EXCHANGE RATES AND OWNERSHIP STRUCTURE
OF FOREIGN SUBSIDIARIES:
An Empirical Investigation

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ABSTRACT

In this paper we test empirically the insight that multinational corporations consider the fluctuations of exchange rates as an important factor in their decision about the ownership structure (i.e. joint venture or wholly owned subsidiary) of their foreign subsidiaries in supplying a foreign market. More over, we empirically investigate the company and industry conditions that influence the inertia (hysteresis) in adjusting this ownership structure. We test our hypotheses by using company-level US FDI inflow data from the ITA Transaction Database. We find that a Wholly Owned Subsidiary is preferable to a Joint Venture for relatively appreciated home country currency. Also, exchange rate volatility increases the degree of ownership switching inertia, while market competition and sales in the foreign market decreases it.
1 Introduction

The decision of a company to enter a foreign market has been studied extensively by economists and management researchers. Several economists emphasize the impact of fluctuating and volatile exchange rates on this decision. On the other hand, Dixit (1989a, b), Baldwin and Krugman (1989) and Kogut and Chang (1996) identify some sluggishness (hysteresis) in companies’ response to exchange rate fluctuations when they enter or exit a foreign market. However, very little has been done in testing empirically the hysteresis phenomenon in FDI flows.

In the present study we test empirically theoretical results developed in Kouvelis, Axarloglou and Sinha (2001) that discuss the impact of exchange rate fluctuations on the optimal ownership decision for foreign subsidiaries a multinational corporation makes in supplying a foreign market. In addition to the initial choice of the optimal ownership structure of foreign subsidiaries, we emphasize subsequent adjustments to this structure the company might decide to perform, in the presence of evolving company, industry and macroeconomic conditions.

Our study focuses on the company’s optimal choice of the ownership structure of its foreign subsidiaries in organizing its production activities in a foreign market, after it has decided to enter in this market. We often refer to this as “production mode” choice. Among the vast array of alternatives that a firm can choose are: (i) joint venture mode (JV): an equity-based cooperative venture, where the firm entering the foreign market shares the ownership, and the required investment, of production facilities in the foreign market with a local partner; (ii) wholly owned subsidiary (WOS): wholly owned and completely controlled production facilities in the host country are used to supply the demand.

Each of the above production modes for supplying foreign markets has different implications for the degree of control that a firm can exercise over its foreign production activities, the resources it must commit to these activities, and the risks it must bear to expand into the foreign market. It is, however, shown in the literature that the choice of

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2 Parsley and Wei (1993) find little evidence for hysteresis in US trade flows from Canada and Japan.
the production mode is a critical determinant of the likely success of the foreign operation (Root (1987), Davidson (1982), Killing (1982), Austin (1990)).

There has been considerable scholarly interest in the choice of production mode for supplying foreign markets (for brevity reasons we refer to it as Choice of Mode Problem (CMP)). The common approaches to solve CMP are transaction cost, competitive strategy and organizational learning.\(^3\) The three perspectives of transaction cost, strategic behavior and organizational learning provide distinct, though at times overlapping, explanations for the choice of production mode.

The above research has emphasized the initial selection of the production mode in entering a foreign market and has not placed substantial emphasis in explaining subsequent changes on the used production mode by the same firm in supplying a specific foreign market, in the presence of nontrivial fluctuations of certain macroeconomic parameters of the foreign market. The macroeconomic parameter of interest to our study is the exchange rate. A first indication, mostly at the anecdotal evidence level, on the presence of substantial production mode change activity, as affected by the change in macroeconomic parameters, can be found in Austin (1990).

The main objectives of our paper are:

\textbf{i.} to substantiate through rigorous empirical research, based on available company-level data, the claim that the original choice and subsequent adjustments of the ownership structure of foreign subsidiaries are affected in a systematic way by the fluctuations of exchange rates;

\textbf{ii.} to test a set of hypotheses, which are mostly motivated by recent theoretical results, on the nature of ownership structure adjustments of foreign subsidiaries when substantial exchange rate fluctuations occur.

The structure of this paper is as follows. In section 2, we discuss the theoretical results developed in Kouvelis et al. (2001), and summarize them in few testable hypotheses. Section 3, along with appendix A, provides information on the sources of our data and the necessary modifications in order to put the data in an appropriate for our estimations form. Section 4 includes our empirical results. Finally, we conclude in

section 5 with the main insights of this study, along with some thoughts about possible extensions and other directions for future research.

2 Theoretical Results in Choosing a Production Mode under Exchange Rate Fluctuations

2.1 Synopsis of Supporting Model and Theory

The main premises of our model are the following:

(i) The firm has already decided to enter the foreign market;

(ii) The firm chooses, at any point in time between three modes. Two of these modes correspond to specific ownership structures of their foreign subsidiary: a Joint Venture (JV) or a wholly owned subsidiary (WOS) located in the foreign country. The third mode is an export (EXP) based one. The firm opts to supply the foreign market by exporting from production facilities in the home country. Our analysis emphasizes comparison between the two modes: JV vs. WOS, but always in the presence of an EXP alternative. (Similar analysis applies if the firm is choosing between exporting in the foreign market and a JV, or exporting in the foreign market and a WOS. However, in those cases the presence of a third available mode is not necessary). The level of ownership is prespecified if the JV option is pursued. (Kouvelis et al. (2001) provide results for choice among any two modes and for general cases with a choice among three modes);

(iii) The firm can switch between production modes over time, but such switches usually incur switching cost;

(iv) Regardless of the choice of production mode the firm has adequate capacity to meet all foreign market demand;

(v) We assume that the ownership share translates in an equivalent share of control over production activities with such consideration reflected in the relevant production and transaction cost per unit sold in the foreign market;

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4 The switching costs vary according to the switch between specific production modes the firm intends to do. For instance, if the firm decides to switch from a WOS to a JV, the switching cost might involve for example all transaction costs in establishing a contractual relationship with a local partner and organizing the joint production activities. Similarly, if the firm plans to switch from a JV to a WOS the switching cost might consist of the acquisition costs of the local partner’s share or the termination cost of the JV and the development costs of new production facilities in the foreign market, etc.
(vi) The main element of macroeconomic uncertainty is the volatility of real bilateral exchange rates.

