

The Impact of Acquiring *Control* on Productivity*

Francisco Pérez-González

Columbia University

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Empirical studies on the importance of control rights on efficiency are hindered by actual –presumably efficient– ownership patterns. Finding settings where the *right* owner does not own the *right* asset and where ownership *arbitrarily* changes is challenging. In this paper I aim at overcoming these problems by investigating the elimination of foreign majority ownership restrictions in Mexico. Specifically, I study the performance of affiliates of multinational corporations for which (1) ownership restrictions appeared to bind before they were lifted, and (2) parent ownership increased from minority to majority as the reform was implemented. Using detailed plant-level information, I find that multinational control leads to large improvements in total factor productivity, particularly in industries that rely on technological innovations from their parent companies. Control is also associated with higher investment –particularly in technology intensive forms of production–, and with an improvement in the skill profile of the labor force. Overall, 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, Glenn Hubbard, Tom Hubbard, Josh Lerner, Max Maksimovic, Miguel Messmacher, David T. Robinson, Luigi Zingales and seminar participants at the AFA meetings, Columbia, Duke, HBS, Harvard-MIT Organizational workshop, LACEA, London Business School, NBER Corporate Finance, Northwestern and the University of Pennsylvania (Wharton) for comments. I am grateful to the Chazen Institute and the Center for International Business Education for funding, and to Abigail Duran and 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 companies¹”

Building on the work of Coase (1937), Williamson (1975, 1979, 1985) and Klein, Crawford and Alchain (1978), Grossman and Hart (1986) and Hart and Moore (1990) (hereafter GHM) show that the patterns of asset ownership are important for efficiency 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 this privilege affects surplus sharing and investment decisions.

While the seminal work of GHM has made a profound impact on the profession, there is little empirical work examining the importance of their insights on firm performance. Previous studies have shown the importance of specific investments in explaining *organizational form* (Monteverde and Teece (1982), Joskow (1987), Baker and Hubbard (2003)), but not the importance of organizational form on *productivity*.²

The main obstacle in testing for the ideas of GHM is the difficulty of isolating an environment in which specific investments are important, contracts are incomplete, and where ownership structures and thus investment incentives *arbitrarily* change.

This paper aims 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. This setting is attractive for the following reasons:

First, Mexico recently modified its foreign ownership rules. Between 1973 and until the late 1980s Mexican regulations prohibited the entry of foreign majority-owned firms, and these

¹ *Wall Street Journal* (WSJ) 2/16/82 on foreign firms in Mexico.

² Mullainathan and Scharfstein (2001) examine the impact of organizational form on firms’ investment decisions.

restrictions were recently eliminated.³ Ownership constraints required that, in order to launch an affiliate, multinationals had to find a Mexican partner and sell a majority interest to them.

Second, majority and full ownership by multinationals is pervasive around the world. In 1994, 89 percent of foreign affiliates of American MNCs were majority-owned by their parent companies (Mataloni and Fahim-Nadar (1996)). Ownership restrictions potentially forced a number of foreign affiliates into sub-optimal ownership arrangements, particularly in technology-intensive sectors.⁴ Previous studies (Gatignon and Anderson (1988) and Gomes-Casseres (1989)) have shown that wholly-owned status is more likely in the presence of proprietary assets and less common in labor-intensive industries (Moran (2001)). Furthermore, recent models of international trade (Antràs (2003) and Antràs and Helpman, (2004)) rationalize these ownership patterns using the GHM framework to explain the composition of intra-firm volumes of trade. I use these previously identified ownership patterns from extant studies to guide the empirical work in this paper onto identifying industries where restrictions were more likely to be costly.⁵

Third, once plants were operating, Mexican majority partners were in an ideal position to expropriate parent companies. Mexico's poor minority-shareholder protection and weak law enforcement (La Porta, López de Silanes, Shleifer and Vishny (1998)) suggest that expropriation costs faced by minority investors were potentially large. The resulting lack of incentives to enhance performance in minority ventures is consistent with previous studies that have shown 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 ventures. As restrictions were lifted

³ The restrictive law was introduced in 1973. Foreign ownership constraints were reduced in 1989 and a new law designed to promote foreign investment was approved in 1993.

⁴ Ownership restrictions by themselves should not necessarily affect firm performance (Coase (1960)). Foreign owners could obtain *de facto* control through, for example, management service contracts.

⁵ For some firms these costs might have prevented entry into joint arrangements altogether. IBM's decision not to build a manufacturing facility in Mexico unless it was granted 100 percent ownership, and their entry once IBM's wholly-owned status was approved, illustrates this point.

and MNCs acquired control of their affiliates, their incentives to exert effort, monitor operations, transfer technology, and in consequence improve plant performance, increased.

