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Import Penetration and Capacity Utilization in Indian Industries

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Import Penetration and Capacity Utilization in Indian Industries

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Abstract

The paper analyzes trends in import penetration and capacity utilization in Indian industries in the post-reform period. An attempt is made to assess econometrically the impact of import penetration on capacity utilization in Indian industrial firms using a dataset covering 62 industrial firms for eight years, 1996-97 to 2003-04. The selected firms belong to industries that encountered significant import penetration during 1996-2003. The analysis of trends reveals that a liberalization of imports of manufactures led to a significant increase in import penetration between 1991 and 1998, which was followed by a slight decrease in import penetration between 1998 and 2003. Estimates of capacity utilization presented in the paper show that capacity utilization in organized manufacturing fell between 1995 and 2001, but rose between 2001 and 2004. Firm-level analysis of the determinants of capacity utilization, based on cross-sectional regression and estimates of a dynamic model, brings out that capacity utilization is positively related to size of the firm, market share and market concentration. There are indications from the econometric results that while import penetration may have a short-term adverse effect on capacity utilization in industries, over time firms are able to make adjustments and thus contain, and even neutralize, the adverse effect.

Key words: Trade liberalization, Import penetration, Capacity utilization

JEL Classification: D24, F14

Import Penetration and Capacity Utilization in Indian Industries

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1. INTRODUCTION

Since 1991, there has been a progressive and cumulatively large reduction in the level of tariff protection of Indian industries, accompanied by an extensive relaxation of quantitative restrictions on imports of manufactures. The unweighted average rate of tariff (excluding countervailing duty and specific exemptions) on imports of manufactured products was 122% in 1986 and 129% in 1991, which declined to 40% in 1996 and 35% in 1998. There was further reduction in tariff rates from 2004 onwards, and the unweighted average tariff rate on manufactured product imports came down to 12% in 2007 (Pursell et al., 2007).[1] As regards quantitative restrictions (QRs) on imports of manufactures, by the end of the 1980s, about 90% of manufacturing value added was subject to import QRs. This proportion declined to about 46% in May 1992 and further to about 36% by May 1995 (Pursell et al., 2007). After 1995 and the completion of the Uruguay Round, India's remaining industrial QRs were contested at the WTO (World Trade Organization) by other WTO members (including the US and the EU). India therefore had to phase out the remaining QRs which were not compatible with WTO rules; this process started in 1998 and finished in April 2001.[2] Thus, by April 2007, the conventional QR coverage of manufacturing in the aggregate declined to only about half of one percent of manufacturing GDP (Gross Domestic Product), although two large industries namely, Sugar and Urea remained protected (Pursell et al., 2007).

The post-1991 liberalization of imports of manufactured products in India has led to a marked increase in imports of manufactures. The ratio of manufactured product

[1] Between 1996-97 and 2003-04, there was only a small decline in the average tariff rate. The tariff rates started declining when a fresh round of tariff cuts began from 2004.

[2] Another factor that led to the removal of QRs in the period after 1995 is India's commitments under the Agreement on Textiles and Clothing. See Goldar (2005) and Pursell and Sattar (2003).

imports to manufacturing GDP increased from about 30% in 1990 to slightly less than 60% in 2006 (Pursell et al., 2007). This increase in imports of manufactured products has been accompanied by a sharp increase in manufactured product exports, which has grown faster than manufactured product imports. The ratio of manufactured product exports to manufacturing GDP increased from about 30% in 1990 to a little over 60% in 2006 (Pursell et al., 2007).

The object of this paper is to (a) analyze the increase in import penetration in the domestic markets of the Indian manufacturing industries resulting from the liberalization of imports of manufactured products, and (b) assess the effect of increased import penetration on capacity utilization in Indian industries. These are important issues to study because the magnitude of productivity gains that may accrue to domestic industries from trade liberalization depends, among other factors, on whether and how far capacity utilization in industries is affected by trade liberalization.

The rest of the paper is organized as follows: Trends in import penetration in Indian manufacturing industries in the post-reform period are analyzed in Section 2. Trends in capacity utilization in organized manufacturing in the post-reform period are analyzed in Section 3. This is followed by a firm-level analysis of the effect of import penetration on capacity utilization in Section 4. The main findings of the study are summarized and some concluding remarks are made in Section 5.

2. TRENDS IN IMPORT PENETRATION IN INDIAN INDUSTRIES

Das (2003) undertook a study of import penetration ratios[3] for 72 three-digit industries in India.[4] The analysis revealed an upward trend in the average level of import penetration in Indian industries in the post-reform period. According to his estimates, the average

[3] Das computed the import penetration ratio as, $MPR_j=M_j/(P_j+M_j-X_j)$, where P, M and X denote production, imports and exports, and subscript j is for industry.

[4] Das used *Annual Survey of Industries* (ASI) data (Central Statistical Organization, Government of India) for value of production and thus covered only the organized manufacturing sector. Data on imports and exports were taken from the *Monthly Statistics of Foreign Trade* (Ministry of Commerce, Government of India). The trade data related to both organized and unorganized industry. ASI provides data for about 150 three-digit industries. Of these, Das covered about half. However, in terms of value added in organized manufacturing, the selected industries had a share of about 70%.

value of the import penetration ratio for these 72 industries increased from about 11% in the period 1986-90 to about 16% in the period 1996-2000. An increase in the import penetration ratio was found for all the three use-based industry groups into which the 72 industries were divided: intermediate goods (from 13% in 1986-90 to 18% in 1996-2000), capital goods (from 12% to 19%) and consumer goods (from 4% to 10%).

For this study, import penetration ratios have been computed from the input-output tables (commodity×industry absorption matrix) prepared by the Central Statistical Organization, Government of India. Following Das (2003), the import penetration ratio (MPR) of each (manufacturing) industry j is computed as:

$$MPR_j=M_j/(P_j+M_j-X_j), \quad \ldots (1)$$

where P, M and X denote production, imports and exports, respectively, and subscript j is for industry. Input-output tables for 1983-84, 1989-90, 1993-94, 1998-99 and 2003-04 have been used for the analysis, as the source of data on domestic production, exports and imports of different industries. The advantage of using the input-output tables as the database for the analysis is that the coverage is complete; both organized and unorganized manufacturing sectors are covered and all the manufacturing industries are included. The disadvantage is that a continuous time series cannot be built; the input-output tables are available only for some select years and therefore import penetration ratios can be computed only for those years.

Table 1 shows the import penetration ratios for 66 manufacturing industries (the sectors of the input-output tables belonging to manufacturing) for the years 1983-84, 1989-90, 1993-94, 1998-99 and 2003-04. It is seen from the table that between 1989-90 and 1998-99 there was an increase in import penetration in most industries. In many cases, the increase in the import penetration ratio was significant, reaching a 20% or higher level. In some cases, the import penetration ratio in 1998-99 even exceeded 40%. It may be concluded therefore that in the first eight years of the post-reform period, 1991-92 to 1998-99, there was increasing import penetration of the domestic markets of Indian industries caused by the liberalization of imports.

