On the Origins of the Multinational Premium *

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Abstract

This paper studies the relationship between management, firm expansion, and firm risk exposure. We document two empirical regularities. First, firms run by better managers are more likely to become multinationals (MNEs). Second, risk premia are higher for current and future MNEs compared to firms that sell always and only in their domestic market. To provide a mechanism that connects these facts, we develop a dynamic model in which managerial ability shapes the relationship between firm characteristics, selection into FDI, and risk premia. The model lends itself to a quantitative analysis that exploits its mechanisms to suggest that distortions to the market for managerial talent may affect multinational activity and financial market outcomes.

Keywords: multinational firms, management, stock returns.

JEL Classification: F12, F23, F36.

1 Introduction

Managers have an impact on many firm decisions, some of them related to the firm global presence, and hence to the risks a firm is exposed to. Take Sergio Marchionne as an example. Before taking over Italian carmaker Fiat, Marchionne was CEO of SGS, a Swiss-based multinational company specializing in inspection, testing, and certification services. This role gave him deep experience running a complex internationally active firm. In 2004, he became CEO of Fiat, which at the time had a very limited international footprint. Marchionne pushed Fiat onto the global stage — most notably by orchestrating the acquisition of Chrysler in 2009, and eventually merging the two into Fiat Chrysler Automobiles (FCA), a multinational with major operations

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across Europe, North America, and beyond. His prior experience leading a multinational is widely credited with giving him the strategic framework and confidence to execute such an ambitious global expansion.

In this paper, we study the relationship between management, firm expansion, and firm risk exposure. More precisely, we examine firm expansion via entry into foreign markets through foreign affiliates (multinational entry). We argue that managers play an important role in the decisions of firms to engage in multinational activity, and that managerial characteristics affect the risk exposure of these firms. Specifically, we focus on the role of the CEO, as CEOs have a strong influence on firms' decisions that affect strategy, risk, portfolio, and footprint. CEOs may have a direct impact on decision making or, equivalently, influence decision making by designing processes, culture, and structures at the firm level. Therefore, it is natural that CEO characteristics simultaneously determine the firm's risk profile and its international presence, directly or indirectly.

We establish two empirical regularities. Our first fact establishes a relationship between managerial expertise and firm expansion. Firms run by "better managers" are more likely to become multinationals (MNEs). We proxy for managerial quality using measures of the expertise of a manager within multinational firms, and manager compensation measures. We provide evidence on the mechanism linking managerial ability and multinational expansion by showing that firms' fixed costs are correlated with manager characteristics. In particular, the correlation of managerial ability and firm-level fixed costs depends on the firm international status: MNEs (domestic firms) with high ability managers have lower (higher) fixed costs than than MNEs (domestic firms) with low ability managers, reflecting a possible impact of managerial know-how on operating costs.

Our second fact establishes a relationship between firms' multinational activity and risk exposure. We find that the risk premia of current and future MNEs –the latter being defined as firms that currently operate only in their domestic market, but will engage in FDI sometime in the future– are higher than the risk premia of firms that sell always and only in their domestic market. We establish this fact by looking at differences in long-term average stock returns and differences in firm *betas* for firms with different multinational status.

To provide a narrative that connects and rationalizes these novel empirical patterns, we nest a dynamic model of foreign direct investment with endogenous firm-manager assignment into a standard consumption-based asset pricing model. In the model, heterogeneous firms decide the type of manager they hire and whether and when to enter the foreign market and become multinationals. Consistently with our empirical evidence, we assume that firms that are run by high-ability managers have higher fixed costs of domestic operations but lower fixed costs of multinational expansion than firms that are run by low-ability managers. The manager hiring process is modeled as a competitive search framework with coordination frictions á la Shimer (2005), where firm characteristics and the effect of managerial ability on firm costs shape the distribution of managerial compensation and the likelihood of a firm-manager match. In the model, on average, more productive firms tend to hire better managers and –as a result– firm productivity and managerial

ability jointly drive selection into FDI.

Dynamics in the model economy are driven by fluctuations in aggregate consumption. Accordingly, the aggregate source of risk is given by fluctuations in the agents' stochastic discount factor. Firm-level expected stock returns in the model, in turn, are given by the covariance between the stochastic discount factor and changes in the value of the firm. Managerial ability and multinational status, by affecting firms' fixed operating costs, also affect firm operating leverage and drive heterogeneity in firm exposure to aggregate risk, and hence heterogeneity in expected returns.

The model is extremely tractable and delivers analytical predictions that rationalize the empirical regularities we document. First, and naturally, since high-ability managers reduce the fixed costs of FDI, firms that are run by better managers are more likely to become MNEs. Second, since domestic firms run by high-ability managers have a higher option value of starting FDI, they have higher expected returns than domestic firms run by low-ability managers. Since domestic firms that are run by higher ability managers are more likely to become MNEs, these predictions rationalize the future MNEs' risk premia. Third, since high-ability managers reduce the fixed costs of FDI, they reduce MNEs' operating leverage, so that MNEs run by high-ability managers have lower returns than MNEs run by low-ability managers. Lastly, our model predicts a positive correlation between managerial compensation, managerial ability, and the multinational status of the firm, a feature that is also consistent with the data.

We believe that this is the first paper to show a systematic relationship between managerial characteristics, firms' multinational status, and firm risk. Since the assumptions we make in setting up the model are carefully driven by the empirical evidence, we are confident in exploring its lessons further. We calibrate the model to match moments related to aggregate multinational activity, managerial compensation, and expected returns. We then exploit the implications of the model for managerial compensation in a quantitative analysis that studies the effects of distortions to the market for managerial talent for aggregate real and financial market outcomes. Our results suggest that taxing firms with high CEO pay (a measure that has been proposed and discussed in the US Congress) may distort firms' efficient entry into foreign markets, reduce the gains from openness, and skew the size distribution of firms that make up the market portfolio, with ambiguous effects for aggregate asset prices. In addition, we study the effects of multinational taxation on multinational activity, both directly and indirectly, through the effect that MNE taxation has on the market for managerial talent.

Our analysis is made possible by a novel data set derived from a combination of sources. We combine firm-level data from Compustat and from the Center for Research on Security Prices (CRSP) with manager information from Execucomp and Boardroom Alpha, which track the CEOs of a sub-sample of publicly listed firms. CRSP contains data on one of our dependent variables of interest, the stock returns of the firm, used to construct our measures of risk premium. Compustat has accounting data that allow us to control for several firm characteristics. We recover information about the multinational status of the firm from the SEC

10-K filings using a textual analysis algorithm that identifies the existence and location of each firm's foreign subsidiaries. The resulting sample is an unbalanced matched firm-manager panel for the period 1993-2017. It is important to point out that our data are unique in that they allow us to compare a firm's characteristics before and after its first episode of multinational entry, and to observe the managerial history of the firm.

Our emphasis on management as an important driver of firm decisions links this paper to a rich literature on the role of managers for firms' outcomes. Theoretically, the link between managerial ability and the firm's returns to scale is reminiscent of Lucas (1978), where managerial ability affects firms' returns to scale through a "span of control" technology. In our setup, the relationship between managerial ability and returns to scale is modulated by the firm's fixed cost function, consistent with the empirical evidence. A positive relationship between firm productivity and managerial ability is also present in Terviö (2008) and Gabaix and Landier (2008), who model the match between firms and managers through an assignment model. Our modeling of the managers' market, based on Shimer (2005)'s competitive search framework, produces analogous results in terms of positive assortative matching between firms and managers, and it allows us to evaluate distorsions to manager hiring in a more flexible way. Empirically, several papers examine the relationship between management and firm performance using the World Management Survey, most notably, Bloom and Van Reenen (2007), and Bloom et al. (2013). We build on this literature by examining the relationship between managerial ability and multinational activity. Our emphasis on risk premia makes our paper also close to contributions in finance. Bertrand and Schoar (2003) investigate how individual managers affect corporate behavior and performance, and Schoar et al. (2020) study the effect of managers on firm's exposure to systematic risk. To deepen our understanding of the properties of management that drive firm outcomes, Malmendier and Tate (2008) highlight the role of managerial overconfidence. Our paper contributes to this line of research by finding that managers affect both the risk exposure of a firm and also its likelihood of engaging in FDI, especially thanks to the skills that they acquire by working in multinational firms.

This paper contributes to the literature at the intersection of international economics, asset pricing, and corporate finance. There is a growing literature studying the relationship between risk, stock returns, and firms' international activities. De Sousa et al. (2020), Esposito (2022), and Heiland (2021) study export decisions in risky environments. Barrot et al. (2019) and Bianconi et al. (2021) link measures of globalization and trade policy to asset prices. The analysis of the decisions of MNEs under conditions of risk is inherently more complex, as it involves decisions about the location of production. International macro analyses of the risk implications of multinational production are featured in Rowland and Tesar (2004) and Ghironi and Wolfe (2018). Ramondo and Rappoport (2010) and Fillat et al. (2015) study MNEs' location decisions in risky environments. By exploiting cross-sectional variation across firms, Fillat and Garetto (2015) document stock return differentials among multinationals, exporters, and domestic firms, and rationalize them within a model where the different fixed costs associated with international activities drive operating leverage and heterogeneity in returns. This paper contributes to this line of work by examining the role of managers in

the dynamic relationship between multinational entry and stock returns.

Lastly, our analysis is related to a large empirical literature in finance focusing on anomalies or regularities in the cross section of expected returns that cannot be rationalized by theoretical models. The seminal work in Fama and French (1993) presents evidence on the relation between firm stock returns, aggregate market returns, book-to-market ratios, and market value. They find that market betas—the slope of a regression of individual stock returns on the aggregate market return—are not sufficient to describe the cross section of returns. This suggests that there is more than one source of aggregate risk. The extensive literature generated by this finding cannot be adequately summarized here. Our paper's analysis aligns more closely with studies such as Berk et al. (1999) and Gomes et al. (2003), which explore the implications of production and investment on the cross section of returns and argue that firms' exposure to a single systematic source of risk does explain the cross-sectional differences but only conditional on the firm's life cycle. The results in Berk et al. (1999) rely on the difference between assets in place and growth options, and Gomes et al. (2003) account for cross-sectional differences in firm productivity in addition to differences in growth options. These papers establish a negative relationship between productivity and stock returns, conditional on firm size. In our model, the relationship between productivity and stock returns is further modulated by the role of managerial ability and the decision to undertake foreign investment.

2 Data and summary statistics

Our data set derives from combining several sources: the linked CRSP-Compustat data, the 10-K files, Execucomp, and Boardroom Alpha. For robustness checks, we also use information from the Thomson Reuters Mergers & Acquisitions database, and the World Management Survey.[1] Our sample period spans 25 years, from 1993 through 2017.[2]

The linked CRSP-Compustat dataset contains quarterly accounting data and monthly stock returns of publicly listed firms in the United States, providing a comprehensive picture of firms' accounting data over a long period of time. CRSP-Compustat, however, has no information on firms' international activities. We recover information about each firm's exposure to international markets from the firm's 10-K filings, which firms with publicly traded securities are required to file annually by the Securities and Exchange Commission (SEC). More precisely, we extract data from the text of each firm's Exhibit 21, a document that lists the firm's set of significant subsidiaries and the countries where they are located.[3] We define a firm as a *multinational* in a given year if it reports the existence of foreign affiliates in its Exhibit 21.

[1] See Bloom et al. (2013) for a description of the survey.

[2] We set the start of the sample period to 1993 because the coverage of the Boardroom Alpha data is significantly worse prior to that year.

[3] The 10-k data include both direct and indirect subsidiaries into the Exhibit 21. Inclusion in the data is determined by a reporting threshold based on the ratio of sales over assets, not on ownership share. Precisely, firms must report subsidiaries that represent at least 10% of consolidated assets or 10% of consolidated income. Appendix A contains details of the textual analysis procedure and examples of the information contained in Exhibit 21.

Alternately, we define a firm as *domestic* in a given year if its Exhibit 21 does not report the existence of foreign subsidiaries.[4] The resulting sample contains data for 11,982 firms, among which 41.2 percent don't report any foreign subsidiaries at any point in time (*always domestic* firms), while 23.8 percent report the existence of foreign affiliates every year they are present in the sample (*always MNEs*).[5] The remaining firms exhibit changes in international status during their life: we define as *new MNEs* those firms that enter the sample as domestic and gain exposure to foreign markets via a merger with or an acquisition of a foreign firm, or by establishing an affiliate afresh. We use the term *other firms* to refer to firms that enter the sample as MNEs but stop reporting the existence of foreign affiliates later in their life.

Table 1 reports firm counts and summary statistics of size measures of the firms in our sample. The table confirms the well-known fact that MNEs are larger than domestic firms in terms of sales, employment, and market capitalization.

Table 1: Firm Characteristics by Firm Type.

	Revenue (USD Million)	Employees (Thousands)	Mkt. Cap. USD Million	Nr. of Firms
Always Dom.	85.96	1.59	470.96	4936
Always MNE	740.86	9.83	4508.23	2846
New MNE	312.00	5.06	1426.04	2732
Other Firms	333.99	5.64	1517.44	1382

Note: Firms missing all quarterly returns are dropped. Source: CRSP/Compustat and SEC 10-K filings.

In our sample, foreign affiliates are located in 169 countries. The geographic distribution of FDI activity is comparable to other data sets, including the Bureau of Economic Analysis data on the operations of multinational enterprises.[6] It is worth noting that our merged data set is unique in its capacity to identify US firms' entry into multinationality: the information contained in the 10-K affiliate reporting informs us about the extensive margin of multinational activity, on aggregate and by foreign country.[7]

Since part of our empirical analysis focuses on stock returns, Table 2 reports summary statistics of firm-level stock returns by firm type.[8] A comparison of mean and median returns across groups shows that i)

[4]Non-multinational firms could also be exposed to foreign markets through exports. In a robustness exercise, we performed all the empirical analysis contained in this paper after dropping from the sample all firms that report exports but not foreign affiliates at any point in time. The results, available upon request, are qualitatively unchanged compared with the baseline specification.

[5]These numbers reveal the selection of firms populating the Compustat sample: since the data set contains only publicly listed firms, only the largest firms in the economy are represented, so the share of multinationals is much higher than in the entire population of firms.

