The Comparative Performance of Foreign and Domestic Firms in Brazil

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Summary.— This paper analyzes data for 282 pairs of foreign-owned and private Brazilian firms which are matched by sales and by four-digit manufacturing industry. Differences between the two types of firms are surprisingly large and highly significant. Compared to their local counterparts, foreign firms operate fewer plants, have higher ratios of value-added to output, higher levels of advertising and royalty payments, greater exports, higher labor productivity, higher wages and greater capital intensity.

1. INTRODUCTION

No author can hope to attract readers to yet another study of transnational firms unless some justification for the paper is provided at the outset. In this case, the inspiration arises from the fact that existing studies of the comparative performance of transnational firms in Brazil and elsewhere tend to be very aggregate and fail to control for differences in size or type of product. Studies based on data for individual firms or plants do exist, but they have few observations, cover very few industries, refer to only a few aspects of performance, or fail to control for size differences as well as industry (product mix) differences.

The present study represents an attempt to be both disaggregate and comprehensive. Detail and breadth are both necessary if we are to reach conclusions concerning the typical differences between local firms and their foreign counterparts operating in Brazil. The analysis is based on data for 282 pairs of foreign-owned and private Brazilian firms drawn from 80 manufacturing industries in the year 1978. The firms are matched by volume of sales, and in no case does the difference in sales exceed 10%. Average differences between the two sets of firms are measured, and their significance is tested, using various measures of size, value-added to output ratios, advertising expenditure, royalty payments, export performance, productivity, skill intensity and capital intensity.

An important caveat should be noted at this point: the paired firms in our sample interact in the same market, so it is possible that the behavior of local firms has been altered, through competitive and demonstration effects, by the presence of foreign rivals. Foreign firms in developing countries are thought to introduce "inappropriate" (capital-intensive) technology and consumer goods that fail to meet the needs of the vast majority of the population (Stewart, 1979, pp. 78-100, and the references cited therein). If foreign firms, through advertising, create a demand for "inappropriate" products, this may induce local firms to satisfy the changed preferences of the population by producing the same type of products. Moreover, local firms may choose to follow the example of foreign firms and adopt the same "inappropriate" production techniques. In short, our control group, which consists of local firms that survive and thrive in the face of foreign competition, may conceivably act as a mirror, reflecting characteristics of the comparison group of foreign firms.

The plan of the paper is as follows. The second section presents a brief review of the literature. Section 3 reports the results of tests for significant differences between matched pairs of firms in our data base. A concluding section summarizes the main empirical findings.

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2. REVIEW OF THE LITERATURE

The purpose of this section is to provide a concise survey of previous studies of the comparative performance of transnational firms in Brazil's manufacturing sector. Selected references to studies of that topic are included to illustrate alternative methods of analysis. For a broad survey of the literature, see Lall (1978) and Caves (1983, Chapter 9).

Published data are not available, but foreign-controlled firms are believed to account for approximately a quarter of manufacturing employment in the output and, more than a third of the sector's exports (Bonnell, 1980, p. 871; ECLAC, 1985, pp. 65-67; and ECLAC, 1983). Published estimates tend to vary by year, but rather by sample size. Foreign-owned subsidiaries are much larger on average than local firms, so exclusion of small firms increases the foreign share. Von Döbelinger and Cavalcanti (1975), for example, found foreign-controlled firms to account for 35% of the total sales in their sample of 318 large manufacturing enterprises. Foreign direct investment is concentrated in the technologically "dynamic" industries which have shown rapid rates of growth. Nonetheless, despite years of "import-substitution" local firms and publicly-owned firms have grown at a faster pace than foreign subsidiaries in recent years. Moreover, the wide difference in the re- eruption of foreign compared to local private firms, but foreign firms are believed to reflect profits by under-invoicing exports and over-invoicing imports despite the existence of a licensing system designed to prevent such practices (see Zini, 1984; Tyler, 1978, p. 361).

Numerically the foreign firms can be characterized by higher export-sales ratios, greater labor productivity, greater capital intensity and higher wage levels compared to local firms in Brazil (Hoffding and Cavalcanti, 1975; Meller and Mitzola, 1982; Goncalves, 1982; Meller, 1984). These studies are quite aggregate, however, with no procedures for subdividing only to 21 subsectors — the two-digit level. The ob- served differences between foreign and local firms could be due to the fact that foreign firms are larger and operate in different industries rather than to the existence or nonexistence of foreign ownership in itself.

