Felipe, Jesus; Estrada, Gemma

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Benchmarking Developing Asia’s Manufacturing Sector

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About the Paper
Jesus Felipe and Gemma Estrada document the transformation of developing Asia’s manufacturing sector during the last three decades, and benchmark its share in GDP with respect to the international regression line by estimating a logistic regression.

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BENCHMARKING DEVELOPING ASIA’S MANUFACTURING SECTOR

JESUS FELIPE AND GEMMA ESTRADA

SEPTEMBER 2007

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Asian Development Bank
FOREWORD

The ERD Working Paper Series is a forum for ongoing and recently completed research and policy studies undertaken in the Asian Development Bank or on its behalf. The Series is a quick-disseminating, informal publication meant to stimulate discussion and elicit feedback. Papers published under this Series could subsequently be revised for publication as articles in professional journals or chapters in books.
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ABSTRACT

This paper documents the transformation of developing Asia’s manufacturing sector during the last three decades and benchmarks its share in GDP with respect to the international regression line by estimating a logistic regression.
I. INTRODUCTION

In a recent paper, Rodrik (2006) has revived the long-standing but perhaps forgotten argument that rapid growth is associated first and foremost with the expansion of the industrial sector. While this idea was part of the toolkit of the development economists of the “old” school (Rodrik cites Lewis 1954), Rodrik argues that it is somewhat paradoxical that recent thinking on policy reforms pays scant attention to structural transformation and industrial development. Many economists see the development of a modern industrial sector as the key for propelling the structural transformation of an economy. Modern development textbooks (e.g., Ros 2000, Ghatak 2003, Thirlwall 2006) emphasize the special role that industry (in particular the manufacturing sector) plays in the development process.

The role attributed to manufacturing in the process of take-off and subsequent catch-up is usually a key element of sectoral studies of growth (Kaldor 1966 and 1967; see Felipe et al. 2007). It is no surprise, therefore, that economists and policymakers worry about swings in manufacturing. Though economies like Australia, Canada, New Zealand, the Scandinavian countries, and others relied heavily on the primary sector for their development, they all experienced periods of strong industrial growth and diversification as essential components of their sustained economic growth. Rodrik (2006) has argued that sustained growth requires a dynamic industrial base. One can, therefore, speak of the “logic of industrialization” (Nixson 1990, 313) and understand why many developing countries have adopted strategies toward rapid industrialization, often starting with industries that use relatively simple technologies, and that have the potential to be labor-intensive thus absorbing labor, such as textiles. The experience of the industrial economies appears to show that establishing a broad and robust domestic industrial base holds the key to successful development, and the reason that industrialization matters lies in the potential for strong productivity and income growth of the sector. This potential is associated also with a strong investment drive in the sector, rapidly rising productivity, and a growing share of the sector in total output and employment. The presence of scale economies associated with the secondary sector, gains from specialization and learning, as well as favorable global market conditions, imply that the creation of leading industrial subsectors, along with related technological and social capabilities, remains a key policy challenge.

The objective of this paper is to provide an analysis of developing Asia’s manufacturing sector during the last three decades, benchmarking it with respect to the international regression line by estimating a logistic regression. The rest is structured as follows. In Section II we briefly discuss the transformation of developing Asia’s manufacturing sector during the last three decades. Section III benchmarks the sector by estimating a regression based on the logistic pattern of growth. The final section summarizes the main findings.
II. STRUCTURAL TRANSFORMATION IN DEVELOPING ASIA’S MANUFACTURING SECTOR

During the last three decades, most economies in developing Asia have undergone massive structural change, in particular in terms of changes in both output and employment sectoral shares. The rise in developing Asia’s share in world manufacturing value-added during the last few decades has been significant (Figure 1). In particular, the joint share of the People’s Republic of China (PRC), the newly industrialized economies (NIEs)\(^1\), and ASEAN-4\(^2\) has more than doubled since the 1980s, representing in 2000–2004 close to 14% of the world total. This increase has been due, obviously, to a much faster growth of manufactured value-added in this region—8–10% per annum since the 1970s—compared to the rest of the world. In context, though, the share of the PRC (the highest among all developing economies) is just over 5% of the world’s manufacturing value-added, significantly less than the shares of Japan or the United States (more than 20% each), while the share of India has barely increased. Growth in manufacturing value-added has been substantially higher than that of gross domestic product (GDP) in many economies in developing Asia, including India; the NIEs (except Hong Kong, China, which registered a shrinkage); ASEAN-4 (except the Philippines, which also registered a decrease); as well as the economies under Other Southeast Asia\(^3\) and Other South Asia.\(^4\) In the PRC, however, manufacturing growth was slightly below that of GDP. Several of the ex-Soviet republics (Armenia, Azerbaijan, Kyrgyz Republic, Tajikistan) registered contraction in manufacturing value-added after the breakup of the Soviet Union.

