EVALUATING THE IMPACT OF FOREIGN INVESTMENT: Methodology and the Evidence from Mexico, Colombia, and Brazil*

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INTRODUCTION

Much of the focus of, indeed much of the impetus for, the current discussion of science and technology policy for the Latin American industrial sector has involved comparisons of foreign and domestic ownership. While such traditional concerns as the quantity of repatriated profits and interference in domestic politics (in the case of foreign firms) continue to be important, much of the recent literature is on comparative financial performance, growth, technology, and the interrelationships among these elements. The following conclusion is ubiquitous: Domestic enterprises, due largely to "technological" shortcomings, are simply unable to compete with the foreign firms and are therefore restricted both to secondary positions within individual product markets and to the less profitable sectors.

In spite of the widespread popularity of such a conclusion, the authors suggest that it is perhaps obtained from a misinterpretation of aggregative data and that the results obtained are as likely due to a large firm/small firm dichotomy as to a foreign/domestic one. Furthermore, when research is structured to test adequately for differences due explicitly to foreign ownership, the expected foreign advantage does not appear.

In testing the empirical implications of the theory of the firm, it is important to keep in mind the theoretical constructs and the methodology of industrial organization. In that body of theory, the functional links between performance (which includes both private profitability

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and broader social concerns) and structure (the number and size distribution of firms, product and process characteristics, and the organization of ownership) hypothesized by neoclassical economic theory are subjected to empirical testing and more elaborate analysis.

Because of the field's policy orientation and because structure is generally believed to be circumscribed by technical constraints, an intervening variable, conduct (decision-making by the firm), provides a link in the analysis. Thus the outline of the theory is that structure determines the range of feasible conduct which in turn determines performance. In addition, and in a dynamic sense, there may be feedback from conduct to structure.

The implications of this line of reasoning for Latin American industrialization may be summed up in the question: In what ways does the nationality of ownership affect conduct and therefore performance and the evolution of structure within an industry? The question has rarely been of significance to U.S. practitioners of the field, who have been notoriously reluctant to consider even the role of international trade in their analysis, much less foreign direct investment.

In this case, then, academic ethnocentricity has meant that a reverse transfer is taking place. Latin American economists are providing analyses of the behavior of U.S. and other multinational corporations that are rich in hypotheses for the evaluation of the theoretically most troublesome of firm types—the multinational, multiproduct, vertically integrated firms which increasingly are the focus of policy debate, if not academic research, in the developed countries.

THE FAJNZYLBER-MARTÍNEZ STUDY

The example par excellence of this transfer is the report submitted to the Subcommittee on Multinational Corporations of the U.S. Senate's Committee on Foreign Relations by Richard S. Newfarmer and Willard F. Mueller,[1] in which the work of Fernando Fajnzylber in Brazil and Fajnzylber and Trinidad Martínez Tarrago in Mexico plays a prominent role.

The most detailed of these studies is that of Mexico,[2] where the authors have used the 1970 Mexican Census of Manufactures supplemented by data from the Bank of Mexico and other data to document the presence of MNCs in the whole of manufacturing, in twenty broad industry groups, and in 230 individual industries. This latter level of disaggregation ("four-digit" industries) is particularly noteworthy, since it is generally considered to be the empirical counterpart of the individual markets of economic theory.

Fajnzylber and Martínez find that MNC subsidiaries are concentrated in the most rapidly growing, capital intensive, concentrated industries and that they tend to be among the leading firms in these industries. While these are not startling conclusions, what is significant about this study is that these conditions have been analyzed and documented at a level of disaggregation not before available. Such conclusions at the level of the broader industry groups[3] (the twenty "two-digit" industries) have suffered from the shortcoming that most such groups tend to be statistically dominated by one or two of the larger subgroupings and therefore of limited value as generalizations regarding individual markets.

AGGREGATIVE COMPARISONS AND FALLACY: A SIMULATION

There remains, however, a weakness in this analysis that the authors believe is crucial in deriving policy implications. The specific conclusions can also be obtained as the result of differences in the sizes of firms, rather than in the ownership structure. How this comes about can be seen more clearly with the aid of a simple simulation presented below.