Let $e$ be the real exchange rate between home country and foreign currency defined as units of home currency – say a German mark (DM) - per unit of foreign country currency – say a US dollar. (“Home country” is the country of the parent company, and “foreign country” is the foreign market where the firm’s subsidiary is located. We are using the US as the “foreign country” since it is consistent with our data that record FDI inflows in the US) Then, the real exchange rate $e$ follows a geometric Brownian motion with a drift

$$de = [kd] dt + [sd] dz$$

(1)

where $k$ = drift parameter, $s$ = variance parameter, and $dz$ = increments of a Winer process.

We denote by $Q_a(e)$ the corresponding operating profit function when using a JV with ownership share $a$ (WOS formula for $a = 1$).

$$Q_a(e) = e\left[P^f D - c_a\right]$$

(2a)

where $D$ = foreign market demand, $P^f$ = the price (in the foreign currency) the firm charges to its product when it produces it locally in the foreign market that is assumed to be the same for all local producers, and $c_a$ = all production, and other relevant transaction costs per unit sold, when the firm produces all units in facilities in the foreign country, with the assumed level of ownership share. For the EXP mode, the corresponding operating profit function is

$$Q_e(e) = e\left[P^f - c_e\right]$$

(our convention for EXP: $a = 0$)

(2b),

where $P^f$ = the price (in home country currency) the firm charges for its exports to the foreign market, and $c_e$ = the corresponding production and total transaction cost per unit for the EXP alternative. An appropriate pricing equation that governs the company’s pricing strategy in the foreign market in response to exchange rates has to be introduced.5

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5 It follows the economic intuition presented in Hooper and Mann (1989). For an example of such a pricing equation see Kouvelis et al. (2001).
In such an equation $E$ is a function of $\theta$, $e$, degree of competition in the foreign market, and any price premiums potentially commanded on relevant brand equity by the exporting firm.

We now proceed with the problem formulation. Let $I$, the index set of feasible production modes. We denote by $V_i(e)$ the maximum profit the firm can earn over an infinite planning horizon, when it currently uses production mode $i \in I$. The switching cost from mode $i$ to $i'$, where $i,i' \in I$, is denoted by $c_{ii'}$. It is assumed that $c_{ii'} = 0$ for $i \neq i'$. Then the Choice of Mode Problem (CMP) can be formulated as follows:

$$V_i(e) = \max \left\{ Q_i(e) t + \frac{1}{1 + \Delta e} EV_i(e) + Q_i(e) t + \frac{1}{1 + \Delta e} EV_i(e), \right\}$$

for $i,i' \in I, i \neq i'$

where $E$ is the expectation operator of the exchange rate distribution after $t$ time units conditional on the realization of the current period exchange rate, and $\Delta$ is an appropriate discount rate.

Using standard results from Ito calculus, we can easily conclude that for a firm in mode $i$, and for exchange rates for which it is optimal to continue operating in mode $i$ (i.e., $i = i'$), it holds that,

$$\frac{1}{2} \Delta^2 e^2 V_i^2(e) + \Delta e V_i(e) V'_i(e) + Q_i(e) = 0 \quad \text{for } i \in I$$

(4)

where $V'_i$ and $V''_i$ denote first and second derivatives respectively.

Using standard arguments from contingent claims valuation literature, (Dixit and Pindyck (1994)) we obtain that the parameters $\Delta$ and $\gamma$ should be estimated as $\gamma = r - \gamma$ and $\Delta = r$, where $r$ is the riskless rate of return and $\gamma$ is the dividend or convenience yield on a financial asset perfectly correlated with the exchange rate $e$. From now on we use these parameter values in (4). Therefore, for $i = \gamma$ the differential equation becomes,

$$\frac{1}{2} \gamma^2 e^2 V_i^2(e) + (r - \gamma) e V_i(e) V'_i(e) \gamma r V'_i(e) + Q_i(e) = 0$$

(5)
Using methodological arguments as in Dixit’s (1989a), we can verify that there exist threshold values of the real exchange rate $e$ and $\bar{e}$ such that for $e \geq \bar{e}$ (or for relatively depreciated home country currency) the dominant mode is JV $(i = a)$, $\square < 1$, and for $e \leq \bar{e}$ (i.e. relatively appreciated home country currency) the dominant mode is WOS $(i = 1)$. In the range $\bar{e} < e < \bar{e}$, also referred to as “hysteresis band”, we follow a “keep the current mode” policy. Thus, equation (5), for a prespecified $\square < 1$ is valid for all $e \geq \bar{e}$, and equation (5) for $\square = 1$ is valid for all $e \leq \bar{e}$. The boundary conditions for equation (5) are specified, through value matching and smooth pasting conditions at $\bar{e}$ and $\bar{e}$.

Equation (5) has the general solution (see Shimko (1992), pg. 35-36):

$$V_a(e) = Be^{\alpha m} + \frac{(p^{\gamma} c_a) \theta}{e}$$

where $m$ is the positive root of the equation $\frac{1}{2} \square^2 m(m \square 1) + (r \square \square) m \square r = 0$.