**Figure 1**

SHARE OF GLOBAL MANUFACTURING VALUE ADDED, DEVELOPING ASIA

<table>
<thead>
<tr>
<th>Year</th>
<th>PRC</th>
<th>India</th>
<th>NIEs</th>
<th>ASEAN 4</th>
<th>Other Southeast Asia</th>
<th>Central and West Asia</th>
<th>Pacific</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000–04</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
ASEAN-4 includes Indonesia, Malaysia, Philippines, and Thailand. Central and West Asia covers Armenia, Azerbaijan, Kazakhstan, Kyrgyz Republic, Mongolia, Tajikistan, Turkmenistan, and Uzbekistan. NIEs consist of Hong Kong, China; Republic of Korea (henceforth Korea); Singapore; and Taipei, China. Other Southeast Asia comprises Cambodia, Lao People’s Democratic Republic, Myanmar, and Viet Nam. Other South Asia covers Bangladesh, Bhutan, Maldives, Nepal, Pakistan, and Sri Lanka. Pacific includes Fiji, Kiribati, Marshall Islands, Micronesia, Palau, Papua New Guinea, Samoa, Timor-Leste, Tonga, and Vanuatu.

**Sources:**
Authors’ estimates based on data from *World Development Indicators Online* (World Bank 2006) and the Directorate General of Budget, Accounting and Statistics (2006).

\(^1\) The NIEs are Hong Kong, China; Republic of Korea; Singapore; and Taipei, China.

\(^2\) ASEAN-4 includes Indonesia, Malaysia, Philippines, and Thailand.

\(^3\) Other Southeast Asia comprises Cambodia, Lao People’s Democratic Republic, Myanmar, and Viet Nam.

\(^4\) Other South Asia covers Bangladesh, Bhutan, Maldives, Nepal, Pakistan, and Sri Lanka.
Figure 2 shows the scatter plot of the output share of manufacturing in output vis-à-vis income per capita, pooling data since 1970 for the whole world. The figure shows that as economies' income per capita increases, so does the share of output in manufacturing, although there seems to be a point beyond which the share starts declining. The figure also shows a wide dispersion in this share for a given income per capita, from very low shares up to 50%.

**Figure 2**

**Manufacturing Output and Employment Shares versus per Capita GDP, All Economies (Logarithmic Scale)**

![Graph showing manufacturing output share versus GDP per capita.](image)

Source: *World Development Indicators Online* (World Bank 2006).

Tables 1 and 2 show decadal averages of the manufacturing share in output and employment. The NIEs have undergone severe deindustrialization as manufacturing has lost significant weight in total output between the 1970s and 2000–2004. In terms of manufacturing employment, all four NIES have clearly deindustrialized, especially Hong Kong, China, where the share decreased by about 25 percentage points in two decades. The declines in the other three economies are significant but smaller. These developments should not be interpreted as “failure” of these economies, but as results of the natural and dynamic process of development, i.e., the transition to service-led economies. Rowthorn and Ramaswamy (1997 and 1999) have noted that this group of economies is going through a process similar to that of countries of the Organisation for Economic Co-operation and Development (OECD), although it must be noted that it is a process affecting Taipei, China but especially Hong Kong, China, and to a much lesser extent, Korea and Singapore. This is the result of transferring production facilities to the PRC. In Korea and Singapore, the share of manufacturing has remained at about 27% since the 1980s.
India’s manufacturing output share has remained stable at about 15–16% since the 1970s, while the share of manufacturing employment has been at around 11% during the periods under consideration. The ASEAN-4 countries (except the Philippines), Cambodia, and Lao PDR have increased their manufacturing shares significantly, both in terms of output and employment. Although Indonesia, Malaysia, and Thailand are cases of what can be labeled as “successful industrialization”, this must be qualified with the following two observations. First, other than Singapore; Korea; Taipei, China; Malaysia; and Kyrgyz Republic, none of the other economies in Table 2 in 2000–2004 had a share of employment in manufacturing as high as that of the OECD average. Second, in terms of labor productivity, there is still a large differential between most developing Asian economies and the OECD average. Indeed, it appears that many economies across developing Asia have industrialized at low levels of productivity (Figure 3). This could be due to two reasons: (i) the product mix of new employment has been toward relatively low-productivity industries; and/or (ii) the increase in employment has taken place in low-productivity techniques.