Fourth, the restrictive foreign ownership laws prevalent during the 1970s and 1980s were not retroactive, which left pre-existing majority-owned investments by foreign firms unaffected. Thus the empirical work of this paper can compare the performance of affiliates that experience a change in control to (i) themselves before such transitions, (ii) to locally owned firms, and (iii) more importantly, to affiliates of multinational corporations that entered the local market before the restrictive law was implemented. These counterfactuals allow me to control for concurrent structural reforms experienced in Mexico during the sample period, such as macroeconomic stabilization, the introduction of the North American Free Trade Agreement (López-Córdova (2003)), or the large currency depreciation of 1994-1995 that might have affected firms with foreign ownership in a differential way (Desai, Foley and Forbes (2004)).

The empirical setting is, however, imperfect for testing the models of GHM as (1) managers of multinational firms are not the owners of the relevant assets (Bolton and Scharfstein (1998)), (2) I cannot identify the exact nature of key non-contractible investments per project (Whinston (2001)), and (3) I do not observe changes in alternative incentive structures that might affect managers decisions (Holmstrom and Milgrom (1991, 1994), Holmstrom and Roberts (1998), Holmstrom (1999)). In consequence, I will not seek to literally test for GHM, but instead to investigate if the key insight of the property rights theory of the firm related to *ownership changes* and its link to obtaining *control* (herein MNCs obtaining majority ownership) does affect *investment incentives* and *efficiency* using a “natural experiment approach” (Whinston (2001)).

I start by documenting the impact of foreign ownership on the performance of a large panel of Mexican manufacturing plants using total factor productivity (TFP) as measure of plant performance. The data is from the Mexican Annual Industrial Survey at the Mexican Institute of Statistics, Geography and Informatics, which covers manufacturing establishments with 100 or more employees and at least 80 percent of the value-added in the manufacturing sector in Mexico

for the 1984 to 2001 period. I examine plant TFP relative to the average productivity in a given two-digit industry and year. As described above, looking at relative ranks within an industry instead of productivity levels is particularly pertinent in Mexico.

Consistent with previous studies (Aitken and Harrison (1999)), I find that foreign ownership is positively correlated with plant productivity. Yet, contrary to pure cash-flow incentive arguments (Jensen and Meckling (1976)), productivity gains are not increasing in foreign ownership if multinationals' ownership does not translate into majority control. I further examine the importance of acquiring control and show that in Mexico, productivity gains derived from foreign ownership are concentrated in plants where MNCs acquire majority to full ownership interests.⁶

Transactions where the ownership of multinationals crossed beyond 50 percent were classified into two groups: those already associated to MNCs through minority arrangements during the period of restrictions to foreign majority ownership, and unrelated acquisitions. The bulk of the empirical work focuses on the former group since productivity gains of plants with no pre-existing multinational shareholdings may reflect initial access to proprietary assets, economies of scale, etc. (Caves (1996)) that distinguishes MNCs but not the importance of residual control rights. The evidence, however, does indicate that plants with initial access to multinationals do improve their performance.

Ownership patterns for plants in which MNCs shift from minority to majority shareholdings suggest that parent companies were effectively constrained by the 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. Moving to full parent ownership might be indicative of significant expropriation costs. In lieu of poor minority

⁶ Aitken and Harrison (1999) do not analyze the importance of ownership concentration on productivity nor use changes in regulations as part of their empirical strategy.

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 increased from minority to majority experienced economically large and statistically significant gains in productivity. Relative to their industry peers, TFP increased by 7.2 percentage points around these ownership changes. The estimates suggest that under multinational control, these plants produced 8.5 percent more output per unit of inputs than competitors. To examine whether these findings reflect MNCs' increased incentives to invest, I further divide acquisitions by pre-existing industry characteristics to capture affiliates' dependency on the parent. According to GHM, the associated efficiency gains from having the *right* owner are a function of the relative importance of investment decisions of alternative owners. I use two categorical variables to proxy for dependency on the parent, based on whether a plant belongs to an industry with above-average: (1) imports of machinery and equipment to total investment, and alternatively (2) technology transfer payments to total expenses, both at the two-digit industry level.⁷

My main findings are four:

First, minority ventures that are acquired by parent companies are typically in technology-intensive sectors. This is consistent with pre-existing work that argued for gains from integration are associated to firms' asset specificity (Williamson (1975, 1979, 1985), Klein, Crawford and Alchain (1978), Grossman and Hart (1986), Monteverde and Teece (1982), Joskow (1987), Gatignon and Anderson (1988) and Gomes-Casseres (1989), among others).

Second, 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 throughout the sample period (affiliates that pre-existed the 1973 foreign ownership restrictions).

⁷ Industry-wide indicator variables are used in order to prevent sorting by plant-level variables that might be correlated to changes in performance.

Third, after control changes technology intensive plants significantly improved their performance both in comparison 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, formerly minority-owned plants produced 10 percent more output per unit of inputs than other plants. Moreover, under-performance relative to pre-existing wholly-owned affiliates quickly disappears. These findings are summarized in Figure 1.

Fourth, upon acquisitions, plants observe a significant increase in total investments, in investments in imported machinery and equipment, in the use of automatic and computerized equipment, as well as a significant improvement in the skill profile of the production-worker pool, which is consistent with higher involvement by parent companies and with increased specific investments.