Equation (6) applied for the prespecified value of $\square < 1$ and for $\square = 1$, and the boundary conditions previously mentioned, (i.e. value matching and smooth pasting) result in a system of four equations with four unknowns. The solution of this system provides values for $A$, $B$, $\bar{e}$ and $\bar{e}$. Sensitivity analysis on those parameters leads to useful insights on factors affecting the hysteretic behavior of firms in uncertain exchange rate environments.\(^6\) We discuss briefly below the simple intuition governing the switching behavior between JV and WOS modes (always in the presence of an EXP alternative). These insights are discussed further in the next two sections as well.

For simplicity of presentation of our argument, let us assume and also that the switching cost between a WOS and a JV, $\bar{e}$, is low. In this case, and assuming that the firm produces in the foreign market, if the home country currency depreciates, the EXP mode becomes more desirable. However, the switching cost in the presence of uncertain future exchange rates discourages the firm from switching immediately to the EXP mode. Under the specific assumptions, if the firm was operating

\(^6\) For more on this issue see also Kouvelis et al. (2001).
with a WOS mode, then it will stay with its current suboptimal mode longer than if it was operating under a JV structure. Consequently, the firm, through its continuing operations in a WOS mode, has higher forgone profits than if it switched to a JV (and then later to an EXP), since it will stay in a JV mode for less time prior to switching to the optimal EXP mode. Consequently a depreciation of the exchange rate makes the company to switch from a WOS to a JV mode, not because of its current period operating profits (actually in our case), but because the long term operating profits as a result of reduced hysteresis in switching from a suboptimal mode. In this case, the firm views the JV as a convenient intermediate platform in serving the foreign market demand while waiting for further resolution of exchange rate uncertainty. In the early stages of home currency depreciation, the firm might decide to use a gradual foreign production disinvestment strategy via a planned move from WOS to a majority JV relationship with one of its established local partners. In a similar fashion, early trends of home currency appreciation could lead to increased foreign production investments via gradual increase of ownership in the JV.

2.2 The Choice Between a JV and a WOS

Hypothesis 1 describes the appropriate level of the real exchange rate under which either the WOS or the JV mode is preferable.

**Hypothesis 1** A WOS is (is not) preferable to a JV, when the home country currency is relatively appreciated (depreciated) with respect to the foreign country currency.

According to this hypothesis, for a rather appreciated home real exchange rate we expect a dominance of the WOS mode of production and therefore ownership structure over a JV, because of a total transaction cost per unit advantage of the WOS mode, and a lack of incentives to move out from the market in the future.7

7 The total transaction cost per unit depends on the company’s (and in the case of a JV, on the synergy between the firm’s and the local partner’s) organizational capabilities on product and process technology know-how, access to supply and distribution network, cultural understanding and experience in managing in the foreign environment and ability to successfully transfer technology. We expect, for instance, the total transaction cost per unit to be lower under a WOS mode for a large multinational firm that possesses
2.3 Market Conditions and the Size of the Hysteresis Band

As discussed already, the level of the real exchange rate is critical in deciding the optimal ownership structure for a foreign subsidiary and any subsequent adjustments in it. However, the existence of switching cost in ownership adjustments might make companies to keep a sub-optimal level of ownership of their foreign subsidiary since the foregone profits are less than the switching cost of adjusting their ownership share. Kouvelis et al. (and also section 2.1 above) discuss thoroughly the impact various economic conditions have on the inertia (hysteresis) in the process of ownership adjustments of a foreign subsidiary. The hysteresis in adjusting to the optimal ownership structure is influenced by various factors. In particular, the exchange rate volatility, the magnitude of the switching cost, and the foreign market demand influence the hysteresis in a certain direction. On the other hand the degree of market competition in the foreign market has, at least theoretically, an undetermined impact on the size of the hysteresis, and therefore the degree of ownership switching inertia.

A volatile exchange rate increases the degree of economic uncertainty for companies supplying in a foreign market. If they are operating with a sub-optimal ownership structure, they might decide to wait before switching to the optimal one, not only due to the switching cost, but also because they are unable to predict the future level of the exchange rate due to its significant volatility. Under exchange rate volatility, companies are willing to tolerate larger appreciations of their home currency before they actually decide to increase their ownership share of a foreign subsidiary. Consequently, ceteris paribus, the inertia for ownership adjustments is stronger in the presence of high exchange rate volatility. Hypothesis 2 captures this idea.

**Hypothesis 2** The hysteresis in ownership adjustments becomes stronger (weaker) as the volatility of the exchange rate increases (decreases).

proprietary know-how, has experience in global transfer of technology, or has the financial capabilities as well as government and market contacts to do the needed networking. See also Kouvelis et al. (2001) for more on this issue.
The reason that companies might decide to postpone an adjustment of their ownership share of a foreign subsidiary is the existence of switching cost (usually a sunk cost) associated with this adjustment. High switching cost implies strong inertia in ownership share adjustments of foreign subsidiaries, and therefore larger hysteresis. Companies can tolerate larger appreciations of their home currency before they decide to increase their ownership of foreign subsidiaries. **Hypothesis 3** incorporates this idea.

**Hypothesis 3** *The hysteresis in adjusting the ownership share of a foreign subsidiary becomes stronger (weaker) in the presence of high (low) switching cost.*

A multinational company also considers the demand in the foreign market in adjusting the ownership structure of its foreign subsidiary. Specifically, high market demand implies high foregone profits for the company from operating with a sub-optimal ownership structure. The company has strong incentives to increase its ownership share of its subsidiary, since otherwise, it does not fully benefit of the high market demand. Consequently, the inertia in ownership adjustments is expected to be weaker in the presence of high market demand, intuition that is captured in **hypothesis 4**:

**Hypothesis 4** *The hysteresis in adjusting the ownership share of a foreign subsidiary becomes weaker (stronger) in the presence of high (low) demand in the foreign market.*

Finally, Kouvelis et al. (2001) argue, within the confines of their modeling assumptions, that the degree of market competition and market structure of the industry in which the foreign subsidiary operates has an unclear impact on the hysteresis in adjusting the optimal ownership share of the subsidiary. However, in the present study we give an empirical answer to this question.

