# The Impact of Acquiring "Control" on Productivity: Evidence from Mexican Manufacturing Plants

Francisco Pérez-González*

Columbia University

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This paper investigates the importance of corporate "control" on the performance of foreign affiliates of multinational corporations (MNCs). Using detailed micro-level information from Mexico, I show that manufacturing plants where MNCs acquire majority ownership ("control") become more productive. To explore whether this link is causal, I use the elimination in foreign majority ownership restrictions and study the performance of plants where multinational ownership increased from minority to majority as a result. I find that acquiring control is associated with large improvements in total factor productivity, and that enhanced performance is concentrated in industries that rely on technological innovations from their parent companies. I interpret the evidence as supportive of the property rights theory of the firm.

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* Columbia University, Graduate School of Business, 3022 Broadway, Uris 422, New York, NY, 10027. Email: fp2010@columbia.edu. I thank Ken Ayotte, Miguel Messmacher, David Robinson, seminar participants at Columbia University and London Business School for comments, and to the Center for International Business Education for funding. I am indebted to Abigail Duran and particularly to Alejandro Cano for granting me access to the Mexican National Institute of Statistics, Geography and Informatics' (INEGI) manufacturing data. The databases used in this paper were accessed under arrangements that maintain legal confidentiality requirements. All errors are my own.

"*Giving up 51 percent is anathema to many foreign companies*[1]"

Building on the work of Coase (1937), Williamson (1975, 1985) and Klein, Crawford and Alchain (1978), Grossman and Hart (1986) (hereinafter GH) show that the allocation of ownership is important in the presence of incomplete contracts. Ownership determines who has the right to use assets beyond what is stipulated in a contract –who has *residual control rights*–, and because these rights affect surplus sharing and investment decisions.

While GH have made a profound impact on the profession, there is little empirical work examining the importance of their insights on firm performance. The main obstacle in testing for their ideas is finding a suitable laboratory where specific investments are important, contracts are incomplete, and where ownership structures and thus investment incentives arbitrarily change.

The objective of this paper is to fill that gap. I argue that changes in ownership experienced by a subset of Mexican affiliates of multinational corporations (MNCs) provide a near ideal experimental setting for examining the importance of acquiring majority ownership – hereinafter defined as acquiring "control"– on plant performance, for the following reasons:

First, Mexico recently modified her foreign direct investment rules. Between 1973 and until the late eighties Mexican regulations prohibited the entry of foreign majority firms, and these restrictions were eliminated in the early nineties.[2] Ownership constraints required that in order to launch an affiliate, multinationals had to find a Mexican partner and sell a majority interest to her.

Second, majority and full ownership by multinationals is pervasive around the world. In 1994, 89 and 80 percent of foreign affiliates of US MNCs were majority and wholly owned by their parents, respectively (Mataloni and Fahim-Nadar (1996).) Ownership restrictions potentially

[1] *Wall Street Journal* 2/16/82 on foreign firms fighting red tape in Mexico.
[2] The restrictive law was introduced in 1973. It was not retroactive: pre-existing investments by foreign firms were not affected.

forced a number of foreign affiliates into sub-optimal ownership arrangements, particularly in technology intensive sectors.[3] Previous work has shown that wholly owned status is more likely in the presence of proprietary assets (Gatignon and Anderson (1988) and Gomes-Casseres (1989)) and less common in labor intensive industries like textiles or footwear (Moran (2001.)) [4]

Third, once plants were operating, Mexican majority partners were in an ideal position to expropriate parent companies.[5] Mexico's poor minority shareholder protection and weak law enforcement (La Porta, López de Silanes, Shleifer and Vishny (1998)) suggests that expropriation costs faced by minority investors were potentially large. Thus parent companies had little incentive to enhance performance in these minority projects. Consistent with this view, there is evidence that partially owned affiliates receive less training (Ramachandran (1993)), use older technologies (Mansfield and Romero (1980)) and export less to their parents (Stopford and Wells (1972), Desai, Foley and Hines (2003)), relative to wholly owned firms. As regulations changed and multinationals acquired control of their affiliates, their incentives to exert effort, monitor, transfer technology and improve plant performance increased.

My empirical work starts by documenting the impact of foreign direct investment (FDI) on the performance of a large panel of Mexican manufacturing plants. I use total factor productivity (TFP) as measure of plant performance. I examine plant TFP relative to average productivity in a given two-digit industry and year. Looking at relative ranks instead of productivity levels is particularly pertinent in Mexico since the period under analysis is plagued with significant structural reforms. Consistent with previous studies (Aitken and Harrison (1999)), I find that FDI is positively correlated with plant productivity.

[3] For some firms, these cost might have prevented entry altogether.
[4] Other consistent non-MNC evidence is Monteverde and Teece (1982) automobile evidence which shows that in-house production are positively correlated to (1) the amount of engineering effort required in designing a part and to (2) whether parts are specific to a single assembler, and Joskow (1987)' coal mining results that contract duration and relation specific investments are positively correlated.
[5] For example, through outright theft, higher salaries, investments in projects to enhance the power of local partners (Shleifer and Vishny (1989)), etc.

I then examine the importance of acquiring "control" and show that in Mexico, productivity gains derived from FDI are concentrated in plants where MNCs acquire majority to full ownership. I subsequently classify acquisitions into two groups: plants already associated to multinationals through minority arrangements during the period of restrictions to foreign majority ownership, and unrelated plants. I concentrate the bulk of the empirical work on the former group. Productivity improvements of plants with no pre-existing MNC shareholdings may reflect initial access to proprietary assets, economies of scale, etc. (Caves (1996)) that distinguish multinationals and not the importance of control. The evidence, however, does indicate that these latter target plants improved their performance.

Ownership patterns for plants where MNCs move from minority to majority shareholdings suggest that parent companies were effectively constrained by law. Before acquisitions, 93 out of 121 target plants had minority ownership in the 40-49.9 range and 54 plants had ownership levels between 48-49.9 percent. Interestingly, after these restrictions were eliminated, 97 of these 121 affiliates moved to 100 percent foreign ownership (not 51 percent). Moving to full parent ownership might be indicative of significant expropriation costs. In lieu of poor minority rights, the value of a share for a domestic partner falls when control shifts to foreigners. Thus local investors would prefer to sell their entire stockholdings as part of the control package.

Plants where multinational ownership increases from minority to majority experience large and statistically significant gains in productivity. Relative to their industry peers TFP increases by 7.2 percentage points around these ownership changes. The estimates suggest that under the control of multinationals these plants produced 8.5 percent more output per unit of inputs than competitors. I investigate whether these findings are driven by MNCs' increased incentives to invest by further dividing acquisitions by pre-existing industry characteristics with the objective of capturing affiliates' dependency on the parent. According to GH, associated efficiency gains of having the "right" owner are a function of the relative importance of

investment decisions of different partners. I therefore create two categorical variables to proxy for dependency on the parent, based on: (1) whether a plant belongs to an industry with above average imports of machinery and equipment to total investment, and alternatively (2) whether a given plant belongs to an industry with above average technology transfer payments to total expenses, both at the two-digit industry level.

Consistent with GH, I find that: (1) minority ventures that are acquired by parent companies are typically in technologically intensive sectors, (2) before acquisitions, plants in technology intensive sectors performed similarly to average plants in their industries, but under-performed same industry plants with 100 percent parent ownership (plants with 100 percent ownership by MNC are organizations that pre-existed the 1973 FDI Law.) (3) Upon acquiring control, these technologically dependant plants significantly improved their performance both relative to locally owned plants and to wholly owned subsidiaries of MNCs. Relative to the average plant in their industry and after the change in control, former minorities produced 10 percent more output per unit of inputs than other plants. Interestingly, under-performance relative to pre-existing wholly owned affiliates quickly disappears. (4) I show that upon acquisitions, dependant plants significantly increase total investment and investment in imported machinery and equipment, which is also consistent with higher involvement by the parent company.

To address whether estimated improvements in TFP could be explained by selection, that is, multinationals acquiring only those plants with superior ex-ante expected performance I examine the average productivity of minority plants regardless of acquisitions decisions. Plants with minority FDI during the period of ownership restrictions show a subsequent improvement in productivity as restrictions are eliminated that is not observed in plants with local or 100 percent multinational ownership throughout.