Fajnzylber and Martínez conclude that the MNC affiliates differ from their national competition in the following ways: MNCs exhibit: (1) larger sizes, (2) greater capital intensity, (3) greater labor productivity, (4) higher average wages, (5) higher rates of profit, and (6) lower shares of labor remuneration in value added. Their method is to aggregate for all national and all foreign firms in each industry. Thus, average size for each set of firms is simply the sum of sales for all firms divided by the number of firms, and average capital intensity the sum of capital for all firms divided by employment of all firms. The limitations of this method are apparent in the following simulation, the basic data for which are reported in table 1 and the results of which are reported in tables 2 and 3.

We assume that there are only three sizes of firms in the industry and that all firms of the same size are identical in all other respects, i.e., there are no differences between foreign and domestic firms of the same size. There are, however, an identical number of foreign firms in each size class, while the great majority of domestic firms are in the smallest size class. We also assume that larger firms are more capital-intensive and exhibit higher rates of growth and profit.

Without growth, comparing the foreign and domestic firms by the Fajnzylber-Martínez method provides the results of table 2. The "average" foreign firm is more than three times as large as the "average"

domestic firm when size is measured by assets, it has nearly 80 percent more capital per employee, and exhibits a profit rate very nearly 50 percent greater. To generate table 3, each firm is assumed to grow at a constant rate through time depending only on its size class. The evolution of the averages for the two sets of firms in capital per firm, capital intensity, the rate of profit, and the share of the foreign firms in total assets are calculated after one, five, ten, and twenty-five years. The average annual rates of growth of assets are also reported to each indicated point in time.

The implications of the simulation are, then, self-evident. The foreign share of assets in the industry continuously rises, and the "average" foreign firm continuously exhibits greater capital intensity, a higher rate of growth, and greater profitability. These differences are not, however, indicative of differences in behavior by foreign firms. They are the result of the greater foreign presence in the largest size class. Aggregated comparisons of the two types of firms provide misleading conclusions about the independent influence of ownership when firm characteristics are related to size and the foreign and domestic firms have differing size distributions.

Thus the Fajnzylber-Martínez results *could* have been merely the reflection of such differences in size distribution. Two questions remain: (1) are such size distributions realistic? and (2) is size clearly and positively related to such industry characteristics? We may safely assume that with few exceptions, the smallest firms in any industry are overwhelmingly domestic. In the case of Mexico this is confirmed by Fajnzylber and Martínez's observation that the size differentials between foreign and domestic firms would have been diminished had the small and medium sized firms been eliminated from analysis.[4] Further evidence that firm size may be more important in determining the characteristics of the firm than ownership is provided, albeit at a rather crude level, even by highly aggregate data in the case of the most recent Venezuelan industrial survey.[5] A summary is provided in table 4, where the correlations of two variables, size (the share of firms with more than one hundred employees in total value-added of the industry group) and foreignness (the share of foreign capital in total subscribed capital) with several industry characteristics are compared.

The rather impressive differences between size and foreignness with respect to correlations with the capital/labor ratio, the average wage, and the nonlabor share in value-added, strongly suggest that there are large domestic firms in significant numbers whose characteristics are similar to those of the foreign firms. The single case where size is not "superior," that of royalty payments, suggests support for the

argument that royalty payments are made by and large by foreign subsidiaries to the parent and as such simply provide an indirect means of profit transfer. These data are, of course, sketchy, but combined with the arguments of the simulation analysis, suggest that a large firm/small firm dichotomy may be more important than a foreign/domestic one in determining trends in industrial characteristics.

THE PPSTDN PAIRING METHODOLOGY

Further evidence related to this hypothesis is found in the work of Loretta Good Fairchild, which uses pairs of firms to analyze the relative behavior of Mexican and joint-venture firms in Monterrey, Mexico, in 1969.[6] Each pair was required to contain one firm which was wholly Mexican owned and one containing foreign equity capital, where the two firms produced similar products and were of similar size and age.

