ldots.. (11)$$

Where,

L.A= Lagged TFP

IPR = Import penetration ratio of a firm

RD = RandD expenditure of a firm

AD = Advertising expenditure of a firm

MS =Market share of a firm

PROF = Profits of a firm

X = Export of a firm

OWN = Dummy assigned value '1' if the firm is a foreign firm.

CU = Capacity Utilization of a firm

The third performance indicator observed in the analysis is the Capacity Utilization of the firm. The basic equation for analyzing the impact of import competition on the CU can be stated in the equation given below.

$$CU = f(L.CU, IPR, RD, K, AD, MS, X, OWN, TFP, PROF) \quad \ldots\ldots \quad (12)$$

Where,

L.CU= Lagged CU

IPR = Import penetration ratio of a firm

RD = RandD expenditure of a firm

K = Capital stock of a firm

AD = Advertising expenditure of a firm

MS =Market share of a firm

X = Export of a firm

OWN = Dummy assigned value '1' if the firm is a foreign firm.

TFP= Total Factor Productivity of a firm

PROF= Profits of a firm

The fourth performance indicator undertaken by the study is the exports of the firm. The equation for assessing the impact of import competition on the exports is given as:

$$X = f(L.X, RD, IPR, AD, MS, K, OWN, TFP, PROF, CU) \quad \ldots\ldots\ldots \quad (13)$$

Where,

L.XI= Lagged export

K = Capital stock of a firm

IPR = Import penetration ratio of a firm

RD = RandD expenditure of a firm

AD = Advertising expenditure of a firm

MS =Market share of a firm

OWN = Dummy assigned value '1' if the firm is a foreign firm.

TFP= Total Factor Productivity of a firm

PROF= Profits of a firm

The analysis has been carried out in the dynamic framework using System Generalized Method of Moments approach. The motivation behind using the GMM technique was the endogeneity encountered amongst some key variables in the study.

In context of panel data, taking first difference must allow one to deal with the unobserved heterogeneity as in case of fixed effects model. However, as Nickell (1981) pointed out that such transformation in case of dynamic panel data models can lead to biased estimates of the coefficient for lagged dependent variable (Baum, 2013). This bias is not mitigated by increasing 'N'. Nickell (1981) further pointed out that the inconsistency of this estimate as N nears infinity is of the order 1/T which becomes quite substantial when T is small. This process is not caused due to the error process being auto correlated. In case of the auto correlated error term, the problem is more severe. The same problem arises in case of one way random effects model. The error component enters every value of Y_{it} so that the lagged dependent variable is not independent of the error process.

One solution to this problem can be taking first differences of the original model. The first difference transformation wipes out the constant and the firm specific effects. However, there is still correlation between differenced lagged dependent variable and the disturbance process. The former contains the term $Y_{i,(t-1)}$ and the latter contains $\varepsilon_{i(t-1)}$. With no firm specific effects, an Instrumental Variable (IV) estimation is possible. The instruments for lagged dependent variable can be constructed from the second and third lags of Y, either in form of lagged levels or differences of lags. If ε_i is iid, then the lags of Y will be highly correlated with the lagged dependent variable and its difference but would be uncorrelated with the error term. Even in case of ε_i following AR(1) process, one could follow this strategy backing one period and using third or previous lags of Y. This instrumental variable approach was proposed by Anderson and Hsiao (1981) for dynamic panel data analysis.

Holtz *et al*., (1988), further expanded the Anderson-Hsiao approach to estimate a vector auto regression model with time varying parameters. Arellano and Bond (1991) used Monte Carlo studies to evaluate a GMM estimator that is very similar to Holtz *et al*., (1988). It was based on the approach that the instrumental variable approach noted above does not exploit all the information available in the sample. Generalized Method of Moments (GMM) constructs more efficient estimates of the dynamic panel data model. Arellano and Bond (1991) state that the Anderson- Hsiao estimator while consistent, fails to take all of the potential orthogonality conditions into consideration. A key assumption of Arellano and Bond strategy is that the necessary instruments are 'internal'. They are based on the lagged values of the instrumented variables. The inclusion of external instruments is also permitted.

A potential short coming was revealed in the Arellano and Bond (1991) estimator in later work by Blundell and Bond (1998). The lagged values adopted in this modelling strategy are often poor instruments for first difference variables if the variables were seen to be close to a random walk. The modification of the estimator included lagged levels as well as lagged differences. The original estimator is termed as difference GMM while the latter is termed as System GMM. Arellano and Bond (1991) present a specification test (Hansen J test) to check for the validity of instruments and presence of no serial correlation in the error term. The acceptance of the null hypothesis of the Hansen test states that the instruments used in the model are valid. In case of a significant AR (2) statistic the second lags of the endogenous variables fail to act as a valid instrument for their current values.

However, this process of estimation amplified gaps in unbalanced panels due to first difference transformation. Blundell and Bond (1998) also showed that in case of high persistence effect in the dependent variable, the consistency of Arellano and Bond (1991) estimator was compromised. In this case, past values of the dependent variable had very limited explanatory power for predicting future changes. Arellano and Bover (1995) and Blundell and Bond (1998) generated forward orthogonal deviations for countering this issue. The average of all available future observations was subtracted from the present one. This transformation does not enlarge gaps in unbalanced panels. Along with that the assumption that first difference of instrumental variables is uncorrelated with the fixed effects gives a system of two equations. In this approach,

the forward orthogonal deviations are instrumented with levels whereas the levels are instrumented with difference of lags. This generates more instruments and also addresses the problems faced by the Arellano and Bond (1991). System GMM thus provides a consistent and asymptotically efficient estimator.