While several hypotheses (initial access to proprietary assets, economies of scale, etc) could potentially explain why productivity is enhanced as manufacturing plants first become associated with MNCs, these theories alone cannot explain why acquiring control relative to

holding a minority interest with a contract should affect performance. I, therefore, interpret the evidence as providing strong support to the GH view of the firm.

The rest of the paper is organized as follows. Section I describes changes in the regulatory regime for foreign direct investment in Mexico and aggregate trends in FDI flows. Section II describes the data. Section III the methods of analysis and the empirical predictions. Section IV describes the results, and Section V concludes.

## *I. Foreign Direct Investment in Mexico: Regulation and Aggregate Trends*

Mexico has had a love-hate relationship with foreign direct investment.[6] During the late 19th century FDI played an important role in developing basic petroleum, railroad and mining industries. Yet post-revolutionary Mexican governments pushed a "nationalistic" economic model, in which "strategic" sectors of the economy were to reside in the hands of the Mexican government or Mexican nationals. As a consequence, railroad, and more significantly petroleum companies with foreign investment were nationalized in 1937 and 1938, respectively.

The nationalistic project was reinforced by an array of policies between 1940 and 1973. In 1944, a Presidential Decree gave discretionary powers to the government to require 51 percent Mexican ownership in any existing company operating in Mexican soil. In 1959, electric companies with foreign ownership were nationalized. Furthermore, during the fifties and sixties, the government was actively promoting Mexican-owned firms through the tax system (Ortiz-Mena (1998).)

The promotion of domestic ownership of industry became Law in 1973. At its core the new rules (1) prohibited foreign investment in certain sectors of the economy that were restricted to Mexicans, and (2) restricted foreign participation to 49 percent of total capital in new firms.

[6] A recent concise review of FDI regulation in Mexico is presented in Economic Commission for Latin America and the Caribbean (2000).

The Law left room for discretion by stating that exceptions to (2) were to be made if majority foreign ownership enhanced domestic interests. However, before 1982, the law was applied in a "restrictive way" (United Nations (1992)). For example, while MNCs tried to go around the law by selling 51 percent of shares to dispersed investors, the Mexican Government ruled out the practice "saying that in effect, it left foreigners with control.[7]" Conversely, it is worth noting that the Law of 1973 did not affect existing firms operating in Mexico that were majority controlled or wholly owned by foreign nationals.

Mexican restrictions on FDI were reexamined in lieu of the severe contraction of economic activity after the debt crisis.[8] In 1985, a previous decision to prevent IBM from operating a wholly owned manufacturing plant was overturned (Peres-Nuñez (1990).) In 1986, a selective debt-equity conversion program to subsidize FDI was implemented.[9]" Firms with FDI could acquire government debt from banks (at a large discount), selling it back to the Mexican government (at a lower discount) in exchange for Mexican pesos to be used for new investments.

The new flexibility in interpreting the 1973 Law was made clear through the FDI Act of 1989, which stated that foreign nationals could establish new businesses and own up to 100 percent of firms' capital in "unrestricted" activities. This Act reduced the room for government discretion by clearly specifying the list of industries where restrictions applied and by granting automatic government approval for most projects. In practice, the entire manufacturing sector except petroleum products was opened to FDI.

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[7] WSJ 2/16/1982. Examples of large corporations whose wholly owned ventures were rejected and reported by the media include Chrysler (Seattle Times 9/6/1985), Gerber Products (WSJ 5/5/1982), Pennwalt (NYT 5/8/1979), Procter and Gamble (2/06/1989).

[8] In this section I concentrate on changes in regulations affecting FDI. For a comprehensive review of Mexican structural reforms during the eighties and early nineties, see Aspe (1993). For other key dates related to major political and economic events in Mexico see Bekaert and Harvey's chronology at http://www.duke.edu/~charvey/Country_risk/couindex.htm

[9] Rules for foreign investors were outlined in "indecipherable language in a 44-page *Manual Operativo* Fortune, 3 August 1987. The program was later scaled back to "strategic sectors" (basically tourism) due to its inflationary impact.

The 1989 Act was, however, legally questionable and potentially unconstitutional since it represented a new interpretation of the rigid and nationalistic Law of 1973, which remained valid in paper. The complete reversal from restricting to promoting foreign investment was completed with the approval of the new FDI Law of 1993, which ratified and enhanced the changes of the FDI Act of 1989.[10] Finally, The North American Free Trade Agreement (NAFTA) further reduced restrictions to US and Canadian investors by granting domestic treatment to them in all but a few sectors of the economy.

FDI reforms, together with macroeconomic stabilization and the subscription of trade agreements (joining The General Agreement on Tariffs and Trade (GATT) in 1986 and signing NAFTA in 1993) lead to a significant increase in the flows of foreign investment. Table I presents net FDI flows to Mexico between 1970 and 2001 using data from the online version of the *World Development Indicators*. Between 1970 and 1985, FDI flows were on average equivalent to 0.9 and 4.1 percent of gross domestic product and gross capital formation, respectively. As Mexico eased restrictions (1986-1993), these ratios increased to an average of 1.2 and 5.5 percent, respectively, and rose dramatically to 3.0 and 13.2 percent between 1994 and 2001, as restrictions were eliminated. In sum, FDI relative to GDP and gross capital formation during 1994-2001 more than tripled compared to the 1970-1986 levels. In dollar terms, average FDI flows between 1994 and 2000 were equivalent to USD $11.6 billion, reaching $24.7 billion in 2001.

Given that this paper focuses on acquisitions of Mexican plants one would expect that if the above-described restrictions were effective, there would be little or no purchase of domestic firms by foreign companies before 1989), and these transactions would be intensified upon approval of the new investment Law of 1993 and NAFTA. Column IV of Table I show that this is the case. Based on publicly available data, SDC Platinum recorded only eight acquisitions

[10] The new Law was published by the Official Gazette, Dec 27th, 1993. An updated online English version can be obtained at http://www.economia.gob.mx.

involving a control exchange between a foreign bidder and a Mexican target between 1985 and 1988 or an average of two per year.[11] The number of such transactions increased to an average of 15.2 between 1989 and 1993, and to 44.4 between 1994 and 2001.

Aggregate data suggests an increased role of FDI in the Mexican economy in response to falling FDI restrictions and increased stability and openness of the Mexican economy. In the following section I will describe the microeconomic data used in this paper and the methods of analysis implemented to evaluate the impact of changing foreign ownership on plant performance.

## *II. Data*

The data in this study is from the Mexican Annual Industrial Survey (MAIS) at the Mexican National Institute of Statistics, Geography and Informatics (INEGI). The MAIS is a large micro database containing annual information on the value of production, employment, investment, input and energy use in large manufacturing plants in Mexico. This survey is available in electronic form since 1984 and it was expanded in 1993, in both cases with the objective of capturing at least 80 percent of the value-added in the manufacturing sector and the activities of establishments with 100 or more employees. The survey had originally 3,199 plants in 1984 and it was expanded in 1993 to 6,856 plants.

The MAIS has several limitations. First, during 1984-1993 it did not add new plants into the survey and INEGI' personnel claim that there was no exit out of the sample, which I have no way to verify. Second, it has two waves, the 1984-1993 and 1993-2001 surveys, making it an unbalanced panel.[12] Third, post-1993 inclusion into the sample was rarely done, but there was significant exit out of the sample. The main advantages of the sample are three. First, Law

[11] These numbers are calculated based on transactions where foreign investors end up owning at least 50 of targets after transaction are completed. Transactions where no ownership was reported are excluded.
[12] Using a balanced panel with those firms that stay in the Survey for the entire 1984 to 2001 period does not change the results of the paper.

mandates that information should be reported and INEGI reports excellent levels of compliance. Second, it is not shared with tax authorities, so it minimizes incentives to misreport information. Third, it provides a detailed account of plants' production decisions.

Identifying ownership data involved merging several databases since ownership information is not part of the MAIS survey. I therefore constructed my ownership data combining information from (1) INEGI, which gave me ownership data for 2,891 plants in 1988, 2,027 in 1992, 5,664 in 1994, and 1,993 plants in 1999, (2) the FDI database at the Central Bank of Mexico, which is a census of firms with FDI starting in 1990, (3) SDC platinum, and (4) news searches using Dow Jones *Factiva* tool and individual firms web searches to verify unclear ownership data or actual dates of ownership changes, where available.