### Table 1

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRC</strong></td>
<td>37.27</td>
<td>36.26</td>
<td>32.90h</td>
<td>34.50i</td>
</tr>
<tr>
<td><strong>India</strong></td>
<td>15.32</td>
<td>16.43</td>
<td>16.58</td>
<td>15.71</td>
</tr>
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<td><strong>NIEs</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Hong Kong, China</td>
<td>–</td>
<td>21.18</td>
<td>9.43</td>
<td>4.32</td>
</tr>
<tr>
<td>Korea</td>
<td>21.61</td>
<td>27.51</td>
<td>27.14</td>
<td>27.82</td>
</tr>
<tr>
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<td>24.84a</td>
<td>26.09</td>
<td>26.11</td>
<td>27.39</td>
</tr>
<tr>
<td>Taipei, China</td>
<td>32.43</td>
<td>34.95</td>
<td>27.11</td>
<td>22.80</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>10.42</td>
<td>15.35</td>
<td>23.72</td>
<td>29.04</td>
</tr>
<tr>
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<td>16.82</td>
<td>20.42</td>
<td>27.05</td>
<td>31.21</td>
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<td>25.03</td>
<td>23.29</td>
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</tr>
<tr>
<td>Thailand</td>
<td>18.98</td>
<td>23.32</td>
<td>29.55</td>
<td>34.00</td>
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<td><strong>Other Southeast Asia</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>–</td>
<td>–</td>
<td>11.08</td>
<td>19.40</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>–</td>
<td>9.27d</td>
<td>14.20</td>
<td>18.67</td>
</tr>
<tr>
<td>Myanmar</td>
<td>9.64</td>
<td>9.07</td>
<td>6.90</td>
<td>8.49m</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>–</td>
<td>19.69e</td>
<td>15.23</td>
<td>19.94</td>
</tr>
<tr>
<td><strong>Other South Asia</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bangladesh</td>
<td>–</td>
<td>13.76</td>
<td>14.87</td>
<td>15.73</td>
</tr>
<tr>
<td>Bhutan</td>
<td>–</td>
<td>5.29</td>
<td>10.39</td>
<td>7.79m</td>
</tr>
<tr>
<td>Maldives</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Nepal</td>
<td>4.11</td>
<td>5.24</td>
<td>8.77</td>
<td>8.85</td>
</tr>
<tr>
<td>Pakistan</td>
<td>15.89</td>
<td>15.98</td>
<td>16.44</td>
<td>15.99</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>19.02</td>
<td>15.39</td>
<td>15.68</td>
<td>15.90</td>
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**Continued next page**
### Table 1. Continued.

<table>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
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<td><strong>Central and West Asia</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Armenia</td>
<td>–</td>
<td>–</td>
<td>27.56</td>
<td>22.68</td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>–</td>
<td>–</td>
<td>14.08</td>
<td>7.87</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>–</td>
<td>–</td>
<td>13.30</td>
<td>16.33</td>
</tr>
<tr>
<td>Kyrgyz</td>
<td>–</td>
<td>–</td>
<td>20.04</td>
<td>16.19</td>
</tr>
<tr>
<td>Mongolia</td>
<td>–</td>
<td>31.04</td>
<td>18.70</td>
<td>6.37</td>
</tr>
<tr>
<td>Tajikistan</td>
<td>–</td>
<td>27.70</td>
<td>25.43</td>
<td>32.35</td>
</tr>
<tr>
<td>Turkmenistan</td>
<td>–</td>
<td>–</td>
<td>26.30</td>
<td>15.47</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>–</td>
<td>25.06</td>
<td>11.96</td>
<td>9.40</td>
</tr>
<tr>
<td><strong>Pacific Islands</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fiji</td>
<td>11.79</td>
<td>10.59</td>
<td>14.44</td>
<td>15.02</td>
</tr>
<tr>
<td>Kiribati</td>
<td>1.62b</td>
<td>1.16</td>
<td>0.98</td>
<td>0.89</td>
</tr>
<tr>
<td>Marshall Islands</td>
<td>–</td>
<td>–</td>
<td>1.63</td>
<td>4.54o</td>
</tr>
<tr>
<td>Micronesia</td>
<td>–</td>
<td>0.40g</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>7.26</td>
<td>10.06</td>
<td>8.89</td>
<td>8.50m</td>
</tr>
<tr>
<td>Palau</td>
<td>–</td>
<td>–</td>
<td>0.97</td>
<td>1.19n</td>
</tr>
<tr>
<td>Samoa</td>
<td>–</td>
<td>–</td>
<td>17.10</td>
<td>15.37</td>
</tr>
<tr>
<td>Timor-Leste</td>
<td>–</td>
<td>–</td>
<td>2.78k</td>
<td>3.29</td>
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<tr>
<td>Tonga</td>
<td>6.63a</td>
<td>5.42</td>
<td>4.85</td>
<td>4.61</td>
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<tr>
<td>Vanuatu</td>
<td>3.90c</td>
<td>4.45</td>
<td>4.88</td>
<td>4.21o</td>
</tr>
</tbody>
</table>

* a Refers to 1975–79 average.*
* b Refers to 1978–79 average.*
* c Refers to 1979.*
* d Refers to 1989.*
* e Refers to 1985–89 average.*
* f Refers to 1987–89 average.*
* g Refers to 1983.*
* h Refers to 1990–92 average.*
* i Refers to 1992–99 average.*
* j Refers to 1994–99 average.*
* k Refers to 1999.*
* l Refers to 2000.*
* m Refers to 2000–03 average.*
* n Refers to 2000–02 average.*
* o Refers to 2000–01 average.*

Note: – means data not available.