It is interesting to note that the upward trend in import penetration ratio did not persist after 1998-99. Between 1998-99 and 2003-04, there was an increase in the import penetration ratio in some industries, but in a larger number of industries, there was a fall in the import penetration ratio. The average import penetration ratio in Indian industries increased from about 9% in 1989-90 to about 16% in 1998-99, but declined to about 14% in 2003-04.[5]

Table 1: Import Penetration in Indian Industries, 1983-84 to 2003-04, Select Years

Industry	Import penetration ratio (%)				
	1983-84	1989-90	1993-94	1998-99	2003-04
Sugar	0.0	1.6	0.0	8.2	0.3
Khandsari, boora	0.0	0.0	0.1	0.6	0.0
Hydrogenated oil	0.0	0.0	0.0	0.0	0.0
Edible oil other than vanaspati	12.5	4.4	10.0	21.7	25.5
Tea and coffee processing	0.0	0.0	0.1	1.1	0.9
Miscellaneous food products	1.4	2.2	1.7	0.6	0.7
Beverages	0.3	0.9	0.3	0.7	0.3
Tobacco products	0.0	0.1	0.1	0.1	0.3
Khadi, cotton textile in handloom	0.0	0.0	0.2	2.1	10.6
Cotton textiles	0.1	0.3	0.3	1.5	3.7
Woolen textile	5.3	4.5	19.9	21.9	23.8
Silk textiles	0.5	14.9	26.6	24.9	67.5
Art silk, synthetic fibre textiles	2.0	1.7	2.5	2.5	6.3
Jute, hemp, mesta textiles	1.5	0.1	3.6	3.8	4.5
Carpet weaving	0.0	0.0	0.4	4.5	7.5
Ready made garments & made up	2.3	7.2	9.3	18.2	1.0
Miscellaneous textile products	1.3	2.3	5.1	10.3	6.8
Furniture & fixtures	0.0	0.0	0.0	0.1	0.5
Wood and wood products except furniture & fixtures	0.2	1.1	0.5	1.2	12.5
Paper, paper products & newsprint	15.1	15.0	16.9	29.6	17.3
Printing publishing and allied	6.1	6.4	7.6	20.8	6.2
Leather footwear	0.2	1.6	2.3	1.8	1.3
Leather & leather products except leather footwear	1.2	6.2	12.1	12.4	13.9
Rubber products	1.5	1.8	2.6	4.1	4.7
Plastic products	2.4	3.4	2.8	11.8	5.3
Petroleum products	14.8	15.4	30.0	27.1	10.5
Coal tar products	0.0	27.3	34.9	43.4	22.1

[5] The wide fluctuations in the import penetration ratio found in Table 1 for some of the industries (e.g. motor vehicles) might be due to data incomparability, i.e. the data on output and trade flows reported in the input-output tables for different years may not be comparable in such cases. However, the overall inter-temporal pattern of change in import penetration ratios observed in the table seems reliable.

(Table 1 continued)

Industry	Import penetration ratio (%)				
	1983-84	1989-90	1993-94	1998-99	2003-04
Inorganic heavy chemicals	19.8	28.4	26.8	30.8	17.7
Organic heavy chemicals	29.6	26.8	48.4	47.4	50.9
Fertilizers	6.5	14.8	16.5	11.2	6.7
Pesticides	8.8	3.6	0.3	3.2	7.2
Paints, varnishes & lacquers	2.8	6.3	5.0	7.2	8.9
Drugs and medicines	6.6	4.3	2.1	2.4	2.7
Soaps, cosmetics & glycerine	3.1	4.7	4.6	10.0	1.5
Synthetic fibres, resin	18.4	19.0	14.0	32.9	18.5
Other chemicals	8.9	7.1	9.1	14.9	14.1
Structural clay products	2.9	1.8	0.8	2.0	1.9
Cement	6.3	0.1	0.0	0.0	0.1
Other non-metallic mineral products	51.0	4.8	74.2	77.6	51.5*
Iron & steel and ferro alloys	8.2	25.3	7.8	6.4	9.8
Iron and steel casting and forging	1.2	11.2	6.2	6.4	3.6
Iron and steel foundries	16.4	4.5	9.8	13.1	3.6
Non-ferrous basic metals	23.7	13.8	20.2	52.7	59.3
Hand tools, hardware	3.6	6.5	5.7	7.9	9.5
Miscellaneous metal products	7.4	0.6	1.3	2.3	2.4
Tractors and other agricultural machinery/implements	6.1	0.7	3.5	2.3	0.8
Industrial machinery for food & textiles	15.1	20.4	27.4	27.2	33.1
Industrial machinery (except food & textiles)	53.8	48.7	50.4	63.0	23.6
Machine tools	33.3	23.3	27.3	44.4	17.2
Office computing and accounting machinery	40.4	1.3	9.7	11.3	23.7
Other-non-electrical machinery	25.2	15.1	32.1	41.3	
Electrical industrial machinery	9.4	6.7	20.9	23.2	6.3
Electrical cables, wires	2.9	2.1	2.6	4.1	3.4
Batteries	1.8	6.0	2.8	7.7	7.0
Electrical appliances	5.1	3.8	10.4	18.6	2.4
Communication equipment	22.1	31.5	24.3	46.6	19.9
Other electrical machinery	46.7	39.0	49.8	45.4	11.9
Electronic equipment incl. television	17.0	14.3	13.0	28.3	55.3
Ships and boats	19.6	6.4	17.3	32.9	85.9
Rail equipment	2.4	2.6	1.4	4.1	5.2
Motor vehicles	2.4	2.7	35.7	5.0	3.9
Motor cycle and scooter	0.5	1.3	0.0	1.0	0.4
Bicycles, cycle-rikshaw	0.2	0.7	0.7	1.2	0.1
Other transport equipment	3.5	1.5	6.9	6.4	6.8
Watches and clocks	12.0	7.2	5.2	11.1	11.4
Miscellaneous manufacturing	24.1	28.4	40.2	36.4	74.5
Average	**9.7**	**8.6**	**12.5**	**16.1**	**14.1**

* includes Gems and Jewellery

Source: Authors' calculations based on Input-output tables prepared by the Central Statistical Organization, Ministry of Statistics and Programme Implementation, Government of India.

Some discussion on the changes in the export intensity of Indian industries in the post-reform period would be in order here. The ratio of exports to domestic production in various manufacturing industries in the years 1983-84, 1989-90, 1993-94, 1998-99 and 2003-04, computed from the input-output tables, is shown in Table 2. In a majority of cases, there was an increase in export intensity in the period 1989-90 to 1998-99 as shown by the ratio of exports to output in the table. The average value of the ratio of exports to output increased from about 10% to about 14% between 1989-90 and 1998-99. But, between 1998-99 and 2003-04, export intensity fell in about half of the manufacturing industries with the consequence that the average value of the ratio of exports to output of manufacturing industries declined from 13.9% in 1998-99 to 13.1% in 2003-04. Evidently, there is similarity in the direction of movement in the average levels of import penetration ratio and export intensity in Indian industries, both increasing in the period 1989-90 to 1998-99 and falling in the period 1998-99 to 2003-04.