The above-described results could be argued to be alternatively explained by a selection story where multinationals only acquire those plants with superior ex-ante expected performance, which would occur if, for example, MNCs had an informational advantage.⁸ Yet a competing selection hypothesis should account for the above described findings. First, gains in productivity are not observed across the board but in sectors where the role of multinationals was expected to be important ex-ante. Second, productivity gains occur only where foreign ownership crosses the 50 percent ownership threshold but not when ownership increases without translating into majority control. Third and potentially most importantly, productivity gains by former forced minorities exceeded those of affiliates of other multinational corporations with pre-existing majority ownership in the same industry.

⁸ Previous work has not found robust support to the idea that foreign acquirers are associated to productivity gains (Rajan, Volpin and Zingales (2000)). Yet, evidence from the U.S. market for corporate assets does suggest that asset sales tend to improve productivity when acquirers are more productive than their targets (Maksimovic and Phillips (2001)).

I address whether the estimated improvements in TFP could be explained by selection by examining the average productivity of minority plants *regardless* of acquisitions decisions. Without selection, pre-reform minority owned plants as a group, should not over-perform other firms. Yet, plants with minority foreign ownership during the period of restrictions, do show a subsequent improvement in productivity after restrictions are eliminated, which is not observed in plants with local or 100 percent multinational ownership throughout.

While alternative hypotheses, such as, superior governance by multinational corporations, initial access to proprietary assets, economies of scale, among others, could potentially explain why productivity is enhanced as plants first become associated with MNCs, these explanations alone cannot explain why acquiring control relative to holding a minority interest with a contract should affect performance.

The overall results of this paper are consistent with the transaction costs literature, and in particular, with the property rights theory of the firm. The finding that not only integration matters for the allocation of resources, but integration around a specific owner who contributes key specific resources and whose investments do increase once control is obtained, suggests that investment incentives as highlighted by GHM might be crucial for performance.⁹

In sum, and using the terminology of Coase (1937), the paper shows that “it pays” to bring inside a multinational firm those transactions that are intensive in the multinationals’ proprietary assets. The rest of the paper is organized as follows. Section I describes changes in the regulatory regime for foreign ownership in Mexico and aggregate trends in foreign direct investment (FDI). Section II describes the data. Section III the methods of analysis and the empirical predictions. Section IV describes the results, and Section V concludes.

⁹ Note that integration around Mexican owners was never prohibited by law.

I. Foreign Ownership and Investment in Mexico: Regulation and Aggregate Trends

Mexico has had a love-hate relationship with foreign ownership and investment.¹⁰ During the late 19th century, foreign investment 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” industries were to reside in the hands of the Mexican government or Mexican nationals. As a consequence, railroad, and more significantly petroleum companies with foreign participation 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 discretion to the government to require 51 percent Mexican ownership in any existing company operating in Mexico. In 1959, electric companies with foreign ownership were nationalized. Furthermore, during the 1950s and 1960s, 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 prohibited foreign investment in certain sectors of the economy that were restricted to Mexicans, and restricted foreign participation to 49 percent of total capital in new firms. The law left room for discretion by stating that exceptions to foreign ownership restrictions 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.¹¹” Conversely, the Law of 1973 did not affect existing firms operating in Mexico that were majority-controlled or wholly-owned by foreign nationals.

¹⁰ A recent concise review of FDI regulation in Mexico is presented in Economic Commission for Latin America and the Caribbean (2000).

¹¹ WSJ 2/16/1982. Examples of large corporations whose new 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).

Mexican restrictions on foreign ownership were reexamined in lieu of the severe contraction of economic activity after the debt crisis.¹² 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.¹³ Through it, firms with foreign capital 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 unrestricted foreign ownership.

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 ownership and investment was completed with the approval of the new FDI Law of 1993, which ratified and enhanced the changes of the FDI Act of 1989.¹⁴ Finally, the North American Free Trade Agreement (NAFTA) further reduced restrictions to U.S. and Canadian investors by granting domestic treatment to them in all but a few sectors of the economy.

¹² 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

¹³ 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.

¹⁴ 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>.

Foreign investment reforms, macroeconomic stabilization and the subscription of trade agreements (The General Agreement on Tariffs and Trade (GATT) in 1986 and 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. 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 \$11.6 billion, reaching \$24.7 billion in 2001.

Given that the focus of this paper is on acquisitions of Mexican plants, if the above-described restrictions were effective, there should be little or no purchase of domestic firms by foreign companies before 1989, and these transactions should increase after the approval of the new Investment Law of 1993 and of NAFTA. Column IV of Table I shows that this is the case. Based on publicly available data, SDC Platinum recorded only eight acquisitions involving a control exchange between a foreign bidder and a Mexican target between 1985 and 1988 or an average of two per year.¹⁵ 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 suggest an increased role of foreign investment 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.

¹⁵ These numbers are calculated based on transactions where foreign investors end up owning at least 50 of targets after transaction are completed. Transactions in which no ownership was reported are excluded.