[6]See Appendix Figures B.1 and B.2. Garetto et al. (2026) report the same sorting properties of FDI destinations for US MNEs using the Bureau of Economic Analysis (BEA) data.

[7]Most empirical analyses of US MNEs use the affiliate-level data from the Bureau of Economic Analysis (https://www.bea.gov/surveys/diasurv), which is a sample including only MNEs, hence it does not allow us to observe these firms *before* they become MNEs.

[8]Stock returns are defined as one-year capital gains plus dividend yields: $R_{t+1} = (p_{t+1} + d_t)/p_t$, where p_t denotes the price of a share and d_t the dividends per share at time t. We identify firm-level returns with the returns of the firm's common equity. We compound monthly returns to the annual level for the summary statistics and to the quarter level for the regressions in Section 3.

MNEs have on average higher returns than domestic firms (consistent with Fillat and Garetto, 2015); and ii) new MNEs (established either through M&A or greenfield investment) have higher returns than firms that are MNEs throughout the entire sample period. Interestingly, the groups that present higher mean and median returns also tend to have lower standard deviations of returns: the returns of new MNEs tend to be higher *and* less volatile than the returns of other firms. The return differentials shown in Table 2 are robust to the inclusion of size controls and industry-quarter fixed effects.

Table 2: Annualized Quarterly Returns by Firm Type.

	Mean	Median	Standard Dev.
Always Dom.	4.37	5.04	16.87
Always MNE	5.31	5.92	15.89
New MNE	7.15	6.78	10.60
Other Firms	6.73	6.35	11.52

Note: Firms missing all quarterly returns are dropped. Source: CRSP/Compustat and SEC 10-K filings.

We augment our firm-level data with management information by merging in CEO-firm pairs obtained from Execucomp and Boardroom Alpha. These data sets track several levels of executive positions. We focus on the CEO as an important driver of the decisions that are relevant to our paper: firm expansion into foreign countries. 46.05% (28.11%) of firms in our sample have information about the identity of their CEO at some point in their lifetime (for their entire lifetime). The CEOs sample is composed of 10,391 managers, 690 (6.64%) of whom change company at some point in the sample period. Since managers exhibit limited mobility across firms, the average (median) number of managers that a firm has during its life in the sample is 1.9 (1).

Our analysis links firms' MNE expansion to managerial characteristics. Given the difficulty of measuring managerial ability, we focus on observable characteristics of the managers that we can construct in our data set. More specifically, our data provide us with information on the involvement of managers in multinational activity. 70.07% of managers in our sample worked for a MNE at some point in their lifetime. However, only 19.59% of managers in our sample oversaw their firm's transition from being domestic to becoming a multinational. Looking at the extensive margin of countries, 35.66% of managers in our sample oversaw their firm's entry into a new country. We use this information to construct measures of managerial ability based on the manager's expertise at multinational firms.

Finally, we perform some robustness exercises using a smaller sample of firms which exploits additional data on management practices contained in the World Management Survey.[9] We use the aggregate score of management practices for the subset of surveyed firms that are headquartered in the United States and are

[9]The survey methodology is described in detail in Bloom and Van Reenen (2007). Each surveyed firm provides scores for different management practices for each firm. The management score is an aggregation of practices related to operations management, performance monitoring, target setting, leadership management, and talent management. We successfully match 238 firms to our Compustat sample.

publicly traded.

3 Empirical Analysis

In this section we establish two empirical findings: 1. Firms run by "higher ability" managers are more likely to become multinationals; 2. Current and future MNEs command a higher risk premium than firms that sell always and only in their domestic market. The uniqueness of our merged data, which contains information about firms' characteristics, international presence, and identity of the managers, allows us to explore these three dimensions simultaneously.

3.1 Management and Multinational Entry

There is a large empirical literature documenting the role of managers and managerial practices for various aspects of firm performance.[10] Inspired by this literature, we explore the relationship between managerial characteristics and firm expansion through multinational entry. We run the following regression:

$$M_{it} = \alpha + \beta A_{mt} + \gamma X_{it} + \delta_{NAICSt} + \delta_i + \varepsilon_{it}. \tag{1}$$

The left-hand side variable M_{it} is a "MNE dummy" taking value 1 if firm i reports having foreign affiliates in quarter-year t. The term A_{mt} denotes measures of managerial ability which leverage the information that our data make available about the employment history of the managers. In particular, we look at managers' expertise within multinational firms: A_{mt} denotes a dummy taking value 1 if the manager had previous experience guiding a firm through a transition from domestic to multinational (column 1), or if the manager previously worked in a MNE (column 3), or reports the number of countries where the manager opened affiliates while working at previous firms (column 2). In column 4, we proxy managerial ability with the manager compensation.[11] The regressions include among the explanatory variables a vector of time-varying firm-level controls X_{it} including capital/labor ratio, sales per employee (our measure of productivity), measures of size (such as total revenues and market capitalization), leverage, the firm annual market *beta*,[12] industry-quarter and firm fixed effects.

[10] Bloom et al. (2013) illustrate the existence of a relationship between good managerial practices and multinational activity: they show that multinational corporations consistently achieve higher management scores in the WMS compared to domestic firms, regardless of their location or country of incorporation.

[11] Since only about 20% of managers guide firms through transitions into multinationality, and managers' mobility is low, only about 1% of managers have "high ability" according to the most restrictive definition (having guided a previous firm through a transition from domestic to multinational).

[12] The market *beta* of the primary security of firm i captures the comovement of the firm's excess returns with the aggregate excess market returns. We computed yearly market *betas* at the firm level by running regressions of daily individual security returns on the market aggregate returns (NYSE, AMEX, and Nasdaq) for each year firm i present in our sample. The risk-free rate is the yield on the three-month US Treasury Bill. The purpose of adding the market *betas* is to control for each firm's individual exposure to aggregate market risk. Results are robust to alternative ways to compute firm-level betas (e.g., at the quarterly level or annual rolling windows).

Table 3: Becoming a Multinational: Management Matters

	(1)	(2)	(3)	(4)
Previous MNE transition experience	0.052***			
	(0.013)			
Number of country entries		0.006***		
		(0.002)		
Previous MNE experience			0.034***	
			(0.006)	
Log-compensation				0.008***
				(0.001)
Observations	133,519	133,519	133,519	111,428
Adjusted R-squared	0.701	0.701	0.701	0.719

Note: The dependent variable is a dummy taking a value of 1 if a firm is a multinational in quarter-year t. The variable "Previous MNE transition experience" ("Previous MNE experience") takes the value of 1 if the manager has prior experience in guiding another firm's transition from domestic to MNE (in working at an MNE). "Number of countries entries" denotes the natural log of 1 + the number of countries where previous MNEs established new affiliates under the manager's leadership. All specifications include market capitalization, leverage ratio, sales per employee, capital per employee, and the firm *beta* as controls, and industry-quarter and firm fixed effects. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Source: CRSP/Compustat, SEC 10-K filings, Execucomp, Boardroom Alpha.

The results of these regressions are shown in Table 3. All the proxies of managerial ability are positively correlated with the multinational status of the firm.[13] Since the regressions include firm fixed effects, coefficients are identified from firms that change multinational status during the sample period. Precisely, a domestic firm that is managed by a CEO who has prior experience in expanding a domestic firm beyond domestic borders has an 5.2 percentage points higher probability of becoming multinational compared with a domestic firm managed by a manager without such experience. In addition, for every country that the manager has expanded into in their previous jobs as CEO, the probability of becoming multinational increases by 0.6 percentage points. Given that the median (average) number of countries entered by a manager with MNE entry experience is 5 (9.72), hiring a manager that has led previous firms through one more country entry episode than the median (average) leads to an increase of 3.6 (6.4) percentage points in the probability of becoming a multinational.

Table 3 focuses on manager characteristics that are measurable in our data, and that appear intuitively important. In line with the methods of the corporate finance literature (see most notably Bertrand and Schoar, 2003 and Schoar et al., 2020), Appendix Table C.2 reports the result of a regression analogous to (1), but where managerial characteristics are replaced by manager fixed effects. Lastly, the role of managerial practices for multinational activity is also confirmed by a probit regression run on the smaller WMS sample:

[13] In the interest of space, we only show the coefficients on the managerial ability proxies. Appendix Table C.1 reports the full results of regression (1), including the estimated coefficients on the controls X_{it}.

Table 4: Exogenous variation in CEO and CEO experience.

	(1) ΔM_{it}	(2) ΔM_{it+1}	(3) ΔM_{it+2}	(4) ΔM_{it+3}	(5) ΔM_{it+4}	(6) $\Delta M_{i,t_0-t_4}$
$NewCEO_{t-1}$	-0.017***	0.101	-0.016*	-0.010	0.216**	0.276**
	(0.006)	(0.075)	(0.008)	(0.006)	(0.098)	(0.112)
$NewCEO_{t-1} \times A_{mt}$	-0.001	0.004**	-0.000	-0.000	0.006**	0.009***
	(0.000)	(0.002)	(0.000)	(0.000)	(0.003)	(0.003)
Observations	52695	52695	52695	52695	52695	52695
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	-0.031	-0.076	-0.032	-0.031	-0.336	-0.107

Note: The dependent variable ΔM_{it} takes the value of 1 if the company becomes a multinational in a given year t. The dummy $NewCEO_{t-1}$ takes the value of 1 if the company hires a new CEO in the previous 4 quarters. The variable $A_{i,t-1}$ is the number of countries the CEO expanded into in the previous 4 quarters. $NewCEO_{t-1}$ and $NewCEO_{t-1} \times A_{i,t-1}$ are instrumented exploiting information on previous CEO death. Source: CRSP/Compustat, SEC 10K filings, Execucomp, Boardroom Alpha, Factiva.

managerial practices are positively correlated with and contribute to explaining a firm's multinational status, as shown in Appendix Table C.3.

The selection of firms' CEOs is not exogenous, which could introduce endogeneity bias into our results. To at least partially address this concern, we perform a robustness exercise that exploits quasi-exogenous changes in firms' management. We hand-collected information on CEO deaths from news sources (Factiva), identifying 81 active CEOs of Compustat companies in our sample who passed away. We use these events as an instrument to examine the impact of CEOs's ability on a firm's likelihood of becoming a multinational enterprise, by focusing on CEOs hired after an unexpected CEO death.

Specifically, we run a regression of changes in multinational status on manager changes after episodes of CEO death. The dependent variable ΔM_{it} takes the value of 1 if the company becomes a multinational in a given year t. The dummy $NewCEO_{t-1}$ takes the value of 1 if the company hires a new CEO in the previous 4 quarters. The variable $A_{m,t-1}$ is one of our measures of managerial ability, namely the number of countries the CEO expanded into in the previous 4 quarters. We instrument $NewCEO_{t-1}$ with a dummy variable taking the value of 1 if the company has experienced a death in the previous 4 quarters. We instrument $NewCEO_{t-1} \times A_{m,t-1}$ with the interaction between the death variable and managerial ability measures.[14]

The results are summarized in Table 4. Column (1) shows the contemporaneous effect of a new CEO on firm status, while columns (2)–(5) show the effects in the subsequent 1, 2, 3, and 4 years, respectively, Column (6) summarizes the cumulative effect. We find that the exogenous appointment of a CEO with MNE experience increases the likelihood of a firm becoming a multinational by almost 1 percentage point more compared to a new CEO without such experience, in any of the subsequent four years.

[14]Our regressions include the same firm-level controls as (1), that is, market capitalization, leverage ratio, sales per employee, capital per employee and firm beta, in addition to industry fixed effects.

What is the mechanism by which managerial ability increases the likelihood that a firm engages in FDI? The international trade literature, both empirical and theoretical, has stressed the importance of fixed frictions as a deterrent to firm entry into foreign markets (see, among others, Helpman et al. 2004). To shed light on the mechanism linking managerial characteristics and multinational entry, we investigate the relationship between managers' characteristics and the firms' fixed costs. To this end, we run a regression analogous to (1), but with a measure of firm-level fixed costs ("Selling, General and Administrative Expense") on the left-hand side:[15]

$$\log(f_{it}) = \alpha + \beta_1 M_{it} + \beta_2 A_{mt} + \beta_3 M_{it} \times A_{mt} + \gamma X_{it} + \delta_{NAICSt} + \delta_i + \varepsilon_{it}. \quad (2)$$

Regression (2) examines the correlation of firm-level fixed costs with multinational status M_{it} and managerial ability A_{mt}. The results of this regression are reported in Table 5.[16] While MNEs tend to have higher fixed costs than non-multinational firms, consistent with what the theoretical literature posits (see, among others, Helpman et al., 2004), the relationship between managerial ability and firm's fixed costs depends on the firm's multinational status. All our proxies of managerial ability are positively correlated with the fixed operating costs of domestic firms, while the correlation with the fixed operating costs of MNEs is negative. This is an important finding, as fixed costs play a crucial role in the engagement of firms in multinational activities.

Building on the evidence shown in this section, in our model we assume that managerial ability affects the fixed costs of domestic and foreign operations differently.

3.2 Multinational Premia

We follow two complementary approaches to establish a relationship between firms' multinational status and firm-level risk premia. First, we study the correlation of firm characteristics, including indicators of multinational activity, with expected returns and firm-level market *betas*. We take expected returns as a measure of risk because, keeping everything else constant, and under standard risk aversion specifications, riskier investments should have higher expected returns than safer investments. The firm-level market *betas* represent the individual firms' exposure to systematic risk.[17] Second, we examine whether the covariance of indicators of multinational activity with aggregate risk factors drives the risk premia of multinational firms.

[15] The description of the variable "Selling, General and Administrative Expense" in Compustat reports that *"this item represents all commercial expenses of operation (i.e., expenses not directly related to product production) incurred in the regular course of business pertaining to the securing of operating income"*. Since Compustat does not report separate accounting data for a firm's headquarters and its subsidiaries, this measure should be interpreted as describing the total fixed costs of the entire corporation.

[16] Also for this table, in the interest of space, we do not report the estimated coefficients on the controls. Appendix Table C.4 reports the full results of regression (2).