Table 2: Ratio of Exports to Output in Indian Industries, 1983-84 to 2003-04, Select Years

Industry	Ratio of Exports to Output (%)				
	1983-84	1989-90	1993-94	1998-99	2003-04
Sugar	6.6	0.3	1.4	0.0	3.3
Khandsari, boora	9.8	2.3	3.6	0.4	0.0
Hydrogenated oil	0.0	0.0	0.4	0.9	0.0
Edible oil other than vanaspati	2.8	8.9	17.0	5.8	9.9
Tea and coffee processing	23.9	25.4	17.4	27.0	15.3
Miscellaneous food products	3.2	14.0	7.3	3.1	7.6
Beverages	0.1	1.3	1.3	0.7	0.4
Tobacco products	1.0	3.4	2.4	3.4	2.2
Khadi, cotton textile in handloom	4.4	4.2	14.5	16.7	31.3
Cotton textiles	2.6	5.4	9.6	13.8	11.6
Woolen textile	2.1	3.9	6.3	12.9	10.1
Silk textiles	6.2	24.8	21.9	32.8	66.7
Art silk, synthetic fibre textiles	0.7	2.3	5.7	9.9	13.5
Jute, hemp, mesta textiles	15.8	13.5	13.0	12.0	8.6
Carpet weaving	60.4	65.4	65.8	66.4	69.6
Ready made garments & made up	36.4	70.3	75.6	76.4	60.8
Miscellaneous textile products	3.3	4.9	13.1	22.5	11.3
Furniture & fixtures	0.3	0.1	0.4	0.5	3.0
Wood and wood products except furniture & fixtures	1.6	2.0	2.5	1.1	2.2
Paper, paper products & newsprint	3.2	3.7	3.6	14.3	4.4
Printing publishing and allied	2.1	1.5	1.5	3.9	1.6
Leather footwear	19.2	35.5	36.3	37.2	10.7
Leather & leather products except leather footwear	41.8	51.7	49.5	44.9	48.9

(Table 2 continued)

Industry	Ratio of Exports to Output (%)				
	1983-84	1989-90	1993-94	1998-99	2003-04
Rubber products	1.7	3.6	8.1	8.8	16.1
Plastic products	2.6	2.9	7.7	9.8	6.8
Petroleum products	4.3	4.4	5.6	0.9	7.9
Coal tar products	0.0	0.0	0.0	0.0	2.5
Inorganic heavy chemicals	1.7	16.5	8.2	17.1	5.9
Organic heavy chemicals	2.6	9.2	23.9	33.7	44.4
Fertilizers	0.0	0.0	1.1	0.2	0.1
Pesticides	0.9	7.7	5.9	13.4	18.0
Paints, varnishes & lacquers	5.2	11.3	15.3	12.8	12.2
Drugs and medicines	5.8	9.2	7.4	12.2	14.2
Soaps, cosmetics & glycerine	8.2	17.6	20.6	20.8	4.8
Synthetic fibres, resin	0.1	2.6	0.9	4.1	13.5
Other chemicals	3.4	2.0	3.4	5.9	5.0
Structural clay products	0.2	0.3	0.9	1.0	8.3
Cement	0.0	0.3	2.0	0.7	3.0
Other non-metallic mineral products	51.3	53.1	91.2	91.3	52.9*
Iron & steel and ferro alloys	0.1	2.7	2.7	2.3	12.7
Iron and steel casting and forging	0.4	8.4	4.0	10.8	6.2
Iron and steel foundries	1.8	0.7	8.2	4.2	6.7
Non-ferrous basic metals	1.5	1.8	3.7	4.0	13.7
Hand tools, hardware	4.7	4.4	10.6	8.0	10.5
Miscellaneous metal products	3.4	1.7	4.8	7.8	8.8
Tractors and other agricultural machinery/implements	1.0	0.5	0.4	0.8	3.9
Industrial machinery for food & textiles	4.1	13.4	6.8	8.9	14.4
Industrial machinery (except food & textiles)	3.7	12.1	10.7	24.1	9.8
Machine tools	8.7	5.2	8.0	14.4	7.7
Office computing and accounting machinery	19.3	1.3	4.3	20.7	17.5
Other-non-electrical machinery	10.7	3.5	7.3	8.3	
Electrical industrial machinery	0.5	1.6	3.9	6.3	3.5
Electrical cables, wires	1.5	1.7	0.9	2.4	1.5
Batteries	7.0	10.8	5.5	8.1	4.6
Electrical appliances	13.6	10.1	28.5	23.4	1.7
Communication equipment	1.2	15.2	9.3	26.7	7.2
Other electrical machinery	14.5	8.3	15.3	12.2	7.6
Electronic equipment incl. television	2.2	9.1	8.7	2.3	19.1
Ships and boats	0.3	0.0	0.3	12.1	33.0
Rail equipment	0.3	1.7	1.4	0.5	0.7
Motor vehicles	3.7	2.4	6.7	8.0	8.3
Motor cycle and scooter	0.5	0.6	3.6	5.2	6.7
Bicycles, cycle-rikshaw	6.7	4.1	14.8	14.5	5.7
Other transport equipment	4.7	3.1	4.4	0.7	5.0
Watches and clocks	0.8	0.8	4.0	8.0	14.0
Miscellaneous manufacturing	33.0	36.7	36.9	34.4	14.0
Average	**7.4**	**9.8**	**11.9**	**13.9**	**13.1**

* includes Gems and Jewellery

Source: Authors' calculations based on Input-output tables prepared by the Central Statistical Organization.

3. TRENDS IN CAPACITY UTILIZATION IN INDIAN INDUSTRIES

There have been very few studies on capacity utilization in Indian industries. To mention here some earlier research work covering the post-reform period, Goldar and Kumari (2003) presented an estimate of capacity utilization in India industry at the aggregate level covering the period 1981 to 1997. The estimates indicated that there was an upward trend in capacity utilization in the 1980s and a downward trend in the period 1990 to 1997. A more detailed study of capacity utilization in Indian manufacturing was undertaken by Azeez (2005). This study covered the period 1973-74 to 1997-98. Estimates of capacity utilization were made by four alternative methods namely, (a) installed capacity or engineering approach, (b) Wharton index, (c) minimum capital-output ratio, and (d) economic capacity utilization obtained by estimating a cost function. The estimates obtained by the Wharton index, minimum capital-output ratio, and the measure of economic capacity utilization showed an increase in the average rate of capacity utilization in the period 1985-91 compared to the period 1980-85, but a decline in the average rate of capacity utilization in the period 1992-98 compared to the period 1985-91. A fall in the capacity utilization in the period 1992-98 compared to the period 1985-91 was indicated also by the estimates based on the engineering approach. The capacity utilization estimates of Azeez are reproduced in Table 3 below.

Table 3: Estimates of capacity utilization in Indian manufacturing, 1980-98

Period	Method of estimation			
	Installed capacity (engineering approach)	Wharton index	Minimum capital- output ratio	Economic capacity utilization, based on cost function
1980-85	0.685	0.916	0.904	0.922
1985-91	0.625	0.948	0.924	0.948
1992-98	0.580*	0.929	0.846	0.937

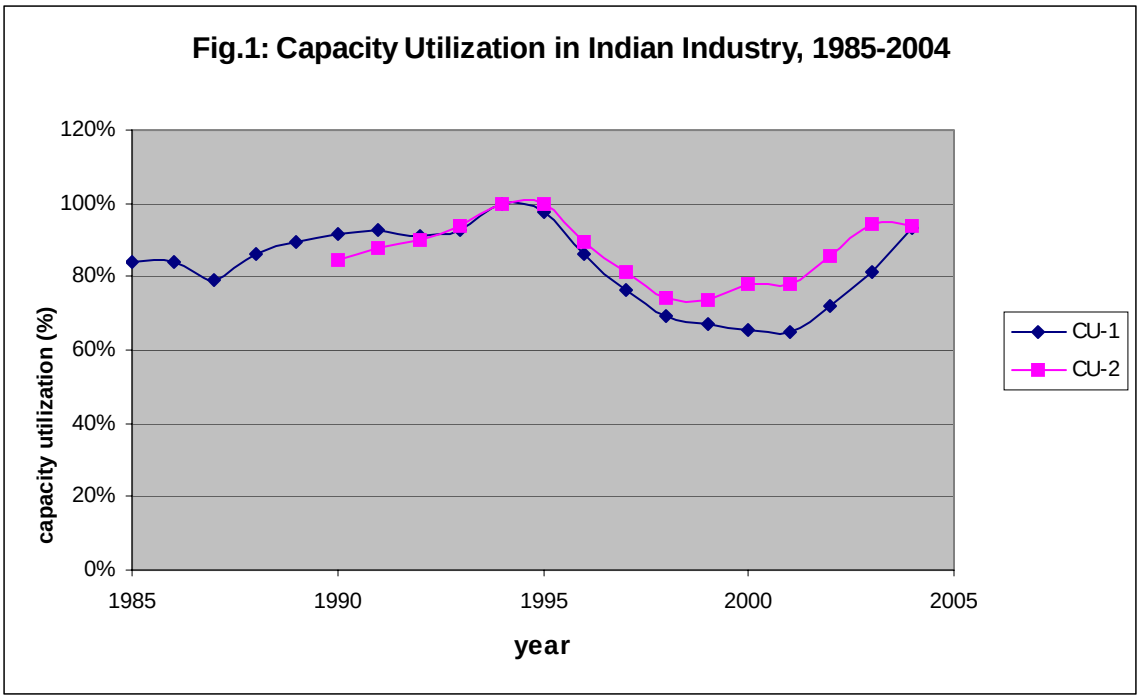
*These figures are only up to 1995-96.
Source: Azeez (2005).