Fairchild sought, with this methodology, to measure the average advantage in financial performance of the joint ventures and to relate this advantage to variables measuring access to and choice of technology. The conclusion of this original study was, however, that the expected foreign advantage was not present.

Tom E. Davis and Fairchild, sponsored by Cornell's Program on Policies for Science and Technology in Developing Nations (PPSTDN), (a) repeated the research in Monterrey with some methodological changes, but chiefly with the purpose of ensuring that the results had not been an accident of timing, and (b) replicated the study in some further sites. To date, the research has been repeated in Mexico and replicated in Medellin-Cali, Colombia, and São Paulo, Brazil, with approximately twenty-five pairs of firms in each case. The results of these studies regarding financial performance are summarized in table 5.

The data were constructed by subtracting, for each pair, the observation of the foreign firm from that of the domestic firm, calculating the mean and standard error for these differences, and testing the mean difference against the null hypothesis of no difference. In table 5 the direction of the advantage, however small, is reported and those differences significant at 5 percent are indicated. As is clear from the table, the earlier results from Mexico were confirmed, the Brazilian results were similar, and a foreign advantage appeared in the Colombian case, except in the variables measuring growth. The uniqueness of the results from Colombia is not easily explained by reference to technological considerations, since the data for all three samples are very similar, as is indicated by table 6. In that table the percentage of firms of each type responding positively to the items indicated at the left is reported.

In general, the domestic firms indicated more attention to their own innovative activity, while the foreign firms indicated a greater reliance on foreign sources of technology. The Colombian results do not appear "out of line" with those of Brazil and Mexico. The domestic firms more often indicated designing some of their own machinery, developing their own patents, and having formal attention devoted to the development of new products. With the exception of Colombia, where the difference is not large, the domestic firms also more often reported R&D effort in developing new processes. The Colombian firms did indicate greater attention to R&D on raw materials, while in Brazil the foreign firms appeared slightly more active in this area.

In both Colombia and Mexico the foreign firms more often reported using U.S. patents, licenses, and technical assistance contracts, while these agreements with other foreign countries were almost always fewer and more equally distributed between the firm types. The Brazilian responses, not strictly comparable because the "U.S./other foreign" distinction was not made, indicate less use of such instruments by the foreign firms and a much higher use of foreign licenses by the domestic firms. With regard to engineering consultants, the results for Mexico and Colombia are consistent with those above—the foreign firms were more likely to use U.S. consultants while the domestic firms more often used domestic ones.

Thus one popular assumption in the literature tends to be confirmed in these studies: the domestic firms are more likely to depend on national resources for technology while the foreign firms tend to undertake less internal activity, depending on foreign resources. However, the Brazilian and Mexican cases do not support the argument that the foreign firms possess an advantage in technology which translates into obviously better financial performance.

One other set of data from the more than three hundred variables in the PPSTDN project will be reported here. On grounds that perceptions of reality may be as important as reality itself, all firms in the Colombia and Brazil studies were asked whether they believed that the foreign or the domestic firms (or neither) held advantages in several cases. Firms which feel they are at a disadvantage may compete less aggressively and tend to follow the lead of their competition to their ultimate disadvantage.

Tables 7 and 8, respectively, report the share of firms indicating an advantage for the foreign or domestic firms. The tables show that there is far from unanimity on the idea that the foreign firms have an advantage in any of the areas indicated. A bare majority do think that the foreign firms have greater access to technology, but far fewer appear

to think this is reflected in the costs of such technology. In Brazil the domestic firms were more likely to perceive more easy access for foreign firms while in Colombia domestic firms did not feel that foreign firms had an advantage. In cost of technology, marketing and distribution, and the availability of credit, more firms than not indicated a foreign advantage, but the degree of such feelings is certainly not strong.

With respect to access to the Colombian or Brazilian governments, a general feeling of "equal treatment" seemed to prevail. The interesting exception is that the foreign firms in Brazil overwhelmingly felt their domestic competitors were favored.