[17] We use long-run average stock returns as an empirical measure of expected returns. The firm-level market *betas* are estimated by regressing the daily stock returns of individual firms on market returns (NYSE, AMEX, and Nasdaq), for every year. The distribution of the estimated market *betas* is shown in Appendix Figure C.1.

Table 5: Managerial Experience is Negatively Related to Firm Fixed Costs

	(1)	(2)	(3)	(4)
MNE	1.183***	1.178***	1.176***	1.010***
	(0.015)	(0.015)	(0.015)	(0.157)
Previous MNE transition experience	0.239***			
	(0.086)			
MNE x Previous MNE transition experience	-0.096			
	(0.098)			
Number of country entries		0.389***		
		(0.030)		
MNE x Number of country entries		-0.138***		
		(0.031)		
Previous MNE experience			0.524***	
			(0.053)	
MNE x Previous MNE experience			-0.119**	
			(0.057)	
Log-compensation				0.612***
				(0.017)
MNE x Log(compensation)				-0.035*
				(0.020)
Observations	102,379	102,379	102,379	86,433
Adjusted R-squared	0.454	0.457	0.456	0.614

Note: The dependent variable is log-firm-level fixed costs, measured as "Selling, General and Administrative Expense". The variable "Previous MNE transition experience" takes the value of 1 if the manager has prior experience in guiding another firm's transition from domestic to MNE. "Number of countries entries" denotes the natural log of 1 + the number of countries where previous MNEs established new affiliates under the manager's leadership. All specifications include market capitalization, leverage ratio, sales per employee, capital per employee, and the firm *beta* as controls, and industry-quarter fixed effects. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Source: CRSP/Compustat, SEC 10-K filings, Execucomp, Boardroom Alpha.

This analysis takes the form of portfolio regressions in which the construction of the portfolios is based on multinational status.

3.2.1 Characteristics Regressions

To identify a cross-sectional correlation between a firm's multinational status and its stock returns, we regress firm-level stock returns on MNE dummies and on a set of firm characteristics, following an approach similar to Fillat and Garetto (2015). We also regress firm-level market *betas*, which capture the firms' exposure to systematic risk, on firm characteristics. The estimates provide insights into how firms' multinational status is associated with their systematic risk exposure.

In these specifications, we acknowledge that multinational activity is an endogenous choice of the firm, and our data allow us to identify the time when firms start operating abroad. We take advantage of this dimension of the data to investigate whether multinational firms exhibit higher returns than domestic firms not only during, but also prior to their engagement in foreign markets. To do so, we examine both *current* and *future* MNEs, where we define future MNEs as firms that are currently domestic, but will become MNEs in future periods. Stock returns can be influenced by the market's anticipation of the future MNE status. This concern is mitigated in the regression of market *betas* on firm characteristics, as the market *betas* are a backward-looking measure, and their relationship with future MNE status can be examined with a lower degree of look-ahead bias.

We compare the stock returns and market *betas* of current and future MNEs with the stock returns and market *betas* of firms that are domestic for the entire sample period. To do so, we regress:

$$y_{it} = \alpha + \beta_m M_{it} + \beta_f [1 - M_{it}] \cdot \max_{\tau > t} M_{i\tau} + \gamma X_{i,t} + \delta_{NAICSt} + \varepsilon_{it}, \tag{3}$$

where the dependent variable y_{it} denotes the stock returns of firm i in quarter-year t, or the annual market *beta* of firm i in year t. Like in regression (1), M_{it} is a dummy variable that takes a value of 1 if firm i is an MNE at time t. The combination of dummies $[1 - M_{it}] \cdot \max_{\tau > t} M_{i\tau}$, instead, takes a value of 1 if firm i is not an MNE at time t, but will become an MNE at some future time $\tau > t$. The other controls have been defined in the previous section.

The coefficient of the current MNE dummy, β_m, identifies the cross-sectional differential stock returns (firm *beta*) of multinational firms compared with always domestic firms (the excluded category) within an industry-quarter bin. The coefficient β_f measures the additional stock returns (firm *beta*) that firms that are not currently MNEs, but will be at some point in the future, carry over always domestic firms. To correct for the fact that the number of future MNEs decreases by construction toward the end of our sample period, we run the regression using data for the first half of the sample only: $t = 1993, ...2005$, so that τ can go up to 12 years after t.

Table 6: Stock Returns and Market *betas* of Current and Future MNEs.

	ret_{it}		$beta_{it}$	
	(1)	(2)	(3)	(4)
Current Multinationals	1.119***	0.949***	0.163***	0.134***
	(0.285)	(0.307)	(0.008)	(0.008)
Future Multinationals	1.570***	1.424***	0.118***	0.080***
	(0.328)	(0.353)	(0.009)	(0.009)
Observations	30,992	28,885	30,992	28,885
Adjusted R-squared	0.059	0.056	0.243	0.245
Current minus Future MNE p-Val	.157	.139	0	0
PSM	No	Yes	No	Yes

Note: The dependent variable y_{it} is annual firm-level stock returns (columns 1-2) or firm-level annual market betas (columns 3-4). Controls include market capitalization, leverage ratio, sales per employee, capital per employee, and the firm *beta*. All specifications include industry-quarter fixed effects. The sample excludes "Other MNEs" or firms that enter the sample period as MNEs and later switch to only domestic operations. Columns 2 and 4 feature a propensity score-weighted control group. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Source: CRSP/Compustat and SEC 10-K filings.

Table 6 presents the results.[18] Columns 1-2 show that multinational firms exhibit significantly higher stock returns compared with domestic firms, consistent with what Fillat and Garetto (2015) show for the manufacturing sector. In addition, Table 6 indicates that, prior to MNE entry, future MNEs already have higher stock returns compared with domestic firms. In our baseline specification (column 1), the premia for current and future MNEs are both sizeable, and they are statistically different from each other. Interestingly, the premium associated with future MNEs is even higher than the one associated with current MNEs. For robustness, the specification in column 2 uses a propensity-score-matching procedure to restrict the sample by using a subset of domestic (untreated) firms that are comparable to the current and future MNEs.[19] The results are analogous to the baseline specification. In both specifications, the industry-quarter fixed effects absorb industry- and time-specific risk factors that affect all firms in a given quarter, so we can interpret the estimates on the dummies and firm characteristics as the marginal effects on risk-adjusted returns.

Columns 3-4 report the results with the firm *beta* as the dependent variable. Current and future MNEs exhibit systematically higher firm *betas* than domestic firms, controlling for measures of size and profitability and for industry- and time-specific risk factors, indicating higher exposure of these firms to aggregate risk.

[18] Appendix Table C.5 reports the full results of regression (3).

[19] For the propensity-score-matching regression, we first compute a logistic regression for the treatment (current MNE) probabilities as a function of firm characteristics. Each treated firm is matched with the untreated firm that has the highest propensity scored. These matched firms are used in the regression (3), along with the treated firms.

3.2.2 Portfolio Regressions

We complement the characteristics regression with a more common approach in the finance literature to show evidence about current and future MNEs' exposure to systematic risk. As first introduced by Fama and French (1993), firm characteristics may be proxies for non-diversifiable factor risk.[20] We follow a simple approach in which we form portfolios based on multinational status to estimate portfolio covariances with systematic risk factors as drivers of risk premia. In these portfolio-level regressions, we explore the source of the multinational premium by estimating the portfolio loadings on non-diversifiable factor risks. Higher average returns in the cross section do not constitute a puzzle per se; they simply indicate that MNEs are riskier than domestic firms. We adopt a classic asset pricing interpretation and view the risk exposure of a firm as reflecting a higher covariance of its stock returns with financial-market risk factors.

We build portfolios based on time-invariant MNE status categories. The returns of each portfolio are given by the market capitalization-weighted average of the stock returns of the firms in the portfolio. For each portfolio, we run one time-series regression of returns on the Fama-French factors.[21] The results are displayed in Table 7.

The risk to which multinationals are exposed, and the corresponding higher returns they provide to investors, are partially explained by higher coefficients on the aggregate market portfolio: the portfolios formed by multinational corporations exhibit higher market *betas* compared with the portfolios of domestic firms. Interestingly, this is true for both current and future MNEs.

These results show that current and future multinational firms' stock returns co-vary more with systematic risk factors, especially with the aggregate US stock market, than the stock returns of domestic firms. This evidence motivates the structure of the model in Section 4, in which firms' cash flows are exposed to an aggregate source of risk, and endogenous multinational status drives heterogeneous exposure.

To summarize, the evidence reported in this section establishes the existence of sizable risk premia for current and future MNEs. The results for future MNEs, in particular, suggest that these firms are somehow "different" from other domestic firms, and stockholders can observe (and price) the characteristics that make these firms different. Our evidence on the importance of managerial characteristics for firm-level fixed costs

[20] In Fama and French (1993), the firm characteristics are related to size and value relative to fundamentals (book value divided by market value).

[21] The CAPM model explains higher returns of certain assets as being generated by a larger covariance with systematic risk, represented by the returns on the aggregate market portfolio. Fama and French (1993) introduced a multifactor extension of the original CAPM that explains a high portion of the variation in expected returns. Higher returns must be explained by higher exposure to either of these three factors: market excess returns, high-minus-low book-to-market, or small-minus-big portfolio, as these characteristics seem to provide independent information about average returns. The small-minus-big (SMB) and high-minus-low (HML) factors are constructed on six portfolios formed on size and book-to-market. The portfolios are the intersection of two portfolios formed on size (small and big) and three portfolios formed on book equity to market equity (from higher to lower: value, neutral, and growth.) This generates six portfolios: small-value, small-neutral, small-growth, big-value, big-neutral, and big-growth. SMB represents a portfolio formed by going long on the three small portfolios and short on the three big portfolios. HML is a portfolio formed by going long on the two value portfolios and short on the two growth portfolios. For more details, see Fama and French (1993). Therefore, any asset is represented as a linear combination of the three Fama-French factors.

Table 7: Fama-French Portfolio Regressions: MN status

	Always Domestic	Future MNEs	Always MNEs
β_{MKT}	**0.821*** **	**1.011*** **	**0.977*** **
	(0.031)	(0.033)	(0.019)
β_{HML}	0.435***	0.225***	-0.158***
	(0.045)	(0.047)	(0.028)
β_{SMB}	0.388***	0.349***	-0.125***
	(0.034)	(0.036)	(0.021)
Constant	0.011***	0.010***	0.010***
	(0.001)	(0.001)	(0.001)
Observations	156	156	156
Adjusted R-squared	0.841	0.889	0.958

Note: The dependent variable is the market capitalization-weighted average of the stock returns of firms in each portfolio at a monthly frequency. Sample years 1993-2005. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: CRSP/Compustat and SEC 10K filings.

and selection into MN status suggests a mechanism by which managerial characteristics have an effect on both firms' expansion decisions and on risk premia. We present such mechanism in the structural model that follows.

4 Model

We propose a simple model where managers' role for firm expansion rationalizes the higher risk premia and risk exposure of MNEs that we observe in the data.

Following a long tradition in international trade that started with Melitz (2003), in the model, we assume that firms are heterogeneous in productivity. Firms choose the type of manager they hire, whether and when to become MNEs, and their output levels in each country they operate in.

The results of the Fama-French regressions in Table 7 show that stock returns are linked to firm-level exposure to aggregate factors. Consistent with this evidence, we assume that aggregate risk factors are reflected in the agents' intertemporal marginal rate of substitution, so that firm-level stock returns are driven by heterogeneous firm-level exposure to aggregate factors. More precisely, the expected returns of firm i are higher the lower the covariance between the agents' stochastic discount factor (dM/M) and changes in the value of the firm (dV_i/V_i):

$$E(ret_i) - r_f = -r_f \cdot Cov\left(\frac{dM}{M}, \frac{dV_i}{V_i}\right), \tag{4}$$

where $E(ret_i)$ denotes the expected return of firm i, and r_f denotes the risk-free rate.

The asset pricing component of our model is a simple consumption-based CAPM model, where assumptions on preferences and risk aversion imply an expression for the stochastic discount factor dM/M. Changes in the value of the firm, dV_i/V_i, are endogenous and firm-specific, and depend on firms' manager hires and FDI decisions. The role of the model is to make explicit how $Cov\left(\frac{dM}{M}, \frac{dV_i}{V_i}\right)$ depends on firm productivity and manager ability.

4.1 Preferences, Technology, and Shock Structure

There are two countries, Home and Foreign, populated by agents with identical preferences:

$$U = \int_0^\infty e^{-\rho t} \frac{C(t)^{1-\gamma}}{1-\gamma} dt, \tag{5}$$

where $\rho > 0$ is the subjective discount factor, and $\gamma > 1$ denotes risk aversion. Variables related to the foreign country are denoted by an asterisk. The consumption level C is a CES aggregate of differentiated varieties:

$$C(t) = \left[\int c_i(t)^{\frac{\eta-1}{\eta}} di \right]^{\frac{\eta}{\eta-1}}, \tag{6}$$

where $\eta > 1$ denotes the elasticity of substitution across varieties.

Each country is populated by a continuum of firms of given mass N_f. Firms are heterogeneous in their productivity level φ. Firm-level productivity is drawn at firm birth from an exogenous and time-invariant distribution $G(\varphi)$. Since each firm produces a unique variety, as it is customary in the literature, we denote a variety by the productivity level of the firm that produces it, $c_i(t) = c(\varphi; t)$.

Firms hire labor to produce output, and operate under monopolistic competition. The production function is linear in labor: $c(\varphi; t) = \varphi l(t)$. Given CES demand, a firm's variable profits, $\tilde{\pi}(\varphi; t)$, can be written as:

$$\tilde{\pi}(\varphi; t) = A(t)\varphi^{\eta-1} C(t) \tag{7}$$

where $A(t) = \frac{1}{\eta-1}\left(\frac{\eta}{\eta-1}\right)^{-\eta}\left(\frac{1}{w}\right)^{\eta-1} P(t)^\eta$ is an aggregate demand shifter, w denotes the wage, which we take as exogenous, and $P(t)$ is the ideal price index: $P(t) = \left[\int p(\varphi; t)^{1-\eta} d\varphi\right]^{\frac{1}{1-\eta}}$.

