

**ECONOMIC RESEARCH REPORTS**

EFFICIENCY DIFFERENCES BETWEEN  
FOREIGN AND DOMESTIC FIRMS  
IN MEXICO

by

Magnus Blomstrom

R.R. #87-01

January 1987

**C. V. STARR CENTER  
FOR APPLIED ECONOMICS**



**NEW YORK UNIVERSITY  
FACULTY OF ARTS AND SCIENCE  
DEPARTMENT OF ECONOMICS  
WASHINGTON SQUARE  
NEW YORK, N.Y. 10003**

## Efficiency Differences Between Foreign and Domestic Firms in Mexico

### ABSTRACT

This paper examines the efficiency differences between foreign and domestic firms in Mexican manufacturing industries. Controlling for differences in capital intensity, labor quality, scale and concentration, we find that foreign affiliates are significantly more efficient in their use of labor than are their Mexican counterparts.

Magnus Blomström  
C.V. Starr Center for Applied Economics  
New York University  
and  
National Bureau of Economic Research  
269 Mercer Street, 8th Floor  
New York, New York 10003  
(212) 598-3159

# EFFICIENCY DIFFERENCES BETWEEN FOREIGN AND DOMESTIC FIRMS IN MEXICO

Magnus Blomström\*

## 1. Introduction

The industrial organization approach to the multinational corporation (MNC) seeks to identify why the source-country firms can compete efficiently with host-country firms on the latter's own turf. Several reasons like product and process technology, and management, have been suggested in the literature, but there is still no conclusive empirical verification of the key ownership specific advantages. Particularly the development literature is characterized by confusion. An extensive number of studies suggest that MNCs are more efficient in their use of capital and labor than local LDC firms, but none of these studies have been able to ascertain whether this has been due to any ownership specific advantages or to other factors such as industrial distribution, size and market concentration. (See Willmore (1986) for a survey.)

The purpose of the present study is to test whether MNCs are more efficient or more productive than local enterprises of similar size, in similar activities and using similar technologies by using unique data from the Mexican manufacturing industry. Section 2 describes the data, in Section 3 we examine the effect of ownership structure on firms' labor productivity, and finally Section 4 concludes the study.

---

\*I am grateful to HSFR, Sweden for support of the research reported here.

## 2. The Sample

The empirical data for this study comes from the Mexican 1970 Census of Manufactures supplemented by unpublished data broken down by ownership in different industries.<sup>1</sup> Ownership in the statistical material is divided into three categories: state ownership, domestic private ownership and foreign ownership. Those plants of which at least 15 per cent of the shares are foreign owned are there defined as "foreign." If the State owns more than 49 per cent of a plant it is defined as a public enterprise, even if foreigners own more than 15 per cent of its shares. The state owned plants, however, are excluded from this study since they may have other goals than the privately owned ones. They may, for instance, accept lower productivity if that could contribute to higher employment or have a favorable effect on the geographical decentralization of the industry.

The level of aggregation is the four-digit level. Of the existing 230 individual four-digit industries, 15 had to be discarded, because of lack of information. For the remaining 215 industries, divided between domestically owned private and foreign owned plants, the following variables were used: number of plants, employment, wages, assets, gross production and value-added. The following data, not separated by ownership, was also used: size distribution of plants (measured in gross production) and the division between blue-collar and white-collar workers. All information is for 1970.

## 3. The Empirical Test

Much of the productivity differences between foreign and domestic firms in the Mexican manufacturing industry can be explained by the fact that the

former are concentrated on the most capital intensive and concentrated industries, that they use more capital intensive technology, and that they are able to reap economies of scale (Blomström (1985)). The question in this paper is whether these factors may explain the whole difference in productivity between the two types of firm, or whether the multinationals have other advantages that are specific to that type of ownership. We will try to answer this question by using a Chow-test (see Chow, 1960).

The Chow-test concerns the equality of two linear regression equations and we may use it to see whether productivity in foreign and domestic plants may be described in one single linear regression model. Of course, we would like to measure productivity as the ratio of net output to an index of total factor inputs, but the available data did not permit this. Instead a partial measure based on labor productivity is used. We may then build a model which relates labor productivity in foreign and domestic plants to their respective capital intensity, labor quality and scale of production. The degree of competition in different industries is also accounted for by a concentration index.