I was able to match data for 5,266 plants and 55,317 plant-year observations, which had ownership and production data between 1988 and 2001. The fact that INEGI was unable to provide me with ownership characteristics for all plants for at least one year may reflect that those plants with missing data were acquired by foreign or local owners. If this were true, I might under-represent the importance of foreign acquisitions in Mexican manufactures.[13] I have no information from INEGI that this is the case.

Table II shows the number of plants with all relevant data broken by year and ownership characteristics. Out of a total of 1,881 plants in 1988, 79.3 percent were 100 percent owned by Mexican nationals or 1,492 plants, 8.1 percent (153 plants) had direct minority interests by foreign investors, 4.8 percent (30 plants) had majority ownership and 12.8 percent (206 plants) were wholly owned subsidiaries by multinational corporations. Interestingly, foreign direct investment is very important in the sample. Weighted by sales, FDI accounted for 31.8 percent of output in 1988.

[13] If plants with missing ownership data were acquired by foreign investors and their associated subsequent underperformance was large enough to drop from the AIS, then the empirical work would reflect performance of successful acquisitions.

Table II shows significant changes in the composition of foreign ownership between 1993 and 2001. While in 1993 38.4 percent of all plants with foreign direct investment were minority ventures, by 2001 this share was only 25 percent. Wholly owned affiliates increased from 51 percent of all plants with FDI to 67 percent. Given the limited entry into the sample, the increase in the number of wholly owned affiliates is explained by acquisitions of plants formerly owned by domestic investors and plants jointly owned by MNCs and local partners. Consistently, by 2001, the sales weighted foreign ownership in the sample was equivalent to 47.6 percent. It is worth pointing out that while the sample in this paper is only a fraction of all plants in the Survey, data from INEGI suggests that plants included in this analysis accounted for 92.4 percent of all employment reported in 2001.

Table III shows industry definitions at the two-digit level for plants with information about (1) export to output ratios and (2) FDI data since 1993 (export data is first reported in 1993). The Table tries to show that as indicated in previous work (Gatignon and Anderson (1988), Gomes-Casseres (1989), Moran (2001)) FDI is not solely explained by export activity. While in certain industries like industry code 38 (machinery, equipment and transportation vehicles), both exports to output ratios (on average 16 percent) and FDI are relatively high (on average 23 percent), in other industries like manufacturing code 35 (artificial fibers, chemicals and rubber products) we observe substantial FDI (average 24 percent) with relatively low export activity (8.7 percent.) Conversely, in industries like industry lumber and furniture (code 33) or textiles and footwear (code 32) have significant export ratios (10.6 percent and 9.2 percent respectively) with tiny FDI (2.4 percent and 3.4 percent respectively).

Summary Statistics

Given that restrictions to FDI were implemented in steps, first with the FDI Act of 1989 and then with the new Law in 1993, I will focus on plants where MNCs obtained majority

ownership anytime after the FDI Act of 1989. Using the data in Table II, I am able to identify 222 cases where MNCs increased their ownership interest and crossed the 50 percent line: 121 cases involving a former minority interest, i.e. a plant that was already affiliated to a MNC and 101 cases where there was no previous ownership by foreign investors.

Accordingly, Table IV splits plants into three categories: plants that throughout the sample period did not had FDI (4,226 plants), plants had some FDI but were not involved in an acquisition by a MNC (818 plants), and plants where an acquisition was identified (222 plants). Data on output, number of employees and capital stock suggests that plants owned by Mexican nationals were smaller than other plants. For example, the average output per year for plants with no FDI was equivalent to 172 million pesos a year (pesos of 2001, approximately equivalent to 18.5 US million), while the average output of plants with FDI (non-acquired) was 778 million pesos, and for plants that were acquired by MNCs it was 601 million.

Output per reported hour of work suggests that plants owned by local investors produce less than those with FDI. Output per hour was on average equal to 312.8 pesos for locally owned plants while for plants with FDI with no change in control was equivalent to 659 pesos and 585 pesos for those plants that were eventually acquired by their parents.

Consistent with Ramachandran (1993), Table II suggests that plants with no change in FDI control (typically 100 percent owned) received higher technology transfers than firms that were not majority controlled throughout (Column III) or had no FDI (Column I). Technology transfers for the first group accounted for 2 percent of total expenses, while it was equivalent to 1.5 percent for those plants where multinationals eventually acquired control and only 0.4 percent for plants with no FDI.

## *III. Methodology and Empirical Predictions*

*IV. A. Methodology*

The measure of performance used in this paper is plant total factor productivity (TFP). To obtain this metric, and I estimate a standard log-linear Cobb-Douglas production function for each two-digit industry and year:

$$\ln(Y_{ijt}) = a_{jt} + b_{jt} \ln(K_{ijt}) + c_{jt} \ln(L_{ijt}) + d_{jt} \ln(M_{ijt}) + \varepsilon_{ijt} \qquad (1)$$

Where plant $i$, in industry $j$ and time $t$. Plant TFP is the estimated residual from these regressions and it can be interpreted as the relative productivity rank of a given plant in its industry. Given that (1) includes a constant for each industry and year, TFP does not capture aggregate industry trends, but the idiosyncratic part of plant productivity. This is extremely important in Mexico, where structural reforms (privatization, reduction in tariffs, macroeconomic stabilization, etc) were significant during the sample period.[14]

Using data from the MAIS I construct as closely as possible the variables needed to estimate (1).[15] Although $Y$ above is real output, I can only construct nominal output with the data at hand. Output is the value of goods produced.[16] Using nominal output is potentially problematic since estimated residuals will reflect price and efficiency variations. If all plants were to receive the same price for their products then estimated residuals using nominal variables do reflect productivity ranks. While potentially this is a strong assumption when comparing plants owned by foreign versus local investors, the assumption that relative price differentials do not change in time is less strong, and that is what I implicitly assume in the empirical work.

[14] For an analysis on NAFTA's impact on Mexican productivity see López-Cordova (2002.)
[15] In constructing these measures I follow Lichtenberg (1992) and Schoar (2002), who use the Longitudinal Research Database (LRD), the US counterpart to the MAIS, to (1) construct TFP measures and (2) test the impact of changes in ownership on plant performance.
[16] INEGI requires plants to report the value of goods produced (at market prices) regardless of whether these products were sold. Using sales as dependant variable does not affect the results. Price deflactors were obtained from INEGI.

As proxy for $L$, I use total labor hours as reported in the survey.[17] The capital stock $K$ was generated using the perpetual inventory formula using initial book values of capital and annual investment information to update value, less a linear rate of depreciation, which I assume is five percent per year. The values for $M$ are expenses for inputs and energy used by the plant as reported in the MAIS.

*IV. B. Predictions*

With estimated TFP at hand I use the insight of GM to test the following predictions:

Prediction 1: FDI should have a non-linear impact on TFP.

Acquiring majority ownership implies the transfer of residual control rights, which could be substantial in an environment of poor minority rights and weak law enforcement. In this environment, technological improvements by a minority foreign investor, for example, could be subject to expropriation by Mexican majority partners, and as argued above, there is evidence that MNCs provide less training and use older technologies in minority ventures. I expect that changes in FDI investment that do not cross the majority ownership line, should have a lower impact on performance relative to cases where foreign ownership translate in a majority stake. Likewise, increases in FDI investment once a MNC has control should be relatively unimportant since the MNC already has acquired the residual control rights associated with the plant's assets.

Yet, even if prediction (1) is supported empirically, one should be careful in interpreting observed changes in performance since productivity improvements of plants with no pre-existing MNC shareholdings might reflect initial access to MNCs and not the importance of control.

[17] Using total wage bill instead to total hours does not affect the results. The data does not divide workers by production and managerial workers.

