Efficiency of Large-scale Manufacturing in Pakistan: A Production Frontier Approach

TARIQ MAHMOOD, EJAZ GHANI, and MUSLEH-UD DIN

1. INTRODUCTION

The large scale manufacturing sector in Pakistan has gained increasing prominence over the years with its share in output rising to about 13 percent in 2005-06 from 5.67 percent in 1959-60.¹ The sector has operated amid varying policy environments ranging from outright import substitution in the early years to a more deregulated and liberal environment in the recent years driven largely by concerns to improve the efficiency of the industrial sector which is critical for attaining greater competitiveness. While industrial and trade policy reforms in recent years have exposed domestic enterprises to greater internal and external competition, most of these enterprises continue to seek state patronage and have yet to reposition themselves to compete effectively in the global market place. Furthermore, the trade policy still has an import substitution bias for certain critical sectors whose imports are subject to tariff peaks and this raises concerns on their efficiency.

This study aims to assess the efficiency of large scale manufacturing sector in Pakistan using the production frontier approach. Section 2 reviews the literature while Section 3 sets out the methodology and discusses data employed in the study. Section 4 analyses empirical findings, and Section 5 concludes the discussion.

2. REVIEW OF LITERATURE

Since the seminal work of Aigner, Lovell and Schmidt (1977), who first proposed the stochastic production frontier technique, a growing body of literature has used the approach to estimate industrial efficiency. Taymaz and Saatci (1997) analyse the extent and importance of technical progress and efficiency in Turkish manufacturing industries. The rate and direction of technical change in three industries—textiles, cement, and motor vehicles—are estimated by using panel data on plants for the period 1987–92, using cobb-douglas, and translog stochastic frontier production functions. In addition to traditional inputs like labour, raw materials, energy and capital inputs etc, other factors like sub-contracting, advertising intensity, ownership type are also included in the analysis. The results show that there are significant inter-sectoral differences in the rates

¹Pakistan (various issues).

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of technical change and the factors influencing technical efficiency at the plant level. Subcontracting is found to improve the efficiency of user firms in the textile, cement, and motor vehicles industries. The ownership type and the source of technology are found to be important determinants of plant-level efficiency. Other important factors in efficiency are legal status of the firm, product characteristics, and regional agglomeration. The study finds a positive relationship between the plant size and technical efficiency in the cement and motor vehicles industries.

Ikhsan-Modjo (2006) examines the patterns of total factor productivity growth and technical efficiency changes in Indonesia’s manufacturing industries over the period 1988-2000. The study uses the data incorporating both the liberalisation years and the crisis/post crisis years sourced from an annual panel survey of manufacturing establishments. Following the approach of Battese and Coelli (1992), a translog frontier production function is estimated. Gross output is regressed on inputs like the cost of capital, wages, intermediate inputs and energy, and the study finds that technical progress is the most important factor in explaining TFP growth in the Indonesian manufacturing sector.

Tripathy (2006) examines efficiency gap between foreign and domestic firms in eleven manufacturing industries of India during 1990-2000. Two different techniques, i.e. stochastic frontier and data envelopment analysis are used to measure efficiency of the firms. The study assumes a Cobb-Douglas technology and estimates stochastic production and cost frontier in each industry to measure technical efficiency and cost efficiency of each firm as well as to obtain some inference on allocative efficiency. The stochastic frontier estimations show that generally foreign firms are technically efficient with significant mean difference as compared with the domestic firms. The data envelop technique comes at the same conclusions albeit with a few exceptions. The average cost efficiency scores in terms of stochastic frontier show mixed results: it indicates that there is a weak evidence for foreign firms to be allocatively inefficient in drugs and pharmaceuticals as compared with the domestic firms since the former are on average technically efficient but cost inefficient. On the other hand the data envelop results show that foreign firms are generally more efficient than domestic firms in terms of allocative efficiency. The evidence indicates that foreign firms tend to use more labour than capital as compared with domestically owned firms and hence the study concludes that the foreign firms are not using an inappropriate technology.