Since estimates of capacity utilization in Indian industry are not available for recent years, some estimates have been made in this study. Two approaches have been taken for the estimation of capacity utilization. One set of estimates has been made by

using the methodology applied earlier by Mulega and Weiss (1996).[6] The ratio of electricity consumption to capital stock is first computed for different years in the period under study. A trend line is fitted to the data, which is then shifted up so that it passes through the point having largest positive residual. The actual ratio of electricity to capital is then compared with the ratio indicated by the trend line (adjusted) to compute capacity utilization. For applying the Mulega-Weiss methodology, data on electricity consumed by industry have been taken from two sources: *Energy Statistics* (2004-05), published by the Central Statistical Organization (Ministry of Statistics and Programme Implementation, Government of India) and the *TERI Energy Data Directory and Yearbook* (various issues) published by the Energy and Resources Institute, New Delhi. From the former source, energy consumption data were taken for the years 1985 to 2004. From the latter, such data could be obtained for the period 1990 to 2004. As regards capital stock, the estimates of net fixed capital stock of registered manufacturing (at 1993-94 prices) have been used, taken from the *National Accounts Statistics* (published by the Central Statistical Organization, Ministry of Statistics and Programme Implementation, Government of India). The estimates of capacity utilization in Indian manufacturing obtained by this method are shown in Fig. 1.

The estimates of capacity utilization in Fig. 1 indicate that there was a downward trend in capacity utilization in Indian manufacturing in the latter half of the 1990s. After 2001, the trend seems to have been reversed, and capacity utilization improved between 2001 and 2004.

[6] This method has been used by Goldar and Kumari (2003).



Notes: CU-1 is based on electricity consumption in industry reported in *Energy Statistics*, 2004-05, Central Statistical Organization; CU-2 is based on electricity consumption in industry reported in *TERI Energy Data Directory and Yearbook* (various issues). Estimation method of capacity utilization is explained in the text.

Source: Authors' calculations.

An alternate set of estimates of capacity utilization in Indian manufacturing has been made by using the Wharton index of capacity utilization. The monthly series on Index Number of Industrial Production (IIP) for 17 major groups (constituting the manufacturing sector) have been used for this purpose.[7] The series could be obtained for the period 1994-95 to 2004-05. The production peaks have been identified by examining the monthly index values. Having identified the peaks, the following equation has been estimated for each product group:

$$Y_t = \alpha + \beta\, t + \gamma\, t^2 + \lambda\, D + u, \qquad \ldots (2)$$

where Y_t is the production index for the product group in period t, D is a dummy variable that takes value one for peaks and zero otherwise, and u is the random error term. Y has

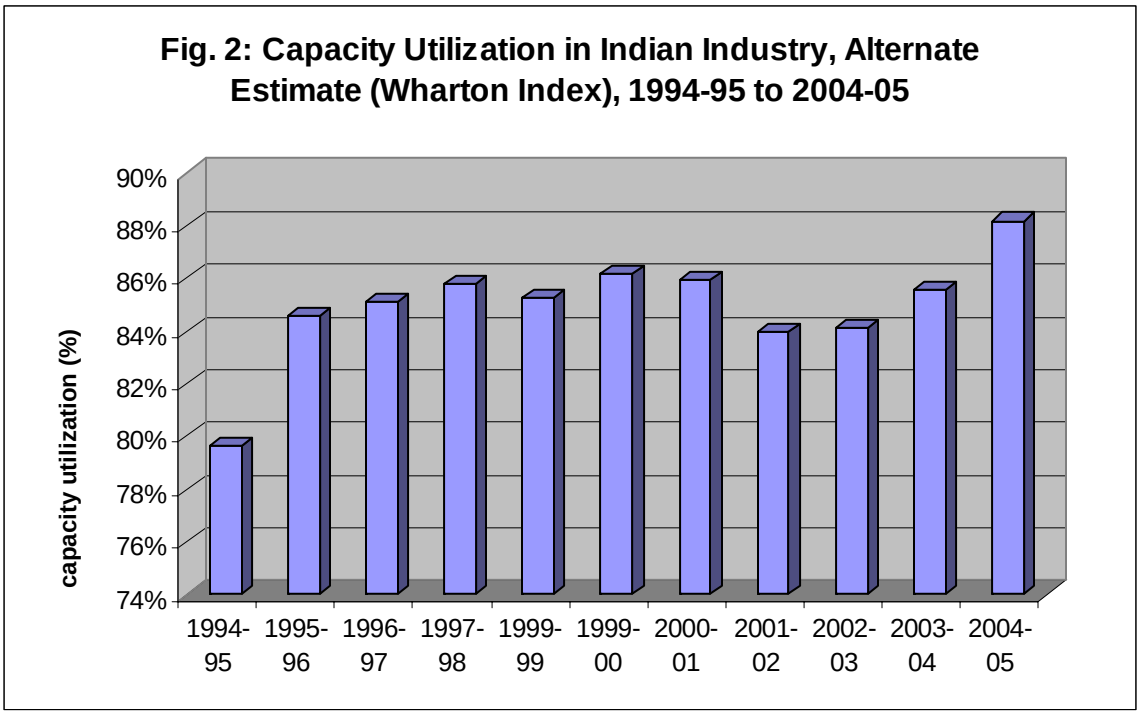
[7] The IIP series is brought out by the Central Statistical Organization, Ministry of Statistics and Programme Implementation, Government of India.

been regressed on t, t^2 and D. After estimating the parameters, D is assigned value one for all observations and potential output Y* is thus estimated. The ratio of Y_t to Y_t* gives the rate of capacity utilization at time period t. After estimating the rate of capacity utilization for each of the 17 industry groups, a weighted average has been taken to obtain the overall rate of capacity utilization in Indian manufacturing (organized).

Since the method described above has been applied at the level of major industry groups (each of which comprise a large number of products), the identified production peaks for a group cannot be taken as a satisfactory measure of potential output of the industry group (because the production of different products forming the group need not peak simultaneously).[8] This is a serious limitation of the estimates of capacity utilization obtained by the second method described above. The consequence is that capacity utilization tends to be over-stated and inter-temporal variations in capacity utilization may not be properly depicted. Nonetheless, it is useful to have the second set of estimates of capacity utilization as a check on the first set based on electricity consumption.

The estimates of capacity utilization made by the Wharton index are shown in Fig. 2. In the estimates obtained, there are only small year-to-year variations in capacity utilization. The estimates suggest that an improvement in capacity utilization in Indian manufacturing took place between 2001-02 and 2004-05, which is in line with the estimates presented in Fig. 1.

[8] If the method was applied separately to each of the products belonging to the various groups, then the estimate of potential output and hence the estimate of capacity utilization would have been better.