4. EMPERICAL ANALYSIS:

The following sub-section presents the empirical findings based on the methodology discussed in the previous sections. The sub-section 4.1 examines the effect of import competition on the performance of machine tools industry for the period 1993-94 to 2015-16. This is then followed by the performance analysis in the early period of reforms (1993-94 to 2004-05) followed by the performance analysis in the latter years (2005-06 to 2015-16).

4.1. Effect of import competition on machine tool performance (1993-94 to 2015-16):

In accordance with the aim of study, the analysis for the impact of import competition on machine tools industry performance has been undertaken at the aggregated 2-digit industry level. The hypothesis of learning from foreign competition has been further tested by splitting the time period as the initial phase of reforms (1993-94 to 2004-05) and the latter phase of reforms (2005-06 to 2015-16). The partial correlation coefficients indicate that import competition has a significant impact on firm performance indicators such as profitability, TFP and CU. The impact of import competition on firm's market share is not found to be significant. IPR is found to be endogenous when running a regression with export as the dependent variable and hence is left out. The dependent variables have been given in rows and the independent variables have been presented as columns for studying the partial correlation coefficients.

Table. 1: Partial Correlations results with performance indicators
(1993-94 to 2015-16)

	PROF	TFP	CU	RD	MS	AD	K	X	**IPR**	FOREIGN
PROF	--	--	0.1025***	--	0.0142	0.1001***	--	--	**0.0494****	0.0693***
TFP	--	--	0.0087		-0.013	--	0.0093	-0.0361***	**-0.0475****	0.0236
CU	0.0737***	--	--	-0.0728***	--	-0.0297	0.0138	0.0881***	**-0.1334*****	--
MS	--	--	0.2299 ***	0.0258	--	0.0332	-0.0331	0.0700***	**-0.0103**	0.0373
X	0.0230	-0.0290	0.0639**	0.2401***	0.0445*	0.0664**	--	--	--	0.1913***

Table 1 shows the partial correlation coefficients of various performance indicators with IPR and other firm specific variables. The results indicate that import competition has an impact on three performance indicators examined. The impact of competition on firm's profits is found to be positive significant, whereas negative on capacity utilization and TFP. This analysis though indicative, cannot be taken as final as it leaves out the inclusion of important variables which are found to be endogenous. The theoretical underpinning of the model also requires the inclusion of lags of certain important variables such as RandD, capital stock, exports and IPR. Hence, the study undertakes the analysis in a dynamic framework to study the impact of import competition on various important performance indicators.

The possible endogeneity between some of the independent variables or the possibility of the reverse causality between the dependent and independent variables has been vividly discussed in literature. Kambhampati and Parekh (2003) suggest that one way to circumvent this problem is to consider the timings of the effects. While the effect of variables such as size, IPR, capital stock, RandD, market share, advertising or export on firm's profits is contemporaneous; profitability is only likely to affect the future values of these variables. Several studies in Indian context have not addressed the issue of endogeneity in independent variables. The study presents the test results for GMM after addressing the potential endogeneity found in some of the key variables in the analysis.

Research and development expenditure (RandD) of the company can act as an expense in the short run. Hence, the effect can be negatively associated with

contemporaneous profits of the firm. The examination of the long run impact of this variable on profit margins of firm requires analysis in the dynamic framework. An increase in this variable is hypothesized to boost the productivity and profitability in the long run. Thus, we also include the lagged value of RandD in estimating the current value of firm's profits and productivity.

Following the similar argument, the firm's capital stock should also be considered with a two period lag as the investment in capital goods does not yield immediate returns. The argument for considering the lag selection is based on the nature of products produced by this industry. The Machine tools industry constitutes two subcomponents namely: Manufacture of general purpose machinery (NIC-281) and manufacture of special purpose machinery (NIC-282). The manufacture of special purpose machinery contributes to more than 50 percent share of output in this industry. The former is relatively insensitive to the foreign competition as it produces the conventional machine tools equipment which do not require continuous quality upgrading. The RandD investment initiatives to produce differentiated products would hence yield higher results in the latter subsection.

However, this positive impact of RandD and capital augmentation is hypothesized to be higher in the immediate past as the innovations or use of new equipment would yield lesser profits on becoming outdated or redundant due to newer techniques and ideas being introduced in the later years (Hall *et al*., 2009). The results also suggest the same. The two period lag for RandD and capital suggest a significant positive impact on the performance of this industry. The lags for the latter years depict a positive yet insignificant co-efficient.