### 3 Data Sources

In testing empirically the above hypotheses, we use company-level data on US FDI inflows that come from the publication “Foreign Direct Investment in the United
States”. The data set reports the dollar value of FDI transactions in the United States of non-US companies that own at least ten percent of their US subsidiaries in which they invest. Every FDI transaction is classified according to the 4-digit SIC code and the US State that received the FDI inflow. In addition, the FDI transactions are classified according to their type in six categories as Mergers and Acquisitions, Equity Increase, Joint Ventures, New Plants, Existing Plant Expansions, and Other.

The data set spans eighteen years (from 1977 to 1994), and we focus on the FDI transactions in all twenty 2-digit SIC US manufacturing industries coming from the nine most important countries from where US inflows are originated. In appendix A, we present a more detailed description of the sources of the data, along with a description for the appropriate data transformations for our empirical tests.

4 Empirical Results

Tables 1 and 2 include descriptive statistics and correlations among the most important variables in our estimations. In the remaining of this section we test formally the theoretical hypotheses described in section 2.

4.1 Decision Between JVs and WOS

*Hypothesis 1* suggests that a relatively appreciated home currency favors FDI flows that finance a WOS over a JV. To test *hypothesis 1*, we construct dependent variables (fdi) capturing FDI flows for WOS and JV. The first variable includes the US FDI inflows classified as Mergers and Acquisitions, New Plants and Plant Expansions, while the second one the respective flows classified specifically as Joint Ventures. On the other hand, various explanatory variables are used to capture the impact of exchange rate fluctuations on WOS and JV FDI flows.

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8 These data were maintained by the International Trade Administration (ITA), the US Department of Commerce, and were disconnected after 1994.
9 See appendix A for more on the description of these types of FDI inflows.
10 The nine countries in the sample are the source of approximately 87% of all FDI inflows in the US manufacturing the ITA data set records.
11 Given our FDI data, “home country” is considered the country from where the FDI flow is originated, while “foreign country” is the US, the country that receives the FDI inflow.
Specifically, an index of the level of the real exchange rate \((\text{exg})\) between the US dollar and the currency of the country where the FDI was originated is used in estimations.\(^{12}\) Also, the volatility of the real exchange rate \((\text{evol})\), calculated as the annualized standard deviation of a moving average of \((\text{exg})\) for the past thirty-six months, captures the exchange rate uncertainty in FDI decisions.\(^{13}\) Finally, companies in their FDI decisions also consider their exchange rate expectations based on the past fluctuations of these exchange rates (Campa (1993)). For that, we calculate the monthly change of \((\text{exg})\) for the past thirty-six months and we annualize it \((\text{etrend})\). A positive value of \((\text{etrend})\) indicates expectations for a depreciated home currency with respect to the US dollar. In testing Hypothesis 1, we use the Random Effects model to estimate the reduced form equation (7), since our data are in a panel form.\(^{14}\)

\[
\text{fdi} = f(\text{exg}, \text{etrend}, \text{evol})
\]

The results are reported in table 3. Initially, the dependent variable is the FDI flows that finance WOS. The estimated coefficients for \((\text{exg})\) and \((\text{etrend})\) are negative and statistically significant implying that a depreciated home currency with respect to the US dollar deters FDI inflows for WOS in the US from the respective country of origin. At the same time, the volatility of the real exchange rate has a negative but statistically insignificant impact on WOS. On the other hand, the inflows in the US for JV (third column in table 3) do not respond either to the exchange rate or the exchange rate expectations. However, the exchange rate volatility seems to discourage FDI inflows in the US for JV. Overall, the empirical results indicate that FDI flows for WOS are deterred by depreciated home exchange rates. FDI flows for JV do not seem responsive to exchange rate fluctuations.

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\(^{12}\) For instance, the real exchange rate between the US dollar and the German DM is defined as

\[
\text{exg} = \frac{\text{DM}}{\frac{\text{CPI}_{\text{US}}}{\text{CPI}_{\text{Germany}}}}
\]

where \(\text{CPI}_{\text{US}}\) and \(\text{CPI}_{\text{Germany}}\) are the Consumer Price Indices in the US and Germany respectively. An increase in \((\text{exg})\) implies a depreciation of the DM with respect to the US dollar.

\(^{13}\) See Goldberg and Kolstad (1995).

\(^{14}\) The panel data has three dimensions: across the nine countries from which the FDI inflows to the US are originated, the twenty 2-digit SIC manufacturing industries based on which the FDI inflows are classified, and finally the time dimension of the data (from 1977 to 1994). Also, in estimations all regressors are in logarithms.
The estimations so far identify the specific responses of WOS and JV to exchange rate fluctuations, but obviously do not test directly companies’ decisions to adjust the ownership share of their US subsidiaries and switch from a JV towards a WOS. For that, we take a sub-sample of our data set that includes only the FDI inflows in the US classified as Equity Increase (EI). These are FDI flows originated by non-US multinational companies to specifically finance an equity increase of their respective US subsidiaries. Through these funds non-US companies increase their ownership of their US subsidiaries revealing a gradual move away from a JV and towards a WOS. Equation (7) is estimated again using the same independent variables as before. The results are reported in the last column of table 3.

The estimated coefficients indicate that an expected depreciation of the home currency with respect to the US dollar (etrend) deters FDI flows that finance EI in US subsidiaries, implying that foreign companies are discouraged to switch to a WOS when they expect a depreciation of their home currency with respect to the US dollar. Overall, hypothesis 1 is supported by the data.