Firms can operate in their home country, and by paying a sunk cost F they can enter the foreign country and produce and sell there, so becoming MNEs. A firm's labor productivity is the same at home and abroad, and FDI is only horizontal in scope (FDI sales are entirely directed to the host market).[22] In addition, there are fixed operating costs f_D, f_I to be paid to produce in the domestic and foreign country, respectively.

Managers. Each country is also populated by a continuum of managers of given mass N_m. Managers are heterogeneous in their ability a. Managerial ability is drawn from an exogenous and time-invariant

[22] **?** report that, in the period 1987-2011, 72% of the sales of affiliates of US MNEs are directed to the host market.

distribution $H(a)$. At birth, firms and managers are matched through a competitive search process, and firm-manager matches last for the entire lifetime of the firm.[23] We assume that a firm hires only one manager, independently of its MN status. The firm manager handles operations in all markets where the firm is active. We describe the firm-manager assignment problem in Section 4.4.

We borrow Lucas (1978)'s interpretation whereby a manager is akin to a technology that affects a firm's output through the firm's returns to scale. Our implementation of this idea, consistent with the empirical evidence shown in Table 5, is that managers do not directly affect firm output but affect firm-level fixed operating costs. More precisely, we assume that $f'_D(a) > 0$ and $f'_I(a) < 0$: the fixed costs of domestic operations (FDI) are increasing (decreasing) in managerial ability.[24] In addition, as in Helpman et al. (2004), we assume that FDI is subject to higher fixed operating costs than domestic production, regardless of the ability of the manager guiding the firm: $f_I(a) > f_D(a)$, $\forall a$.

Shocks. The dynamics of the economy are driven by fluctuations in the aggregate consumption levels in the two countries. C and C^* are exogenously given and evolve according to:

$$\frac{dC}{C} = \mu dt + \sigma dz \tag{8}$$

$$\frac{dC^*}{C^*} = \mu^* dt + \sigma^* dz^*, \tag{9}$$

where $\mu, \mu^* \in \Re$, $\sigma, \sigma^* \in \Re_+$ and $E(dz, dz^*) = \chi dt$, where $\chi = \in [-1, 1]$ denotes the correlation between the two country-specific shocks. It follows that the stochastic discount factor is given by:[25]

$$\frac{dM}{M} = -r dt - \gamma \sigma dz, \tag{10}$$

with $r = \rho + \gamma\mu - \gamma(\gamma+1)\frac{1}{2}\sigma^2$ denotes the risk-free rate.

Like in Fillat and Garetto (2015), fluctuations in aggregate consumption levels are the source of risk in the economy. The correlation of shocks across countries, χ, is a source of diversification potential of MNEs, while the fixed costs of FDI drive firms' operating leverage, as it will become clearer in Section 4.3. These two forces operate in opposite directions in determining the firms' expected returns. On the one hand, diversification drives expected returns down. On the other hand, operating leverage results in higher risk, and drives returns up, as we explain below.

Lastly, we assume that the fixed and sunk costs of production grow deterministically at the same rate as aggregate consumption:[26] $\frac{df_D}{f_D} = \mu dt$, $\frac{df_I}{f_I} = \mu^* dt$, and $\frac{dF}{F} = \mu^* dt$.

[23] As detailed in Section 2, only 6.64% of managers in the sample change firm, and the median number of managers that a firm has during its life in the sample is 1.

[24] The results of regression (2), shown in Table 5, imply that $f'_D(a) > 0$ and $f'_I(a) < f'_D(a)$. Requiring $f'_I(a) < 0$ is a stronger sufficient condition that is qualitatively consistent with the empirical results.

[25] The stochastic discount factor is equal to the agents' inter-temporal marginal rate of substitution. The marginal utility of consumption is: $M = e^{\rho t} C(t)^{-\gamma}$. By applying Ito's Lemma to M, one obtains equation (10).

[26] The assumption of growing fixed and sunk costs prevents the outcome whereby, in the long-run, all firms become multina-

4.2 The Firm's Intertemporal Problem

A firm chooses its international status (domestic or multinational) to maximize the present discounted value of its profit flow, conditional on its productivity φ, manager ability a, and the realization of the aggregate shocks C, C^*. We solve the firm problem conditional on managerial ability. In Section 4.4 we illustrate how firms' production and investment decisions influence the firm-manager matching process.

Let $\mathcal{V}(\varphi, a, C, C^*)$ denote the value of a firm with productivity φ and managerial ability a when the realization of the aggregate shock is (C, C^*). Similar to Melitz (2003), we assume that the firm takes decisions in the two markets independently, so that we can write the value function as:

$$\mathcal{V}(\varphi, a, C, C^*) = V_D(\varphi, a, C) + \max\{V_F^o(\varphi, a, C^*), V_F(\varphi, a, C^*)\} - S(\varphi, a, C_0, C_0^*), \tag{11}$$

where $V_D(\varphi, a, C)$ denotes the value of domestic activities, $V_F(\varphi, a, C^*)$ denotes the value of foreign activities for a firm which is currently a multinational, $V_F^o(\varphi, a, C^*)$ denotes the option value of foreign activities for a firm that doesn't currently operate in the foreign market, and $S(\varphi, a, C_0, C_0^*)$ is the expected value of manager compensation, which depends on the realization of the shocks at time 0 since the manager market clears at firm birth.

Bellman Equations. Next, we illustrate how each of the sub-value functions in equation (11) can be written recursively in a Bellman equation. In the domestic market, a firm simply makes profits from domestic sales. Hence, its value is given by its current profit plus the continuation value:

$$V_D(\varphi, a, C) = \pi(\varphi, a, C) M\Delta t + E[M\Delta t \cdot V_D(\varphi, a, C')], \tag{12}$$

where $\pi(\varphi, a, C) = \tilde{\pi}(\varphi, C) - f_D(a)$. All flows are discounted with the agents' stochastic discount factor M, and C' denotes the realization of the shock at a future time $t + \Delta t$.

A firm that currently operates only in its domestic market must choose whether to start operating in the foreign market as well or to continue selling only domestically. For a domestic firm, foreign sales are an option that the firm exercises if it decides to become a multinational. Hence the option value of foreign sales is given by the maximum between its continuation value (in the event in which the firm decides not to exercise the option) and the value of foreign sales $V_F(\varphi, a, C^*)$ minus the sunk entry cost F (if the firm decides to exercise the option and become a multinational):

$$V_F^o(\varphi, a, C^*) = \max\left\{E[M\Delta t \cdot V_F^o(\varphi, a, C^{*\prime})], V_F(\varphi, a, C^*) - F\right\}. \tag{13}$$

Once it becomes a multinational, the firm also makes profits from foreign sales, so the value of foreign

tionals.

sales is given by the current foreign profit flow plus the continuation value:

$$V_F(\varphi, a, C^*) = \pi^*(\varphi, a, C^*)M\Delta t + \left\{E[M\Delta t \cdot V_F(\varphi, a, C^{*\prime})]\right\} \tag{14}$$

where $\pi^*(\varphi, a, C) = \tilde{\pi}(\varphi, C^*) - f_I(a) = A^*(t)\varphi^{\eta-1}C^*(t)$ and aggregate variables are defined analogously as for the domestic market. For tractability, we assume that there is no endogenous exit from either the domestic or the foreign market.[27]

Value Functions. By using standard tools in the literature on investment under uncertainty (see K. Dixit and S. Pindyck, 1994), we can solve for the value functions in the continuation regions.

The value of domestic activities is given by the domestic profit flows, discounted by taking into account the evolution of the shock process and agents' risk aversion:

$$V_D(\varphi, a, C) = \frac{\tilde{\pi}(\varphi, C)}{r - \mu + \gamma\sigma^2} - \frac{f_D(a)}{r - \mu}. \tag{15}$$

The solution for the value of existing foreign activities is analogous:

$$V_F(\varphi, a, C^*) = \frac{\tilde{\pi}^*(\varphi, C^*)}{r - \mu^* + \gamma\chi\sigma\sigma^*} - \frac{f_I(a)}{r - \mu^*}, \tag{16}$$

Lastly, the option value of foreign activities is given by:

$$V_F^o(\varphi, a, C^*) = B^F(\varphi, a){C^*}^{\beta^*}, \tag{17}$$

where $B^F(\varphi, a)$ is the option value of becoming an MNE, and $\beta^* > 1$ is the positive root of the fundamental quadratic equation, $\frac{\sigma^{*2}}{2}\beta^{*2} + \left(\mu^* - \gamma\chi\sigma\sigma^* - \frac{\sigma^{*2}}{2}\right)\beta - r = 0$.

As is standard within this class of models, value functions are given by the sum of the present discounted value of profits plus the option value of additional activities that the firm can undertake: FDI in this case. Given our assumptions on the fixed costs functions, managerial ability decreases (increases) the value of domestic (foreign) sales, and so affects the option value of MNE expansion, as we clarify below.

Policy Function. Becoming an MNE is a discrete choice. Hence, the policy function is a firm-specific threshold in the realization of the aggregate foreign composite shock that induces the firm to enter the foreign market. More precisely, a firm becomes an MNE when $C^* \geq \bar{C}^F(\varphi, a)$, where $\bar{C}^F(\varphi, a)$ is determined by value matching and smooth pasting conditions between $V_F^o(\cdot)$ and $V_F(\cdot)$:

$$\bar{C}^F(\varphi, a) = \left(\frac{\beta^*}{\beta^* - 1}\right)\left(\frac{f_I(a) + rF}{r - \mu^*}\right)\left(\frac{r - \mu^* + \gamma\chi\sigma\sigma^*}{A^*}\right)\varphi^{1-\eta}. \tag{18}$$

[27] Introducing endogenous exit is conceptually straightforward, but implies that the value functions also include a term representing the option value of exit. The presence of this extra term doesn't change the intuition of the model, but prevents us from deriving closed-form solutions for the value functions.

The MNE entry threshold is decreasing in firm productivity φ, indicating that more productive firms need smaller positive demand shocks to enter foreign markets. The MNE entry threshold is also decreasing in managerial ability (since $f_I'(a) < 0$, indicating that firms with better managers need smaller positive demand shocks to enter foreign markets.

The value-matching and smooth-pasting conditions also deliver an expression for the option value of becoming an MNE, $B^F(\varphi, a)$:

$$B^F(\varphi, a) = \frac{1}{\beta^*}\left[\left(\frac{\beta^* - 1}{\beta^*}\right)\left(\frac{r - \mu^*}{f_I(a) + rF}\right)\right]^{\beta^* - 1}\left(\frac{A^*\varphi^{\eta-1}}{r - \mu^* + \gamma\chi\sigma\sigma^*}\right)^{\beta^*}. \tag{19}$$

Examining the dependence of the option value (19) on φ reveals that more productive firms have a higher option value of multinational activity compared to less productive firms. Lastly, and importantly for the link between the model and our empirical analysis, the option value of becoming an MNE is increasing in managerial ability.

Details on the derivation of the results in this section are contained in Appendix D.

4.3 Stock Returns

We now turn to one of the variables of interest of our empirical analysis, firm-level expected returns. In our model, fluctuations in aggregate consumption, coupled with agents risk-aversion, give rise to stock returns in excess of the risk-free rate. In a model without selection into MN status (and without fixed costs), the covariance of the cash flows with the stochastic discount factor would be the same for all firms, and equal to $\gamma\sigma^2$, so that all firms would have the same excess returns. In our model, the presence of fixed costs and selection into MN status puts a firm-specific "wedge" between firm revenues and firm profits, so that the covariance of cash flows with the stochastic discount factor varies across firms, and so do the returns.

In the model, the expected excess returns of a domestic firm and of a multinational firm can be written as:[28]

$$E[ret_D(\varphi, a, C, C^*)] - r = \frac{\gamma\sigma^2 C V_D'(\varphi, a, C) + \gamma\chi\sigma\sigma^* C^* V_F^{0'}(\varphi, a, C^*)}{\mathcal{V}_D(\varphi, a, C, C^*)} \tag{20}$$

$$E[ret_{MN}(\varphi, a, C, C^*)] - r = \frac{\gamma\sigma^2 C V_D'(\varphi, a, C,) + \gamma\chi\sigma\sigma^* C^* V_F'(\varphi, a, C^*)}{\mathcal{V}_{MN}(\varphi, a, C, C^*)}. \tag{21}$$

Equations (20)-(21) clarify the trade-off between diversification potential and higher riskiness of multinational activity. When shocks are independent across countries, $\chi = 0$ and the returns of domestic firms and MNEs coincide and are equal to $\gamma\sigma^2$. A positive (negative) correlation amplifies (dampens) the effect of

[28] The derivation of equations (20)-(21) is contained in Appendix D.

operating leverage induced by the fixed costs of multinational activity, increasing (decreasing) the returns.

Through its effect on fixed costs, managerial ability affects the returns of both domestic firms and MNEs. Besides its effect on domestic sales, which is symmetric across firms, managerial ability affects the returns of domestic firms through the option value of becoming a multinational, $V_F^{0'}(\cdot)$, which contains the term $B^F(\varphi, a)$, and it affects the returns of MNEs through the fixed costs of FDI, $f_I(a)$, which enters their profit flows, and hence $\mathcal{V}_{MN}(\cdot)$. In Section 5, we provide a set of analytical results that clarify the implications of managerial ability for the expected stock returns of firms with different MN status.

4.4 Firm-Manager Matching

Having described the elements of the model conditional on manager ability, we describe here the firm-manager matching process.

We model the manager hiring process with a competitive search framework with two-sided heterogeneity á la Shimer (2005). Each firm in the economy is characterized by its productivity φ, and each manager by its ability a. Each firm can hire one manager. To do so, at time 0, each firm posts an ability-contingent manager wage contract. Managers observe the posted contracts, and each manager applies to one firm. Each firm that receives at least one application hires one manager. We adopt the same assumptions as Shimer (2005) by modeling an "anonymous" manager labor market: first, firms' compensation offers may be conditioned on manager type but not on manager identity, and second, in equilibrium, identical managers must use identical mixed strategies when deciding where to apply. Actual applications are the random realizations of these mixed strategies, so generating realistic coordination frictions.