Prediction 2: Plants with pre-existing minority investments by multinationals during the period of restrictions to foreign majority ownership, that were acquired by their parent MNC after restrictions were eliminated, should improve performance

We are asking whether MNC control is optimal relative to a minority shareholding with a contract. If feasible contracts are incomplete as they potentially are in Mexico, and if MNC ownership were ex-ante optimal as one would expect for the average affiliate given the pervasiveness of wholly owned subsidiaries, then we should expect that when MNCs increase their shareholding from minority to majority (MNCs acquire control), plant productivity should increase. This is an initial test to GH since we are able to find a scenario where ownership structures and thus investment incentives change in part as the result of changing regulation. The test focuses on within plant variation in TFP relative to average productivity in a given industry.

Failing to find an effect would not imply that GH' view of the firm can be rejected. Expropriation costs could be prohibitive in the sense that they can prevent entry altogether and in consequence, observed plants would not be representative of those ventures where multinational control is most important.

Prediction 3: Productivity gains by target plants should be a function of the importance of investment decisions made by the MNC relative to local partners.

To address Prediction 3, I construct two measures of the relative importance of MNCs in their ventures. From Gatignon and Anderson (1988), Gomes-Casseres (1989), Moran (2001) and average numbers from Table III and IV, there is evidence that foreign ownership is relatively more common in technologically intensive sectors and less common in labor intensive industries. The first measure is based on the share of imported machinery and equipment on total investment at the two-digit industry level. The second proxy is based on the ratio of technology transfer payments relative to total expenses paid by local affiliates. I am implicitly assuming that imported

machinery and equipment or technology transfers are provided by MNCs. In both cases, I create an indicator variable equal to one in industries with above average imports of machinery or technology transfers relative to the universe of the manufacturing sector.[18] I rely on industry-wide averages in order to prevent sorting by plant level variables that might be correlated to changes in performance.

The test tries to capture the idea that pre-acquisition MNCs has little incentive to innovate in Mexican ventures, since majority owners could expropriate the value of their investments or that local partners couldn't commit not to expropriate them. Post-acquisition, controls shift and now locals will be less likely to invest in ventures. In technological intensive sectors, where MNCs' investment is really important (but local partners' investment is not), control would imply a drastic response from the parent company and productivity could potentially increase, even as locals invest less. Conversely, in other industries where MNCs' are less important relatively to local partners, the impact on productivity should be harder to predict.

Out of the nine two-digit Mexican industry codes, the first definition of dependency on the parent includes plants in industry codes 34, 35, 37, 38 and 39 and the second includes plants in industry codes 35 and 38 only. Consistent with the intuition of this test, Table III showed that industry codes 35 and 38 had the highest concentration of FDI in the sample.

Additionally, estimated productivity gains by newly acquired targets should not be driven by factors that might benefit multinationals but not local plants. For example, Desai, Foley and Hines (2003) argue for increasing in-time gains from coordinating global operations. Alternatively, NAFTA could have led to improvements in the operational efficiency of multinationals only. To test for this possibility I calculate "excess TFP" defined as TFP in each plant in technologically dependent industries minus average TFP of plants in their own industry that were wholly owned by multinationals. Given that the 1973 Law was not retroactive, there

[18]For this test, it is important not to use plant specific data in order to sort on a plant level variable that might be correlated to changes in performance.

was a subset of plants where MNCs did not face expropriation risks by local partners because they had none. I need to show the gains in former minority ventures are not matched by gains in the wholly owned control group.

> Prediction 4: Plant investment, in general, and investment in MNC proprietary assets should increase as MNCs move from minority to majority ownership.

I will examine changes in reported investment at the plant level, both total investment and investment in imported machinery and equipment. While estimated productivity could reflect changes in transfer pricing at the plant level, the fact that parents make incremental investments in the plant should make the GH view more plausible.

To further assess the sensibleness of the assumption used to test Prediction 3, –that technology is related to the role of the MNC, I again split acquisitions using the indicator variables related to machinery imports and technology expenses.

> Prediction 5: Regardless of acquisition decisions, average plant productivity for the group of plants that had foreign minority investments pre-liberalization, should increase, after FDI restrictions were eliminated.

Focusing on the performance of the group of plants that is actually acquired by their parents is potentially problematic since MNCs' select which plants they acquire. To the extent that MNCs have superior information on the future business prospects of plants, the identified gains might be spurious. Finding an average gain in the pre-liberalization minority ownership group without conditioning on future information is a stronger test to the insights of GH.

## *IV. Results*

### *IV. A. Foreign Direct Investment: Basic Results*

The impact of FDI on Mexican manufacturing plants is initially explored in Table V. Column I investigates if firms with foreign investment have higher output levels, regardless of input use. Ordinary least squares (OLS) estimates indicate that plants with foreign investment have higher output per plant than other entities. The estimated coefficient indicates that on average, plants moving from 0 to 100 percent FDI would produce 1.6 times more than before. Once we control for fixed effects, the estimated increase from moving from 0 to 100 percent foreign ownership implies an increase in output of 30 percent. The decline in the estimates suggests that foreign investments tend to be allocated to large ventures, but once we control for the average size of a plant, FDI' incremental effect is significantly lower. Column III shows that crossing the 50 percent ownership line is key for increasing output. Beyond the linear impact of FDI on output, plants where FDI crosses the 50 percent boundary increase output by 20 percent.

Higher output does not necessarily imply superior performance. I now therefore control for input use as described in (1) and focus on TFP. It is important to keep in mind that TFP here is a relative rank within a two-digit industry for a given year. By construction, an average plant in an industry has a residual in (1) equal to zero, and the residual is positive (negative) for above (below) average plants.

Column IV in Table V shows that FDI and TFP are positively correlated at the plant level. The estimated coefficient indicates that a plant with no FDI that becomes wholly owned by a MNC would increase output by 14.8 percent relative to other local plants, using the same inputs. This estimated coefficient is very similar in magnitude to existing panel data studies on the impact of FDI on plant productivity (Aitken and Harrison (1999).)

To partially address the reverse interpretation that FDI flows into relative productive plants, Column V presents estimates when plant fixed-effects are introduced. Results indicate that

changes in FDI from 0 to 100 percent would still increase output per level of inputs, but by a lower amount or 4.1 percent, an increment significant at the one-percent level.

In Column III, I address whether the impact of FDI on productivity is concentrated in plants where MNCs acquire majority control (Prediction 1). I therefore introduce a categorical variable equal to one for plants where MNCs acquire majority and interact it with the dummy variable of the post-acquisition period and include this control in the basic specification. Interestingly, the impact of increasing FDI on TFP when FDI does not cross the 50 percent line disappears. In contrast, when FDI does cross the majority ownership line, the impact on productivity is substantial and statistically significant. The interpretation is however, distinct. FDI improves TFP but only when foreign investors acquire majority control. Plants where multinationals acquire control produce 5.6 percent more output per level of inputs than other firms in their industry benchmark.

*IV.B. Acquisitions by Multinational Corporations (MNC)*

Ownership Patterns

I now examine in detail cases where MNCs acquired majority ownership. Table V shows ownership information for 222 plants for which plant level production information and foreign ownership data was available. Within this group, there are two types of acquisitions. New affiliates, which involve a plant that was previously fully owned by a Mexican business group, and "old affiliates" or plants where MNCs were minority shareholders during the period of restrictions and became majority owners as legal constraints were eliminated. There are 101 new affiliates and 121 former minorities that become majority owned by multinationals. For new affiliates foreign ownership increased from 0 to an average ownership of 91.5 percent. Interestingly, in 78 cases (77 percent) ownership moved to the 95-100 percent range and in 75 cases it increased to exactly 100 percent.

Ownership patterns in pre-existing affiliates are consistent with binding ownership restrictions and potential expropriation by majority owners. First, 93 out of 121 plants (77 percent) had minority shareholdings in the 40-49.9 range and 54 plants were the 47-49.9 range. Clustering close to the legal restriction to majority ownership suggests that potentially these plants were not established with an optimal ownership level but rather that MNCs entered the Mexican market with a constrained ownership arrangement. As MNC acquired majority, 97 out of 121 plants became 95-100 owned by the parent company and 87 of them became wholly owned subsidiaries.

These patterns in ownership are consistent with substantial fear of expropriation. Under weak minority rights and enforcement, majority can translate into more than pro-rated cash flow rights. Thus, majority investors that sell their controlling stake to MNCs have little incentive to keep a small slice thereafter: the value of holding a minority interest is negligible once they give up control. Furthermore, MNCs do seem to prefer wholly owned status as means for controlling their affiliates (Mataloni and Fahim-Nadar (1996).)