II. Data

The data in this study are 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 as the file that I had access to was a balanced panel for the 1984 to 1993 period. Second, the MAIS has two waves, the 1984-1993 and 1993-2001 surveys, making it an unbalanced panel.¹⁶ Third, inclusion into the sample after 1993 was rarely done, but there was significant exit out of the sample.

The main advantages of the MAIS survey are three. First, it is mandatory 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 because ownership information is not part of the regular MAIS survey. Ownership data were constructed 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 1998, (2) the foreign ownership database at the Central

¹⁶ 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.

Bank of Mexico, which is a census of firms with foreign investment 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 likely to be 100 percent owned by locals (the most common ownership arrangement) or alternatively, plants that were acquired by either foreign or local owners. If this latter case were true, I might under-represent the importance of foreign acquisitions in Mexican manufactures.¹⁷ 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 domestically-owned (1,492 plants), 8.1 percent (153 plants) had minority interests by foreign investors, 4.8 percent (30 plants) had majority ownership and 12.8 percent (206 plants) were wholly-owned subsidiaries of MNCs. Interestingly, foreign ownership is very important in the sample. Weighted by sales, foreign ownership accounted for 31.8 percent of output in 1988.

Changes in the composition of foreign ownership between 1993 and 2001 are presented in Table II. While in 1993 38.4 percent of all plants with foreign ownership were minority ventures, by 2001 this share was only 25 percent. Wholly-owned affiliates increased from 51 to 67 percent of all plants with foreign participation. 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 47.6 percent. While the sample in this paper is only a fraction of all plants in the survey, data from INEGI suggests that plants

¹⁷ 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.

included in this analysis accounted for 92.4 percent of all manufacturing employment reported in the Annual Industrial Survey of 2001.

Table III shows industry definitions at the two-digit level for plants with exports and foreign ownership data since 1993 (export data is first reported in 1993). As indicated in previous work (Gatignon and Anderson (1988), Gomes-Casseres (1989), Moran (2001)) average patterns show that foreign ownership 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 foreign ownership are relatively high (on average 23 percent), in other industries like manufacturing code 35 (artificial fibers, chemicals and rubber products) we observe substantial foreign ownership (average 24 percent) with relatively low export activity (8.7 percent.) Conversely, 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 low foreign ownership (2.4 percent and 3.4 percent respectively).

Summary Statistics

Given that the restrictions to foreign ownership were phased out in steps, first with the FDI Act of 1989 and then with the new Law in 1993, I 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.

Table IV splits plants into three categories: plants that throughout the sample period did not had foreign ownership (4,226 plants), plants that had some foreign ownership but were not involved in an acquisition by a MNC during the sample period (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 foreign ownership 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 foreign ownership (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 foreign ownership. Output per hour was on average equal to 312.8 pesos for locally owned plants while for plants with foreign ownership 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 foreign ownership control (typically 100 percent owned) received higher technology transfers than firms that were not majority controlled throughout (Column III) or had no foreign involvement (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 foreign ownership.

III. Methodology and Empirical Predictions

III. A. Methodology

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

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

where i represents plants, j represents industries and t represents time. Plant TFP is the estimated residual from these regressions, and it represents the relative productivity rank of a

given plant in its industry. Given that equation (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, and macroeconomic stabilization) were significant during the sample period.¹⁸

Using data from the MAIS I construct as closely as possible the variables needed to estimate (1).¹⁹ Although Y above is real output, I can only construct nominal output with the data at hand. Output is the value of goods produced, adjusted using industry price deflators from INEGI.²⁰ Starting using nominal output to compute quantities is potentially problematic because 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.

As proxy for L , I use total labor hours as reported in the survey.²¹ 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.

¹⁸ For an analysis on the impact of trade liberalization on Mexican productivity, see López-Cordova (2002.)

¹⁹ In constructing these measures I follow Lichtenberg (1992) and Schoar (2002), who use the Longitudinal Research Database (LRD), the U.S. counterpart to the MAIS, to (1) construct TFP measures and (2) test the impact of changes in ownership on plant performance.

²⁰ INEGI requires plants to report the value of goods produced (at market prices) regardless of whether these products were sold. Using sales as dependent variable does not affect the results.

²¹ Using total wage bill instead to total hours does not affect the results. The data does not divide workers by production and managerial workers.

III. B. Predictions

With estimated TFP at hand, I use the basic insights of GHM to develop and test empirical predictions. While some of these predictions might be argued to be consistent with the transaction cost literature as developed by Williamson (1975, 1979, 1985) and Klein, Crawford and Alchain (1978), I, however, emphasize their link to the property rights theory of the firm as developed by GHM as the setting of this paper allows me to examine not only if integration affects firm performance, but whether integration around a *specific owner* who contributes key specific resources is paramount (Hart (1995)). The GHM theory of the firm makes sharp predictions regarding gains from integration under alternative owners.²² In this regard, it is important to highlight that integration around Mexican owners was never prohibited by law.