We assume that there is a number N of "firm productivity types", and that $N_f/N = 1$, so that there is a unit measure of firms for each productivity level φ. Consistent with our empirical analysis, we assume that there are two manager ability types, so that $a \in \{a_L, a_H\}$.

Let $S(\varphi, a, C_0, C_0^*)$ denote the manager compensation contract offered by a firm with productivity φ to a manager with ability a. Similarly, let $q(\varphi, a, C_0, C_0^*)$ denote the expected application queue that a firm with productivity φ receives from managers with ability a. Lastly, let $v(a, C_0, C_0^*)$ denote the outside value of a manager with ability a. Since these variables are determined at time 0, we omit the aggregate state of the economy (C_0, C_0^*) from the notation for the remainder of this section.

An equilibrium in the manager market is defined by a wage contract $S(\varphi, a, C_0, C_0^*)$, expected application queues $q(\varphi, a, C_0, C_0^*)$, and manager outside values $v(a, C_0, C_0^*)$ such that: i) firm profits are maximized, ii) managers' expected compensation is equal to their outside value, and iii) a resource constraint is satisfied (application probabilities implied by the expected queues sum up to one).

Since there is a finite number of firm productivity levels and of managerial ability types, we order them

as follows. Firm productivity can assume values $\varphi_n = \varphi_1, ...\varphi_N$, and manager ability can assume values a_L, a_H, where we assume that $\varphi_n < \varphi_{n+1}$, $\forall n$, and $a_L < a_H$. In addition, let μ_L (μ_H) denote the mass of managers with ability a_L (a_H).

Shimer (2005) shows that $S(\varphi, a)$, $q(\varphi, a)$, and $v(a)$ are the solution of the following system of equations:

$$v(a_L) \geq e^{-q(\varphi_n,a_L)-q(\varphi_n,a_H)}\mathcal{V}(\varphi_n, a_L) \text{ and } q(\varphi_n, a_L) \geq 0 \ \forall\varphi_n \tag{22}$$

$$v(a_H) \geq e^{-q(\varphi_n,a_H)}\mathcal{V}(\varphi_n, a_H) - e^{-q(\varphi_n,a_H)}(1 - e^{-q(\varphi_n,a_L)})\mathcal{V}(\varphi_n, a_L) \text{ and } q(\varphi_n, a_H) \geq 0 \ \forall\varphi_n \tag{23}$$

$$\mu(a_L) = \sum_n q(\varphi_n, a_L) \tag{24}$$

$$\mu(a_M) = \sum_n q(\varphi_n, a_H) \tag{25}$$

$$w(\varphi_n, a_L) = \frac{q(\varphi_n, a_L)e^{-q(\varphi_n,a_L)}}{1 - e^{-q(\varphi_n,a_L)}}\mathcal{V}(\varphi_n, a_L) \ \forall\varphi_n \tag{26}$$

$$w(\varphi_n, a_H) = \frac{q(\varphi_n, a_H)e^{-q(\varphi_n,a_H)}}{1 - e^{-q(\varphi_n,a_H)}}[\mathcal{V}(\varphi_n, a_H) - \mathcal{V}(\varphi_n, a_L)(1 - e^{-q(\varphi_n,a_L)})] \ \forall\varphi_n. \tag{27}$$

Equations (22)-(27) define a system of $4N + 2$ equations in as many unknowns.

Notice that, since the manager-firm assignment happens at time 0, when all firms are domestic, manager compensation posting and job applications are conditional on the initial state of the economy (C_0, C_0^*). Since the value function $\mathcal{V}(\varphi, a, C, C^*)$ is supermodular in firm productivity φ and managerial ability a, the equilibrium assignment will exhibit imperfect positive assortative matching: on average, high-ability managers will be matched with high-productivity firms. The anonimity assumptions create a coordination friction that makes the match imperfect.

A testable implication of the compensation structure implied by the model is that $S(\varphi, m, C_0, C_0^*)$ is positively correlated with firm productivity and size, hence with MN status, and with measures of managerial ability. Appendix Figure C.2 and Table C.6 show support for these predictions.

4.5 Partial (Industry) Equilibrium

In the asset pricing literature tradition, we present the model in a partial industry equilibrium. We compute price indexes in the economy by aggregating firms' individual prices depending on firm's multinational status, but we take aggregate consumption in each country and workers' wages as given. This is equilvalent to say that we do not impose an aggregate labor market clearing condition or a goods market clearing condition.

5 Analytical Results: Management, Firm Status, and Stock Returns

In this section we present three propositions that spell out the theoretical relationship between managerial experience, MNE status, and expected stock returns, and provide an explanation linking the facts we have shown in Section 3.

Our first result speaks to the relationship between managerial ability and multinational entry.

Proposition 1. $\frac{\partial \bar{C}^F(\varphi, a)}{\partial a} \leq 0$. *Firms that are run by better managers are more likely to become MNEs.*

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Proof: Proposition 1 follows immediately by differentiating expression (18) with respect to a.

Since the fixed costs of foreign operations are decreasing in a ($f_I'(a) < 0$), firms with higher ability managers have lower costs of FDI, hence, keeping everything else equal, they need smaller positive shocks to enter foreign markets and are more likely to become MNEs. Model assumptions based on our empirical evidence on fixed costs (Table 5) deliver the effect of managerial ability on firm selection into multinational status that we observe in the data (Table 3).

We now examine the effect of managerial ability on the expected stock returns of domestic and multinational firms, respectively.

Proposition 2. *If* $\beta^* \chi \sigma^* > \sigma$ *and* $f_D(a) \ll f_I(a)$, *then* $\frac{\partial E[ret_D(\varphi, a]}{\partial a} > 0$. *Domestic firms' risk premia depend positively on managerial ability.*

Proof: See Appendix D.

Managerial ability lowers the fixed costs of FDI and –as equation (19) shows– it increases the option value of FDI. As a result, the curvature of the value function increases, and so does its covariance with the stochastic discount factor, and the firm expected returns.

We have shown that domestic firms that are run by higher ability managers are more likely to become MNEs (Proposition 1), hence they are the "model equivalent" of future MNEs in the data. Proposition 2 shows that domestic firms that are run by higher ability managers have higher expected stock returns. The two propositions together are then consistent with the future MNE premia that we have shown in our empirical analysis (see Table 6): future MNEs (in the model, domestic firms run by high ability managers, that have high option values of FDI), have higher returns than firms that sell only and always domestically.

The intuitive reason behind this result is that stockholders forecast the higher likelihood of MN entry when a firm is run by a high ability manager. If foreign operations are perceived as risky, stockholders command higher returns to be compensated for that risk.

How does managerial ability affect the returns of multinational firms? Our last proposition answers this question.

Proposition 3. *If* $-f_I'(a) > f_D'(a)$, *then* $\dfrac{\partial E[ret_{MN}(\varphi, a)]}{\partial a} < 0$.

Proof: Proposition 3 follows immediately by differentiating expression (21) with respect to a.

Proposition 3 states that the effect of managers on current MNE premia depends on the relative effect of managerial ability on the fixed costs of domestic versus foreign operations. If the effect of managerial ability on the fixed cost of FDI dominates, MNEs' risk premia depend negatively on managerial ability, and managerial ability reduces the premium differential between MNEs and domestic firms.

The intuition behind this result is simple: higher fixed costs increase operating leverage, making assets in place riskier (the mechanism that Fillat and Garetto, 2015 use to explain the MNE premium). Managerial ability affects the fixed costs of firms. For MNEs, managerial ability increases (decreases) the fixed costs of domestic (foreign) operations, so the net effect on risk (and expected returns) depends on the net effect of managerial ability on total fixed costs.

6 Quantitative Analysis

We conclude the paper with a quantitative analysis whose goal is to examine the effect of market frictions on firm selection and aggregate financial market outcomes.

We calibrate the model to match moments related to managerial characteristics, firm selection into FDI, and stock market variables. We then evaluate the effect of two counterfactuals: a tax on the foreign profits of MNEs, and a tax on CEO pay.

6.1 Calibration

The calibration of the model entails setting values for parameters related to preferences (the subjective discount factor ρ, the elasticity of substitution η, and the risk aversion coefficient γ), shocks (the drifts μ, μ^*, standard deviations σ, σ^*, correlation coefficient χ, and initial values $C(0)$, $C^*(0)$), production technology (the parameters of the firm productivity distribution $G(\varphi)$, the fixed costs functions $f_D(a)$, $f_I(a)$, and the sunk entry cost F), and manager labor market equilibrium (the mass of managers of each type, μ_L and μ_H). We take some of these parameters from the literature or from direct observations in the data, and we calibrate the others using the structure of the model.

6.1.1 External Calibration

For the calibration of the aggregate shock processes, we choose the Brownian motion parameters to be equal to the mean and standard deviation of aggregate GDP growth in the US and in an aggregate of countries representing the top destinations of US FDI. This procedure yields parameter values $\mu = 0.035$, $\mu^* = 0.049$, $\sigma = 0.04$ and $\sigma^* = 0.063$. To select a value for χ, we computed the correlation between the GDP growth rate in the US and in this aggregate of FDI destinations: $\chi = 0.936$.[29]

We set the elasticity of substitution to $\eta = 5$, in line with estimates in the literature (e.g. Broda and Weinstein 2006), and the risk aversion parameter to $\gamma = 4$, a common and conservative choice in the asset pricing literature.

The value of the subjective discount rate ρ needs to be such that the present discounted value of profits does not diverge: $r - \mu + \gamma\sigma^2 > 0$ and $r - \mu^* + \gamma\chi\sigma\sigma^* > 0$, where $r = \rho + \gamma\mu - \gamma(\gamma+1)\frac{\sigma^{*2}}{2}$. We set $\rho = 0.01$.[30]

We assume that the distribution of firm productivity $G(\varphi)$ is Pareto with location parameter one and shape parameter $\vartheta = 4.25$, as calculated by Kondo et al. (2023) using Census data for US firms. We assume that there is one firm for each productivity type, and we simulate the economy for $N = 1000$ firms.

Table 8 summarizes the parameters we set directly from the data or from previous literature.

Table 8: Direct Calibration.

Parameter	Definition	Value	Source
μ, μ^*	drift of demand processes	0.035, 0.049	WDI
σ, σ^*	st. dev. of demand processes	0.04, 0.063	WDI
χ	correlation of demand processes	0.936	WDI
η	elasticity of substitution	5	Broda and Weinstein (2006)
γ	risk aversion coefficient	4	
ρ	subjective discount factor	0.01	model restriction
ϑ	shape parameter of firm productivity distribution	4.25	Kondo et al. (2023)

6.1.2 Model-based Calibration

We set values for the remaining parameters using a procedure that identifies them jointly to match relevant moments from our data.

[29] Data on GDP growth by country are from the World Development Indicators (WDI). We compute GDP growth rates from the series "GDP (constant 2015 US dollars)" for each country for the time period 1993-2017. Garetto et al. (2026) report that the top destinations of US FDI for this time period are Brazil, Canada, China, France, Germany, Ireland, Japan, Mexico, Singapore, and the United Kingdom.

[30] The calibrated risk-free rate is higher than that observed in the data, reflecting the well-known risk-free rate puzzle (Weil, 1989). This arises because the CES demand structure does not provide sufficient flexibility to simultaneously match the equity premium and the level of the risk-free rate. In the model-based calibration, we target stock returns in excess of the risk-free rate.

Since we assume that there are two managerial ability levels, low-ability $a = a_L$, and high ability $a = a_H$, the fized costs function only take values f_D^L, f_D^H, f_I^L, and f_I^H. As we do not have information on firm domestic entry and exit in the data, we assume that $f_D^L = f_D^H = 0$. As a result, the model-based calibration amounts to assigning values to 7 parameters: the mass of managers of each type, $\mu(a_H)$ and $\mu(a_L)$, the fixed costs of FDI associated to each manager type, f_I^L, and f_I^H, the sunk MNE entry cost F and the initial values of the aggregate consumption processes C_0, C_0^*.

To recover values for these parameters, we choose the following target moments:

1. the average share of MNEs in the sample,
2. the average stock returns of domestic firms in excess of the risk-free rate,
3. the average stock returns of MNEs in excess of the stock returns of domestic firms,
4. the average manager compensation differential between MNEs and domestic firms
5. the average manager compensation ability premium
6. the average manager compensation as a share of firm value
7. the share of non-matched firms.

We compute the average share of MNEs in the sample from Compustat data. For this reason, the share of MNEs in the sample, 48.99%, is much higher than in samples that are representative of the entire population of firms in a country, but it is in line with what reported by other papers using the same data (like Fillat and Garetto 2015). Average stock returns in excess of the risk-free rate for domestic firms are 1.24%,[31] while MNEs exhibit an additional average stock return of 0.62%. We use our data on managerial compensation to construct three additional moments: the MNE compensation premium, or the the average manager compensation differential between MNEs and domestic firms, equal to 58 in the data; the ability compensation premium, or the the average compensation differential between for managers above and below median compensation, equal to 26% in the data; and managerial compensation as a share of firm value, equal to 0.02% in the data. In addition, we set as a target of the calibration a zero share of unmatched firms in the sample.

Our calibration procedure starts with a grid search to identify a good initial condition for the simulated method of moments procedure. We perform 500 simulations of an economy with 1000 firms and 300 periods, and select the parameter values that minimize the distance between model and data moments using the optimal weighting matrix. Table 9 shows the match between model and data moments, and Table 10 shows the implied calibrated parameters.

[31] We compute excess returns by taking the average 3-month Tbill rate from 1990 to 2016, equal to 2.7%, as our measure of the risk free rate.

Table 9: Joint Calibration.

Moment Description	Data	Model
Share of MNEs	48.99	48.03
Excess Returns of D firms	1.24	2.45
Returns Spread of MNE over D firms	0.62	0.92
MNE Compensation Premium	58	156.80
Ability Compensation Premium	26	121.40
CEO Compensation over Firm Value	0.02	0.44
Share of non-matched Firms	0	4.80

Note. All values are expressed in percentages.

Table 10: Calibrated Parameters.