Alvares and Crespi (2003) explore differences in technical efficiency in Chilean manufacturing firms. The authors use plant survey data and apply non-parametric frontier Data Envelopment Analysis. A stratified random sample is employed and firms are classified according to ISIC (3-digits) classification. It is found that the average efficiency of the sample is 65 percent with a large heterogeneity among sectors, and that the professional and scientific equipment sector exhibits 91 percent efficiency, while agro-industries and textiles have much lower efficiency levels at 49 percent and 34 percent respectively. Efficiency estimates are further used in regression analysis to explore the factors influencing efficiency levels, and the study finds no relationship between firm size and level of efficiency. The key attributes of the efficient firms are found to be access to credit, labour skills, experience and education level of firm owner, and orientation to international markets etc.
Efficiency of Large-scale Manufacturing

Njikam (2003) assesses the effects of trade reform on firm-specific technical efficiencies in Cameroon manufacturing using firm-level balanced panel data for the period from 1988-89 to 1997-98. This period is further sub-divided into two sub-periods: the pre trade reform period covering the years 1988-89 to 1991-92, and the post trade reform period covering the years 1994-95–1997-98. A Cobb–Douglass stochastic production frontier is estimated for each industrial sector. Results indicate that relative to the pre-reform scores, the post-reform average technical efficiency increased in six of eight industries and in total manufacturing. The pre-reform firm-specific technical efficiencies decreased on average at the annual rate of 0.76 percent, while the post-reform firm-specific technical efficiencies increased on average at an annual rate of 1.4 percent. The study concludes that the trade reform provided an enabling environment for improving firm-level technical efficiency.

In the context of Pakistan’s economy, Burki and Khan (2005) analyse the implications of allocative efficiency on resource allocation and energy substitutability. The study covers the period 1969-70 to 1990-91 and utilises pooled time series data from Pakistan’s large scale manufacturing sector to estimate a generalised translog cost function. The study also computes factor demand elasticities and elasticities of substitution by using the parameters of the estimated generalised cost function. The results indicate strong evidence of allocative inefficiency leading to over- or under-utilisation of resources and higher cost of production. Input-mix inefficiency takes the form of over-utilisation of raw material and capital vis-à-vis labour and energy. The study finds that allocative inefficiency of firms has on average decreased the demand for labour by 0.19 percent and increased the demand for energy by 0.12 percent. Own price elasticities of factors of production imply that the demand for capital is much more sensitive to its own price than the demand for labour. However, the elasticity of substitution between all factors is found out to be positive, which implies that they are substitutes. This is attributed to installation of new but more energy-efficient capital. The new machinery and plants, although more energy-intensive and raw material saving, leave the share of capital and labour unchanged.

3. METHODOLOGY AND DATA

This study utilises the Stochastic Frontier (SF) technique, originally proposed by Aigner, Lovell, and Schmidt (1977), to estimate a production frontier which will serve as benchmark to estimate the technical efficiencies of various industries. The study covers 101 industries for the years 1995-96 and 2000-01. So, it is a comparative study of two cross-sections.

The Stochastic Production Frontier is assumed to be of Cobb-Douglass form with a composite error term:

$$\ln Y = \beta_0 + \beta_1 \ln K_i + \beta_2 \ln L_i + \beta_3 \ln IC_i + \beta_4 \ln NIC_i + v_i - u_i \quad i = 1 \ldots N$$

Where:
- $Y_i$ is output of the $i$th industry,
- $K_i$ is the amount of capital used in the $i$th industry,
- $L_i$ is the average number of persons engaged in the $i$th industry,
- $IC_i$ is the industrial cost in the $i$th industry,
$NIC_i$ is the non-industrial cost in $i$th industry,
$v_i$ is a component of the error term with normal distribution i.e. $v_i \sim N(0, \sigma_v)$
$u_i$ is a component of error term with half-normal distribution$^2$ i.e. $u_i \sim N^+ (0, \sigma_u)$
$N$ is the total number of industries.