Prediction 1: The impact of foreign ownership on productivity should be more than proportional for majority-owned affiliates

Prediction 1 states that crossing the 50 percent ownership line should be associated to a more than proportional increase in productivity relative to similar increases in foreign ownership that do not result in majority ownership, or pure cash flow incentives (Jensen and Meckling (1976)). Majority can become extremely important because it can confer the transfer of residual control rights. Majority ownership is likely to be associated to a large increase in decision rights relative to a 49 percent interests. Technological improvements by a minority foreign investor, for example, could be subject to expropriation by Mexican majority partners. As indicated before, there is evidence that MNCs provide less training and use older technologies in minority ventures. Changes in foreign ownership short of majority ownership should have a lower impact on performance relative to cases in which the change in foreign ownership translates into a

²² As previously indicated, I do not address how the predictions below would change under the separation of ownership and control (Bolton and Scharfstein (1998)) or in the presence of alternative incentive structures (Holmstrom and Milgrom (1991, 1994), Holmstrom and Roberts (1998), Holmstrom (1999)), as information on management shareholdings o agents' tasks, is not available.

majority interest. Likewise, increases in foreign ownership once a MNC has control should be relatively unimportant because the MNC already has acquired the residual control rights associated with the plant's assets.

Yet, even if this prediction obtains empirical support, one should be careful in interpreting observed changes in performance because productivity improvements of plants with no pre-existing MNC shareholdings might reflect initial access to MNCs and not the importance of obtaining residual control.

Prediction 2: Plants with pre-existing minority investments by multinationals during the period of foreign majority restrictions that were subsequently acquired by their parents as restrictions were eliminated, should improve performance.

The question that this prediction seeks to assess is whether MNC control is optimal relative to a minority shareholding with a contract. If feasible contracts are incomplete, and if MNC ownership were optimal ex-ante, 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 ownership (MNCs acquire control), plant productivity should increase. This is a closer test of GHM because one can isolate a change in ownership structures and thus investment incentives 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 the property rights view of the firm could necessarily be rejected. Expropriation costs could be prohibitive in the sense that they can prevent entry altogether. In consequence, observed plants would not be representative of those ventures where multinational control is most important, which suggests that the estimated results might underestimate the true effect of control.

Prediction 3: Productivity gains by target plants should depend on the relative importance of investment decisions made by the multinational corporations.

Testing this prediction requires 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 technology-intensive sectors and less common in labor-intensive industries. I therefore construct two measures to capture the relative anticipated role of MNC in affiliates based on: (a) the share of imported machinery and equipment on total investment at the two-digit industry level, and alternatively based on (b) 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. I rely on industry-wide averages in order to prevent sorting by plant-level variables that might be correlated to changes in performance.

This test captures the idea that before acquisitions, MNCs have little incentive to innovate in Mexican ventures because majority owners could –at least partially– expropriate the value of their investments. After the acquisition, control shifts and in consequence, locals will be less likely to invest in ventures, thereafter. In technology-intensive sectors, in which MNCs' investment is arguably important (but local partners' investment is not), control would imply a drastic response from the parent company and productivity could potentially increase, even as the investment by local partners falls. 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 basic logic of this test, Table III showed that industry codes 35 and 38 had the highest concentration of foreign ownership 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 or the devaluation of 1994-1995 could have led to improvements in the operational efficiency of multinationals only (Desai, Foley and Forbes (2004)). 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 throughout the sample period. Given that the 1973 Law was not retroactive, there was a subset of plants for which MNCs did not face expropriation risks by local partners because they retained majority ownership. One needs to show that the gains in formerly minority-owned ventures are not matched by gains in the wholly-owned control group.

Prediction 4: Parent control should increase investment in general, and in MNC proprietary assets, in particular.

I examine changes in reported investment at the plant level, both total investment and investment in imported machinery and equipment, and their potential impact on actual production processes. While estimated productivity could reflect changes in transfer pricing at the plant level, finding *real* changes driven by incremental investments or technology adoption should ameliorate this alternative interpretation.

Beyond investment levels in monetary values, I test for changes in (a) production processes –towards higher intensity in the use of modern technologies, such as computerized and automatic equipments and away from manual tools and machines– and, (b) in the skill profile of the labor force –the share of unskilled workers relative to the total plant level workers–, which would be consistent with higher levels of human capital at the plant level.

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

Focusing on the performance of the group of plants that is actually acquired by their parents is potentially problematic because 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 the property rights theory of the firm.

IV. Results

IV. A. Foreign Ownership: Basic Results

The impact of foreign ownership 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 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 foreign ownership 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 productive ventures, but once we control for fixed effects, the incremental effect of foreign ownership is significantly lower. Column III tests for whether the impact of foreign ownership on affiliates is particularly strong as MNCs acquire majority ownership. I use 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. It shows that crossing the 50 percent ownership line is important for increasing output. Beyond the linear impact of foreign ownership on output, plants where foreign ownership crosses the 50 percent boundary, increase output by 20 percent.