Changes in Total Factor Productivity

Table VII examines the change in plant productivity around acquisitions, for both new and existing affiliates. Panel A, reports average productivity of all 222 plants two years before and after acquisitions took place. TFP before acquisitions is comparable to average productivity in the industries in which these plants operate. The estimated coefficient is equal to 1.3 percent but it is not statistically different from zero.

Consistent with a positive impact of MNCs on performance, plant productivity improves with-in two years of acquisitions. On average, target plants produce 8.5 percent more output per unit of inputs than other plants in their industries. The change in TFP is statistically significant at the one-percent level.

As in Table VI, I divide acquisitions by new and old affiliates. As argued before, there are competing explanations of why new affiliates can improve performance upon acquisition. Productivity gains by new affiliates could reflect, for example, initial access to proprietary assets, economies of scale, access to distribution channels, cheaper inputs, etc that distinguish MNCs in the first place. Also, selection into the pool of target plants is not random. MNCs might select into promising targets. Yet, a decline in productivity should be surprising. Consistent with mainstream views about FDI, TFP improves as plants move from zero to majority foreign ownership. Target plants increase output per units of inputs by 7.0-percentage points relative to the pre-acquisition period, which is statistically significant at the one-percent level.

To test if control –who owns assets– matters, I hereafter concentrate the analysis on affiliates where multinational ownership increased from minority to majority. Under comprehensive contracting, these affiliates should be able to have access to MNCs' proprietary assets, obtain economies of scale or cheaper inputs regardless of whether the MNC has a minority or majority stake in a plant.

Somewhat surprising, plant productivity for pre-existing affiliates was on average, not statistically different than average productivity in the respective industries before these plants became majority owned by parent multinationals. Interestingly and consistent with the incentive-expropriation hypothesis, once MNCs established majority ownership, target plants produce 10 percent more output per level of inputs than their industry-year peers. Relative plant productivity increases by 7.4 percentage points, a difference that is statistically significant at the one-percent level. These results provide support to Prediction 2.

In interpreting these findings it is important to highlight that estimates of TFP already control for industry-wide yearly shocks. The constant in annual industry regressions captures average industry productivity, which was likely to be affected by structural reforms introduced in Mexico during the sample period.

*IV.C. The Importance of MNCs in their Affiliates*

As explained in Section III, the gains from having MNC control should be a function of the importance of MNC' investment decisions relative to local partners. Panel B in Table VII divides plants by whether they belong to an industry with relatively high dependency on imports of machinery and equipment compared to the entire Mexican manufacturing sector. Overall, results provide support to Prediction 3, the core question in this paper.

First, 71 percent of all acquired affiliates or 86 plants were in industries where technology is important relatively to the average of the manufacturing sector.

Second, pre-acquisition performance is higher for plants in sectors where technology is not important. Labor-intensive plants outperformed their industry benchmarks while plants in technology intensive industries did not outperform their industry peers. In other words, to the extent that investment decisions by domestic partners were important in labor-intensive industries, minority arrangements might not had been inefficient in the first place.

Third, post-acquisition gains occur only in plants where technology is relatively important. After control shifts to parent companies, plants in technologically dependant industries produce 10.2 percent more output per inputs than industry peers, a gain of 10.4 percentage points, which is statistically significant at the one-percent level. The fact that plants in other industries do not seem to gain from parent control also casts doubt on the idea that multinationals select to acquire only plants that are likely to improve performance.

Fourth, pre-acquisition "excess-TFP" for technology intensive plants is negative and significantly significant but this gap disappears after MNCs acquire control. Panel C in Table VII shows that on average wholly owned subsidiaries produced 9.4 percent more output per unit of inputs than target companies, yet after multinational' ownership increases, the gap goes is lo longer statistically different from zero. Results while sorting by the alternative proxy for dependency on the parent company do not change the above-described interpretations.

Table VIII extends the analysis for a five-year window before and after changes in control, whenever available, but only for the 121 plants where MNC ownership went from minority to majority. The estimated coefficient in Column I suggests an average improvement in TFP of 5.9 percentage points, statistically significant at the one-percent level. Column II explores if productivity gains are a short-term event occurring around acquisitions either because plants were temporarily below their normal TFP level due to a prospective transaction by the MNC, or because higher performance with-in two years of acquisition was driven by an unusual positive shock. Column II in Table VIII, therefore, omits data for two-year before and two years after acquisitions. The estimated results show average productivity gains in the order of 4.8 percentage points, significant at the five-percent level.

Column III in Table VIII explores if improvements in productivity are concentrated in small plants only. Intuitively, one might expect that improving production efficiency of a small plant is potentially easier relative to large establishments. Results suggest that improvements in productivity are not confined to any size grouping. When we divide plants in three equally sized groupings we find that upon acquisition all observe improvements in TFP of similar magnitude: productivity gains for the smallest or largest groupings are not statistically different than those observed by the middle-sized group of affiliates (omitted category), which is positive and statistically significant at the five-percent level.

Columns IV and V in Table VIII reassess the differential improvement in productivity when we sort plants by industries' relative dependency on imported machinery and equipment, or technology transfers as discussed in Table VII. Consistent with previous results, TFP gains seem to be a function of plants' relative reliance on MNCs' investments. Plants in technologically dependant industries concentrate the gains from multinational control.

Total Investment and Direct Imports of Machinery and Equipment

Thus far, the evidence indicates that multinational control improves productivity in technologically dependent sectors. Yet, estimated TFP might be manipulated by parent companies, who could manipulate transfer pricing in a way that cannot be controlled for in the empirical analysis as developed herein. It is therefore important to show that Mexican affiliates receive increased resources from the parent: that real changes do occur. Failing to find any significant transactions might cast doubt on the idea that MNCs become more involved in their affiliates once they acquire control.

Ideally one would like to observe effort or time spent by MNCs' executives and actual technology transfers among the entities. While the Mexican manufacturing database does not provide proxies for these metrics, it does include information on (1) investment, which is now potentially determined by parent headquarters and (2) direct imports of machinery and equipment, which are likely to be acquired from the parent.

Panel A in Table IX presents average investment at the plant-level around ownership changes. On average, annual investments were equivalent to 14.7 million pesos ($1.6 US million) before MNCs acquired majority ownership and 31 million pesos thereafter. The difference (16.3 million) is statistically significant at the one-percent level. Plants in sectors where imports of machinery are relatively more important, explain the bulk of the increase in investment. For this latter group, investment increased by an average of 19.0 million, statistically significant at the one-percent level. Again, I fail to find significant changes for affiliates in industries with low technology use.

I also examine direct imports of machinery and technology, which are likely to be the main channel for transferring physical resources and technology from the parent to an affiliate. The data provides statistical support to the idea that parents' willingness to share assets increases upon acquiring majority. Direct imports of machinery and equipment increase from an average of

2.7 million per year (3.5 m for technologically dependant industries) to 7.9 million per year (10.7 m for dependant affiliates), an increase of 5.2 millions (7.2 m), statistically different from zero at the 5-percent level. OLS and Tobit estimates yield similar results.

*IV.D. Are MNCs selecting "winners"?*

The results thus far presented could be explained by superior information of multinational corporations. If MNCs knew which plants were likely to become increasingly productive, and they were likely to acquire these plants then focusing on plants that switch ownership should yield by construction to an improvement in TFP.

To test for this possibility I limit the sample to those plants for which I have production information for at least two-years before FDI regulations were softened in 1989 and compare their performance to post 1993-performance, given that the new FDI was approved in 1993.[19] If plants that in 1988 were minority owned by their multinationals on average improve performance regardless of acquisitions, then productivity gains are likely to be caused by their sub-optimal arrangements derived from the restrictive FDI law. Column I in Table X shows that this is the case. On average, plants that had minority ownership in 1998 produce 3.1 percent more output per unit of inputs than their peers after FDI controls are eliminated, an increase that is statistically significant at the one-percent level.