Source: Authors' calculations based on the Index Number of Industrial Production (brought out by the Central Statistical Organization, Government of India).

4. DETERMINANTS OF CAPACITY UTILIZATION: FIRM-LEVEL ANALYSIS

Trends in import penetration in Indian manufacturing industries in the post-reform period were analyzed in Sections 2 above and an analysis of inter-temporal changes in capacity utilization was undertaken in Section 3. An attempt is made next to relate these two phenomena. Using data on a sample of Indian industrial firms belonging to industries that encountered significant import penetration in the later half of the 1990s and in subsequent years, this section presents an analysis of the determinants of capacity utilization at the firm level, with a focus on the impact of import penetration on capacity utilization.

4.1 Findings of Some Earlier Studies

To mention here some earlier studies on determinants of capacity utilization in Indian industries, Paul (1974) carried out a cross-industry multiple regression analysis to explain variations in the level of capacity utilization. He used data for 39 industry groups

for 1965. A positive relationship was found between demand pressure and capacity utilization and a negative relationship between the effective rate of protection and capacity utilization. The results indicated that industries characterized by large-size firms and more capital-intensive units tend to have higher capacity utilization. Also, capacity utilization was found to be relatively higher for more concentrated industries. Both import penetration and import content of production were found to have an adverse effect on capacity utilization.

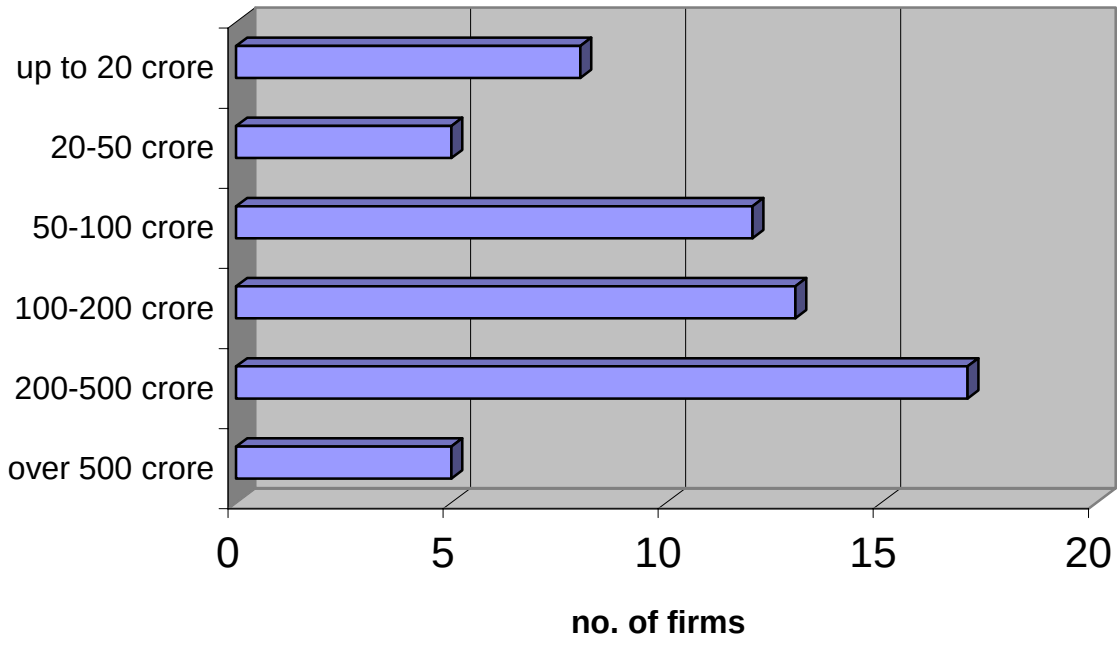
Goldar and Renganathan (1991) carried out an analysis similar to that of Paul (1974). Cross-section multiple regression analysis was applied; data for 73 industries for the year 1983 were used. The rate of capacity utilization was regressed on variables representing market concentration, demand pressure, trade and tariff policies (captured by the effective rate of protection) and the industrial policies of the government. Four dummy variables were used to represent the industrial polices. These dummy variables were for the following four categories of industries, reflecting in each case a particular aspect of industrial policy: (1) industries reserved for small-scale sector, (2) industries subject to industrial licensing, (3) industries subject to special regulation such as price control, and (4) industries earmarked for development exclusively or mainly in the public sector. The econometric results indicated a positive relationship between demand pressure and capacity utilization and between market concentration and capacity utilization. A negative relationship was found between the effective rate of protection and capacity utilization. No significant relationship was found between capacity utilization and industrial policy. The results suggested that the government control on capacity creation was not, in general, detrimental to capacity utilization.

4.2 Present study

The present study differs from the two mentioned above in that regression analysis is carried out at the firm level rather than at the industry level. The study covers the period 1996-97 to 2003-04. Basic data source for the study is the CMIE (Centre for Monitoring Indian Economy Private Limited, Mumbai) as discussed further below. Twenty-four industries, belonging to engineering and the manufacture of chemicals, have been

selected for the study. The selection of industries has been done based on the consideration that these industries experienced significant import penetration (about 10% or higher) during the period 1996-97 to 2003-04. Three firms have been selected for the study from each industry. Generally the relatively bigger firms in the industry have been chosen. In some cases, due to data gaps, fewer firms than three had to be chosen. Altogether, 62 firms have been selected for the study. The distribution of firms according to sales in 2003-04 is shown in Fig. 3. Nearly half of the firms are in the size classes Rs 100-200 crore and Rs 200-500 crore in terms of their sales.