Cost studies are a potentially rich source of information on differences between foreign and local firms, as well as their interaction over time. The collection of such data tends to be costly, however, and requires the cooperation of firms that are studied. As a result, researchers who analyze case studies find it difficult to control for differences in size and product mix, are tempted to generalize from an insufficient number of observations, and are thwarted by the endogeneity of significant. The ambitious research program directed by Jorge Katz in Buenos Aires, for example, covers fewer than 60 firms drawn from a variety of industries in countries of Latin America. Katz himself (1984, p. 15) notes that the case studies "make no claim to statistical representativeness, but the reader should bear this in mind when evaluating the research findings that he reports."

Industry studies can also be used to study differences in the performance of local and foreign enterprise, with the advantage that research is concentrated on firms that pro- duce similar products and compete in the same market. A number of studies of Brazilian industries do exist, of which a few outstanding examples are Evans (1979, Chapter 3) on textiles and pharmaceuticals and Newpower (1977 and 1979) on the electrical industry. These studies provide valuable analyses of changes in market structure, particularly concentration, foreign ownership and state participation, but they neg- lect the topic that is the subject of this paper, namely the comparative performance of foreign and domestic firms. Although the approach adopted here, however, make the interesting point that the nature of technological change may explain why foreign firms were more successful in the penetration of the pharmaceutical industry than they were in competing with local firms in textiles. Textile technology tends to be less capital goods which are available to all firms, domestic or foreign, for the price of new machin- ery, whereas pharmaceutical technology gener- ally takes the form of patents. New pharmaceutical products are developed by transna- tional corporations in developed countries, and produced by subsidiaries in developing countries. This is, however, the case for most ran-some of the foreign-run firms which are concentrated in the industrial policies of three pairs of foreign and local firms operating in Costa Rica, whereas the differences were not statistically significant. It is not clear, however, whether the firms were described as well as by industry. If foreign firms are larger than local firms in the sample, this might account for the unexpected results since, among exporters, a very strong inverse relationship exists between firm size and export performance (see ECLAC, 1985, Chapters 3 and 5). In another study, Goncalves (1983a and b) analyzed 77 pairs of firms matched by four-digit industry and was unable to find significant differences in profit or growth rates in the 1969-1979 period. This study suffers, however, from a failure to control for scale differences; the foreign firms are three times as large as the local firms in terms of average sales (see Goncalves, 1983a, Table 2 or 1983b, Table 2).

The best example of an application of the "matched pairs" approach is to Brazilian industry by Morley and Smith (1977, pp. 285-296) who test for significant differences between foreign establishment- ers of differing national origin as well as differences between them and their locally-owned counterparts. They argue that the lack of competitive pressures allows foreign establishments to produce profitably without adapting their techniques of production to local conditions, then one should observe both (i) foreign plants utilizing more capital-intensive techniques of production and (ii) techniques of production varying by nationali- ty among otherwise comparable foreign establish- ments. Matching establishments by scale (value-added) and by five-digit industry, they assembled a sample of 29 US-Brazilian pairs, 10 Western Europe-Brazil pairs, 19 US-West Ger- many pairs, and 24 US-other Western Europe pairs. Value-added per production worker was significantly higher for both groups of foreign establishments compared to their local counterparts, and the productivity of US plants was significantly higher than those owned by compa- nies from West Germany or other countries of Western Europe. These results are consistent with the existence of differences in techniques of production; nonetheless, a proxy measure of capital intensity seems a more meaningful measure per production worker — was significantly different only for the US-West Germany pairings, so their evidence on choice of technique is not conclusive.

(a) Matched pairs of firms

The "matched pairs" approach to control for size and industry mix, due to a dearth of adequate data, has been used very little in comparative studies of foreign and domestic firms. The few studies that do exist are based on a very small number of observations, which makes it difficult to reject the null hypothesis of no difference between the two types of firms at any conventional level of statistical significance. Mason's (1973) data, for example, consist of 14 pairs of firms: five from Mexico and nine from the Philippines. The present author (1976) obtained information for a sample of 33 matched pairs of foreign and local firms operating in Costa Rica, whereas Chung and Lee (1980) were able to assemble data for only 17 matched pairs in South Korea.

In Brazil, ECLAC (1983, pp. 33-38) reports that for 65 matched pairs, foreign firms show lower capital-intensity ratios than domestic firms, but the differences were not statistically significant. It is not clear, however, whether the firms were described as well as by industry. If foreign firms are larger than local firms in the sample, this might account for the unexpected results since, among exporters, a very strong inverse relationship exists between firm size and export performance (see ECLAC, 1985, Chapters 3 and 5). In another study, Goncalves (1983a and b) analyzed 77 pairs of firms matched by four-digit industry and was unable to find significant differences in profit or growth rates in the 1969-1979 period. This study suffers, however, from a failure to control for scale differences; the foreign firms are three times as large as the local firms in terms of average sales (see Goncalves, 1983a, Table 2 or 1983b, Table 2).