Given that the elimination of foreign ownership constraints coincides with NAFTA, it is again important to compare the estimated productivity gain of former minorities to the average change in TFP of plants that were wholly owned by MNCs throughout the sample period. Column II in Table X suggests that productivity gains after 1993 are not uniform across plants affiliated to foreign parents, but are significantly higher for those plants that prior to 1988 were minority owned by multinationals. Finally, Column III compares changes in TFP to average

[19] Re-estimating (1) for each year and industry for the reduced sample of plants that have data for the entire period (balanced panel) does not affect results.

changes in performance of plants that were owned by Mexican nationals throughout, before and after restrictions were eliminated. I find no similar gains in TFP for this alternative control group.

## *V. Conclusions*

In this paper I study the impact of acquiring majority ownership on the performance of Mexican affiliates of multinational corporations (MNCs.) I use the elimination in majority ownership restrictions on foreign direct investment as a plausible source of exogenous variation.

I show that foreign direct investment restrictions harmed production efficiency of affiliates of multinational corporations. Upon liberalization, a large fraction of minority owned affiliates became majority or wholly owned by their parent companies. Plants where foreign ownership translated into a majority or full ownership experienced economically and statistically large productivity gains. These gains were concentrated in technology intensive industries.

The results suggest that government policies directed to attract technological transfers should recognize the importance of residual control rights, particularly in countries with poor shareholder protection and weak legal enforcement. Governments often limit foreign direct investment to promote local interests or to prevent expropriation by multinationals. While domestic majority rules do shift the balance in favor of local partners, the impact on overall welfare is uncertain. Fear from expropriation by local partners deters foreign investors from sharing their technologies or making country specific investments, which does hurt economic performance.

Overall, I interpret the evidence as supportive of the property rights theory of the firm as developed by Grossman and Hart (1986). The evidence herein presented can potentially explain why eight out of ten affiliates of US multinational corporations are wholly owned by their parent companies. Yet, whether these findings can be extrapolated to other countries that do not share the Mexican institutional and economic environment is an open research question.

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# Table I

## Foreign Direct Investment (FDI) Inflows to Mexico

This table presents FDI (net) inflows to Mexico from 1970 to 2001, and acquisition of Mexican firms by foreign investors since 1985. Column I presents net FDI flows in US millions. Column II shows net FDI flows relative to GDP (in percent). Column III presents net FDI flows relative to gross capital formation (in percent). Column IV displays the number of cases where foreign investors acquired at least 50 percent of shareholdings after the transaction was completed. Data: Columns (I-III) *World Development Indicators* online, and Column (IV) *SDC Platinum*.

| Year | FDI USD M | FDI % GDP | FDI % Gross Capital Formation | Foreign Acquisitions of Mexican Targets | Comments (Mexico) |
|---|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) | |
| 1970 | 323 | 0.9 | 4.0 | | |
| 1971 | 307 | 0.8 | 3.9 | | |
| 1972 | 301 | 0.7 | 3.3 | | |
| 1973 | 457 | 0.8 | 3.9 | | |
| 1974 | 678 | 0.9 | 4.1 | | |
| 1975 | 609 | 0.7 | 2.9 | | |
| 1976 | 628 | 0.7 | 3.2 | | |
| 1977 | 556 | 0.7 | 3.0 | | |
| 1978 | 824 | 0.8 | 3.4 | | |
| 1979 | 1,332 | 1.0 | 3.8 | | |
| 1980 | 2,090 | 1.1 | 4.0 | | |
| 1981 | 3,078 | 1.2 | 4.5 | | |
| 1982 | 1,901 | 1.1 | 4.8 | | |
| 1983 | 2,192 | 1.5 | 7.1 | | Debt crisis |
| 1984 | 1,542 | 0.9 | 4.4 | | |
| 1985 | 1,984 | 1.1 | 5.1 | 1 | |
| 1986 | 2,036 | 1.6 | 8.5 | 2 | Joins GATT |
| 1987 | 1,184 | 0.8 | 4.4 | 1 | |
| 1988 | 2,011 | 1.1 | 4.9 | 4 | |
| 1989 | 2,785 | 1.2 | 5.4 | 6 | Softened FDI restrictions |
| 1990 | 2,549 | 1.0 | 4.2 | 10 | |
| 1991 | 4,742 | 1.5 | 6.5 | 16 | |
| 1992 | 4,393 | 1.2 | 5.2 | 20 | |
| 1993 | 4,389 | 1.1 | 5.2 | 24 | New FDI Law |
| 1994 | 10,973 | 2.6 | 12.0 | 31 | NAFTA effective |
| 1995 | 9,526 | 3.3 | 16.8 | 39 | |
| 1996 | 9,186 | 2.8 | 12.0 | 36 | |
| 1997 | 12,831 | 3.2 | 12.4 | 44 | |
| 1998 | 11,897 | 2.8 | 11.6 | 50 | |
| 1999 | 12,478 | 2.6 | 11.1 | 35 | |
| 2000 | 14,192 | 2.4 | 10.4 | 64 | |
| 2001 | 24,731 | 4.0 | 19.3 | 56 | |

# Table II

## Ownership Characteristics of Manufacturing Plants in Mexico

This Table presents the number of manufacturing plants in the Mexican Annual Industrial Survey (MAIS) for which foreign ownership data was available. Plants are classified into four groups: (I) locally owned, if they are fully owned by Mexican nationals, (II) minority interest, if foreign direct investment (FDI) is less than 50 percent, (III) majority, if FDI is 50 percent or more but less than 100 percent and (IV) wholly-owned, if FDI is equal to 100 percent.

| Year | Total | Locally Owned | Foreign Direct Investment (FDI) | | | Output Weighted by FDI |
|---|---|---|---|---|---|---|
| | | | Minority Interest | Majority Interest | Wholly Owned | |
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| 1988 | 1,881 | 1,492 | 153 | 30 | 206 | 0.318 |
| 1989 | 1,886 | 1,496 | 151 | 29 | 210 | 0.338 |
| 1990 | 1,886 | 1,483 | 155 | 31 | 217 | 0.359 |
| 1991 | 1,886 | 1,483 | 151 | 32 | 220 | 0.366 |
| 1992 | 1,891 | 1,478 | 150 | 36 | 227 | 0.385 |
| 1993 | 5,219 | 4,338 | 338 | 95 | 448 | 0.344 |
| 1994 | 5,227 | 4,318 | 332 | 100 | 477 | 0.360 |
| 1995 | 5,206 | 4,289 | 300 | 92 | 525 | 0.368 |
| 1996 | 5,185 | 4,257 | 265 | 90 | 573 | 0.385 |
| 1997 | 5,173 | 4,230 | 248 | 78 | 617 | 0.416 |
| 1998 | 5,170 | 4,206 | 244 | 79 | 641 | 0.436 |
| 1999 | 5,103 | 4,145 | 244 | 75 | 639 | 0.450 |
| 2000 | 4,975 | 4,035 | 238 | 75 | 627 | 0.468 |
| 2001 | 4,755 | 3,841 | 229 | 74 | 611 | 0.476 |
| 1988 | 1,881 | 1,492 | 153 | 30 | 206 | |
| | 1.000 | 0.793 | 0.081 | 0.016 | 0.110 | |
| 2001 | 4,755 | 3,841 | 229 | 74 | 611 | |
| | 1.000 | 0.808 | 0.048 | 0.016 | 0.128 | |

# Table III

## Ownership Patterns by Two-Digit Industry Level

This Table presents data by two-digit industry codes for manufacturing plants with export data since 1993.

| Code | Industry Definition | Average Exports/ Output | Average FDI | Total Plants-Years |
|---|---|---|---|---|
| 31 | Meat, dairy products, grain mill products, other food products, beverages, soft drinks and tobacco. | 0.088 | 0.107 | 8,113 |
| 32 | Textiles, mill products, apparel, leather, footwear | 0.092 | 0.034 | 6,894 |
| 33 | Lumber and furniture | 0.106 | 0.024 | 1,599 |
| 34 | Paper and printing | 0.023 | 0.121 | 3,409 |
| 35 | Artificial or synthetic fibers, manufacturing of other chemical products, coal products, rubber and plastic | 0.087 | 0.245 | 8,882 |
| 36 | Clay, glass, concrete, gypsum and plaster products | 0.093 | 0.090 | 3,066 |
| 37 | Primary iron and steel industries, primary non-ferrous metals | 0.138 | 0.098 | 1,030 |
| 38 | Structural metal products, industrial machinery and equipment, electronic and electrical equipment, vehicles and transportation equipment, measuring and analyzing instruments | 0.157 | 0.230 | 9,776 |
| 39 | Other manufacturing industries | 0.141 | 0.149 | 480 |
| | All industries | 0.102 | 0.148 | 43,249 |