Table 2.: GMM results with profit as the dependent variable
(1993-94 to 2015-16)

Variables	Co-efficient	Std. Error	Pr(>|t|)
PROF $_{it-1}$	0.2370	0.0195	0.000***
K i_t	0.0524	0.0839	0.533
K i_{t-1}	0.5719	0.0778	0.000***
K i_{t-2}	0.0666	0.0273	0.017**
IPR i_t	0.0681	0.0100	0.000***
IPR i_{t-1}	0.0399	0.0100	0.000***
IPR i_{t-2}	-0.0551	0.0118	0.000***
RD i_t	-0.2023	0.0138	0.000***
RD i_{t-1}	0.1091	0.0096	0.000***
RD i_{t-2}	0.0234	0.0098	0.019**
MS i_t	0.0463	0.0091	0.000***
TFP i_t	0.0476	0.0178	0.009***
AD i_t	0.0334	0.0109	0.003***
X i_t	0.0157	0.0112	0.164
X i_{t-1}	0.0074	0.0077	0.338
X i_{t-2}	-0.0673	0.0054	0.000***
CU	0.0006	0.0003	0.074*
OWN	0.0658	0.0585	0.264
AR1.	-3.72		0.000***
AR2.	-0.12		0.907
Hansen test	85.00		0.685

Significance. codes '***' 0.01 '**' 0.05 '*' 0.1 los.

Table 2 presents the analysis in a dynamic framework. The Durbin-Wu-Hausman test for endogeneity shows the presence of endogeneity in case of RandD, capital stock and exports.

This could possibly explain the negative sign for contemporaneous research and development co-efficient. The results support the argument of pro-competitive (negative) effects of import competition in the second lag of the model. This argument

is similar to the one made by Goldar and Aggarwal (2005) whereby, the immediate impact of trade liberalization can lead to firms earning super normal profits due to cheaper raw materials or product differentiation. However, in the later periods the availability of substitutes and tougher competition from imports has a negative impact on profits.

Both the import competition and exports are seen to exhibit a pro-competitive effect on profits. The RandD lagged exhibits a positive impact on firm profit margins thereby rationalizing the claim made earlier. The coefficient for capital is positive and significant for the period of analysis. Thus, the investment made in form of capital goods shows positive impact on profits over a longer time horizon. This can be justified on the basis of the time taken by the firms to assimilate the positive spillovers arising from the use of new machinery for production. The variable for capacity utilization also exhibits a positive effect on firm's profits.

Market share of the firm and advertising expenditure depict a positive impact on profits. This is an interesting observation as the direct impact of import competition in the form of consumer goods, capital goods, raw materials or intermediate goods has a negative impact on firm's profits This could be the result of better quality products or a niche market developed by consumers opting for costly yet reputed machines. The results therefore show that profits of the firms are impacted by both import competition as well as competition in the domestic market. The procompetitive effect of IPR found in the study supports the profit reducing effect of import competition as reported by Kambhampati and Parekh (2003), Goldar and Kato (2008), Sen (2008). The findings are tested in dynamic framework and hence are robust to the biases induced due to reverse causality or endogeneity of regressors.

Table 3 shows the regression results of the various factors affecting the TFP of Machine Tools industry in the post-reform period.

The Durbin-Wu-Hausman statistic shows the presence of endogeneity in case of profits. There could be an issue of reverse causality between profits and the TFP. The firms with higher TFP would be more capable of taking up the endeavors for

increasing profits. Similarly, the firms with a higher profit would be more capable of investing in long term technology and research projects to increase their productivity.

Table 3.: GMM results with TFP as the dependent variable
(1993-94 to 2015-16)

Variables	Co-efficient	Std. Error	Pr(>|t|)
TFP_{it-1}	0.8776	0.0366	0.000***
PROF	0.0492	0.0283	0.086*
$IPR\ i_t$	-0.0237	0.0157	0.134
$IPR\ i_{t-1}$	-0.0323	0.0130	0.015**
$IPR\ i_{t-2}$	0.0022	0.0151	0.880
$RD\ i_t$	0.0197	0.0198	0.324
$RD\ i_{t-1}$	0.0100	0.0180	0.578
$RD\ i_{t-2}$	0.0206	0.0084	0.016**
$AD\ i_t$	0.0076	0.0199	0.701
$MS\ i_t$	0.0369	0.0305	0.228
$X\ i_t$	-0.0873	0.0161	0.000***
$X\ i_{t-1}$	-0.0010	0.0183	0.956
$X\ i_{t-2}$	0.0620	0.0195	0.002**
OWN	0.1817	0.1124	0.109
CU	0.0008	0.0007	0.304
AR1.	-4.61		0.000***
AR2	0.55		0.580
Hansen	57.41		0.386

Significance. codes '***' 0.01 '**' 0.05 '*' 0.1 los.

The results are seen to be less significant for the analysis presented above. The reduced significance might be explained as the result of inclusion of the lagged dependent variable which explains a large share of the contemporaneous productivity level. The study controls for lagged productivity since the TFP determinants are highly persistent (Dovis and Baleix, 2008). The other crucial firm specific variables like market share, exports and advertising are also accounted for in the model. The lagged value of IPR depicts a negative impact on TFP.

This indicates that the productivity enhancing hypothesis due to the presence of import competition does not hold true in case of machine tools industry. Excessive dependence on imports of intermediate raw materials and slower growth of domestic infrastructure for research and development could be some of the reasons for the recursive impact of competition on productivity. The impact of IPR on productivity has been discussed widely in literature. However, the analysis in dynamic framework enables the cumulative impact of import competition on firm productivity.