The "regression" approach to the control of size, industry and other variables has been utilized quite widely by researchers in Brazil. Braga (1979), in a careful analysis of data for 267 local and foreign firms, regressed profit margins on firm size, market share, advertising, debt, a foreign ownership dummy and other variables. The foreign dummy has a positive coefficient in the regression equation, indicating that foreign firms are more profitable than local firms once the effect of other variables on profitability is accounted for, but the coeffi- cient is significant only at the 20% level in two-tailed test. Newpower and Marsh (1981, pp. 66-72) also failed to find a significant coefficient for an ownership dummy in a similar model estimated with data for over 150 electrical firms. ECLAC (1985) estimated a nonlinear model of the probability of exporting with data for more than 12,000 firms and found the odds of export-
ing for a foreign firm to be double or triple that of a local firm once the effects of size, capital intensity, wage levels and product differentiation are taken into account. Among the subset of over 3,000 exporters, foreign firms had twice the export volume of local firms, highlighting the impact of differences in size, capital intensity, market structure and commercial policy.

Meade's paper has also included a foreign ownership variable in a model of wage determination in Brazil. Like, however, in a study of 141 local establishments and 159 foreign and "mixed" firms in Malaysia found wages of the second group to be 3% higher on average than those of the first group after controlling for the effects of capital intensity, the proportion of employees paid with a fixed monthly salary, expertise ratios and import competition. Surprisingly, variables for scale, trade union and plant location were not significant. A shortcoming of the study is the incomplete control for inter-industry, as opposed to inter-firm, differences in wage levels. In any case, average wage differences though statistically significant, were very small. Moreover, the absence of a variable for skill levels makes it impossible to conclude that foreign firms pay higher wages for labor of the same quality.

Small firms typically use less skilled labor, pay lower wages and labor-intensive techniques of production. To produce fewer sets and produce an output that is quite distinct from that of larger firms in the "same" industry. This means that it is difficult to interpret the results since production functions estimated with cross-section data, especially in developing countries, are not comparable across countries in cross-section analyses of productivity, and there have been several attempts in Brazil to measure the performance of foreign firms relative to local firms by including dummy variables in regression equations.

Tyler (1978) estimated an aggregate Cobb-Douglas production function for the entire manufacturing sector based on published 1971 balance sheet data for 850 local and foreign firms. He estimated output by sales, the capital input by the investment in book value of plant and equipment, and labor by the total number of employees. A foreign ownership dummy variable was used as a significant indicator for the aggregate function, but when the same equation was fitted to each of the 21 two-digit sectors, the foreign dummy was significantly greater than zero in only three equations. When Tyler estimated a more general Constant Elasticity of Substitution (CES) production function with the complete set of observations, the higher productivity of foreign firms appeared as greater returns to scale and a higher elasticity of substitution, but not necessarily greater variable or technical efficiency. Mascolo and Boga (1984) confirmed this result by estimating Variable Elasticity of Substitution (VES) production functions. The study lends support to the thesis that foreign firms are more productive because they are more efficient than local firms, but the evidence is not overwhelming.

In another study by Tyler (1978) assembled similar data for the years 1971-75 and estimated Cobb-Douglas production functions for two broadly defined industries: electrical machinery (S.I. 1205) and communication equipment (56 firms). A time variable captured structural technological change and a dummy variable for each firm captured differential efficiency. The coefficients of the technical efficiency dummies show a positive and significant correlation with foreign ownership, but not after controlling for size differences between foreign and domestic firms.

Tyler's research suggests that foreign firms tend to be more productive than local firms when controlling for differences in size (capital and labor) and industry. Unfortunately, the empirical results suffer from two serious biases. First, which is that by measuring output as "sales we are for explicitly assume that the ratio of value-added to total output is 1.0 (variable over the firm population" (1979, p. 127). If this ratio varies systematically by type of firm, statistical inferences are biased. It is shown below that in Brazil value-added-to-sales ratios are significantly higher for foreign firms, so Tyler's results on this account are biased against the finding of a positive effect of foreign ownership.

In the second bias occurs because there is no provision for differences in the quality of labor hired by the two types of firms. If employees of foreign firms systematically have greater skills than employees of local firms, as is shown below, then the regression results are biased in favor of foreign ownership and technical efficiency; output which should properly be ascribed to human capital is being credited to foreign ownership and management.