Higher output does not necessarily imply superior performance. In controlling for input use as described in equation (1), it is important to keep in mind that TFP here is relative to a two-digit industry-year. By construction, an average plant in an industry has a residual in equation (1) equal to zero, and the residual is positive (negative) for above (below) average plants.

Column IV in Table V shows that foreign ownership and TFP are positively correlated at the plant level. The estimated coefficient indicates that a plant with no foreign ownership 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 (Aitken and Harrison (1999)).

To address the reverse interpretation that foreign ownership flows into relative productive plants, Column V presents estimates when plant-level fixed-effects are introduced. Results indicate that changes in foreign ownership from 0 to 100 percent would still increase output per level of inputs, but by a lower amount, or 4.1 percent, an increment statistically significantly different from zero at the one-percent level.

The results in Column VI, address whether the impact of foreign ownership on productivity is concentrated in plants where MNCs acquire majority control, beyond cash-flow incentives a la Jensen and Meckling (1976) (Prediction 1). Interestingly, the positive impact of increasing foreign ownership on productivity, when foreign participation does not cross the majority threshold, disappears. In contrast, when foreign ownership does cross the majority ownership threshold the impact on productivity is economically substantial and statistically significantly different from zero. Foreign ownership, then, improves TFP, but only when foreign investors acquire majority control. Plants for which 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 turn to cases in which MNCs acquired majority ownership. Table VI shows ownership information for 222 plants for which plant level production information and foreign ownership data was available both before and after. Within this group, there are two types of acquisitions: (a) “new” affiliates, which involve plants that were previously fully owned by a Mexican business group, and (b) “old” affiliates or plants for which 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 formerly minority-owned plants that become majority-owned by multinationals. For new affiliates foreign ownership increased from zero 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 the MNC acquired majority ownership, 97 (87) out of 121 plants became 95-100 (100) percent owned by the parent company.

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 stake 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 a 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 significantly different from zero.

Consistent with a positive impact of MNCs on performance, plant productivity improves within 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 significantly different from zero at the one percent level. The magnitude of the estimated productivity gains are of similar to those reported by Maksimovic and Phillips (2001) in their study of U.S. assets sales. Maksimovic and Phillips (2001) find that target plants acquired by firms that add assets to their main business divisions –the closest comparable group to firms in this sample– experience productivity gains in the 0.062 to 0.14 range.

As in Table VI, acquisitions are divided by new and old affiliates. Again, there are competing explanations of why new affiliates 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, improved managerial practices or cheaper inputs 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 foreign participation, 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 significantly different from zero at the one-percent level.

To test if control matters for performance, the analysis concentrates on affiliates for which multinational ownership increased from minority to majority. Under comprehensive contracting, these affiliates should be able to have access to MNCs' proprietary assets regardless of the parent minority or majority ownership stake in a plant.

Somewhat surprising, plant productivity for pre-existing affiliates was on average, not statistically different from 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 significantly different from zero 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 specification includes industry-year constant, which should control for differential industry-wide shocks resulting from structural reforms during the sample period as discussed in Section III.

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, the results provide support to Prediction 3.

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, relative to their industry benchmarks, 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 have been inefficient in the first place. Consistent with this idea, wholly-owned subsidiaries are less commonly found in labor-intensive industries (Table III).

Third, post-acquisition gains occur only in plants for which technology is relatively important. After control shifts to parent companies, plants in technologically dependent industries produce 10.2 percent more output per inputs than industry peers, a gain of 10.4 percentage points, which is statistically significantly different from zero 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 for acquisition only plants that are likely to improve performance.

Fourth, pre-acquisition “excess-TFP” in for technology-intensive plants relative to average wholly-owned subsidiaries, is negative and significantly significant, but this gap disappears after MNCs acquired 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 no longer statistically significantly different from zero. Results while sorting by the alternative proxy for dependency on the parent company do not change the interpretations above.

Table VIII extends the analysis for a five-year window before and after changes in control, whenever available, but only for the 121 plants for which 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 significantly different from zero 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 years 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, which advance support to multinationals enhancing performance.

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 significantly different from zero 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 technology-intensive industries concentrate the gains from multinational control.

Thus far, the evidence indicates that multinational control improves productivity in technology-intensive sectors. However, estimated TFP could be manipulated by parent companies using transfer pricing in a way not captured by the empirical analysis as described herein. It is therefore important to show that real changes do occur. Failing to find meaningful changes in investment decisions, production processes or in the labor force might cast doubt on the idea that MNCs become more involved in their affiliates once they acquire control.

Total Investment and Direct Imports of Machinery and Equipment

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 million) before MNCs acquired majority ownership and 31 million pesos thereafter. The difference (16.3 million) is statistically significantly different from zero 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 significantly different from zero at the one-percent level. Again, there are no significant changes for affiliates in industries with lower than average technology use.