4.2 Hysteresis in Ownership Adjustments of a Foreign Subsidiary

In the present section we test the impact of macroeconomic, industry and company conditions on the inertia in switching from a JV towards a WOS. Given our data set, this managerial decision takes the form of an ownership adjustment of a US subsidiary owned partially by a non-US multinational company. For that, we focus on a sub-sample of our data set that includes only the FDI inflows to the US for Equity Increase (EI).

The decision of a multinational company to adjust its ownership of its foreign subsidiary is discrete in nature since it can decide to either perform an EI investment or not in a given period of time. However, as previously discussed, there is some inertia in this decision-making due to switching cost associated with it and some economic uncertainty that makes the company hesitant in performing an EI investment. In fact, an EI investment project resembles a call-option, and the company can postpone its decision to exercise the option in the presence of some market uncertainty.
Obviously, the strength of the inertia affects the probability of implementing an EI investment. Although the real exchange rate might favor it, strong inertia makes it less probable, and its postponement more likely. At the same time, industry and company conditions influence the strength of the inertia, and hence the hysteresis, in performing an EI investment. Specifically, the conditions that boost the inertia make an EI investment less probable to happen, while the ones that weaken the inertia increase this probability. Consequently, given the level of the real exchange rate, the statistical impact of these conditions on the probability of an EI investment reveals their impact on the magnitude of the inertia in EI decision-making.

To focus on the inertia in ownership adjustments, we select from our sub-sample with EI investment only the cases of non-US companies that made more than one EI investment to the same US subsidiaries during the period of time that our data span (1977-1994). Consequently, the data capture repeated decisions by multinationals to increase their ownership share of their respective US subsidiary. The time interval between two consecutive EI inflows from the same multinational company and to its US subsidiary indicates possible inertia between these ownership adjustment decisions. Overall, thirty non-US multinational companies in the data are recorded as having made more than one EI investment to their same US subsidiary during 1977 and 1994.\textsuperscript{15}

Next, we construct a binary variable (\textit{binary}) that takes the value of one (1) in the year during which a non-US multinational performed an EI, and the value of zero (0) for each year until the next instance of an EI investment to the same US subsidiary. Regressing (\textit{binary}), using a Probit model, on various independent variables that theoretically affect the inertia in ownership adjustments, reveals the influence these independent variables exercise on the probability of an EI to happen, and therefore the probability of a foreign multinational company to increase its ownership of its US subsidiary. Strong (weak) inertia in ownership adjustments makes an EI investment less (more) probable given the variability of the independent variables, thus indicating a stronger (weaker) hysteresis in switching from a JV towards a WOS. In other words, if a given exogenous variable actually strengthens the inertia in ownership switching, then

\textsuperscript{15} Summary statistics and correlations of key financials from the thirty US subsidiaries that received the EI inflows in the sub-sample are reported in tables 1 and 2.
this will be captured in our estimations by a negative impact of this variable on the probability of an EI investment to happen.

As already discussed, the volatility of the real exchange rate, the switching cost for an ownership increase, the degree of market competition of the industry in which the foreign subsidiary operates, and the market demand for the products the subsidiary sells are the factors that expected to influence the inertia in ownership increases. Hypotheses 2 through 4 capture these ideas and we test them by estimating a reduced form equation (8):

\[
\text{binary} = f(\text{evol, c8, swcost, profit, dsales})
\]

(8)

The dependent variable (binary) that captures the inertia in ownership increases is regressed on proxies for the various independent variables that theoretically are expected to have an impact on this inertia. Specifically, the exchange rate volatility is captured by (evol) as explained already. The switchover cost (swcost) is proxied either by the ratio of the real value of inventories to the real value of total assets of each US subsidiary receiving an EI investment (swcost1), or by the ratio between real inventory and real sales of the same subsidiary (swcost2) and for the appropriate years in the data. For market demand two different sets of proxies are used. At a company level, the real value of profits as a percentage of its total assets (profit1) and its sales (profit2) of the subsidiary receiving the EI investment are used to proxy the profitability of each subsidiary. Also, the growth rate of the subsidiary’s real sales (dsales1) proxy its market demand, while the growth rate of real sales of the industry in which the subsidiary operates (dsales2) proxy the industry demand. Finally, the degree of market competition in the industry in which the subsidiary operates is measured by the 8-firm concentration ratio of the respective industry (c8). Finally, to check the robustness of our empirical results, four different specifications of equation (8) are tested (Model 1 through Model 4, table 4) using the various proxies of our regressors.

In all four specifications of equation (8), the estimated coefficient for the volatility of the real exchange rate is negative and statistically significant. This indicates that as real exchange rates become more volatile, an EI investment becomes less probable
to happen and therefore the inertia in ownership adjustments becomes stronger. Overall, the data support hypotheses 2 and the argument that exchange rate volatility strengthens the hysteresis in ownership expansions.

Hypothesis 3 expresses the idea that high switching cost makes companies to be slower in adjusting their ownership share of a foreign subsidiary. In testing this hypothesis, two specifications of equation (8) are estimated (reported as Model 1 and Model 2 in table 4), using respectively (swcost1) and (swcost2) to proxy the switching cost. In both specifications, the estimated coefficient for the switching cost is negative, but it is statistically significant only in the first case. High switching cost appears to depress the probability of an EI investment, thus supporting the idea of stronger inertia in ownership share adjustments due to high switching cost, finding that is consistent with hypothesis 3.

Market demand is also expected to have an impact on the inertia in ownership adjustments. High market demand presents incentives for a quicker increase in the ownership share of a foreign subsidiary in order to capture a larger share of the expanded market demand. **Hypothesis 4** states this idea that is tested by estimating four different specifications of equation (8) (table 4). In the first two specifications, proxies for the subsidiary’s profits are used to capture its profitability (profit1 and profit2) while in the next two specifications proxies for the subsidiary and industry sales are used (dsales1 and dsales2).