Sources of basic data: *World Development Indicators* (World Bank 2006); Directorate General of Budget, Accounting and Statistics, Taipei, China (various years).
### Table 2
**Developing Asia Manufacturing Employment Shares by Decade**

<table>
<thead>
<tr>
<th></th>
<th>Manufacturing as Percent of Total Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1980s</td>
</tr>
<tr>
<td><strong>PRC</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15.11(^b)</td>
</tr>
<tr>
<td><strong>India</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11.05(^a)</td>
</tr>
<tr>
<td><strong>NIEs</strong></td>
<td></td>
</tr>
<tr>
<td>Hong Kong, China</td>
<td>35.89</td>
</tr>
<tr>
<td>Singapore</td>
<td>27.91</td>
</tr>
<tr>
<td>South Korea</td>
<td>23.93</td>
</tr>
<tr>
<td>Taipei, China</td>
<td>33.41</td>
</tr>
<tr>
<td><strong>ASEAN-4</strong></td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>9.68(^c)</td>
</tr>
<tr>
<td>Malaysia</td>
<td>15.95</td>
</tr>
<tr>
<td>Philippines</td>
<td>9.93</td>
</tr>
<tr>
<td>Thailand</td>
<td>8.87</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td></td>
</tr>
<tr>
<td>Azerbaijan</td>
<td></td>
</tr>
<tr>
<td>Kyrgyz</td>
<td></td>
</tr>
<tr>
<td>Pakistan</td>
<td>13.66</td>
</tr>
<tr>
<td>Viet Nam</td>
<td></td>
</tr>
<tr>
<td><strong>OECD</strong></td>
<td>21.58(^d)</td>
</tr>
</tbody>
</table>

Note:

- \(^a\) For India, the figure for each decade refers only to a single year, as follows: 1983, 1993/94, 1999/00.
- \(^b\) Refers to the period 1987–89.
- \(^d\) For OECD, the number of countries covered each decade are: 18 for the 1980s, 20 for the 1990s, 21 for 2000/04.
- \(^e\) Refers to the period 1992–99.
- \(^f\) Refers to the period 1996–99.
- \(^g\) Refers to the period 2000–02.
- \(^h\) Refers to the period 2000–01.
- \(^i\) Refers to the period 2001–03.

Sources: LABORSTA (International Labour Statistics Organization 2006); Directorate General of Budget, Accounting and Statistics, Taipei, China (various years); Anant et al. (2006).
Figure 3
MANUFACTURING LABOR PRODUCTIVITY, LOGARITHMIC SCALE (US $2000)


Source: Authors’ calculations.
Developing Asia’s increased share in world manufacturing value-added has been accompanied by a significant degree of structural transformation within manufacturing. Table 3 shows the structure of manufacturing output of developing Asia by decadal averages (except latest subperiod). In the 1970s, food and beverages; textiles; and apparel, leather, and footwear accounted for about 39% of total manufacturing, while electrical and nonelectrical machinery and transport equipment accounted for about 17%. By 2000–2003, the former three accounted for a substantially lower 22% while the latter three accounted for about 34%. This shows a very clear change (upgrade) in the structure of manufacturing production. It also shows that the production structure has become slightly more diversified, especially compared to the 1970s. Appendix Table 1 shows this information disaggregated by economy.

### Table 3
**Manufacturing Structure by Decade, Developing Asia (percent of total manufacturing)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Food and beverages</td>
<td>19.40</td>
<td>14.14</td>
<td>12.45</td>
<td>12.55</td>
</tr>
<tr>
<td>Textiles</td>
<td>14.77</td>
<td>11.02</td>
<td>7.11</td>
<td>5.84</td>
</tr>
<tr>
<td>Apparel, leather, and footwear</td>
<td>5.27</td>
<td>4.89</td>
<td>4.74</td>
<td>4.20</td>
</tr>
<tr>
<td>Wood and wood products</td>
<td>3.01</td>
<td>2.10</td>
<td>2.01</td>
<td>1.82</td>
</tr>
<tr>
<td>Paper and paper products</td>
<td>2.20</td>
<td>2.10</td>
<td>2.09</td>
<td>2.28</td>
</tr>
<tr>
<td>Printing and publishing</td>
<td>2.11</td>
<td>1.95</td>
<td>2.58</td>
<td>1.89</td>
</tr>
<tr>
<td>Industrial chemicals</td>
<td>9.41</td>
<td>10.19</td>
<td>10.21</td>
<td>11.45</td>
</tr>
<tr>
<td>Petroleum and coal products</td>
<td>4.90</td>
<td>4.73</td>
<td>4.07</td>
<td>3.57</td>
</tr>
<tr>
<td>Rubber and plastic products</td>
<td>4.55</td>
<td>4.84</td>
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Source: Authors’ computations based on data from INDSTAT (2005).

If we group the different branches of the manufacturing sector according to the level of technology\(^5\) (Table 4), we can see that developing Asia’s shares in the four categories have increased substantially between the 1970s and 2000/03: from 4.86% to 12.75% in low technology; from 2.51% to 8.42% in medium technology and low economies of scale; from 2.14% to 11.34% in medium technology and medium economies of scale; and from 2.19% to 11.33% in high technology. It is

---

\(^5\) This was done by dividing all manufacturing branches into four groups according to level of technology and scale.