Morley and Smith (1977) overcame the first bias of bias, but, by ignoring white-collar workers, aggregate the second source of bias in estimates of the relative efficiency of foreign firms. They obtained access to data at the establishment level from the 1969 Industrial Survey. In each of 17 two-digit industries, value-added per production worker was regressed on size, capital intensity and a dummy variable for foreign ownership. Size and capital intensity were not entered as continuous variables, but rather as a set of dummy variables representing various size classes. Capital intensity classes were divided by production workers. The study lends support to the thesis that foreign firms are more productive because they are more efficient than local firms, but the evidence is not overwhelming.

In the present study every firm except those associated with the joint venture of "Queen & Queen" (VISEA, 1978 and August 1979) and Jean Bernier's "Interiema" Guide (Rio de Janeiro: 4th edition, 1978 and 3rd edition, 1989). Nonetheless, it is not inconceivable that some of the 221 pairs of local and foreign firms may in reality be pairs of foreign firms. If so, this will bias the observed differences between the two sets of firms toward zero.

It is worth emphasizing that this is not a random sample of foreign firms in Brazil. Many industries in which foreign firms are dominant, such as tobacco or rubber tires, are not represented at all due to the lack of locally-owned comparable firms. For example, General Motors is excluded from the study because no local automotive firm exists that is similar in size to these giant industries. On the other hand, 10 pairs of pharmaceutical firms are included, despite the predominance of foreign firms in that industry.

In the matching process, firms are drawn from diverse industries, comparison of the mean values for each type of firm or averages of simple differences can be misleading. Such comparisons inadvertently give a large weight, for example, to capital-intensive industries in measures of differences in capital intensity, or to export industries in measures of differences in capital intensity. To avoid this, we follow Chng and Lee (1980) and calculate for each variable and each pair of firms, the standardized difference, as defined as the absolute difference expressed as a percentage of the average level for the two firms. Algebraically, if $X_i$ represents the value of a variable for the i-th foreign firm and $X_j$ the value for the j-th local firm matched to it, then the standardized difference is

$$
\frac{|X_i - X_j|}{(X_i + X_j)/2}
$$

A negative difference indicates that the value for the local firm exceeds that reported by its foreign counterpart. Note that the standardized difference is bounded so that the absolute values result that result when one of the two firms of a
matched pair registers a positive value and the other zero for a particular variable. When both \( X \) and \( Y \) are zero, as occurs frequently when some variables, the standardized difference is defined as zero.

Previous studies based on "matched pairs" have relied on nonparametric techniques to estimate the sign and significance of difference between the two sets of firms. Significant difference may be so small or so large, however, that nonparametric techniques do not provide us with information as to which variable would be. Fortunately, the large size of our sample permits us, by virtue of the Central Limit Theorem, to assume normality and use standard techniques of statistical inference which provide information on the size as well as on the statistical significance of any observed differences.

(a) Empirical findings for the full sample

Table 1 reports mean values by type of firm for a number of variables, along with the mean standardized difference and its standard error. The large sample size means that it is relatively easy to reject the null hypothesis that average differences are zero even when differences between the two types of firms are quite small. The pairs are matched on the basis of sales volume, so that the 282 foreign firms are only 0.6% smaller on average, than domestic firms. Nonetheless, the standard error for this statistic is a low 0.2%, so the difference is statistically significant in a "t" test at the 1% level. The fact that the difference is significant at all reflects instructions given to the research assistant who assembled the matched pairs. Since foreign firms are larger than local firms, when confronted with a choice between a slightly larger or a slightly smaller local firm to match with our foreign firm, he was asked to favor the former.

The two sets of firms are closely matched by volume of sales, but in other measures of size they differ considerably. Foreign firms are 65% larger, on average, in terms of value-added, and 14% smaller in terms of employment. Value-added was estimated as total sales revenue plus charge in inventories less purchases of raw materials, advertising, electricity, fuel and goods to be sold. In addition, only 45% of the foreign firms operate multiple plants or establishments, whereas 52% of the domestic firms own more than one establishment. As a consequence, the average number of plants operated by foreign firms is significantly lower than the average number operated by their local counterparts. These statistics illustrate the facility of matching foreign to local firms in terms of all aspects of size. The choice of sales as a variable to match the two sets of firms is unavoidably arbitrary.

Given that foreign firms are nearly the same size as their local counterparts in terms of sales, yet considerably larger in terms of value-added, it follows that they add more value per unit of output. The standardized difference of the ratio of value-added to output (sales plus inventory changes) averages 5.9% and is significantly different from zero at the 1% level in a two-tailed test. This result, in terms of sign though not significance, is similar to that found in an earlier study (Willmore, 1976, p. 312) for Costa Rica. The finding is consistent with the thesis that foreign firms are more vertically integrated, i.e., that they process more stages of manufacture within the firm, relying less on outside producers or importers for a supply of intermediate inputs. It lends no support to the belief expressed in early writings that transnational corporations "contribute less to domestic value-added than local firms, but a full study requires knowledge of the linkages of foreign and domestic firms with plants in local and overseas markets.