The symmetric error term $v_i$ is the usual noise component to allow for random factors like measurement errors, weather, strikes etc. The non-negative error term $u_i$ is the technical inefficiency component. The Ordinary Least Square estimation of the above model provides consistent estimates of $\beta_1$, but not of $\beta_0$. More importantly, we cannot obtain efficiency estimates through OLS [Kumbhakar and Lovell (2000)]. This issue is resolved by applying Maximum Likelihood estimation technique to obtain consistent parameter estimates as well as efficiency scores.$^3$

The estimated model forms the basis for computing a predictor of technical efficiencies. Battese and Coelli (1988) suggest the following predictor of technical efficiencies:

$$TE_i = E[\exp(-u_i) | e_i]$$

Where $e_i = v_i = u_i$ and $E$ is the expectation operator. The above expression measures how far a firm lies below the frontier after allowing for random errors.

The next step is to check the significance of inefficiencies estimated by the model, i.e. to test the null hypothesis of no inefficiencies against the alternative hypothesis that inefficiencies are present. As suggested by Coelli (1995), a one-sided likelihood ratio test with a mixed chi-square distribution ($\frac{1}{2} \chi^2_0 + \frac{1}{2} \chi^2_1$) is appropriate here. Therefore, the null hypotheses is rejected if $LR > \chi^2_1 (2\alpha)$.

The data for the year 1995-96 are obtained from the Census of Manufacturing Industries (1995-96)$^4$, whereas data for 2000-01 are obtained from the summary tables prepared by the Federal Bureau of Statistics.$^5$ In all, 101 large-scale manufacturing industries are selected. The excluded industries are those which either do not have common industry codes or fall in some “other” category. Two industries, viz. Matches and Plastic Footwear, are excluded due to their negative value added in the year 1995-96.

The following is a brief description of the variables:

**Output**

CMI reports value added as well as contribution to GDP. Value added reported in CMI does not allow for non-industrial costs. So we have used contribution to GDP as output which equals value of production minus industrial cost minus net non-industrial cost.

$^2$Some writers have used different assumptions about distribution of $u_i$. Afriat (1972) assumes $u_i$ to have a gamma distribution; Stevenson (1980) uses truncated normal distribution; and Green (1990) uses two-parameter gamma distribution.

$^3$The computer program FRONTIER version 4.1, written by Tim Coelli, is used to obtain parameter estimates as well as the efficiency scores.

$^4$This is the latest available published CMI.

Capital

Capital consists of land and building, plant and machinery and other fixed assets which are expected to have a productive life of more than one year and are in use by the establishment for the manufacturing activity.

Labour

Labour includes employees, working proprietors, unpaid family workers and home workers.

Industrial Cost

Industrial cost consists of cost of raw materials, fuels and electricity consumed, payments for work done, payments for repairs and maintenance and cost of goods purchased for resale.

Non-industrial Cost

Non-Industrial Cost consists of cost of payments for transport, insurance payments, copy rights and royalties, postage, telegraph and telephone charges, printing and stationery costs, legal and professional expenses, advertising and selling expenses, traveling expenses and other such expenses incurred by the establishment.

4. EMPIRICAL RESULTS

The model is estimated by maximum likelihood method for both the periods and the results are reported in Tables 1 and 2. All variables are statistically significant for both years except that of labour, which is insignificant for the year 2000-01. A possible explanation may be that the presence of rigidities in terms of worker lay off may prevent firms from an optimal utilisation of the labour input which may become redundant owing to the adoption of more efficient technologies. That such technological developments

\[ \text{Table 1} \]

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
<th>t-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.82</td>
<td>1.56*</td>
</tr>
<tr>
<td>Capital</td>
<td>0.18</td>
<td>2.30**</td>
</tr>
<tr>
<td>Labour</td>
<td>0.3</td>
<td>2.73**</td>
</tr>
<tr>
<td>Industrial Costs</td>
<td>0.36</td>
<td>3.42**</td>
</tr>
<tr>
<td>Non-industrial Costs</td>
<td>0.28</td>
<td>2.52**</td>
</tr>
<tr>
<td>Sigma-squared (( s_\gamma^2 = s_u^2 + s_v^2 ))</td>
<td>0.96</td>
<td>4.20**</td>
</tr>
<tr>
<td>Gamma (( \gamma = s_u^2 / s_v^2 ))</td>
<td>0.72</td>
<td>5.26**</td>
</tr>
</tbody>
</table>

*Significant at 0.10 level of significance.
** Significant at 0.01 level of significance.