Table 4.: GMM results with CU as the dependent variable
(1993-94 to 2015-16)

Variables	Co-efficient	Std. Error	Pr(>|t|)
CU_{it-1}	0.8093	0.0732	0.000***
PROF	0.0101	0.0275	0.714
TFP	0.0055	0.0380	0.885
IPR i_t	0.0010	0.0505	0.983
IPR i_{t-1}	-0.0740	0.0433	0.091*
IPR i_{t-2}	-0.0278	0.0646	0.668
RD i_t	-0.0509	0.0667	0.448
RD i_{t-1}	0.0906	0.1053	0.391
RD i_{t-2}	-0.1242	0.1135	0.277
AD i_t	0.0016	0.0141	0.905
MS i_t	-0.0353	0.0888	0.692
X i_t	-0.1601	0.0977	0.104*
X i_{t-1}	0.1074	0.1147	0.351
X i_{t-2}	0.0944	0.0875	0.283
OWN	0.1736	0.3235	0.593
AR1.	-2.81		0.005***
AR2	0.51		0.609
Hansen	28.64		0.768

Significance. codes '***' 0.01 '**' 0.05 '*' 0.1 los.

Table 4 depicts the impact of import competition on capacity utilization of firm. The inclusion of this variable is of crucial importance as it represents the real dimension

of firm's production cycle. As against the financial performance indicators discussed above, this variable captures the total capacity utilized as against the total output potential of firm. The variables such as market share, TFP and IPR are found to be endogenous in the analysis. The results indicate that import competition affects firm's capacity utilization negatively. The pro-competitive effect of IPR on firm's profitability as seen earlier leads to firm cutting down on its variable cost. This could adversely affect output, thereby leading to fall in capacity utilization. The idling of resources due to cost cutting could lead to excess capacity and fall in productivity of resources; thereby creating a vicious circle.

Table 5.: GMM results with exports as the dependent variable
(1993-94 to 2015-16)

Variables	Co-efficient	Std. Error	Pr(>|t|)
X_{it-1}	0.4579	0.1401	0.001***
PROF	-0.0577	0.1025	0.574
TFP	0.0029	0.0096	0.758
IPR i_t	0.4418	0.0972	0.000***
IPR i_{t-1}	0.0907	0.1811	0.617
IPR i_{t-2}	-0.0774	0.0707	0.276
AD i_t	0.0356	0.0611	0.561
MS i_t	0.0197	0.0349	0.574
CU	0.0047	0.0025	0.065*
RD i_t	0.3479	0.2646	0.192
RD i_{t-1}	-0.3609	0.4137	0.385
RD i_{t-2}	0.1244	0.2670	0.642
K i_t	-1.0908	1.4210	0.445
K i_{t-1}	-0.3867	0.4405	0.382
K i_{t-2}	0.1653	0.2787	0.554
OWN	0.0563	0.1701	0.741
AR1.	-3.29		0.001***
AR2	0.46		0.646
Hansen	55.35		0.424

Significance. codes '***' 0.01 '**' 0.05 '*' 0.1 los.

Thus, investing in productivity enhancing activities is essential for creating a positive impact on firm's capacity utilization. The variable of exports is also seen to be affecting capacity utilization positively indicating that increased exports leads to better utilization of resources.

Table 5 depicts the impact of import competition and other variables on the exports of the firms. It can be seen from the table above that the effect of contemporaneous IPR on exports is positive. This supports the hypothesis that firms are benefitted in the export markets due to increase in import competition. The increase in capacity utilization is also seen to be yielding a positive impact on firm's exports. This indicates that the firms are benefitted in the export markets due to increased capacity utilization.

The study further analyzes the risk of doing business in the following section. The regression results have been presented in the section below. The variables representing the risk of doing business such as variance in cash flow measure (VCFM), coefficient of variance of return on assets (VCROA) and coefficient of variance of return on capital employed (VROCE) have been regressed on import competition and other important variables to examine how competition from imports affects the risk of doing business in case of machine tools industry. Table 5, 6 and 7 below present the regression results for VCFM, VCROA and VROCE respectively. The analysis of the risk given in the tables 6, 7 and 8 depicts the notion that business risk is negatively related to advertising expenditure, market share, import competition, TFP and rate of capacity utilization. This proves the hypothesis that the risk involved in doing business is reduced with the increasing capacity utilization, TFP and market share of the firms. At the same time, it also validates the use of three variables as risk indicators. The negative relationship between risk and import competition also bring out an interesting finding that the negative spillovers of competition are outweighed by the positive externalities. That is, the firm's risk of doing business is not increased due to rise in import competition. On the other hand, the firms may be able to reduce their risk and sustain better in the competitive atmosphere. Creation of niche markets or adoption of more efficient methods of production leading to better quality output could be some of the factors contributing to their sustenance.