CRITIQUE OF THE PAIRING METHODOLOGY

Just as aggregative methodologies necessarily suffer from insufficient attention to possibly crucial detail, so does the pairing methodology reported here have shortcomings in proceeding to generality. The detailed questionnaires used in the PPSTDN study and the insistence on personal interviews with the chief executive officer or the principal accountant limits the number of cases that can be considered. This insistence seemed crucial in order to ensure minimal differences in questionnaire interpretation and to avoid attractive, yet inappropriate, responses. On this point, and referring to questions considered in table 6, firms were not allowed to simply respond "yes" to questions on, for example, formal attention to R&D in processes. Firms which responded "yes" were pressed for an explanation and asked to provide specific examples of attempts and/or successes at innovation.

However, the most common objection to these results usually concerns the accuracy of the financial data. Thus, it is argued, do not the MNCs hide profit transfers in costs of equipment and raw material inputs sold by the parent to the subsidiary, in exorbitant interest on loans, in depreciation, etc.?

Ultimately, of course, this objection can never be answered. There are, however, certain points that should be considered. First, the domestic firms also have an incentive to hide profits, so that the differences need not be affected. With respect to the general problem of transfer pricing, two considerations would seem to be important: (1) In countries with incentives to promote investment in the least developed regions, the domestic firms in the industrial centers considered here may establish subsidiaries in the poorer regions. The result may be that profits are underreported on operations in the center. (2) Many writers leap from the correct theoretical proposition that transfer pricing by redistributing accounting profits can maximize profits after taxes, to a hasty assump-

tion that the direction of such transfers is self-evident. The principle to be applied by such a firm is to equate the effective marginal tax rate in every country or region. These rates are incredibly elusive in empirical studies due to the complexity of tax regulations, but in countries with low effective marginal tax rates the incentive is to transfer profits toward, not away from, such countries.

The multinationals may, however, have additional incentives to transfer profits from their Latin American subsidiaries. Where their holdings are less than 100 percent of equity capital they may maximize their share of earnings through such practices, though here again it is equally possible that certain groups within domestic firms will have such incentives. Furthermore, and perhaps more importantly, restrictions on the quantity and timing of profit repatriation, when they represent binding constraints,[7] and other regulations on financial behavior may be circumvented by transfer pricing.

The researchers in the PPSTDN effort have some additional evidence for testing the proposition that the profits for the foreign firms are significantly understated with respect to those of their competition. The first of these is to consider the whole of cash flow as reflecting the relative size of profits. Thus the ratios of cash flow to net worth and total assets were considered as alternatives to the profit ratios as indicated in table 5. Secondly, various cost items were also tested for significant differences between the pairs of firms in a search for items that might hide greater relative profits for the foreign firms. No clear indications appeared that this was the case.

The major limitations of the pairing analysis seem, therefore, to lie in other areas. The most important of these are the limitations as to the feasible sample size and to industries. On the former point, this limitation is the unavoidable result of demanding great detail and considered reporting. It must be noted, however, that while small samples suffer from large variances—and it could be argued that were sample sizes large enough many of the nonsignificant differences might become significant—truly large differences should be clearly demonstrated even in small samples.

The most critical shortcoming of the methodology is, however, that it tends to avoid precisely those cases where there is a clear foreign advantage. The point is simple: where the foreign advantage is great there will not exist a domestic counterpart. Thus there are no automobile manufacturers, for example, in any of the country studies. In general, therefore, it is fair to object that the "highest technology" sectors have been automatically ruled out of the analysis. Thus while the cases considered in the country studies reported here include the manufac-

ture of products with moderately high technical requirements, such as machined parts, synthetic textiles, and even chemicals, the objection is a fair one.

Might not this objection be turned around, however, and suggest equally reasonably that the method may indicate the areas of significant foreign advantage by elimination? Furthermore, this limitation does not detract from the basic argument concerning comparisons of conduct. If foreign firms totally dominate a given industry, all speculation about the contribution of foreign equity per se to conduct in that industry *is* speculation, and the problem is not solved by comparing the behavior of these firms to domestic firms in different industries and/or size classes.

All of these contradictions, moreover, point to the need for more attention to the case-study approach.