The higher value-added to output ratios observed for foreign firms may also be the result of specialization in higher-quality or more uniform goods in addition to (or instead of) greater vertical integration. In other words, foreign firms may typically have higher ratios of value-added to output not because they produce more intermediate inputs in their Brazilian plants, but rather because the goods they produce command higher prices due to advertising, prestige and brand names, higher quality or greater quality control. The high advertising and expenditure observed for foreign firms is consistent with this interpretation, as is the finding, reported below, that foreign firms employ techniques of production that are capital- and skill-intensive compared to those used by their local counterparts.

Foreign firms operating in Brazil are known to advertise heavily and to repatriate part of their profits as royalties and technical assistance payments which are claimed as costs and deducted from local income for tax purposes. Brazilian law, however, does not allow royalty payments when a nonresident owner holds 50% or more of the equity of a firm (see von Dohlerger and Cavalcanti, 1975, pp. 38-50).

The statistics reported in Table 1 confirm that foreign firms do advertise much more heavily than comparable local firms. This fact that transnational subsidiaries account for a disproportionate share of advertising expenditures in Brazil (Newfarmer, 1977, pp. 205-214).

Table 1. Tests for significant differences between matched pairs of foreign and domestic firms (mean values for 282 firms unless otherwise indicated)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Foreign</th>
<th>Local</th>
<th>Standardized difference (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of firm</td>
<td>165.5</td>
<td>168.8</td>
<td>-0.6*</td>
</tr>
<tr>
<td>VAY — value-added, million cruzados</td>
<td>102.5</td>
<td>96.4</td>
<td>-6.2*</td>
</tr>
<tr>
<td>L — number of employees</td>
<td>338.5</td>
<td>416.5</td>
<td>-13.8*</td>
</tr>
<tr>
<td>EST — number of establishments</td>
<td>1.9</td>
<td>2.1</td>
<td>-7.0*</td>
</tr>
<tr>
<td>MULT1 — percentage of multi-establishment firms</td>
<td>45.0</td>
<td>51.8</td>
<td>-5.9*</td>
</tr>
<tr>
<td>Value-added/Output</td>
<td>58.3</td>
<td>55.1</td>
<td>5.2</td>
</tr>
<tr>
<td>VAQO — value-added as a percentage of total output</td>
<td>1.2</td>
<td>0.9</td>
<td>2.0</td>
</tr>
<tr>
<td>Product differentiation, Royalties</td>
<td>261.0</td>
<td>123.1</td>
<td>8.5</td>
</tr>
<tr>
<td>ADV — advertising expenditures/domestic sales, percentage</td>
<td>14.2</td>
<td>10.6</td>
<td>3.7</td>
</tr>
<tr>
<td>ROYTOT — total royalty payments, thousand cruzados</td>
<td>126.3</td>
<td>45.8</td>
<td>9.0*</td>
</tr>
<tr>
<td>ROYTOT% — percentage of firms paying royalties</td>
<td>7.4</td>
<td>3.5</td>
<td>2.4</td>
</tr>
<tr>
<td>ROYFOR% — percentage of firms paying royalties abroad</td>
<td>14.9</td>
<td>8.0</td>
<td>6.1*</td>
</tr>
<tr>
<td>Export performance</td>
<td>48.6</td>
<td>48.6</td>
<td>0.0</td>
</tr>
<tr>
<td>EXPORT — exports (million cruzados)</td>
<td>30.5</td>
<td>17.4</td>
<td>57.3*</td>
</tr>
<tr>
<td>XSUB — export subsidies as % of export sales</td>
<td>16.2</td>
<td>18.0</td>
<td>7.2</td>
</tr>
<tr>
<td>Labor productivity</td>
<td>374.3</td>
<td>295.2</td>
<td>19.9*</td>
</tr>
<tr>
<td>VAEP — value-added per employee, thousand cruzados</td>
<td>838.6</td>
<td>492.1</td>
<td>62.4*</td>
</tr>
<tr>
<td>Skill intensity</td>
<td>35.4</td>
<td>28.7</td>
<td>23.7*</td>
</tr>
<tr>
<td>NONPL — non-production workers as a percentage of total employed</td>
<td>91.6</td>
<td>65.4</td>
<td>30.5*</td>
</tr>
<tr>
<td>WIL — annual wage per employee, thousand cruzados</td>
<td>133.1</td>
<td>106.1</td>
<td>22.6*</td>
</tr>
<tr>
<td>WNPJ — annual wage per non-production worker, thousand cruzados</td>
<td>64.2</td>
<td>51.8</td>
<td>20.6*</td>
</tr>
<tr>
<td>Capital intensity</td>
<td>252.2</td>
<td>206.5</td>
<td>21.3*</td>
</tr>
<tr>
<td>MMV — non-wage value-added per employee (thousand cruzados)</td>
<td>546.5</td>
<td>528.2</td>
<td>14.9*</td>
</tr>
<tr>
<td>NMMV — non-wage value-added per production worker, thousand cruzados</td>
<td>252.2</td>
<td>206.5</td>
<td>12.8*</td>
</tr>
<tr>
<td>ELEC — electricity consumption per production worker, thousand cruzados</td>
<td>9.3</td>
<td>7.1</td>
<td>23.9*</td>
</tr>
<tr>
<td>Note: The numbers in parentheses are the standard errors of the mean of the standardized difference, * indicates statistical significance at the 0.01 level and ** at the 0.05 level. All tests are one-tailed except those for firm size and VAQO, which are two-tailed. Royalties include payments for technical assistance as well as payments for licensed technology and &quot;brand names&quot;.</td>
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</tr>
</tbody>
</table>
ECLAIC, 1982, pp. 78-80) is thus not attributable solely to their greater size or differences in production rates.