Group 1 corresponds to the manufacturing branches with the lowest technology and scale economies, e.g., food and beverages, tobacco, wearing apparel, leather products. Group 2 consists of plastic and rubber products, paper, among others. Group 3 consists of iron and steel, nonmineral products, among others. Group 4 consists of products with the highest technology and scale economies, such as electrical and nonelectrical machinery, industrial chemicals, professional equipment, transport equipment, among others.
also worth noting that the PRC’s shares have increased in all four categories. On the other hand, the shares of the NIES and ASEAN-4 increased until the 1990s, but decreased in 2000–2003.

### Table 4

**Share of World Manufacturing by Type of Technology and Decade**

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<td>2.19</td>
<td>18</td>
<td>6.07</td>
</tr>
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Note: N denotes number of economies. LAC means Latin America and Caribbean; SSA means Sub-Saharan Africa. ASEAN-4 includes Indonesia, Malaysia, Philippines, and Thailand. CWA denotes Central and West Asia covering Armenia, Azerbaijan, Kazakhstan, Kyrgyz Republic, Mongolia, Tajikistan, Turkmenistan, and Uzbekistan. NIEs consist of Hong Kong, China; Korea; Singapore; and Taipei, China. Other Southeast Asia comprises Cambodia, Laos PDR, Myanmar, and Viet Nam. Other South Asia covers Bangladesh, Bhutan, Maldives, Nepal, Pakistan, and Sri Lanka. Pacific includes Fiji, Kiribati, Marshall Islands, Micronesia, Palau, Papua New Guinea, Samoa, Timor Leste, Tonga, and Vanuatu.

Source: Authors’ computation based on data from INDSTAT (UNIDO 2005).
ADB (2007) provides evidence that the manufacturing sectors in a number of Asian economies, especially Korea; Malaysia; Singapore; and Taipei, China, have undergone important transformations and shifted their manufacturing output to more technology- and scale-intensive subsectors. This upward shift is an important component of what structural change is about, as the production of more sophisticated manufactured products leads to faster growth by enlarging the potential for catch-up. In the PRC and India, the shift to more technology- and scale-intensive subsectors is taking place more slowly, while in most other Asian countries the evidence is lacking.

Summing up, the two most significant features of the transformation of developing Asia’s manufacturing sector are, first, its increasing share in world total manufacturing output; and second, its technological upgrade, as reflected in the increasing production of more technologically advanced products.

III. HOW LARGE IS DEVELOPING ASIA’S MANUFACTURING SECTOR?
A LOGISTIC REGRESSION

In order to benchmark developing Asia’s manufacturing sector we have to compare the actual share with that given an economy’s control variables. Which are the latter? The theory underlying the logistic pattern of growth model (Chenery 1960 and 1971, Kuznets 1966, Chenery and Taylor 1968, Chenery and Sirquin 1975) indicates that the most important variable is, not surprisingly, income per capita. This is the result of Engel’s law, namely, the empirical observation that the proportion of consumer expenditure on foodstuffs, the principal product of the agricultural sector, declines as per capita income rises, i.e., the income elasticity of demand for food is less than unity. Hence, there is a decline in the agricultural share, which in turn leads to a decline in the sector’s share of the labor force in the course of economic development. And as the income elasticity of demand for manufactures tends to be relatively high in developing countries and relatively lower in the rich countries, the share of manufacturing in output and employment rises at first and falls later on.

To this purpose, we estimate econometrically the elasticity of the manufacturing share with respect to income per capita by hypothesizing the relationship \( S_i = e^{a_1 y_{i2}} \) between the manufacturing output share \( (S_i) \) and income per capita \( (y) \). This relationship can be estimated econometrically by taking logarithms as \( 1nS_i = a_1 + a_2 1n y \). The elasticity is given by the estimate of \( a_2 \). However, given the possibility of a hump-shaped relationship between both variables, we hypothesize the nonlinear relationship \( S_i = e^{a_1 y_{i2}} + a_3 1n y \), which can also be estimated by taking logarithms. The income elasticity is then given by \( \eta_i = a_2 + 2a_3 1n y \), which varies with \( y \). The regression also includes two additional regressors. First we introduce population, a proxy market size. Moreover, the change in the size of population also reflects the change in the actual or potential labor supply. Second, as many Asian economies have followed an export-oriented development path, export performance, which depends largely on the expansion of the overseas market, is an important factor affecting the changing share of the secondary sector in total product. For this reason, we estimate the regression for the manufacturing sector including the trade ratio in GDP (\( Tr \)). Hence we estimate:

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\( \text{erD Working Paper Series no. 101} \)

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6 The investment ratio was also included as an additional variable as increases in investment favors the expansion of the secondary sector. Also, the rate of capital formation is an important variable that influences the composition of demand. The majority of investment expenditure involves the purchase of manufactured goods such as prefabricated buildings, construction materials, and producer durables. For these reasons, a high rate of investment should be reflected in a high share of a manufacturing in both output and employment. Results were not satisfactory and hence, the investment ratio was dropped.
where \( S_{MA} \) is the manufacturing share in GDP; \( u \) is the error term; \( \eta_{MA} = (a_i + 2a_i \ln y^*) \) is the estimated elasticity of the share with respect to income per capita at each income per capita (\( y^* \) is actual income per capita); and the symbol \(^{\wedge}\) denotes the estimated coefficient. Regression (1) is estimated with cross-sectional data using ordinary least squares.\(^7\)