All the 215 individual four-digit industries contain privately owned Mexican firms, but only 155 contain firms operating under foreign ownership. The statistical model for the domestic privately owned firms may thus be written as:

$$(3.1) \quad y_i^d = \alpha_1 + \alpha_2 KL_i^d + \alpha_3 SCALE_i^d + \alpha_4 LQ_i + \alpha_5 CR_i + \epsilon_i \\ (i = 1, 2, \dots, 215)$$

and the model for the foreign owned as:

$$(3.2) \quad y_i^f = \beta_1 + \beta_2 KL_i^f + \beta_3 SCALE_i^f + \beta_4 LQ_i + \beta_5 CR_i + \epsilon_i \\ (i = 216, 217, \dots, 370)$$

where

- y = Value-added divided by the total number of employees as a measure of labor productivity.
- KL = The ratio of total assets (book value) to total number of employees as a measure of capital intensity.<sup>2</sup>
- SCALE = The ratio of average gross production in plants in an industry to the average gross production in plants within the size class of largest plants within each industry, as a measure of scale.<sup>3</sup>
- LQ = The ratio of white-collar workers to blue-collar workers as a measure of labor quality.<sup>4</sup>
- CR = An absolute concentration index which shows the proportion of an industry's employment accounted for by the four largest plants.<sup>5</sup>

The superscripts f and d denote foreign and domestic plants respectively. Our null hypothesis that the two sets of observations can be regarded as belonging to the same regression model would then be:

$$H_0 : \alpha_1 = \beta_1, \alpha_2 = \beta_2, \dots, \alpha_5 = \beta_5.$$

This is to be tested against the hypothesis that  $H_0$  is not true. According to Chow, this is obtained by applying the least square estimation method to the data on domestic plants ( $i = 1, 2, \dots, 215$ ), to the data on multinationals ( $i = 216, 217, \dots, 370$ ), and to the two sets of data combined ( $i = 1, 2, \dots, 370$ ). To carry through the analysis we need to calculate the sum of the square of errors (SSE) from each of these estimates (denoted

SSE<sub>1</sub>, SSE<sub>2</sub> and SSE<sub>c</sub> respectively).

Under the null hypothesis that both groups of observations belong to the same regression model, the following ratio:

$$(3.3) \quad \frac{(SSE_c - SSE_1 - SSE_2)/K}{(SSE_1 + SSE_2)/(n + m - 2K)}$$

where

K = number of parameters (K-1 coefficients plus one intercept)

n = number of observations in the first set of data

m = number of observations in the second set of data

will be distributed as F(K, n+m-2K).

The empirical results from the least square estimations (standard errors in parenthesis) are:

$$y_i^d = 9.96 + 0.25 KL_i^d + 2.53 SCALE_i^d + 25.24 LQ_i + 14.07 CR_i.$$

(4.25)      (0.02)      (14.58)      (8.10)      (6.70)

$\bar{R}^2 = 0.55$

$$y_i^f = -11.50 + 0.23 KL_i^f + 4.70 SCALE_i^f + 48.51 LQ_i + 84.70 CR_i.$$

(16.48)      (0.03)      (10.33)      (26.82)      (26.49)

$\bar{R}^2 = 0.43$

$$y_i^{Comb.} = -2.49 + 0.23 KL_i + 19.43 SCALE + 39.00 LQ_i + 37.57 CR_i.$$

(7.07)      (0.02)      (5.07)      (12.74)      (11.30)

$\bar{R}^2 = 0.49$

$$SSE_1 = 112794$$

$$SSE_2 = 808491$$

$$SSE_c = 981076$$

The ratio (3.3) is 4.67. In order to interpret the two sets of observations as coming from the same structure at the 0.05 level of signifi-

cance, this ratio should be less than 2.21 (less than 3.02 at the 0.01 level of significance). We thus have to reject the null hypothesis that the two sets of observations can be regarded as belonging to the same regression model.