LR test of the one-sided error = 4.2997, with number of restrictions = 1.

\(^6\) Due, perhaps, to trade unions, strict labour laws, etc.
Table 2

Regression Results for the Year 2000-01

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
<th>t-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.26</td>
<td>0.53</td>
</tr>
<tr>
<td>Capital</td>
<td>0.36</td>
<td>5.19**</td>
</tr>
<tr>
<td>Labour</td>
<td>0.08</td>
<td>0.72</td>
</tr>
<tr>
<td>Industrial Costs</td>
<td>0.5</td>
<td>5.73**</td>
</tr>
<tr>
<td>Non-industrial Costs</td>
<td>0.1</td>
<td>1.54*</td>
</tr>
<tr>
<td>sigma-squared (s^2 = s^2_u + s^2_v)</td>
<td>0.62</td>
<td>3.34**</td>
</tr>
<tr>
<td>Gamma (\gamma = s^2_u / s^2_v)</td>
<td>0.64</td>
<td>2.92**</td>
</tr>
</tbody>
</table>

*Significant at 0.10 level of significance.
**Significant at 0.01 level of significance.

LR test of the one-sided error = 1.3446.
with number of restrictions = 1.

have indeed taken place is corroborated by Burki and Khan (2005) who note that “traditional labour intensive technologies have gradually been replaced with more state of the art efficient technologies”. The magnitude of the parameter gamma is 0.72 in 1995-96 and 0.64 in 2000-01; an indication that inefficiencies are the major component of the composite error terms in both the periods.

The likelihood ratio test of one-sided error gives a value of 4.3 for the year 1995-96 (significant at 95 percent) and 1.3 for the year 2000-01 (significant at 88.5 percent); implying that the use of stochastic frontier is justified.

Overall, the mean efficiency score increased from 0.58 in 1995-96 to 0.65 in 2000-01, indicating an improvement in efficiency of the large scale manufacturing sector (see appendix for detailed efficiency scores). The results are, however, mixed at the disaggregated level. Table 3 reports the mean efficiency scores of various industries at the 3-digit level. In 1995-96, the top five industries in terms of their efficiency levels included tobacco manufacturing, petroleum refining, other non-metallic mineral products, other manufacturing, electrical machinery and supplies. Among this group, while the level of efficiency of petroleum refining and electrical machinery and supplies improved marginally in 2000-01, the efficiency levels of tobacco manufacturing, other non-metallic mineral products, and other manufacturing declined. The five least efficient industries turned out to be sports and athletic goods, surgical instruments, leather and leather products, manufacturing of textiles, and wearing apparel. It is important to note that all of these industries are export-oriented industries. Their low level of efficiency probably explains why the government has all along provided a host of incentives to such export-oriented industries i.e. to offset their inherent inefficiencies.

\[^1\]It is important to note that the efficiency scores in each period measure technical efficiency in relation to the respective frontier in each period.
Table 3