Table 6.: Regression results with VCFM as the dependent variable
(1993-94 to 2015-16)

Variable	Coefficient	Standard Error	P-value
PROF	0.0130	0.0127	0.309
K	0.0473	0.1344	0.725
AD	-0.0087	0.0056	0.124
RD	-0.0020	0.0052	0.703
IPR	-0.0087	0.0057	0.130
X	0.0063	0.0042	0.141
MS	-0.0047	0.0033	0.155
TFP	-0.0008	0.0005	0.116
CU	-0.0296	0.0143	0.040**

Table 7.: Regression results with VCROA as the dependent variable
(1993-94 to 2015-16)

Variable	Coefficient	Standard Error	P-value
PROF	0.0179	0.0131	0.177
K	0.0039	0.1389	0.978
AD	-0.0108	0.0058	0.066*
RD	-0.0033	0.0054	0.535
IPR	-0.0097	0.0059	0.102*
X	0.0069	0.0044	0.118
MS	-0.0051	0.0034	0.133
TFP	-0.0009	0.0005	0.097*
CU	-0.0357	0.0147	0.017

Table 8.: Regression results with VROCE as the dependent variable (1993-94 to 2015-16)

Variable	Coefficient	Standard Error	P-value
PROF	0.0180	0.0153	0.241
K	0.0242	0.1705	0.887
AD	-0.0049	0.0068	0.475
RD	-0.0014	0.0063	0.823
IPR	-0.0080	0.0067	0.230
X	0.0045	0.0052	0.387
MS	-0.0064	0.0037	0.093*
TFP	-0.0004	0.0006	0.470
CU	-0.0370	0.0165	0.028**

After analyzing the performance of Machine Tools industry for the entire period of 1993-94 to 2015-16, the study tries to find if the initial period of reforms had a negative effect on performance as against the latter years, whereby, the firms learnt their lessons and ultimately emerged competitive in the world markets. The study investigates this by dividing the time period during post-reforms into two sub-components. One period chosen for analysis is 1993-94 to 2004-05 and the other period chosen is from 2005-06 to 2015-16. The year 2004-05 has been considered as the demarcation year on the grounds of turnaround of events that happened in the Indian economy during that period (Parikh and Radhakrishnan, 2004). The first decade of liberalization witnessed a slump in the manufacturing growth rate from 7.63 in 1980s to 6.22 per cent (Bhat, 2014). The machine tool industry's output registered a Compounded Annual Growth Rate (CAGR) of 3.12 percent during the period of 1993-94 to 2004-05. This initial period can be seen as the time taken for adjustment to get accustomed to the watershed reforms. The financial crises in 1997-98 further hampered the manufacturing growth. During the decade of 2005-06 to 2012-13, the manufacturing sector grew at about 8.27 percent per annum on an average. The growth witnessed in machine tools stood at 10.30 percent (Bhat, 2014). The rise in imports also has been substantial during this period due to falling tariff rates and removal of several import restrictions on consumer goods. The study further states that nearly eighty-three percent of industries grew at modest rate during this period. However, machine tools and

transport equipment industry were amongst the few which registered high growth rates. High degree of complementarity due to rise in linkages with other sectors such as automobile components, construction and hotel industry resulted in spurt in demand. This decade also noticed a considerable rise in intra-industry trade and rising capital in production process.

4.2. Effect of import competition on machine tool performance (1993-94 to 2004-05):

Liberalization of imports during 1991 led to a significant spurt in imports from 1991-1998. This trend was slightly reversed between 1998 and 2003. Goldar (2004) stated that the tariff rates were not reduced during 1998 to 2003. This could have arrested the upward trend in import penetration during this period. However, the quantitative restrictions on imports for a large number of consumer goods were lifted leading to a marked increase in their imports. The growth rate of productivity also depicted a decline during this period. This section analyzes the effect of import competition on the performance of machine tools industry during 1993-94 to 2004-05. The results presented in table 9 depict the positive influence of one year lagged profits on the present level of profitability. The lagged value of capital and RandD are seen to exhibit positive impact on profitability in the earlier period of reforms. Lagged value of IPR is seen to exhibit a negative influence on profitability of firms.

This could be the result of an increased competition in the domestic markets. The immediate impact of competition need not necessarily be negative as the firms could benefit from their brand value or product differentiation. The effect of competition on pricing can only be observed after some time has passed. The firms with foreign ownership are seen to earn higher profits in this industry. The impact of capacity utilization is also observed to be positive in the early phases of reforms. The Compound Annual Growth Rate (CAGR) of capacity utilization during 1993-94 to 2004-05 is 0.55 percent. This shows that the reforms brought about better utilization of resources. Goldar (2004) states that though major reforms began in 1991, the process of tariff reduction was spread over a longer period of time.

Table 9.: GMM results with profit as the dependent variable (1993-94 to 2004-05)

Variables	Co-efficient	Std. Error	Pr(>|t|)
PROF $_{it-1}$	0.2704	0.0781	0.001***
K i_t	0.2792	0.3142	0.377
K i_{t-1}	1.0575	0.3494	0.003**
K i_{t-2}	0.3179	0.1190	0.009***
IPR i_t	0.0753	0.0249	0.003***
IPR i_{t-1}	-0.0067	0.0266	0.802
IPR i_{t-2}	-0.0656	0.0330	0.050**
RD	0.0690	0.0340	0.046**
RD i_{t-1}	-0.0980	0.0366	0.009***
RD i_{t-2}	0.1132	0.0456	0.015**
MS i_t	0.0547	0.0167	0.002***
AD i_t	-0.0411	0.0298	0.172
X i_t	-0.0038	0.0361	0.915
X i_{t-1}	-0.0239	0.0235	0.312
X i_{t-2}	0.0123	0.0167	0.464
OWN	0.1301	0.0698	0.066*
CU	0.0033	0.0014	0.029**
AR1.	-2.47		0.013**
AR2	0.03		0.974
Hansen	28.56		0.807

Significance. codes '***' 0.01 '**' 0.05 '*' 0.1 los.