Only a tiny proportion of the firms in our sample registered any payments for royalty fees or technical assistance. This presumably reflects strong government control over such expenditure. Nonetheless, the average difference is positive for both total and overseas payments, and significant at the 1% level in the case of the latter.

The results for comparative export performance confirm those reported in ECLAIC (1989). The exports of foreign firms are much higher, on average, than comparable local firms. Moreover, two-thirds of the foreign firms export at least part of their output whereas fewer than half the local firms are exporters. Restricting the sample to the 111 pairs in which each firm exports, the standardized difference between foreign and local firms averages 57% and is highly significant. These results are to be expected on a priori grounds, for the costs of exporting are much lower for foreign firms, which have access to market information and sales organizations through their parent companies overseas. The ECLAIC (1989) study reports first that a positive correlation exists between export volume and the rate of export subsidy and, secondly, that the foreign firms' share of subsidies tends to exceed their share of exports. The present study shows that the second finding may well be a spurious result stemming from the larger export of foreign firms, for differences in the rate of subsidy for the 111 matched pairs of exporters are not significantly different from zero.

The results reported in Table 1 also reveal that foreign firms have much higher levels of labor productivity, even after controlling for scale and industrial differences. The average wage difference is 26% in terms of value-added per production worker and 20% when productivity is measured as value-added per employee; both differences are significant at the 1% level. The division of employment between white-collar and blue-collar workers was not reported for all firms, so the number of matched pairs is reduced from 282 to 268 when this information is required.

Do foreign firms pay higher wages for the same quality of labor in Brazil? This question cannot be answered with the data available to us in this sample. What is evident is that foreign firms pay higher wages and employ higher quality labor than their local counterparts. The ratio of white-collar to blue-collar employees, a crude indicator of labor skills, is more than 20% higher for foreign firms. The average wage is also much higher for each category of employee: standardized differences are 26% in the case of white-collar employees and 19% in the case of blue-collar employees. Disaggregate wage data are needed to reach definite conclusions, but it would be surprising if a major portion of such large wage differences were not attributable to differences in skill levels.

Transnational enterprises are often criticized for transferring capital-intensive technologies to less developed countries which require labor-intensive techniques if the manufacturing sector is to absorb their abundant supply of labor. The relevant question, however, is how well do foreign firms do, compared to similar local firms, in absorbing labor? The evidence from this sample of matched pairs of firms suggests that in Brazil they perform quite poorly.

Physical capital intensity has been measured by three different variables: non-wage value-added per employee, non-wage value-added per production worker, and electricity consumption per production worker. All three measures suggest that foreign firms utilize techniques of production that are significantly more capital-intensive than their local counterparts. This may be a result of the fact that they are accustomed to large-scale, capital-intensive production in their home countries and utilize similar techniques in their scaled-down Brazilian plants, or it may simply reflect the fact that foreign firms pay higher wages and have access to less expensive credit compared to local firms. Our finding, because of a large sample size, differs from that reported by Morley and Smith (1977, pp. 283-286).