Parameter	Value
f_I^L	0.1026
f_I^H	0.0964
F	0.1
$\mu(a_H)$	1000
$\mu(a_L)$	3028
C_0	2103.35
C_0^*	4586.49

The model is able to match perfectly the share of MNEs in the data. The rest of the moments are over-predicted, but capture the overall patterns in the data, whereby MNEs have higher returns than domestic firms, CEO compensation is a small share of firm value, and there are significant compensation premia associated with multinational firms and high-ability CEOs. The particularly high discrepancy between the model and data moments for the compensation premia may be due to our Pareto parameterization of the productivity distribution, which generates large firms that are "too large" compared to the data.

Since all the moments are matched jointly, it is hard to talk about identification. However, numerical experiments show that the average share of MNEs and the returns moments are helpful in identifying the level of fixed and sunk costs and the initialization of the consumption processes. Obviously, moments related to manager compensation are helpful to identify the number of manager per type, $\mu(a_H)$ and $\mu(a_L)$. A large overall number of manager is needed to generate a share of non-matched firms that is close to zero, but is also modulates the magnitude of manager compensation as a share of firm value. In addition, while , there is a tradeoff generated by the relative sizes of $\mu(a_H)$ and $\mu(a_L)$: scarcity of high-ability managers increases the ability premium, but it is also related to the MNE compensation premium through the role that the mass of managers of each type has for selection.

6.1.3 Non-Targeted Moments

We conclude this section by reporting additional features of the calibrated economy that were not targeted by the calibration.

As explained in Section 4.4, the model generates imperfect assortative matching between managers and firms. In the calibrated economy, almost all the multinationals are run by high-ability managers, while only 32% of domestic firms are run by high-ability managers. From the manager's perspective, about 50% of high-ability managers work in multinational firms, while only 0.2% of high-ability managers work in domestic firms.

Consistent with Propositions 2-3, managerial ability has opposite effects on the returns of domestic versus multinational firms. In the model, domestic firms run by high-ability managers have excess returns that are 7 percent higher than domestic firms run by low-ability managers. Conversely, MNEs run by high-ability managers have excess returns that are 11 percent lower than MNEs run by low-ability managers.

6.2 Counterfactuals

We conclude our analysis by with two counterfactual exercises whose goal is to examine the effect of market frictions on firm selection and aggregate financial market outcomes. First, we evaluate the effects of a policy that imposes a tax on MNE's foreign profits. Second, we examine the effects of a policy that imposes a tax on the profits of firms with CEO to worker compensation ratios above a certain threshold.[32]

6.2.1 Taxing MNE Profits

In our first counterfactual, we examine the effects of a tax on the foreign profits of multinational corporations for firm selection, the distribution of managerial talent across firms, and financial market outcomes. Intuitively, taxing MNEs' profits reduces the incentives of firms to enter foreign markets. In addition, by decreasing overall firm value, the tax affects the match between managers and firms, making it less likely that MNEs hire high ability managers. Since the tax affects both firm value and selection, its ex-ante effects on asset prices are ambiguous.

Figure 1 shows the effects of a 25% tax on foreign profits on firm selection and on the allocation of managerial talent across firms. Foreign profits taxation reduces the incentive of firms to become MNEs, so that in the counterfactual economy the share of MNEs is lower than in the baseline. The share of high-ability managers slightly increases in domestic firms, and decreases in multinational corporations.

The second column of Table **??** illustrates the magnitudes precisely. A tax on MNEs' foreign profits

[32]This exercise is loosely based on policies that have been debated in the US Congress.

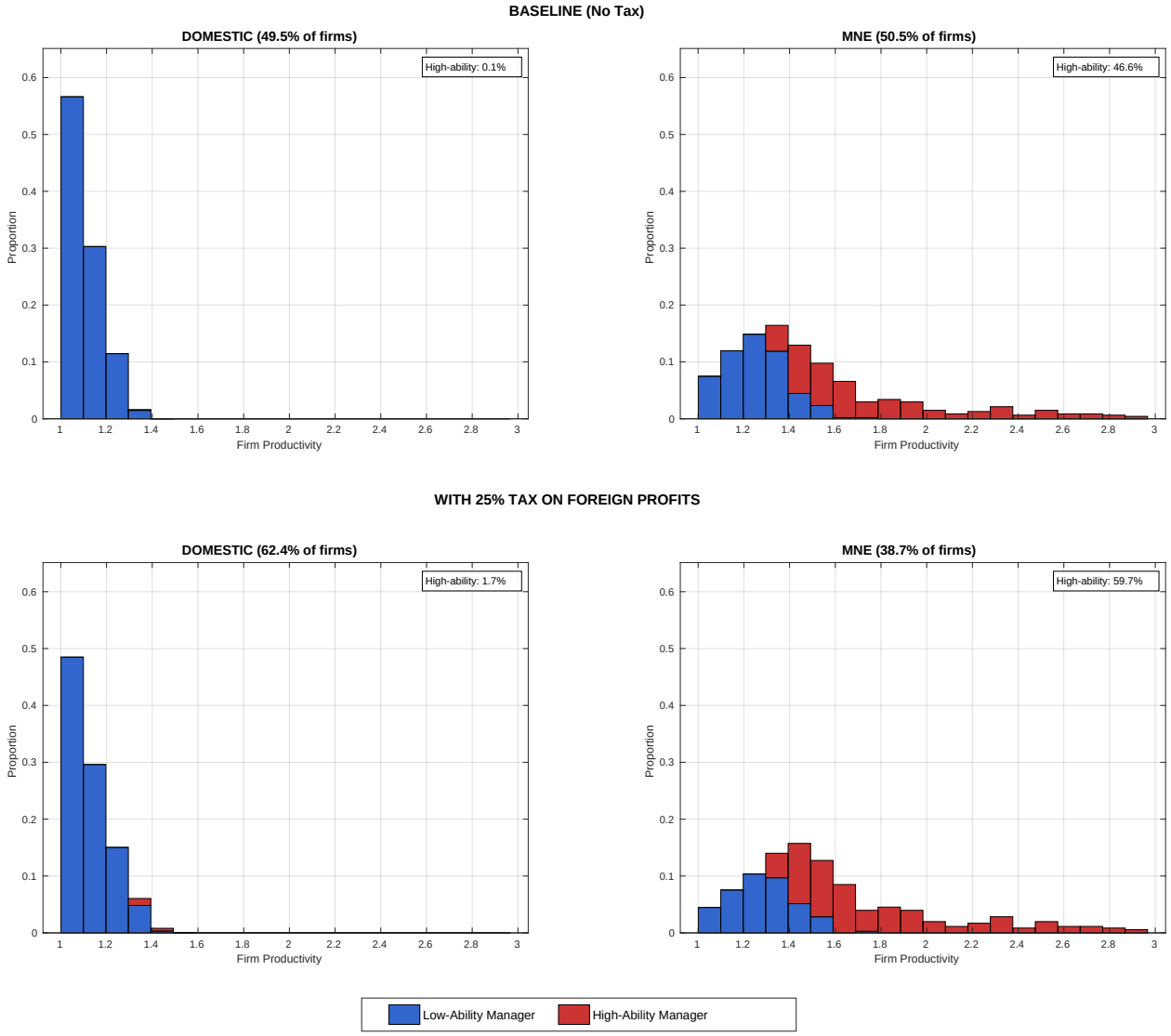

Figure 1: Counterfactual in which we impose a 25% tax on foreign profits.

	Baseline	Tax + LM	Tax only
Panel A: Targeted Moments			
Share of MNEs	0.483	0.371	0.364
$[R_D] - R_f$	0.0245	0.0224	0.0224
$[R_{MN}] - [R_D]$	0.0092	0.0067	-0.0179
MNE Compensation Premium	1.568	1.174	—
Ability Compensation Premium	1.214	0.728	—
CEO Compensation/Firm Value	0.0044	0.0037	—
Share of Non-matched Firms	0.048	0.037	0.000
Panel B: Firm-manager matches Composition			
Domestic | Low-type	0.680	0.812	0.636
MNE | High-type	0.997	0.956	—
High-type | MNE	0.498	0.615	—
High-type | Domestic	0.002	0.017	—
Panel C: Expected Returns			
VW Market Return $-R_f$	0.0132	0.0146	0.0147

Table 11: Targeted and untargeted moments a) baseline calibrated economy; b) counterfactual economy with assignment c) counterfactual economy with no assignment

decreases the share of MNE firms from 48.3% to 37.1%. The lower option value of FDI decreases the returns of domestic firms. Also the returns of MNEs decline, due to the effect of selection on returns: in the counterfactual economy, MNEs are larger than in the baseline, hence exhibit lower returns. The allocation of talent across firms is also affected by the tax: both domestic firms and MNEs increase the share of low-ability managers they hire. Lastly, the returns of the value-weighted market portfolio increase.

The results in the second column of Table 11 depend on both the effects of the tax on selection into FDI and on the allocation of managers to firms. In the third column of the table, we isolate the effect of selection by computing the relevant moments in a scenario without heterogeneity in managerial ability.

6.2.2 Taxing CEO Pay

[TO BE ADDED]

7 Conclusions

Multinational corporations are the largest players in the global economy. In this paper, we offer some insights on the origin of the risks these firms are exposed to. Since we believe that managers have an important role in the firms' decision making process, we focus on their role as drivers of firm expansion into foreign markets.

Our empirical analysis shows that management matters for firms' selection into multinational activity: firms run by managers with previous experience in MNE entry are more likely to become MNEs. In addition, current and future MNEs command a higher risk premium than domestic firms.

We developed a simple dynamic model of manager choice and MNE entry that rationalizes our empirical findings. The model posits a mechanism whereby managers' ability affects firms' expansion costs, the option value of expansion, and the exposure to risk of assets in place.

The model's tractability makes transparent the channels linking these firms' decisions and highlights how managerial decisions play a fundamental role in the origins and dynamics of MNEs' risk premia.

The model is rich, yet simple, and lends itself to a quantitative analysis that exploits its mechanisms to suggest that distortions to the market for managerial talent (in the form of taxes punishing high CEO pay) may have unwanted effects on multinational activity and financial markets.

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Appendix

A Data Assembly and 10-K Parsing Procedure

We download from the SEC Edgar's website all the 10-K filings for the universe of firms with publicly traded equity from 1993 through 2017. More recent filings have an *html* format, while older files are plain text. The structure for recent filings is such that an Exhibit 21 is submitted as a separate *html* file. Older text filings may have a separate Exhibit 21 *txt* file or include all the information in a unique 10-K file that contains the exhibit 21 information too. Figure A.1 shows the Exhibit 21 for a firm in our sample, McDonald's Corporation.

The 10-K filings are our main source of information for classifying firms as domestic or multinational in a given year. Our algorithm processes the different *html* and *txt* files separately. For *html* files, the code looks for the label *tables* inside the Exhibit 21 files and extracts the information on each subsidiary and location. For the text files, the algorithm reads each line of the file, looking for a structure containing names of subsidiaries, blank spaces, and locations. For the 10-K files that contain all the information in one file, the code reads each line of the file, looking for any country name from a dictionary. If no country name is found, the firm is defined as domestic. Of the remaining firms where a foreign country is mentioned, the algorithm looks for the structure of the name, blank spaces, and location to determine the multinational status. In addition, the algorithm searches for wording referring to "affiliate," "subsidiary," "subsidiaries," "plant," "foreign operations," or "21," in a window of 100 characters surrounding the mention of a foreign country in order for the firm to be classified as a multinational.

We use quarterly fundamentals from CRSP/Compustat Merged, a detailed database of standardized financial and market information for publicly traded firms provided by Wharton Research Data Services, for the sample firms present during the 1993–2017 period. The data we use range from financial fundamentals such as long-term debt; short-term debt; EBITDA; revenues; property, plant and equipment; and employment to market information such as monthly returns and market capitalization. The parsed SEC 10-K filings are merged onto the quarterly CRSP/Compustat data set based on the Central Index Key (CIK) to provide annual information on the multinational status of Compustat firms. Firms with missing 10-K filings at the start or end of the sample are imputed using the first or latest non-missing filing, respectively. For firms that contain short 10-K filing gaps (that, is domestic to missing to domestic or multinational to missing to multinational for one or two years), values are imputed as the status before and after the gap. For gaps where the status changes following the gap, if the gap is greater than or equal to four quarters, we parse through the 10-K Exhibit 21s manually, imputing values that supersede the algorithm's output. For gaps shorter than four quarters, we leave it as is, and the missing status is considered within the year of the gap, with respect to firm categorization (described below). There are no attempts made to impute the multinational status for firms that are never captured in the algorithm unless that information was hand-collected at an

earlier point in time. We compute the firm-level betas by running rolling one-year window regressions of monthly firm returns on the CRSP Total Market Index.

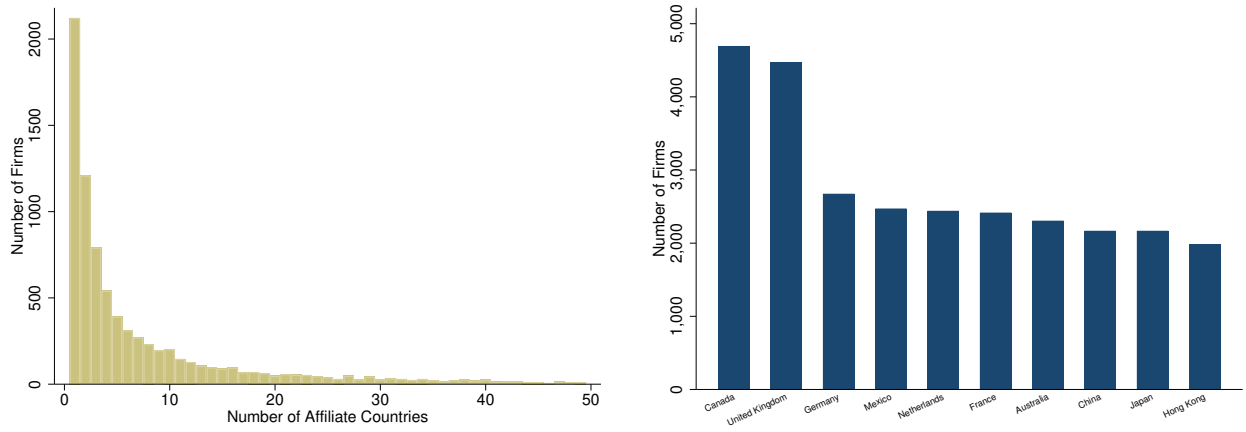
Thomson Reuters Mergers and Acquisitions Data provide deal-level M&A data for domestic firms from 1993 through 2017. Thomson Reuters M&A is an expansive platform for analyzing financial market, company fundamentals, and transaction deal data. We opt to exclude any deals that involve buybacks and recapitalizations to ensure we capture only proper acquisitions. Any deals that are related to territories of larger entities are re-categorized within the parent state. Data at the acquisition level are then merged back into the quarterly fundamentals using the historical CUSIP to record the number of acquisitions and the value of the deals, both domestic and foreign, within a given quarter. Foreign acquisitions that do not match with a change of multinational status in the firms' 10-K are checked by hand. If an acquirer shows no change in multinational status following the acquisition, the acquisition is removed.