The initial cuts may not have had much effects because of tariff redundancy and the devaluation of rupee in 1991. Also imports of consumer goods were freed from quantitative restrictions only after 2001. One possible explanation could be that the positive effects of reforms were neutralized by the adverse effects of some other factors. Kathuria *et al*., (2014) stated that the growth in machine tools industry registered a sharp fall during the period 1993-94 to 2004-05.

The findings that the TFP growth rate slumped during the post-reform should not be indicative of the reforms having a negative impact on firm performance. As stated in Kathuria *et al*., (2014), presence of exit barriers due to huge sunk costs, poor market integration, high concentration and dominant state ownership could have adversely affected efficiency of private sector manufacturing firms in the industry during the early reform period.

Table 10.: GMM results with TFP as the dependent variable
(1993-94 to 2004-05)

Variables	Co-efficient	Std. Error	Pr(>|t|)
TFP_{it-1}	0.7232	0.1445	0.000***
$IPR\ i_t$	0.1853	0.1376	0.182
$IPR\ i_{t-1}$	-0.2557	0.1839	0.168
$IPR\ i_{t-2}$	-0.2355	0.1154	0.044**
$RD\ i_t$	0.0917	0.2118	0.666
$RD\ i_{t-1}$	0.0217	0.2226	0.922
$RD\ i_{t-2}$	-0.1330	0.1261	0.295
PROF	0.0758	0.1202	0.533
$AD\ i_t$	0.1284	0.1121	0.255
$MS\ i_t$	-0.1566	0.1049	0.139
$X\ i_t$	-0.2850	0.1336	0.036**
$X\ i_{t-1}$	-0.0456	0.1876	0.808
$X\ i_{t-2}$	0.1766	0.1300	0.178
OWN	1.1331	0.4942	0.024**
CU	0.0164	0.0054	0.003***
AR1.	-1.55		0.121
AR2.	-1.33		0.184
Hansen	4.74		0.980

Significance. codes '***' 0.01 '**' 0.05 '*' 0.1 los

Table 10 presents the GMM results using TFP as the dependent variable. The results show that lagged vale of TFP exerts a positive significant impact on the current TFP. The effect of two period lagged IPR depicts a negative significant co-efficient. As

stated earlier, the studies such as Virmani and Hashim (2011) have found evidence for the J- curve of liberalization and productivity in their study of organized manufacturing. The study finds a higher growth rate of productivity in the next decade of reforms as compared to the initial period of 1993-94 to 1997-98. The adverse impact of import competition on TFP could also be the result of the immediate onslaught of liberalization on machine tools industry. Hence, it can be inferred that firms were not able to reap the positive impact of import competition in the initial years of reforms. This could be the result of lack of adequate technology or infrastructure to support and encourage the growth of productivity enhancing production techniques.

Table 11.: GMM results with CU as the dependent variable
(1993-94 to 2004-05)

Variables	Co-efficient	Std. Error	Pr(>|t|)
CU_{it-1}	0.3849	0.1471	0.011**
PROF	-0.0037	0.0953	0.969
IPR i_t	0.1272	0.0767	0.101
IPR i_{t-1}	-0.0818	0.0332	0.016**
IPR i_{t-2}	-0.0240	0.0284	0.400
RD i_t	-0.0506	0.0786	0.522
RD i_{t-1}	-0.0525	0.0944	0.579
RD i_{t-2}	0.1775	0.0866	0.044**
AD i_t	-0.0522	0.0453	0.253
MS i_t	0.2703	0.0795	0.001***
X i_t	0.0424	0.0430	0.326
X i_{t-1}	0.0045	0.0547	0.934
X i_{t-2}	0.0166	0.0547	0.762
OWN	-0.3146	0.2123	0.142
TFP	0.0559	0.0367	0.131
AR1.	-2.77		0.006***
AR2.	-1.30		0.193
Hansen	41.36		0.124

Significance. codes '***' 0.01 '**' 0.05 '*' 0.1 los

The firms with foreign ownership are seen to exhibit higher productivity. Advanced infrastructure coupled with better quality raw materials and imported inputs could be some of the reasons for higher productivity of these foreign counterparts. The effect of capacity utilization as hypothesized earlier, also depicts a positive impact on productivity during initial decade of reforms.

Table 11. demonstrates the effect of import competition and other variables on the capacity utilization during the initial period of financial reforms. The impact of lagged value of import competition on capacity utilization in the initial period is seen to be negative. The negative impact of competition on TFP along with the fall in profits of the firms could be adversely affecting the performance of machine tools industry. Hence, the effect of import competition on capacity utilization is seen to be negative during the earlier period of reforms. The firms with a higher market share and RandD are seen to exhibit positive impact on capacity utilization.