The estimated coefficients indicate that only the growth rate of industry sales has a statistically significant impact on the probability of an EI investment and this is robust for all the estimated specifications of equation (8). In addition, the positive sign of the estimated coefficient reveals that strong industry demand growth strengthens the probability of an EI investment and therefore reduces the inertia for an ownership adjustment, finding that is consistent with hypothesis 4. Overall, it appears that industry demand considerations are more important in determining the inertia in ownership adjustments than individual company sales or profits. In other words, the industry outlook appears as a stronger incentive in expediting an EI investment than the outlook of the individual companies.
Finally, another factor that influences the strength of the inertia in ownership adjustments is the degree of market competition in the industry in which the foreign subsidiary operates. Industries that are closer to pure competition are characterized by stronger market competition while the ones with significant market concentration are usually less competitive. However, theoretically we were unable to determine the specific effects of market competition on the size of the hysteresis in ownership adjustments. Empirically though it appears that market competition, as expressed by the industry’s 8-firms concentration ratio \((c_8)\), strengthens the inertia in ownership adjustments (by decreasing the probability of an EI), and this finding is robust across all specifications in estimating equation (8) (table 4). Overall, highly concentrated industries are characterized by stronger inertia in ownership adjustments something that can be attributed to the strategic nature of interaction among oligopolistic companies in the market. Companies appear hesitant before making an investment for an ownership increase since they might be waiting to see future action of their competitors. Also, they might be having lengthy strategic planning cycles in their investment decision-making that strengthens the inertia in ownership adjustments. Therefore, the stronger inertia in EI investment decisions in concentrated industries can be explained by the strategic nature of companies’ interaction with their competitors.\(^{16}\)

### 4.4 Robustness

The magnitude of the hysteresis in ownership adjustments of foreign subsidiaries is the outcome of the interaction between industry and company conditions and the switching cost associated with such adjustments. In fact, the switching cost is a necessary condition for this inertia in company’s decision making. As discussed already, high switching cost strengthens the inertia in ownership adjustments of the US subsidiaries in our sample. Overall, we expect that the interaction of the switching cost with exchange rate volatility and industry concentration to further strengthen the inertia, while its interaction with market demand to weaken it.

\(^{16}\) Strategic interaction among oligopolists is also very important for FDI flows in the presence of trade restrictions such as tariffs. (Campa et. al. (1998)).
This intuition is tested by estimating equation (9), where interaction variables between the exogenous variables that influence the inertia in ownership adjustments and the switching cost are included (e.g. \( \text{swcost1} \times \text{sevol} = \text{sevol} \)).

\[
\text{binary} = f(\text{swcost1}, \text{sevol}, \text{sc8}, \text{dsales1}, \text{dsales2})
\]  

(9)

The results are reported in table 4 (Model 5). The coefficients for the interaction variables for both exchange rate volatility (sevol) and industry concentration (sc8) are negative and statistically significant indicating that both variables strengthen the impact of switching cost on the inertia in ownership adjustments by decreasing the probability of an EI investment to happen. At the same time, industry sales weaken this impact while company sales have a statistically insignificant influence on switching cost’s impact on the inertia in ownership adjustments.

4.5 The Magnitude of Ownership Adjustments

The analysis so far reveals the impact of exchange rate fluctuations on WOS and JV flows and also the influence of various economic, industry and company variables on the inertia in ownership adjustments of foreign subsidiaries. In the present section we extend the analysis further by exploring the factors that determine the magnitude of the pursued ownership increase of a foreign subsidiary given the company’s decision to increase its equity of its foreign subsidiary.

Our data set includes as before the thirty non-US multinational companies that performed more than one EI investment to the same of their US subsidiaries for the period between 1977 and 1994. In our estimations, the dependent variable \((a)\) is the share of the real value of each EI investment out of the real value of the total assets of the US subsidiary receiving the investment. In fact, \((a)\) measures the size of the ownership increase of its US subsidiary a multinational company achieves through an EI as it is given by the increase in its equity share of this subsidiary. On the other hand, the independent variables are the same as before capturing exchange rate expectations (etrend), the volatility of the exchange rate (sevol), market concentration (c8), switchover cost (swcost1 and swcost2), profits of the subsidiary receiving the EI investment (profit1 and profit2), the growth rate of the subsidiary’s sales (dsales1), and finally the growth
rate of industry sales \((d\text{sales}_2)\). The results from estimating the reduced form equation (10), using the Random Effects Model, are reported in table 5.

\[
a = f(e\text{trend}, e\text{vol}, c8, s\text{wcost}, \text{profit}, d\text{sales})
\]  

(10)

The estimated coefficients indicate that an expected depreciation of the home currency with respect to the US dollar \((e\text{trend})\) reduces the size of the ownership increase of the US subsidiary. Also, these results are robust in all the specifications in estimating equation (10). Multinational companies tend to pursue lower ownership increases of their US subsidiaries in case they expect a depreciation of their home currency. Consequently, a depreciated home currency does not favor large ownership increases of foreign subsidiaries, finding that is consistent with hypothesis 1.

Also, market concentration \((c8)\) seems to favor higher ownership adjustments. Multinational companies increase the ownership of their subsidiaries in concentrated industries in anticipation of higher profits stemming from the market power of the companies in highly concentrated industries. Finally, neither the switching cost nor the proxies for profits and sales of the subsidiaries receiving the EI investment seem to influence the size of the ownership adjustments.

5 Conclusions

In the present paper we test empirically, the structure of an important decision a company has to make in supplying a foreign market. This incorporates the factors that influence the decision of the company to adjust its mode of operations in the presence of changing market and macroeconomic conditions.