The residuals from the estimation of the two sets of data combined were also plotted. Figure 1 shows that the residuals from the first 215 observations (i.e. the domestic plants) have a tendency to be negative, while the opposite is true for the multinationals (the last 155 observations). If, then, we use one single model for the two types of ownership for predicting productivity, we will overestimate the dependent variable for domestic firms and underestimate it for MNCs.

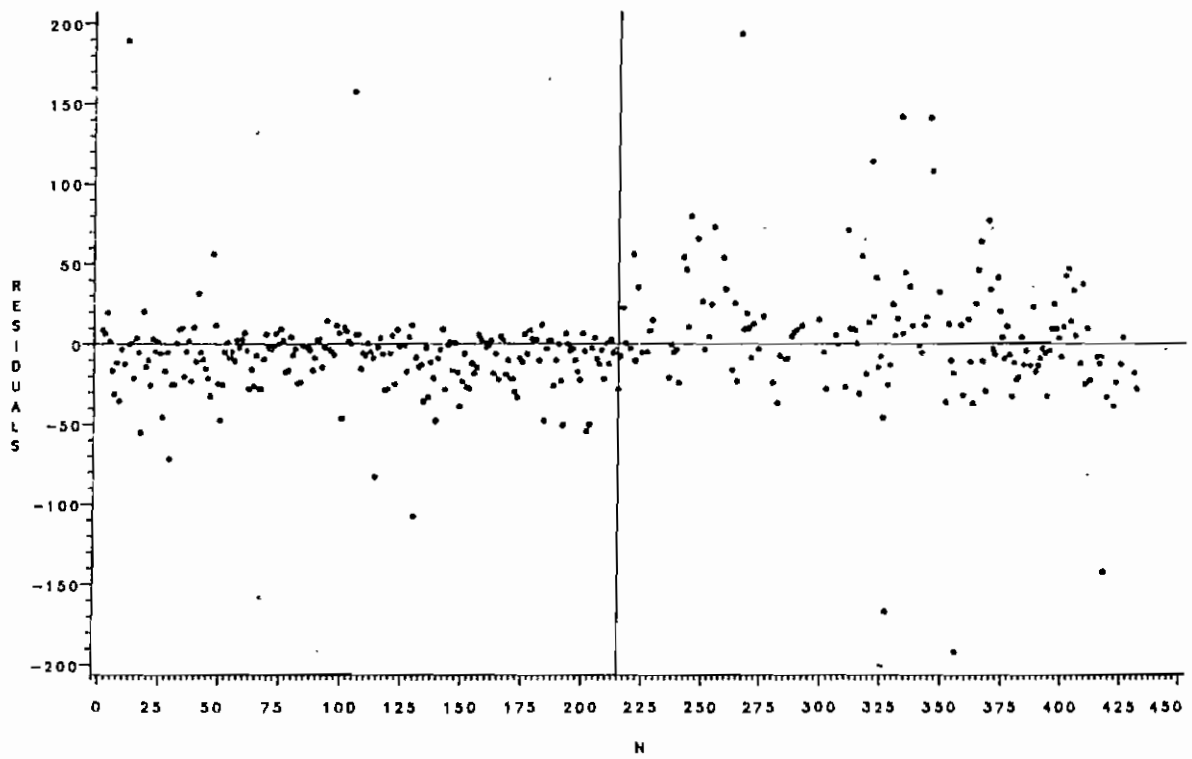
It was also tested whether the variance of residuals in the regression on the combined data set is a function of any one of the independent variables. This was not the case.

Lastly, there might be some sector-specific variable for an industry explaining efficiency there, rather than the independent variables. To test for this, we should analyze whether the residuals from the first estimation (data on domestic plants) are correlated with the residuals from the second one (data on foreign plants). A system of seemingly unrelated regression equations (see e.g. Kmenta (1971), p. 517) was used for this purpose, but this test did not show any systematic variation in the residuals that were sector-specific.