Table 12.: GMM results with Export as the dependent variable
(1993-94 to 2004-05)

Variables	Co-efficient	Std. Error	Pr(>|t|)
X_{it-1}	0.6961	0.1760	0.000***
PROF	-0.1013	0.1353	0.456
IPR i_t	0.7035	0.3817	0.069*
IPR i_{t-1}	0.0515	0.1756	0.770
IPR i_{t-2}	0.0560	0.1657	0.736
K i_t	1.3877	0.8764	0.117
K i_{t-1}	-1.8273	2.5804	0.481
K i_{t-2}	-2.5812	2.6340	0.330
RD	-0.1793	0.5052	0.724
RD i_{t-1}	0.1734	0.5250	0.742
RD i_{t-2}	0.0169	0.5664	0.976
AD i_t	-0.0597	0.0812	0.464
MS i_t	0.0045	0.0617	0.941
CU	-0.2548	0.1996	0.205
OWN	-0.3482	0.4214	0.411
TFP	0.0017	0.0203	0.932
AR1.	-2.96		0.003***
AR2.	-1.10		0.271
Hansen	13.59		0.480

Significance. codes '***' 0.01 '**' 0.05 '*' 0.1 los

Table 12 shows the effect of import competition and other variables on exports of firms during the initial period of reforms. The present value of import competition is said to be positively impacting RandD of the firm. Increased competition from imports could promote firms to have better access to imported raw materials and technology. This could result into a higher competitiveness in the export markets. The lagged value of exports is also seen to be impacting the present export value positively suggesting that the firms with the existing export market for their products benefitted their past export values.

4.3. Effect of import competition on machine tool performance (2005-06 TO 2015-16):

Indian machine tools industry registered growth in domestic production and consumption during the period 2003-04 to 2005-06 (IBEF, 2008). However, the share of indigenous machine tools in India's consumption reduced to just about 25 percent (IMTMA, 2006). The imports of this industry were restricted to specialized machine tools not produced indigenously. These mostly included high speed, high precision and heavy-duty machines. The exporters in this sector also imported their capital goods under export promotion and credit guarantee schemes on price consideration.

Thus, this period marked the start of a new phase of opportunities and challenges for Indian machine tools industry. The industry registered a positive TFP growth rate during the period of 2005-06 to 2012-13. This section analyzes the impact of import competition on the performance of this industry during the next decade of reforms.

The analysis using GMM estimator is presented in table 13. The effect of import competition on profit during post-reforms is not observed to be significant. The two year lagged value though negative, does not portray a significant coefficient. The two year lagged value of exports depicts a negative impact on firm profits. This could be indicative of the fact that the firms wanting to participate in the export markets have to compromise on their profit margins. The appreciation of Real Effective Exchange Rate (REER) in this period is also found to be higher as compared to the period 1993-94 to 2004-05. This could have also resulted in the firms losing in the export markets.

Table 14 shows the analysis of TFP in a dynamic framework. The lagged value of TFP depicts a positive and significant influence on the current TFP level. Thus, the firms which were productive in the previous periods were more capable of undertaking productivity enhancing measures later on. As stated earlier, reduced significance might be explained as the result of inclusion of the lagged dependent variable explaining a large share of the contemporaneous productivity level.

Table 13.: GMM results with Profit as the dependent variable
(2005-06 to 2015-16)

Variables	Co-efficient	Std. Error	Pr(>|t|)
$PROF_{it-1}$	0.2752	0.1644	0.098*
K_{it}	-0.3484	2.0490	0.865
K_{it-1}	0.0895	1.1334	0.937
K_{it-2}	-0.0202	0.1239	0.871
IPR_{it}	0.0066	0.0688	0.923
IPR_{it-1}	0.0082	0.0988	0.934
IPR_{it-2}	-0.0002	0.1006	0.998
RD_{it}	-0.4404	0.3035	0.151
RD_{it-1}	-0.0327	0.3136	0.917
RD_{it-2}	0.2175	0.1736	0.214
$MS\ i_t$	0.1064	0.1320	0.422
$AD\ i_t$	0.0914	0.0607	0.137
$X\ i_t$	0.0851	0.1202	0.481
$X\ i_{t-1}$	0.0747	0.1163	0.522
$X\ i_{t-2}$	-0.1386	0.0775	0.078*
OWN	-0.1384	0.3178	0.664
CU	-0.0018	0.0050	0.721
AR1.	-1.46		0.144
AR2	-1.44		0.149
Hansen	38.54		0.233

Significance. codes '***' 0.01 '**' 0.05 '*' 0.1 los.

The co-efficient of two year lagged exports depicts a positive effect on TFP levels. This hints towards the productivity enhancing effect of exports over a longer time period in the machine tools industry during latter years of reforms. The variable of capacity utilization also bears a positive impact on productivity of machine tools industry in the later years of reforms.