Our empirical results are in agreement with our theoretical hypotheses. Specifically, it is shown that an appreciated home country currency favors the WOS ownership structure, while a depreciated one favors the JV. On the other hand, the inertia associated with ownership adjustments of a foreign subsidiary becomes stronger with high exchange rate volatility, and in more concentrated, and usually less competitive, industries. Also, the inertia weakens in case of large market demand. Finally, expectations for a depreciation of the home currency depresses the amount of an equity increase of a foreign subsidiary, while market concentration seems to favor higher ownership increases of a foreign subsidiary.
It is in our future plans to extend our empirical research on this topic by testing the inertia in other types of FDI flows such as Mergers and Acquisitions or FDI on New Plants.
Appendix A

Data Sources and Transformations

Countries in the sample: Belgium, Canada, France, Germany, Italy, Japan, Sweden, Switzerland, and United Kingdom.

Bilateral Real Exchange Rate: We follow the same derivations as in Goldberg and Kolstad (1995). Specifically, we multiply the nominal exchange rate, defined as the price of a US dollar in terms of the currency of the home country, and multiplied by the price deflator of the home country and divided by the respective one of US. Then we index it with respect to its 12/1994 value (Source: IMF International Financial Statistics).

Volatility of the real exchange rate: We follow the calculations suggested by Campa and Goldberg (1995), and Goldberg and Kolstad (1995). Specifically, we calculate the standard deviation of a moving average of the real exchange rate for the past 36 months

Consumer Price Index: We use the “Consumer Price Index” for Belgium, Canada, France, Germany, Italy, Japan, Switzerland, UK and the US, and the “Consumer Price” for Sweden. (Source: Datastream International).

Acquisition (AM): A transaction in which title to stock or assets of the U.S. target is secured by another person or enterprise. The substantive result is that one party obtains ownership of another. (Source: ITA Transaction Database, US Department of Commerce).

Equity Increase (EI): An FDI that raises the percentage of securities of US subsidiaries held by a non-US investor. (Source: ITA Transaction Database, US Department of Commerce).

Joint Venture (JV): A transaction in which two or more parties establish a new corporation to which each contributes according to the provisions of the joint venture agreement. (Source: ITA Transaction Database, US Department of Commerce).

Merger (AM): A transaction which results in the dissolution of the acquired business enterprise, either into another already existing or into a reorganized (but not always renamed) company. (Source: ITA Transaction Database, US Department of Commerce).
New Plant (NP): A new operating facility, established either in conjunction with an existing non-US owned productive enterprise or as a completely new venture. (Source: ITA Transaction Database, US Department of Commerce).

Plant Expansion PE: An addition to the capacity of an existing non-US owned operating facility. (Source: ITA Transaction Database, US Department of Commerce).

Company Data: We use the dollar value of inventory, profit, total assets and sales of the US subsidiaries in our sample. (Source: Compustat; in millions of US dollars)
Appendix B

### Table 1. Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Stand. Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>wos</td>
<td>82.950</td>
<td>350.844</td>
<td>0.100</td>
<td>8800.000</td>
</tr>
<tr>
<td>jv</td>
<td>42.310</td>
<td>87.226</td>
<td>0.100</td>
<td>820.000</td>
</tr>
<tr>
<td>evol</td>
<td>12.227</td>
<td>5.888</td>
<td>1.481</td>
<td>32.295</td>
</tr>
<tr>
<td>c8</td>
<td>63.333</td>
<td>21.064</td>
<td>13.200</td>
<td>97.000</td>
</tr>
<tr>
<td>assets</td>
<td>627.304</td>
<td>1235.706</td>
<td>7.925</td>
<td>2723.154</td>
</tr>
<tr>
<td>sales</td>
<td>1044.478</td>
<td>1950.329</td>
<td>12.552</td>
<td>3870.474</td>
</tr>
<tr>
<td>inventory</td>
<td>107.689</td>
<td>790.727</td>
<td>0.00</td>
<td>530.007</td>
</tr>
<tr>
<td>profits</td>
<td>39.184</td>
<td>836.106</td>
<td>-228.213</td>
<td>480.501</td>
</tr>
</tbody>
</table>

Notes: “Assets”, “sales”, “inventory” and “profits” come from the respective financials of the US subsidiaries in our sample that received Equity Increase investment from non-US multinationals (in millions of US dollars).

### Table 2. Correlations: Company Data

<table>
<thead>
<tr>
<th></th>
<th>EI</th>
<th>evol</th>
<th>c8</th>
<th>assets</th>
<th>sales</th>
<th>inventory</th>
<th>profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EI</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>evol</td>
<td>0.238</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c8</td>
<td>-0.164</td>
<td>0.297</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>assets</td>
<td>0.341</td>
<td>-0.371</td>
<td>-0.253</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sales</td>
<td>0.235</td>
<td>-0.373</td>
<td>-0.224</td>
<td>0.962</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>inventory</td>
<td>0.283</td>
<td>-0.047</td>
<td>0.032</td>
<td>0.705</td>
<td>0.784</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>profits</td>
<td>0.593</td>
<td>-0.260</td>
<td>-0.382</td>
<td>0.796</td>
<td>0.712</td>
<td>0.338</td>
<td>1.00</td>
</tr>
</tbody>
</table>
Table 3. Exchange Rates and FDI Inflows in the US.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Dependent Variable: WOS</th>
<th>Dependent Variable: JV</th>
<th>Dependent Variable: EI</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant</td>
<td>3.612* (24.341)</td>
<td>3.119* (8.591)</td>
<td>2.859* (6.134)</td>
</tr>
<tr>
<td>exg</td>
<td>-0.0045*(-3.014)</td>
<td>0.0005 (0.152)</td>
<td>-0.0007 (-0.143)</td>
</tr>
<tr>
<td>etrend</td>
<td>-25.703** (-1.776)</td>
<td>-29.949 (-0.669)</td>
<td>-88.594* (-2.353)</td>
</tr>
<tr>
<td>evol</td>
<td>-0.0039 (-0.619)</td>
<td>-0.032** (-1.888)</td>
<td>0.0094 (0.436)</td>
</tr>
</tbody>
</table>