Fig. 3: Distribution of Firms according to Sales in 2003-04

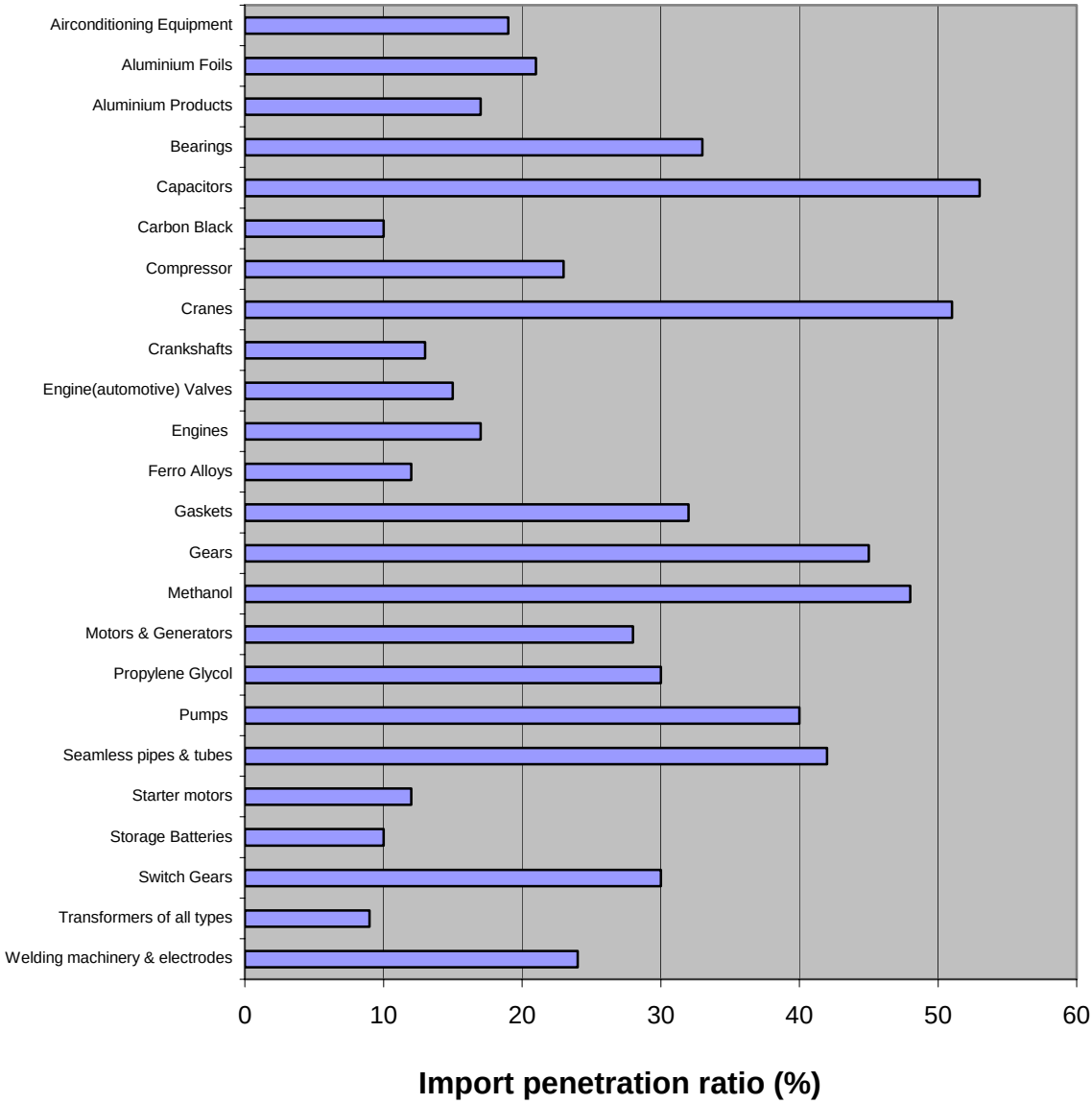


Note: one crore =10 million.

Source: Authors' calculations and CMIE.

The list of industries covered in the study is provided in Fig. 4 along with the import penetration ratio in 2003-04. It would be noticed that in several industries the import penetration ratio was 40% or higher. The average import penetration ratio across the 24 industries covered in the study was about 18% in 1996-97, which increased to about 26% in 2003-04.

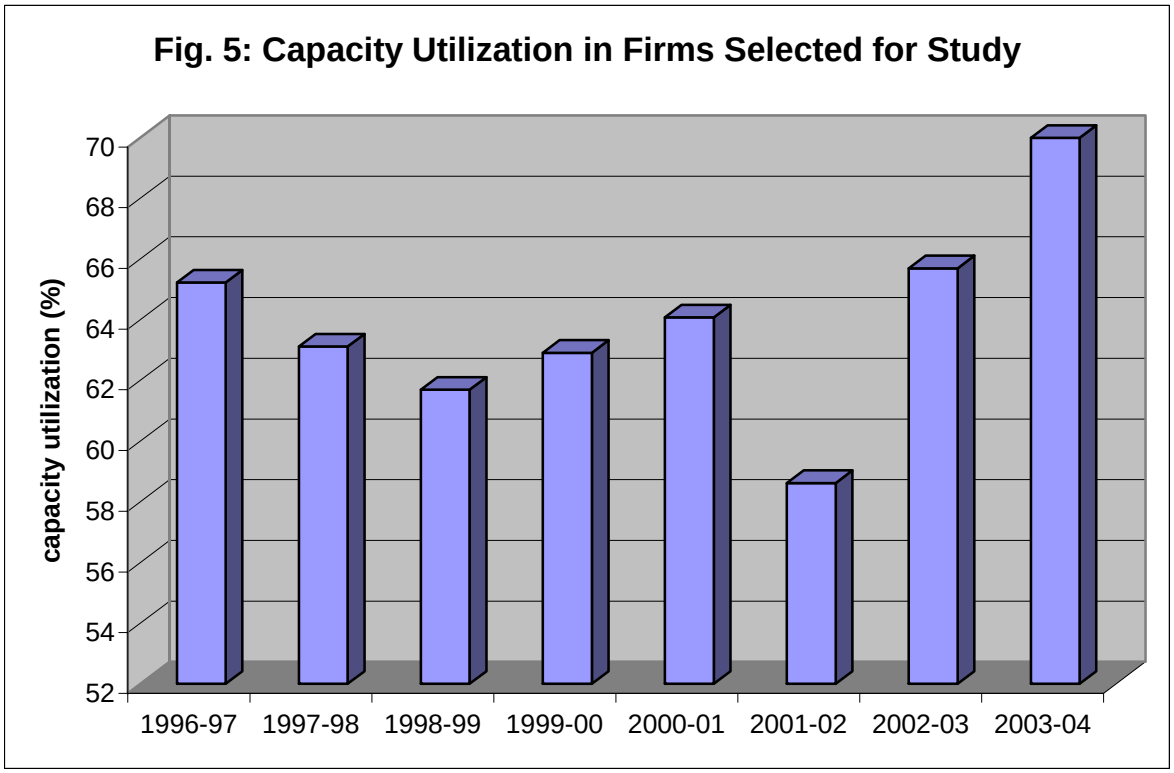
Fig.4: Import Pentration Ratio (2003-04) in Industries covered in the Study



Source: Authors' calculations and CMIE.

The average level of capacity utilization in the selected firms (in respect of the products selected for the study) in various years during 1996-97 to 2003-04 is shown in Fig. 5. This is based on the production capacity reported by the firms. The estimates

suggest that capacity utilization was relatively low in 2001-02 and there was a significant improvement in capacity utilization between 2001-02 and 2003-04.



Note: For some firms, estimates of capacity utilization are not available for all years between 1996-97 and 2003-04. The average capacity utilization (across firms) for different years has been computed by leaving out the firms for which figures on capacity utilization are not available for specific years.

Source: Authors' calculations and CMIE.

Data and Variables for the Regression Analysis

Data on capacity utilization and other variables of interest (for carrying out regression analysis) for the select industrial firms have been taken from CMIE (Centre for Monitoring Indian Economy) sources. For some variables, the CMIE publication, *Industry: Market Size and Shares* is used, and for others the CMIE database, *Prowess*, is used. Data on sales and market share of individual firms and data on imports, exports and market size of the 24 industries selected for the study have been taken from *Industry: Market Size and Shares***.** Data on production, capacity, capacity utilization, ownership of

firms, and the date of incorporation has been taken from *Prowess*, which is a reliable database, providing data for more than ten thousand companies covering 12 years.

As mentioned above, the period covered in the study is 1996-97 to 2003-04. The econometric analysis is undertaken in two steps. First, a cross-section regression analysis is undertaken for three years 1996-97, 1999-00 and 2003-04. For this part of the analysis, three cross-section datasets for 62 firms covered in the study have been formed on capacity utilization and explanatory variables, and then regression equations have been estimated for the three years.[9] This is followed by the estimation of a dynamic model based on a panel dataset for 62 firms and eight years, 1996-97 to 2003-04. The construction of variables used for the cross-section regressions and the dynamic model is described below.

Capacity utilization: Ratio of production to capacity available (for the specific product considered).

Market concentration: Sales of top three firms as a ratio to the total sales of the CMIE sample (for the specific industry).

Import penetration: Value of imports of the product divided by the market size where market size is equal to total sales plus imports.

Export intensity in the industry: Value of exports divided by the total sales of the CMIE sample.

Market share of each firm: Sales of the firm divided by the market size (= total sales of the CMIE sample + imports).

Firm size: logarithm of sales of the firm.

Age of the firm: this is computed from the respective date of incorporation.