Industry-wise Mean Efficiency Scores

<table>
<thead>
<tr>
<th>Industry</th>
<th>1995-96</th>
<th>2000-01</th>
<th>%Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco Manufacturing</td>
<td>0.88</td>
<td>0.87</td>
<td>-0.84</td>
</tr>
<tr>
<td>Petroleum Refining</td>
<td>0.74</td>
<td>0.76</td>
<td>3.70</td>
</tr>
<tr>
<td>Other Non-metallic Mineral Products</td>
<td>0.72</td>
<td>0.67</td>
<td>-6.39</td>
</tr>
<tr>
<td>Other Manufacturing</td>
<td>0.71</td>
<td>0.61</td>
<td>-14.14</td>
</tr>
<tr>
<td>Electrical Machinery and Supplies</td>
<td>0.69</td>
<td>0.70</td>
<td>0.08</td>
</tr>
<tr>
<td>Pottery, China and Earthware</td>
<td>0.68</td>
<td>0.65</td>
<td>-2.40</td>
</tr>
<tr>
<td>Industrial Chemicals</td>
<td>0.66</td>
<td>0.72</td>
<td>8.45</td>
</tr>
<tr>
<td>Other Chemical Products</td>
<td>0.66</td>
<td>0.64</td>
<td>-4.25</td>
</tr>
<tr>
<td>Printing and Publishing</td>
<td>0.66</td>
<td>0.73</td>
<td>24.33</td>
</tr>
<tr>
<td>Glass and Glass Products</td>
<td>0.66</td>
<td>0.56</td>
<td>-15.10</td>
</tr>
<tr>
<td>Paper and Paper Products</td>
<td>0.65</td>
<td>0.66</td>
<td>2.19</td>
</tr>
<tr>
<td>Drugs and Pharmaceutical Products</td>
<td>0.63</td>
<td>0.67</td>
<td>8.76</td>
</tr>
<tr>
<td>Iron and Steel</td>
<td>0.60</td>
<td>0.75</td>
<td>25.34</td>
</tr>
<tr>
<td>Fabricated Metal Product</td>
<td>0.59</td>
<td>0.67</td>
<td>13.86</td>
</tr>
<tr>
<td>Rubber Products</td>
<td>0.57</td>
<td>0.73</td>
<td>30.25</td>
</tr>
<tr>
<td>Food Manufacturing</td>
<td>0.56</td>
<td>0.58</td>
<td>16.11</td>
</tr>
<tr>
<td>Transport Equipment</td>
<td>0.56</td>
<td>0.53</td>
<td>-6.79</td>
</tr>
<tr>
<td>Non-ferrous Metal Industries</td>
<td>0.54</td>
<td>0.78</td>
<td>46.69</td>
</tr>
<tr>
<td>Non-electrical Machinery</td>
<td>0.49</td>
<td>0.62</td>
<td>30.61</td>
</tr>
<tr>
<td>Ginning and Baling of Fibre</td>
<td>0.48</td>
<td>0.73</td>
<td>51.30</td>
</tr>
<tr>
<td>Wearing Apparel</td>
<td>0.47</td>
<td>0.56</td>
<td>18.28</td>
</tr>
<tr>
<td>Manufacturing of Textiles</td>
<td>0.46</td>
<td>0.59</td>
<td>39.47</td>
</tr>
<tr>
<td>Leather and Leather Products</td>
<td>0.41</td>
<td>0.72</td>
<td>81.09</td>
</tr>
<tr>
<td>Surgical Instruments</td>
<td>0.30</td>
<td>0.58</td>
<td>90.44</td>
</tr>
<tr>
<td>Sports and Athletic Goods</td>
<td>0.30</td>
<td>0.77</td>
<td>154.58</td>
</tr>
</tbody>
</table>

The situation is somewhat different in 2000-01, when sports and athletic goods, non-ferrous metals, and iron and steel made into the top five efficient industries. Most remarkable is the turnaround shown by the sports and athletic goods which earlier ranked among the least five efficient industries. Among the five least efficient industries are transport equipment, wearing apparel, glass and glass products, surgical instruments, and food manufacturing. It is noteworthy that the textiles and manufacturing is only marginally better off as compared with 1995-96 lying a notch above the 5 least efficient industries.

The efficiency scores of a diverse range of industries including textiles manufactures, food manufacturing, industrial chemicals, iron and steel, drugs and pharmaceutical products, electrical machinery and supplies, and non-electrical machinery etc indicate improvement in efficiency over time. It is important to note that while efficiency levels have improved, big gaps remain in terms of the location of firms from the frontier: for example, in 2000-01, the mean efficiency score ranged from 0.53 (transport equipment) to 0.87 (tobacco manufacturing). This implies that there is considerable room for improvement in the efficiency levels of these industries.