Not only do techniques of production differ markedly between foreign and local firms, there is also evidence that differences tend to be greater, the greater the skill- and capital-intensity of the activity. Table 3 reports the rank correlation between standardized differences and the average levels of various measures of productivity, skills and capital intensity. The coefficients are not very large, but, with the exception of the correlation between differences in wages of white-collar employees (WNPL and average wage of white-collar employees), all coefficients are positive and statistically significant at the 0.01 level. In other words, techniques of production show some similarity, but differ more by type of ownership in industries characterized by high skills, high capital intensity and high productivity.

Empirical findings for subsets of the sample

The large sample of 564 foreign and local firms

| Table 2. Labor productivity, wages and capital intensity: Rank correlation between average levels and standardized differences |
|---------------------------------|-----------------|-----------------|
|                                  | Spearman rank correlation coefficients |
| Labor productivity              |                              |                 |
| VAI/P (n = 282)                  | 0.156                       |                 |
| VAI/P (n = 268)                  | 0.184                       |                 |
| Wages                           |                              |                 |
| W/P (n = 282)                    | 0.180                       |                 |
| W/P (n = 268)                    | -0.013                      |                 |
| Capital intensity                |                              |                 |
| NUW/P (n = 282)                  | 0.151                       |                 |
| NUW/P (n = 268)                  | 0.197                       |                 |
| ELECLIF/P (n = 248)              | 0.185                       |                 |

Note: Data for 268-282 matched pairs of firms ranked by average levels and by standardized differences (difference divided by average level). For definition of variables, see Table 1. All coefficients except -0.013 are statistically significant at the 0.01 level in a two-tailed test.  

affords us the luxury of calculating statistics for subsets of the data. Results are reported below for two distinct divisions of the sample: (i) combination of single and multi-plant operations, and (ii) manufacturing subsectors. It would also have been interesting to divide the sample by the nationality of the foreign owners, but this information was not available.

Since foreign firms tend to operate fewer plants than their local counterparts, some of the differences reported in Table 1 might arise from differences in multi-plant operations rather than foreign or local ownership per se. To test this possibility, the sample was divided into four groups: (i) foreign plants with which only operate one single plant, 79 which only operate more than one plant, 67 for which the foreign firm operates a single plant and its local counterpart multi-plant, and 48 for which the converse is true. As can be seen in Table 3, calculated differences do not vary significantly between the four possible combinations of average wages. Wages and single plant operations. The highest value the F statistic attains in analysis of variance (ANOVA) tests is 1.75, which does not allow one to reject, even at the 10% level of confidence, the null hypothesis that the four standardized differences are equal. Therefore, it would appear that observed differences in capital intensity of foreign and domestic firms are not the result of differences in the extent of multi-plant operations in addition, average differences between foreign and local firms were calculated for each of the 20 subsectors (two-digit industries) covered by the sample. The significant results of these calculations, along with the standard errors and the F statistics of the ANOVA tests, are reported in Table 4. There is surprisingly little evidence of sector heterogeneity in the results. In only one case — wages — it is possible, at the 5% level, to reject the null hypothesis that differences between the two types of firms do not vary by subsector. Greater heterogeneity might have been expected, given the existence of a significant positive relationship between the standardized differences and average levels of these variables (see Table 2). Apparently the subsectors are themselves too heterogeneous to reveal these potential inter-industry differences.

In sum, the findings reported in Table 1 appear to be applicable throughout Brazil’s manufacturing sector. Nonetheless, it is worthy of note that some of the variables achieve statistical significance in a large number of subsectors, whereas others do so in very few. Wages, for example, are significantly higher for foreign firms at the 5% level in 11 industries. In contrast, differences in advertising intensity attain statistical significance in only three subsectors. Advertising differences also show the least significant variations from subsector to subsector (F = 0.93), whereas differences in wages and capital intensities are statistically significant (F = 1.70).

4. SUMMARY AND CONCLUSIONS

The empirical analysis of the previous section leaves us with a number of definite conclusions as well as some unanswered questions concerning the typical characteristics of a foreign firm in the local market in contrast to its local counterpart in the same industry.

One finding of interest is that foreign firms in Brazil operate significantly fewer plants than their local counterparts. The difference is not large because single plant operations are common for both types of firms. Though unexpected, this finding seems reasonable for two reasons. First, foreign firms operate plants of a much larger scale in their countries of origin than they do in Brazil. Therefore, they can be expected to be less prone than local firms to divide their output among several plants in the smaller Brazilian market. Second, we found that foreign plants operate significantly higher numbers of production and domestic firms compared to their local counterparts, and capital intensity tends to increase the importance of scale economies.
Foreign firms also have significantly higher ratios of value-added to output, but it is not clear why this occurs. To what extent does this reflect greater vertical integration of production and to what extent does it reflect higher quality goods sold at higher prices? This is a point that requires further research and could profitably be included in detailed case studies of firms and industries. Chahinovsky (1979, p. 54), in his study of the Argentine pharmaceutical industry, actually found foreign firms to charge considerably lower prices than their local rivals, which is not true for all industries and developing countries.