Point elasticities for 1975, 1985, 1995, and 2000 are shown in Table 5.\(^8\) A one percentage point increase in income per capita leads, on average, to a less-than-one percentage point increase in output and employment shares in industry. This elasticity increased between 1975 and 1985, but then decreased for 1995 and 2000. Moreover, since the relationship between the logarithm of the manufacturing share and the logarithm of income per capita is nonlinear (a hump-shaped relationship), the actual elasticity varies with income per capita. The hump-shaped relationship implies that the elasticity of the manufacturing share is relatively high (positive, i.e., the share increases as income per capita increases) when an economy is poor and then falls as the economy becomes rich (becomes negative, i.e., the share decreases as income per capita increases). The range is shown in brackets.\(^9\) In 1975, the elasticities varied between 0.58 for the poor economies and –0.36 for the rich economies. On the other hand, in 2000, the elasticities varied between 0.36 for the poor economies and –0.11 for the rich economies. The five economies with the lowest and highest elasticities are shown in the bottom half of Table 5.

Figure 4 graphs the complete range of income elasticities for 1975, 1985, 1995, and 2000 vis-à-vis income per capita. As noted above, the elasticities increased between 1975 and 1985 (i.e., the curves shifted upward), but then decreased in 1995 and 2000 (i.e., the curves shifted downward). The bottom half of Figure 4 provides the economies with the highest and lowest elasticities each year.

The regression results also allow us to calculate the turning point, that is, the point at which elasticity turns from positive to negative (i.e., the manufacturing share becomes highest, at which point the income elasticity is zero). This occurs at $9,998 (dollars of 2000). Since the population and trade variables are statistically significant in the regression, we have graphed the predicted line for 2000 in Figure 5 for two different populations, 50 and 100 million, as well as for two different trade ratios, 30% and 100%. Results indicate that population size matters: doubling population from 50 to 100 million increases the manufacturing share by about 2 percentage points.
for low income per capita, and by about 3 percentage points at high income per capita. Moreover, openness also matters: increasing the trade ratio from 30% to 100% increases the manufacturing share by 6 percentage points for low income per capita, and by about 8 percentage points for high income per capita. The results also indicate that the maximum income per capita corresponds to a manufacturing share of between 19% and 27% (depending on the population and trade share combinations).

Actual and predicted shares (i.e., where the latter is each economy’s expected share given its income per capita, population, and trade ratio) for developing Asia are shown in Table 6. Economies can be divided into three groups, depending on whether (i) the actual share is higher than the predicted one; (ii) the actual share is lower than the predicted; or (iii) the predicted and actual shares are about the same and the economy is on or very close to the regression line.

In the first group of economies we find PRC; the NIEs except Hong Kong, China; the ASEAN-4 except the Philippines; Cambodia; Lao People’s Democratic Republic; Armenia; Kyrgyz Republic; Tajikistan; Fiji; and Samoa. The PRC and the NIEs’s very high manufacturing shares are the result of explicit industrialization policies as the basis for their development (see Wang and Li 1995 on the PRC). Although declining with respect to the average of the 1980s, the share of the manufacturing subsector in total output in the PRC has been traditionally much higher than anywhere else. It still accounts for about 34.5% of total output, only matched in developing Asia by Malaysia, Thailand, and Tajikistan. The share of manufacturing employment, on the other hand, has declined from about 15% in the 1980s to 11% at present.

### Table 5

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<td>(4.72)**</td>
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Turning Point $9,998

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<td>Nepal (0.55)</td>
<td>United Arab Emirates (–0.36)</td>
<td>Korea (0.09)</td>
</tr>
<tr>
<td></td>
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<td>PRC (0.54)</td>
<td>Kuwait (–0.27)</td>
<td>Fiji (0.16)</td>
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<td>India (0.48)</td>
<td>Japan (–0.23)</td>
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<td>Pakistan (0.44)</td>
<td>US (–0.23)</td>
<td>Philippines (0.26)</td>
</tr>
<tr>
<td></td>
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<td>Indonesia (0.43)</td>
<td>Denmark (–0.22)</td>
<td>Papua New Guinea (0.31)</td>
</tr>
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<td></td>
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<td>Switzerland (–0.02)</td>
<td>Singapore (0.04)</td>
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<td>India (0.30)</td>
<td>Japan (–0.02)</td>
<td>Taipei, China (0.08)</td>
</tr>
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<td>Singapore (–0.08)</td>
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<td>US (–0.11)</td>
<td>Malaysia (0.06)</td>
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<td>Switzerland (–0.09)</td>
<td>Malaysia (0.07)</td>
</tr>
</tbody>
</table>