A comparison of efficiency scores across two different production frontiers is akin to Battese, Rao and O’Donnell (2004) who compare efficiency levels of different groups in terms of their own frontier as well as a metafrontier.
There has been a decline in efficiency of other non-metallic mineral products, tobacco manufacturing, transport equipment, other chemical products, pottery, china and earthenware, and glass and glass products. The highest decline is recorded by glass and glass products (15.10 percent) followed by transport equipment (6.79 percent), other non-metallic products (6.39 percent), other chemical products (4.25 percent), pottery, china and earthenware (2.4 percent) and tobacco manufacturing (0.84 percent).

5. CONCLUDING REMARKS

This paper has examined the efficiency of the large scale manufacturing sector of Pakistan using the stochastic production frontier approach. A stochastic production frontier is estimated for two periods—1995/96 and 2000/01—for 101 industries at the ISIC 5-digit level. The results show that there has been some improvement in the efficiency of the large scale manufacturing sector, though the magnitude of improvement remains small. The results are mixed at the disaggregated level: whereas a majority of industrial groups have gained in terms of technical efficiency, some industries have shown deterioration in their efficiency levels including, for example, transport equipment, glass and glass products, other non-metallic mineral products, and other manufacturing. There may be several factors that may have caused a decline in the technical efficiency of such firms, not least the trade policy environment that may have shielded such industries from external competition. Further research may focus on the specific determinants of technical efficiency including the macroeconomic and trade policy environment.
APPENDIX