# Table IV

## Mexican Industrial Survey: Summary Statistics

This Table presents data for Mexican manufacturing plants for which plant level production information from the Mexican Annual Industrial Survey (MAIS) and foreign ownership data is available between 1988-2001 as described in the text. The value of production and capital stock are in thousands of Mexican pesos of 2001, the ratio of the value of production to hours is in 2001 pesos. The average exchange rate (pesos per dollar) during 2001 was 9.3. Plants are classified into three groups: plants with no FDI (Column I), plants with FDI which were not subject to a control change (Column II), and plants where foreign investors acquired a majority interest during the sample period (Column III). Clustered (plant) standard errors are in parentheses

| | **All Plants** | **No FDI investment** | **Recipients of FDI, not subject to a change in control** | **Acquired by Foreign Investors (MNC)** | **Differences of Means** | |
|---|---|---|---|---|---|---|
| | | (I) | (II) | (III) | (III)-(I) | (III)-(III) |
| Number of plants | 5,266 | 4,226 | 818 | 222 | | |
| Total value of production | 291,485<br>*(16,622)* | 171,911<br>*(7,330)* | 778,135<br>*(90,219)* | 601,511<br>*(69,247)* | 429,600$^{***}$<br>*(69,486)* | -176,623<br>*(113,650)* |
| Number of employees | 279.1<br>*(7.56)* | 223.6<br>*(5.95)* | 487.8<br>*(33.2)* | 482.3<br>*(34.9)* | 258.7 $^{***}$<br>*(35.4)* | -5.4<br>*(48.1)* |
| Capital stock | 71,804<br>*(4,175)* | 43,245<br>*(2,166)* | 185,296<br>*(22,021)* | 155,433<br>*(18,030)* | 112,189$^{***}$<br>*(18,122)* | -29,863<br>*(28,440)* |
| Total value of production/ Total hours worked | 382.3<br>*(10.6)* | 312.8<br>*(10.4)* | 659.0<br>*(37.4)* | 585.1<br>*(37.1)* | 272.3 $^{***}$<br>*(38.4)* | -73.9<br>*(52.6)* |
| Payments for tech. transfers / Total expenses (%) | 0.70<br>*(0.02)* | 0.39<br>*(0.01)* | 1.98<br>*(0.12)* | 1.45<br>*(0.17)* | 1.06 $^{***}$<br>*(0.18)* | - 0.53 $^{**}$<br>*(0.215)* |
| Number of observations | 55,317 | 43,650 | 9,072 | 2,595 | | |

$^{*}$ Statistically different from zero at the 10-percent level, $^{**}$ at the 5-percent level, $^{***}$at the 1-percent level.

# Table V

## The Impact of Foreign Direct Investment on Output and Plant Productivity

The dependent variables are: plant output (Columns I-III) and total factor productivity (TFP) at the two-digit industry level (Columns IV-VI). TFP is the residual from estimating a log linear Cobb-Douglas production function for each two-digit industry and year, regressing plant output (value of goods produced) on labor hours, capital stock (using the perpetual inventory method) and materials (inputs and energy used). Plant output is the natural log of output as defined above. Foreign ownership is the fraction of ownership owned by foreign investors. Foreign owner acquires majority in a plant *Acquisition is the interaction of a dummy that takes the value of one if foreign investors acquire at least 50 percent of the shareholdings in a plant and a post-acquisition period dummy. Standard errors are in parentheses

| | **Impact of FDI on Output** | | | **Impact of FDI on TFP** | | |
|---|---|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) | (V) | (VI) |
| Foreign ownership in the plant (fraction or total) | 1.6364 *** *(0.0608)* | 0.3080 *** *(0.0228)* | 0.1526 *** *(0.0314)* | 0.1477 *** *(0.0117)* | 0.0410 *** *(0.0130)* | - 0.0035 *(0.0180)* |
| Foreign owner acquires majority * Post-Acquisition | | | 0.1958 *** *(0.0273)* | | | 0.0561 *** *(0.0157)* |
| Constant | 10.885 *** *(0.0237)* | 11.080 *** *(0.0041)* | 11.098 *** *(0.0047)* | - 0.0216*** *(0.0041)* | - 0.0060*** *(0.0022)* | - 0.0008 *(0.0027)* |
| Plant fixed-effects | No | Yes | Yes | No | Yes | Yes |
| *Adjusted* $R^2$ | 0.1057 | 0.9201 | 0.9202 | 0.0165 | 0.4972 | 0.64973 |
| Number of plants | 5,266 | 5,266 | 5,266 | 5,266 | 5,266 | 5,266 |
| Number of observations | 55,317 | 55,317 | 55,317 | 55,317 | 55,317 | 55,317 |

** Statistically different from zero at the 5-percent level, ***at the 1-percent level.

# Table VI

## Foreign Acquisitions of Mexican Manufacturing Plants

A plant is "acquired" when a foreign multinational corporation controls at least 50 percent of shareholdings after the transaction is completed. Acquisitions are classified into two groups. *MNC Minority Interest*: when multinationals had a pre-existing minority stake in the plant during the period of restrictions to foreign majority ownership, and otherwise *No Pre-Acquisition Investment*. Plants with pre-existing MNC investments were sorted into three groups based on MNC pre-acquisition ownership. All acquisitions are sorted into two groups based on post-acquisition ownership.

| | **Number of Acquisitions** | **MNC Minority Interest before Acquisition** | | | | |
|---|---|---|---|---|---|---|
| | | **No** | **Yes** | **Ownership Pre-Acquisition** | | |
| | | | | < 20% | 25-40 | 40-49.99 |
| | 222 | 101 | 121 | 9 | 19 | **93** |
| **MNC Post-Acquisition Ownership** | | | | | | |
| 50-95 | 47 | 23 | 24 | 3 | 4 | 17 |
| 95-100 | **175** | 78 | **97** | 6 | 15 | **76** |

# Table VII

# The Impact on Productivity of Acquiring "Control"

A plant is "acquired" when ownership by a foreign multinational corporation reaches at least 50 percent. In Panel (A) acquisitions are classified into two groups: *MNC Minority Interest*: when MNCs had a minority ownership interest in the plant during the period of restrictions to foreign ownership, and *No Pre-Acquisition Investment*, otherwise. In Panel (B) acquisitions with pre-existing foreign minority investment are sorted by two measures of the relative dependence of the affiliate on the parent. "Large" imports of machinery and equipment are acquisitions of plants in two-digit industries where imports of machinery and equipment relative to industry investment are above the average of the manufacturing sector, otherwise, "Small." "Large" payments associated with technology transfers are acquisitions of plants in two-digit industries where technology transfer payments relative to industry total costs are above the average of the manufacturing sector, otherwise, "Small." The dependent variable is total factor productivity (TFP) at the two-digit industry level as defined in Table V. Panel (C) calculates "excess" TFP as the difference between TFP in a plant minus average TFP of wholly owned subsidiaries of MNC in the same industry and year. Wholly owned subsidiaries were organizations that preceded the restrictive 1973 FDI Law, which was not retroactive. Clustered (plant) standard errors are in parentheses, and the number of plants is in brackets.