We then categorize firms using the PERMCO, a unique permanent identifier for firms provided by CRSP/Compustat. Once domestic or multinational status is assigned to each firm in each quarter using 10-K information, firms are categorized into seven unique classifications based on characteristics the year of, the year before, and the year after the initial change into multinational status or the first foreign acquisition. Always domestic firms and always multinational firms are firms for which their status is domestic and multinational, respectively, throughout the entire sample period, with no foreign acquisitions or change of status. New MNE acquirers are firms that enter in the sample as domestic firms and we observe a foreign acquisition in Thomson Reuters M&A data within a year of the 10-K filings showing the existence of a foreign subsidiary. Additionally, we impute the status of new MNE acquirers following the first foreign acquisition as multinational if the foreign acquisition occurs prior to the indicated status change. New greenfield MNEs are firms that change their multinational status according to the 10-K filings but for which we do not identify a foreign acquisition in Thomson Reuters within the year before, of, and after the event. The set of *other firms* comprises firms that change from multinational to domestic or that change status several times in the sample, and also firms for which we do not observe a status change one year around a foreign acquisition. There are 6,155 firms in Compustat for which we are not able to parse 10-K information.

Figure A.1: Example of Exhibit 21: McDonald's Corporation

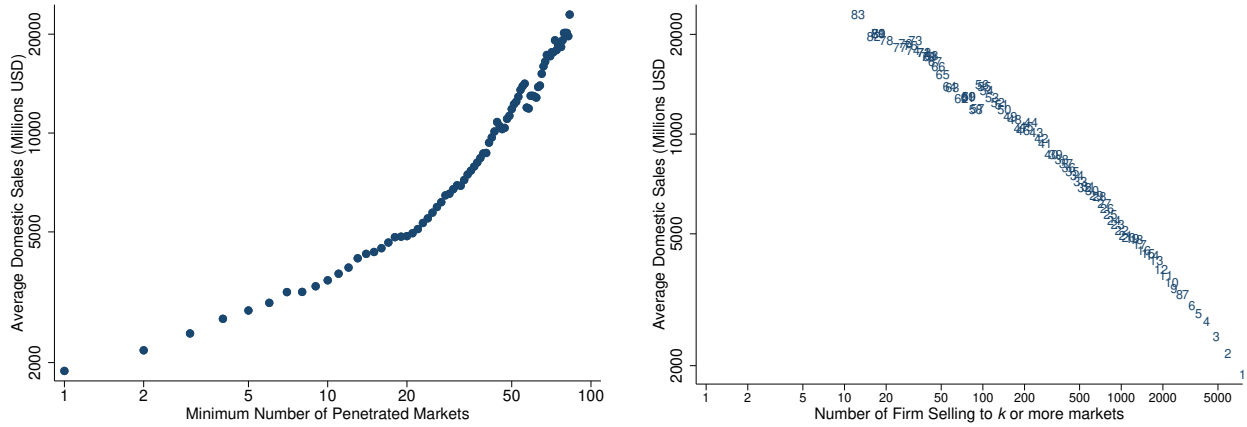
B Additional Data Description

Figure B.1: MNE Affiliates' Host Countries



Note: The left panel shows the distribution of the number of firms having affiliates in n host countries. The right panel shows the number of firms having affiliates in the top 10 host countries.
Source: SEC 10-K filings.

Figure B.2: MNE Sorting by Size into Host Countries



Note: The left panel shows an increasing relationship between parent sales and the number of countries in which the firm has affiliates: Firms that are larger in the United States enter more markets. The right panel also shows that larger firms sell to less popular markets.
Source: SEC 10-K filings.

C Empirical Analysis: Additional Tables and Figures

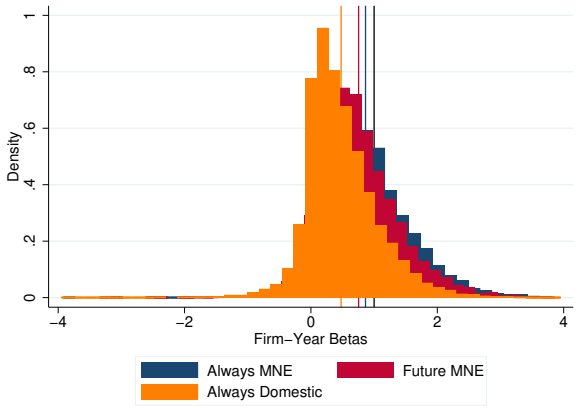
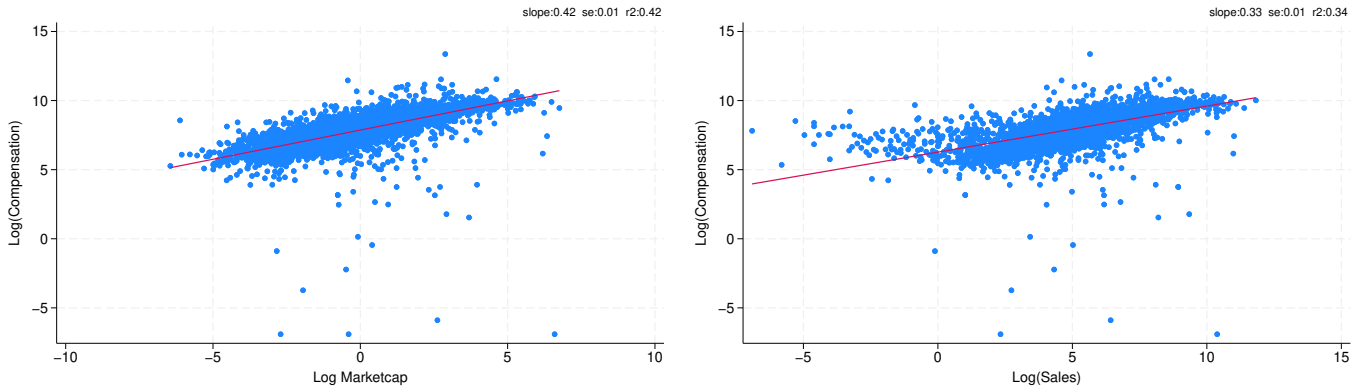


Figure C.1: Distribution of Firm *Betas*, by Firm International Status.

Note: Distribution of annual firm-level CAPM *betas*. The black line indicates a firm-year *beta* equal to one. The colored lines indicate the average *beta* of the respective subsample.

Figure C.2: Manager Compensation and Firm Size



Note: Scatter plot of annual CEO compensation against measures of firm size: firm market capitalization in the left panel, and firm sales in the right panel. Year 2017.
Source: Execucomp, Boardroom Alpha, CRSP/Compustat.

Table C.1: Becoming a Multinational: Management Matters.

	(1)	(2)	(3)	(4)
Previous MNE transition experience	0.052***			
	(0.013)			
Number of country entries		0.006***		
		(0.002)		
Previous MNE experience			0.034***	
			(0.006)	
Log-compensation				0.008***
				(0.001)
Market Capitalization	-0.023***	-0.022***	-0.021***	-0.029***
	(0.003)	(0.003)	(0.003)	(0.003)
Leverage Ratio	0.060***	0.060***	0.060***	0.062***
	(0.015)	(0.015)	(0.015)	(0.008)
Sales/Employee	-0.012	-0.012	-0.012	-0.458*
	(0.036)	(0.036)	(0.036)	(0.266)
Capital/Employee	-0.001	-0.001	-0.001	0.033*
	(0.003)	(0.003)	(0.003)	(0.020)
Beta (Annual)	0.021***	0.021***	0.021***	0.013***
	(0.002)	(0.002)	(0.002)	(0.002)
Observations	133,519	133,519	133,519	111,428
Adjusted R-squared	0.701	0.701	0.701	0.719

Note: The dependent variable is a dummy taking a value of 1 if a firm is a multinational in quarter-year t. The variable "Previous MNE transition experience" takes the value of 1 if the manager has prior experience in transitioning a firm from domestic to MNE. "Number of countries entries" denotes the natural log of 1 + the number of countries where previous MNEs established new affiliates under the manager's leadership. All specifications include market capitalization ($100 Billions), leverage ratio, sales per employee ($ 100 Billions / Thousand Employees), capital per employee ($ 100 Billions / Thousand Employees), and the firm *beta* as controls, and industry-quarter fixed effects. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Source: CRSP/Compustat, SEC 10-K filings, Execucomp, Boardroom Alpha.

Table C.2: Becoming a Multinational: Management Matters. Robustness.

	(1)	(2)	(3)	(4)
Market Capitalization	0.242***	-0.025***	0.023***	-0.013***
	(0.008)	(0.003)	(0.007)	(0.005)
Leverage Ratio	0.136***	0.062***	0.036**	0.058***
	(0.014)	(0.017)	(0.016)	(0.009)
Sales/Employee	-0.216**	-0.009	-0.045	-0.041*
	(0.106)	(0.035)	(0.035)	(0.023)
Capital/Employee	-0.013*	-0.002	-0.012	-0.003
	(0.007)	(0.003)	(0.009)	(0.003)
Beta (Annual)	0.121***	0.023***	0.028***	0.021***
	(0.003)	(0.002)	(0.002)	(0.002)
Firm FE	No	Yes	No	Yes
Executive FE	No	No	Yes	Yes
Observations	121,718	121,718	121,718	121,718
Adjusted R-squared	0.156	0.707	0.748	0.764
F-test FE		$p < 0.0001$	$p < 0.0001$	$p < 0.0001$

Note: The dependent variable is a dummy taking a value of 1 if a firm is a multinational in quarter-year t. Market capitalization is in \$100 Billions; Sales/Employee and Capital/Employee are in \$ Billions / Thousand Employees. *** p<0.01, ** p<0.05, * p<0.1. The comparison of the adjusted R^2 across columns (1)–(4) shows that manager fixed effects significantly contribute to explaining a firm's choice to engage in multinational activity, more than 4 percent beyond what firm characteristics and industry-time trends explain. Moreover, the addition of manager fixed effects has an incremental effect on the R^2 also when firm fixed effects are included. Source: CRSP/Compustat, SEC 10-K filings, Execucomp, Boardroom Alpha.

Table C.3: Becoming a Multinational: Good Management Matters

	(1)	(2)
Leverage Ratio	0.077***	0.077***
	(0.015)	(0.013)
Beta (Annual)	0.063***	0.059***
	(0.007)	(0.007)
Sales/Employee	0.000	0.000**
	(0.000)	(0.000)
Capital/Employee	-0.000***	-0.000***
	(0.000)	(0.000)
Market Capitalization	0.098***	0.149***
	(0.003)	(0.005)
Average Management Score (Filled)	0.057***	
	(0.006)	
Bad Management Score		-0.012
		(0.012)
Good Management Score		0.073***
		(0.009)
Observations	5,762	11,382

Note: Probit regression. The dependent variable is a dummy taking a value of 1 if a firm is a multinational in quarter-year t, scaled to 100 for interpretation purposes. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Source: CRSP/Compustat, Thomson Reuters M&A, SEC 10-K filings, World Management Survey.

Table C.4: Manager Characteristics and Fixed costs

	(1)	(2)	(3)	(4)
Market Capitalization	0.027***	0.027***	0.027***	0.021***
	(0.001)	(0.001)	(0.001)	(0.001)
Leverage Ratio	0.984***	0.976***	0.979***	0.658***
	(0.115)	(0.114)	(0.115)	(0.014)
Sales/Employee	0.008***	0.008***	0.008***	-0.033**
	(0.002)	(0.002)	(0.002)	(0.017)
Capital/Employee	-0.012***	-0.012***	-0.012***	-0.020***
	(0.003)	(0.003)	(0.003)	(0.002)
Beta (Annual)	0.589***	0.586***	0.586***	0.158***
	(0.010)	(0.010)	(0.010)	(0.010)
MNE	1.183***	1.178***	1.176***	1.010***
	(0.015)	(0.015)	(0.015)	(0.157)
Previous MNE transition experience	0.239***			
	(0.086)			
MNE x Previous MNE transition experience	-0.096			
	(0.098)			
Number of country entries		0.389***		
		(0.030)		
MNE x Number of country entries		-0.138***		
		(0.031)		
Previous MNE experience			0.524***	
			(0.053)	
MNE x Previous MNE experience			-0.119**	
			(0.057)	
Log-compensation				0.612***
				(0.017)
MNE x Log(compensation)				-0.035*
				(0.020)
Observations	102,379	102,379	102,379	86,433
Adjusted R-squared	0.454	0.457	0.456	0.614
Controls	Yes	Yes	Yes	Yes
Industry-Quarter FE	Yes	Yes	Yes	Yes
Executive FE	No	No	No	No
Firm FE	No	No	No	No

Note: The dependent variable is firm-level fixed costs, measured as "Selling, General and Administrative Expense". The variable "Previous MNE transition experience" takes the value of 1 if the manager has prior experience in guiding another firm's transition from domestic to MNE. "Number of countries entries" denotes the natural log of 1 + the number of countries where previous MNEs established new affiliates under the manager's leadership. Market capitalization is in $ Billions; Sales/Employee and Capital/Employee are in $ Billions / Thousand Employees. All specifications include industry-quarter fixed effects. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Source: CRSP/Compustat, SEC 10-K filings, Execucomp, Boardroom Alpha.