Efficiencies Scores at Industry Level

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Manufacturing of Textiles</th>
<th>1995-96</th>
<th>2000-01</th>
<th>%Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>32011</td>
<td>Cotton spinning</td>
<td>0.39</td>
<td>0.57</td>
<td>47.60</td>
</tr>
<tr>
<td>32012</td>
<td>Cotton weaving</td>
<td>0.43</td>
<td>0.48</td>
<td>11.50</td>
</tr>
<tr>
<td>32020</td>
<td>Woolen textiles</td>
<td>0.59</td>
<td>0.66</td>
<td>11.30</td>
</tr>
<tr>
<td>32030</td>
<td>Jute textiles</td>
<td>0.52</td>
<td>0.56</td>
<td>7.63</td>
</tr>
<tr>
<td>32040</td>
<td>Silk and art silk textiles</td>
<td>0.49</td>
<td>0.62</td>
<td>28.25</td>
</tr>
<tr>
<td>32050</td>
<td>Narrow fabrics</td>
<td>0.27</td>
<td>0.84</td>
<td>213.48</td>
</tr>
<tr>
<td>32070</td>
<td>Finishing of textiles</td>
<td>0.38</td>
<td>0.50</td>
<td>33.08</td>
</tr>
<tr>
<td>32120</td>
<td>Made up textile goods</td>
<td>0.44</td>
<td>0.48</td>
<td>8.60</td>
</tr>
<tr>
<td>32130</td>
<td>Knitting mills</td>
<td>0.33</td>
<td>0.54</td>
<td>62.39</td>
</tr>
<tr>
<td>32150</td>
<td>Cordage, rope and twine</td>
<td>0.61</td>
<td>0.61</td>
<td>–0.86</td>
</tr>
<tr>
<td>32160</td>
<td>Spooling and thread ball making</td>
<td>0.57</td>
<td>0.63</td>
<td>11.16</td>
</tr>
<tr>
<td></td>
<td>Average (Group 1)</td>
<td>0.46</td>
<td>0.59</td>
<td>39.47</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 2</th>
<th>Food Manufacturing</th>
<th>1995-96</th>
<th>2000-01</th>
<th>%Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>31121</td>
<td>Dairy products</td>
<td>0.56</td>
<td>0.51</td>
<td>–8.82</td>
</tr>
<tr>
<td>31122</td>
<td>Ice cream</td>
<td>0.60</td>
<td>0.78</td>
<td>29.46</td>
</tr>
<tr>
<td>31130</td>
<td>Canning of fruits and vegetables</td>
<td>0.63</td>
<td>0.80</td>
<td>26.01</td>
</tr>
<tr>
<td>31140</td>
<td>Canning of fish and sea food</td>
<td>0.48</td>
<td>0.42</td>
<td>–11.97</td>
</tr>
<tr>
<td>31151</td>
<td>Vegetable Ghee</td>
<td>0.54</td>
<td>0.78</td>
<td>45.64</td>
</tr>
<tr>
<td>31153</td>
<td>Cotton seed and inedible animal oils</td>
<td>0.59</td>
<td>0.56</td>
<td>–4.75</td>
</tr>
<tr>
<td>31161</td>
<td>Rice milling</td>
<td>0.41</td>
<td>0.53</td>
<td>29.23</td>
</tr>
<tr>
<td>31162</td>
<td>Wheat and grain milling</td>
<td>0.19</td>
<td>0.58</td>
<td>209.63</td>
</tr>
<tr>
<td>31163</td>
<td>Grain milled products and other grain milling</td>
<td>0.75</td>
<td>0.69</td>
<td>–8.23</td>
</tr>
<tr>
<td>31171</td>
<td>Bread and bakery products</td>
<td>0.50</td>
<td>0.67</td>
<td>34.74</td>
</tr>
<tr>
<td>31172</td>
<td>Biscuits</td>
<td>0.52</td>
<td>0.60</td>
<td>14.91</td>
</tr>
<tr>
<td>31181</td>
<td>Refined sugar</td>
<td>0.64</td>
<td>0.65</td>
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<td>31191</td>
<td>Confectionery, not sweetmeats</td>
<td>0.64</td>
<td>0.44</td>
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<tr>
<td>31192</td>
<td>&quot;Desi&quot; sweetmeats and confectionery</td>
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<td>0.37</td>
<td>–48.52</td>
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<td>31212</td>
<td>Blending of tea</td>
<td>0.71</td>
<td>0.49</td>
<td>–31.35</td>
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<tr>
<td>31221</td>
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<td>0.77</td>
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<td>31222</td>
<td>Feeds for fowls</td>
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<td>31291</td>
<td>Starch</td>
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<td>31292</td>
<td>Edible salt</td>
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<td>31293</td>
<td>Ice</td>
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<table>
<thead>
<tr>
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<th>Industrial Chemicals</th>
<th>1995-96</th>
<th>2000-01</th>
<th>%Change</th>
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<tbody>
<tr>
<td>35111</td>
<td>Alkalies</td>
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<td>Acids, salts and intermediates</td>
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<td>0.76</td>
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<td>35120</td>
<td>Dyes, colours and pigments</td>
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<td>0.76</td>
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<tr>
<td>35130</td>
<td>Compressed gases, etc.</td>
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<td>0.70</td>
<td>15.48</td>
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<tr>
<td>35140</td>
<td>Fertilisers</td>
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<tr>
<td>35150</td>
<td>Pesticides, insecticides, etc.</td>
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<td>0.79</td>
<td>18.08</td>
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<tr>
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<td>Synthetic resins, etc.</td>
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<td>0.72</td>
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<table>
<thead>
<tr>
<th>Group 4</th>
<th>Tobacco Manufacturing</th>
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<th>%Change</th>
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<tbody>
<tr>
<td>36910</td>
<td>Bricks and tiles</td>
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<td>0.64</td>
<td>1.60</td>
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<tr>
<td>36920</td>
<td>Cement</td>
<td>0.73</td>
<td>0.72</td>
<td>–1.35</td>
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<tr>
<td>36930</td>
<td>Cement products</td>
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<tbody>
<tr>
<td>31410</td>
<td>Cigarettes</td>
<td>0.88</td>
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<tr>