Sample: 4219 436 534

Notes: The OLS and the Fixed Effects regressions are not reported because they have been rejected in favor of the Random Effects Model. A (*) next to a coefficient indicates its significance at 0.01 level, and a (**) its significance at 0.05 level. The reported t-statistics in parentheses are corrected for heteroscedasticity.
Table 4.  
Hysteresis in Ownership Adjustments of US Subsidiaries

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant</td>
<td>2.347 (3.538)</td>
<td>1.881 (3.259)</td>
<td>2.299 (3.518)</td>
<td>1.963 (3.276)</td>
<td>0.860 (1.865)</td>
</tr>
<tr>
<td>evol</td>
<td>-0.0198 (-2.176)</td>
<td>-0.0199 (-2.231)</td>
<td>-0.0203 (-2.256)</td>
<td>-0.022 (-2.450)</td>
<td></td>
</tr>
<tr>
<td>c8</td>
<td>-0.218 (-2.002)</td>
<td>-0.222 (-1.972)</td>
<td>-0.204 (-1.870)</td>
<td>-0.188 (-1.713)</td>
<td></td>
</tr>
<tr>
<td>swcost1</td>
<td>-1.338** (-1.774)</td>
<td>-1.351** (-1.811)</td>
<td>-0.985 (-1.515)</td>
<td>0.567 (0.596)</td>
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<tr>
<td>swcost2</td>
<td>-0.714 (-1.113)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>profit1</td>
<td>-1.287 (-1.614)</td>
<td>-1.110 (-1.545)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>profit2</td>
<td></td>
<td></td>
<td>-1.320 (-1.534)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dsales1</td>
<td></td>
<td></td>
<td></td>
<td>-0.0001 (-0.052)</td>
<td></td>
</tr>
<tr>
<td>dsales2</td>
<td>0.241* (2.692)</td>
<td>0.244* (2.694)</td>
<td>0.243* (2.686)</td>
<td>0.222* (2.429)</td>
<td></td>
</tr>
<tr>
<td>sevol</td>
<td></td>
<td></td>
<td></td>
<td>-0.0302* (-2.499)</td>
<td></td>
</tr>
<tr>
<td>sc8</td>
<td></td>
<td></td>
<td></td>
<td>-0.269** (-1.766)</td>
<td></td>
</tr>
<tr>
<td>sdsales1</td>
<td></td>
<td></td>
<td></td>
<td>-0.262E-03 (-0.088)</td>
<td></td>
</tr>
<tr>
<td>sdsales2</td>
<td></td>
<td></td>
<td></td>
<td>0.285* (2.389)</td>
<td></td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>-51.598</td>
<td>-52.665</td>
<td>-51.851</td>
<td>-54.042</td>
<td>-53.851</td>
</tr>
<tr>
<td>Pseudo $R^2$</td>
<td>0.172</td>
<td>0.156</td>
<td>0.169</td>
<td>0.146</td>
<td>0.149</td>
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<tr>
<td>Sample</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>98</td>
<td>98</td>
</tr>
</tbody>
</table>

Notes: A (*) next to a coefficient indicates its significance at 0.01 level, and a (**) its significance at 0.05 level. The reported t-statistics in parentheses are corrected for heteroscedasticity.
Table 5.
Size of Ownership Change of US Subsidiaries

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant</td>
<td>-0.042</td>
<td>-0.020</td>
<td>-0.065</td>
<td>-0.263</td>
</tr>
<tr>
<td></td>
<td>(0.117)</td>
<td>(-0.058)</td>
<td>(-0.181)</td>
<td>(-0.076)</td>
</tr>
<tr>
<td>etrend</td>
<td>-37.400*</td>
<td>-37.279*</td>
<td>-37.929*</td>
<td>-34.885*</td>
</tr>
<tr>
<td></td>
<td>(-3.359)</td>
<td>(-3.407)</td>
<td>(-3.437)</td>
<td>(-3.489)</td>
</tr>
<tr>
<td>evol</td>
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<td>0.010</td>
<td>0.101</td>
<td>0.0069</td>
</tr>
<tr>
<td></td>
<td>(1.415)</td>
<td>(0.129)</td>
<td>(1.475)</td>
<td>(1.103)</td>
</tr>
<tr>
<td>c8</td>
<td>0.152**</td>
<td>0.159</td>
<td>0.156**</td>
<td>0.127</td>
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<td></td>
<td>(1.828)</td>
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<td>(1.886)</td>
<td>(1.610)</td>
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<td>(-0.635)</td>
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<td>(-1.038)</td>
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<td></td>
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<td>(0.196)</td>
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</tr>
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<td>profit2</td>
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<td>(-1.915)</td>
<td></td>
</tr>
<tr>
<td>dsales2</td>
<td>0.084</td>
<td>0.082</td>
<td>0.078</td>
<td>0.105**</td>
</tr>
<tr>
<td></td>
<td>(1.429)</td>
<td>(1.414)</td>
<td>(1.332)</td>
<td>(1.857)</td>
</tr>
<tr>
<td>Sample</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>52</td>
</tr>
</tbody>
</table>

Notes: The OLS and the Fixed Effects regressions are not reported since they have been rejected in favor of the Random Effects Model. A (*) next to a coefficient indicates its significance at 0.01 level, and a (**) its significance at 0.05 level. The reported t-statistics in parentheses are corrected for heteroscedasticity.
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Austin, J.E. (1990), Managing in Developing Countries: Strategic Analysis and Operating Techniques, Free Press, New York.