Dummy variables for foreign firms and public sector firms: these dummy variables have been formed on the basis of ownership. Foreign firm is defined as one in which 20% or more equity is held abroad.

[9] For some firms, capacity utilization in 2003-04 was not available. In such cases, the available estimate of capacity utilization in the latest year before 2003-04 has been used.

It should be noted that some variables (e.g., capacity utilization) are at firm level while others (e.g., import penetration) are at industry level. For industry-level variables, the same value is applied to all firms belonging to the industry.

Regression Results: Cross-section analysis

The estimated regression equations for 1996-97, 1999-00 and 2003-04 are presented in Tables 4, 5 and 6, respectively. Firm size, market share and age of the firm are found to be important determinants of capacity utilization in the results for all three years. A positive relationship is found between capacity utilization and firm size and similarly between capacity utilization and market share of the firm. The results indicate that capacity utilization was higher in older firms than new firms. The coefficient of the market concentration variable is consistently positive, but in almost all cases it is statistically insignificant. Only in one equation estimated for 2003-04, the coefficient is found to be statistically significant at the 10% level. The numerical value of the coefficient is relatively higher in the results for 2003-04 than that in the results for 1996-97 and 1999-00. Paul (1974) and Goldar and Renganathan (1991) had found a significant positive relationship between market concentration and capacity utilization. The results obtained in this study are not as strong but are consistent with the results obtained by Paul and Goldar-Renganathan. It appears from the results that the positive relationship between market concentration and capacity utilization had become stronger in 2003-04 compared to 1996-97.

Table 4: Determinants of Capacity Utilization in Indian Industrial Firms, 1996-97, Regression Results

Explanatory variables	Regression								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Import penetration	-0.545 (-1.85)	-0.545 (-1.98)	-0.430 (-1.69)	-0.429 (-1.24)	-0.335 (-1.05)	-0.357 (-1.50)	-0.241 (-0.84)	-0.339 (-1.35)	-0.224 (-0.76)
Market share			0.841 (2.22)			0.845 (2.30)		0.877 (2.31)	
Market concentration				0.179 (0.78)	0.253 (1.19)		0.258 (1.28)		0.269 (1.28)
Age		0.517 (4.16)	0.464 (3.55)	0.528 (4.37)	0.401 (2.65)	0.513 (3.86)	0.447 (3.02)	0.525 (3.94)	0.460 (3.10)
Export intensity						-0.775 (-1.44)	-0.918 (-1.61)	-0.772 (-1.36)	-0.929 (-1.54)
Firm size (log sales)					5.56 (1.95)		6.15 (2.15)		6.14 (2.08)
Public sector firm								6.19 (0.66)	5.78 (0.55)
Foreign firm								6.93 (0.66)	4.01 (0.41)
R^2	0.058	0.216	0.294	0.224	0.275	0.312	0.308	0.325	0.313

Note: t-ratios shown in parentheses; these are based on heteroscedasticity consistent estimator of variance. Data for 62 firms have been used for the regression equations estimated.

Table 5: Determinants of Capacity Utilization in Indian Industrial Firms, 1999-00, Regression Results

Explanatory variables	Regression								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Import penetration	-0.230 (-0.67)	-0.230 (-0.72)	-0.081 (-0.26)	-0.153 (-0.39)	-0.037 (-0.10)	-0.038 (-0.12)	0.007 (0.002)	-0.131 (-0.40)	-0.093 (-0.26)
Market share			0.959 (2.57)			0.944 (2.58)		0.878 (2.56)	
Market concentration				0.120 (0.52)	0.132 (0.63)		0.122 (0.60)		0.179 (1.28)
Age		0.470 (3.16)	0.464 (3.30)	0.514 (3.47)	0.368 (2.40)	0.474 (3.37)	0.370 (2.40)	0.497 (3.52)	0.437 (2.70)
Export intensity						-0.264 (-0.65)	-0.242 (-0.57)	-0.264 (-0.65)	-0.209 (-0.50)
Firm size (log sales)					6.47 (2.41)		6.63 (2.37)		5.64 (1.83)
Public sector firm								18.17 (1.20)	19.96 (1.20)
Foreign firm								-4.15 (-0.28)	-4.13 (-0.28)
R^2	0.067	0.115	0.205	0.119	0.207	0.211	0.211	0.244	0.252

Note: t-ratios shown in parentheses; these are based on heteroscedasticity consistent estimator of variance. Data for 62 firms have been used for the regression equations estimated.

Table 6: Determinants of Capacity Utilization in Indian Industrial Firms, 2003-04, Regression Results

Explanatory variables	Regression								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Import penetration	-0.248 (-0.67)	-0.171 (-0.46)	0.025 (0.07)	0.097 (0.24)	0.259 (0.68)	-0.006 (-0.02)	0.215 (0.60)	-0.104 (-0.31)	0.137 (0.41)
Market share			1.035 (3.84)			0.912 (3.24)		0.916 (3.26)	
Market concentration				0.576 (1.79)	0.426 (1.51)		0.371 (1.29)		0.423 (1.34)
Age		0.497 (2.52)	0.510 (2.71)	0.712 (3.03)	0.441 (1.98)	0.602 (3.86)	0.524 (2.22)	0.648 (3.43)	0.593 (2.36)
Export intensity						-0.659 (-2.23)	-0.664 (-2.47)	-0.732 (-2.41)	-0.720 (-2.57)
Firm size (log sales)					10.37 (4.16)		9.92 (4.06)		9.33 (3.88)
Public sector firm								22.06 (1.12)	19.44 (1.06)
Foreign firm								11.08 (0.75)	8.31 (0.56)
R^2	0.008	0.095	0.223	0.159	0.329	0.280	0.388	0.316	0.414

Note: t-ratios shown in parentheses; these are based on heteroscedasticity consistent estimator of variance. Data for 62 firms have been used for the regression equations estimated.

The coefficient of the import penetration variable is consistently negative in the results obtained for 1996-97 and it is statistically significant at the 10% level in some of the equations estimated. In the results obtained for 1999-00, the coefficient of import penetration is negative in most equations, but it is statistically insignificant in all the equations estimated. The variable performs worse in the results obtained for 2003-04. The coefficient is statistically insignificant in all the equations, and the sign of the coefficient is positive (contrary to expectations) in five of the nine equations estimated. It seems from the results that import penetration had an adverse impact on capacity utilization in 1996-97, but over time this effect became weaker.

The coefficients of the dummy variables for public sector firms and foreign firms are statistically insignificant. Thus, after controlling for other factors, no significant difference in capacity utilization is found between public and private sector firms and between domestic and foreign firms.

The coefficient of the export intensity variable is negative in the results for all three years and it is statistically significant at the 5% level in the results for 2003-04. This indicates that capacity utilization was relatively lower in firms belonging to industries characterized by high export intensity. The reason for the observed negative relationship is not clear, since exports should provide a better opportunity for using the available production capacity. This may have something to do with domestic demand pressure. In certain cases, high domestic demand pressure may improve capacity utilization while it may have at the same time an adverse effect on exports made by the firms. As a result, the expected positive relationship between the two variables may not be observed.

Regression Results: Dynamic Model

One limitation of the cross-sectional regressions presented above is that these do not allow for a lagged effect of import penetration on capacity utilization in industrial firms. To allow for a lagged effect of import penetration on capacity utilization and study the

cumulative effect over time, a dynamic model has been estimated. The model is specified as:

$$CU_{it} = \alpha + \beta_1 CU_{i,t-1} + \beta_2 CU_{i,t-2} + \beta_3 MP_{it} + \beta_4 MP_{i,t-1} + \beta_5 MP_{i,t-2} + \sum \gamma_k X_{k,it} + \phi_i + \xi_{it}$$
$$i = 1,\ldots N;\ t = 1,\ldots T. \qquad \ldots(3)$$

In the above equation, CU denotes capacity utilization, MP import penetration and $X_{k,it}$ other explanatory variables (say, firm size and market concentration). The subscripts i and t are for firms and time (year), respectively. N denotes the number of firms and T the number of years. ϕ_i represents the random effects which are independent and identically distributed over the firms with variance σ^2_ϕ. This captures the influence of firm-specific factors on capacity utilization. ξ_{it} is a random disturbance term, which is assumed to be independently and identically distributed over the entire sample with variance σ^2_ξ.