#### 4. Some Comments

There is little doubt that multinationals and local LDC firms in general do perform differently, but it may be questioned whether this is due

Figure 1. A plot of residuals from the regression on the combined data set.



to ownership as such. This paper tries to do an empirical contribution to this field of research by analyzing the sources of productivity differences between foreign and local firms in the Mexican manufacturing industry. Taking into account differences in capital intensity, labor quality, scale and concentration, we still find that MNCs are significantly more efficient in their use of labor than their Mexican rivals. This suggests that multinational corporations have other advantages that are specific to that type of ownership. The nature of the data precludes a more refined analysis of these advantages, but a discussion built on other studies may shed some light on the problem at hand.

Generally, economists tell us that technological advantage allows MNCs to compete successfully with local firms on their home markets. Some argue that this technological advantage is located in a superior technique of production (see e.g. Hufbauer and Nunns, 1975), while others, following Hymer (1960), suggest technological advantage in superior products. If we believe in any of these views, there may exist technological differences between the firms that are not captured in our model.

On the other hand, several studies have criticized this conventional wisdom by claiming that apparent technological differences between multinationals and domestic firms reflect a movement along a fixed isoquant rather than a shift, and stem from differing factor prices faced by the firms. For Mexico there are at least three empirical studies supporting this view (Mason, 1973, Fairchild, 1977, and Flamm, 1979). These evidences are consistent with the proposition that our model in fact captures the technological differences between the two types of firm, and that our

results indicate a more efficient use of similar technology in MNCs than in Mexican firms. The MNCs may, for instance, have higher managerial efficiency and/or better capacity utilization.<sup>6</sup>

Notes

1) Data specified for different ownership categories has been provided by la Dirección de Estadística de la Secretaría de Industria y Comercio in Mexico.

2) Our measure of capital intensity is affected by the number of shifts worked, and the proper measure of capital intensity relates to the flow of capital services instead of the stock. Since the Mexican data does not provide us with any information on shift work we have to assume that the rate of shift work is the same across industries.

3) We assume that the largest plants in an industry exhaust available economies of scale. The Mexican census provides data for different size categories of plants. By "largest plants" we then mean the average plant in the size class containing the largest plants within each four-digit industry.

4) The usual measure of labor quality in productivity studies is average wages. However, to avoid simultaneity problems, we have to reject the possibility of using this measure. Instead we use the ratio of white-collar workers to blue-collar workers in the different industries as a proxy. The available data did not permit us to construct this variable for different ownership within an industry, only for different industries. This variable will thus only take care of differences specific to industries.

5) A Herfindahl index was also tested, but it did not change our results in any significant way.

6) A case study of the yogurt industry in Mexico finds that the dif-

ference in performance between joint ventures and their Mexican competitors lies, not in the capital's origin, but much more in the management methods with which this capital is linked (Montavon (1979)).

References

- Blomström, M. (1985) "El comportamiento de las empresas nacionales y extranjeras en México. Una revisión del estudio de Fajnzylber y Martínez Tarragó", El Trimestre Económico 52(1), Núm 205, pp. 175-194.
- Chow, G.C. (1960) "Tests of equality between sets of coefficients in two linear regressions", Econometrica 28 (3), pp. 591-605
- Fairchild, L.G. (1977) "Performance and technology of United States and national firms in Mexico", Journal of Development Studies 14 (1), pp. 14-34
- Flamm, K.S. (1979) "Technology, employment and direct foreign investment: Evidence from the Mexican manufacturing sector", Ph.D. thesis, MIT
- Hufbauer, G.C. and J.R. Nunns (1975) "Tax payments and tax expenditures on international investment and employment", Columbia Journal of World Business 10 (2), pp. 12-20
- Hymer, S. (1960) "The international operation of national firms: A study of direct investment", Ph.D. thesis, MIT
- Kmenta, J. (1971) Elements of Econometrics (New York: Macmillan)
- Mason, R.H. (1973) "Some observations on the choice of technology by multinational firms in developing countries", Review of Economics and Statistics 55 (3), pp. 349-355
- Montavon, R. (1979) The Role of Multinational Companies in Latin America. A Case Study in Mexico (Hampshire: Saxon House).
- Willmore, L.N. (1986) "The comparative performance of foreign and domestic firms in Brazil," World Development 14 (4), pp. 489-501