Source: Authors’ estimates.
Figure 4

**INCOME ELASTICITIES OF MANUFACTURING OUTPUT**

Note: $y^*$ is actual income per capita. Elasticities were computed using the following equations:

\[
\begin{align*}
\varepsilon_{75} &= 1.333 + (2 \times (-0.079)) \ln y^* \\
\varepsilon_{85} &= 0.684 + (2 \times (-0.034)) \ln y^* \\
\varepsilon_{95} &= 0.721 + (2 \times (-0.041)) \ln y^* \\
\varepsilon_{02} &= 0.711 + (2 \times (-0.039)) \ln y^*
\end{align*}
\]

Source: Authors’ estimates.
**Figure 5**

**FITTED REGRESSION LINE OF MANUFACTURING OUTPUT SHOES VERSUS GDP PER CAPITA, 2000**

![Graph showing fitted regression line for manufacturing output shares versus GDP per capita for Developing Asia and Rest of the World, 2000.](image)

**Note:**
1. The dashed lines refer to the prediction for varying populations (lower line is for 50 million while upper line is for 100 million), for a trade ratio of 78%.
2. The continuous lines refer to the prediction for varying trade openness (lower line refers to an openness of 30% while the upper line is for 100%) for a population of 100 million.
3. Estimated regression:
   \[
   \ln S_i = -4.628 + 0.710\ln y - 0.039(\ln y)^2 + 0.289Tr + 0.180\ln P
   \]
   t-stat: (-4.05)** (2.97)** (-2.55)** (2.76)** (5.92)**

   where \(S_i\) = manufacturing output share; \(y\) = GDP per capita; \(P\) = Population; and \(Tr\) = Trade ratio.

   "**" and "***" mean significant at 1% and 5%, respectively.

4. Predicted manufacturing output shares at various income levels for varying trade ratio and population:

<table>
<thead>
<tr>
<th>Income Per Capita ($)</th>
<th>Average Openness (78% of GDP)</th>
<th>Population: 50 Million</th>
<th>Population: 100 Million</th>
<th>Trade Ratio: 30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td></td>
<td>15.777</td>
<td>17.879</td>
<td>13.536</td>
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<td>18.178</td>
<td>20.601</td>
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<td>5,000</td>
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<td>21.894</td>
<td>24.812</td>
<td>18.785</td>
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<td>10,000</td>
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<td>22.304</td>
<td>25.276</td>
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<tr>
<td>15,000</td>
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<td>22.163</td>
<td>25.116</td>
<td>19.015</td>
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<td>20,000</td>
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<td>21.894</td>
<td>24.812</td>
<td>18.785</td>
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<tr>
<td>25,000</td>
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<td>21.593</td>
<td>24.470</td>
<td>18.526</td>
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</table>

Source: Authors’ estimates.
### Table 6
**Predicted versus Actual Manufacturing Output Shares, 2000**

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<thead>
<tr>
<th>Region</th>
<th>Predicted</th>
<th>Actual</th>
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</thead>
<tbody>
<tr>
<td>PRC</td>
<td>27.31</td>
<td>34.50</td>
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<tr>
<td>India</td>
<td>19.55</td>
<td>15.85</td>
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<tr>
<td><strong>NIEs</strong></td>
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<tr>
<td>Hong Kong, China</td>
<td>21.72</td>
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</tr>
<tr>
<td>Korea</td>
<td>22.04</td>
<td>29.42</td>
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<td>Singapore</td>
<td>21.68</td>
<td>28.73</td>
</tr>
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<td>Taipei, China</td>
<td>20.82</td>
<td>23.76</td>
</tr>
<tr>
<td><strong>ASEAN-4</strong></td>
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<td></td>
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<tr>
<td>Indonesia</td>
<td>21.90</td>
<td>27.75</td>
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<tr>
<td>Malaysia</td>
<td>25.51</td>
<td>32.60</td>
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<tr>
<td>Philippines</td>
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<td>22.23</td>
</tr>
<tr>
<td>Thailand</td>
<td>23.93</td>
<td>33.59</td>
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<td><strong>Other Southeast Asia</strong></td>
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<tr>
<td>Cambodia</td>
<td>11.84</td>
<td>16.86</td>
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<tr>
<td>Lao PDR</td>
<td>8.95</td>
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<td>Viet Nam</td>
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<td>18.56</td>
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<td><strong>Other South Asia</strong></td>
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<td>Bangladesh</td>
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<td>8.06</td>
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<td>Nepal</td>
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<td>14.81</td>
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<td>Sri Lanka</td>
<td>15.37</td>
<td>16.83</td>
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<td>Turkmenistan</td>
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<td><strong>Pacific Islands</strong></td>
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<td>Fiji</td>
<td>10.98</td>
<td>14.62</td>
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<td>Kiribati</td>
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<td>Papua New Guinea</td>
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<td>Samoa</td>
<td>7.16</td>
<td>14.82</td>
</tr>
<tr>
<td>Tonga</td>
<td>5.99</td>
<td>5.16</td>
</tr>
</tbody>
</table>