Estimation of the above model has been done by the Arellano-Bond General Method of Moments (GMM) estimator. As mentioned earlier, panel data for 62 firms for eight years (1996-97 to 2003-04) have been used for estimating the model. The results are reported in Table 7.[10]

The estimates of the dynamic model indicate a positive relationship between firm size and capacity utilization, and between market share held by the firm and capacity utilization. This is consistent with the results of the cross-sectional regression reported in Tables 4-6 above. Thus, for these two variables, the results of the dynamic model match with the results of the cross-sectional regression. The same applies to market concentration. It would be noticed from Table 7 that the coefficient of the market concentration variable is positive but statistically insignificant, which is in agreement with the results of the cross-sectional regression reported in Tables 4-6.

[10] The results reported in the table have been obtained by the one-step method. The results obtained by the two-step method are similar, hence not reported. To check for sensitivity of the results, the two-year lagged term of the dependent variable has been dropped from the model in the results reported in the last two columns of Table 7.

Table 7: Determinants of Capacity Utilization, Estimates of the Dynamic Model

Dependent Variable: CU
Method of Estimation: Generalized Method of Moments (GMM) Estimator

Explanatory variables	Regression			
	(1)	(2)	(3)	(4)
CU(t-1)	-0.146 (-1.04)	-0.168 (-1.17)	-0.013 (-0.11)	-0.035 (-0.30)
CU(t-2)	-0.097 (-1.21)	-0.094 (-1.15)		
MP	-0.446** (-2.00)	-0.390* (-1.69)	-0.460** (-2.00)	-0.415* (-1.74)
MP(t-1)	0.037 (0.16)	0.023 (0.10)	0.041 (0.17)	0.043 (0.17)
MP(t-2)	0.389* (1.68)	0.452* (1.90)	0.456* (1.92)	0.528** (2.18)
SIZE	7.947*** (2.95)		7.643*** (2.79)	
MS		0.494** (2.07)		0.447* (1.84)
CON	0.119 (0.75)	0.126 (0.76)	0.097 (0.60)	0.117 (0.68)
AGE	0.741 (1.04)	0.844 (1.14)	0.557 (0.77)	0.569 (0.75)
XI	0.063 (0.34)	0.070 (0.37)	0.109 (0.60)	0.115 (0.59)
No. of Observations	270	271	273	274
Sargan test of over-identifying restrictions, Chi-square and probability value	χ^2 (18) =19.4 P=0.37	χ^2 (18) =18.5 P=0.42	χ^2 (19) =19.6 P=0.42	χ^2 (19) =18.6 P=0.48
A-B test of autocorrelation#, z and probability value	z = 1.13 P= 0.26	z = 0.73 P= 0.46	z = 0.48 P= 0.63	z = 0.17 P= 0.87
Wald test, Chi-square	χ^2 (9) =22.4	χ^2 (9) =19.0	χ^2 (8) =18.7	χ^2 (8) =15.4

Notes:
#Arellano-Bond test that average autocovariance in residuals of order 2 is 0.
CU: Capacity utilization; MP: Import penetration (ratio); SIZE= firm size (logarithm of deflated sales)
MS: Market share held by the firm; CON: Market concentration (share of top three firms in the industry);
AGE: age of the firm; XI: export intensity (ratio of exports to sales).
Values in the parentheses are t-values. *** indicates significance at the 1% level, ** 5% level and * 10% level.

The coefficient of the age variable in the estimated dynamic model is positive, which matches with the results of cross-sectional regression. However, the coefficient is statistically insignificant, while in the results of the cross-sectional regression, the

coefficient was found to be statistically significant in all cases. Yet considering the broad agreement between the two sets of results, it may be inferred that, in the industries covered in the study, capacity utilization bears a positive relationship with the age of the firm.

A notable difference between the results of the cross-sectional regression and the estimates of the dynamic model pertains to export intensity. The coefficient of this variable is negative in the results of the cross-sectional regression and positive in the estimates of the dynamic model. As mentioned earlier, a positive relationship is expected between export intensity and capacity utilization. Thus, it is the results of the dynamic model that are in line with the expected relationship.

Turning to import penetration, the main explanatory variable of interest, the coefficient of the current level of import penetration is found to be negative and statistically significant while the coefficient of this variable with a two-year lag is found to be positive and statistically significant. In numerical magnitude, the latter coefficient is about the same size as the former coefficient. It appears from the results that while an increase in import penetration tends to lower capacity utilization in industrial firms, the firms are able to recover shortly and re-establish the previous level of capacity utilization. This would explain why a significant negative relation between import penetration and capacity utilization was found earlier in the cross-sectional regression for 1996-97, but not for 2003-04.

5. MAIN FINDINGS AND CONCLUDING REMARKS

Liberalization of imports of manufactures in India led to a significant increase in import penetration between 1991 and 1998. This trend was reversed subsequently, and there was a slight decrease in import penetration between 1998 and 2003. The fact that tariff rates on imports of manufactures were not reduced in the period 1998-2003 must have helped in arresting the upward trend in import penetration. Although quantitative restrictions on imports of a large number of consumer goods were lifted in 2000 and 2001,

this did not result in any marked increase in import penetration. Indeed, Goldar (2005) noted that the lifting of quantitative restriction on about 1400 items (6-digit HS) in 2000/2001 did not lead to any large-scale across-the-board increase in the imports of such products.[11]

Capacity utilization in organized manufacturing fell between 1995 and 2001. Subsequently, the trend reversed. Between 2001 and 2004, there was a significant improvement in capacity utilization in organized manufacturing.

Firm-level analysis of the determinants of capacity utilization brings out that capacity utilization is positively related to size of the firm, market share and market concentration. A positive relationship is found also between capacity utilization and the age of the firm. An adverse effect of import penetration on capacity utilization is found for 1996-97, and to a lesser extent also for 1999-00, but not for 2003-04. The estimates of the dynamic model indicate that the immediate effect of import penetration on capacity utilization is negative, but the cumulative effect over a period of three years or so is almost zero. One possible interpretation of these results is that while import penetration may have had a short-term adverse effect on capacity utilization in Indian industries, over time firms were able to make adjustments and thus contain or even neutralize the adverse effect.

Trade liberalization is expected to have a favourable effect on industrial productivity because of the competitive pressure it creates and the improved access it provides to imported inputs and technology. These favorable effects may be offset to some extent by the adverse effect import penetration may have on capacity utilization in domestic industries. The analysis presented above suggests that the adverse effects on

[11] Three reasons were given for the absence of any large-scale across-the-board increase in imports of items freed from QR. First, a number of them (nearly half) were already importable by the SIL (Special Import License) route, and the removal of QR was unlikely to have led to any large increase in imports. Second, a number of agricultural items in the list were canalized. Third, a number of 'trade defensive measures' were put in place to provide 'adequate protection and a level playing field to domestic players vis-à-vis import' as a result of phasing out of QR (*Economic Survey*, Ministry of Finance, Government of India, 2002).

capacity utilization may get neutralized in the medium to long term as firms make adjustments so that the benefits of trade liberalization are more fully realized.

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