<th>Group 6</th>
<th>Iron and Steel</th>
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<tr>
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<td>Iron and steel mills</td>
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<tr>
<th>Group 7</th>
<th>Drugs and pharmaceutical products</th>
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<tbody>
<tr>
<td>35010</td>
<td>Medicines and basic drugs(allopathic)</td>
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<tr>
<td>35020</td>
<td>&quot;Unani&quot; medicines</td>
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<tr>
<td>35040 and 90</td>
<td>Homeopathic and other medicinal preparation</td>
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<tr>
<th>Group 8</th>
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<tbody>
<tr>
<td>38310</td>
<td>Electrical industrial machinery</td>
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<tr>
<td>38320</td>
<td>Radio and television commu</td>
</tr>
<tr>
<td>38330</td>
<td>Electrical appliances</td>
</tr>
<tr>
<td>38340</td>
<td>Insulated wires and cables</td>
</tr>
<tr>
<td>38350</td>
<td>Electrical bulbs and tubes</td>
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<tr>
<td>38360</td>
<td>Batteries</td>
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<th>Group 9</th>
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<tr>
<td>38440</td>
<td>Motor vehicles</td>
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<tr>
<td>38450</td>
<td>Motor cycles, auto rickshaws</td>
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<tr>
<td>38460</td>
<td>Cycles and pedicabs</td>
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<thead>
<tr>
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<tbody>
<tr>
<td>35210</td>
<td>Paints, varnishes and lacquers</td>
</tr>
<tr>
<td>35220</td>
<td>Perfumes and cosmetics</td>
</tr>
<tr>
<td>35230</td>
<td>Soap and detergents</td>
</tr>
<tr>
<td>35240</td>
<td>Polishes and waxes</td>
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<tr>
<td>35260</td>
<td>Ink (all kinds)</td>
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<table>
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<th>Non-electrical Machinery</th>
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<tbody>
<tr>
<td>38210</td>
<td>Engines and turbines</td>
</tr>
<tr>
<td>38220</td>
<td>Agricultural machinery</td>
</tr>
<tr>
<td>38230</td>
<td>Metal and wood working machinery</td>
</tr>
<tr>
<td>38240</td>
<td>Textile machinery</td>
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<thead>
<tr>
<th>Group 12</th>
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<tbody>
<tr>
<td>34210</td>
<td>Newspapers</td>
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<tr>
<td>34220</td>
<td>Books, periodicals, maps, etc.</td>
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<tr>
<td>34230</td>
<td>Job printing</td>
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<tr>
<td>34240</td>
<td>Printed cards and stationery</td>
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<table>
<thead>
<tr>
<th>Group 13</th>
<th>Petroleum Refining</th>
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<tr>
<td>353 and 354</td>
<td>Petroleum refining and products of petroleum and coal</td>
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<tr>
<th>Group 14</th>
<th>Paper and Paper Products</th>
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<tr>
<td>34110</td>
<td>Pulp and paper</td>
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<tr>
<td>34120</td>
<td>Paperboard</td>
</tr>
<tr>
<td>34130</td>
<td>Pulp, paper and board articles</td>
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<th>Group 15</th>
<th>Wearing Apparel</th>
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<tr>
<td>32210</td>
<td>Ready-made garments</td>
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<table>
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<tr>
<th>Group 16</th>
<th>Leather and Leather products</th>
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<tr>
<td>32310</td>
<td>Tanning and leather finishing</td>
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Continued—
### Efficiency of Large-scale Manufacturing

#### Appendix—(Continued)

<table>
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<th>Code</th>
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<td>120.32</td>
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<td>32410</td>
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<td>32510</td>
<td>Ginning and Baling of Fibre</td>
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<tr>
<td>32510</td>
<td>Ginning (Cotton and others)</td>
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<td>32410</td>
<td>Leather footwear</td>
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<td></td>
<td>Average (Group 17)</td>
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<td>35510</td>
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<td>Retreading tyres and tubes</td>
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<td>35591</td>
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<td>35592</td>
<td>Vulcanised rubber products</td>
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<td>Earthenware and other pottery</td>
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<td>36210</td>
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<td>37210</td>
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<td>Average (All Industries)</td>
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<td>36940</td>
<td>Lime, plaster and manufacture of refractories</td>
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<td>0.65</td>
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REFERENCES