Table C.5: stock Returns and Market *betas* of Current and Future MNEs.

	ret_{it}		$beta_{it}$	
	(1)	(2)	(3)	(4)
Current Multinationals	1.119***	0.949***	0.163***	0.134***
	(0.285)	(0.307)	(0.008)	(0.008)
Future Multinationals	1.570***	1.424***	0.118***	0.080***
	(0.328)	(0.353)	(0.009)	(0.009)
Market Capitalization	1.442***	1.419***	0.127***	0.124***
	(0.114)	(0.117)	(0.003)	(0.003)
Leverage Ratio	-1.043***	-0.735**	-0.274***	-0.337***
	(0.312)	(0.367)	(0.039)	(0.010)
Sales/Employee	0.725**	1.630*	-0.007	-0.034
	(0.299)	(0.910)	(0.006)	(0.024)
Capital/Employee	-0.053***	-0.093**	-0.001	0.001
	(0.019)	(0.041)	(0.000)	(0.001)
Beta (Annual)	0.208	0.188		
	(0.246)	(0.260)		
Constant	1.217***	1.284***	0.561***	0.600***
	(0.242)	(0.289)	(0.006)	(0.006)
Observations	30,992	28,885	30,992	28,885
Adjusted R-squared	0.059	0.056	0.243	0.245
Executive FE	No	No	No	No
Firm FE	No	No	No	No
Current minus Future MNE p-Val	.157	.139	0	0
PSM	No	Yes	No	Yes

Note: The dependent variable y_{it} is annual firm-level stock returns (columns 1-2) or firm-level annual market betas (columns 3-4). Market capitalization is in $ Billions; Sales/Employee and Capital/Employee are in ($ Billions / Thousand Employees). All specifications include industry-year fixed effects. The sample excludes "Other MNEs" or firms that enter the sample period as MNEs and later switch to only domestic operations. Columns 2 and 4 feature a propensity score-weighted control group.

Table C.6: Manager Compensation, Experience, and MN Status

	(1)	(2)	(3)	(4)
Manager w. previous MNE entry experience	0.294*** (0.034)		0.249*** (0.034)	0.079** (0.033)
MNE		0.562*** (0.008)	0.561*** (0.008)	0.064*** (0.009)
Firm FE	No	No	No	Yes
Observations	112,077	112,077	112,077	111,920
R-squared	0.153	0.187	0.187	0.717

Note: The dependent variable is annual CEO compensation. Sample years 1993-2005. All specifications include controls (market capitalization, leverage ratio, sales per employee, capital per employee, and the firm *beta*) and industry-quarter fixed effects. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: Execucomp, Boardroom Alpha, CRSP/Compustat, and SEC 10K filings.

D Derivations and Proofs

D.1 Solution of the Value Functions and Policy Function

Domestic sales. The Bellman equation for the value of domestic sales is given by equation (12). This equation can be re-written as:

$$\pi(\varphi, a, C)M\Delta t + E[d(M \cdot V_D(\varphi, aC')] = 0 \tag{D.1}$$

where it can be shown that:

$$E[d(M \cdot V_D] = Mdt\left[-rV_D + E\left(\frac{dV_D}{dt}\right) + E\left[\frac{dM}{M} \cdot \frac{dV_D}{dt}\right]\right] \tag{D.2}$$

where the dependence of the value function on (φ, a, C') is omitted to ease the notation.

Hence the Bellman equation can be rewritten as:

$$\pi(\varphi, a, C) - rV_D + E\left(\frac{dV_D}{dt}\right) + E\left[\frac{dM}{M} \cdot \frac{dV_D}{dt}\right] = 0 \tag{D.3}$$

where Ito's lemma implies that:

$$dV_D = \left[\mu CV_D' + \frac{1}{2}\sigma^2 C^2 V_D''\right]dt + \sigma CV_D' dz. \tag{D.4}$$

Plugging the result of Ito's lemma into the Bellman equation and eliminating higher order terms, one obtains the fundamental quadratic equation:

$$\frac{1}{2}\sigma^2 C^2 V_D'' + (\mu - \gamma\sigma^2)CV_D' + \pi(\varphi, a, C) - rV_D = 0. \tag{D.5}$$

One can guess that the solution of the value function takes the form:

$$V_D = B_1 C^{\beta_1} + B_2 C^{\beta_2} + B_3 C. \tag{D.6}$$

By the method of undetermined coefficients, β_1 and β_1 are the positive and negative roots, respectively, of: $\frac{1}{2}\sigma^2\beta^2 + (\mu - \frac{1}{2}\sigma^2 - \gamma\sigma^2)\beta - r = 0$ and $B_3 = \frac{A\varphi^{\eta-1}}{r-\mu-\gamma\sigma^2}$. In addition, it must be that $B_2 = 0$ in order for the value function to have a finite limit for $C \to 0$, and $B_1 = 0$ so that the value function is equal to the discounted value of profits for $C \to \infty$. These restrictions lead to the value function in equation (15).

Foreign sales. By following an identical procedure to the one above, one can also show that the value function of foreign sales $V_F(\varphi, a, C^*)$ takes the form in equation (16).

In order to derive the value function of the option value of foreign sales, the procedure needs to start from evaluating the Bellman equation in the continuation region:

$$E[d(M \cdot V_F^o(\varphi, a, C^{*\prime})] = 0. \tag{D.7}$$

In this case, the fundamental quadratic equation doesn't include a profit term, so the solution of the value function takes the form:

$$V_F^o = B_1 C^{\beta_1} + B_2 C^{\beta_2}, \tag{D.8}$$

where it must be that $B_2 = 0$ in order for the value function to have a finite limit for $C \to 0$.

Policy Function. It remains to determine the expression for the option value term B_1, and the policy function, which in this case takes the form of a firm-specific threshold $\bar{C^F}$ in the realization of the shock C^* such that a firm will decide to become a multinational for any realization of foreign demand $C^* > \bar{C^F}$.

B_1 and $\bar{C^F}$ are the solutions of the system of value matching and smooth pasting conditions:

$$V_F^o(\varphi, a, C^*) = V_F(\varphi, a, C^*) - F \tag{D.9}$$

$$V_F^{o'}(\varphi, a, C^*) = V_F'(\varphi, a, C^*). \tag{D.10}$$

D.2 Derivation of Expected Returns

For a domestic firm, combining the no-arbitrage conditions (the fundamental quadratic equations) for domestic and foreign sales:

$$\pi - rV_D + (\mu - \gamma\sigma^2)CV_D' + \frac{1}{2}\sigma^2 C^2 V_D'' - rV_F^o + (\mu^* - \gamma\chi\sigma\sigma^*)C^* V_F^{o\prime} + \frac{1}{2}\sigma*^2 C^{*2} V_F^{o\prime\prime} = 0. \tag{D.11}$$

This condition can be rewritten as:

$$\begin{aligned}
\pi - rV_D - \gamma\sigma^2 CV_D' + E(dV_D) - rV_F^o - \gamma\chi\sigma\sigma^* C^* V_F^{o\prime} + E(dV_F^o) &= 0 \\
\pi + E(dV_D) + E(dV_F^o) &= rV_D + rV_F^o + \gamma\sigma^2 CV_D' + \gamma\chi\sigma\sigma^* C^* V_F^{o\prime} \\
\frac{E(\mathcal{V}_D) + \pi}{\mathcal{V}_D} &= \frac{r\mathcal{V}_D + \gamma\sigma^2 CV_D' + \gamma\chi\sigma\sigma^* C^* V_F^{o\prime}}{\mathcal{V}_D}
\end{aligned} \tag{D.12}$$

where the left hand side of the equation is the definition of expected returns.

Similarly one can show that the expected returns of a multinational firm are given by equation (21).

D.3 Proof of Proposition 2

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The risk premia of domestic firms can be written as:

$$\begin{aligned} E[ret_D(\varphi,a,C,C^*)]-r &= \frac{\gamma\sigma^2 CV_D'(\varphi,a,C)+\gamma\chi\sigma\sigma^* C^* V_F^{0'}(\varphi,a,C^*)}{\mathcal{V}_D(\varphi,a,C,C^*)} \\ &= \frac{\gamma\sigma^2\frac{A\varphi^{\eta-1}C}{r-\mu-\gamma\sigma^2}+\gamma\chi\sigma\sigma^*\beta^* B_F(\varphi,a)C^{*\beta^*}}{\mathcal{V}_D(\varphi,a,C,C^*)}. \end{aligned} \tag{D.13}$$

The derivative of excess returns with respect to managerial ability is:

$$\begin{aligned} \frac{\partial E[ret_D(\varphi,a,C,C^*)]-r}{\partial a} &= \left\{\gamma\chi\sigma\sigma^*\beta^* C^{*\beta^*}\frac{\partial B_F(\varphi,a)}{\partial a}\cdot\left[\frac{A\varphi^{\eta-1}C}{r-\mu-\gamma\sigma^2}-\frac{f_D(a)}{r}+B_F(\varphi,a)C^{*\beta^*}\right]-\right. \\ &\left.\left[\left(\gamma\sigma^2\frac{A\varphi^{\eta-1}C}{r-\mu-\gamma\sigma^2}+\gamma\chi\sigma\sigma^*\beta^* B_F(\varphi,a)C^{*\beta^*}\right)\cdot\left(-\frac{1}{r}\frac{\partial f_D(a)}{\partial a}+\frac{\partial B_F(\varphi,a)}{\partial a}C^{*\beta^*}\right)\right]\right\}\Big/ \\ &\mathcal{V}_D(\varphi,a,C,C^*)^2 \end{aligned} \tag{D.14}$$

Inspecting (D.14), we start by noticing that a restrictive sufficient condition to ensure that $\frac{\partial E[ret_D(\varphi,a,C,C^*)]-r}{\partial a}>0$ is to impose that the fixed costs of domestic activities are zero: $f_D(a)=0$, $\forall a$.

For positive values of $f_D(a)$, we need to show that the numerator of (D.14) is positive. We can re-write the numerator of (D.14) as:

$$\begin{aligned} &\gamma\chi\sigma\sigma^*\beta^* C^{*\beta^*}\frac{\partial B_F(\varphi,a)}{\partial a}\cdot\frac{A\varphi^{\eta-1}C}{r-\mu-\gamma\sigma^2}-\gamma\chi\sigma\sigma^*\beta^* C^{*\beta^*}\frac{\partial B_F(\varphi,a)}{\partial a}\cdot\frac{f_D(a)}{r}+... \\ &\gamma\chi\sigma\sigma^*\beta^* C^{*\beta^*}\frac{\partial B_F(\varphi,a)}{\partial a}\cdot B_F(\varphi,a)C^{*\beta^*}+\gamma\sigma^2\frac{A\varphi^{\eta-1}C}{r-\mu-\gamma\sigma^2}\cdot\frac{1}{r}\frac{\partial f_D(a)}{\partial a}+... \\ &\gamma\chi\sigma\sigma^*\beta^* C^{*\beta^*}B_F(\varphi,a)\cdot\frac{1}{r}\frac{\partial f_D(a)}{\partial a}-\gamma\sigma^2\frac{A\varphi^{\eta-1}C}{r-\mu-\gamma\sigma^2}\cdot\frac{\partial B_F(\varphi,a)}{\partial a}C^{*\beta^*}-... \\ &\gamma\chi\sigma\sigma^*\beta^* C^{*\beta^*}\frac{\partial B_F(\varphi,a)}{\partial a}\cdot B_F(\varphi,a)C^{*\beta^*} \end{aligned} \tag{D.15}$$

and collecting common terms we obtain:

$$\begin{aligned} &\frac{A\varphi^{\eta-1}C}{r-\mu-\gamma\sigma^2}\frac{\partial B_F(\varphi,a)}{\partial a}C^{*\beta^*}\cdot(\gamma\chi\sigma\sigma^*\beta^*-\gamma\sigma)+... \\ &\gamma\sigma^2\frac{A\varphi^{\eta-1}C}{r-\mu-\gamma\sigma^2}\cdot\frac{1}{r}\frac{\partial f_D(a)}{\partial a}+... \\ &\gamma\chi\sigma\sigma^*\beta^* C^{*\beta^*}\cdot\frac{1}{r}\Big[B_F(\varphi,a)\cdot\frac{\partial f_D(a)}{\partial a}-\frac{\partial B_F(\varphi,a)}{\partial a}\cdot f_D(a)\Big]. \end{aligned} \tag{D.16}$$

Since $\frac{\partial B_F(\varphi,a)}{\partial a} > 0$ and $\frac{\partial f_D(a)}{\partial a} > 0$, under the assumption that $\beta^* \chi \sigma^* > 1$, the first two terms of (D.16) are positive. Hence a sufficient condition for $E[ret_D(\varphi, a, C, C^*)]$ to be increasing in a is:

$$\frac{\frac{\partial f_D(a)}{\partial a}}{f_D(a)} > \frac{\frac{\partial B_F(\varphi,a)}{\partial a}}{B_F(\varphi, a)}. \tag{D.17}$$

Using (19), the right-hand side of (D.17) can be written as:

$$\frac{\frac{\partial B_F(\varphi,a)}{\partial a}}{B_F(\varphi, a)} = \left(\frac{1-\beta^*}{rF + f_I(a)}\right) \cdot \frac{\partial f_I(a)}{\partial a}, \tag{D.18}$$

so that a sufficient condition for $E[ret_D(\varphi, a, C, C^*)]$ to be increasing in a is:

$$\frac{\frac{\partial f_D(a)}{\partial a}}{f_D(a)} > \left(\frac{1-\beta^*}{rF + f_I(a)}\right) \cdot \frac{\partial f_I(a)}{\partial a}. \tag{D.19}$$

Since in our quantitative analysis we use $a \in \{a_L, a_H\}$, we impose a "discretized" version of (D.19):

$$\frac{f_D(a_H) - f_D(a_L)}{f_D(a_L)} > \frac{1-\beta^*}{rF + f_I(a_L)} \cdot [f_I(a_H) - f_I(a_L)]. \tag{D.20}$$