I also examine for changes in 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 provide 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 dependent industries) to 7.9 million per year (10.7 m for dependent affiliates), an increase of 5.2 millions (7.2 m), statistically significantly different from zero at the 5-percent level. OLS and Tobit estimates yield similar results.

Production Equipment and the Skill Profile of the Labor Force

To document how parent control affects production decisions I look at the types of technologies used in the plant and at the skill characteristics of the labor force. Using data from another survey from INEGI, the Mexican Employment, Wage, Technology and Training Survey (Encuesta Nacional de Empleo, Salarios, Tecnologia y Capacitacion (ENESTYC)) implemented in 1992, 1995 and 1999, I am able to find 42 plants for which control shifted to parents as explained before and for which data from ENESTYC exists around acquisitions.

Table X shows that plants moved away from manual tools and machines, and towards automatic and computerized equipment as multinationals' ownership increased to majority. Specifically, the share of higher-end technology relative to total equipment rapidly increased from 23 to 42 percent around control changes. Computerized equipment accounted for around half of this change.

The last row in Table X reports changes in the skill profile of the labor force. The data shows that parent ownership is associated with a large decline in the relative share of unskilled workers in the total employment pool. This share falls from 39 to 27 percent of total workers, a 31 percent decline around control changes. The improvement in the skill profile of the labor force occurs with no significant changes in the number of workers or in the hours worked at the plant (not shown in Table X.)²³ Whether this change is explained by training or hiring decisions could not be established with the data at hand.²⁴

IV.D. Are MNCs Selecting "Winners"?

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

A convincing competing selection alternative, however, should be more elaborate than that as previous findings show that (1) gains in productivity are not observed across the board but in sectors where the role of multinationals was expected to be more important, ex-ante, and (2) that increased TFP by these former forced minorities was larger than the productivity gains of other affiliates of multinational corporations that had foreign majority ownership throughout the

²³ Reported differences in Table X are not explained by time-trends: plants with 100 percent foreign or domestic ownership do not show these changes (results not shown.) As before, these results are explained by plants in technology-intensive industries, which account for 33 out of the 42 plants with data.

²⁴ ENESTYC provides data to potentially separate between these two alternatives. Yet I was not granted access the complete files of that survey.

sample period. In other words, it would have to claim that MNCs whose ventures prior to the reform were constrained in ownership had superior information relative to other multinationals operating in Mexico prior to 1973.

To further address this issue, I limit the sample to those plants for which I have production information for at least two years before foreign ownership regulations were softened in 1989 and compare their performance to post 1993 productivity levels, given that the new FDI was approved in 1993.²⁵ If plants that in 1988 were minority-owned by their parent companies on average improve performance regardless of acquisition decisions then productivity gains are likely to be caused by their sub-optimal arrangements derived from the restrictive FDI law and not from selection. Column I in Table XI provides evidence 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 foreign ownership controls are eliminated, an increase that is statistically significantly different from zero at the one-percent level.

Given that the elimination of foreign ownership constraints coincides with NAFTA and the economic crisis of 194-1995, it is important as argued before, 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 XI 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 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.

²⁵ Re-estimating equation (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.

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 foreign majority ownership restrictions as a plausible source of exogenous variation.

I find that the allocation of control does affect production decisions *and* production efficiency. The results show that ownership restrictions to foreign ownership harmed the 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 for which foreign ownership translated into majority or full ownership experienced economically and statistically large productivity gains. Overall, the analysis shows strong evidence that the choice of organizational form affects productivity, particularly in technology intensive industries.

The evidence suggests that government policies directed to attract technological transfers should recognize the importance of residual control rights, particularly in countries with weak legal enforcement. Governments often limit foreign ownership 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) and Hart and Moore (1990). 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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Figure 1

The Impact of Acquiring “Control” on Productivity in Technology Intensive Sectors

This table shows (1) the average productivity differentials of affiliates of multinational corporations relative to local same-industry plants in Mexico, sorted by foreign ownership arrangements (*minority* when multinationals had a minority ownership interest in the plant during the period of restrictions to foreign ownership and *majority*, when multinationals had a majority interest throughout the sample period), before and after the former moved to majority as foreign ownership restrictions were eliminated, (2) the difference in productivity across groups, and (3) the estimated changes in productivity across periods. Technology intensive sectors are defined as those manufacturing industries with above average imports of machinery and equipment to investment relative to the sample.



Source: authors calculations based on the estimated results reported in Table VII.

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	New FDI Act
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) local ownership, if they are fully owned by Mexican nationals, (II) minority interest, if foreign ownership is less than 50 percent, (III) majority, if foreign ownership is 50 percent or more but less than 100 percent and (IV) wholly-owned, if foreign ownership is equal to 100 percent.