CONCLUSIONS

The focus here has been largely methodological, showing that a common method of attributing differences in conduct to ownership may provide fallacious guidance for policy. Furthermore, the more unusual results of the PPSTDN case studies cannot be dismissed on the mere basis of special cases, since the simulation shows that they can be consistent with the aggregative statistics reported by such studies as the Church Committee report cited above. The results suggest that much of the present concern over the significance of technology transfer may be overblown, at least for a broad range of industries. Despite the greater use by the foreign firms of instruments generally considered to represent technology transfer, these firms are not outstripping their domestic counterparts.

TABLE 1 Basic Data for Simulation

Firm Size Class	Employment per Firm	Assets per Firm	Rate of Growth of Assets	Rate of Profit on Assets	Capital Intensity	Number of Firms	
						Foreign	Domestic
Small	100	100	5%	6%	1	5	50
Medium	200	600	10%	12%	3	5	15
Large	400	2,000	20%	25%	5	5	3

TABLE 2 Simulation, Static Comparison of Foreign and Domestic Firms

	Foreign	Domestic
Number of Firms	15	68
Assets per Firm	900	294
Employment per Firm	233	135
Capital Intensity	3.86	2.17
Rate of Profit	21.4%	14.4%

TABLE 3 Simulation, Dynamic Comparison of Foreign and Domestic Firms

Time Years	Capital per Firm		Capital Intensity		Rate of Profit		Rate of Asset Growth		Share of Assets
	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
0	900	294	3.86	2.17	21.4	14.4	—	—	40%
1	1,055	329	3.93	2.24	21.7	14.8	17	12	41%
5	2,024	524	4.20	2.52	22.5	16.4	18	13	46%
10	4,701	1,009	4.47	2.94	23.4	18.3	19	15	51%
25	65,877	10,100	4.86	4.19	24.5	22.7	20	18	59%

TABLE 4 Linear Correlations of Size and Foreignness with Two-Digit Industry Characteristics: Venezuela, 1971

Industry Characteristic	Correlation (r^2) with Size[a]	Foreignness[b]
Capital/Labor Ratio[c]	.437	.046
Average Wage [d]	.435	.221
Nonlabor Share in Value Added [e]	.496	.161
Share of Raw Materials Imported[f]	.025	.003
Royalty Payments/Value Added[g]	.309	.680

Source: Cordiplan, *Tercera Encuesta Industrial* (Caracas, 1973).

[a]Value added of firms with more than 100 employees ÷ total value added.
[b]Foreign capital ÷ subscribed capital.
[c]Total assets ÷ total employment.
[d]Total labor costs ÷ total employment.
[e](Value added − labor costs) ÷ value added.
[f]Cost of imported raw materials ÷ total raw materials cost.
[g]Royalty payments ÷ value added.

TABLE 5 Results of Paired Analysis: Financial Performance

	Mexico (1973)	*Colombia (1974)*	*Brazil (1974)*
Profitability			
Profit/Net Worth	(Foreign)[a]	Foreign*	(Domestic)
Profit/Total Assets	(Domestic)	Foreign**	(Domestic)
Cash Flow/Net Worth	(Foreign)	Foreign**	(Foreign)
Cash Flow/Total Assets	(Domestic)	Foreign**	(Foreign)
Growth: Annual Average 1970–74[b]			
Of Sales	(Foreign)	(Domestic)	(Foreign)
Of Total Assets	(Domestic)	(Domestic)	(Foreign)

Source: *Mexico*: Loretta Fairchild, "A Comparison of Foreign and Domestic Firms in Monterrey, Mexico: Performance and Sources of Technology" (PPSTDN, Cornell, 1975). *Colombia*: Loretta Fairchild, "U.S. Joint Ventures and Colombian Manufacturing Firms: Comparative Performance, Sources of Technical Information and Research Efforts," unpublished (PPSTDN, Cornell, 1976). *Brazil*: Antonio Dantas Sobrinho, "Technology and Performance of Brazilian and Foreign Firms in São Paulo" (Ph.D. dissertation, Cornell, 1976).

[a]Parentheses indicate lack of statistically significant difference.
[b]Mexico, 1969–73.
*Statistically significant at 5 percent.
**Statistically significant at 1 percent.