Source: Authors’ estimates.
In the second group we find India; Hong Kong, China; Azerbaijan; Mongolia; Turkmenistan; Uzbekistan; Kiribati; and Papua New Guinea. The case of Hong Kong, China was already discussed above: this economy has undergone deindustrialization as a result of the transfer of manufacturing plants to the PRC. Today it is one of the most service-oriented economies in the world. The other interesting case in this group is India. Why is India’s manufacturing share in GDP about 4 percentage points lower than what it should be (i.e., India’s manufacturing base is relatively small by international standards, after controlling for income per capita, population size, and openness to trade)? Economists have not been able to agree on the causes, or resolve the issue empirically. A review of the literature indicates that a combination of factors, which includes the reservation policy (as of January 2007, the manufacture of 237 items was reserved for small and medium-size companies); the “license-permit Raj” (which lasted until 1991 and was responsible for India’s large administrative machinery); and the somewhat restrictive labor laws (although this is very controversial and unsettled), combined with lack of adequate physical, social, and regulatory infrastructure, are responsible for the relative underperformance of the sector.10

Finally, the rest of the economies (i.e., Philippines, Viet Nam, Other South Asia, Kazakhstan, and Tonga) are in the third group. In the case of the Philippines, although the share is well predicted (and therefore it is not low when benchmarked), it is important to note that this country had the highest manufacturing output share among the ASEAN-4 in the 1970s, but by 2000–04 the share had decreased by about three percentage points and was the lowest in the group. Its industrialization policies have been a failure with the result that its actual manufacturing share is much lower than that of Indonesia and, especially, Malaysia and Thailand. So what are the reasons for the lack of industrialization? This is a tricky question given that in the 1950s a sophisticated manufacturing sector emerged, bolstered by protection and a well-developed human capital base. As in the case of India, several reasons account for the poor performance of the sector: an uncompetitive cost structure, fast liberalization and poor infrastructure, and distributive conflicts and dysfunctional institutions that have prevented the development of the appropriate institutional prerequisites for sustained growth.11

IV. CONCLUSIONS

This paper has, first, described the changes in developing Asia’s manufacturing sector during the last three decades. Second, it has used a logistic regression in order to benchmark economies’ share of manufacturing output in GDP with respect to the international regression line. The most salient conclusions are as follows:

(i) The share of developing Asia in world manufacturing output has increased significantly since the 1970s. However, the increase is concentrated in a number of economies, mostly the NIEs, PRC, Indonesia, Malaysia, and Thailand.

(ii) The NIEs have started experiencing a deindustrialization process, very clear in the case of Hong Kong, China (in terms of both output and employment shares). This is the result of maturation of this economy and the transfer of production facilities to the PRC.

10 See, for example, Lewis (2004, chapter 8); Besley and Burgess (2004); Kochhar et al. (2006); Roy (2004); Deshpande (2004); and Anant et al. (2006).

11 See, for example, ADB (2005), Aldaba et al. (2005), Hill (2003), Ofreneo (2003), and Prichett (2003).
(iii) There has been an important upgrading as the share of more technologically advanced manufactures has increased.

(iv) Nevertheless, the productivity levels of most economies across developing Asia are still very far from those of the OECD. The exception is the NIEs.

(v) The PRC; NIEs (except Hong Kong, China); ASEAN-4 (except the Philippines); Cambodia; Lao PDR; Armenia; Kyrgyz Republic; Tajikistan; Fiji; and Samoa have actual manufacturing shares significantly higher than those predicted by a logistic regression that controls for income per capita, trade share, and population.

(vi) India is the most significant case of a country with an actual manufacturing share lower (by four percentage points) than what corresponds given its income per capita, trade share, and population. The actual manufacturing share of Hong Kong, China is very low due to the transfer of manufacturing activities to the PRC. The Philippines’s predicted share is very close to its actual share, but it is significantly lower than that of the other ASEAN-4 economies.

(viii) In the logistic regression, the trade share and population variables are statistically significant. Doubling population from 50 to 100 million increases the manufacturing share by about 2 percentage points for low income per capita and by about 3 percentage points at high income per capita. And increasing the trade ratio from 30% to 100% increases the manufacturing share by 6 percentage points for low income per capita and by about 8 percentage points for high income per capita. The results also indicate that the maximum income per capita, about $10,000 (in 2000), corresponds to a manufacturing share between 19% and 27% (depending on the population and trade share combinations).
## APPENDIX

**Share of Manufacturing Subsector**

<table>
<thead>
<tr>
<th>DMC</th>
<th>Food and Beverages</th>
<th>Textiles</th>
<th>Apparel, Leather, and Footwear</th>
<th>Wood and Wood Products</th>
<th>Paper and Paper Products</th>
<th>Printing and Publishing</th>
<th>Industrial Chemicals</th>
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<td><strong>1970s</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
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<tr>
<td>India</td>
<td>11.19</td>
<td>20.53</td>
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<td>0.68</td>
<td>2.57</td>
<td>2.03</td>
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<td>3.77</td>
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<td>1.55</td>
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<td>0.68</td>
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Source: Author’s calculations based on data from INDSTAT (UNIDO 2005).
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Jesus Felipe and Gemma Estrada document the transformation of developing Asia’s manufacturing sector during the last three decades, and benchmark its share in GDP with respect to the international regression line by estimating a logistic regression.

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