| **Dependant variable: TFP** | **Before Acquisition** Two-year average (I) | **After Acquisition** Two-year average (II) | **Difference** (II) - (I) |
|---|---|---|---|
| ***A. All Acquisitions*** | 0.0133<br>*(0.0160)*<br>[222] | 0.0854<br>*(0.0174)*<br>[222] | 0.0721 ***<br>*(0.0149)* |
| No Pre-Acquisition MNC Investment | - 0.0022<br>*(0.0226)*<br>[101] | 0.0675<br>*(0.0261)*<br>[101] | 0.0698 ***<br>*(0.0207)* |
| **MNC Minority Interest before Acquisition** | **0.0263**<br>***(0.0224)***<br>**[121]** | **0.1003**<br>***(0.0234)***<br>**[121]** | **0.0740** ***<br>***(0.0214)*** |
| ***B. Acquisitions where MNC had a Minority Interest before the Transaction*** | | | |
| **"Large" Imports of Machinery and Equipment** | **- 0.0019**<br>***(0.0252)***<br>**[86]** | **0.1018**<br>***(0.0265)***<br>**[86]** | **0.1038** ***<br>***(0.0236)*** |
| "Small" Imports of Machinery and Equipment | 0.0955<br>*(0.0448)*<br>[35] | 0.0965<br>*(0.0485)*<br>[36] | 0.0010<br>*(0.0236)* |
| **"Large" Payments associated with Technology Transfers** | **- 0.0002**<br>***(0.0248)***<br>**[79]** | **0.1098**<br>***(0.0250)***<br>**[79]** | **0.1099** ***<br>***(0.0242)*** |
| "Small" Payments associated with Technology Transfers | 0.0760<br>*(0.0440)*<br>[42] | 0.0824<br>*(0.0488)*<br>[42] | 0.0064<br>*(0.0400)* |
| ***C. Performance relative to average of wholly owned affiliates in the same industry*** | | | |
| **"Large" Imports of Machinery and Equipment group** | **- 0.0939**<br>***(0.0261)***<br>**[86]** | **0.0084**<br>***(0.0272)***<br>**[86]** | **0.1024** ***<br>***(0.0246)*** |
| **"Large" Technology Transfers group** | **- 0.0845**<br>***(0.0262)***<br>**[79]** | **0.0170**<br>***(0.0258)***<br>**[79]** | **0.1015** ***<br>***(0.0249)*** |

** Statistically different from zero at the 5-percent level, ***at the 1-percent level.

# Table VIII

## The Impact on Productivity of Acquiring "Control" of *your* Foreign Affiliate: Plants where MNC had Minority Equity Shareholdings during the period of Restrictions to Foreign Majority Ownership

The dependent variable is total factor productivity (TFP) at the two-digit industry level as defined in Table IV. All plants reported had MNC minority interest during the period of restrictions to foreign majority ownership and were acquired by their parent companies as restrictions were eliminated. Post-Acquisition is a categorical variable equal to one in the post-acquisition period. "Large" imports of machinery and equipment is a dummy equal to one if the acquisition corresponded to a plant in a two-digit industry where imports of machinery and equipment relative to industry investment were above the average of the manufacturing sector. "Large" payments associated with technology transfers is a dummy that takes the value of one in industries where where technology transfer payments relative to industry total costs were above the average of the manufacturing sector. All columns present information for up-to five years around acquisitions (excluding year *t)*, except for Column II which uses information excluding *t-2,t-1,t, t+1, t+2*. Column III splits plants by pre-acquisition size groupings, where Size_1 includes plants of the lowest size grouping (41 plants), Size_2 (omitted, 40 plants), and Size_3 (40 plants) of medium and largest sized, respectively. Constant is not reported. Standard errors are in parentheses.

| | (I) | (II) | (III) | (IV) | (V) |
|---|---|---|---|---|---|
| Post-acquisition | **0.0591** *** ***(0.0126)*** | **0.0476** ** ***0.0206)*** | **0.0513** ** ***(0.0219)*** | 0.0173 *(0.0214)* | 0.0131 *(0.0237)* |
| Post-acquisition * Size_1 | | | - 0.0008 *(0.0312)* | | |
| Post-acquisition * Size_3 | | | 0.0235 *(0.0301)* | | |
| Post-acquisition * "Large" imports of machinery and equipment | | | | **0.0640** ** ***(0.0265)*** | |
| Post-acquisition* "Large" payments associated with technology transfers | | | | | **0.0649** ** ***(0.0228)*** |
| Plant fixed-effects | Yes | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 0.6030 | 0.6542 | 0.5500 | 0.5529 | 0.5527 |
| Number of plants | 121 | 121 | 121 | 121 | 121 |
| Number of observations | 1,039 | 555 | 1,039 | 1,039 | 1,309 |

* Statistically different from zero at the 10-percent level, ** at 5-percent level, ***at the 1-percent level.

# Table IX

## Plant Investment and Imports of Machinery and Equipment

The dependent variables are (A) average annual plant investment, and (B) average direct imports of machinery and equipment by the plant, in millions, constant pesos of 2001. The number of plants in Panel (B) falls since direct imports of machinery and equipment before acquisition is only available for transactions that occur post 1994. The average exchange rate (pesos per dollar) during 2001 was 9.3. In all plants, a MNC had a minority equity stake in the plant during the period of restrictions to foreign majority ownership, and obtained majority ownership after these restrictions were eliminated. These plants are classified into two groups: "Large" imports of machinery and equipment is a dummy equal to one if the acquisition corresponded to a plant in a two-digit industry where imports of machinery and equipment relative to industry investment were above the average of the manufacturing sector, otherwise "Small." Clustered (plant) standard errors are in parentheses, except for Column IV. The number of plants is in brackets.

| | **Before Acquisition** | **After Acquisition** | **Difference OLS** | **Difference Tobit** |
|---|---|---|---|---|
| | | | (II) - (I) | (II) - (I) |
| | (I) | (II) | (II) | (IV) |
| ***A. Total Investment*** | | | | |
| All acquisitions where MNC had a Minority Interest before the Transaction | 14,674<br>*(2,962)*<br>[121] | 31,019<br>*(6,395)*<br>[121] | 16,345 ***<br>*(4,351)* | 19,221 **<br>*(7,587)* |
| "Large" Imports of Machinery and Equipment | 15,588<br>*(3,751)*<br>[86] | 34,633<br>*(8,334)*<br>[86] | 19,045 ***<br>*(5,194)* | 23,639 **<br>*(9,705)* |
| "Small" Imports of Machinery and Equipment | 12,428<br>*(4,521)*<br>[35] | 22,139<br>*(8,314)*<br>[35] | 9,911<br>*(8,031)* | 9,220<br>*(10,411)* |
| ***B. Direct Imports of Machinery and Equipment*** | | | | |
| All acquisitions where MNC had a Minority Interest before the Transaction | 2,683<br>*(859)*<br>[99] | 7,910<br>*(2,828)*<br>[99] | 5,227 **<br>*(2.184)* | 13,581 ***<br>*(4.813)* |
| "Large" Imports of Machinery and Equipment | 3,454<br>*(1.226)*<br>[67] | 10.653<br>*(4,162)*<br>[67] | 7,199 **<br>*(3,190)* | 15,376 **<br>*(6,720)* |
| "Small" Imports of Machinery and Equipment | 1,069<br>*(631)*<br>[32] | 2,166<br>*(862)*<br>[32] | 1,097<br>*(778)* | 3,596 *<br>*(1.976)* |

** Statistically different from zero at the 5-percent level, ***at the 1-percent level.

# Table X

## Changes in Productivity by Pre-Liberalization Ownership Characteristics

This table splits manufacturing plants with production data for the full sample period into three groups: (1) plants with minority foreign ownership before the restrictions to FDI were eased in 1989 and eventually lifted in 1993, (2) plants with 50 percent or more foreign ownership and (3) plants with 100 percent Mexican ownership. The dependent variable is total factor productivity (TFP) at the two-digit industry level as defined in Table V. *After* in an indicator variable equal to one after 1993, zero otherwise. Column (I) reports estimates for plants in group (1) only, Column (II) reports estimates for plants in groups (1) and (2) only and Column (III) for plants in groups (1) and (3) only. Constant is not reported. Standard errors are in parentheses.

| | (I) | (II) | (III) |
|---|---|---|---|
| *After*-liberalization | **0.0312** *** <br> ***(0.0108)*** | - 0.0104 <br> *(0.0097)* | - 0.0021 <br> *(0.0038)* |
| *After*-liberalization * *Minority* pre-liberalization | | **0.0415** *** <br> ***(0.0145)*** | **0.0332** *** <br> ***(0.0119)*** |
| Post-acquisition* "Large" payments associated with technology transfers | | | |
| Plant fixed-effects | Yes | Yes | Yes |
| Adjusted $R^2$ | 0.5811 | 0.5193 | 0.4034 |
| Number of plants | 146 | 331 | 1,417 |
| Number of observations | 1,752 | 3,972 | 17,004 |

* Statistically different from zero at the 10-percent level, ** at 5-percent level, ***at the 1-percent level.