TABLE 6 Comparative Measures of Technological Activity in Domestic and Foreign Firms: Colombia, Mexico, and Brazil, 1974

	Colombia		*Mexico*		*Brazil*	
	Domestic	*Foreign*	*Domestic*	*Foreign*	*Domestic*	*Foreign*
Design of Own Machinery	81%	77%	33%	15%	83%	58%
Development of Own Patents since 1970	50%	19%	24%	15%	36%	15%
Formal Attention to R&D in:						
Products	73%	48%	—	—	69%	58%
Processes	58%	64%	68%	52%	66%	54%
Materials	69%	60%	—	—	37%	41%
Use of:						
U.S. Patents	15%	35%	12%	41%	12%	15%
Other Foreign Patents	8%	4%	8%	7%		
U.S. Licenses	27%	31%	8%	33%	39%	15%

TABLE 6 (continued)

Other Foreign Lics.	4%	12%	4%	15%		
U.S. Technical Assistance Contracts	8%	19%	32%	59%	21%	8%
Other Foreign Technical Assistance Contracts	19%	4%	12%	15%		
Engineering Consultants:						
U.S.	31%	58%	16%	44%	—	—
Other Foreign	4%	8%	8%	4%	—	—
Domestic	23%	12%	40%	30%	—	—

Sources: Same as table 5.

TABLE 7 Perceived Advantages of Foreign Firms: Colombia and Brazil, 1974

	Percentage of Firms Stating Foreign-Owned Firms in the Industry Have an Advantage in Area Concerned						
		Domestic Firms Only			*Foreign Firms Only*		
	All Firms	*Colombia*	*Brazil*	*All*	*Colombia*	*Brazil*	*All*
Marketing & Distribution	32	8	46	26	46	28	37
Availability of Technology	51	31	57	45	69	48	59
Cost of Technology	33	15	55	37	12	44	27
Availability of Credit	31	35	30	32	31	28	29
Access to Government	14	8	24	17	15	8	12

Sources: Same as table 5.

TABLE 8 Perceived Advantages of Domestic Firms: Colombia and Brazil, 1974

	Percentage of Firms Stating Domestic Firms in the Industry Have an Advantage in Area Concerned						
		Domestic Firms Only			*Foreign Firms Only*		
	All Firms	*Colombia*	*Brazil*	*All*	*Colombia*	*Brazil*	*All*
Marketing & Distribution	23	38	35	37	4	12	8
Availability of Technology	20	31	27	29	4	16	10
Cost of Technology	21	15	24	20	27	16	22
Availability of Credit	21	12	27	20	15	28	22
Access to Government	25	15	18	17	12	60	35

Sources: Same as table 5.

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NOTES

1. "Multinational Corporations in Brazil and Mexico: Structural Sources of Economic and Noneconomic Power," August 1975.
2. *Las Empresas Transnacionales: Expansión a Nivel Mundial y Proyección en la Industria Mexicana*, versión preliminar (México: CONACYT– CIDE, 1975).
3. E.g., for México, Bernardo Sepulveda and Antonio Chumacero, *La Inversión Extranjera en México* (México: Fondo de Cultura Económica, 1973).
4. *Las Empresas*, p. 352. The authors also note that (our translation), "The MNCs which could be called 'modern' are compared with the aggregate of the national firms which include both the modern and traditional. Had the small national firm been excluded the resulting differences would obviously have been smaller," p. 344. Thus the authors agree that size is a crucial determinant of firm characteristics. Despite this observation, Fajnzylber and Martínez argue that this bias is counterbalanced by underrepresentation of the MNCs and do not proceed to account for the influence of size.
5. Jerry Ingles, "Firm Size Duality and Industry Characteristics in Venezuela," unpublished (PPSTDN, Cornell, 1976).
6. *United States Joint Ventures and National Manufacturing Firms in Monterrey, Mexico: Comparative Styles of Management* (Ithaca: Cornell Latin American Studies Program, Dissertation Series, 1972).
7. I.e., when the quantities of repatriation permitted by law are, in fact, less than what otherwise would be transferred.