Table 14.: GMM results with TFP as the dependent variable
(2005-06 to 2015-16)

Variables	Co-efficient	Std. Error	Pr(>|t|)
TFP_{it-1}	0.9734	0.0344	0.000***
$IPR\ i_t$	-0.0213	0.0383	0.580
$IPR\ i_{t-1}$	-0.0037	0.0527	0.943
$IPR\ i_{t-2}$	0.0103	0.0539	0.848
$RD\ i_t$	0.2120	0.1577	0.186
$RD\ i_{t-1}$	-0.0787	0.1186	0.511
$RD\ i_{t-2}$	-0.0327	0.0396	0.414
$MS\ i_t$	-0.0235	0.0410	0.568
$AD\ i_t$	-0.0184	0.0299	0.542
$X\ i_t$	-0.0521	0.0651	0.428
$X\ i_{t-1}$	-0.0361	0.0703	0.610
$X\ i_{t-2}$	0.0952	0.0484	0.056*
OWN	0.1641	0.1845	0.379
CU	0.0034	0.0019	0.082*
AR1.	-2.65		0.008***
AR2	0.57		0.572
Hansen	6.43		0.893

Significance codes '***' 0.01 '**' 0.05 '*' 0.1 los.

Table 15 demonstrates the effect of import competition and other variables on the capacity utilization during the latter period of reforms. The impact of rise in exports on capacity utilization in the later period of reforms is seen to be positive. The lagged effect of import competition on capacity utilization is seen to be negative yet insignificant for the later period of reforms.

Table 15.: GMM results with CU as the dependent variable
(2005-06 to 2015-16)

Variables	Co-efficient	Std. Error	Pr(>|t|)
CU_{it-1}	0.7405	0.2413	0.003***
PROF	-0.0689	0.1129	0.543
IPR i_t	0.0395	0.0876	0.653
IPR i_{t-1}	-0.0767	0.0895	0.394
IPR i_{t-2}	-0.0320	0.0525	0.544
RD i_t	0.1439	0.1321	0.279
RD i_{t-1}	-0.2331	0.1499	0.124
RD i_{t-2}	0.0612	0.1411	0.666
AD i_t	-0.0086	0.0302	0.777
MS i_t	-0.0181	0.0663	0.785
X i_t	-0.1140	0.0897	0.207
X i_{t-1}	-0.0645	0.1135	0.571
X i_{t-2}	0.2192	0.1144	0.059*
OWN	0.0629	0.2055	0.760
TFP	-0.0226	0.0593	0.703
AR1.	2.34		0.019**
AR2.	-0.32		0.750
Hansen	24.72		0.590

Significance. codes '***' 0.01 '**' 0.05 '*' 0.1 los

Table 16 shows the effect of import competition and other variables on exports of firms during the period of 2005-06 to 2012-13. Rise in the level of import competition is seen to positively impact firm's exports. The coefficient of lagged value of RandD also depicts a positive impact on firm's exports. The firm with foreign ownership is seen to have a higher level of exports as compared to the domestic firm. One percent rise in the TFP of a firm is seen to increase the exports of the firm by 0.03 percent.

Table 16.: GMM results with export as the dependent variable (2005-06 to 2015-16)

Variables	Co-efficient	Std. Error	Pr(>|t|)
X_{it-1}	0.0454	0.1076	0.674
PROF	-0.1688	0.2265	0.458
IPR i_t	0.2808	0.1163	0.018**
IPR i_{t-1}	-0.0498	0.1649	0.763
IPR i_{t-2}	-0.2834	0.1950	0.150
K i_t	0.7235	1.0595	0.497
K i_{t-1}	-0.3335	2.5373	0.896
K i_{t-2}	-1.1538	2.4689	0.642
AD i_t	0.1343	0.1185	0.260
MS i_t	0.0184	0.0578	0.750
RD i_t	0.5880	0.3960	0.141
RD i_{t-1}	0.6540	0.3768	0.086*
RD i_{t-2}	-0.1845	0.2927	0.530
OWN	1.4130	0.4296	0.001**
CU	-0.2548	0.1996	0.205
TFP	0.0375	0.0202	0.067*
AR1.	2.40		0.017**
AR2.	-0.26		0.794
Hansen	14.19		0.223

Significance. codes '***' 0.01 '**' 0.05 '*' 0.1 los.

5. CONCLUSIONS:

The present study has analyzed the effect of import competition on the performance of Machine tools industry. The five indicators used in the study (profitability, TFP, CU, business risk and exports) present a holistic picture of company's financial and operational performance. The analysis exhibits profit reducing effect of import competition in this industry. The study presents the evidence that while import competition may have an adverse effect on performance, increased investment in RandD and optimum utilization of capacity can counter such negative impact.

The analysis carried out a disaggregated level further suggests that the firms in this industry still tend to be heavily dependent on the imports of sophisticated intermediates. Several government initiatives such as 100 per cent allowance of FDI, exemption from obtaining industrial licensing, reduction in import duties have increased the role of foreign participation in machine tools industry. This however, has to be complimented with the attempts of uplifting the indigenous productivity levels in order to make this industry competitive at the global front. Investing in RandD activities and infrastructure to develop expertise in high end technology machine tools is instrumental for increasing productivity of this industry.

Some of the main challenges as well as growth opportunities facing the Indian machine tools industry are the growing use of Computer Numerical Control (CNC) machine tools, heightened demand from automobile industry, consumer durables and aerospace, *etc*. According to a study by IMTMA (2015), growth in the manufacturing sector has led to a rapid increase in demand, especially for increasingly sophisticated CNC machines. While imports have risen to meet the demand, local capacity in machine tools needs to be built to cater to its long term growth trajectory.

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