Advertising expenditures and remittances for royalties and technical assistance are both significantly higher for foreign firms, and the evidence is overwhelming that foreign-owned firms export a much larger proportion of their output than do comparable local firms despite the fact that they do not benefit from a significantly higher rate of export subsidy. All these results are to be expected, and the advantages of the transnational corporation often stem from its possession of "brand names," proprietary technology, and links to overseas markets.

There is no doubt that foreign firms in Brazil typically have higher levels of labor productivity compared to local firms of a similar size operating in the same industry. This could result from any of a number of factors: (i) employees which have greater skills and training, (ii) more machinery and equipment per worker, (iii) greater technical efficiency, in the sense that the same output is produced with fewer inputs, or (iv) some combination of these three possibilities. The results of this study show very clearly that the first two factors play an important role in accounting for observed productivity. It is not possible, in the absence of a clearly specified production function, to measure differences in technical efficiency, so nothing can be inferred regarding the possible importance of this factor. The fact that foreign firms utilize more capital- and skill-intensive techniques of production implies that they make less use of unskilled labor, the abundant factor of production in Brazil. This may be because they have to pay higher wages for labor of the same quality, or because quality controls for internationally known products impose rigidities in the production process to an extent unknown by local firms. Or it may simply reflect the absence of competitive pressures, permitting what Morley and Smith refer to as a "limited search" for more labor-intensive techniques of production.

This study has benefited from access to an exceptionally large data base. As a result, in contrast to previous studies in Brazil and elsewhere employing the "matched pairs" approach, we have found quite large and significant differences between local and foreign firms. If local firms imitate their foreign rivals, this imitation is far from perfect. Ownership ties do make a difference. The implementation of policies which encourage or restrict foreign ownership can thus be expected to have direct effects on industry performance, quite apart from any indirect effects that result from modifications of the behavior of locally-owned firms or changes in the size distribution of firms. The finding that foreign firms differ from...
domestic firms should not come as a surprise, for subsidiaries of transnational corporations form part of a larger, multinational organization. Von Dickinger and Cavalvanti (1973), pp. 42-46) estimated that foreign subsidiaries operating in Brazil accounted for only 2% of the total number of foreign enterprises and less than 1% of their total assets. In a broad sense, foreign-owned firms are thus much larger in size than any privately-owned Brazilian firm. Indeed, 95% of the subsidiaries are not tied to a parent company, which gives them the advantage of operating in the Brazilian market with the support of major foreign enterprises.

1. Blochstrom and Petroni (1963) describe evidence for Mexico that could be interpreted as support for such a "spillover" of technology from foreign to local firms. They report a positive coefficient of partial correlation between foreign presence in an industry and labor productivity at locally-owned plants, even after controlling for inter-industry variations in capital and skill intensity. This is imperfect for this reason, their findings may simply reflect the productivity of foreign firms that dominate industries characterized by high capital and skill requirements, hence high output per employee.

2. Katz (1984, p. 24) cites a comparison between "a locally-owned machine tool firm" and a "subsidiary of a British firm producing automobile engines" in support of the generalization that "subsidiaries of transnational corporations tend to develop stronger technological capabilities in process engineering areas as well as in production planning and organization, rather than in product design." Katz (1984, p. 24.) This may be true, but differences between the two types of products, namely rapid technological changes and the creation of demand by foreign subsidiaries, might also explain the differences observed in research and development efforts. Similarly, the (unquestionable) conclusion that large locally-owned firms can "function as technological inventors" with "surprisingly effective performance that is not reported here, for they replicate those produced with the IPI data.

REFERENCES


Brazilian Ministry of Planning, "Empresas de subconquista de obras e exportação de manufaturadas," Pesquisa e Planejamento Econômico, Vo. 11, No. 3 (December 1981), pp. 703-702.


Dickinger, Von and Cavalvanti, "Empresas Multinacionais na Indústria Brasileira.

ECLAC (United Nations Economic Commission for Latin America and the Caribbean), "Das export og importe entre países transnacionais en Brasil," Estudios e Informes de la CEPAL, No. 31, ECEPAUL/329 (March 1979).


Meltzer, Patrice, ""Empresários de exportação e empresas multinacionais: Análise da propriedade de capital estrangeiro na economia brasileira," Revista Brasileira de Economia, Vo. 32, No. 3 (July 1984), pp. 252-274.