Year	Total	Local Ownership	Foreign Ownership			Output Weighted by Foreign Ownership
			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 Foreign Ownership	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 foreign ownership (Column I), plants with foreign ownership 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 Foreign Ownership	Foreign ownership, not subject to a change in control	Acquired by Foreign Investors (MNC)	Differences of Means	
		(I)	(II)	(III)	(III)-(I)	(III)-(II)
Number of plants	5,266	4,226	818	222		
Total value of production	291,485 (16,622)	171,911 (7,330)	778,135 (90,219)	601,511 (69,247)	429,600 ^{***} (69,486)	-176,623 (113,650)
Number of employees	279.1 (7.56)	223.6 (5.95)	487.8 (33.2)	482.3 (34.9)	258.7 ^{***} (35.4)	-5.4 (48.1)
Capital stock	71,804 (4,175)	43,245 (2,166)	185,296 (22,021)	155,433 (18,030)	112,189 ^{***} (18,122)	-29,863 (28,440)
Total value of production/ Total hours worked	382.3 (10.6)	312.8 (10.4)	659.0 (37.4)	585.1 (37.1)	272.3 ^{***} (38.4)	-73.9 (52.6)
Payments for tech. transfers / Total expenses (%)	0.70 (0.02)	0.39 (0.01)	1.98 (0.12)	1.45 (0.17)	1.06 ^{***} (0.18)	- 0.53 ^{**} (0.215)
Number of observations	55,317	43,650	9,072	2,595		

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

Table V**The Impact of Foreign Ownership 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 foreign ownership on Output			Impact of foreign ownership on TFP		
	(I)	(II)	(III)	(IV)	(V)	(VI)
Foreign ownership in the plant (fraction of 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
<i>Adjusted R</i> 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 significantly different from zero at the 10 percent level, ** 5 percent level, *** 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		Ownership Pre-Acquisition		
		No	Yes	< 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 of Acquiring “Control” on Productivity

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.

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

* Statistically significantly different from zero at the 10 percent level, ** 5 percent level, *** 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. The 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 significantly different from zero at the 10 percent level, ** 5 percent level, *** 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 thousands, 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 during 2001 was 9.3 (pesos per dollar). 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)
<i>A. Total Investment</i>				
All acquisitions where MNC had a Minority Interest before the Transaction	14,674 (2,962) [121]	31,019 (6,395) [121]	16,345 *** (4,351)	19,221 ** (7,587)
“Large” Imports of Machinery and Equipment	15,588 (3,751) [86]	34,633 (8,334) [86]	19,045 *** (5,194)	23,639 ** (9,705)
“Small” Imports of Machinery and Equipment	12,428 (4,521) [35]	22,139 (8,314) [35]	9,911 (8,031)	9,220 (10,411)
<i>B. Direct Imports of Machinery and Equipment</i>				
All acquisitions where MNC had a Minority Interest before the Transaction	2,683 (859) [99]	7,910 (2,828) [99]	5,227 ** (2,184)	13,581 *** (4,813)
“Large” Imports of Machinery and Equipment	3,454 (1,226) [67]	10,653 (4,162) [67]	7,199 ** (3,190)	15,376 ** (6,720)
“Small” Imports of Machinery and Equipment	1,069 (631) [32]	2,166 (862) [32]	1,097 (778)	3,596 * (1,976)

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

Table X
Intensity in the Use of *Modern Technologies*
and in the Skill Profile of the Labor Force

The dependent variables are: (1) the intensity in the use of robots, computerized and automatic equipment (as opposed to manual tools and machines), (2) the intensity in the use of computerized equipment in total production equipment, and (3) the share of unskilled production workers relative to the total number of employees at the plant level. The number of plants reported falls relative to previous tables since these data are from the Encuesta Nacional de Empleo, Salarios, Tecnologia y Capacitacion (Mexican Employment, Wage, Technology and Training Survey) implemented in 1992, 1995 and 1999. Data shown for plants where a MNC had a minority equity stake in the plant, and obtained majority ownership after foreign ownership restrictions were eliminated. Clustered (plant) standard errors are in parentheses. The number of plants is in brackets.

	Before Acquisition	After Acquisition	Difference (II) - (I)
	(I)	(II)	(II)
Intensity in the use of robots, computerized and automatic equipment	22.881 (3.420) [42]	42.190 (5.193) [42]	19.310 *** (5.257)
Intensity in the use of computerized equipment in total production equipment	4.142 (1.344) [42]	12.619 (3.311) [42]	8.476 ** (3.199)
Share of Unskilled Production Workers in Total	39.280 (4.262) [42]	27.079 (3.961) [42]	- 12.201 ** (4.891)

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

Table XI**Changes in Productivity by Pre-Liberalization Ownership Characteristics**

The dependent variable is total factor productivity (TFP) at the two-digit industry level as defined in Table IV. 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 foreign ownership 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. The constant is not reported. Standard errors are in parentheses.

	(I)	(II)	(III)
<i>After</i> -liberalization	0.0312 *** (0.0108)	- 0.0104 (0.0097)	- 0.0021 (0.0038)
<i>After</i> -liberalization * <i>Minority</i> pre-liberalization		0.0415 *** (0.0145)	0.0332 *** (0.0119)
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 significantly different from zero at the 10 percent level, ** 5 percent level, *** 1 percent level.